A SMALL MACRO-ECONOMETRIC MODEL FOR NAMIBIA EMPHASISING THE DYNAMIC MODELLING OF THE WAGE-PRICE, PRODUCTIVITY AND UNEMPLOYMENT RELATIONSHIP

by

TAFIRENYIKA SUNDE

Submitted in accordance with the requirements
for the degree of

DOCTOR OF LITERATURE AND PHILOSOPHY

In the subject of

ECONOMICS

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROF. OA AKANBI

AUGUST 2015

DECLARATION

Student number: 49012347

I declare that "**A SMALL MACRO-ECONOMETRIC MODEL FOR NAMIBIA EMPHASISING THE DYNAMIC MODELLING OF THE WAGE-PRICE, PRODUCTIVITY AND UNEMPLOYMENT RELATIONSHIP"** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Signed…… ……..**Date**……11 August 2015……...……

ABSTRACT

The contribution of this thesis is to build a small macro-econometric model of the Namibian economy, which demonstrates that there is significant statistical support for the hypothesis that there is a contemporaneous relationship between real wage, productivity, unemployment and interest rates in Namibia. This phenomenon has not yet been exploited using macro-econometric modelling, and thus, represents a significant contribution to modelling literature in Namibia. The determination of the sources of unemployment also receives special attention given that high unemployment is a chronic problem in Namibia. All models specified and estimated in the study use the SVAR methodology for the period 1980 to 2013. The study develops a small macro-econometric model using three modular experiments, which include, a basic model, models that separately append demand and exchange rate channels variables to the basic model, and the specification of a small macro-econometric model. The ultimate aim is to find out if monetary policy plays a role in influencing labour market and nominal variables. The hypothesis that the basic real wage, productivity, unemployment rate and interest rate system can be estimated simultaneously is validated. Further, demand and exchange rate channels variables are found to have important additional information, which explains the monetary transmission process, and that shocks to labour market variables affect monetary policy in Namibia. The results also show that the demand channel (import prices and bank credit to the private sector) and the exchange rate channel (nominal exchange rate) variables have important additional information, which affects monetary transmission process in Namibia, which justifies their inclusion in the small macro-econometric model. In addition, shocks to the import price and exchange rate in the macro-econometric model significantly affect labour market variables. However, shocks to bank credit only partially perform as expected, implying that its results need to be considered cautiously. The study further finds that tight monetary policy shocks significantly affect real and nominal variables in Namibia. The results also show that shocks to all variables in the unemployment model significantly affect unemployment, suggesting that the hysteresis assumption is corroborated. This implies that long run aggregate demand is non-neutral in Namibia.

KEYWORDS

Real Wages, Prices, Unemployment, Productivity, Import Prices, Exchange Rates, Interest Rates, Monetary Policy Reaction Function, Structural Vector Autoregression, Variance Decomposition, Impulse Response Functions, Namibia.

DEDICATION

I dedicate this work to my beloved wife, Ketiya Cathrine Sunde and our adorable children, Leo, Lynn and Liberty.

ACKNOWLEDGEMENTS

I would like to express my sincere indebtedness to the following:

- The Lord Almighty, for providing me with the strength and determination to be able to complete this study.
- My supervisor, Prof. OA Akanbi, for his guidance, support, encouragement and infinite patience throughout my studies.
- UNISA Student Funding, for awarding me the UNISA Doctoral Study Bursary.
- Dr. RT Chifamba, for the help he rendered by explaining to me how the Structural Vector Autoregression Method works.
- Mr. Kofi Boamah for understanding and giving me the valuable time to work on my thesis.
- My employer, Namibia University of Science and Technology (NUST), for all the support provided.
- My family and friends for their support and patience.
- My late parents Mr Simon Wasarirevhu Sunde and Mrs Elise Makwiramiti Sunde for the love and solid foundation they gave me in life.
- Input from editors and reviewers of the internationally recognised journals that have reviewed and published or accepted for publication articles emanating from this thesis. These journals include:
    - International Journal of Sustainable Economy (IJSE),
    - Journal of Economic and Social Thought (JEST), and
    - African Journal of Economic Review (AJER).
- All those who have assisted and supported me in one way or the other during my studies. Without the support, encouragement and guidance of all the above-mentioned, this thesis would never have become a reality.

Despite the support and contributions of the above-mentioned institutions, individuals and journals, I take complete responsibility for all the viewpoints and any shortcomings of this thesis. All the inaccuracies and attendant omissions are exclusively ascribed to me and should not be attributed to any of the above-mentioned institutions, individuals or journals.

TABLE OF CONTENTS

DECLARATION i
ABSTRACT ii
KEYWORDS iii
DEDICATION iv
ACKNOWLEDGEMENTS v
TABLE OF CONTENTS vi
LIST OF TABLES xi
LIST OF FIGURES xii
ACRONYMS xiii

CHAPTER 1 1
INTRODUCTION AND BACKGROUND 1
1.1 INTRODUCTION 1
1.2 PROBLEM STATEMENT 5
1.3 the Objectives of THE STUDY 6
1.3.1 The specific objectives of the study 7
1.4 HYPOTHESeS OF THE STUDY 8
1.5 JUSTIFICATION OF THE STUDY 8
1.6 Methodology 9
1.7 Outline of the study 9

CHAPTER 2 12
ECONOMIC AND LABOUR MARKET PERFORMANCE OF NAMIBIA 12
2.1 Introduction 12
2.2 OVERVIEW OF THE ECONOMY OF NAMIBIA 13
2.2.1 Macroeconomic framework for Namibia 13
2.2.2 An analysis of the key macroeconomic indicators 14
2.2.3 Comparison of Namibia's growth with other regions and countries 18
2.2.4 Comparison of Namibia's fiscal balances with other regions and countries 19
2.2.5 Supply Side Developments 21
2.2.6 Demand Side Developments 23
2.2.7 Fiscal developments 26
2.2.8 Monetary developments 28

2.2.8.1 Monetary policy in Namibia 30
2.2.9 The external position of the economy 31
2.3 THE NAMIBIAN LABOUR MARKET 33
2.3.1 Unemployment in Namibia 34
2.3.2 Types of Unemployment 35
2.3.4 Basic indicators of the labour market since 1993 39
2.3.5 Namibia's labour market performance compared to SACU countries 43
2.4 THE INFLATIONARY ENVIRONMMENT IN NAMIBIA 49
2.4.1 Namibia's inflation performance 50
2.4.2 The wages and Namibia's economy 52
2.5 CONCLUDING REMARKS 55

CHAPTER 3 59
MACROECONOMIC FOUNDATIONS AND LITERATURE REVIEW 59
3.1 Introduction 59
3.2 Theoretical foundations of the wage-price models 60
3.2.1 The Philips curve 60
3.2.2 The new Keynesian Phillips curve 62
3.2.3 The monetarist revolution 65
3.2.4 Keynesian response to the monetarist challenge 69
3.2.5 Keynesian model of inflation with a vertical Phillips curve 70
3.2.6 Unemployment and hysteresis effects 74
3.2.7 Unemployment and macro policy coordination 76
3.3 THE WAGE-PRICE EMPIRICAL LITERATURE REVIEW 77
3.3.1 A short background to macroeconometric modelling 77
3.3.2 Alternative research strategies in macroeconometrics 79
3.3.3 Literature analysis of the wage-price relationship 81
3.3.4 Justification for the extension of the wage-price model 90
3.3.5 The simultaneous wage-price-productivity-unemployment model specification 91
3.3.6 Unemployment literature analysis 107
3.3.7 Critical analysis of related literature from Namibia 110
3.4 CONCLUDING REMARKS 115

CHAPTER 4.....118

THEORETICAL FRAMEWORK, METHODOLOGY AND DATA ANALYSIS.....118

4.1 Introduction.....118

4.2 wage-price models in imperfect competition.....120

4.2.1 The new Keynesian wage-price model.....120

4.2.2 The competing-claims model of a unionised economy.....126

4.2.3 The efficiency wage model of productivity, unemployment and wages.....134

4.2.4 The wage-price model in an open economy.....137

4.3 THE STRUCTURAL VECTOR AUTOREGRESSION METHODOLOGY.....142

4.3.1 Types of VARs.....143

4.3.2 Modelling the relationship between VAR and the SVAR.....145

4.4 The SVAR model.....149

4.4.1 Introduction to vector auto regression (VAR).....149

4.4.2 Reduced form VAR.....149

4.4.3 Short- run restrictions SVAR model.....150

4.4.4 Long run SVAR Model.....155

4.4.5 Impulse response functions (IRF).....155

4.4.6 Forecast error variance decomposition (FEVD).....157

4.4.7 Assessment of SVARs.....158

4.5 IMPORTANT ISSUES IN ECONOMETRIC ESTIMATION.....160

4.5.1 Unit Root Test.....160

4.5.2 Lag Length Selection.....161

4.5.3 Johansen Cointegration Approach.....162

4.6 DATA DESCRIPTION AND ANALYSIS.....164

4.6.1 Sources of the data and the variables.....164

4.6.2 Descriptions and derivations of variables.....165

5.6.3 Comments on interpolation and extrapolation methods applied.....168

4.7 CONCLUDING REMARKS.....172

CHAPTER 5.....173
THE SOURCES OF UNEMPLOYMENT FLUCTUATIONS.....173
5.1 Introduction.....173
5.2 Unemployment in Namibia.....174
5.3 Unemployment brief Literature.....176
5.4 The unemployment model for Namibia.....177
5.4.1 The model.....178
5.4.2 Identification of structural shocks.....182
5.4.3 Non-stationarity and cointegration.....183
5.5 Data and Estimation Results.....188
5.5.1 Impulse-response functions and variance decomposition.....188

CHAPTER 6.....196
THE SMALL MACRO-ECONOMETRIC MODEL FOR NAMIBIA.....196
6.1 Introduction.....196
6.2 THE SMALL MACRECONOMETRIC MODEL FOR NAMIBIA.....198
6.2.2 Analysis technique.....204
6.2.3 Properties of the Variables.....205
6.3 ESTIMATION AND ANALYSIS OF RESULTS.....207
6.3.1 The basic model.....207
6.3.1.1 Impulse response functions of the basic model.....209
6.3.1.2 Variance decomposition of the basic model.....214
6.3.2 Possible channels of monetary transmission in the macro-econometric model.....217
6.3.2.1 The demand channel model using import prices.....217
6.3.2.2 The demand channel using the bank credit model.....220
6.3.2.3 The exchange rate channel model.....223
6.4.1 The small maroeconometric model for Namibia.....226
6.4.1.1 Impulse response functions for the macro-econometric model.....227
6.4.1.2 Variance decompositions for the macro-econometric model.....232
6.5 Validating the robustness of the models.....235
6.6 CONCLUDING REMARKS.....236

CHAPTER 7 239
CONCLUSION, POLICY IMPLICATIONS AND FUTURE RESEARCH 239
7.1 Introduction 239
7.2 Summary of the study 239
7.3 Summary of empirical findings 242
7.3.1 The sources of unemployment model 242
7.3.2 The small macro-econometric model 243
7.4 Conclusions and Policy implications 245
7.4.1 The sources of unemployment model 245
7.4.2 The small macro-econometric model 247
7.5 Limitations of the study and areas of future research 249

REFERENCES 251
APPENDIX A: GENERAL APPENDICES 269
APPENDIX B: APPENDIX TO CHAPTER 5 281
APPENDIX C: APPENDIX TO CHAPTER 6 286

LIST OF TABLES

Table 2-1: Selected Macroeconomic Indicators (Percentages) 15
Table 2-2: Real GDP growth (percentage) - global 18
Table 2-3: Global fiscal balances and budget deficits for selected economies as a percentage of GDP 20
Table 2-4: Value added by major production sectors as a percentage of GDP 21
Table 2-5: Aggregate demand components (million USD, 2005=100) 23
Table 2-6: Monetary aggregates (million Namibian dollars) and related statistics (%) 30
Table 2-7: Major balance of payments aggregates (N$ million) 33
Table 2-8: Basic labour market indicators from labour force surveys 40
Table 2-9: Labour force, employment and unemployment 41

Table A 1: Data definitions and sources 269
Table A 2: Variable statistics 274
Table A 3: ADF and the PP non-stationarity tests in levels 1990 - 2013 277
Table A 4: ADF and the PP non-stationarity tests in first differences 1990 - 2013 278
Table B 1: Structural estimates of the A and C matrices of the unemployment model 281
Table B 2: Roots of characteristic polynomial of the unemployment model 283
Table B 3: VAR residual serial correlation tests of unemployment 284
Table C 1: Structural VAR estimates for the basic model 286
Table C 2: VAR lag exclusion Wald tests for the basic model 287
Table C 3: Roots of characteristic polynomial for the basic model 288
Table C 4: VAR residual serial correlation LM tests for the basic model 290
Table C 5: Structural VAR estimates for the small macro-econometric model 292
Table C 6: Roots of characteristic polynomial for the composite macro-econometric model 294
Table C 7: VAR residual serial correlation LM tests for the macro-econometric model 296
Table C 8: VAR lag exclusion Wald tests for the composite macro-econometric model 297

LIST OF FIGURES

Figure 1-1: A stylised illustration of the complete macroeconomic model 7
Figure 2-2: Percentage growth Rates of Selected Macroeconomic Indicators 17
Figure 2-3: Value added by major production sectors as a percentage of GDP 22
Figure 2-4: Aggregate demand components (million USD, 2005=100) 25
Figure 2-5: Government revenue, government expenditure and the budget balance (in millions of Namibian dollars) 26
Figure 2-6: Budget balance in millions of Namibian dollars 27
Figure 2-7: Summary of major accounts of the Balance of Payments (million N$) 32
Figure 2-8: Unemployment rates for Namibia 35
Figure 2-9: Unemployment rates for SACU countries 45
Figure 2-10: SACU countries average unemployment rates for the period 1990-2013 45
Figure 2-11: SACU countries employment growth rates 47
Figure 2-12: SACU countries' average employment growth for the period 1990-2013 47
Figure 2-13: SACU countries average labour force growth rates: 1990-2013 49

Figure A1: A stylised illustration of the complete macro-econometric model 272
Figure A2: Regional map of Namibia 273
Figure A 3: Trend diagrams of the variables 275
Figure A 4: First differences of the data used in the estimations 276
Figure A 5: Macro-econometric reduced form VAR equations: parameter stability tests 279

Figure B 1: Evolution of other variables against unemployment in the unemployment model 281
Figure B 2: Accumulated impulse responses for the unemployment model 285
Figure C 1: Inverse roots of AR characteristics polynomial 289
Figure C 2: Evolution of macro-econometric variables against the monetary policy variable. 291
Figure C 3: Inverse roots of AR characteristics polynomial for macro-econometric model 295
Figure C 4: Impulse responses for the small macro-econometric model 298
Figure C 5: Variance decomposition of the small macro-econometric model 299

ACRONYMS

2SLS	Two Stage Least Squares
ADF	Augmented Dickey Fuller Test
ADL	Autoregressive Distributed Lag
AIC	Akaike Information Criterion
BC	Bargaining Centralisation
BoN	Bank of Namibia
BoP	Balance of Payments
BRICS	Brazil Russia India China and South Africa
CGE	Computable General Equilibrium
CMA	Common Monetary Area
CRS	Constant Returns to Scale
CUTT	Customs Union Task Team
EA	Euro Area
ECHP	European Community Household Panel
ECM	Error Correction Model
EPL	Employment Protection Legislation
FEVD	Forecast Error Variance Decomposition
FGSL	Feasible Generalised Least Squares
FIML	Full Information Maximum Likelihood
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GoN	Government of Namibia
HQ	Hannan-Quinn Information Criterion
IMF	International Monetary Fund
IRF	Impulse Response Function
LDCs	Less Developed Countries
LMIs	Labour Market Institutions
MDGs	Millennium Development Goals
MEMWOG	Macroeconomic Modelling Working Group
ML	Maximum Likelihood

MoF	Ministry of Finance
MTEF	Medium Term Expenditure Framework
NAIRU	Non-accelerating Inflation Rate of Unemployment
NAMAF	Namibian Macroeconomic Framework
NAMEX	Namibia Macroeconometrics Model
NAMMAC	Namibia Macroeconomic Model
NDP	National Development Plan
NHIES	National Housing Income and Expenditure Survey
NKPC	New Keynesian Phillips Curve
NLFS	Namibia Labour Force Surveys
NPC	National Planning Commission
NSA	Namibia Statistical Agency
NSX	Namibia Stock Exchange
NUNW	National Union of Namibian Workers
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PC	Phillips Curve
PER	Public Expenditure Review
PP	Philips Peron
RBSA	Reserve Bank of South Africa
RMA	Rand Monetary Area
RMSM-X	Revised Standard Model-Extended
SACU	Southern African Customs Union
SIC	Schwarz Information Criterion
SVAR	Structural Vector Autoregression
SVECM	Structural Vector Error Correction Model
SWAPO	South West Africa Peoples' Organization
TIPEEG	Targeted Intervention Programme for Employment and Economic Growth
UK	United Kingdom
USA	United States of America

USD	United States Dollar
VAR	Vector Auto regression
VECM	Vector Error Correction Model
VEqCM	Vector Equilibrium Correction Model
WASCOM	Wages and Salary Commission
WB	World Bank
WBS	World Bank Statistics

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Macroeconometric modelling has proved to be a significant component of the economics field and it has generated considerable debate for many years among macroeconomists, but with little consensus. To date, debate about the specification of the best macroeconometric model and the variables to include in it still rages on. Worse still, very little research on the small macroeconometric models incorporates the labour market variables. Although literature on macroeconometric modelling is growing (Wallis, 1993; Andrews et al., 1985; Gottschalk, 2005; Nymoen, 2008; Dufour et al., 2009; Uribe and Schmitt-Grohé, 2012; Garratt, Lee, Pesaran., & Shin, 2012) there is still no standard way to specify a macroeconometric model. However, the empirical potential of macroeconometric modelling to explain the real economy has done a lot over the years to assist economic modellers and policy makers in their decision-making processes (Nymoen, 2008). The value of macroeconometric modelling in formulating sound macroeconometric policies should not be overemphasised. Such models primarily reflect the main characteristics and structural inadequacies of an economy. Additionally, macroeconometric modelling is an imperative and extremely useful instrument, which helps in analysing the structure of the economy, making future forecasts of the economy's macroeconomic indicators and analysing policy scenario impacts on the economy.

In many developing countries, it is complex to develop macroeconometric models that give robust results because the data may be inadequate and of poor quality. Implicitly, to be able to develop a macroeconometric model that produces reliable results that can be used for forecasting and policy analysis purposes, a reliable statistical database is required.

The starting point in developing a wage, price, productivity and unemployment macroeconometric model is the wage-price relationship. Previous studies concentrated on analysing the wage-price relationship and its feedback variables simultaneously. The study by Mchugh (2004) established that a simultaneous relationship also exists between wage, price, productivity and unemployment and this is corroborated by other authors such as Marcellino and Mizon (2000), Marcellino and Mizon (2001) Nymoen (1991) and Tsoukis et al. (2011). It is noteworthy that numerous studies were carried out on the macroeconometric relationship between wages and prices in the developed countries, very few studies were conducted in developing countries using various methodologies. Most of these studies specified and estimated wages and prices separately, thereby treating them as if they were not contemporaneously related. Of late, a few scholars have estimated the contemporaneous relationship between wages and prices for advanced economies and they all concluded that such a relationship exists between the two variables for all the countries studied. In addition, the existence of wage and price rigidities is widely recognised as a crucial issue for macroeconometrics and notably for monetary policy. Theory has reaffirmed the importance of price and wage rigidities for the evolution of the macroeconomy in response to shocks and, on the empirical domain, there is now a bulk of evidence on the existence of price and wage rigidities at the firm level (Bårdsen et al., 2007). In addition, the existence of price and nominal wage rigidities is expected to translate into persistent responses of wages and prices to shocks hitting the economy. It is also noteworthy that there are many studies in developed countries that studied the relationships between wage, price and unemployment; wage, price, and productivity; unemployment, productivity and wages, but there are very few studies that studied the simultaneous relationship between wages-price, productivity and unemployment under the macroeconometric setting using the structural vector autoregression (SVAR) methodology.[1]

The proposed approach has not yet been exploited in macroeconometric modelling in Namibia and therefore, represents a significant contribution to modelling and

[1] Some of the studies that studied a relationship close to the current study include Baffoe-Bonnie and Gyapong (2012), Forslund et al. (2008), Annicchiarico and Pelloni (2013), Andrew et al. (1990), Linzert (2001), Brüggemann (2006), Marcellino and Mizon (1999), and Arango et al. (2003).

macroeconometric literature in Namibia. This study follows a recent trend in other open economies such as Ghana, Portugal, Iceland, United States of America (USA), United Kingdom (UK), Norway and Australia, in which the behaviour of wage and price inflation is estimated in a simultaneous equation system. The current study differs from the majority of the previous studies in that it uses a different methodology (the structural vector auto regression (SVAR)) which allows for the study of downstream effects when there are shocks to the key variables in the model. In addition, the current study also differs from the traditional wage-price model, in that, instead of concentrating on the wage-price relationship it expands this relationship to wage-price, productivity and unemployment and then considers the feedback variables to this expanded relationship. In other words, this implies that in order to capture the behaviour of the foremost variables that drive the wage-price, productivity and unemployment model in Namibia, a complete model that incorporates important transmission channels needs to be constructed. In order to close the model, the study incorporates a monetary policy reaction function in the small macroeconometric model. This is not surprising because monetary policy plays a crucial role in the management of the economy. As outlined in the Bank of Namibia Act 15 of 1997, one of the principal objectives of the Bank of Namibia is to influence credit availability, interest rates, money supply and exchange rates in a bid to promote economic growth, employment (reduce unemployment), price and wage stability ultimately. The achievement of this objective obviously requires an understanding of the process through which monetary policy affects economic activity. It is against this backdrop that monetary policy, particularly interest rates, plays an important role in the development of the small macroeconometric model in the current thesis. There is no macroeconometric study in Namibia that has analysed the simultaneous relationship between wage, price, productivity and unemployment. The current study, therefore, contributes to macroeconometric literature in Namibia by filling this gap. Moreover, the study isolates monetary policy autonomous disturbances from other shocks, quantifies their dynamic behaviours and measures the consequent macroeconomic implications using an SVAR model with short run restrictions.

The macroeconometric model of the Namibian economy developed in this thesis was originally developed using three SVAR modular experiments and it borrows ideas from studies by Watzka (2006), Disyatat and Vongsinsirikul (2003) and Ngalawa and Viegi (2011). First, the study estimates a basic model comprising the country's real wage, productivity, unemployment and interest rate relationship. The essence of this basic model that incorporates the interest rate into the key variables of the study is to establish which labour market variables are affected by monetary policy (Watzka, 2006).

At the second level of analysis, the study separately appends demand and exchange rate channel variables to the basic model and estimate the resultant model. If the shocks to the appended variables are important in explaining the variables in the basic model, incorporate them in the small macroeconometric model. Additionally, two sets of impulse responses are estimated in each case: one with the variable of interest calculated endogenously, while the other calculates the variable of interest exogenously (Disyatat and Vongsinsirikul, 2003; Morsink and Bayoumi, 2001; Ngalawa and Viegi, 2011). The latter procedure generates an SVAR comparable to the former even though it blocks off any responses within the SVAR that pass through the variable of interest (Disyatat and Vongsinsirikul, 2003). The next stage in the second modular experiment is to compare the two sets of impulse responses. Therefore, the size differences in the impulse responses are an indicator of the level of additional information contained in the series of interest, which explains a particular transmission channel. Large differences indicate that there is more information in the variable of interest and suggest that the related transmission channel is of great importance. In particular, the current study investigates the level of additional information contained in the individual series of interest, which explain the monetary transmission channel.

At the third and final level of analysis, the researcher pools all variables found to have important additional information in explaining the country's monetary transmission process and append them to the basic model to create a composite SVAR, which the study labels the small macroeconometric model. The ultimate aim of the study is to find out if monetary policy has a role to play in influencing labour market variables. This

implies that only a short run analysis of the study conforms to the subject matter under examination. There is, therefore, little value in extending the study of the monetary transmission process to cover the long run since economists generally agree that monetary policy affects only the price level in the long-run and not the other variables (Disyatat and Vongsinsirikul, 2003).

The research also attempts to give prominence to the problem of unemployment by studying the sources of Namibian unemployment since Namibia has a high unemployment rate. Knowledge of the sources of unemployment in Namibia helps as far as the recommendations of the solutions to the problem is concerned. The sources of unemployment are analysed by using the long run SVAR methodology, which has been used by other previous researchers who studied similar topics in other countries (see Dolado and Jimeno, 1997; Linzert, 2001; Maidorn, 2003; Brüggemann, 2006; Baffoe-Bonnie and Gyapong, 2012).

1.2 PROBLEM STATEMENT

Since independence, the economy of Namibia has performed moderately well, growing at an approximate average rate of four (4) per cent per annum. However, the unemployment rate and poverty levels have remained high while the inflation rate advanced at a manageable average rate of 6.1 per cent. The unemployment problem can mainly be attributed to low productivity, growth in capital-intensive sectors of the economy, especially, the mining sector, low rate of new business start-ups and high cost of capital. It has been argued that sound economic policy is the remedy to these problems that bedevil the Namibian economy. Hence, the necessity of policy transformation and realignment need not be overemphasised.

It can be argued that there is a need to develop appropriate sectoral policy frameworks that can serve as reference points in the determination of whether the economy is in the right track or going astray so that corrective measures can be adopted to address policy issues pertinent to problems the Namibian economy faces. It is also vital that policy makers have a clear understanding of the interrelationships between policy instruments and targets so that they are able to choose the correct policy variables to achieve their

objectives. In addition, it is also necessary for policy makers to be able to assess the degree to which policy variables influence the ultimate targets. The understanding of such transmission mechanisms proves essential when it comes to dealing with the potential policy spill over effects. Specifically, it is essential for Namibia to know the relationship between the labour market variables, and the monetary transmission process since this clearly spells out the relationship between the labour market and monetary policy.

Macroeconometric modelling has always provided answers to policy makers and other interested parties and stakeholders. Despite the fact that econometric modelling was heavily criticised in the past, it has proven handy as far as policy formulation and analysis is concerned. Since the early econometric models that are heavily criticised, econometric modelling has gone through some revolutionary transformations in terms of its theory and computational techniques (Jacobs and Wallis, 2005; Matlanyane, 2005).

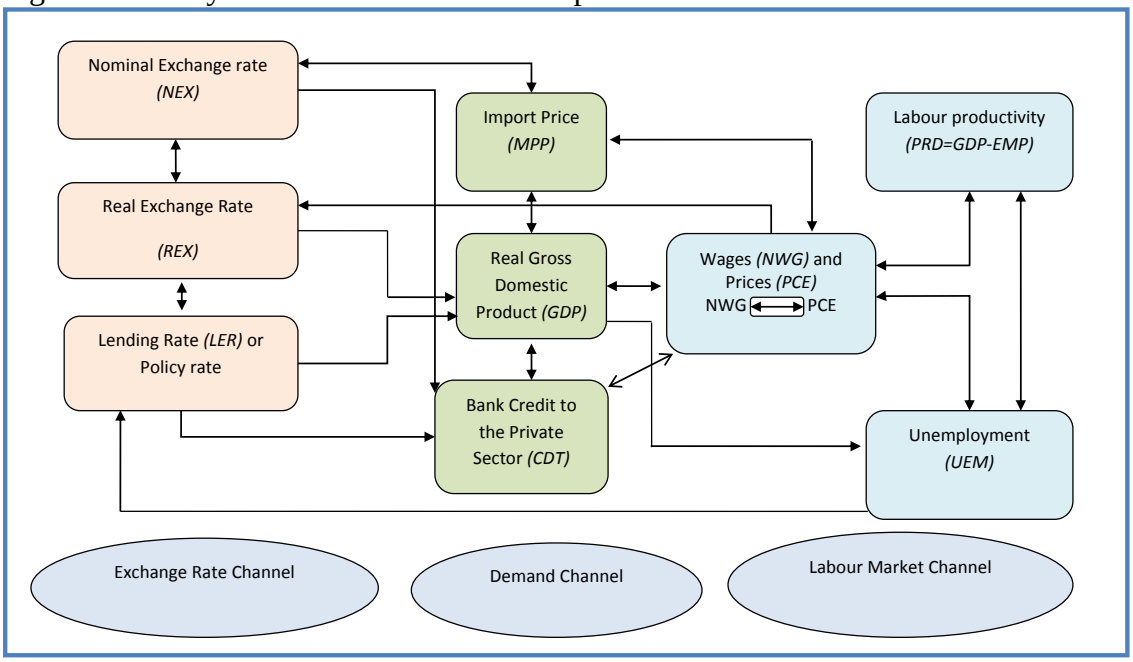
1.3 THE OBJECTIVES OF THE STUDY

The main objective of this thesis is to construct a small structural macroeconometric model for Namibia with particular emphasis on the simultaneous relationship between real wages (wage-price), productivity, unemployment. The basic model constructed includes the interest rate (a monetary variable) which is used to test if the demand and exchange rate channel variables have important additional information that affects the monetary transmission process in Namibia. Special emphasis is placed on analysing the sources of unemployment in Namibia, since Namibia has the highest average unemployment rates among all the countries in SACU and yet it was designated a middle-income developing country in 2009. Figure 1-1, is a stylised representation of the macro-econometric model that the study attempts to develop in this thesis.

Figure 1-1, enlarged in Figure A1 in Appendix A, evidently illustrates the possible interaction of wages, prices, productivity and unemployment, and, the additional feedback variables that determine their behaviour. It is against the backdrop of this schematic depiction of the model, that the study comes up with seven objectives

explained below. Chapter 3 of the thesis gives the justification of the simultaneous modelling and estimation of the wage-price, productivity and unemployment model both theoretically and empirically.

Figure 1-1: A stylised illustration of the complete macroeconomic model



Adaptation from McHugh (2004)

1.3.1 The specific objectives of the study

The specific objectives of the study are:

(i) To review the macroeconomic environment and provide an overview of the labour market in Namibia for the period 1980 to 2013.

(ii) To determine the sources of unemployment in Namibia using the SVAR methodology.

(iii) To empirically test the impact of shocks in the basic real wage, productivity, unemployment and interest rates model.

(iv) To analyse empirically the dynamic effects of demand shocks on the monetary policy transmission process.

(v) To specify, estimate and evaluate the macro-econometric model with a lending rate reaction function.

(vi) To proffer some policy recommendation based on obtained results.

1.4 HYPOTHESES OF THE STUDY

The hypotheses tested in this study are as follows:

(i) There is a contemporaneous relationship between real wage, productivity and unemployment in Namibia.

(ii) Shocks to technology, real wage, price, labour demand and labour supply affect unemployment in Namibia.

(iii) The demand channel variables significantly affect monetary policy in Namibia.

(iv) Shocks to lending rates affect both labour market and other macroeconomic variables in Namibia.

1.5 JUSTIFICATION OF THE STUDY

The Namibia Macroeconometric Model (NAMEX) developed in 2004 is the first and only comprehensive macroeconometric model ever developed in Namibia. This model suffered from severe data deficiency problems that are minimal as far as the current study is concerned. The serious shortcomings of NAMEX (explained in Chapter 3) motivated the researcher to develop the current small macroeconometric model that shows the interaction of some key labour market and monetary variables in an open economy framework. Additionally, the high unemployment rate in Namibia also requires investigation and analysis to proffer possible solutions to resolve the problem.

The 2004 study by Tjipe et al. (2004) used annual data covering the period 1990 to 2004. However, the current study uses annual data for the period, 1980 to 2013 that gives 33 observations, and hence increases the number of observations and possibly improve the quality of the results. In addition, the current study makes use of the structural vector auto regression (SVAR) model, while Tjipe et al. (2004) used Engle Granger two-step econometric procedure. The Engle Granger two-step procedure is also the same methodology, which was used by Eita and Ashipala (2010) who studied the determinants of unemployment in Namibia, for the period 1970 to 2007.

The current study is also the first study that attempts to develop the small macroeconometric model for Namibia giving special emphasis to the labour market variables. Most of the studies that were carried out on similar topics were conducted in

developed countries, and these include Nymoen (1991), Bardsen et al. (2003), Maidorn (2003), Bårdsen et al. (2007), Zumer (2004) and Brüggemann (2006). Some of the few studies on African countries include Wakeford (2004), Baffoe-Bonnie and Gyapong (2012), Ojapinwa and Esan (2013) and Van Zyl (2010). The majority of these studies from both the developed and developing countries made use of cointegration and error correction modelling technique, and only a few of them used the SVAR procedure. It is against this background that the current study makes use of the SVAR methodology. The next section of the chapter discusses the objectives of the study.

1.6 METHODOLOGY

Secondary data are collected for all the variables of interest in this study, and structural vector auto regression (SVAR) methodology is used to estimate the macroeconometric model for the Namibian economy for the period 1980 to 2013. Important issues discussed relating to this methodology, include the stationarity tests, cointegration tests, determination of the optimal lag length, impulse response functions (IRF), variance decomposition and robustness checks.

1.7 OUTLINE OF THE STUDY

Chapter 2 gives an overview of the macroeconomic performance of the Namibian economy, paying particular attention to the performance of the labour market variables that are used in this study. A general analysis of the macroeconomic performance gives deeper understandings of the relationships among the variables that are used in the models developed in this study. The study, therefore, provides a detailed discussion on the performance of the Namibian economy, highlighting some of the challenges that it currently faces. This discussion is done within the economic policy frameworks that the economy has followed. The chapter also analyses the behaviour of the key variables used in the study by using tables of figures and trend diagrams.

Chapter 3 discussions cover both theoretical and empirical literature related to the current study. The chapter discusses the theories related to the basic wage-price model. Some of the theories that are reviewed are the imperfect competition theory of wages and prices, the Phillips curve model, the new Keynesian Phillips curve model, the

monetarist revolution and the Keynesian response. Empirical research on both developed and developing nations are reviewed and analysed.

Chapter 4 discusses the methodological issues of the study. The chapter systematically clarifies the methodology applied in this study. The issues covered and discussed in the chapter include the stationarity tests, cointegration tests, SVAR modelling, determination of the optimal lag length, impulse response functions (IRF) and variance decomposition.

Chapter 5 gives an empirical analysis of the sources of unemployment in Namibia. In order to do this, the study uses the structural VAR methodology. The structural VAR is particularly suited to account unequivocally for the contemporaneous interactions among the variables. However, unlike the traditional VAR framework, the corresponding structural VAR gives a specific behavioural interpretation of the dynamics of the system. Therefore, the SVAR allows the examination of how particular macroeconomic shocks are transmitted in the economy.

Chapter 6, which develops the small macroeconometric model, commences by specifying and estimating the basic model, which contains real wages (nominal wages minus prices) productivity, unemployment and interest rates. It is to be noted that interest rates are included in the basic model by virtue of the fact that they directly and indirectly affect demand, exchange rate and monetary channel variables. In addition, that such a model permits the assessment of whether these channels contain additional information, which is important in monetary policy transmission. To test the latter, demand and exchange rate channel variables are appended to the basic model separately and then shocks to monetary policy in these models are analysed under two conditions where, first, the appended variable is treated as endogenous and second, where the appended variable, is exogenous. In the final analysis, the variables that are found to contain important additional information in the monetary transmission process are then appended to the basic model to develop the small macroeconometric model for Namibia.

Chapter 7 presents the concluding remarks of the study. Firstly, the chapter commences by giving a summary of the study. Secondly, the chapter gives a summary of the empirical findings. Thirdly, the chapter presents a discussion of the conclusions and policy implications. Lastly, a brief explanation of the limitations of the study and areas of future research is given.

CHAPTER 2

ECONOMIC AND LABOUR MARKET PERFORMANCE OF NAMIBIA

2.1 INTRODUCTION

The principal aim of this chapter is to provide the background to the Namibian economy with a view to highlighting the key characteristics of the state of the economic system and the policy developments over the period 1980-2013. Additionally, the two chief issues the current chapter is concerned with are the macroeconomic environment and performance of the Namibian labour market. The current chapter, therefore, offers an overview of the macroeconomic performance indicators of the Namibian economy, paying special attention to the functioning of the labour market indicators that are central to the current study. A general analysis of the macroeconomic performance gives a deeper understanding of the relationships among the variables that are used in the models developed later in the study. The study, therefore, provides a detailed discussion of the performance of the Namibian economy, highlighting some of the key challenges that it currently faces. This discourse is presented within the economic policy frameworks that the economy has been following. The chapter also analyses the inflationary environment in Namibia since it plays a very important function in a wage-price-productivity-unemployment relationship, which is the basic relationship used in the current research. The analysis provided in this chapter is primarily based on the Annual reports of the Bank of Namibia (BoN), Reports of the Government of Namibia (GoN), Ministry of Finance (MoF), Labour Force Surveys, World Bank (WB) Reports for Namibia and the National Statistics Agency (NSA) reports.

Given this brief background, the purpose of this chapter is threefold:

(i) to critically evaluate the macroeconomic performance of Namibia.

(ii) to assess the performance of the Namibian labour market.

(iii) to discuss the inflationary environment in Namibia, since it is fundamental to the basic relationship, which forms the basis of the current study.

2.2 OVERVIEW OF THE ECONOMY OF NAMIBIA

2.2.1 Macroeconomic framework for Namibia

To understand the development trajectory for Namibia, it is necessary to understand the various macroeconomic frameworks that Namibia has been following since independence in 1990. According to the National Planning Commission, (2012) Namibia inherited a dual economy at independence, which had four interrelated challenges, namely: low economic growth, a high rate of poverty, inequitable distribution of income and high unemployment levels. The first attempt by the Namibian government in addressing these challenges was the adoption of the Transitional Development Plan in the first five years of independence. In 1995, the first National Development Plan (NDP 1) was developed and implemented, and it ran for five years up to the year 2000. The NDP 1 only focused on the following four objectives: to boost and sustain economic growth, to create employment, to reduce inequalities in income distribution and to reduce poverty (National Planning Commission, 2008, 2012; Malumo, 2012). Both the Transitional Development Plan and the NDP1 primarily focussed on the same challenges.

The third macroeconomic framework that was developed was the National Development Plan 2 (NDP 2) which ran from 2001 to 2006. Among the twenty-one goals that NDP 2 had, four were the same as those of the NDP 1 mentioned above. In addition, the third National Development Plan (NDP 3) was implemented between 2007 and 2011. Furthermore, the Fourth National Development Plan (NDP4) came into being in July 2012 and it is supposed to guide policies until 2016. It should be noted that the three overarching objectives of NDP4 are economic growth, increased income equality and job creation. NDP4 proposes to realise these objectives by utilising industrial policies, which stimulate growth in regional trade logistics, tourism, agriculture and manufacturing (National Planning Commission, 2012). The reduction of extreme poverty and improvements of health, education, business environment and infrastructure, are considered as basic enablers that support the above economic

priorities. NDP4 grants ten preferred results, each complemented by an indicator for determining achievement of the result, broad approaches anticipated to realise the result, and a ministry that will function as the supporter (National Planning Commission, 2012). This selectivity differentiates NDP4 from previous NDPs, whose agendas covered the entire public policy space. In addition, the issues that were targeted by the Transitional Development Plan also featured in all the national development plans (NDP 1, NDP 2, NDP 3 and NDP 4). These macroeconomic frameworks make up the short-term strategies that Namibia has been following. The reason for the same basic goals featured in all the macroeconomic frameworks that were implemented in Namibia, is that each framework has failed to resolve these issues completely. In some cases, the challenges escalated instead of abating. A good example of this is the unemployment rate, which increased to 37.6 per cent in 2008.

As far as the long-term development plans are concerned, Namibia is implementing two such plans, namely, Vision 2030 and the Millennium Development Goals (MDGs). Vision 2030 in Namibia is a long-term development agenda (framework) which outlines the aspirations and objectives of the people of Namibia. Issues central to Vision 2030 are the desire to increase living standards and improve quality of life for the whole population in Namibia. The other central issue that Vision 2030 wants to achieve is that it wants to ensure that Namibia becomes an industrialised nation by 2030. However, for Namibia to achieve this feat it is supposed to achieve a growth rate of 7 per cent per annum. This goal is also similar to what the Millennium Development Goals also aim to achieve.

2.2.2 An analysis of the key macroeconomic indicators

According to Sunde (2013: 53) “since the attainment of independence in 1990, the Namibian government has made great strides to grow the economy, which performed below its potential before independence due to the armed struggle and also the fact that Namibia was considered as an annex or province of South Africa." This demonstrates that, between 1980 and 1989, the average growth rate of Namibia was 3.3 per cent, and the average growth rate for the period 1990 to 2013 was 4.2 per cent, that is, a remarkable improvement from the pre-independence era. Sunde (2013: 53) further adds

that: “After independence in 1990, the government of Namibia made sure that certain economic structures that were not available before independence were developed, and these include a vibrant financial system (financial markets and intermediaries), the Namibia Stock Exchange (NSX), the Bank of Namibia (BoN) just to name but a few."

Table 2-1: Selected Macroeconomic Indicators (Percentages)

YEAR	GDPGR	GNPGR	INFR	M2GR	GINVEG	IMPCVR	INTPTR
1990	2.49	10.74	9.78		44.70		1.34
1991	8.17	10.16	10.89	30.30	-33.32		0.79
1992	7.19	4.24	19.28	46.57	39.03		0.74
1993	-2.01	-0.78	14.14	19.41	-8.21		2.26
1994	7.32	7.02	12.61	30.93	25.64		3.22
1995	4.11	6.79	13.09	22.59	7.81		3.56
1996	3.20	1.07	7.13	24.08	17.77		5.37
1997	4.22	4.00	8.33	8.09	-11.10		6.20
1998	3.29	4.06	2.77	10.55	29.27		7.97
1999	3.37	0.35	5.91	19.50	-0.68	2.71	7.07
2000	3.49	4.90	7.41	13.20	-6.91	2.62	6.22
2001	1.18	-2.80	12.95	6.17	37.37	2.94	7.22
2002	4.79	8.50	1.15	7.99	-9.50	2.58	7.86
2003	4.24	7.37	7.15	9.59	0.75	1.64	8.87
2004	12.27	9.03	4.15	16.11	7.73	1.81	8.80
2005	2.53	0.68	2.26	9.79	6.54	1.23	8.88
2006	7.07	8.15	5.05	29.64	25.48	1.64	7.18
2007	5.37	4.40	6.73	10.17	13.48	2.66	6.29
2008	3.38	2.70	10.35	17.87	2.89	3.17	7.54
2009	-1.09	-0.78	8.78	63.24	-14.17	4.51	8.38
2010	4.43	2.78	4.47	8.04	8.15	3.21	6.24
2011	3.64	7.36	5.05	11.91	4.80	3.02	4.99
2012	4.42	5.38	6.54	11.91	25.18	3.80	4.28
2013	5.1	4.9	6.4	6.27	22.8	2.4	4.21

Source: World Bank Statistics and BoN

where:

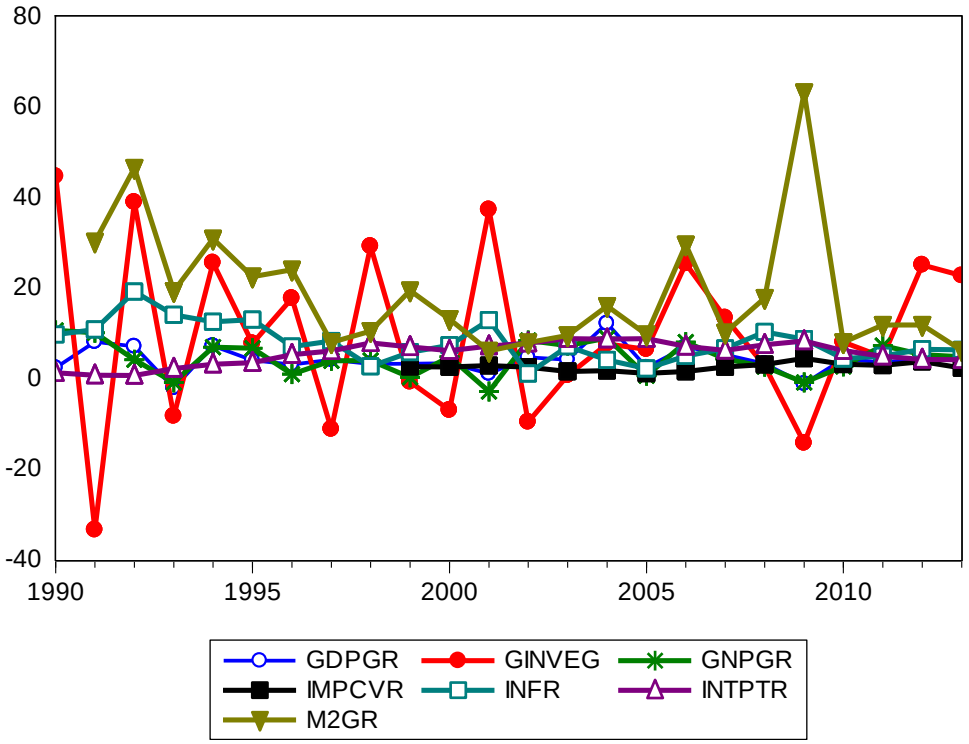
GDPGR	Gross Domestic Product growth
GNPGR	Gross National Product growth
INFR	CPI inflation
M2GR	Broad Money Supply growth
GINVEG	Government Investment Growth
IMPCVR	Import Cover
INTPTR	Interest Payments to Revenue growth

The economy of Namibia has experienced modest economic growth since independence. Before independence, there is virtually very little discussion about simply because the statistics for the majority of the key economic variables are non-existent. The data contained in Table 2-1 and Figure 2-1 indicates that the Namibian economy has been experiencing unstable macroeconomic conditions. The figures show that the average economic growth rate for Namibia is 4.4 per cent; and that the GNP average growth rate is 4.5 per cent. The data shows that the Namibian economy has a high and volatile GDP growth rate and an economic structure that is unable to diversify away from its historic patterns. The volatility and the composition of GDP growth rate could be implicated for the persistently high and mostly growing unemployment rate. Although the Namibian economy has been growing, its growth rates fall short of the growth rates required to become industrialised, as per its Vision 2030. It is noteworthy that Namibia has implemented various economic frameworks since independence as alluded to earlier, and these frameworks have brought significant changes to the structure of the economy. As mentioned earlier, the specific aims common to all the economic frameworks implemented are to boost and sustain economic growth, to create employment, to reduce inequalities in income distribution and to reduce poverty.

The inflation rate was high in the early 1990s, mainly due to a crippling 1992 drought, which affected the greater part of Southern Africa. After 1992, the interest rates steadily declined until they hit a low value of 2.8 per cent in 1998 after which they started escalating again. In 2001, the inflation rate escalated to 12.9 per cent due to another drought experienced in the year 2000/2001. After this drought, the inflation rate fell again until it reached an all-time low of 2.26 per cent in the year 2005. In the year 2008, the inflation rate reached another high of 10.35 per cent, and this was thanks to a combination of factors, namely: the escalating food and oil prices and the global economic crisis. The Bank of Namibia responded to this increase in inflation by consistently reducing the repo rate every quarter in 2009 right through to 2010. The repo rate was reduced from 9 per cent in 2009 to the current 5.5 per cent in 2010. This monetary policy stance can be argued to have helped quell the effects of the global economic crisis on the Namibian economy.

Money supply has consistently grown at a rate that is faster than the growth rate of GDP. Under normal circumstances, this is supposed to lead to an increase in prices since there is too much money chasing too few goods. However, the Namibia situation is peculiar in that the Namibian dollar is pegged to the South African Rand, and that the Namibian economy is minute when compared to the South African economy in terms of the Gross Domestic Product, trade, among other variables.

Figure 2-2: Percentage growth Rates of Selected Macroeconomic Indicators



Source: World Bank Statistics

The implication is that the value of the Namibian dollar is only influenced by the value of the South African Rand and nothing else. Government investment growth is another variable that needs to be explained since it is important as far as infrastructure development is concerned. The average growth rate over the period 1990 to 2013 is 4.2 per cent and that is quite impressive. In addition, the imports cover for the period 2008 to 2011 whose data is shown in Table 2-1, is healthy which implies that Namibia was doing very well concerning the generation of foreign exchange during this period. In addition, the exchange rate for Namibia has also remained stable for the period under review, mainly due to the pegging of the Namibian dollar to the South African Rand.

2.2.3 Comparison of Namibia's growth with other regions and countries

Table 2-2 indicates that world growth was 5.2 per cent in 2010 and in 2011, 2012 and 2013 it was 3.9, 3.2 and 3.0 respectively. These figures were quite impressive given the slowdown that had occurred in 2008 and 2009 due to the global economic crisis. As indicated, global growth, slowed to 3.2 per cent in 2012 from the 3.9 per cent recorded in the previous year as advanced, emerging markets, and developing economies experienced a slowdown in the level of economic activity.

Table 2-2 also shows that growth in **advanced economies** decelerated in 2013, to 1.3 percent, from 3, 1.7, and 1.5 in percent in 2010, 2011 and 2012, despite the fact that both the US and Japan posted better outturns in 2012 and 2013 compared to 2011 as the Euro zone slipped back into recession. Growth in the US accelerated from the 1.8 per cent recorded in 2011 to 2.8 per cent in 2012, while Japan registered an expansion of 2.0 per cent having witnessed a decline of 0.6 per cent in 2011. However, this was not enough to compensate for the weakness witnessed in the Euro zone, where the growth of 1.5 per cent recorded in 2011 was reversed as economic activity contracted by 0.6 and 0.4 percent in 2012 and 2013 respectively.

The economic growth in **emerging markets** and developing economies also decelerated in 2012, to 4.9 per cent from 6.2 percent in 2011. The deceleration was largely due to the slowdown experienced in China, where growth declined from the 9.3 per cent in 2011 to 7.7 per cent to mark the weakest rate of expansion since 1999.

Table 2-2: Real GDP growth (percentage) - global

REGION OR COUNTRY	2010	2011	2012	2013
World	**5.2**	**3.9**	**3.2**	**3.0**
Advanced economies	**3.0**	**1.7**	**1.5**	**1.3**
Euro area	2.0	1.5	-0.6	-0.4
United States	2.5	1.8	2.8	1.9
Japan	4.7	-0.6	2.0	1.7
Emerging market and developing economies	**7.5**	**6.2**	**4.9**	**4.7**
China	10.4	9.3	7.7	7.7
Brazil	7.5	2.7	0.9	2.3
Russia	4.5	4.3	3.4	1.5
India	10.5	6.3	3.2	4.4
Namibia	**4.4**	**3.6**	**4.4**	**4.4**

Source: IMF World Economic Outlook (2013) and Namibia Statistical Agency (NSA)

Weaker growth in other BRICS countries, however, also contributed to the slowdown experienced by emerging market and developing countries, with Brazil posting growth of just 0.9 percent in 2012 (down from 2.7 percent in 2011), Russia expanding by 3.4 per cent (down from 4.3 per cent in 2011) and India grew by just 3.2 per cent (down from 6.3 per cent in 2011).

A comparison of the GDP growth rate for Namibia and the average growth rate of the world economies indicates that in 2010 and 2011, the world economies grew by an average that was higher than the growth rate of Namibia; but in 2012 and 2013, the Namibian economy grew by rates that were above the world average growth rates. In comparison with the advanced economies, Namibia grew by higher rates in all the years. In addition, the growth rate for Namibia falls short of the average growth rates of the emerging markets and developing countries. The one feature that distinguishes Namibia from other developing countries is that its agriculture, particularly crop farming, is weak and this can be attributed to weather and climatic conditions in Namibia not conducive for crop farming. This one factor explains why the growth rates in Namibia do not compare favourably with other emerging markets and developing countries. In addition, China is the only country that consistently grew at rates higher than Namibia did in all the years.

2.2.4 Comparison of Namibia's fiscal balances with other regions and countries

Table 2-3 shows the comparison of global fiscal balances and budget deficits for selected economies during the period the world experienced the global economic crisis. For the majority of the countries shown in the table, their debts rose in 2009 and then began to fall after 2010. This is the case with the advanced economies, the United States of America (USA), the Euro Area, the United Kingdom (UK), emerging and developing economies, other European countries, Russia, China, Latin America and Caribbean countries and Brazil. What these figures show is that the global economic crises spurred world economies to borrow so that they could deal with the negative effects the crisis was likely to have on their economies. The world overall fiscal balance shown mirrors the pattern described above. As far as fiscal balances and budget deficits are concerned, Namibia compares favourably with the other countries and

regions shown in the table. The figures show that Namibia has not over borrowed and that it still has the fiscal space to finance development. This is not surprising because Namibia was upgraded from being a low-income country to a middle-income country in 2009. Such upgrades are only accorded to countries whose macroeconomic performance is improving and whose macroeconomic indicators are stable. Table 2-3 indicates that Namibia experiences smaller deficits when compared to the Advanced Economies, United States of America, Japan, United Kingdom and India.

Table 2-3: Global fiscal balances and budget deficits for selected economies as a percentage of GDP

REGION/COUNTRY	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
World Overall Fiscal Balance	**-2.2**	**-7.4**	**-5.9**	**-4.5**	**-4**	**-3.2**
Advanced Economies	**-3.5**	**-8.9**	**-7.7**	**-6.5**	**5.9**	**-4.3**
United States	-6.5	-12.9	-10.8	-9.7	-8.3	-5.8
Euro Area	**--2.1**	**-6.4**	**-6.2**	**-4.2**	**-3.7**	**-3.0**
Japan	-4.1	-10.4	-9.3	-9.9	-10.1	-8.2
United Kingdom	-5.0	-11.3	-10.0	-7.8	-7.9	-5.8
Canada	-0.3	-4.5	-4.9	-3.7	-3.4	-3.0
Other Advanced Economies	2.9	-0.9	-0.2	0.4	0.4	0.1
Emerging Markets and Developing Countries	**-0.1**	**-4.6**	**-3.1**	**-1.7**	**-2.1**	**-1.5**
Namibia*	**2.0**	**-1.2**	**-4.6**	**-7.0**	**0.1**	**-5.4**
South Africa*	1.7	-1.2	-4.2	-3.6	-4.2	-4.4
Europe: Other	0.5	-6.1	-4.1	0	-0.7	-1.6
Russia	4.9	-6.3	-3.4	1.5	0.4	-1.3
China	-0.7	-3.1	-1.5	-1.3	-2.2	-0.9
India	-10.0	-9.8	-8.4	-8.5	-8.0	-7.2
Latin America and Caribbean	-0.7	-3.6	-2.8	-2.4	-2.5	-3.4
Brazil	-1.3	-3.1	-2.7	-2.5	-2.7	-3.3

Source: IMF Fiscal Monitor, October 2013. *Notes: Data for Namibia and South Africa is sourced from the Ministry of Finance and National Treasury, respectively, and it refers to budget balances instead of fiscal balances. The data for Namibia and South Africa refer to fiscal years.

2.2.5 Supply Side Developments

The real sector of the Namibian economy is comprised of three major productive sectors, namely, the primary sector (predominantly agriculture, fishing and mining), the secondary sector (including manufacturing and construction) and the tertiary sector (alternatively called the service sector). The service sector in Namibia includes the following: wholesale and retail trade, hotels and restaurants, transport and communication, financial intermediation, real estate and business service and public sector administration. Table 2-4 and Figure 2-2 show that for the entire period under consideration, the value added contribution of the service sector to GDP is consistently the highest, followed by the secondary sector and then the primary sector. The average value added contributions of the primary, secondary and tertiary sectors for the period 1990 to 2013 are 10.43 per cent, 31.02 per cent and 58.44 per cent respectively. In addition, the contribution of agriculture to value added as a percentage of GDP ranged between 7.87 per cent and 12.76 per cent, implying that there were no significant policy shifts during the period 1990 to 2013. The fact that the primary sector is contributing the least to value added as a percentage of GDP is not surprising in Namibia because Namibia is a drought prone country, and many regions of the country are not adequately suited for crop farming but sufficient for animal husbandry.

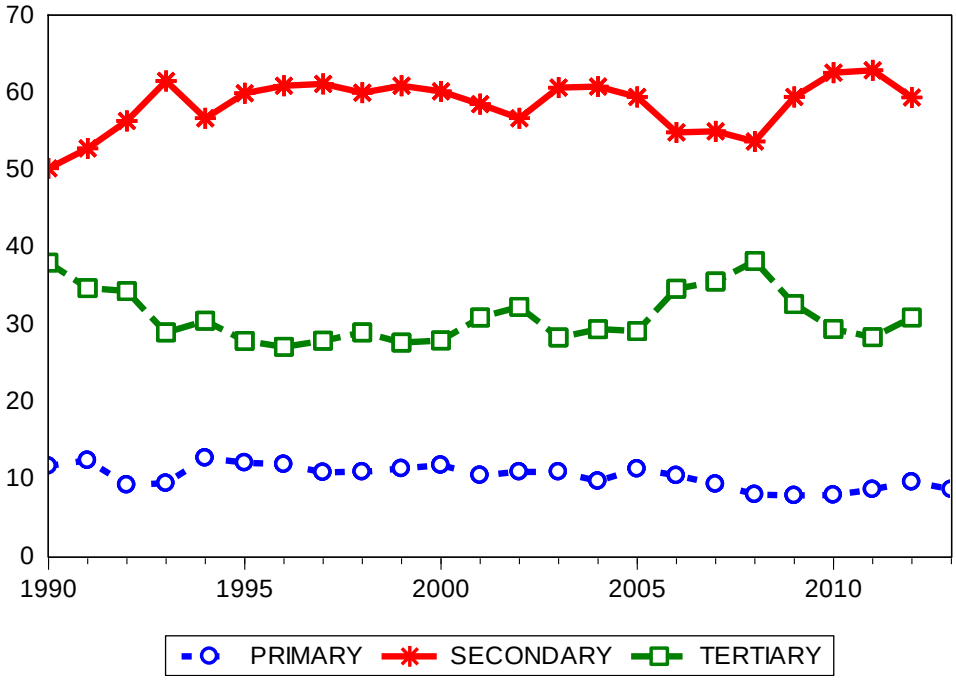
Table 2-4: Value added by major production sectors as a percentage of GDP

Years	Primary Sector	Tertiary Sector	Secondary Sector
1990	11.72	50.25	38.04
1991	12.44	52.85	34.71
1992	9.27	56.38	34.35
1993	9.47	61.55	28.98
1994	12.76	56.73	30.51
1995	12.11	59.99	27.90
1996	11.93	60.94	27.12
1997	10.90	61.18	27.92
1998	10.97	60.04	28.98
1999	11.37	60.95	27.68
2000	11.82	60.22	27.96
2001	10.51	58.57	30.92
2002	10.94	56.74	32.32
2003	10.94	60.71	28.35
2004	9.74	60.84	29.42
2005	11.33	59.50	29.18
2006	10.47	54.89	34.64

2007	9.36	55.04	35.60
2008	8.02	53.74	38.24
2009	7.87	59.48	32.65
2010	7.96	62.62	29.43
2011	8.68	62.94	28.38
2012	9.63	59.43	30.93
2013	8.66	59.08	32.24

Source: World Bank Statistics

Figure 2-3: Value added by major production sectors as a percentage of GDP



Source: Namibia Statistical Agency (NSA)

The regions that are suited for limited crop agriculture include northern regions, such as, Omusati, Oshana, Okavango, Kaprivi, Ohangwena and Oshikoto (see the regional map of Namibia under Appendix 2).

The contribution of value added to GDP by the secondary sector ranges between 27.68 and 38.24 per cent for the entire period. This also implies that the macroeconomic frameworks that Namibia implemented from independence onwards engendered no major shifts in sectoral growths. Additionally, there were also no major changes as far as the value added contribution of the service sector to GDP is concerned. The service sector is the main contributor to value added as a percentage of GDP, and the retail,

financial, and tourism and hospitality services are fundamental to this sector in Namibia. The pattern that prevailed concerning the contributions of these three sectors to GDP and the magnitude of their contribution has not changed significantly since independence. This suggests the ineffectiveness of the macroeconomic frameworks Namibia adopted and implemented since independence since there were no major shifts in sectoral growths.

2.2.6 Demand Side Developments

If a broader perspective is taken, the national accounts reveal a fascinating feature of the economy. Comparing economic activities from the supply and demand sides show quite transparently that the economy is supply driven, and demand constrained. The fact that throughout the period under investigation, GDP was greater than consumption expenditure by an average of 58 per cent illustrates the latter. This indicates that the economy is saving because its income is greater than its consumption expenditure. Another interesting feature shown in Table 2-5 and Figure 2-3 is the relationship between imports and exports in Namibia.

Table 2-5: Aggregate demand components (million USD, 2005=100)

YEAR	GDP	Government	Consumption	Investment	Imports	Exports
1990	3783.22	941.22	3019.25	572.146	1163.00	1085.00
1991	4092.42	1051.92	2525.76	442.637	1149.00	1213.00
1992	4386.69	1122.18	2440.85	618.273	1283.00	1341.00
1993	4298.58	1130.04	1653.39	652.896	1326.00	1240.00
1994	4613.07	1146.91	2351.31	697.353	1412.00	1308.00
1995	4802.83	1177.90	2123.24	802.797	1616.00	1409.00
1996	4956.29	1208.583	2342.55	942.154	1670.00	1418.00
1997	5165.33	1257.37	2877.35	816.761	1753.00	1338.00
1998	5335.42	1296.03	3214.31	1015.679	1648.00	1232.00
1999	5515.35	1354.02	2981.37	1058.142	1610.00	1234.00
2000	5707.75	1371.20	3253.85	962.957	1550.00	1320.00
2001	5775.12	1411.09	3498.00	1302.660	1547.00	1179.00
2002	6051.58	1374.80	3016.04	1292.615	1470.00	1071.60
2003	6308.13	1417.94	3647.08	1232.513	1980.00	1262.00
2004	7082.25	1488.31	3932.97	1304.471	2395.63	1827.00
2005	7261.30	1400.31	4421.23	1351.401	2577.47	2070.00
2006	7774.89	1554.91	4049.85	1753.840	2884.13	2646.66
2007	8192.74	1749.40	5028.31	1966.916	3520.00	2921.62
2008	8469.36	1855.89	5973.45	2109.186	4340.00	3140.53

2009	8377.10	1968.54	6131.84	1876.845	4980.00	3146.31
2010	8902.64	2087.36	6024.44	2033.276	5570.00	4025.52
2011	9407.93	2139.38	6060.14	2479.657	6360.00	4406.85
2012	9879.87	2170.26	7640.82	3011.333	6750.00	4100.00
2013	10003.00	2221.48	6851.90	2725.329	6405.10	4639.00

Source: World Bank Statistics

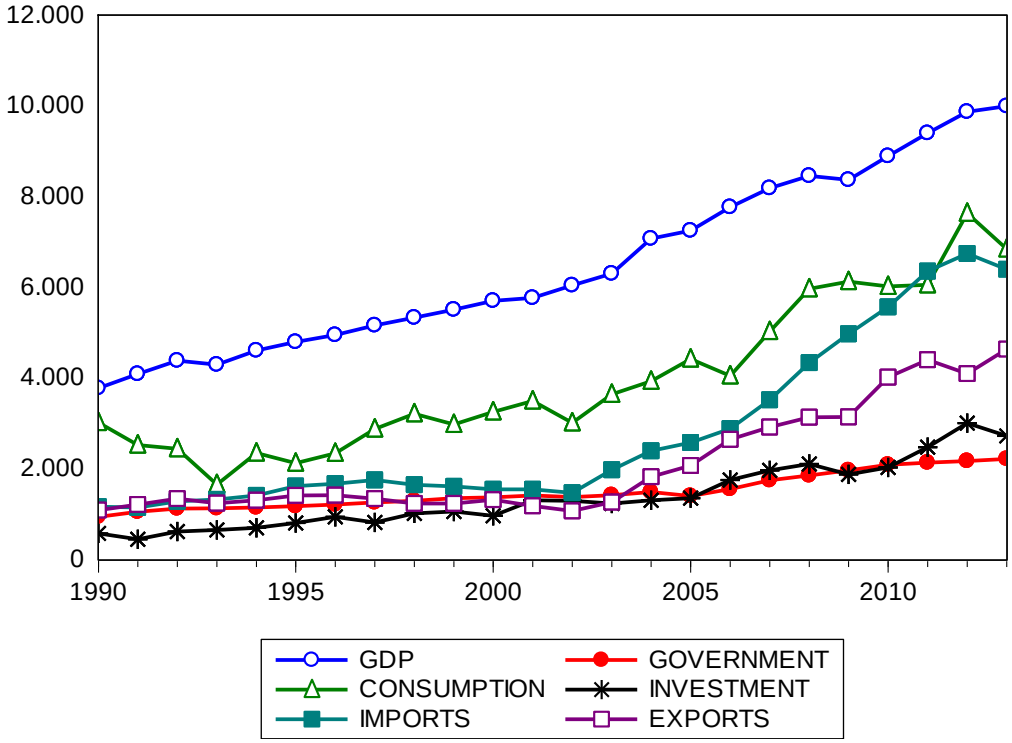
For the entire duration being studied, imports were consistently greater than exports and this is not sustainable in the long run. If the economy continues to experience the trade deficits, there will come a time when the sources being used to finance the deficits will dry up and this may lead the economy into an economic downturn. It is, therefore, advisable that the government pursues some policies that promote exports while at the same time ensuring that critical imports needed to grow the economy are adequate.

Between 1990 and 2002, both imports and exports were relatively stable, growing at moderately very slow rates. In addition, between 1990 and 2006, although imports were greater than exports, the gap between them was very small averaging only 20 percent per year. However, from 2007 onwards, the gap between imports and exports started widening, and between 2007 and 2013, it averaged at 44 percent per year. In addition, if the economy fails to make exports greater than imports, then it should aim to balance its trade or just oscillate around the trade balance region.

From 1990 to 2005, government expenditure was greater than gross investment; between 2006 and 2009, gross investment was greater than government expenditure and between 2005 and 2010, the gap between government expenditure and gross investment was small. It is to be noted that when the gross investment is greater than government expenditure the economy is likely to grow faster and vice versa. Higher government expenditure in a developing country simply means that the majority of the resources are going towards the operational expenses and not to the productive sector. Efforts should be made to ensure that the majority of the government resources are channelled towards investment and not towards government expenditure.

It is also interesting to note that the largest component of aggregate demand in Namibia is consumption, and the second largest component is imports. The third largest component of aggregate demand is exports, and the fourth and fifth largest components are government expenditure and investment respectively. It should also be noted that consumption is the largest component of aggregate demand in almost all economies and, government expenditure and exports sometimes switch places between the second and third positions. The fact that imports are greater than exports throughout the period in question means that Namibia has a negative current account balance and it is therefore using more money to import than the money it is generating through exports. Namibia needs to reverse this trend through seriously promoting agriculture and industrialisation since the current scenario is untenable in the long term. The government also needs to increase aggregate investment if it wishes to see an increased economic growth rate in future. Investment is the foundation the economy needs to grow, so it has to be financed and promoted.

Figure 2-4: Aggregate demand components (million USD, 2005=100)

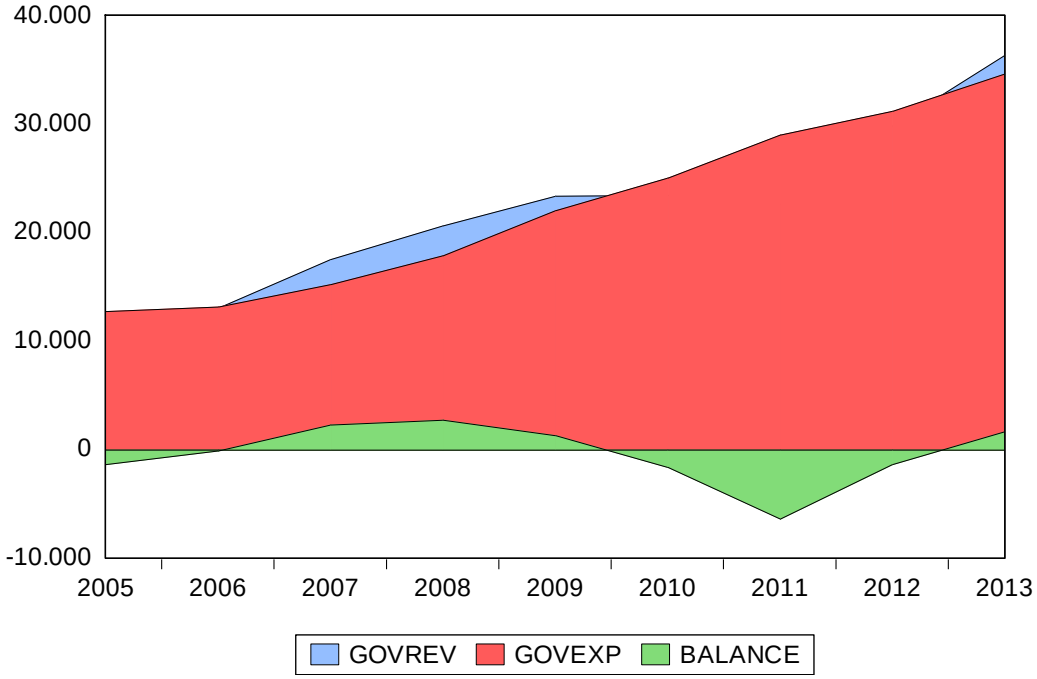


Source: World Bank Statistics

2.2.7 Fiscal developments

The Namibian government has always been very frugal as far as its fiscal management is concerned. This is reflected by the fact that the average budget balance during the period 2005 to 2013 is a negative 295 million Namibian dollars, which is very small, by any standard. This implies that the Namibian government has largely been trying to live within its means and in the process avoiding over-burdening future generations with debt. Between the period 2005 and 2013, Namibia experienced 5 years of surpluses and 4 years of deficits. The government revenue definition used in this analysis refers to total government receipts excluding grants. Government revenue is mainly composed of customs revenue and the various taxes of which customs revenue comprises a third of the total revenue. Fiscal control has often been a principal policy option for Namibia despite the slight loss of sovereignty engendered by the common tariff of the SACU arrangement. Figures 2-4 and 2-5 below show a summary of the position of government finances from 2005 to 2013.

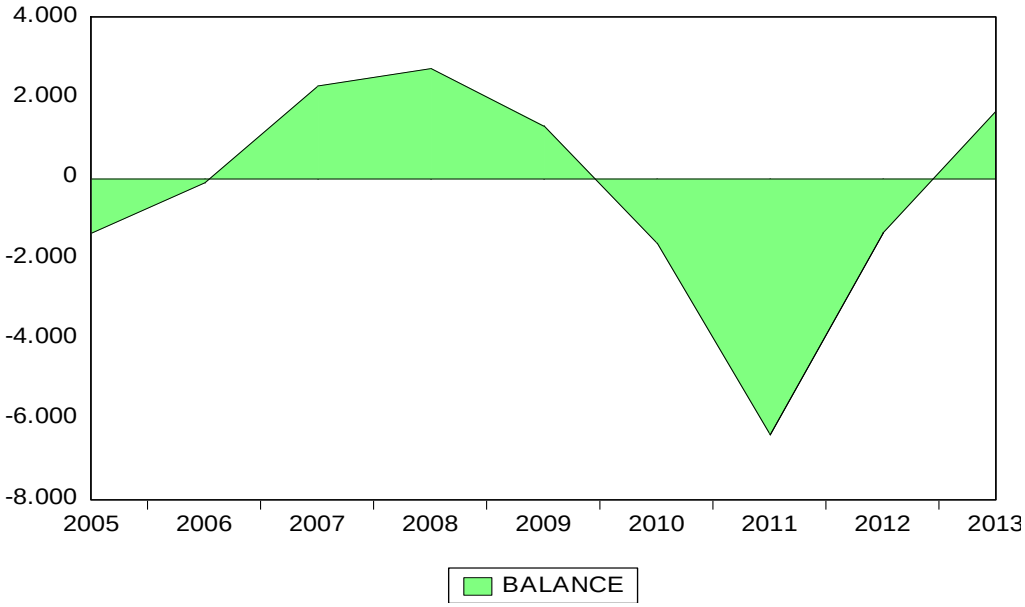
Figure 2-5: Government revenue, government expenditure and the budget balance (in millions of Namibian dollars)



Source: Namibia Statistical Agency

The figure above shows the government revenue (GOVREN), government expenditure (GOVEXP) and the budget balance (BALANCE). The years where the blue colour is visible are the years when the government experienced budget surpluses. Moreover, the areas where the blue colour is not visible indicate that the country experienced budget deficits. In the same diagram, the green colour, which denotes the budget balance, is divided by a straight horizontal line running through point 0 on the vertical axis. Parts of the green colour above this line denote the positive budget balance (surpluses), the parts below the line denote the negative budget balance (deficits) and as explained earlier, the deficits are heavier from 2009 to 2012. The budget balance is separately shown in Figure 2-5 below. In this figure, the parts of the diagram above the zero line are the surpluses and those parts below the zero line, are the deficits.

Figure 2-6: Budget balance in millions of Namibian dollars



Source: Own calculation

Arguments can be advanced to the effect that Namibia could have used its fiscal space to create public sector employment through the funding of public sector projects and hence reduce unemployment. Additionally, it could have availed some funds to the commercial and specialised banks so that they could give start up loans and other loans to the Small and Medium Scale Enterprises and businesses that want to expand their operations respectively (Mwinga, 2012; Kanyenze et al., 2012). It is also interesting to note that unemployment was increasing despite the fact that all the macroeconomic

frameworks that Namibia implemented after independence had the reduction of unemployment as one of their main objectives. From the year 2008, the Namibian government started to use its healthy fiscal position to try to create employment for the Namibians and this appears to be bearing fruit. Consequently, the government embarked on a major fiscal expansion since the year 2009 to cushion the economy from the effects of the global financial and economic downturn. Furthermore, fiscal expansion was further reinforced in 2011 with the introduction of the Targeted Intervention Programme for Employment and Economic Growth (TIPEEG) as a medium-term measure to address high unemployment and support long-term economic growth through targeted investment in strategic economic infrastructure. This programme is supposed to run until 2016 under the Medium Term Expenditure Framework (MTEF).

The fiscal expansion undertaken since 2008 offered necessary support to the economy, with a mild recession of 1.1 percent only experienced during 2009. Economic growth has since rebounded, but the pace of economic activity remains subdued.

Given the reduced growth outlook and weakened fiscal space, the medium-term challenge for fiscal policy in Namibia is to maintain a judicious balance between the need to support growth and ensure that the benefits of fiscal consolidation are not reversed. A narrow window of fiscal manoeuvre exists for Governments to render policy support to economic activity, while ensuring that public debt remains within sustainable levels. The countries, which have achieved an appreciable level of fiscal space because of fiscal consolidation and emerging growth, are encouraged to undertake limited fiscal expansion to support economic recovery.

2.2.8 Monetary developments

As alluded to in section 2.2.7, Namibia enjoyed budget surpluses for the greater part of the period under consideration, and this implies that it has not yet over-borrowed from both the domestic and international markets. Significant government deposits with the banking system help to ease government borrowing from the banking sector and shift domestic financial resources in favour of the private sector, which does not happen

when the government competes for loans from the domestic market with the private sector. However, treasury bills have become the principal instruments of monetary control and government short-term financing. Between 2008 and 2012, the government has run fiscal deficits. The government incurred deficits after 2009 because it wanted to counteract the negative effects of the recession caused by the global economic crisis in 2008. Nevertheless, from 2011 onwards the government implemented the TIPEEG, which demanded a lot in terms of fiscal resources. In Namibia, money (M1) is defined as the addition of currency outside banks and demand deposits other than those of central government. In addition, broad money (M2) is defined as the sum of currency outside the banks, demand deposits other than those of the central government, the time, savings and foreign currency deposits of resident sectors other than the central government; bank and traveller's checks; and other securities such as certificates of deposit and commercial paper. Both M1 and M2 (measured in local currency units) increased by 3501 per cent between 1990 and 2010 and this is thanks to inflation and the consistent growth of the economy during this period. It is to be noted that in all the years the net foreign assets are positive they contribute the largest share to money supply. Although the net domestic assets are positive in all the years, their contribution to money supply is very small.

The argument for the need to increase money supply is that if the level of economic activity for a growing economy increases, the amount of money needed to conduct transactions escalates. Both the net domestic and foreign assets escalated during the years indicated in Table 2-6. In spite of this, the net foreign assets, however, were negative in 1995 and 2005. Furthermore, the patterns of figures, which relate to domestic credit provided by the banking sector as a percentage of GDP and domestic credit to the private sector as a percentage of GDP are similar and do not change by huge margins after 2005.

Taking into account the fact that real GDP has been increasing in Namibia, this implies that the volume of credit escalated by huge margins. This is partly what has led to the stable economic growth, prices and money supply.

Table 2-6: Monetary aggregates (million Namibian dollars) and related statistics (%)

Monetary aggregate	Year				
	1990	1995	2000	2005	2010
Net foreign assets	341	-325	2 656	-158	20 607
Net domestic assets	1.19	7.0	11.6	25.7	43.1
Money supply (M1)	614	1 760	5 752	9 408	24 053
Money supply (M2)	1 477	5 407	10 845	17 370	53 194
	Percentages				
Domestic credit to private sector (% of GDP)	22.57	49.29	39.79	51.81	50.12
Claims on private sector (annual growth as % of broad money)	15.38	30.50	16.26	25.31	8.39
Broad money (% of GDP)	24.30	42.56	39.98	37.62	65.56
Interest rate spread (lending rate minus deposit rate, %)	10.60	7.67	7.89	4.37	4.72

Source: International Monetary Fund, International Financial Statistics and data files

2.2.8.1 Monetary policy in Namibia

Namibia does not have total control and flexibility in the conduct of fiscal, monetary and other policies. This inflexibility and limited control of economic policy can be attributed largely to prevailing institutional arrangements. In particular, the membership of Namibia to the Common Monetary Area (CMA) and the Southern Africa Customs Union (SACU) effectually means that it cannot have autonomous monetary and fiscal policies that are the leading tools of economic management. It should be noted that the principal objective of monetary policy in Namibia is to achieve and maintain price stability. It is noted that Namibia is a member of the CMA, which replaced the Rand Monetary Area (RMA) of 1974 in 1986. In addition, it is also noteworthy that the potency of monetary policy is to a large degree circumscribed by this arrangement. Since the Namibian dollar is pegged to the Rand (which also circulates in the economy), Namibia has circumscribed control over money supply and none over the exchange rate. To the degree that the Namibian dollar is fully backed by the Rand, the BoN (Bank of Namibia) can issue the Namibian dollars only if it has sufficient backing of Rand deposits. The only problem with this arrangement is that if SA sneezes,

Namibia catches a cold. In spite of this, the drought prone and weak supply side Namibia has gained a lot from the CMA arrangement, in terms of price stabilisation. If Namibia's currency was not pegged to a stronger currency, it is most likely that it will be much weaker than it currently is due to Namibia's recurrent droughts and weak supply side.

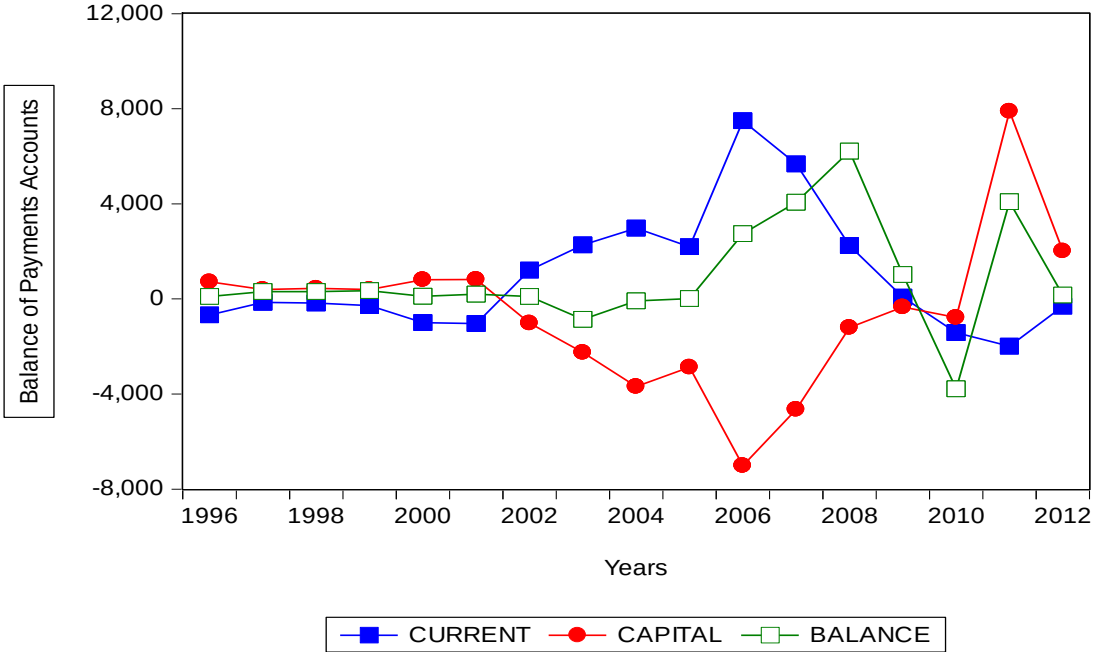
2.2.9 The external position of the economy

The external position of the economy is best explained by the balance of payments account (BoP). The balance of payments account is defined as the record of transactions between Namibia and the rest of the world. Figure 2-6 below, shows the summary of the major BoP accounts for the Namibian economy from 1996 to 2012 in millions of Namibian dollars. In addition, Table 2-7 indicates the major BoP aggregates also in millions of Namibian dollars. Figure 2-6 and Table 2-7 both show that the current account balance was positive in 2008 and 2009 and negative between 2010 and 2012. The negative balances in the capital account and vice versa offset the positive balances in the current account. The position of the BoP for the period 2008 and 2012, is shown in Table 2-7. Merchandise trade is negative between 2008 and 2012, and this is because imports are consistently greater than exports during this period. This is not surprising because Namibia has a weak supply side and this is what makes it import the majority of its consumer goods from other countries, particularly South Africa. Another interesting aspect to note is that during this period the world economies were being negatively affected by the global economic crisis and the Eurozone crisis, which started in 2008 and 2010 respectively. Consequently, exports from developing economies like Namibia to the developed world decelerated remarkably.

The overall balance of payments (excluding valuation adjustments) recorded surpluses between 2008 and 2012 except in 2010. The surplus recorded in 2012 was N$156 million compared to a surplus of N$4.1 billion in 2011. A significant reduction in capital and financial account inflows and deficits in the current account, contributed to this development. In addition, the international investment position of Namibia did not show a very clear trend during this period simply because even though it increased in 2009, it remained negative. Furthermore, the capital and financial account increased

by more than 1000% in 2011, decreased by slightly more than 70% in 2012 and then remained positive.

Figure 2-7: Summary of major accounts of the Balance of Payments (million N$)



Source: Bank of Namibia

Direct investment shows that the inflows into Namibia were by far more than the outflows out of Namibia. Thus, direct investment was positive throughout the five years as presented in Table 2-7. The information in Table 2-7 shows that Namibia has a healthy balance of payments account since the overall balance is generally positive except for the year 2010. This is despite the fact that the time period considered relates to the years when the world economies were reeling from the effects of the global economic crisis. Table 2-7 further strengthens the fact that exports are smaller than imports and the country is consistently running a trade deficit. The table also shows the fact that the capital account performed very well during the period in question and this is what resulted in a positive overall balance in four of the five years considered. A negative overall balance in the balance of payments was only experienced in 2010 and, all the other years between 2009 and 2013 had positive overall balances.

Table 2-7: Major balance of payments aggregates (N$ million)

	2009	2010	2011	2012	2013
Merchandise trade balance	**-10,340**	**-8,187**	**-8,199**	**-17,753**	**-19,196**
Exports fob	26,274	29,364	31,944	35,835	44,809
Imports fob	-36,614	-37,551	-40,143	-53,588	-64,005
Services (net)	**596**	**-348**	**-276**	**-166**	**-2,258**
Credit	5,446	4,982	5,375	5,558	5,489
Debit	-4,850	-5,330	-5,651	-5,724	-7,747
Compensation of employees (net)	**-34**	**-112**	**-102**	**-56**	**-55**
Credit	67	67	67	67	67
Debit	-101	-178	-168	-123	-121
Investment income (net)	**-1,539**	**-3,661**	**-2,784**	**-3,008**	**-1,136**
Credit	1,935	1,239	1,624	1,421	1,822
Debit	-3,474	-4,900	-4,408	-4,429	-2,958
Current transfers in cash and kind (net)	**10,042**	**8,888**	**8,340**	**12,977**	**15,216**
Credit	10,670	9,525	8,909	13,838	16,218
Debit	-628	-636	-569	-861	-1,002
Current Account Balance	**-1284**	**-3,424**	**-3,025**	**-8,010**	**-7,433**
Net capital transfers	**558**	**808**	**1,353**	**1,218**	**1,246**
Credit	628	878	1,426	1,293	1,321
Debit	-70	-70	-74	-75	-75
Direct investment	**4,448**	**5,773**	**5,886**	**7,125**	**6,829**
Abroad	24	-33	-39	52	79
In Namibia	4,424	5,806	5,925	7,073	6,750
Portfolio investment	**-5,201**	**-4,633**	**224**	**-4,480**	**-4,476**
Assets	-5,244	-4,675	-3,747	-5,404	-4,639
Liabilities	44	42	3,971	924	163
Other investment - long term	**4,719**	**490**	**1,997**	**321**	**4,993**
Assets	143	200	-25	239	329
Liabilities	4,576	290	2,022	83	4,663
Other investment - short term	**-1,381**	**-541**	**-890**	**2,298**	**-1,451**
Assets	-1,438	451	-359	1,972	-1,958
Liabilities	57	-993	-531	326	507
Capital and financial account excluding reserves	**3,144**	**1,897**	**8,571**	**6,482**	**7,142**
Net errors and omissions	**-838**	**-2,267**	**-1,432**	**1,759**	**888**
Overall balance	**1,022**	**-3,794**	**4,114**	**231**	**598**
Reserve assets (including valuation adjustment)	**-1,022**	**3,794**	**-4,114**	**-231**	**-598**

Source: Bank of Namibia

Section 2.3 is going to discuss the labour market performance of Namibia for the period 1990 to 2012. The section also compares the performance of Namibia's labour market with the performance of the other SACU countries and selected middle-income countries.

2.3 THE NAMIBIAN LABOUR MARKET

This chapter will be incomplete if it does not discuss the performance of the labour market in Namibia, since the labour market forms the basis for the current research. In addition to the macroeconomic indicators discussed above, the chapter also discusses the other macroeconomic indicators that are closely linked to the current research, namely unemployment, employment and the labour force. The current section, therefore, delves into the unemployment-employment profile for Namibia and attempts to compare Namibia with SACU and selected middle-income countries. Though the

labour market statistics are scanty, inferences can be made based on surveys regularly conducted by the National Statistical Agency (NSA) (formerly executed by the National Planning Commission (NPC). Given an estimated average population growth of 2.15 per cent, labour force growth of 2.88 per cent and an average employment growth of 2.54 per cent between 1990 and 2013, it is not surprising that unemployment reduction has been one of the focuses of government since the beginning of the 1990s. The NLFS (2012) shows that 66.39 per cent of the population aged 15 years and above in Namibia is in the economically active group, which forms the labour force, while 31 per cent is outside the labour force.

2.3.1 Unemployment in Namibia

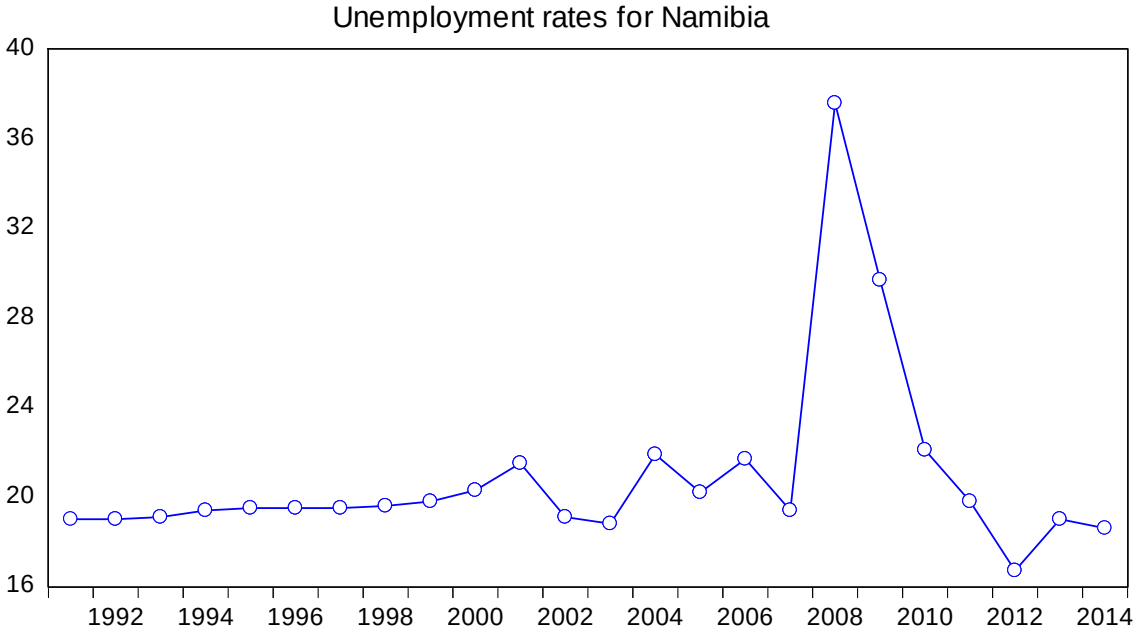
Namibia inherited a country that already showed high unemployment at independence, which stood at 19 percent. In 1991, unemployment decreased to 19 percent, and thereafter started to escalate insignificantly up to 2007. Today, the unemployment rate in Namibia is about 3 percent lower than what it was at independence in 1990. To get a clearer picture of the historical record of unemployment, this section attempts to provide some stylised facts. Namibia has developed different economic frameworks after independence, with the reduction of unemployment as one of their main goals. Although the policy stance adopted in 2009 has helped to reduce unemployment below its 1990 level, it has failed to lessen it below the 10 percent mark.

Unemployment was generally stable between 1990 and 2007. During this time, the unemployment rate oscillated insignificantly and after 2007, unemployment increased drastically and this can be blamed on the rising food and oil prices and, the onset of the global economic crisis. The upward trend in unemployment which started in 2007, only ended in 2008 when the unemployment rate reached an all-time high of 36.7 percent, after which it consistently and significantly started to fall.

In 2009, Namibia changed its monetary policy stance and started to reduce its repo rate systematically, which led to reduction in lending rates. The loosening of the monetary policy was principally engendered by escalating global oil and food prices and the onset of the global economic crisis. Thus, this measure was meant to counteract the

effects of these three phenomena and save the economy from falling into a recession. The fall in the interest rates meant that the cost of borrowing had gone down, which spurred businesses to start borrowing and investing. From 2008 onwards, the fall in the unemployment rate appears to mirror the fall in the lending rates, which were also being influenced by the fall in the repo rate. The current unemployment rates indicate that unemployment has actually fallen below its 1990 to 2007 average.

Figure 2-8: Unemployment rates for Namibia



Source: Namibia Labour force surveys and interpolation

While analysing the regional diversity and differences across demographic groups are interesting features of the Namibian unemployment, they are beyond the scope of macroeconometric analysis of this thesis. It is to be noted that the Namibian unemployment rate is affected by numerous macroeconomic shocks, which may have an impact on unemployment. The next section analyses the basic indicators of the Namibian labour market since the attainment of independence.

2.3.2 Types of Unemployment

It is always important to make a distinction between the various types and states of unemployment. This section considers the relevant issues of frictional, structural and cyclical issues of unemployment. Policy makers should know at all times which type

and state of unemployment are predominant in the country in order to devise appropriate policy prescriptions.

2.3.2.1 Structural unemployment

Structural unemployment is long-lived and is not sensitive to changes in aggregate demand. It refers to the overall inability or inflexibility of the economy to provide or create employment due to structural imbalances in the economy. Structural unemployment is believed to be caused by structural factors such as the nature of the educational system and its interface with the needs of the labour market (i.e., the skills mismatch problem), technical change and the use of capital-intensive techniques of production, permanent shifts in the demand for goods and services, especially, in export markets, the skill mix of the labour force and available job opportunities (Mwinga, 2012). He further suggests that the unemployment experienced in Namibia is largely structural in nature. This is because even during periods of high economic growth, employment opportunities do not increase faster, that is the employment intensity in Namibia is very low (no positive relationship between economic growth and employment growth).

2.3.2.2 Cyclical unemployment

Cyclical unemployment is associated with cycles and is associated with cyclical factors such as the fluctuations in aggregate domestic and foreign demand for goods and services (Mwinga, 2012). It surfaces during the periods of economic depressions and disappears at the times of troughs and booms. Cyclical unemployment varies from structural and frictional unemployment in that it is tied to short-term economic fluctuations.

2.3.2.3 Seasonal unemployment

Seasonal unemployment arises from seasonal variations, for example due to changes in climatic conditions. As an example, farmers may be fully employed during cultivation, planting, weeding and harvesting times, but unemployed at other periods. This type of unemployment is very common in Namibia because of the effects of climatic and weather conditions on the agriculture and fishing sectors.

2.3.2.4 Frictional unemployment

Frictional unemployment may be regarded as a subset of structural unemployment, mainly reflecting temporary unemployment spells because of job search and matching difficulties in connection with quits, new entries to the labour market. At any given time, there are workers changing jobs while others are leaving or entering the labour force. Since the flow of labour market information is imperfect, employers and workers are not matched instantaneously; it takes time to locate available jobs. Ordinarily, this kind of unemployment does not usually pose much threat to individual's welfare, as it is temporary in nature.

2.3.3 POTENTIAL MISMATCH BETWEEN SKILLS AND JOBS

2.3.3.1 Meaning of skill mismatch

Skill mismatch is a specific consequence of the intricate interplay between skill supply and demand within a market economy, both of which are frequently affected by adjustment lags and market failures and are shaped by the prevailing contextual conditions (demographics, technological progress, institutional settings) (European Commission, 2012b, p. 352).

Skill mismatch exhibits itself principally in a situation where unemployment coincides with unfilled vacancies due to a shortfall of suitably skilled workers (Barlevy, 2011). At the same time, skill obsolescence or skills gaps among employees can be another manifestation of a skill mismatch, either quantitative or qualitative in nature. Di Pietro and Urwin (2006) defined quantitative discrepancies as the lack of sufficiently qualified school leavers or job seekers in a sector as a whole, or where there are not enough vacancies to make use of that supply. Qualitative discrepancies occur where there is both sufficient supply of labour and a sufficient number of vacancies, but where the demands and wishes of - potential - employees and employers regarding skills, job requirements, working conditions or work content diverge (European Commission, 2012b, p. 352; Manacorda and Petrongolo, 1999; Di Pietro and Urwin, 2006).

More country-specific factors such as demographics, the economic structure and progressing technology cannot be ignored. Skill mismatch can also exist without imbalances between skill supply and demand, as a result of information asymmetries or other matching frictions on the labour market. The potential outcomes of skill mismatch, which may include growth and productivity losses, or consequences with regard to social capital and social inclusion.

2.3.3.2 Potential solutions to skill mismatch

European Commission (2012b) and Di Pietro and Urwin (2006) argued that policy instruments targeting skill mismatch must take this complex interplay of factors into account; analysis of policy instruments also needs to start from a framework within which skill mismatch challenges can be embedded. The European Commission added that this enables assessment and comparison of possible solutions (policy measures and programmes). They are the three broad solution pathways to structure and characterise skill mismatch policy instruments (European Commission, 2012b):

(i) Target the unemployed to develop unused skill reserves. From a skill mismatch perspective, a distinction can be made between persons having difficulties entering the labour market, because they lack more generic professional skills, and unemployed people whose skills could be upgraded to the specific skills demands of hard-to-fill vacancies;

(ii) Target the skills of groups in education and training, to be able to match their future skills better to (future) labour market needs. This solution includes the creation of new specific learning paths, campaigns stimulating people to choose educational paths in sectors with shortages, and structural improvement of the education to labour market transition;

(iii) Targeting existing employees, to optimise their potential as well reduce the risk of them involuntarily leaving the labour market. Solutions may include the introduction of training and retraining programmes and providing better career perspectives for employees. Policies or measures on wage and working conditions are relevant, but only if they relate to skill matching.

While the first solution pathway directly aims to reduce unemployment, the second and third options can be seen as policies to prevent it. Considering both types of policies implies that curative and preventive skill mismatch policies targeting unemployment are addressed in this study (European Commission, 2012b, p. 352).

It should also be noted that the faster pace of digital technological change within a globalised economy is compounding the problem of skills mismatch to both economic theoreticians in general and macroeconometric modelling in particular. In addition, nowadays it is very feasible both theoretically and empirically to have robust economic growth in a given country and yet at the same time unemployment can rise and coexist with employment vacancies. This appears to be the case in Namibia. It should be noted that if the introduction of greater mechanisation in sectors such as agriculture is making great contribution to output, then the gap in education and skills imply that the free hands from agriculture will not be employed elsewhere. In other words, the re-invention of the economy towards other sectors leads to a shortage of qualified labour. The economy most probably may need to re-invent itself in terms of higher skills tertiary sector. Only if the higher labour force numbers are matched by an increase in skills will unemployment decrease overtime. Despite the potential relevance of skills mismatch as an explanation of unemployment in Namibia, the current study is not going to incorporate it in its analysis. This may therefore be considered as a weakness associated with the current study, which needs to be tackled by future researchers.

2.3.4 Basic indicators of the labour market since 1993

The current subsection highlights basic indicators of the labour market in Namibia and the changes that have taken place over the years from 2004 to 2013. The analysis starts in the year 1993/4 because that is the first year post independence during which Namibia started carrying out labour market related surveys. Table 2-8 below summarises labour market indicators for Namibia for all the years the labour surveys were conducted in post-independence Namibia. These figures acted as a guide in the interpolation and extrapolation of some of the unemployment variables that are fundamental to the current study. The population of people who are 15 years or older in

Namibia shows an upward trend and it grew by 50.8 per cent over the period 1993/4-2013. Table 2-8 also indicates that the labour force and the labour force participation rates grew by 66.39 and 17.85 per cent respectively over the period 1997-2013. The indigenous Namibians can partially attribute these growths to increased access to education after independence. Before independence, only minority groups had unfettered access to quality education.

Table 2-8 also indicates that the numbers of the employed and unemployed people have been increasing steadily over the years and they increased by 79.88 and 30.84 per cent respectively. What is surprising is that unemployment has also been increasing in the face of an average economic growth rate of 4.4 per cent between 1990 and 2013.

Table 2-8: Basic labour market indicators from labour force surveys

Variable/Year	1993/4	1997	2000	2004	2008	2012	2013
Population (older than 15 years)	871965	972157	1024110	1067219	1082249	1106854	1315662
Labour force	521821	612618	652484	608610	678 680	868268	980781
Unemployed population	171541	211416	220634	223281	255184	238174	290762
Employed population	350280	401203	431850	385329	331444	630094	690019
Unemployment rate	32.9	34.5	33.8	36.7	37.6	16.7	19
Labour force participation rate	56	54.9	56.4	54	55.4	66.0	59.9

Source: Namibia Labour Force Surveys (NLFS)

The reason why this moderate average economic growth rate has not created jobs, is that growth after independence has largely been attributed to growth in the mining sector which is heavily capital intensive (Mwinga, 2012). It has also been argued that for the Namibian economy to create enough jobs that assist reduce the level of unemployment it has to grow at an average rate of seven per cent per annum. The figures also denote that unemployment increased by 4.86 per cent between 1993/4 and 1997, declined by 2.03 per cent between 1997 and 2000, increased by 8.58 and 2.45 per cent between 2000 and 2004, and 2004 and 2008 respectively, and then declined by 27.1 per cent between 2008 and 2013. In addition, the average growth of the unemployment rate for the entire period was a negative 2.65 per cent.

Table 2-9 also contains information about labour force, employment, and unemployment derived from the labour force surveys conducted in Namibia since independence, as alluded to earlier. The difference between Table 2-8 and 2-9 is that Table 2-9 goes a step further to give a breakdown of these variables between sexes and between the urban and rural areas. Table 2-9 shows that female unemployment rate is higher than male unemployment for all the years in both urban and rural areas.

Another point to note is that male labour force and employment figures are greater than female labour force for all the years shown. In addition, the unemployment rates for both sexes are greater in rural areas than in urban areas, except in 2012 where the opposite is true. This could be because of unemployment measurement errors that took place in the year 2008, which estimated the unemployment rate in Namibia to be 51.3 per cent. According to Mwinga (2012), the overestimation of unemployment was engendered by the timing of the labour force surveys, which were executed in August when most people who work in the seasonal agricultural sector, were out of work. Additionally, Mwinga (2012) also argues that the broad definition of unemployment was used and it contributed towards the generation of inflated unemployment rate. The above scenario is not surprising in that data is unavailable, scanty or incorrectly measured in some developing countries and this creates intractable difficulties for the economic researchers who want to study the performance of the economies of these countries.

Table 2-9: Labour force, employment and unemployment

SURVEY/ AREA	TOTAL				FEMALES				MALES			
	Employed (No.)	Unemployed (No.)	Labour Force (No.)	Unemployment Rate (%)	Employed (No.)	Unemployed (No.)	Labour Force (No.)	Unemployment Rate (%)	Employed (No.)	Unemployed (No.)	Labour Force (No.)	Unemployment Rate(%)
1993/94	**NHIES**											
Urban	134407	62124	196531	31.6	56001	37087	93088	39.8	78406	25037	103443	24.2
Rural	215873	109417	325290	33.6	107547	68812	176358	39	108327	40605	148932	27.3
National	**350 280**	**171 541**	**521 821**	32.9	**163 547**	**105 899**	**269 446**	39.3	**186 733**	**65 642**	**252 375**	26
1997	**NLFS**											
Urban	178033	85472	263504	32.4	72209	46792	119001	39.3	105824	36680	144503	26.8
Rural	223170	125944	349114	36.1	109546	76618	186165	41.2	113624	49326	162950	30.3
National	**401 203**	**211 416**	**612 618**	34.5	**181 755**	**123 410**	**305 165**	40.4	**219 447**	**88 006**	**307 453**	28.6
2000	**NLFS**											

Urban	201 985	91 934	293 919	31.3	91 416	54 213	145 629	37.2	110 569	37 721	148 290	25.4
Rural	229 865	128 700	358 565	35.9	113 606	77 071	190 677	40.4	116 529	51 629	167 888	30.8
National	**431 850**	**220 634**	**652 484**	33.8	**205 021**	**131 284**	**336 305**	39	**226 828**	**89 350**	**316 178**	28.3
2004	**NLFS**											
Urban	219 974	89 726	309 700	29	98 889	50 549	149 438	33.8	121 085	39 177	160 262	24.4
Rural	165 355	133 554	298 909	44.7	69 788	78 623	148 711	53	95 567	54 932	150 499	36.5
National	**385 329**	**223 281**	**608 610**	36.7	**168 677**	**129 172**	**298 149**	43.4	**216 652**	**94 109**	**310 761**	30.3
2008	**NLFS**											
Urban	208 075	91 960	300 035	30.6	93 678	52 081	145 760	35.7	114 397	39 878	154 275	25.8
Rural	123 369	107 610	230 979	46.6	51672	57 710	109 382	52.8	71 696	49 900	121 596	41.0
National	**331 444**	**199 570**	**531 014**	**37.6**	**145 351**	**109 791**	**255 142**	**43.0**	**186 093**	**89 778**	**275 871**	**32.5**
2012	**NLFS**											
Urban	354 763	140 185	494 948	28.3	160 457	81 314	241 771	33.6	194 306	58 871	253 177	23.3
Rural	275 330	97 989	373 319	26.2	139 933	58 858	198 791	29.6	135 397	39 131	174 528	22.4
National	**630 094**	**238 174**	**868 268**	**27.4**	**300 390**	**140172**	**440 562**	**31.8**	**329 704**	**98 002**	**427 706**	**22.9**
2013	**NLFS**											
Urban	367 662	151 309	518 971	29.2								
Rural	322 357	139 453	461 810	30.2								
National	**690 019**	**290 762**	**980 781**	**29.6**	**344 727**	**170 550**	**415 277**	**41.1**	**345 292**	**120 212**	**465 504**	**25.8**

Sources: Ministry of Labour and Social Welfare (1997; 2000; 2004; 2008; 2012, 2014) and Odada (2008: 52)
National Housing Income and Expenditure Survey (NHIES)
Namibia Labour Force Survey (NLFS)

It is to be noted that unemployment represents a waste of resources, a cost to the economy in terms of lost income, and without jobs, most people are excluded from taking advantage of opportunities created by the economy. Namibia faces an unemployment problem with the unemployment rate at 27.4 per cent in 2012, falling from 37.6 per cent in 2008. This reduction can be attributed to the expansionary monetary and fiscal policies that the country adopted as a way of counteracting the effect of the global economic crisis. In some of the successive years in Table 2-9, not only is the country failing to create new jobs, but also existing jobs are being reduced. As alluded to earlier, Namibia still suffers from the problem of poor quality labour statistics. Poor quality labour statistics make international comparisons difficult, misinform policy makers and make it difficult to evaluate the effectiveness of policies toward achievements of targeted goals.

The other fact that needs to be highlighted is that despite the fact that 51 per cent of Namibia's population is comprised of females, the employment numbers show that the majority of people employed are males for all the years shown in Table 2-9. The statistics show that 53 per cent of the people employed in the 1993/4 survey were males and 47 per cent were females. In 1997, 55 per cent of the employed people in Namibia were males and 45 per cent were females. In the year 2000, 53 per cent of the employed people were males and 47 per cent were females. The years 2004, 2008 and 2012 also show that 56, 56 and 52 percent respectively of the people employed were males. The fact that more males are employed when their population is actually smaller than that of females in Namibia is not surprising. The reasons can be categorised into three parts. The first reason is that in the past parents in Namibia were more inclined to educate the male child as opposed to the female child and this circumscribed the employability of the girl child. The other reason is that in the recent past, there were no laws that promoted gender equality in Namibia and the role of women was child bearing and looking after the family homestead. The third and last reason is that in the past, the laws that used to exist were discriminatory against women; for instance, women were not allowed to own land and property as these were the preserve of men. These are some of the reasons, which explain why more males are employed in Namibia even if the country has more females than males.

2.3.5 Namibia's labour market performance compared to SACU countries

Namibia is a member of the Southern African Customs Union (SACU), which came into existence on 11 December 1969 with the signature of the Customs Union Agreement between South Africa, Botswana (B), Lesotho (L), Namibia (N) and Swaziland (S). The SACU agreement entered into force on the 1st of March 1970, thereby replacing the Customs Union Agreement of 1910. SACU is the oldest Customs Union in the world.

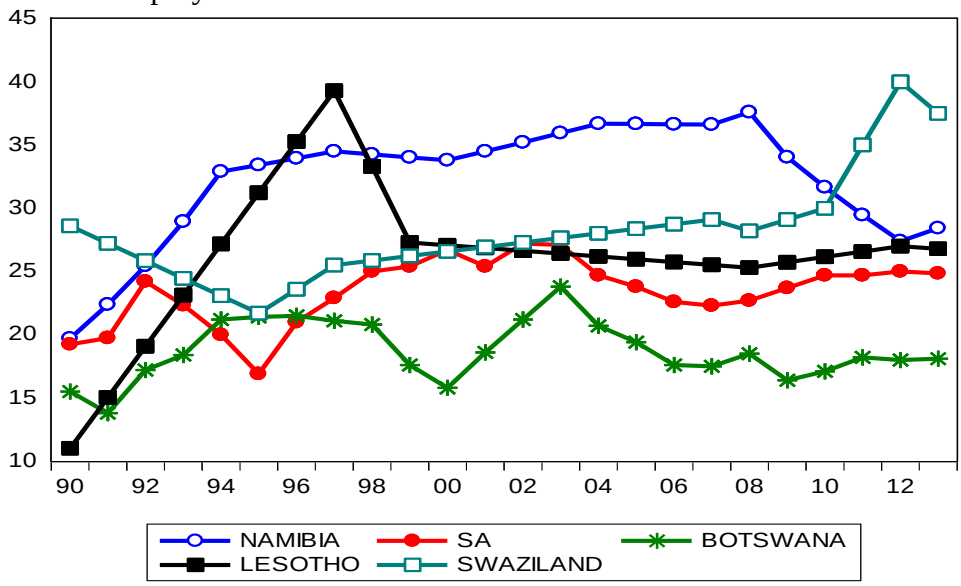
The aim of SACU is to maintain free interchange of goods between member nations. SACU nations charge a common external tariff when they trade with non-member countries. The agreed arrangement is that all customs and excise collected in the common customs area are paid into South Africa' national Revenue Fund (Langton,

2008). The revenue collected is then shared among the SACU nations, according to the agreed revenue-sharing formula. The SACU nations have concurred that South Africa has to be the custodian of the SACU revenue pool. The BLNS state get their SACU revenue share first and South Africa receives the residual (Langton, 2008). It should be noted that SACU revenue make up a considerable share of the state revenue of the BLNS countries. For example, in Namibia, the SACU revenue constitutes, on average, a third of the government revenue.

Langton (2008) argued that after the founding of the Government of National Unity in South Africa in April 1994, Member States agreed that the contemporary Agreement should be renegotiated in order to democratise SACU and address existing needs of the SACU Member States. He went on to say that the Ministers of Trade and Industry of the five member states met in Pretoria on 11 November 1994 to discuss the renegotiation of the 1969 agreement. He further added that the Ministers appointed a Customs Union Task Team (CUTT), which was mandated to make recommendations to the Ministers. CUTT members met on numerous occasions in the various Members States and made good progress in the renegotiation process. In the meeting of Trade Ministers and Finance Departments of the five SACU Member nations, held on September 5, 2000, the Ministers unanimously agreed on the principles of institutional reform in SACU (Langton, 2008).

Given the fact that the SACU countries trade more with each other and share the revenue receipts that they generate through trade with non-SACU members, this arrangement bring them close together. It is against this background that the current section attempts to compare the performance of key labour market variables for Namibia and other SACU countries. The variables utilised in the comparisons are unemployment, employment and the labour force. These three variables were chosen because of the central roles they play as labour statistics and for the sake of being pithy. The statistics shown indicate that unemployment increased in all the SACU countries between 1990 and 2012.

Figure 2-9: Unemployment rates for SACU countries



Source: WBS and NSA

Figure 2-10: SACU countries average unemployment rates for the period 1990-2013

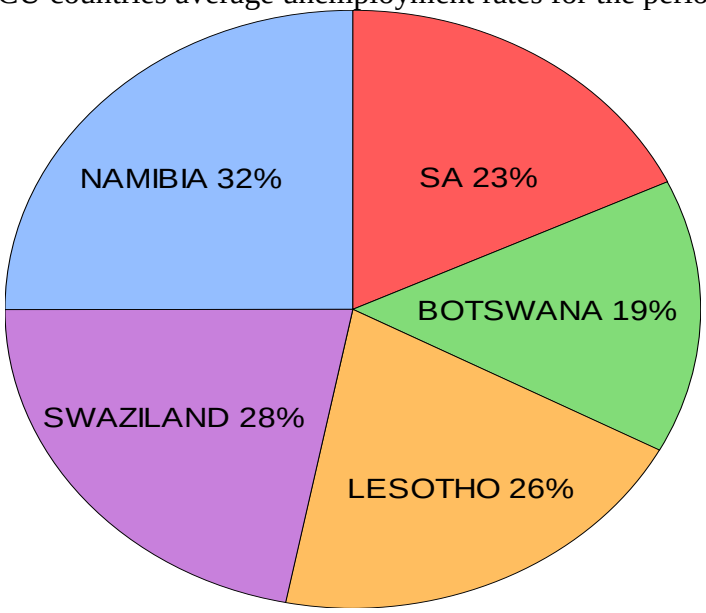


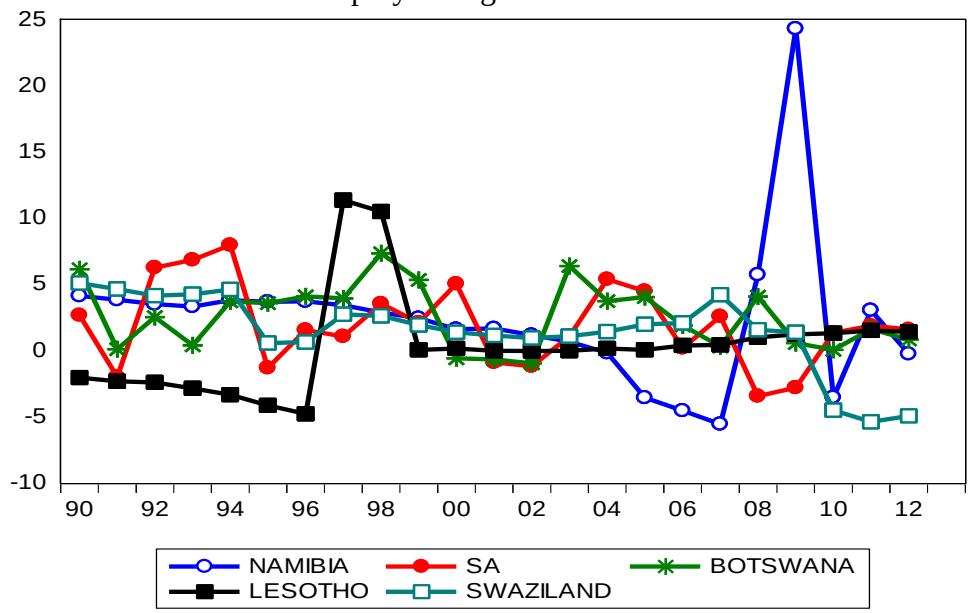
Figure 2-8 shows that unemployment in Namibia increased from 19.30 per cent in 1990 to 27.60 per cent in 2013; this constitutes an increase of 39 per cent. In addition, the unemployment rates for South Africa, Botswana, Lesotho and Swaziland increased by 39, 16, 145 and 40 per cent respectively. This means that highest increase in unemployment was experienced in Lesotho followed by Swaziland; Namibia is third. Botswana and South Africa enjoy the lowest and the second lowest increases in unemployment rates, respectively, between the period 1990 and 2013. Figure 2-9 is a

summary of the average of SACU countries unemployment rates for the period 1990-2013. The average unemployment rates reveal a different picture in that Namibia has the highest average unemployment rate of 32.4 per cent. Swaziland has the second highest average unemployment rate of 27.7 per cent, followed by Lesotho with 26.2 per cent, followed by South Africa with 23.4 per cent; Botswana, just as before, has the lowest average unemployment rate of 18.8 per cent. It can be seen that the increase in unemployment rates between the years 1990 and 2013 show that Namibia's unemployment grew by 39 per cent, which places it as third among the SACU countries. Looking at average unemployment, Namibia has the highest average unemployment among the SACU countries. This means that unemployment in Namibia has been, on average, consistently higher than in all other countries.

The annual employment growth rates and the average employment growth rates for the period 1990 to 2013 are shown in Figures 2-10 and 2-11 respectively. In this case, there is no country with a consistently higher employment growth rate than the rest. The employment growth rate in Namibia in 1991 was about 4.1 per cent; it was this high mainly because it was just after independence and the government was still busy putting in place structures and, therefore, creating jobs in various sectors of the economy. In 2012, the employment growth rate for Namibia was 3.1 per cent. The employment growth rates in South Africa in 1991 and 2013 were 2.67 and 1.88 per cent respectively. In addition, the employment growth rates for Botswana, Lesotho and Swaziland in 1991 and 2013 were 6.15 and 1.63, -2.03 and 1.52, and, 5.11 and -5.37 respectively. The negative signs that appear in some of the years indicate that some jobs were lost in these countries in the respective years. Almost all of the countries had years in which jobs were lost, because they all have years in which the employment growth rates were negative. The average employment growth rates for all the SACU countries for the period 1990 to 2013 are summarised in Figure 2-11. The summary indicates that Botswana is the one that on average realised the highest average employment growth of 2.63 per cent during the period 1990 to 2013. Namibia realised the second highest average employment growth rate of 2.54 during the same period. The other three SACU countries realised average growth rates of less than 2 per cent with South Africa, Swaziland and Lesotho realising 1.93, 1.76 and 0.29 per cent

respectively. In spite of this impressive, average employment growth rate for Namibia, unemployment still remains very high which implies that the rates at which jobs are being created needs to be increased drastically.

Figure 2-11: SACU countries employment growth rates



Source: WBS

Figure 2-12: SACU countries' average employment growth for the period 1990-2013

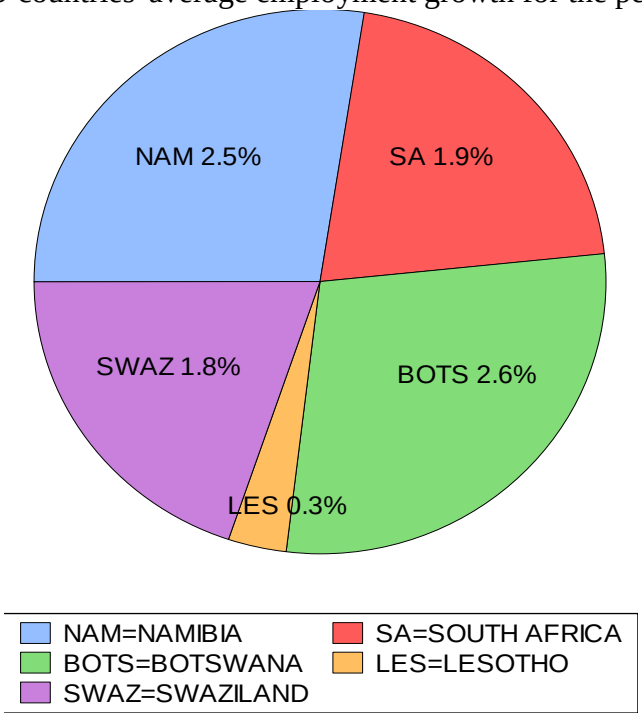


Figure 2-12 shows the average labour force growth rates for the SACU countries during the period 1990-2013. Namibia, Botswana and Swaziland consistently had positive labour force growth rates for the entire period, while South Africa and Lesotho had negative labour force growth rates in some of the years. The Figure shows that the average labour force growth rate for Namibia for the period 1990 to 2013 is 2.88 per cent, which is greater than the employment growth rate shown in Figure 2-10. Average labour force growth rate for South Africa is 2.25 per cent, which is also greater than its average employment growth rate.

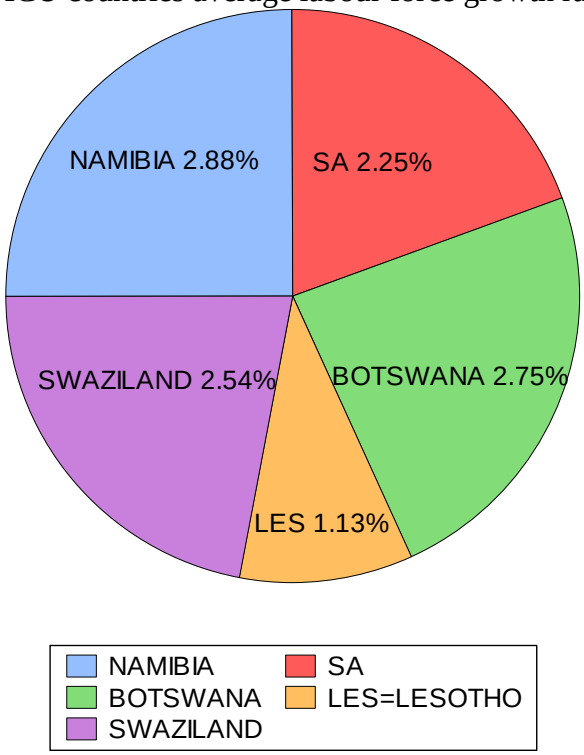
In addition, Botswana, Lesotho and Swaziland have average labour force growth rates of 2.75, 1.13 and 2.54 per cent, which is greater than their employment growth rates of 2.6, 0.3 and 1.8 per cent respectively. In all these SACU countries, if the creation of new jobs is not enhanced to the extent that the countries end up with average employment growth rates that are greater than their average labour force growth rates, the unemployment rates which are already high will get exacerbated. In terms of the gap between average labour force growth rates and employment growth rates Botswana has the smallest gap of 0.15 per cent, followed by South Africa with 0.35 per cent and Namibia with 0.38 per cent. Swaziland and Lesotho have gaps of 0.74 and 0.83 per cent respectively.

From the analysis done in this section, it can be observed that the country that performed best in terms of the average unemployment rate for the period 1990 to 2013 is Botswana, which had an average unemployment rate of 19 percent. Namibia and Swaziland had the highest average unemployment rates of 32 and 28 percent, respectively, which makes them the worst performers amongst the SACU countries. The average employment growth rates between 1990 and 2013 give an idea about the employment generation capacity of SACU countries. Botswana had the highest average employment growth rate of 2.6 percent, followed by Namibia with 2.5 percent.

The worst performers in terms of average employment rates were Swaziland and Lesotho with 1.8 and 0.3 percent respectively. The labour force growth rates were

compared with employment growth rates and it was discovered that all countries had labour force growth rates that were higher than employment growth rates.

Figure 2-13: SACU countries average labour force growth rates: 1990-2013



Employment growth rates were subtracted from labour force growth rates to determine average rates by which unemployment grew during the period 1990-2013. This calculation established that Botswana had the lowest average unemployment growth rate of 0.15 percent between 1990 and 2013. In the second position, is South Africa with an average unemployment growth rate of 0.35 percent, followed by Namibia with 0.38 percent, and then followed by Swaziland with 0.74 percent. The worst performing country on the average unemployment growth rate totem pole is Lesotho with 0.83 percent unemployment growth. Of the three middle-income countries within SACU (Namibia, South Africa and Botswana), Namibia was the worst performer in terms of the average unemployment rates and the average unemployment growth rates.

2.4 THE INFLATIONARY ENVIRONMMENT IN NAMIBIA

It is essential to review economic conditions surrounding the behaviour of wages and prices in Namibia since early 1990s. Information about the inflationary environment is

critical in discussions about modelling approaches and development, which are dealt with later on.

2.4.1 Namibia's inflation performance

Namibia's economy is closely linked to South Africa's economy through trade, investment and common monetary policies. The Namibian dollar is pegged to the South African Rand, making economic trends (including inflation) closely follow those in South Africa. Prior to the 2009 global financial crisis, Namibia had experienced steady growth, moderate inflation, limited public debt and steady export earnings. Gross domestic product (GDP) declined by 1.1% in 2009, primarily because of declining external demand for diamonds, gold, and agricultural exports.

The counter-cyclical macroeconomic policies adopted by the BoN dampened these shocks to some extent. In the wake of the crisis, Namibia launched an ambitious fiscal expansion aimed at stimulating job creation, with central government spending rising by 20% per year on average since the 2010 fiscal year. Output rebounded quickly, growing at 6.6% in 2010 and it has moderated between four and five per cent since then. Inflation fell after the onset of the crisis, bottoming out at 3.1% in February 2011, and oscillated within a range of 5.5–7.5% since the beginning of 2012. The government debt has grown rapidly, in part, due to successful bond issues on international markets, and is expected to peak at 30% of GDP in 2014 (BoN, 2014).

The period 1990 to 1995 was characterised by double-digit inflation rates with the highest rate of 17.9 per cent experienced in the 1991/1992 agricultural season, and this was mainly because of drought that affected the whole of Southern Africa. After 1992, the inflation rate was on a downward trend and the lowest inflation rate of 2.3 per cent was experienced in 2004. In 2001, another drought related high of 11.3 per cent was experienced. Inflation increased to about 10.3 per cent in 2007 principally because of the increases in the world food, oil prices and the global economic crisis. According to the Bank of Namibia (BoN) (2012), approximately 80 per cent of goods and services from which the CPI is calculated, comprise imports from South Africa (SA). The implication of the pegging of the Namibian dollar to the South African Rand is that

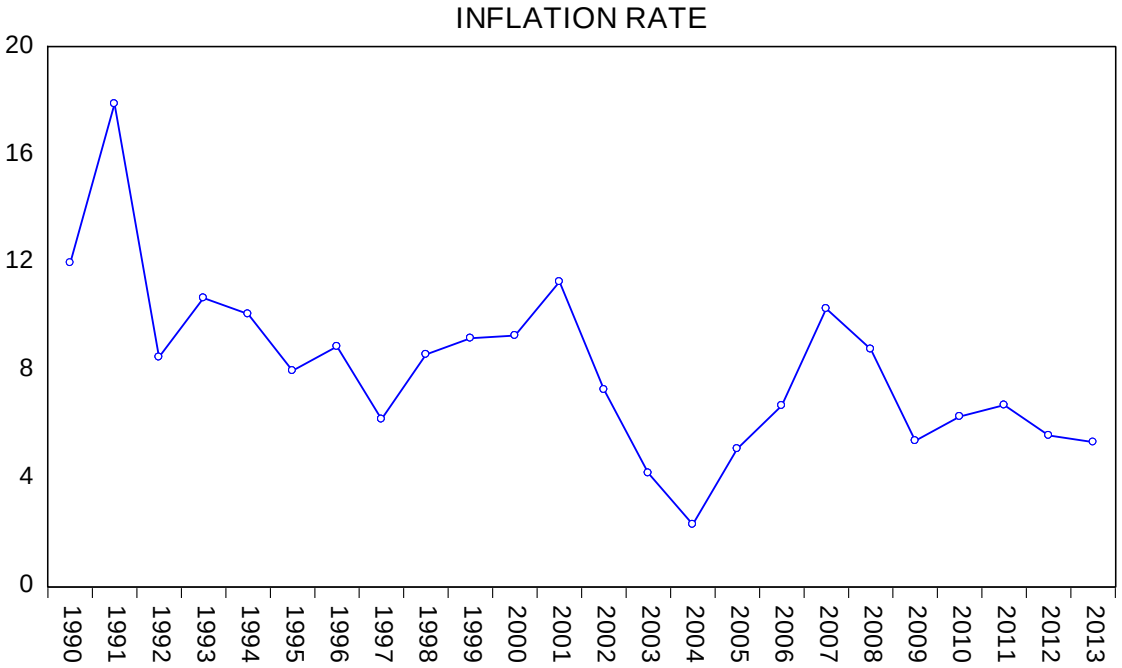
imported inflation and exchange rate dynamics in SA pass through to domestic prices, and, justify the majority of the changes in domestic prices. Moreover, this does not rule out the impact of pressure from aggregate demand in spite of efforts to reign in through tight monetary policy and wage restraints. Despite the fact that authorities have not had much leverage with respect to monetary policy, it is to be noted that general price developments were in tandem with stable money supply growth during the period being studied.

As mentioned earlier, since 1990, there has been conscious efforts by policy makers at the BoN to utilise the unanticipated seriousness of the 1991/92 drought induced recession and the associated deceleration in real output to realise a structural downward shift in inflation. As mentioned earlier, single digit inflation has not always been a feature of the Namibian economic landscape. In addition, the largest swings in inflation in Namibia have been associated with droughts, but of late, it looks as if the drought is having very little effect on inflation. During the 2012/13 agricultural season, Namibia experienced a drought, and this drought never significantly affected the inflation rates in Namibia as they remained between 5.5 and 7.5 per cent as alluded to earlier on. While inflation remains one of the policy goals, the objective of monetary policy is a mixture of controlling monetary aggregates, interest rates, the exchange rate (pegged one to one to the Rand) the balance of payments and economic growth.

The floating of the Rand and hence the Namibian dollar since the pre independence era in both Namibia and SA, however, further emphasise the importance of international factors in determining the rate of domestic price inflation. This is because exchange rate flexibility was accompanied by a series of depreciations and appreciations in the Rand from 1990 to 2013. In the case where the Rand depreciated it increased domestic currency denominated import prices and placed upward pressure on price inflation. The opposite is true in cases where the Rand appreciated. In addition, movements in the exchange rate become more important to inflation as the openness of the economy increased over time. On a number of occasions the Namibian government has managed to tame inflation, this led to its fall from 1990 to reach its lowest value of 2.3 per cent in 2004. After 2004, inflation increased to reach another high of about 10.3 per cent in

2007. Due to the counter-cyclical policies adopted from 2009 onwards, inflation started falling again as explained earlier on.

Figure 2-14: Inflation rates for Namibia



Source: NSA and BoN

2.4.2 The wages and Namibia's economy

According to Green (1987), the "May Day of 1987 marked a milestone in Namibian labour history". Green (1987) explained that for the first time, more than 20,000 Black workers throughout the country downed their tools to celebrate International Labour Day. The success of this action signalled the growing strength of the Black trade union movement. Note should be taken that by 1987, Namibia had been illegally occupied by the South African army for over two decades, and workers cried out for a living wage, an end to the migrant labour system, the withdrawal of South African troops and the implementation of a United Nations plan for elections and independence (Green, 1987).

The May Day meetings were the first public sign that the fledgling trade union movement had found its feet. The first two years after 1987 saw the formation of four militant unions under the National Union of Namibian Workers (NUNW), the National Labour Federation affiliated with the South West Africa Peoples' Organization (SWAPO), which led the struggle for Namibian independence. The NUNW's efforts

resulted in the unionization of over 50 per cent of the African workforce in the mining, food and metal industries, as well as in the public sector (Green, 1987). In addition, workers' committees were set up in other industries as a first step towards amalgamating all workers into national industrial unions. The contemporary trade union activism in Namibia is closely associated with the history of the labour movement. This history is firmly rooted in Namibia's legacy of colonialism and the way in which political domination has shaped its economy.

According to Green (1987), the African workers were only allowed to join government-registered trade unions in 1978. Additionally, African workers were not allowed to legally strike. He further stated that there is, nevertheless, a history of worker resistance in Namibia, ranging from acts of individual rebellion like "desertion" and sabotage to strikes and stoppages. While trade unions were suppressed, workers found an important channel through which to voice their grievances, which was the SWAPO. Although SWAPO did not intervene in the day-to-day, bread-and butter issues of workers' lives, migrant employees were instrumental in its establishment and activities. It is this close relationship, nurtured over the years, that helps explain the political nature of the new generation of Namibian unions.

Workers have also experienced severe inflation in Namibia. Namibia experienced an inflation rate of 15 per cent a year, and food prices rose so dramatically that local newspapers showed in 1984 that the cost of living in urban areas in Namibia was much higher than in any urban area in South Africa. However, the cost of living situation was worse in the northern rural areas as compared to other areas.

The drought of 1981, a fall in the world market prices of copper and diamonds, and the vulnerable nature of the distorted export economy resulted in large numbers of workers being laid off. In 1986, unemployment was estimated to be as high as 55 per cent in some areas, with a general average of around 30 per cent. Namibia’s labour unions operated during this period in this economic environment. The resurgence of trade union activity in Namibia from the 1990s to date can be partially attributed to some of the resounding gains made by workers across the border in South Africa, where the

Black trade union movement has become an established part of the political scene. This upsurge has also led to concerted attempts by management and government authorities to stifle or co-opt independent worker organisations. The government stated in 1983 that no industrial agreement would be enforceable if unions were not registered.

The argument advanced for an increase in the money supply to have an effect on inflation remains questionable. Critics argue whether monetary expansion is in itself a cause of inflation, or simply a reflection of other more fundamental factors. Nevertheless, Friedman (1968) always claimed that "inflation is always and everywhere a monetary phenomenon" and some empirical studies support this theoretical position. In the long-run, it seems likely that money supply has a major impact on inflation, but in the short run there are other phenomena, such as food shortages, oil price increases or wage increases, that are important determinants of inflation. Another postulated cause of inflation is the role of the cost-push factors. The cost-push factors operate through the economy's supply side by raising the production unit cost, so that real GDP contraction co-exists with the resulting inflation. This means that, there is a possibility that increased inflation may have a negative impact on real GDP growth, which suggests, again, that the relationship between the variables should be investigated. Other potential cost-push causes of inflation that could be looked at in the Namibian context are:

(i) Increases in nominal wages in the economy in excess of productivity increases;
(ii) Rise in imported raw material prices and costs of other goods and services caused by external shocks (resulting in escalated foreign prices of imports) or currency domestic depreciation.

It should be noted that the results of the first macroeconometrics model for Namibia (NAMEX) were extensively utilised for recommending measures for expenditure restraint in the Wages and Salary Commission (WASCOM) report, in constructing of the macroeconomic framework for NDP1. In addition, wages are also an important explanatory variable in price development. Since critical wage figures for the entire Namibian economy are not accessible, the study generates the real wage figures from a formula that was also applied by Akanbi and Du Toit (2010). Empirical research

suggests that wages together with import price index have a positive influence on the consumer price index.

As of now, no reliable time series for unemployment and wages is available, which complicates the model building process. So far, the labour force, population and household survey data have been used to generate the unemployment rate, labour force, employment and unemployment figures for the years the surveys were conducted. The data for the other years in which no surveys were conducted were derived from the methods of extrapolation and interpolation in both Eviews and Excel.

2.5 CONCLUDING REMARKS

The purpose of the chapter was to evaluate and assess Namibian macroeconomic performance, the performance of the labour market and to discuss the inflationary environment in the wage-price context. The chapter established that the beginning of the 1990s was characterised by major changes in both the macroeconomic policy and structure of the economy. This is because Namibia attained its independence in 1990, and was obliged to develop new structures for the new government to function as expected. Namibia has crafted and implemented a number of national development frameworks since independence, and these include the Transitional Development Plan and the National Development Plans one (1) up to four (4). The main objectives of all these national development frameworks were to boost and sustain economic growth, to create employment, to reduce inequalities in income distribution and to reduce poverty (National Planning Commission, 2008, 2012; Malumo, 2012). These objectives featured in all the development frameworks for Namibia simply because the government had failed to address them objectives to its satisfaction. Cases in point are unemployment and the levels of poverty, which appear to have escalated between 1990 and 2013. In addition, not much was achieved as far as pushing economic growth rate to the desired rate of seven per cent, and reducing the income inequality, that is, a phenomenon inherited from the colonial era.

The macroeconomic indicators for Namibia were also examined; and in some cases compared to other countries in the region. The analysis revealed that the average

economic growth rate for Namibia between 1990 and 2013 was 4.2 per cent. This is quite impressive when compared with the average growth rates for Africa and the rest of the world. The average growth rate for Namibia mentioned above falls short of the seven per cent average growth rate required to resolve the unemployment problem. The other macroeconomic variables like inflation were in double-digit levels in the early 1990s, they have since stabilised to single digit levels and this is because of the fact that the Namibian dollar is pegged to the South African Rand, which is one of the most stable currencies on the African continent. Comparing Namibia's fiscal balances with other regions, and some selected countries, the study notes that Namibia has not over-borrowed. Its fiscal deficit as a percentage of GDP is still well below the prescribed ceiling of 35 per cent (Mwinga, 2012).

On the supply side of the economy, the service sector is the main contributor to value added as a percentage of GDP. Additionally, key to the supply-side sector are the retail, financial, tourism and hospitality service industries. The pattern that prevailed concerning the contributions of the service, primary and secondary sectors to GDP and the magnitudes of their contributions have not changed significantly since independence. This suggests that there were no major policy shifts in Namibia since independence. On the demand side of the economy, the largest component of aggregate demand in Namibia is consumption; the second largest component is imports. The third largest component of aggregate demand is exports, and the fourth and fifth largest components are government expenditure and investment respectively. The fact that imports are greater than exports throughout the period in question means that Namibia has a negative current account balance and it is therefore using more money to import than the money it is generating through exports. Namibia needs to reverse this trend through seriously promoting agriculture and industrialisation since the current scenario is untenable in the very long term.

An analysis of the fiscal developments revealed that Namibia believed in living within its means since it had more budget surpluses than deficits between 1990 and 2012. However, from 2008 onwards Namibia is consistently running budget deficits. The deficits experienced after 2008 were principally associated with the global economic

crisis, and those experienced after 2011 are associated with the TIPEEG programme, put in place to create jobs for the Namibians. Furthermore, the monetary developments show that money supply growth is stable and this is because the economy has not experienced major swings in prices during the period under consideration. The BoP account shows that Namibia has a healthy balance of payments account since the overall balance was generally positive between 2008 and 2012 except for the year 2010. This is despite the fact that the years considered, are years when the world economies were reeling under the effects of the global economic crisis.

The current chapter also analysed the basic labour market indicators since 1990. Some of the variables that were utilised in the analysis include the population older than 15 years, labour force, unemployed population, employed population, the unemployment rate and labour force participation rates. The section noted that the population older than 15 years, unemployed population and the labour force increased during the period considered. The unemployment rate and the employed population do not show a clear-cut trend as they both increased and decreased between 1990 and 2012.

The Namibian labour market was then compared with the labour markets of the other SACU countries. Various statistics were analysed for the period between 1990 and 2012. The statistics show that Namibia has the highest unemployment rates when compared with the other SACU countries. In terms of the average employment growth rates between the SACU countries, Namibia is second and Botswana is first. The country that outperformed the other SACU countries is Botswana in all the spheres of comparison

The chapter also discussed the inflationary environment in Namibia paying particular attention to the possible relationships between wages and prices in Namibia. The chapter established that the Namibian currency is a stable currency and this is attributed to the fact that the Namibian dollar is pegged to the South African Rand, which is one of the most stable currencies in Africa. Inflation in Namibia was in double-digit figures between 1990 and 1995 and towards the end of 2008 (due to the global economic crises, and escalating food and oil prices). However, it was below 10 per cent in all the

other years after 1990. In fact, the pattern that the Namibian inflation rate follows, is more or less the same as that of South Africa and this because of the fact that they are both members of SACU and the Common Monetary Area (CMA) and also that their monetary policies are closely related due to the latter arrangement. It is established that cost-push factors appear to explain inflation in Namibia and these include increases in nominal wages induced by labour union activity, and rises in prices of imported raw materials.

CHAPTER 3

MACROECONOMIC FOUNDATIONS AND LITERATURE REVIEW

3.1 INTRODUCTION

Wage-price macroeconometric modelling is still a relatively new research area in economics, and consequently, it still has not received adequate attention from economic researchers despite its policy relevance. The majority of the studies conducted so far are primarily for developed economies and very few are on developing countries. This chapter, therefore, reviews macroeconometric-modelling literature in preparation for the development of the small macroeconometric model of the Namibian economy. The review starts by exploring the origins, development and salient characteristics of the wage-price models, extended into small macroeconometric models both theoretically and empirically. This is because the majority of the literature available concentrated on the wage-price model and it is relatively recent that researchers attempted to incorporate labour productivity, employment and unemployment in their studies. Different parts of the chapter, therefore, attempt to justify the simultaneous modelling of wages, prices, labour productivity and unemployment by invoking both theoretical and empirical literature. Moreover, to get the wage-price-productivity-unemployment model, the study extends the simple wage-price model taking into account the necessary justifications.

The relationships between wages and prices date back to seminar papers presented by Phillips in 1958 and 1959, which claim that wages tend to rise when unemployment is low, but, fall when unemployment is high. The Phillips curve, conveniently named after Phillips, indicates a negative relationship between unemployment and nominal prices. The clear implication of this relationship is that unemployment rate tends to decline as the economy's rate of growth increases, but the inflation rate also tends to increase.

Conversely, a decline in economic growth increases the unemployment rate but decreases the inflation rate. While the Phillips curve relationship is entirely consistent with Keynesian economics it does not adequately describe the emergence of stagflation and this leads to its breakdown. Lipsey (1960) and, Samuelson and Solow (1960) subjected the original Phillips relation to empirical tests and found results that were consistent with the predictions of the Phillips curve. In the 1970s, the monetarists successfully discredited the Phillips curve, and this was thanks to the oil price shocks. According to the monetarists, the vanishing of the Phillips curve may be explained through the notion of the natural rate of unemployment, and by distinguishing between the short run and long run Phillips curve (Phelps, 1967; Friedman, 1968). To the monetarists, it is simply impossible to move unemployment below the natural or lowest sustainable rate in the longer run, and this assertion patently implies that the long run Phillips curve is vertical rather than downward sloping.

Given this brief background, the purpose of this chapter is threefold:

(i) to present and critically evaluate fundamental theoretical foundations of the development of the basic wage-price relationship,

(ii) to present empirical models that serve to justify the wage-price-labour productivity-unemployment model specification and,

(iii) to examine and evaluate macroeconometric modelling studies on Namibia.

3.2 THEORETICAL FOUNDATIONS OF THE WAGE-PRICE MODELS

3.2.1 The Philips curve

William Phillips discovered the trade-off between the money-wage changes and unemployment in 1958 when he carried out a study on the United Kingdom, which covered the period 1861-1957. In this study, Phillips argued that workers negotiate higher nominal wages in cases where the demand for labour is higher or, alternatively, the level of unemployment is lower. This is transmitted to inflation in the economy. Phillips concluded that the trade-off between unemployment and inflation in the economy is a long lasting

one. The statistical relationship between inflation and unemployment is what is known as the Phillips curve.

The capitalists argue that unemployment results from a real wage of labour, which is higher than the equilibrium level. The essential argument is that the labour market for labour mirrors any other market, as there is a negative relationship between the price of a commodity and demand. In terms of labour, high wages cause lower demand for labour that result in unemployment. Workers are assumed more interested in nominal wages and not real wages, (which is the quantity of products they can purchase with their nominal wages). This causes them to oppose wage cuts even when prices are declining resulting in an increase in their real wages with the result that they price themselves out of employment without realising it. Consequently, some economists have argued that if employees are permitted to compete 'freely' with one another for jobs, real wages would eventually drop and so unemployment would decline. State intervention through things like unemployment benefits, welfare programmes, legal rights, minimum wage laws and workers union activity are the main causes of unemployment, as such intervention and action force wages to be above their market level and therefore compel employers to retrench workers The key action to be adopted to reduce unemployment is simply to cut wages.

Economists argue that the original Phillips curve was not based on theoretical microeconomic foundations. The concept of a trade-off between inflation and unemployment was not in tandem with classical and contemporary classical theories. Instead, the classical and new classical theories say that wages and prices flexibly adjust to shocks where any disequilibrium is temporary and short-lived. This implies that the authorities can increase the employment level at the expense of increasing inflation, which is mentioned in Friedman's seminal paper entitled "The Role of Monetary Policy" in 1968.

Simultaneously, Phelps (1967) also criticised the Phillips curve for its failure to distinguish between real and nominal wages. Friedman contended that it is real wages that workers care about and not the nominal wages. Friedman further explained that households and

firms have expectations about future levels of inflation. In line with this, he also argues that economic agents learn from past inflation and readjust their inflation prospects accordingly with variations in monetary policy. The inflation and unemployment trade-off has been found unstable and short-lived. In cases where the expected inflation equals actual inflation, unemployment is determined by real rather than nominal variables (wages).

Phelps (1968) highlighted the role played by expectations in nominal money wages. He also contended that only unanticipated inflation, which causes money illusion, would affect real economic activity. The Friedman-Phelps adaptive augmented Phillips curve was responsible for the reduction in the popularity of the original Phillips curve relationship.

The views about the Phillips curve were also changed by rational expectations in the 1970s. Lucas (1972, 1975) stressed the rationality of economic agents and that they quickly adjust inflation expectations once there had been shifts in monetary policy. The trade-off between inflation and unemployment does not hold even in the short run. In addition, for policy purposes, statistical estimates obtained from historical data are also no longer useful for predictions as the reduced form coefficients, of the Phillips curve also vary with the shift in policy known as the Lucas critique (Gordon, 2011).

Another setback for the Phillips curve came in the early 1970s, when episodes of stagflation (cases where both inflation and unemployment escalated), indicated that a positive rather than a negative relationship between inflation and unemployment existed. All the problems associated with the Phillips curve highlighted above led to the development of new ways of thinking about the way prices and wages are related, resulting in the development of the new Keynesian Phillips curve and the monetarist approach.

3.2.2 The new Keynesian Phillips curve

Concerning the arguments expounded in subsection 3.2.1 doubts were raised about the predictions of the original Phillips curve relationship**.** The Keynesians, at the time, had not

developed an inflation model, which could provide an alternative explanation to the Phillips curve, as well as for stagflation in the early 1970s. The focus of the Keynesian macroeconomics was more on aggregate demand policies for explaining movements in employment and output. Money wages were treated as exogenous while it was believed that whenever aggregate demand exceeded aggregate supply, it would trigger inflation in the economy. The supply side of the economy, which could advance linkages between inflation, employment, output etc., was not developed at that time.

Keynes rejected the notion that market forces guarantee full employment without policy assistance. He also emphasised in the 1936 General Theory that the economy could operate at multiple equilibriums and that any equilibrium is not full employment equilibrium. For instance, the economy can stay for longer episodes below the full employment level, which creates unemployment as witnessed during the Great Depression. The Keynesian ideas overshadowed all other macroeconomic ideas until the classical economic theory was revived in the 1970s. During this era, the Keynesian macroeconomic theory was criticised for lacking strong microeconomic foundations.

The central intellectual challenge for the Keynesians was to provide the microeconomic foundations to support the nominal rigidities in the presence of rational expectations. This, therefore, led to very significant contributions to macroeconomics in the form of staggered contracts, asymmetric information, efficiency wage hypothesis and the New Keynesian Phillips Curve (NKPC).

The NKPC is one of the contributions, which lays down the microeconomic foundations to Keynesian macroeconomics. The NKPC assumes that inflation expectations are rational and not adaptive and this means that the inflation-unemployment trade-off is non-existent. Rudd and Whelan (2005) gave a comparative review of the Phillips curve and the NKPC. The NKPC, based on microeconomic foundations, also describes the process of inflation dynamics and the rationale for nominal price rigidities.

Rudd and Whelan (2005) further argue that the NKPC also suggests that prices are sticky downwards and that the role of price expectations in price setting in the economy cannot be disregarded. They added that, dynamics in the wage-price adjustments are clarified within the framework of time dependent and state dependent models. On the one hand, time dependent models suggest that firms adjust prices according to an exogenous time schedule, which is unaffected by the state of the economy. On the other hand, state dependent models suggest that firms can optimise prices whenever they find it profitable in the market. The wage and price stickiness are endogenous in the state dependent models.

Taylor (1980), Rotemberg (1982) and Calvo (1983), argue that the NKPC can be derived from various versions of the time-dependent models. Identical firms produce differentiated products in a monopolistically competitive environment and face similar kinds of restrictions in optimising prices. The price elasticity of demand for a product is assumed to be constant across firms (e.g. see Roberts, 1995), which suggests that forward looking firms do not optimise prices in each period, rather they incorporate expected real marginal costs in current prices. Firms believe that they are not able to optimise prices in the near future. In this context, the NKPC relates current inflation to expected future inflation and real economic activity, such as, marginal costs and output gap (Roberts, 1995).

The Phillips curve theory has widely been tested empirically in the United States, Europe and even developing countries since 1958. The empirical tests show that, in spite of lack of theoretical foundations, the Phillips curve does an excellent job of describing inflation on empirical grounds. The review of these and related empirical findings is presented later in the chapter.

The NKPC has also been empirically tested in the United States and some European countries. The results provide mixed evidence on the success or failure of the NKPC in explaining inflation dynamics. The NKPC has evolved over time, and researchers normally invoke it in contemporary research.

3.2.3 The monetarist revolution

The monetarists theoretically and empirically challenged the Keynesian consensus in the early 1970s (Blanchard and Watson, 1986; and Wallis, 1993). From a theoretical perspective, they showed that the traditional Phillips curve was not correctly specified, and this, therefore, spurred them to propose that expectations augmented Phillips curve instead. On the empirical front, the monetarist position was vindicated by the 1970s stagflation, which made the expectations-augmented Phillips curve perform better empirically than the traditional Phillips curve.

Milton Friedman, who is considered the father of monetarism, began his theoretical objections to the traditional Phillips curve by contending that unemployment is the difference between labour supply and demand according to standard economic theory. He also added that households and firms base their decisions about labour supply and demand on real and not nominal wages (Espinosa-Vega and Russell, 1997). This implies that it is the real wage and not the nominal wage that should rise when there is excess demand for labour and decrease when labour is in excess supply (Wallis, 1993). This further implies that the Phillips curve should be re-specified in terms of real wages. The traditional Phillips curve formulation implies that the association between nominal wages and the unemployment rate implicitly assumes that current changes in nominal wages are equivalent to expected future changes in real wages, taking into consideration the forward-looking nature of wage contracts (Espinosa-Vega and Russell, 1997). Friedman also noted that the later relationship encompasses two assumptions. The first assumption being that price expectations need to be rigid so that people do not expect the level of prices to change, so that nominal and real wage changes are seen as the same. The second assumption being that workers do not resist a change in real wages engendered by higher inflation and this means that the Phillips curve obtained is stable enough to provide policy makers with a functional options menu.

Both assumptions are not justifiable. The first assumption exposes the fact that the Keynesian models did not pay attention to the expectation formation process. The second assumption is a bit bizarre if one recalls the fact that Keynesian economics is based on an assumption that workers resist reductions in their real wages. In addition, it is not readily clear why they should accommodate a real wage fall if it occurs through an increase in inflation. In addition, Tobin (1993) argues that this type of behaviour is justifiable as long as workers do not care so much about their absolute wage, but their wage relative to what their co-workers are paid. Workers are, therefore, unwilling to accept a negotiated wage cut because they are not sure if their co-workers will do the same. However, an increase in inflation ensures that everyone's real wage is essentially affected in a similar manner.

The Keynesian Phillips curve can be modified to account for expectations formations about future price changes and this changes the short- and long-run relationship between inflation and unemployment significantly (Romer, 1996). Doing this, gives the following expectations-augmented Phillips curve:

$$\Delta wag_t = f(uem_{t-1}) + \Delta pce_t^{e2} \qquad [3.1]$$

The change in nominal wages, Δwag_t, is still explained by the recent rates of unemployment $f(uem_{t-1})$, as hypothesized by the traditional Phillips curve, however, an additional variable expected inflation (Δpce_t^e) is added as the other variable which explains nominal wages. The envisaged short-run relationship between inflation and unemployment is the same as before, but the transmission mechanism is different. For example, an increase in aggregate demand spurs firms to increase their price, and this in turn, leads to higher rates of inflation. Friedman assumes the adaptive expectation formation, ($\Delta pce_t^e = \Delta p_{t-1}$), in which an increase in current inflation levels is not anticipated by workers given that they expect current inflation rate to be the same as that of the previous period (Taylor, 2001). The unexpected increase in inflation reduces real wage rates, which thereby, increases firms' demand and employment and reduces unemployment. Therefore, as predicted by the traditional Phillips curve, there is still a negative short-run relationship

[2] Small letters denote logarithms throughout the entire research paper.

between inflation and unemployment. The only difference between the traditional Philips curve and the monetarist model lies in the transmission mechanism, which in the case of the monetarist model runs from aggregate demand via unexpected inflation to the unemployment rate while in Keynesian models; it runs from aggregate demand via the unemployment rate to nominal wages and inflation (Taylor, 2001). The expectations-augmented Phillips curve postulates quite the opposite direction of causality as compared to its counterparts. The traditional Phillips curve and the expectations-augmented Phillips curve also differ in terms of their long-run properties. In the case of the traditional PC, there is a long-run trade-off between the rates of inflation and unemployment, while there is no such relationship in the case of the expectations augmented PC (Espinosa-Vega and Russell, 1997). This mainly emanates from the fact that in the long-term, when the economy is in equilibrium, the nominal wages rate growth is equal to $\Delta wag_t = \Delta pce_t + \lambda$ where λ is explained by productivity and growth in equilibrium (Espinosa-Vega and Russell, 1997). Substituting this condition into [3.1] gives the following equilibrium relationship between inflation and unemployment:

$$\Delta pce + \lambda = f(uem) + \Delta pce^e \qquad [3.2]$$

In the steady state expected inflation is equal to actual inflation ($\Delta pce^e = \Delta pce$) and the two terms drop out of [3.2], leaving :

$$\lambda = f(uem). \qquad [3.3]$$

This shows that when the PC is augmented to take into account expectations, the equilibrium unemployment rate is not related to the equilibrium inflation rate, which is not in line with predictions of the traditional PC. There is, therefore, no long run trade-off between inflation and unemployment anymore. This technically means that super neutrality holds in monetarist models, and this phenomenon has far-reaching policy implications, which are discussed in detail below.

The disappearance of the long-run trade-off is also called the accelerationist hypothesis (Espinosa-Vega, 1998). To illustrate this, thesis the steady state unemployment rate is

denoted as $\overline{uem}$ and specify $f(uem_{t-1})$ as uem_{t-1}. Moreover, the expectations-augmented Phillips curve can be formulated as a relation governing the inflation process and introduce a supply side shock $\varepsilon_{s,t}$, which proved crucial for modelling the inflation process in the 1970s when major oil price shocks hit the world economy. This gives:

$$\Delta pce_t = \Delta pce_t^e - a(uem_{t-1} - \overline{uem}) + \varepsilon_{s,t}, \quad \text{with } a > 0 \qquad [3.4]$$

If adaptive expectations are assumed, the following version of the expectations-augmented Phillips curve is obtained (Romer, 1996):

$$\Delta pce_t = \Delta pce_{t-1} - a(uem_{t-1} - \overline{uem}) + \varepsilon_{s,t} \qquad [3.5]$$

Romer (1996) shows in equation [3.4], that an increase in inflation leads to a decrease in unemployment, and, such a relationship between the two variables is not permanent. He also argued that when unemployment is at the equilibrium level, inflation could be held constant at a certain level, and, at this level, any rate of inflation is sustainable. In this case, each time the policy makers seek to keep unemployment at a level below its equilibrium, this often results in accelerating inflation. Note should be taken that the traditional Phillips curve has been hailed for providing a good description of inflation and unemployment in the late 1950s and 1960s. Nevertheless, the expectations-augmented Phillips curve predicted that this relationship is not tenable because if policy makers try to ride this trade-off between inflation and unemployment this would lead the country into inflation that is more serious and/or unemployment problems. According to Wallis (1993), the stagflation experience of the 1970s confirmed this prognosis. The expectations-augmented Phillips curve explained both the steady connection between unemployment and inflation rates in the 1950s and 1960s (when the movements in inflation were short-lived and inflation expectations were almost stable) and the volatility of the 1970s, when the original PC completely failed. The Keynesians did not take these criticisms lying down, as they came up with a response to the monetarist challenge, which is the subject of section 3.2.4.

3.2.4 Keynesian response to the monetarist challenge

The stagflation era, which followed the first oil price shock, represented a major setback for the traditional Phillips curve as alluded to previously. The concurrent upsurge in unemployment and inflation during the greater part of the 1970s led to a characteristically positive relationship between unemployment and inflation, which contradicted the prediction of traditional Phillips curve that a negative long-run relationship exists between the two variables. The 1970s experience led Lucas and Sargent (1978) to suggest that the traditional Phillips curve had dismally failed. One reason for the collapse of the traditional Phillips curve had to do with its failure to account for the effects of aggregate supply shocks on unemployment and inflation (Romer, 1996). An adverse supply shock, like an escalation in oil prices leads to a positive correlation between unemployment and inflation even in the Keynesian models implying that the oil price shocks of 1973 and 1979 are predisposed to account for a part of the failure of the Phillips curve. The other problem was that the rise in inflation coincided with the attempt by policy makers to stop increases in unemployment using expansionary demand management policies (Espinosa-Vega and Russell, 1997). The monetarists' warnings that the Phillips curve would break down if monetary policy makers tried to exploit the trade-off between inflation and unemployment proved true during the inflation acceleration of the 1970s. The poor performance from using the Phillips curve strengthened the credibility of the monetarist position to a large extent.

Strand (1988) added that the traditional Phillips curve had to be adapted in order to rescue the Keynesian position. This resulted in the NAIRU (non-accelerating inflation rate of unemployment) theory that broadens the Keynesian theory of the equilibrium unemployment and inflation process in three different ways. The first way is that the NAIRU concept boosts the traditional downward sloping Phillips curve by adding a vertical Phillips curve; this helps account for the role of expected inflation in the inflation process. The second way is that the NAIRU is often estimated by means of the so-called triangle model of inflation where inflation is determined by demand and supply conditions

and inertia. Finally, the NAIRU concept permits for adjustments in the equilibrium rate of unemployment over time.

3.2.5 Keynesian model of inflation with a vertical Phillips curve

The NAIRU is the unemployment rate, which is consistent with a fixed inflation rate. An unemployment rate below the NAIRU puts upward pressure on the inflation rate; and an unemployment rate above the NAIRU puts downward pressure on the inflation rate (Stiglitz, 1997). The NAIRU is, therefore, the unemployment rate at which the Keynesians' downward sloping Phillips curve crosses the Monetarists' vertical Phillips curve. In this case, the position of the vertical Phillips curve helps the natural rate of unemployment in the monetarist framework, which means that the NAIRU is numerically identical with the natural rate. This is shown in Figure 3-1 reproduced from Espinosa-Vega and Russel (1997).

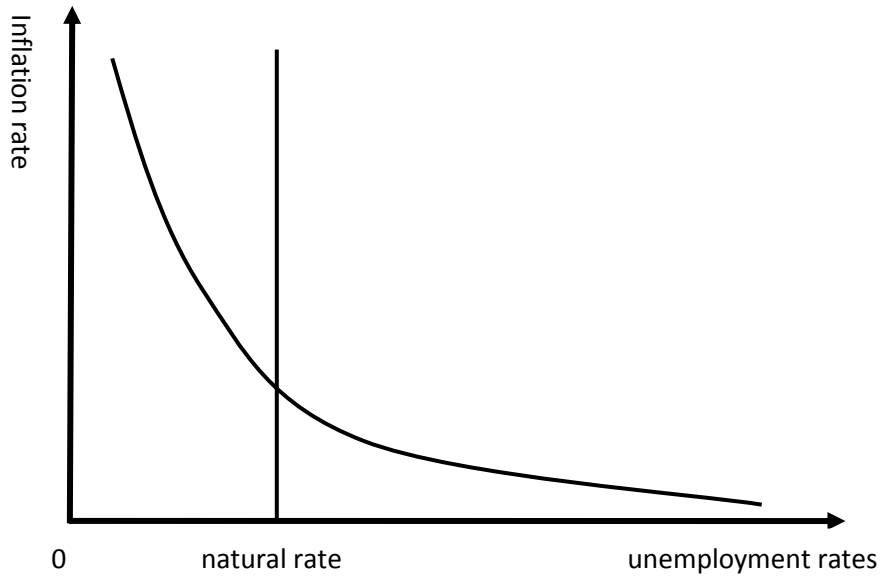
The addition of a vertical Phillips curve by the Keynesians to the traditional downward sloping curve means that they accept the monetarist argument that the Phillips curve needs to be improved by adding a term that captures the expectations formation process. This, therefore, implies that the Keynesians embrace the monetarists' expectations-augmented model of inflation. Alternatively, this means that the Keynesians accepted the monetarist acceleration hypothesis, which argues, that attempts to push the unemployment rate to levels below the NAIRU and/or the natural rate leads to accelerating inflation.

Stiglitz (1997) contends that using the terms NAIRU, and the natural rate interchangeably simply because they are numerically identical, risks blurring significant discrepancies between the two concepts that remain. These differ, in particular, with respect to their stabilisation policy implications. According to Walsh (2010), the natural rate responds to essential shifts in demand and supply as it develops over time. He also went on to argue that the natural rate symbolises the economy's sustainable unemployment rate in cases where prices and wages have had adequate time to adjust to supply and demand pressures. The natural rate's role in monetary policy is two-pronged. First, it serves as a reminder in

that the economy's average rate of unemployment is not dependent on the inflation average and that it cannot be lowered by employing an inflationary monetary policy. Walsh (2010) proposed that alternative, microeconomic policies targeted at the labour market are the appropriate tools for affecting the natural rate, and not policies that influence aggregate spending. He also emphasised that the natural rate serves as a suitable standard if stabilisation objectives are being considered as a goal for monetary policy. Walsh (2010) asserted that monetary policy cannot stabilise unemployment around any random level, but it may assist lessen fluctuations of unemployment around the natural rate.

Walsh (2010) also argued that the short-run NAIRU could play a more direct role in the conduct of policy. If the NAIRU assists to predict future inflation, then it can be principally essential in an inflation targeting policy. Unfortunately, the variability of the short-run NAIRU makes it less appropriate as a benchmark for explaining policy actions to the public. Basing policy on something that is not directly measured, that varies regularly and is complicated to estimate, restricts the transparency of policy and renders it more complex for the public to evaluate monetary policy.

Figure 3-1: The NAIRU



Source: Espinosa-Vega and Russel (1997)

The monetarists intended to illustrate by employing the expectations augmented Phillips curve, the effectiveness of aggregate demand management policies. Even though Keynesians incorporated the expectations augmented Phillips curve into their framework they, however, disagree with the monetarist argument. The monetarist position with respect to the futility of demand management policies is premised on a number of assumptions. Besides the acceleration hypothesis, the assumptions that prices are flexible enough to clear labour and goods markets matters the most in this regard. The Keynesians maintained their disagreement with the latter assumption and argued that nominal rigidities matter and that involuntary unemployment can persist for longer periods. In consequence, recognition of the expectations augmented Phillips curve fails to refute the Keynesian stabilisation policy rationale. Modigliani and Papademos (1978), who originally propose the NAIRU concept, interpret the NAIRU as a constraint to policy makers in the exploitation of the trade-off that remains both available and useful in the short-run (Espinosa-Vega and Russell, 1997:11). This means that, in terms of Figure 3-1, Modigliani and Papademos (1978) emphasise that the economy is most of the time operating in the range where unemployment rates are significantly to the right of the NAIRU. The trade-off between inflation and unemployment is considerably low since the Phillips curve is relatively flat in this range. The problem of accelerating inflation can only occur if policy makers try to push the unemployment rate below, the NAIRU because the short run Phillips curve is quite steep in this range. Hence, from this viewpoint, the Keynesian economists' acceptance of the natural rate in the form of the NAIRU does not constitute an exception to the monetarists' standpoint.

Despite the fact that the NAIRU continues to be a crucial element of New Keynesian models, which concisely captures the Keynesian research programme of the 1980s and 1990s, it has to be taken into account that the modern genre of Keynesian economics is considerably more cynical about the benefits of stabilisation policy that Modigliani and Papademos (1978) came up with when they proposed the NAIRU concept. The traditional

affirmation of demand management policies by Keynesians is based on the assumptions that a short-term Phillips curve is convex to the origin and that nominal rigidities are strong enough to prevent the clearing of labour and goods markets for extended periods of time (Karanassou et al., 2010). On the other hand, the Phillips curve is often assumed linear by the new Keynesian models. Besides, despite the fact that nominal rigidities have an important role in New Keynesian models, they do not lead to such a strong level of persistence in real variables so that the economy is more often than not on the right side of the NAIRU. The unemployment rate, however, is assumed to fluctuate in a symmetric fashion about the NAIRU. In view of the fact that the New Keynesian models adopted a key characteristic of monetarist models, it can be concluded that these stabilisation policy models are closer to the monetarist perspective than to the traditional Keynesian perspective.

The previous discussion indicated that the expectations-augmented Phillips curve ensures that there is an equilibrium unemployment rate, which is independent of the equilibrium inflation rate. Friedman (1968) suggested that this steady state unemployment rate is, alternatively called, the natural rate of unemployment. One outstanding characteristic of the natural rate of unemployment is that it is determined by real and not by nominal variables. In spite of the fact that it is possible for policy makers to force the level of actual unemployment below the natural rate by creating unexpected inflation, it is impossible for them to indefinitely keep unemployment below the natural rate and, this means that, money is super neutral (Romer, 1996); (Espinosa-Vega, 1998).

Friedman (1968) further argues that in cases where unemployment is at its natural level, the real wage rates are in equilibrium, and the corresponding rate of growth of real wages can be maintained indefinitely providing that capital formation, productivity increases, etc., stay on their long run trends. In addition, if unemployment goes below the natural rate, this leads to excess demand for labour and an increase in the real wage, whereas, if the unemployment rate rises above the natural rate, this shows that there is excess supply of labour that causes a decline in real wages. The fact that the natural rate of unemployment is

similar to the traditional Phillips curve is not accidental. Friedman (1968) reformulated the Phillips curve in terms of real wages in order to overcome the basic defect of the traditional Phillips curve (failure to distinguish nominal from real wage rates).

Friedman reinforces the fact that the term 'natural' should not give the impression that the natural rate of unemployment cannot be altered. He also points out that the majority of the market features that affect it are policy-made and manmade. Such factors include minimum wages, and the strength of trade unions, among others.

The preceding discussion unequivocally demonstrates the relationship among the four variables of interest in this study was referred to, since the introduction of the original Phillips curve. The relationship among the four variables has been explained leading theorists and empirical analysts to develop models that encompass all four variables. Some of the studies have developed models for only three of these four variables, namely, wages, employment, unemployment and labour productivity for the simple reason that they assumed that wages and prices are closely related and; therefore, there was no need to incorporate the price variable.

In the following section, the wage-price model literature is reviewed and analysed setting the stage for the development and specification of a model that is going to be used in the current study. The literature review follows a chronological order where early literature is reviewed first and then recent literature is reviewed last. The review of literature also patently indicates the fact that methodologies that have been used in carrying out economic research have been improving over time, which is why the methodology applied in this study can only be traced to relatively recent literature.

3.2.6 Unemployment and hysteresis effects

The close relationship between unemployment and inflation has been discussed much after the influential contributions of expectations-augmented Phillips Curve established by Friedman and Phelps independently. Friedman put forward the concept of the natural rate

of unemployment which is a market equilibrium rate linked to stable rate of inflation. Keynesian economists, as an alternative, favour the term NAIRU (Non-Accelerating Inflation Rate of Unemployment) whose micro foundations relate to imperfect competition in the labour and product market. The NAIRU is defined as that rate of unemployment that reconciles the feasible real wage determined by labour productivity and a firm's mark-up with the target real wage of workers.

Though the natural rate of unemployment (or NAIRU) was at first presumed to be constant, the dramatic increase in unemployment rates, particularly in Europe since the 1980s, has put this notion in question. Certainly, the natural rate of unemployment (or NAIRU) appears to have risen. Two strands of ideas have been put forward to explain this phenomenon.

One justification attributes this high level of unemployment to particular variations, which have increased the labour market inflexibility (rigidity). These fluctuations are usually understood to comprise trade unions that are powerful, minimum wage laws, excessive regulations, higher taxation and higher unemployment compensation. Though the increase in unemployment rates in the 1970s might be accounted for by some of these factors, it is not conclusive that they offer a reasonable and comprehensive description of the unemployment development in the 1980s.

A second reason is advanced which relates to hysteresis theories. The principal notion is that the equilibrium natural rate depends on the development of the actual unemployment rate. The hysteresis theories propose that the natural rate of unemployment (or NAIRU) will go up if the actual rate of unemployment in the erstwhile period is higher than the steady-state equilibrium level.

To account for the observed hysteresis effects, two major clarifications are developed by new Keynesian economists: insider-outsider theories and duration theories. As illustrated in the insider-outsider analysis later, insider power obstructs the downward adjustment of

wages in the face of high unemployment. Therefore, unemployed outsiders are incapable of bidding down wages to be employed following an upsurge in unemployment. Consequently, insider-outsider theories highlight the effect of employed insiders. Duration theories as an alternative pay much consideration to unemployed workers. It is contended that if the actual rate of unemployment outstrips the steady-state equilibrium level, the problem of structural unemployment is exacerbated since the human capital of unemployed will deteriorate. Hence, unemployed workers become progressively unemployable. Besides, a high rate of unemployment tends to produce additional long-term unemployment. Meanwhile these long-term unemployed exercise only little influence on wage negotiations, the natural rate of unemployment is raised once more.

3.2.7 Unemployment and macro policy coordination

High significance is given to the coordination of fiscal and monetary policies in the new Keynesian approach. In new Keynesian theory, these policies have a joint responsibility for employment and should be coordinated to realise high employment. Monetary and fiscal policies need to be coordinated not only at the national level, but also at the international level, particularly in currency areas with a common monetary policy.

The Keynesian economics contends that the development of aggregate demand determines production and employment in the short run. Effective demand, monetary and fiscal policies, therefore, affect production and employment at least in the short run since prices and wages are anticipated to adjust rather sluggishly to their long-run equilibria. The short run is expected to last at least a few years though its precise duration is not clear. Post-Keynesian economists maintain instead that monetary and fiscal policies have such special effects also in the long run. Monetary policies' interest rate setting and firms' profit expectations affect private investment that for its part is a central determinant of effective demand and economic growth. Fiscal policy is also an important determinant of aggregate demand working through channels of both tax and expenditure, in particular through public investment. It is effective demand via the level of aggregate output, which determines the level of actual employment in the labour market. In the long run, unemployment is

determined by the NAIRU that may be influenced by on structural factors. Along these lines, monetary and fiscal policies are capable of stimulating demand and employment when the economy is in recession. The coordination of these policies plays a critical role in affecting output, employment and hence unemployment. With hysteresis effects considered, the coordination is particularly significant as the NAIRU will be contingent upon the evolution of the actual unemployment rate that is influenced by macro policies. Section 3.3 attempts to address a related issue of skills mismatch, which has become topical when discussing employment and unemployment related issues.

3.3 THE WAGE-PRICE EMPIRICAL LITERATURE REVIEW

Most of the research on the wage-price relationships involves estimation of wage and price equations separately in individual equation frameworks. The main criticism levelled against single equation estimation of wage-price model is that it ignores the contemporaneous nature of the two variables. It does not take into account the fact that the two variables can be simultaneously determined. Many large macroeconometric models also choose the single equation estimation method when estimating wage-inflation macroeconometric models. Economists, who attempted to address this deficiency, estimate the wage-price equations simultaneously by using different estimation techniques.

In the light of this brief background, the empirical literature section is divided into four parts. The first section discusses the background to macroeconometric modelling. The second section explores the development of wage-price literature, which is also, largely explained by econometric development. The third section attempts to investigate the development of wage-price macroeconometric modelling, while the last section critically reviews macroeconometric modelling in Namibia.

3.3.1 A short background to macroeconometric modelling

The primary objective of macroeconomic modelling is to proffer a system that satisfactorily represents the real economy. Additionally, macroeconometric modelling has undergone several developmental phases that have transformed it into a more relevant,

functional and effective policy analysis tool. The early macroeconometric models came up with strong foundations for the development of macroeconomic modelling, despite the fact that they were severely criticised for being abstract and static in representing the economy Walrus, Pareto and Frisch (1933)[3] and Kalecki (1935)[4]. Later work by Tinbergen (1937) was a significant success in terms of developing theoretical foundations and improved estimation techniques of macroeconomic models.

Studies by Tinbergen (1937) and the Klein (1950)[5] represent important contributions in the development of macroeconometric models. After these studies, macroeconomic modelling was revived, and it became prominent again in the formulation of macroeconomic policy and forecasting. However, as time went by macroeconomic models failed to deliver desired results in terms of explanations to policy makers leading once again to the decline in their popularity. In addition, levels of scepticism on the part of policy makers escalated, resulting in considerable criticisms of the models by both the authorities and academics.

The criticisms that were based on identification restrictions were the most damaging. The identification process would depend largely on the existence of dynamics in the model due to its requirement of a complex system of simultaneous equations. Moreover, the interaction of policy regimes and the significance of the role of expectations rendered the process of identification a tricky one.

These criticisms sparked a lot of debate on modelling which regenerated interest in the development of alternative modelling techniques. This led to extensive research in developing techniques that overcame the weaknesses inherent in macroeconomic modelling, resulting in the development of the CGE, Maximum Likelihood (ML), vector auto regression (VAR), structural VAR modelling and the state space modelling techniques. Initial work on these techniques is attributed to Davidson and Hall (1991),

[3] Unpublished work.
[4] Unpublished essay in 1935.
[5] Also discussed in Wallis (1994) and Allen, Hall and (eds) (1997).

Allen and Hall (1997), among others. These techniques developed ways to evaluate and check structural relationships and over-identification restrictions. Because of these developments and other breakthroughs, macroeconometric modelling has since been transformed, making it regain its status in the policy-making arena; it is still being invoked today in policy making and forecasting processes.

3.3.2 Alternative research strategies in macroeconometrics

A key concern in empirical econometrics is to develop quantitative models that are empirically relevant to match economic theories with observed data features. Empirical econometric models are systems of quantitative relationships linking observed data series. Modelling requires matching theory and data in a formal quantitative framework. Any strategy in empirical research is based on the combination of theoretical analysis and data exploration. Thus, the roles of economic theory and empirical evidence and their relationships are quite important in empirical modelling.

There was agreement on both the theoretical foundation of macroeconomics and the empirical specification of macroeconometrics modelling in the 1950s and 1960s. The consensus was centred on the Cowles Commission method. Nevertheless, such a consensus broke down dramatically at the inception of the 1970s when it was realised that 'the models did not represent the data…did not represent the theory…were ineffective for practical purposes of forecasting and policy' (Pesaran and Smith, 1995). Ever since, various methods have been developed to overcome the failure of this traditional method. The Cowles Commission methodology was then substituted by a number of prominent methods of empirical research: the LSE (London School of Economics) approach, the VAR (Vector Autoregression) approach and the intertemporal optimization/calibration approach.

Introduced by Denis Sargan, the LSE methodology critiques the Cowles Commission models of not satisfactorily paying attention to the statistical model underlying the specific economic structure, which is adopted to examine the influence of different

macroeconomic policies. Consequently, the empirical failure of this method is embedded in the lack of adequate interest in the statistical model. In line with the LSE explanation, the recipe for the Cowles Commission method is a cautious diagnostic checking on the specification employed.

In addition, the LSE critique of traditional structural modelling, two prominent critiques due to Lucas (1976) and Sims (1980) are also rather influencing. In addition, in the explanation of the LSE method, both authors criticise the identification in the Cowles Commission method by focussing on the frail theoretical foundation of this kind of structural models. According to Lucas, structural models fail to forecast the effects of different macroeconomic policies on the macroeconomic series if the relevant coefficient describing these impacts is not regime-invariant. In the case that the coefficient of interest is affected by the policy regimes, the model estimated. Sims criticises the identification in the Cowles Commission models by pointing out instead that the restrictions needed to ensure exogeneity in these models are 'incredible' when agents optimize intertemporal.

Following the contribution of Sims, research program focusing on VAR models has become popular in empirical macroeconometrics. Concentrating on shocks, VAR models are estimated to yield empirical evidence concerning the response of macroeconomic variables to shocks in order to discriminate among alternative theoretical models of the economy.

Lastly, the Generalized Method of Moments (GMM) is frequently applied to the first-order conditions to answer intertemporal optimization problems. This technique aims to get estimates of the deep parameters in the economy, which describe taste and technology and are independent of expectations. With such deep parameters being estimated, models based on microeconomic foundations could be calibrated and the effects of economic policies on variables of interest could be assessed consequently.

In brief, the LSE approach, the VAR method and the intertemporal optimization (calibration) method strive to rationalise the failure of the Cowles Commission methodology in various ways and are regarded as alternative strategies. The existence of such a plurality of approaches arises because economists do not share a common view on the methodology of macroeconomic modelling. The next section discusses the chronological development of the wage-price macroeconomic models.

3.3.3 Literature analysis of the wage-price relationship

As alluded to earlier, many studies have been conducted on the relationship between wages and prices, and, a number of them have incorporated productivity and unemployment. Vanderkemp (1996) was one of the first researchers to study the determination of wages and prices in Canada. The arguments for the wage equation used in this study were, the percentage change in the consumer price index and the lags of the inverse of the unemployment rate. Correspondingly, the arguments for the price equation were the percentage change in the average wage, unemployment change, the percentage change in the import price index and the lagged value of the consumer price index. The wage and price equations that he came up with were estimated using the full information maximum likelihood (FIML) system that he contended to be more superior to the Ordinary least Squares (OLS) and the Two Stage Least Squares (2SLS) techniques. Vanderkemp (1996), finds that the profit rate (corporate profits as a percentage of GDP) does not explain the wage equation; the change in employment does not explain the rate of wage changes in the organised sector and a change in productivity in the unorganised sector does not explain the wage equation (and this was mainly attributed to the importance of agriculture in the unorganised sector). In addition, the change in finished goods inventory and the unfulfilled order rate in manufacturing as a percentage of shipments were included as demand variables in the prices equation, and they were all rejected. However, prices and wages were found to be significant explanatory variables of each other.

Van Hoa (1981) carried out a study on the causality of wages and prices in West Germany. The model consists of six arbitrarily testable interrelating variables in the deterministic form as shown below:

$$W = f_w(U, A, P, M_r, D)$$
$$U = f_u(W, A, P, M_r, D)$$
$$A = f_a(W, U, P, M_r, D)$$
$$D = f_d(W, U, P, M_r, A)$$
$$P = f_p(W, U, M_r, A, D)$$
$$M_r = f_m(W, U, A, P, D) \quad ` \quad [3.6]$$

where f_w , f_u etc., denote an arbitrary functional form for the arguments in parenthesis, *W* are money wages, *A* are the negotiated minimum wages, *U* the difference between actual and potential real GNP (capacity utilisation), *P* are prices, *D* is a measure of union power and militancy and M_r is money supply. Van Hoa (1981) finds that his model lends support to the wage push theory and shows an insignificant role for money supply. In addition, he also finds that a two-way causality exists between money wages and negotiated minimum wages rates and he concludes that the practice of specifying a distributed lag structure for these wage rates in the wage equation or, correspondingly, for money wages in the negotiated minimum wage rates equation is inappropriate. The study identifies the main causes of wage inflation as anticipated inflation and negotiated minimum wage rates. Likewise, the principal causes of price inflation are identified as expected price increases and the increase in capacity utilisation where the latter can be represented as a distributed lag structure.

Ashenfelter and Card (1982) get results that are at variance with the latter study. They use a model, which includes the nominal interest rate, the unemployment rate, the hourly wage and prices. Applying a four variable vector autoregressive (VAR) system with four (4) lags, they show that wages Granger cause prices. Additionally, prices are found to weakly Granger cause wages. The study also rejects the influence of unemployment on wages and

prices. However, interest rates are found to have a crucial role to play in the behaviour of prices but not wages.

The study by Shanon and Myles (1986) adjusts the previous studies in two ways. First, they incorporate an output variable in the VAR (p) model. Second, to control wage increases associated with productivity gains they use unit labour costs, which are not expected to be inflationary. The addition of income and money to the VAR (p) model containing unit labour costs and GNP deflator yield results that are in conformity with Ashenfelter and Card who find bidirectional Granger causality running from wages to prices.

Overall, these early studies indicated that the relationship between wages and prices was sensitive to the selection of additional right hand side variables. In addition, they provided at least marginal support for importance of income, money and nominal interest rate variables in altering the estimation of the wage-price relationship. However, most time series including wages and prices are nonstationary, and therefore, much of the variability in results may have had something to do with the spurious nature of regressing nonstationary variables on each other.

The intuitive solution proffered in literature to remove the spurious effect is to difference the non-stationary variable until each variable becomes stationary. The inefficiency and unreliability of the estimation are patently removed since the estimation now involves stationary variables only. Nevertheless, as Hendry (1986) and Granger (1988) argue, differencing economic time series data removes all the information about the long-term relationships. In cases where series are cointegrated, valuable information is lost. Additionally, Hakkio and Rush (1989) demonstrate that taking first differences of cointegrated series in order to obtain a stationary variable may result in bias caused by omitted variables.

Instead of omitting information that may be relevant, the focus has shifted towards evaluating and analysing cointegrating relationship between unit labour costs and GNP deflator. Nonetheless, the Granger causality analysis requires not only that the lagged variables be insignificant but also that the speed of adjustment coefficient is zero. The vector error correction (VEC) model modifies the VAR system to incorporate the speed of adjustment variables.

Some researchers in the 1990s and early 2000s have incorporated both cointegration and VEC in their wage-price studies. Mehra (1991), Darrat (1994), Marcellino and Mizon (2000) and Marcellino and Mizon (2001) re-examine the relationship between wage and price inertia taking into account stationarity behaviour of the data. These researchers surprisingly obtain contradictory results. Using the GNP deflator, unit labour costs and an output gap variable, Mehra (1991) got augmented Dickey-Fuller (ADF) test results that indicate that both unit labour costs and the GNP deflator are integrated of order two [I(2)] while the output gap variable is integrated of order one [I(1)]. In line with the ADF results, integration of order zero [I(0)] is then found between differences of unit labour costs and the difference of prices but not between their levels. In addition, incorporation of the speed of adjustment parameters within the VEC yields support for Granger causality from prices to wages. These results could not be generalised since wages were found not to Granger-cause prices.

Lütkepohl (1982), Darrat (1994) and Mehra (1991) argue that Granger causality test results are subject to bias engendered by an omission of variables. Furthermore, since cointegration and VEC models are closely related to Granger causality, these may also suffer from the same bias. Darrat (1994) suggests that the wage-price relationship is more accurately estimated within a general inflation equation. Darrat (1994) specifically follows much of the earlier literature by including a money variable and an interest rate variable, in addition to introducing a measure, of exchange rates into the wage-price vector. Once these omitted variables are included, Darrat (1994) is unable to find a cointegrating relationship between either the levels or differences of unit labour costs and the GNP deflator. These

results bolster the view by Gordon (1986) that prices and wages do not affect each other and that wages exist independently.

Schmidt (2000) argues that lack of consensus in the results is mainly due to improperly specified models and that once the wage-price relationship is embedded within a multiple vector system, identification of a wage-price cointegrating relationship is significantly improved. He also asserts that the increased efficiency yields evidence in support of the dual feedback between wages and prices. Table 3-1 gives additional empirical literature on the wage-price models, which are ordered according to the times the studies were executed.

Table 3-1: Summary of other literature of the wage-price models

Number	Title	Authors (Date)	Data type and Period	Methodology	Main Findings
1	The determinants of wage rate changes and the inflation-unemployment trade-off for the United States	Perry (1964)	Quarterly data from 1947 to 1960 for the United States of America	Correlation Analysis and Ordinary Least Squares	Unemployment explains wage changes. The lag in adjusting wages to living costs does not explain wage rate changes. Change in profits in durable and nondurable goods industries does not significantly explain changes in the wage rate.
2	The short-run Phillips curve with monopoly unions	Strand (1988)	A review		The study found that the Phillips Curve might be sloping upward or downward for given preferences of agents depending on the nature of shocks. The results also show that high average inflation is reduced by union indexation of wages to the price level.
4	Specification of Dynamic wage-price relations in Poland	Blangiewicz and Bolt (1993)	Annual data 1980 to 1991	Single equation modelling using cointegration and ECM	Provides evidence of non-stationarity of all the investigated quarterly wages and price series. Wages and prices were found influence each other strongly in Poland. Real wages and a technology variable explain productivity.

Number	Title	Authors (Date)	Data type and Period	Methodology	Main Findings
5	Wage growth and the inflation process: a multivariate cointegration analysis	Ghali (1999)	Quarterly data from 1959:1 to 1983:3 in the United States	Multivariate cointegration and error correction modelling	Found the existence of a linear time component in the price and wage variables, which suggest that the two need to be modelled within an unrestricted error correction model. The output gap and import prices that were previously treated purely as exogenous variables are found to be significant in getting a stable long run relationship between wages and prices. Monetary policy should profit from the fact that labour cost data predicts future rates of inflation.
6	Wage-price dynamics and deflation in Hong Kong	Genberg (2005)	Quarterly data from 1984:1 to 2003:1 in Hong Kong,	Generalised Method of Moments (GMM)	The results demonstrate that Foreign impacts constitute principal essential shocks and adjustment processes in domestic wages and prices, which determine details of the transmission mechanism. The decline in local nominal prices is explained largely by the declining prices of imported intermediate goods. Foreign shocks and local wage adjustment process explain the negative output gap and unemployment.
7	Keynesian dynamics and the wage-price spiral: identifying downward rigidities	Chen and Flaschel (2005)	Quarterly data from 1955:1 to 2000:4	Switching regression techniques, with structural simultaneous equations using the general VAR model that nests the specification of the linear regime.	The results show that wages respond faster than prices with respect to economic activity. Economic activity may depend positively or negatively on the level of real wages, and this distinguishes wage-led from profit-led regimes. The article also found that there are positive flows to wage and price inflation that are quite weak in nature, and which, when removed through unconventional policy advice, may exacerbate the existing situation considerably.

Number	Title	Authors (Date)	Data type and Period	Methodology	Main Findings
8	Minimum wage effects on wages, employment and prices in Brazil	Lemos (2007)	Survey data: Monthly Employment Industrial, and CPI survey for the period 1982 to 2000	Ordinary Least Squares	The key finding is that increasing the minimum wage raises wages and prices with minor adverse employment effects. This suggests that there is a general wage-price inflation spiral where persistent inflation offsets some of the wage gains
9	Nominal and real wage rigidities in New Keynesian models: a critical survey	Riggi (2010)	A review		The comparison between the model and that of Blanchard and Gali highlights trivial distinctions, which exist in the way real wage, and nominal wage rigidities steer the economy's dynamics. The study concluded that models incorporating nominal wage rigidities and some degree of price stickiness produce a better description of macroeconomic dynamics than models with real wage rigidities
10	Labour markets and monetary policy: a new Keynesian model with unemployment	Blanchard and Gali (2010)	Quarterly data: period not stated		The study constructs a utility-based model of fluctuations, with nominal rigidities and unemployment, and draws its implications for the unemployment-inflation trade-off and for the conduct of monetary policy. Leaving nominal rigidities aside the study shows that, under a standard utility specification, productivity shocks have no effect on unemployment in the constrained efficient allocation. The study focuses on the implications of alternative real wage setting mechanisms for fluctuations in unemployment. The results show the role of labour market frictions and real wage rigidities in determining the effects of productivity shocks on unemployment. The study then introduces nominal rigidities in the form of staggered price setting by firms. The relation between inflation and unemployment is derived and discussed and how it is influenced by the

					presence of labour market frictions and real wage rigidities. The study also shows the nature of the trade-off between inflation and unemployment stabilization, and its dependence on labour market characteristics. Lastly, it draws the implications for optimal monetary policy.
11	Causal inference for structural equations: with applications to wage-price spiral	Chen and Hsiao (2010)	Quarterly seasonally adjusted data from 1978:3 to 2009:2	Six dimensional VAR model using Ordinary Least Squares	The article shows that regression is not the best way to infer causal relations. Using the theory of inferred causation, the article proposes a method to derive structural equations from multivariate time series. This method produces reliable and robust results when used to study the wage-price spiral for the Australian economy.
12	Labour market institutions and wage setting: evidence from Organisation for Economic Co-operation and Development (OECD) countries	Podrecca (2011)	Annual data for the period 1960 to 1999	Conditional ECM in the Ordinary Least Squares Framework	The results support the existence of significant wages push slope effects of union density and benefit replacement rates, benefit duration and employment protection. A generous employment benefit structure lowers the responsiveness of the wage to unemployment while higher employment protections, contrary to what one expects, are found to enhance it. The tax wedge and bargaining coordination have insignificant level and slope effects.
13	Labour market dynamics in Australia: What drives unemployment?	Karanassou and Sala (2010)	Annual data 1973-2006	Vector auto regression (VAR) and Ordinary Least Squares	The article established that the main determinants of the unemployment rise in the 1970s and early 1980s were wage-push factors, the two oil price shocks and the increase in interest rates. It further found that the acceleration in capital accumulation was the critical driving force of unemployment in the 1990s and 2000s.

Number	Title	Authors (Date)	Data type and Period	Methodology	Main Findings
14	Causality between prices and wages: VECM analysis for EU-27	Hoxha (2010)	Quarterly data for the period 1996:Q1-2007:Q4	Vector Error Correction Model (VECM)	The study found evidence in support of a bilateral relationship between prices and wages both in the long run and short run
15	Measuring the NAIRU-a structural VAR approach	Zhao and Hogan (2011)	US annual data for the period 1961-2009	Vector auto regression (VAR)	The article estimates the NAIRU for the US in a framework that allows inflation and unemployment to be jointly endogenous. The article finds that the US business cycle for the period 1975-1985 is largely attributable to the gap disturbance and that for the period 1986-1993 is attributable to both the gap and the NAIRU. The NAIRU occupied dominant position in the economic boom at the end of the 1990s. The NAIRU fell during this period.
16	Do minimum wage increases cause inflation?: evidence from Vietnam	Cuong (2011)	Vietnam monthly data from Jan 1994 to Dec 2008	Feasible Generalised Least Squares (FGSL) and Ordinary Least Squares	The article concludes that minimum wage increases did not increase inflation. Increases in consumption demand are the ones that were responsible for increasing inflation.
17	Wage persistence and labour market institutions: an analysis of young European employees	Menezes et al. (2011)	Standardised seven year survey (1995-2001) of the European Community Household Panel (ECHP)	Survey results analyses using Statistical Packages	The study finds that Labour Market Institutions (LMIs) explain wage persistence. In particular, the study finds that a high level of Employment Protection Legislation (EPL) and a high level of Bargaining Centralisation (BC) increase wage persistence.

Number	Title	Authors (Date)	Data type and Period	Methodology	Main Findings
18	Elusive persistence: wage and price rigidities, the Keynesian Phillips Curve and inflation dynamics	Tsoukis et al. (2011)	Literature Survey	Literature Survey	The review finds that New Keynesian inflation equations cannot account for inflation persistence, a key feature of the empirical dynamics of inflation with significant policy implications. The only exceptions seem to be when indexation is allowed in price setting or when stickiness is combined with wage rigidity and staggering.
19	Generalised Taylor and generalised Calvo price and wage setting: micro-evidence with macro implications	Dixon and Le Bihan 2012)	Monthly data for the period 1994:7 to 2003:2	Dynamic Stochastic General Equilibrium (DSGE) modelling	The Generalised Taylor model is found to help rationalise the hump-shaped and persistent response of inflation, without resorting to the invalid assumption of consistent wage and price indexation. The Impulse response functions (IRFs) of output and inflation for the various pricing models employed do not give any significant variation
20	Price and wage stickiness, inflation and profits	Gwin and VanHoose (2012)	Quarterly data for the period 1961:1 to 2007:2	Ordinary least Squares in Panel models	The results suggest that mark-ups respond positively to inflation in industries with sticky prices and flexible wages. Responses are either inconclusive or muted in industries either with sticky prices and sticky wages or both flexible prices and flexible wages.

3.3.4 Justification for the extension of the wage-price model

The studies reviewed above, are studies that relate to wage-price relationships, in which Ordinary Least Squares (OLS), single equation cointegration and error correction, generalised least squares, and vector autoregression models were applied to a limited number of variables and equations which were not in a macroeconometric framework. This implies that other notable macroeconomic relationships between the wage-price model, its feedback variables and policy implications to the rest of the economy were left unexplored. The studies that are reviewed in this section are those that were conducted using

macroeconometric models, which also incorporate the effect of monetary and other policies on these variables.

The empirical studies on relationship between employment, wages, prices and productivity are extensive, particularly, for the developed economies (Gordon, 1986; Ando and Brayton, 1993; Strauss and Wohar, 2004; Marques, 2008 and Duarte and Marques, 2013). However, remarkably few such studies exist in developing countries and with the exception of studies by Wakeford (2004), Yusof (2008), and Baffoe-Bonnie and Gyapong (2012). Otherwise, there is a dearth of empirical literature analysis on dynamic interactions of these variables in developing countries like Namibia. One fact, which is consistent in literature, is that changes in any of these four variables are guaranteed to impact on other variables. The usual inconsistencies lie in how these variables affect each other in either the short-run or long run. For example, Gali (2005) and Zhao and Hogan (2011) found that an increase in productivity reduces overall employment in the economy in the short run, but such productivity reduction has no effect on employment in the long run. However, Christiano et al. (2004) found a positive relationship between productivity and employment in the short run using a different estimation method. In the next section, study strives to justify the wage-price-labour productivity-unemployment model.

3.3.5 The simultaneous wage-price-productivity-unemployment model specification

As mentioned earlier, some studies carried in the past show that wages and prices are simultaneously determined (Nymoen, 1991; Bardsen et al., 2003; Bårdsen et al., 2004; Bårdsen et al., 2005; Bårdsen et al., 2007). One phenomenon that emerges when modelling the core wage-price system and its principal feedback variables in these studies is the establishment of contemporaneous relationships between:

(i) wage, price inflation and labour productivity growth,
(ii) the unemployment rate and productivity growth, and,
(iii) labour productivity growth, real wages and the unemployment rate.

These findings are not surprising because labour market theories and those theories related to the behaviour of workers and firms detail relationships, which exist among these four variables (wages, prices, productivity and unemployment). There are, however, four popular theoretical explanations on this relationship held:

(i) Unit labour costs in the form of nominal wages and labour productivity are key arguments of firms' total costs of production and, hence, consumer general price level in the economy (Carlin and Soskice, 1990).

(ii) Real wage level affects the levels of worker productivity taking into consideration that real wages are an essential determinant of worker effort (Lindbeck and Snower, 1986 1987, 1988 and Lindbeck, 1993).

(iii) There are generally two views concerning the association between labour productivity growth and unemployment. The first view asserts that productivity growth due to technological improvements increases unemployment. Proponents of this view argue that technological shocks in the US increase unemployment (Blanchard, 1989; Blanchard and Quah, 1989). Evans (1989) also added that technological shocks that instantly decrease unemployment have a favourable positive long-term effect on output. In addition, Gali (2005) demonstrates that the above result is still relevant for total hours worked which decrease after a positive technological shock. The second view says that productivity growth reduces unemployment. This accounts for the boom experienced in the US in the 1990s. Studies by Ball and Moffitt (2002) and Staiger, Stock and Watson (2002) both describe the extremely low unemployment rate and the exceptionally high productivity growth experienced in the 1990s. The first view means that there are positive co-movements, while the second view means negative co-movements.

(iv) Unemployment in any economy is affected by real wages in two ways. First, the real wage level can affect the workers' decisions to quit if, for instance, the real wage levels are lower than their reservation wage (Lindbeck, 1993). Second increasing wages influence the decisions of firms' to recruit new workers or to

maintain the existing number of workers in view of the significance of labour costs in the total production costs of the firm (Carlin and Soskice, 1990).

Gali (2005) used data for the G7 countries to estimate conditional relationships of productivity and employment, based on the decomposition of the two series into technology and non-technology components. His results indicate that for the majority of the countries the following results apply: (a) technology shocks appear to generate a negative co-movement between employment and productivity counter-balanced by a positive co-movement generated by demand shocks; (b) the impulse responses show a sustained decline of employment in response to a positive technology shock; and (c) productivity temporarily increases in response to a positive demand shock. Gali (2005) concluded that the pattern of economic movements explained by technology shocks appear to be largely irrelevant to the main post war cyclical episodes. He also added that a simple model with sticky prices, monopolistic competition, with variable effort is shown to be able to account for the above-mentioned empirical findings.

Marcellino and Mizon (2001) did a small-system modelling of real wages, inflation, unemployment and output per capita in Italy. The methodology they used was vector auto regression (VAR) and vector equilibrium correction model (VEqCM) commonly referred to as a vector error correction model (VECM) in contemporary econometrics jargon. The quarterly and seasonally adjusted data was used for the period 1970 (1) to 1994 (4). In this study, w_t is the log of nominal average earnings, which is referred to as wages, p_t is the log of consumer price index, so that $(w-p)_t$ is the log of real wages and Δp_t is the quarterly inflation rate. Additionally, u_t is the log of the percentage unemployment rate and $(y-l)_t$ is the log of the ratio of real GDP to total employment, which was used by Sargan in 1964. The primary purpose of this study was to develop a model of wage determination similar to that developed by Sargan in 1964 within a small system instead of a single equation analysis. All the variables used in the study were found to be nonstationary and, therefore, either integrated of order one [I (1)] or of order two [I (2)]. Further, the variables used in the study were combined with dummy variables, to capture

the separation between the Bank of Italy and the treasury, a period of strong devaluation following withdrawal of the lira from the EMS, tight monetary policy leading to recession in the period 1980 (1) to 1982 (2), and a change in the definition of unemployment.

Evidence from the study shows that even if the structural VAR and the reduced form model are congruent and provides reasonable econometric representations for the variables in the 1970s; they performed poorly in the 1980s and 1990s. The principal forecast failures are over prediction of $(w-p)_t$ and under prediction of, Δp_t. The study also analysed whether structural changes in the Italian economy could be captured by interest rates (as a proxy for monetary policy), effective exchange rate and net trade balance weighted by GDP (as a proxy for the openness of the economy) and hours lost in labour disputes (as a proxy for the importance of unions and generally for the climate in the labour market). The results also show that split-sample analysis produced better results than the other methods that were applied. It shows that equilibrium error correction mechanisms do not error correct to changes in equilibrium. The study illustrates the use of equilibrium error correction mechanisms for small-system modelling of the evolution of real wages, output per capita, unemployment and inflation similar to the single equation modelling done by Denis Sargan in his ground breaking study in 1964, but for an economy subject to substantial changes.

The main weakness of the summarised study is its failure to examine results by using variance decomposition and impulse response functions. This is probably because these two techniques were still in their infancy stage, when this study was executed. The other weakness is that the study results could have benefited from the use of the structural VAR methodology given the numerous structural changes that occurred in Italy during the period in question. The current study, which invokes both the VAR and structural VAR techniques attempts to ensure that such obvious problems are totally avoided.

Schmidt (2000) analysed the dynamic behaviour of wages and prices within a large macroeconomic framework and argues that there is lack of consensus as far as the results

of wage-price models are concerned, due to the fact that, the models are generally specified improperly. Schmidt (2000) further argues that if the wage-price relationship is embedded within a multiple vector system of a wage-price cointegrating relationship, the performance of the model is significantly improved. He also argues that the resulting increased efficiency leads to evidence in support of the dual feedback between wages and prices. Schmidt (2000) come up with a simple way to represent macroeconomic relations, which allow establishment of the wage-price relationship. This is shown below:

$$c_t - a_0 - a_1 y_t - a_2 r_t = \epsilon_{ct} \quad [3.7]$$

$$i_t - b_0 - b_1 y_t - b_2 r_t = \epsilon_{it} \quad [3.8]$$

$$M_t - d_0 - d_1 y_t - d_2 r_t - d_3 P_t = \epsilon_{Mt} \quad [3.9]$$

$$W_t - f_0 - f_1 P_t = \epsilon_{WPt} \quad [3.10]$$

where *y* is the logarithm of real output, *c* is the real domestic consumption, *i* are the logarithm of real domestic investment, *r* is the proxy for interest rates, *M* is the logarithm of nominal money balances, *P* is the logarithm of the aggregate price level, and *W* is the logarithm of the productivity-adjusted wage level while it is the time subscript. ϵ_{ct}, ϵ_{it}, ϵ_{Mt} and ϵ_{WPt} denote the respective disequilibrium error terms.

Schmidt (2000) further argues that each of the equations denotes a long-run equilibrium equation and the residual error terms denote the disequilibria in each equation, which implies that each equation can be linked to a separate cointegrating relationship. In addition, he also contended that most macroeconomic models predict that *P* and *W* must satisfy equation [3.10] so that ϵ_{WPt} is a stationary process. Schmidt was mostly worried about the likely biases which crop up when estimating inappropriately specified cointegrating vectors. Work by Phillips (1991) and Johansen (1992) show that omission of relevant variables in a cointegration analysis tends to result in biased and inefficient estimates of the number of both cointegrating relationships and cointegrating coefficients. Therefore, the fact that the majority of economic variables are relationships that are not

determined in isolation means that if they are estimated in single equations, their results may lead to concerns raised by Phillips and Johansen. A study by (Cutler et al., 1997) found empirical evidence, which supports the efficiency gains linked with embedding a single macroeconomic equation within the framework of a larger macroeconomic system. To determine the efficiency gains associated with the systems approach to estimation, Schmidt (2000) estimated the wage-price model within a single equation and then within a two variable system and then finally within the larger system of equations.

The results of the Schmidt study show that single equation estimation of the wage-price model was only marginally successful. In addition, the complete system evaluation resulted in error-correction results, which are consistent with bidirectional feedback/causality between prices and wages. The main weakness of this study was that it does not go a step further to give forecasting performance, variance decomposition and impulse response of the model.

Pétursson (2002) studied the open economy version of the wage-price model within the framework of imperfect competition in the goods and labour markets for the period 1973 to 1999. The three main sources of wage and price inflation in Iceland were identified as conflicting claims, a real exchange rate and an excess demand channels. The study models price formation as a mark-up over marginal costs where the mark-up can vary because of pricing-to-market effects. This gives an empirical steady state relationship in which consumer prices are explained by homogeneous import prices and unit labour costs. In addition, Pétursson (2002) argued that wage formation is modelled as a wage bargaining process between firms and labour unions. He further adds that the steady state result of the Nash bargaining process yields real consumption wages per unit of production as an inverse function of the unemployment rate or equally the wage share in value added as a function of unemployment rate and real exchange rate.

Pétursson (2002) employed the vector auto regression (VAR), single equation Error Correction Model (ECM) and the VECM to make his estimations. The results of the study

show that there is some evidence of an upward shift in the equilibrium mark-ups in the late 1980s. This was due to a substantial escalation in the cost of capital that reflected the move towards market determined interest rates and a shift in policy priorities towards price stability, which culminated in a path breaking labour market agreement in the early 1990s. The results also show that these changes led to a downward shift in equilibrium inflation and an upward shift in the natural rate of unemployment. As mentioned earlier on, the type of analysis that researchers use in most cases depend on tools available to the researcher at that particular point in time. One criticism that could be levelled against this study is that the depth of its analysis is not exhaustive and so, its results have to be used cautiously.

Wakeford (2004) studies the link between labour productivity, average real wages and the unemployment rate in South Africa at the macroeconomic level using time series econometrics techniques. He found strong evidence of a structural break in 1990, after which time all series rapidly rose. The break negatively affected level of employment in the first instance, and subsequently fed through into per employee wages and productivity. A long-term equilibrium relationship is found between real wages and productivity, but unemployment is apparently unconnected to the system, which gives support to the insider-outsider theory. Wakeford (2004) also found a long-term wage-productivity elasticity of 0.58 which indicates that productivity has grown more rapidly than wages, and this is in line with the finding that labour's share of gross output was shrinking over the period studied. He concludes that these trends are explained plausibly through the adoption of job-shedding technology and capital intensification.

Bårdsen et al. (2007) carried out a study in which they modelled wages and prices in Australia. Their study estimated a simultaneous equation model of wages and prices for Australia underlined by a conflicting/competing claims framework of imperfect competition. This theoretical model is extensively explained in the article. The study was carried out for the period 1985Q3 to 2004Q2 and all the variables except for consumer prices (CPI) were seasonally adjusted. The study utilised the full-system co-integration in which the formal model is the H_1 model adopted from (Johansen et al., 2000). The model

they estimated incorporated the following vector of variables and some dummy variables that I do not mention here for brevity's sake:

$$z_t = [w \;\; p \;\; pr \;\; u \;\; pm] \qquad [3.11]$$

where:

w = wages

p = consumer prices

pr = labour productivity

u = unemployment, and,

pm = import prices

The results of the VAR study suggest that productivity is not fully reflected in wages. Moreover, the results of the final model also support the hypothesis that wages and prices are jointly determined in Australia. For both wage and price growth, the speed of adjustment parameters was found to be -0.26 and -0.14 respectively, and this means that the adjustment of wages to equilibrium is faster than that of prices, ceteris paribus. The results also indicate that there exist statistically identified and economically sensible co-integrating relationships for wages and prices. The study further found that the estimated steady state relationships are embedded in dynamic equations for wages and prices, which are estimated by using the maximum likelihood method. The most significant result to emerge from this modelling exercise is that there is significant statistical support for the hypothesis that wages and prices in Australia are jointly determined. In addition, they also found that there exist two separate identified cointegrating vectors for wages and prices and they went on to state that this issue is rarely tackled in literature as a result of the well-known difficulty in estimating the wage curve in Australia. The simultaneous equation model applied is both simple, parsimonious and is capable of fully describing the process of wage and price inflation with less than one (1) per cent variation in the data left unexplained. As explained earlier, the speed of adjustment parameters for both wage and price growths is highly significant and negative, and that the wages adjust faster than prices to any disequilibrium.

The study by Bårdsen et al. (2007) made use of the VAR methodology in an open economy macroeconomic framework. The current study goes a step further to combine the VAR and the structural VAR (SVAR) to do its analysis.

Yusof (2008) examined the long run and dynamic behaviours of real wage-employment and productivity association, by invoking the Malaysian manufacturing data, and determined which labour theories were supported by the data. His study made use of the time series econometrics, which involves stationarity, cointegration tests, vector error correction model, impulse response function and variance decomposition to analyse the above-mentioned relationship. Yusof (2008) found that a long run relationship exists between real wages, employment and real productivity, with real wages being the key variable that adjusts to maintain cointegration. He also found that the theory, which says that real wages inversely affect employment, and the efficiency wage theory were not supported, while the performance-based pay scheme theory was supported.

Additionally, Marques (2008) evaluated the persistence of wages and prices in the Portuguese economy using the VAR and structural vector error-correction model (SVECM), by assuming a model in which the collective bargaining process determines the wages and imperfectly competitive firms set the prices. This study invokes the imperfectly competitive market structure as expounded under the theoretical literature section above. The variables considered in the study include nominal wage rate (w), consumer price level (p), unemployment rate (u), labour productivity (h) and foreign prices (z). The VAR lag length is three and, this is the smallest number of lags needed to ensure the VAR model residuals are normally distributed and do not show significant autocorrelation. Thus, the reduced form model used in this study is represented as:

$$\Delta x_t = \mu_0 + \varphi\gamma' x_{t-1} + \sum_{i=1}^{2} \Gamma_i \Delta x_{t-i} + \pi D_t + \varepsilon_t, \qquad t = 1, 2, \ldots T, \quad [3.13]$$

Where $x_t = (w, p, u, h, z)$ D_t is the vector of dummy variables, φ and γ are the $5 \times r$ matrices of the loading coefficients and cointegrating vectors, respectively, under the assumption of r cointegrating vectors (with$r \leq 5$). It is from the information provided here that the SVECM model (which cannot be discussed in detail for brevity's sake) was developed, estimated and then used for analysis.

The study found that the relative persistence of wages and prices is shock specific. In line with this, real wages are particularly persistent following a permanent import price shock such that only 53 per cent of total disequilibrium dissipates in the first two years after the shock. The permanent unemployment and the permanent productivity shocks, which were 66 percent and 69 percent respectively, dissipate in the first two years after the shock. Contrastingly, price inflation was found to be more persistent following a permanent unemployment shock (only 42 per cent of the total disequilibrium dissipates in the first two years, while 53 per cent in the case of a permanent import price shock). Marques (2008) further argued that his results were quite logical because an import price shock impacts directly on domestic prices and only indirectly on wages, while an unemployment shock impacts directly on wages and to a large extent, indirectly on prices through lower wages. Marques (2008) study also found that from the business cycle perspective variation in the forecast errors of wages are attributable mainly to unemployment shocks (approximately 80 per cent) whereas variation in the forecast errors of prices are attributable mainly to import price shocks (approximately 60 per cent) and unemployment shocks (approximately 20 per cent). Productivity shocks were found to explain a relatively small percentage of forecast errors in both prices and wages (less than 10 per cent).

Forslund et al. (2008) derived and estimated a wage equation for Nordic countries. These researchers started by arguing that according to standard union bargaining model, unemployment benefits should have significant effects on wages, and that product prices and productivity should have no role to play in wage bargaining process. They formulated a different strategic bargaining model, where product and labour market conditions collectively determine wages. They estimated the wage equation using aggregate data for

four Nordic countries. The study finds that unemployment explains wages, the replacement ratio, productivity, exchange rates and international prices. The evidence suggests that there is considerable nominal wage rigidity and that exchange rate fluctuations have significant and chronic effects on competitiveness.

De la Croix et al. (2009) carried out a study on generalised existing fair wage models to let work effort change over the business cycle. Their results indicate that when effort is variable, wage changes, are to some extent, compensated for by endogenous effort changes so that the responsiveness of marginal cost to output and employment fluctuations is reduced. They conclude that this new approach lessens the need for sluggishness to explain the observed high inflation persistence.

Hu and Toussaint-Comeau (2010) used much recent data, to analyse labour market indicators, such as productivity adjusted wages and unemployment (as well as supply shock and demand factors), to determine the degree to which they are capable of predicting inflation. They found that the wage growth does not Granger cause price inflation and price inflation Granger causes wage growth. In addition, they also found that unemployment has additional predictive power on inflation when they use the full sample (1960:Q1–2009:Q2) and the same applies to the subsample (1984:Q1–2009:Q2) used. As their results indicate the unemployment gap is, therefore, a useful indicator of inflation. By analysing statistical data, they concluded that, in recent years, wage growth has been particularly slow and, because of this, some analysts believe that there is no need to be overly concerned about future inflation. Their findings, in this article, however, do not support the claim that slow wage growth leads to low inflation.

A similar study was carried out by Christopoulos and LeÃ n-Ledesma (2010) who examined the long-run real wages-unemployment relationship for five OECD countries over the period 1960:1–2001:4. They employed econometric techniques that allow for the presence of non-linearity in long-run equilibrium. They adopted the idea of ‘hidden co-integration’ suggested by Granger and Yoon, which has several advantages over other

nonlinear models. Christopoulos and LeÃ n-Ledesma (2010) found that there is a long-run positive relationship between real wages and unemployment only in cases where both are affected by positive shocks. They also get a negative relationship between productivity and unemployment. The empirical analysis for the study is complemented with the estimation of error correction models for all countries.

Bhattacharyya and Hatton (2011) attempted to model wage setting and unemployment over more than a century since Federation. The model they used which captures essential features of centralised wage setting worked well over the century as a whole and provided logical equilibrium predictions in levels for both unemployment rate and real wage. The results indicate that both equations for unemployment and wage setting are necessary to evaluate equilibrium unemployment, as opposed to the single equation methods used in Phillips Curve studies. They also found that although demand and wage pressure variables have the expected signs, some of them are not particularly important and cannot account for dramatic shifts to persistently low-average unemployment rates in the 1940s and higher unemployment period during the mid-1970s. The low unemployment era between 1942 and 1973 appears to be influenced by a change in dynamics of the unemployment equation. Strong wage pressure re-emerged in the mid-1970s, but it was successfully thwarted by corporatist wage setting under the new Accord. They also found that wage pressure returned with the transition from corporatist wage setting to enterprise bargaining. Nevertheless, this effect appeared to have been offset by the weakening bargaining strength of trade unions.

Majsterek and Welfe (2011) empirically tested major economic hypotheses dealing with long-term relationships between producer prices, wages, consumer price index, prices of consumer goods and services, unemployment, productivity of labour and payroll expenses other than the wages themselves. They emphasised the fact that it is of importance in this approach to come between net wages that affect employees' decisions and the gross wages that affect employers' decisions. Since the tool applied to evaluate data was a vector equilibrium correction model (VEqCM), Welfe and Majsterek (2002) findings suggest that

prices and payroll expenses are the most significant sources of shocks in the system analysed. They added that wages and prices are most sensitive to stochastic trends. They concluded that since prices are integrated of order two in the Polish economy they can be effectually be influenced by the anti-inflationary policy.

Dixon and Le Bihan (2012) found that the Generalised Calvo and the Generalised Taylor models of wage and price setting are precisely consistent with the distribution of durations observed in the data. They used price and wage micro-data from one of the main euro area economy (France), to come up with calibrated versions of these models. In addition, they assessed the monetary policy transmission effects by embedding the calibrated equations in a general equilibrium model, which is dynamically standard and stochastic. These researchers found that the Generalised Taylor model helps to rationalise the hump-shaped sustained response of inflation, without resorting to systematic wage and price indexation.

Kolsrud and Nymoen (2015) conducted heuristic dynamics modelling of the wage and price curve model of equilibrium unemployment. They used a standard model of equilibrium unemployment consisting of static equations for real wage curve and price curve, which jointly determine the NAIRU. The model heuristics suggest that unless the rate of unemployment approaches the NAIRU from any given initial value, inflation will be rising or falling over time. Kolsrud and Nymoen (2015) showed that the NAIRU unemployment dynamics are adequate but not necessary for inflation stabilisation and that the dynamic wage-price spiral model usually has a dynamically steady solution for any pre-set rate of unemployment. They also discussed a restricted version of the model, which is in line with the accelerationist view that inflation rises/decreases if unemployment is not at its 'natural rate'.

Dos Santos Ferreira and Michel (2013) presented a simple log-linear macroeconomic model designed to explain fundamentals of the dynamic analysis by Keynes in the *General Theory* and the *Treatise on Money*. The model used has the usual static Aggregate Demand-Aggregate Supply block and a three-dimensional dynamic process including

money wage, rates of change and the expected levels of output and price. They went on to say that, the model indicates Keynes' ideas, in particular, the nature of unemployment and the stabilising nature of *money*-wage stickiness. Their model also permits the reconciliation with empirical observations on the Keynes false conjecture of the negative correlation between money and real wages.

Duarte and Marques (2013) analysed the dynamic effects of shocks to wages and prices in the United States (US) and the Euro Area (EA) with special emphasis on the persistence of real wages, wage and price inflation. They also utilised the SVECM, which identifies structural shocks using long run characteristics of the underlying theoretical model including the cointegrating properties of the estimated system. In line with the theoretical model employed, which assumes an economy where wages are determined through collective bargaining and prices are set by imperfectly competitive firms, an empirical SVECM involving nominal wages, prices, the unemployment rate, productivity and import prices were estimated and, three permanent and two transitory structural shocks were identified. The three permanent shocks labelled as import price, unemployment and productivity/technology shocks, were allowed to have long run impacts on some or all the variables included in the system. Additionally, the two transitory shocks labelled as wage and price shocks were not allowed to have any long run effects on the variables of the system.

The main findings of Duarte and Marques (2013) study are summarised as follows: After an import price shock, wages and prices rise more significantly in the long run in the EA as compared to the US, in line with the relative degree of international openness of the two economies. They also found that the homogeneity property of the model made real wages and labour share remain unchanged in the long run. However, this was not the case after unemployment or a productivity/technology shock. The unemployment shock implies a permanent decrease of wages and of labour share in both economies, but productivity shock has different implications for labour share in the long run, as it decreases in the EA, and increases slightly in the US. This was argued to stem principally from the fact that in

the EA wages only absorb a small proportion of productivity gains, whereas in the US they are completely absorbed. The evidence of real wages was not clear-cut as their relative persistence depends on the type of shock hitting the economy. For instance, these researchers found that in EA, real wages emerged as more persistent, following permanent unemployment and productivity shocks, but somewhat less persistent in the face of import price shock. In terms of long run persistence, wage and price inflation emerge as more persistent in the EA, than in the US in the face of permanent shocks especially so for the unemployment and productivity shocks. This finding was found robust to the changes in the sample period in the models' specifications entertained in the paper.

Moreover, Van Zyl (2010) carried out a study whose purpose was to determine econometrically the extent and sign of the relationship between employee-remuneration gaps and labour productivity. The study used the Gauteng manufacturing sector as its laboratory test ground. The research design used was a log-linear two-step OLS estimation to determine the extent and sign of the relationship between employee-remuneration gaps and labour productivity. The study estimated the employee remuneration gap-labour productivity indicator coefficients taking into consideration employee characteristics, skill levels and business or economic uncertainty. Van Zyl (2010)'s main finding was that signs of the remuneration gap-labour productivity indicator coefficients were found to be positive in terms of all categorisations, indicating a positive relationship between labour productivity (at varying magnitudes) and employment-remuneration gaps. The squared indicator employee remuneration gap-labour productivity coefficients justified existence of diminishing marginal productivity characteristics after an optimal employee wages gap level.

Ojapinwa and Esan (2013) used data for the period 1970 to 2010 to investigate the existence and stability of the Phillips relationship in Nigeria. They checked for stationarity using Augmented Dickey Full test, Philip Peron (PP) test and the Graphical method. They used autoregressive distributed lag models (ARDL), OLS general-to-specific approaches to cointegration to examine the Philips relationship, and the ECM was used to test the short

run dynamics. Their results show that the relationship between the change in the unemployment rate and the inflation rate is negative in the short run. This means that a low unemployment rate leads to an escalation in the inflation rate and, therefore, acceleration of the price level; nonetheless, the relationship became non-existent in the long run with a positive relationship between inflation and unemployment signifying stagflation. In addition, they used the recursive residual, CUSUM and CUSUMsq tests to confirm the stability of the Philips relationship. Ojapinwa and Esan (2013) estimate a Philips Curve for Nigeria using ARDL General to Specific bounds testing and DOLS approaches. They apply the ADF unit root test to confirm the order of integration. The results obtained indicate cointegration between inflation, unemployment, money supply and real gross domestic product for Nigeria suggesting a long run relationship over the study period. The results show that while inflation is increasing, unemployment also increase in the long run, which implies that Phillips curve does not exist for Nigeria in the long run. This suggests that policy makers cannot use the trade-off in choosing appropriate strategy. They conclude that government should be careful in adopting a monetary policy that would keep inflation at a politically acceptable level in Nigeria. These conflicting results might be because of the high level of the natural rate of unemployment in Nigeria. Rational policy making, therefore, means that Nigeria policy makers would have to settle for that combination that minimises the twin macroeconomic evils.

Leshoro (2013) adopted the Toda-Yamamoto technique of causality in order to test causality between economic growth and employment. He investigated if an increase in the Gross Domestic Product (GDP) led to increased employment in South Africa, by employing quarterly data for the period 2000Q1 to 2012Q3. Leshoro (2013) further observed that South Africa has been experiencing strong and increased growth for the past decade, yet the rate of employment is not significantly high. However, he argued that the main aim of the government since the first democratic election in 1994 was to increase economic growth along with a reduction in the unemployment rate. They added that although the economy experienced significant success of increased economic growth, it performed poorly as far as job creation is concerned. The results obtained show that

causality does not run from employment to economic growth in South Africa as the null hypothesis was not rejected at all levels of significance. However, the Keynes General Theory holds for South Africa, which shows that economic growth leads to employment. These results support the criticism of 'jobless growth' against South Africa. The study concludes by giving various recommendations necessary to create employment in South Africa.

3.3.6 Unemployment literature analysis

In this section, literature related to the SVAR analysis of unemployment is reviewed. Linzert (2001) investigated the sources of German unemployment for the period 1969:1 to 1998:4 using the SVAR model. The results indicated that the demand and the wage setting schemes are economically meaningful long run equilibriums in the data. The results indicate that technology and wage shocks only exhibit short run effects on unemployment. Besides, demand shock significantly reduced unemployment in the short to medium term as was expected, but this effect diminished and vanished in the long term. Unemployment was significantly escalated by labour supply shock in the first three years of the shock. In addition, results also show that price shocks had the most persistent effect on unemployment; unemployment only bounced back to its pre-shock level after six years had elapsed.

Fritsche and Logeay (2002) investigated structural unemployment and output gap in Germany using the SVAR analysis within a hysteresis framework for the period 1970 to 2000. Their results indicate that for the unemployment rate mostly demand shocks matter as the supply shocks disappear in the long run. In line with this, the jumps in unemployment rate are mainly explained by short run labour supply and demand shocks. The demand shocks were also established to drive a gap between output and potential output. They also established that demand led unemployment is simply a mirror of the output gap. The conclusion they came to was that the evolution of the unemployment rate could therefore be attributed to a lack of effective demand.

Maidorn (2003) studied the effects of shocks on the Austrian unemployment rate using the structural VAR approach for the period 1964:1 to 1992:2. The results show that the demand shocks dominate the dynamics of employment and, to a lesser degree, unemployment. The results also show that labour supply shocks are the main source of variability in unemployment, even though they do not have an impact on employment. The results also established that increased demand seems to be located in the less productive sectors of the economy. In a similar study, Balmaseda et al. (2000) investigated the dynamic effects of shocks to labour markets for OECD countries for the period 1950 to 1996 the SVAR framework. The results demonstrate that for most of the countries unemployment fluctuations are dominated by aggregate demand shocks and productivity shocks in the short run. In addition, in Italy and Spain demand shocks were found important in accounting for the variability of unemployment in the medium to long term. This result was also established to hold in the US and it is in tandem with previous findings by Blanchard and Quah (1989), and Gamber and Joutz (1993). Further, the results show that in countries where the population changes have been significant like Ireland the labour supply shocks dominate in both the short and long run.

van Montfort et al. (2003) conducted a study on unemployment dynamics, propagation of aggregate demand and reallocation shocks in the Netherlands for the period 1970 to 1997 using the SVAR approach. The results indicate that aggregate demand and supply shocks, and reallocation demand and supply shocks are all sources of unemployment in the Netherlands in both the short run and the long run. The aggregate labour supply shock was found to have a very limited influence on long run unemployment. Van Montfort et al. (2003) concluded that additional labour supply is also fully absorbed by labour demand in the long run.

Gambetti and Pistoresi (2004) carried out study entitled "*Policy matters: the long run effects of aggregate demand and mark-up shocks on the Italian unemployment rate for the period 1960:1 to 1999:4*". Their results indicate that both mark-up and aggregate demand shocks permanently reduce the unemployment rate. In addition, technology shocks were

found not to have any significant effect on unemployment rate in the long run. In line with these results, Gambetti and Pistoresi (2004) argued that the policy implication from these results is that expansionary aggregate demand and deregulation policies, which reduce the mark up permanently, decrease the Italian unemployment rate.

Brüggemann (2006) analysed the sources of Germany unemployment for the period 1970 to 2000 using structural vector error correction (SVECM) model employing quarterly data. The study found that productivity, labour demand and labour supply shocks are all significant determinants of unemployment in the long run. Historical decomposition revealed that for shorter time horizons, wage shocks explain unemployment, for example, after the first oil price shock and after the German reunification. The study also revealed that productivity shocks are not particularly significant in the short run. Using the subset of the full SVECM model, the study established that productivity has a negative long run effect on unemployment. In addition, the labour demand shocks were also found to have a more significant role for unemployment than suggested by the full SVECM. The results, therefore, demonstrate that a mixture of shocks to productivity, labour demand and labour supply are important determinants of unemployment in Germany.

Glocker (2012) studied the unemployment compensation and aggregate fluctuations for the period 1971:1 to 2010:1 using the SVAR methodology. The results indicate that the empirical structural vector autoregressive model confirms the theoretical results. In addition, the results highlight importance of real wages in transmitting unemployment benefit shocks to the macroeconomy. In particular, discretionary fluctuations lead to an escalation in real wages, unemployment and consumption while inducing a smaller deceleration in output.

Baffoe-Bonnie and Gyapong (2012) investigated the dynamic implications for wage changes on productivity, prices and unemployment in a developing economy using SVAR for the period 1970 to 2007. The study attempts to provide answers on how changes in wages influence the short-run and long run dynamics of labour productivity, prices and

employment in agricultural and manufacturing sectors. The specific questions that the study wanted to address about the Ghanaian economy were: (i) Do changes in wages, such as increases in the minimum wages in agricultural and manufacturing sectors have any significant dynamic impact on employment, labour productivity and prices, and to what extent? The study also made use of impulse response functions and variance decomposition results of the SVAR model to do the analysis. Their empirical results show that shocks to wages have no significant impact on employment in the two sectors. The results also indicate that while a wage increase does not encourage the workers in the agricultural sector to work more, such an increase induces manufacturing workers to increase their short-run productivity. Their results also show that persistent increases in wages may be inflationary within industries and in the entire economy. Baffie-Bonnie and Gyapong (2012), therefore, concluded that a wage policy that increases wages moderately, particularly, in the manufacturing sector might provide a partial solution to reduce poverty and enhance the standard of living of workers in Ghana.

3.3.7 Critical analysis of related literature from Namibia

Macro econometric modelling is a relatively new phenomenon in Namibia, and to date, only three macro econometric models have been developed and experimented with, in the Namibian economy. Moreover, no small macro econometric model has been developed to study wage-price or wage-price-productivity-unemployment models in Namibia. The efforts to create a framework for macro econometric modelling in Namibians commenced just after independence and led to the creation of the first macroeconomic model for Namibia called the Namibian Macroeconomic Framework (NAMAF) in 1993. NAMAF was developed as a medium term planning tool for Public Expenditure Review (PER) and the first National Development Plan (NDP1). PER was supposed to help in defining sustainable levels of government spending and to explain the methods of achieving this taking into consideration the current economic and social trends and policy direction.

Tjipe et al. (2004) stated that NAMAF was a very useful tool for forecasting the path of the Namibian economy for a while. They further added that it was widely utilised to

recommend measures for expenditure restraints in the wages and salaries commission (WASCOM) report and it was a central input in constructing the macroeconomic framework for NPD1. NAMAF was abandoned in early 1995 because of problems of scarce technical resources in the domestic economy, inadequate institutional capacity in model development and limited statistical data and policy coordination between relevant institutions.

In 1996, the National Planning Commission, Bank of Namibia, Ministry of Finance and the Namibia Economic Policy Research Unit introduced a Macroeconomic Modelling Working Group (MEMWOG) whose main task was to map the way forward as far as macroeconomic model development was concerned. The same group also reviewed the usefulness of NAMAF and considered possible alternatives to it; and this led to the decision to train key people in the use of the International Monetary Fund (IMF) and World Bank (WB) Revised Standard Model-Extended (RMSM-X). This model was used since then and it was adapted to the Namibian economic conditions and relationships. The model derived from the RMSM-X was referred to as the Namibia Macroeconomic Model (NAMMAC). NAMMAC also had its own crippling limitations, in that it failed to incorporate the labour market, financial implications of fiscal deficits and the use of flexible production on the supply side. As Tjipe et al. (2004) argue that the major problem with NAMMAC was that it was solved recursively thus ignoring the contemporaneous nature of the key macroeconomic variables. They further added that the recursive solutions fall short when it comes to consideration of explicit relations among variables.

The macro econometric model estimated by Tjipe et al. (2004) incorporated the following sectors of the economy: the real sector, the financial sector, the monetary sector, the price sector and the labour sector. This research was sponsored by the Bank of Namibia, which also went on to publish it under its working paper series. In addition, this model was referred to as the Namibia Macro econometric Model (NAMEX). The last three sectors are the ones that are central to the small structural macro econometric model developed in this thesis. Although these authors criticised NAMMAC for using single equation estimations,

they also fell into the same trap of using single equation estimations based on cointegration and error-correction modelling techniques. Further, a problem associated with their work is that they did not estimate the model for the labour sector and this is because of the unavailability of adequate data to use. Another flaw with the model was that the price sector equation did not incorporate productivity as an explanatory variable. In addition, glaring weakness of this macro-econometrics model is that instead of summarising results that researchers obtained, the entire conclusion is mainly explaining how the research was done, the fact that the results need to be considered with caution and what needs to be done to improve future macro econometric research in Namibia.

Eita and Du Toit (2009) developed the supply side model of Namibia in a bid to explain the factors that explain long-term growth. They estimated the production, investment, labour demand and wage and price functions for the Namibian economy. This model was a big improvement over the NAMEX because all the equations, including the wage and price equations, were correctly formulated and specified. For example, the wage equation was explained by the rate of unemployment, previous wages and productivity, while, the price equation was explained by import prices, exchange rates, wages, and nominal user cost of capital. The results they got were consistent with theoretical expectations and simulated results indicated that the estimated values approximated actual values, confirming the fact that the model was of a good fit.

Eita and Ashipala (2010) carried out a related research in Namibia, which investigated the determinants of unemployment. They estimate the unemployment model by using the Engle-Granger two-step econometric methodology for the period 1971 to 2007. The results they obtained revealed a negative relationship between inflation and unemployment in Namibia. They also found that unemployment positively responds in cases where wages rise and when the output is below the potential output. In addition, they also established that an increase in investment decreases unemployment significantly. In fact, their results established that the Phillips curve holds in Namibia and that unemployment can be decreased by escalating aggregate demand. Eita and Ashipala (2010)’s results also show

that when total GDP and GDP of the secondary sector are used as measures of output gap, the coefficients are positive and statistically significant. Nevertheless, when they use manufacturing GDP as a measure of output, the coefficient is positive but statistically insignificant. They, therefore, asserted that although output of the manufacturing sector reduces unemployment, this effect is not significant. This is surprising because it is commonly accepted that an increase in manufacturing GDP generates more jobs and reduces unemployment significantly. This can be attributed to rigid labour market in this sector, and the fact that the data used in the evaluation are obtained from different sources and have some inconsistencies. In spite of this, results suggest that it is essential for Namibia to increase its GDP up to its potential magnitude in order to reduce unemployment. They also added that growth in wages causes unemployment to rise. In addition, they also found that the coefficients for all variations of unemployment models are positive and statistically significant and this suggests that an increase in the cost of labour results in an unemployment escalation. In this scenario, Eita and Ashipala (2010) suggest that there is a need for wage for wages to be flexible. They, therefore, recommend that employees' trade unions should scale down their effect on wage demands to help reduce unemployment in the country. Their results also show a negative relationship between investment and unemployment that implies that investment expansion decreases unemployment.

Kanyenze et al. (2012) carried out a situation analysis in Namibia on economic growth, employment and decent work. They start by arguing that, in the past three decades, development philosophy was dominated by a genre of economics, which emphasises the achievement of macroeconomic stability. They also argue that this type of economic thinkers believed that once the economy achieves economic stability, social goals of job creation and poverty reduction would automatically be achieved. They further state that, in this context, the macroeconomic framework was narrowly interpreted to mean minimum fiscal deficits, minimum inflation, minimum tariffs, maximum privatization and maximum liberalization of finance. Kanyenze et al. (2012) further said that despite implementing some notable policy reforms along these lines, most economies in Sub-Saharan Africa

could not improve their economies save for a few success stories, and this is mainly attributed to the one-size-fits-all formula blueprints which confused means (macroeconomic stability) with ends (decent work and poverty reduction). They found that the emerging consensus of the literature is that economic growth does not automatically result in poverty reduction, and that it only succeeds in doing so in situations where it is accompanied by rapid growth of productive, respectable (decent) and remunerative jobs. They also said that, decent work and poverty reduction had assumed greater significance and spotlight in the new millennium in response to this development. In addition, they also argue that the equivalent restrictive macroeconomic policies implemented in Namibia, have resulted in improved growth rates, for example, the average GDP growth rate recorded between 2001 and 2009 was 4.6 percent.

Kanyenze et al. (2012) points out that the following are the key interventions as essential priorities in the Decent Work Country Program 2010-2014:

(i) linking the employment policy framework to National Development Plans and Vision 2030.
(ii) treating decent, productive and remunerative jobs as a cross- cutting issue.
(iii) promoting priority sectors in terms of job creation (including backward and forward linkages).
(iv) promoting social justice and fighting inequalities.
(v) facilitating the transition to formality and decent work.

The information discussed above testifies to the fact that remarkably little has been done in terms of macro econometric modelling in Namibia, and therefore, there is still great need to carry out this type of research in an attempt to continue developing and enhancing macro econometric literature. The next section of the chapter summarises the concluding remarks of the chapter.

3.4 CONCLUDING REMARKS

The main purpose of this chapter was to present and critically evaluate the fundamental literature on the development of the basic wage-price relationship and to justify the extension of this model into a wage-price-productivity-unemployment model. To do this, the chapter invokes both the theoretical foundations and empirical literature, taking into account the econometric methodologies since they have been dynamically changing and improving over time. Another ancillary purpose of the chapter is to discuss and evaluate the macro econometric modelling experience for Namibia. The chapter, therefore, begins by discussing the theoretical foundations of the wage-price models, which can be traced back to the 1958 Phillips curve model. The other theories that are reviewed are the new Keynesian Phillips curve, the monetarist revolution, the Keynesian response to the monetarist challenge, the Keynesian model of inflation with a vertical Phillips curve and the skills mismatch theory. One fundamental point on which all these theories converge is that wages, and prices are related and what principally differentiates them are the channels through which the relationship is explained. As stated earlier, skills mismatch is the main problem faced by researchers and economists, especially, how to incorporate it in econometric modelling. Furthermore, the latter channels help identify the feedback variables of the wage-price relationship which include labour productivity, unemployment, import prices, and output (or output gap).

The results of most of the early studies need to be considered with utmost caution since they were conducted when the Econometrics field was still in its embryonic stage of development. More specifically, studies that were carried out before the development of the tools used to establish the stationarity properties of the individual series have the most problems. Despite this concern, the majority of the studies corroborate the fact that a simultaneous wage-price relationship exists and that this relationship is possibly influenced by other variables as explained earlier on. It should be noted that the development of time-series analysis and its related methodologies like cointegration, error-correction model (ECM), VAR, VECM and SVAR, among others, has led to a dramatic improvement in the robustness of estimation, forecasting and simulation results of econometric models. The

chapter also separately reviews studies that specifically attempted to develop the wage-price macro econometric models some of which have taken into account the feedback and policy variables that affect the relationship. Examples of such studies include Schmidt (2000), Marcellino and Mizon (2001), Garratt et al. (2003), Christiano et al. (2004), Bårdsen et al. (2007), Yusof (2008), Marques (2008), Duarte and Marques (2013), Baffoe-Bonnie and Gyangpong (2012), among others.

The last part of the chapter attempted to discuss and comment on macro econometric modelling in Namibia. There is very little to discuss as far as macro econometric modelling in Namibia is concerned since only one such model was developed and estimated in 2004. The results of this study need to be considered cautiously since the sample size used was very small and the values of some of the variables like, unemployment, had to be generated since the data was not there. Even the authors of the study cautioned future users of their results not to totally rely on them, as there is room to improve them. The section also discussed other related studies that were carried out in Namibia, whose results were noted accordingly.

No study in Namibia has thus far utilised the structural VAR model. A structural VAR model offers one an opportunity to introduce theoretically motivated restrictions on the potential relationship between interest rate and the other macro variables. The modelling framework of the current research, thus, follows a structural VAR model. The second feature of this literature is that the bulk of the studies are based on developed countries. Labour market variable analysis in a monetary policy environment is also relevant for developing countries, especially in judging the impact and effectiveness of monetary policy in the labour market.

Our study on Namibia, a country that has had a turbulent macro-economy, is characterised by high unemployment, sluggish economic growth and somewhat stable prices, adds to the relatively small literature on labour market transmission in developing countries. In this regard, the current study differs from a recent research on Namibia by Tjipe et al. (2004)

and other related studies in Namibia in two fundamental ways: First, their research is based on the cointegration and error correction framework and not the structural VAR framework used in the current study. Second, their study is based on a very short sample period (1990-2004); that is, only 14 years of data, which is unlikely to capture dynamic effects including monetary policy changes (such as interest rate changes) that have often been effected by the Bank of Namibia.

CHAPTER 4

THEORETICAL FRAMEWORK, METHODOLOGY AND DATA ANALYSIS

4.1 INTRODUCTION

The previous chapter covered the existing theoretical foundations and empirical literature, which emphasise wage-price and wage-price-productivity-unemployment relationships. Many studies in literature focus on these relationships using different techniques, different variables and, variable sample sizes, among other characteristics as demonstrated in the previous chapter. Generally, the results of these studies are not uniform over time, mainly, because of the fact that the methodologies applied have been dynamically time variant. The current chapter also discusses the theoretical framework of the study, thereby setting the stage for the development of the models used in this study. In addition, the theoretical framework also buttresses the justification given earlier for the wage-price-productivity-unemployment specification.

The current study uses VAR and SVAR methodologies together as the two perfectly complement each other. However, the study is not going to discuss the VAR methodology in detail, but only discusses it insofar as it relates to the SVAR methodology. It is argued that a VAR can be quite helpful in examining the relationship among a set of economic variables. The VAR methodology is quite useful for forecasting purposes, a function not performed by the SVAR methodology. Nonetheless, it should be emphasised that forecasting with a VAR is a multivariate extension of forecasting using a simple auto regression. The main criticism of the VAR approach is that it is devoid of economic content. The researcher does not invoke economic theory in order to specify the VAR model. The sole task of the economic researcher is to suggest appropriate variables to include in the VAR. From that point on, the procedure is almost mechanical. Since there is so little economic input in the VAR, it is not surprising that there is little economic content

in the results. It has to be noted, however, that innovation accounting in VARs does require ordering of the variables, but the choice of the ordering is usually done in an ad hoc fashion (Enders, 2004: p.321; Misati et al., 2013: p.146).

In cases where a researcher wants to evaluate policy, they use SVAR, and this is because a structural VAR uses economic theory to sort out contemporaneous links among variables (Bernanke, 1986; Blanchard and Watson, 1986; and Sims, 1986). Enders (2004: p. 321) and Alessi et al. (2011: p.19-26) both argue that structural VARs require "identifying assumptions" that allow correlations to be interpreted causally. They also add that the identifying assumptions can cover the whole VAR so that all causal relationships in the model can be spelt out, or just a single equation so that we identify only a specific causal relationship. In addition, they also argue that this generates instrumental variables, which allow contemporaneous relationships to be estimated using instrumental variable regression. In this case, the ingenuity of a researcher is generally the only limitation as to the number of the structural VARs they can develop. Later sections of the chapter briefly discuss VARs and then explain their link with the SVARs.

Given this brief background on the VARs and SVARs, the purpose of this chapter is four-fold:

(i) to discuss the theoretical framework which paves the way for the development of the model used in this study,
(ii) to present the methodology used in the current study
(iii) to present a comprehensive explanation of the estimation techniques employed in this study, and,
(iv) To analyse in detail sources of data and data generating procedures employed in the study.

The next section discusses imperfectly competitive wage-price models for LDCs incorporating productivity and unemployment. This is essential because labour markets in

LDCs are imperfectly competitive, and so, these are the market structures, which are realistic to the LDCs.

4.2 WAGE-PRICE MODELS IN IMPERFECT COMPETITION

This section discusses four different theoretical wage-price models, which have been developed under imperfectly competitive market structure considered applicable to developing economies. This type of market structure is considered more realistic, especially, in developing countries where industries generally tend to be monopolistic, oligopolistic or imperfectly competitive. The cardinal reason for reviewing these theories is to try to understand all the policy and feedback variables that affect the wage-price relationship, which will eventually be utilised to come up with a small macro econometric model for Namibia.

4.2.1 The new Keynesian wage-price model

The current model explains the relationship between equitable wages, prices that are sticky downwards, and co-movements in the growth of labour productivity and employment/unemployment. This model assumes that economy has infinitely lived households whose work effort supply show a relationship with the fair wage principle. In addition, the model also assumes that households consume goods and services, accumulate money and they are the ultimate recipients of the firms' profits. Firms, in this case, operate in a monopolistically competitive market environment in which they use labour as the sole input; and they face a U-shaped (or quadratic) cost function of price adjustment in the intermediate goods sector. The other assumption is that labour productivity is stochastic and thus follows random walk process with drift. This model builds on the basic structure of the model developed by (Collard and de la Croix, 2000).

4.2.1.1 Households

The households optimise the expected discounted utility function with respect to consumption c_t, real money balances m_t, and work effort s_t according to:

$$\max_{c_t, m_t, s_t} E_t \sum_{k=0}^{\infty} \beta^{t+k} [u(c_{t+k}, m_{t+k}) - v(s_{t+k}) \quad [4.1]$$

where E is the expectation operator and β is the subjective discount factor, $0 < \beta < 1$. The per period stream of utility is the sum of two functions. The first function is $u(c_t, m_t)$ where c_t denotes household consumption and $m_t = \frac{M_t}{pce_t}$ denotes the household's real money balances and pce_t is the final goods price. The specification of the function is:

$$u(c_t, m_t) = log(c_t) + \gamma \log(m_t) \quad [4.2]$$

The function in [4.3] determines effort function used in the efficiency wage models. According to Collard and de la Croix (2000), the effort function is written as:

$$v(s_t) = q_t \left[s_t - \delta_c - \delta_a log\left(\frac{wag_t}{wag_t^a}\right) - \delta_s \left(\frac{wag_t}{wag_t^s}\right) \right]^2 \quad [4.3]$$

.

In this case, q_t is a dummy variable, which takes on the value one (1) when the worker is employed and zero otherwise. In the case where the worker is employed, the utility function takes into account both effort and job satisfaction. The pleasure one derives from the job depends on three elements. The first element is the constant measured by δ_c. The two other elements are linked to the real wage the firm pays to the worker, namely, $wag_t = \frac{W_t}{pce_t}$, where W_t is the nominal wage. Additionally, any worker has the ability to compare the real wage to his current alternative opportunities on the labour market (wag_t^a), and to a reference index of past wages (wag_t^s). It can be argued that the higher the real wage compared to the inter- and intra-temporal wage norms, the more contented is the employee. The parameters δ_a and δ_s in the effort function aid to weight the two variables explained in the preceding statement. The existing alternative opportunities and the reference index of past wages are given by:

$$wag_t^a = n_t wag_t, \quad [4.4]$$

and,

$$wag_t^s = \rho_s \sum_{j=1}^{\infty} (1-\rho_s)^{j-1} wag_{t-j} \quad [4.5]$$

In the equation [4.4], n_t represents the employment rate, wag_t represents the real average wage, and, ρ_s indicates the persistence of past wages in the reference index, with, $0 < \rho_s < 1$. The first order condition of equation [4.1] with respect to s_t gives the following equilibrium effort function which according to Collard and de la Croix (2000) gives a value of zero for, $v(s_t)$.

$$s_t = \delta_c + \delta_a log\left(\frac{wag_t}{wag_t^a}\right) + \delta_s \left(\frac{wag_t}{wag_t^s}\right) \quad [4.6]$$

The current paragraph, tries to comment on the above specifications. As in Collard and de la Croix (2000) and Ball and Moffitt (2002), the logarithm employed in the effort function targets to simplify the solution of the models. Danthine and Donaldson (1990) and Danthine and Kurmann (2004) consider a more general effort function, which breaks down each parameter (δ_a and δ_s) into two: one concerning the wage and the other the employment (Bårdsen and Fisher, 1999).

Danthine and Donaldson (1990) introduce employment benefits in the current alternative opportunities. Collard and de la Croix (2000) believe that past alternative opportunities are part of the inter-temporal wage norm. Equation [4.5] represents the reference index of past wages, which corresponds to the particular case of habit formation studied by Collard and de la Croix (2000). It is worth noting that Ball and Moffitt (2002) also consider a habit formation process based on wage growth rather than on wage level considered in this study. Finally, contrary to Collard and de la Croix (2000), only a social norm case is studied and not a personal norm case where the presence of past wages is explicitly taken into account within the labour contract. In this case, past wages act as pure externality. To avoid household heterogeneity induced by the individual person's history on the labour

market, a perfect insurance market is assumed to exist (see Collard and de la Croix (2000)). The household's revenue from the labour market is $wag_t \times n_t$. The household carries M_{t-1}units of money and B_{t-1} bonds into period *t* and obtain the lump-sum transfer $T_t^r$from the monetary authority and nominal profits $D_t$from the intermediate goods producers. Households revenues are used to consume, purchase bonds, and store money. The bonds' gross nominal interest rate between period *t* and *t + 1* is denoted by r_t. The budget constraint is:

$$m_t + \frac{b_t}{r_t} + c_t \leq m_{t-1} + b_{t-1} + \vartheta_t^r + wag_t n_t + d_t \qquad [4.7]$$

where $b_t = B_{t-1}/pce_t$, $\vartheta_t^r = T_t^r/pce_t$ and $d_t = D_t/pce_t$ denote the real values of bonds, transfers and profits respectively.

4.2.1.2 Firms

The final goods sector is perfectly competitive and uses $y_t(i)$ units of the intermediate good *i* to produce y_t units of the final good according to constant returns to scale technology:

$$y_t = \left(\int_0^1 y_t(i)^{(\varepsilon-1)/\varepsilon} di\right)^{\varepsilon/(\varepsilon-1)} \qquad [4.8]$$

where ε is the elasticity of substitution between goods, $\varepsilon > 1$. The profit maximisation programme of a representative firm in the sector of the final good gives the following intermediate good demand function:

$$y_t(i) = \left(\frac{pce_t(i)}{pce_t}\right)^{-\varepsilon} y_t \qquad [4.9]$$

where $pce_t(i)$ is the intermediate good's i nominal price and where final good price pce_t satisfies:

$$pce_t = \left(\int_0^1 pce_t(i)^{(1-\varepsilon)} di\right)^{1/(1-\varepsilon)} \quad [4.10]$$

The intermediate goods producer faces a quadratic cost of adjusting its nominal price, which is measured in final good:

$$\frac{\psi}{2}\left(\frac{pce_t(i)}{\pi pce_{t-1}(i)}\right)^2 pce_t y_t \quad [4.11]$$

where, π is the steady-state gross rate of inflation. The quantity of intermediate goods is produced according to the technology:

$$y_t(i) = prd_t[n_t(i) \times s_t(i)] \quad [4.12]$$

where, prd_t represents stochastic labour productivity at date *t* common to all producers and $n_t(i) \times s_t(i)$ is the effective labour input, namely the product of workers $n_t(i)$ and their individual effort $s_t(i)$. The productivity law of motion is:

$$\log(prd_t) = \log(g) + \log(prd_{t-1}) + \zeta_t \quad [4.13]$$

where g is the steady state gross rate of labour productivity and ζ_t is the productivity shock, with $\zeta_t \sim iid(0, \sigma_\zeta^2)$. In the outcome $g = \log[prd_t/(gprd_{t-1})] = \zeta_t$ is the log-deviation of the growth factor of prd_t from its steady state value g.

The per period nominal profits flow of producer *i* is:

$$D_t(i) = pce_t(i)y_t(i) - W_t(i)n_t(i) - \frac{\psi}{2}\left(\frac{pce_t(i)}{\pi pce_{t-1}(i)}\right)^2 pce_t y_t \quad [4.14]$$

where $\psi > 0$. Because of the existence of the efficiency wage, the wage becomes part of the intermediate good producer maximisation problem:

$$\max E_0 \sum_{t=0}^{\infty} (\beta^t \lambda_t \frac{D_t(i)}{pce_t(i)}) \quad [4.15]$$

with respect to $y_t(i)$, $n_t(i)$ and $W_t(i)$, and subject to constraints [4.6], [4.9], and [4.12], where the relation $s_t(i) = s[W_t(i)]$ is suggested by the efficiency wage hypothesis. λ_t is the multiplier value of the budget constraint in a typical household maximisation programme. In a symmetric equilibrium, all intermediate goods producers make similar decisions and therefore [4.15] leads to the following equilibrium relations:

$$\frac{\pi_t}{\pi}\left(\frac{\pi_t}{\pi} - 1\right) = \beta E_t \left\{\frac{\lambda_{t+1}}{\lambda_t}\frac{y_{t+1}}{y_t}\left(\frac{\pi_{t+1}}{\pi}\right)\left(\frac{\pi_{t+1}}{\pi} - 1\right)\right\} - \left(\frac{\varepsilon - 1}{\psi}\right)\left(1 - \frac{\varepsilon}{\varepsilon - 1}\frac{wag_t}{prd_t s_t}\right) \quad [4.16]$$

and,

$$\frac{\partial s_t}{\partial wag_t}\frac{wag_t}{s_t} = 1 \quad [4.17]$$

Equation [4.16] explains the sluggish adjustment of inflation gross rate, π_t, and equation [4.17] is the famous Solow condition.

4.2.1.3 The monetary authority

Since the focus is on the effects of technological shocks, the monetary authority is assumed to ensure constant money supply growth $M_t = \mu M_{-1}$. Theory also assumed that the newly created money is given to households in the form of transfers.

4.2.1.4 Equilibrium

Danthine and Donaldson (1990) and de la Croix et al. (2009) present the following log-linear equilibrium conditions around a balanced growth steady state. The let $\bar{x}_t^* = x_t g^t$ be the stationary value of a growing variable x_t and, $\bar{x}_t^* = \log(\bar{x}_t / \bar{x})$ [the log deviation of this variable from its steady state value $\bar{x}$ (the bar is omitted for static variables)]. The

endogenous variables $\{m_t, wag_t, wag_t^s, n_t, \pi_t\}$ satisfy the following five conditions de la Croix et al. (2000):

$$(\overline{wag}_t^* - \overline{wag}_t^{*S} + g_t)\frac{\delta_s}{\delta_a} - n_t^* = 0 \quad [4.18]$$

$$\rho_s \overline{wagwag}_t^* + (1-\rho_s)\frac{\overline{wag}^s}{g}(\overline{wag}_t^{*s} - g_t) - \overline{wag}^s \overline{wag}_{t+1}^{*s} = 0 \quad [4.19]$$

$$\overline{m}_t^* + g_t + \overline{\pi}_t^* - \overline{m}_{t-1}^* = 0 \quad [4.20]$$

$$n_t^* - \left(1 - \frac{\beta}{g}\right)\overline{m}_t^* - \frac{\beta}{g}E_t(n_{t+1}^* + g_{t+1}) = 1 \quad [4.21]$$

$$\beta E_t(\pi_{T+1}^*) + \left(\frac{\varepsilon - 1}{\varphi}\right)\overline{wag}_t^* - \pi_t^* = 0 \quad [4.22]$$

where g_t denotes innovation to the productivity method as defined by equation [4.13]. Equation [4.18] denotes the labour market equilibrium condition: the current value of the log deviation of employment is a function of the wage, the wage standard and productivity growth. Equation [4.19] illustrates the law of motion of the wage norm. Equation [4.20] and [4.21] concern the supply and demand of for money respectively. Finally, Equation [4.22] is the Phillips curve.

This theoretical model has attempted to model wages, inflation, employment, labour productivity together with a monetary policy variable within the imperfectly competitive operating environment.

4.2.2 The competing-claims model of a unionised economy

The model discussed in this section is the competing-claims model of a unionised economy under imperfect competition that has been used in empirical work by some authors Bårdsen and Fisher (1999), Bårdsen et al. (2004), Bårdsen and Fisher (1999) and Bårdsen et al. (2007). This model, together with other models explained in subsequent sections, fittingly incorporate productivity and unemployment and, this helps in the specification proposed in this thesis. This model advocates that labour unions that represent workers request a certain real wage on behalf of the workers from employers and this is reflected in

the way they peg their nominal wages. It also goes on to suggest that employers (firms) also seek a certain amount of real profit per worker and this is reflected in the way they set prices. This means that both firms and labour unions are ultimately concerned with real wage, which they can influence through adjustments to nominal wages and prices.

Thus, it is normal that workers develop expectations about the general price level over the period that correspond with their wage contracts. This, therefore, implies that the money wageworkers target in the long run solely depends on the degree of tightness of the labour market as indicated by the rate of unemployment in a country. To capture this notion Carlin and Soskice (1990) came up with the following representation:

$$wag_t^* = pce_t^e - \delta_i uem_t \qquad [4.23]$$

where wag_t^* is the targeted nominal wage, pce_t^e is the anticipated consumer price level, uem_t is the unemployment rate and the lower case letters utilised mean that the variables used are converted to logarithms. Equation [4.23] denotes that the nominal wage claims are revised upwards as anticipated consumer prices escalate and the rate of unemployment declines.

Bryson and Forth (2006) underscored the negative relationship between the current level of unemployment in the economy and the bargaining power of the workers. He contends that unemployment forces workers to be disciplined. This means that workers are willing to work for lower wages when unemployment is high compared to periods when unemployment is low and alternative job availability is high. Lindbeck (1993) proposed that, with reference to labour union models and insider-outsider theories, workers (insiders) are more likely to demand higher wages when the unemployment rate in the economy is low as compared to a situation when it is high. This because tight labour markets provide unions with a credible threat of industrial action if their demands are not met and the prospect to be rehired after losing one's job, due to excessive wage demands is patently better in the former case. Furthermore, Carlin and Soskice (1990) contended that

if tight labour market conditions coincided with a buoyant product market, as is usually the case, then firms are more than willing to go along with real wage increases than the risk of having a loss of production because of industrial action and being unable to accommodate escalating demand in the market. If the labour unions demand higher wages in the face of high unemployment like what is happening in South Africa and Namibia, then this is just a recipe for disaster as the unemployment problem is exacerbated.

Additional factors that affect the desired long-term wage of workers, which also affect their bargaining position for nominal wages, have been identified. One such factor is labour productivity, which has a favourable impact on the target for nominal wage as indicated by the insider-outsider theory and other theories that explain how workers share economic rent with firms (Lindbeck and Snower, 1986, 1987 and 1988; and Lindbeck, 1993). The efficiency wage theories propose a positive relationship between worker productivity and bargains for negotiate for higher nominal wages to realise their desired real wages. This is because firms are willing to agree to higher wage demands as this helps them reduce turnover costs (Salop, 1979), minimise shirking and quitting (Shapiro and Stiglitz, 1984) and uphold high quality worker selection. This means that if workers' individual utility functions and budget constraints are an extended log-linear nominal wage equation which captures the effect of labour productivity, prd, is written as

$$wag_t^* = \delta_{11} pp_t + \delta_{12} prd_t - \delta_{13} uem_t + (1 - \delta_{11}) pce_t \qquad [4.24]$$

where the expected price level over the period of the wage contract is $pce_t^{\,e}$. This price incorporates both the producer price (*pp*) and the consumer price (*pce*) and a linear, homogeneous relationship of degree one exists between the latter two variables.

As workers bargain for real/nominal wages, producers set their desired price level as a fixed mark up over marginal costs defined as nominal wage costs per unit of output. Assuming constant returns to scale, this is the point at which imperfectly competitive firms achieve profit maximisation. This is referred to as normal cost pricing, and gives the targeted producer price as:

$$pp_t^* = m + (wag_t - pce_t) \qquad [4.25]$$

where *m* is the mark up and pp_t^* is the firm's target price level. It is essentially agreed that there is no consensus on how prices are set under imperfectly competitive markets; however because of its simplicity, normal cost pricing is used as the price-setting rule[6].

In addition, consumer prices depend on the price of domestic goods as determined by both firms and import prices. Hence the domestic price level, *pce* is:

$$pce_t = (1 - \zeta)pp_t^* + \zeta pm_t, \quad 0 < \zeta < 1 \qquad [4.26]$$

where *pm* is the import price deflator, ζ is the constant weighting factor which measures the share of imported material costs in the total consumer price level and long term unit homogeneity is imposed. Including import prices allows for the impact of changes in the exchange rate on domestic inflation in an open economy and recognises the significant proportion of imported goods both consumed and used in the production process in Namibia. Consequently, when all equations are estimated, including the one for real exchange rate and the model simulations are performed, changes in the nominal exchange rate will affect domestic inflation via their impact on domestic import prices. This is a key transmission mechanism in a small open economy such as Namibia.

Finally, substituting for [4.25], pp_t^* in equation [4.26] yields the following long run target equations for nominal wages and prices respectively.

$$wag_t^* = \left(1 + \frac{\zeta}{1-\zeta}\delta_{11}\right) pce_t + \delta_{12} prd_t - \left(\frac{\zeta}{1-\zeta}\delta_{11}\right) pm_t - \delta_{13}\mu em_t \qquad [4.27]$$

$$pce_t^* = (1 - \zeta)(m + wag_t - prd_t + \zeta pm_t) \qquad [4.28]$$

[6] For more extensive discussions of the microeconomic fundamentals of the normal cost pricing, and its use in a macroeconomic framework see (Carlin and Soskice, 1990)

As mentioned, however, given that the objective of unions is the real wage and the nominal price level determined by firms implies a certain real wage for workers, equations [4.27] and [4.28] can also be written as

$$rwg_w^* = \zeta d_{11} pce_t + \delta_{12} prd_t + \zeta d_{11} pm_t - \delta_{13} uem_t \quad [4.28]$$

$$rwg_f^* = \zeta(wag_t - pm_t) - (1-\zeta)(prd_t - m) \quad [4.29]$$

where $rwg_w^* = wag_t^* - pce_t, rwg_f^* = wag_t - p_t^*$ and $d_{11} = \delta_{11}/(1-\zeta)$.

The competing claims model of imperfect competition explained in Carlin and Soskice (1990) and Layard et al. (1991) illustrates how in the long run, there is a unique rate of unemployment at which the claims of workers and firms are consistent, that is, $rwg_w^* = rwg_f^*$. This rate of unemployment is referred to as the NAIRU. At this equilibrium rate of unemployment, wage and price inflation are constant because both workers and firms agree on the level of the real wage and so are not competing for different income shares. In the short run, however, it is not surprising that the desired real wage of workers and the real wage implied by the prices which firms set may deviate from the theoretical long run relationship (where $rwg_w^* = rwg_f^*$) because of mistaken price expectations by workers and costs to firms from adjusting their desired price level, such as menu cost and employment contracts. These conflicting claims result in the classic wage-price spiral and become an important source of inflation (Blanchard, 1986). By definition, therefore, a dynamic model must be developed.

This argument is highlighted by Kolsrud and Nymoen (1998, 2012 and 2015) who argue that in order to derive a dynamic wage and price inflation model of imperfect competition, it is necessary to interpret wage and price equations as long term targets that may not be realised by firms and workers in a specific period. Subsequently, these long run relationships, also commonly referred to in literature as the static state of the system, are

embedded in an ECM which allows for short run dynamics and, drives nominal wage and price adjustment towards their respective long run equilibrium levels. Further, it is hypothesised that in order to capture the contemporaneous nature of these claims, both equations must be estimated simultaneously.

Following Bårdsen and Fisher (1999), Bårdsen et al. (2003), Bårdsen et al. (2004) and Bårdsen et al. (2005) a dynamic system is developed by allowing quarterly wage inflation this period to interact with current and past consumer and producer price inflation, changes in labour productivity and previous deviations from the desired wage level.

$$\alpha_{11}(L)\Delta wag_t = c_1 + \alpha_{12}(L)\Delta pp_t + \beta_{11}(L)\Delta prd_t - \beta_{12}(L)\Delta uem_t + \beta_{13}(L)\Delta pce_t - \gamma_{11}(wag - wag^*)_{t-k} + \epsilon_{1t} \quad [4.30]$$

Here, Δ is the difference operator, the maximum lag is k periods, and $\alpha_{ij}(L)$ and $\beta_{ij}(L)$ are polynomials in the lag operator L.

$$\alpha_{11}(L) = 1 - (\alpha_{11,1}L + \cdots + \alpha_{11,k-1}L^{k-1},$$
$$\alpha_{12}(L) = \alpha_{12,0} + \alpha_{12,1}L + \cdots + \alpha_{12,k-1}L^{k-1},$$
$$\beta_{1j}(L) = \beta_{1j,0} + \beta_{1j,1}L + \cdots + \beta_{1j,k-1}L^{k-1}, j = 1, \ldots,3$$

Further γ_{11} is an adjustment term that determines the speed with which wages return to their long run relationship (equation [4.30]) following a short run disturbance. This equation is a generalisation of the typical European wage curve (Bårdsen et al., 2004), where the American version is derived by setting, $\gamma_{11} = 0$. (Blanchard and Kartz, 1999), that is, in which there is no long run target wage level.

Clarida et al. (1999) argued that increases in output exceeding the optimal trend puts lagged positive pressure on prices. They further stated that this output is measured by the output gap denoted by, *gap*, in the Phillips curve inflation equation. Furthermore, product

price inflation simultaneous relates to wage growth, productivity increases and adjustments from a previous period's variation from the equilibrium price, which, may be due to information lags (Bårdsen et al., 2005).

$$\alpha_{22}(L)\Delta pp_t = c_2 + \alpha_{21}(L)\Delta wag_t + \beta_{21}(L)gap_t - \beta_{22}(L)\Delta prd_t - \gamma_{22}(pp - pp^*)_{t-k} + \epsilon_t \quad [4.31]$$

where,

$$\alpha_{22}(L) = 1 - (\alpha_{22,1}L + \cdots + \alpha_{22,k-1}L^{k-1},$$
$$\alpha_{21}(L) = \alpha_{21,0} + \alpha_{21,1}L + \cdots + \alpha_{21,k-1}L^{k-1},$$
$$\beta_{2j}(L) = \beta_{2j,0} + \beta_{2j,1}L + \cdots + \beta_{2j,k-1}L^{k-1}, j = 1,2$$

Just as before, γ_{22} denotes the speed at which the price level returns to the static state after a short run price shock. After solving equation [4.26] for pp^* and substituting it in equations [4.30] and [4.31, the theoretical model becomes a wage-price system which is empirically estimated.

$$\alpha_{11}(L)\Delta wag_t = c_1 + [a_{12}(L) + \beta_{13}(L)]\Delta pce_t + \beta_{11}(L)\Delta prd_t - \zeta a_{12}(L)\Delta pm_t - \beta_{12}(L)\Delta uem_t - \gamma_{11}[wag - (1 + \zeta d_{11})pce - \delta_{13}prd + \zeta d_{11}pm + \delta_{15}uem]_{t-k} + e_{1t} \quad [4.32]$$

$$\alpha_{22}(L)\Delta pce_t = (1 - \zeta)(c_2 + \gamma_{22}m) + a_{21}(L)\Delta wag_t + b_{21}(L)gap_t - b_{22}(L)\Delta prd_t + \zeta\alpha_{22}(L)\Delta pm_t - \gamma_{22}[pce - (1 - \zeta)(m + wag - prd) - \zeta pm]_{t-k} + e_{2t} \quad [4.33]$$

where,

$$a_{12}(L) = \frac{\alpha_{12}(L)}{(1-\zeta)},$$
$$a_{21}(L) = (1 - \zeta)\alpha_{21}(L),$$

$$b_{2j}(L) = (1-\zeta)\beta_{2j}(L),\ j = 1,2,$$

$$d_{11} = \frac{\delta_{11}}{1-\zeta},$$

$$e_1 = \epsilon_1,$$

$$e_2 = (1-\zeta)\epsilon_2.$$

There are, as expected, more variables that may be included to take into account shifts in the bargaining positions of workers and firms. Normally, in most wage-setting theories, the bargained nominal wage rate is an increasing function of the magnitude of real unemployment benefits, which tend to increase the reservation wage of workers and lessen the opportunity for the current workers to be priced out of their current jobs (Lindbeck, 1993). Additional variables comprise a union's monopoly power, the ratio of workers whose wages are set through a collective bargaining process, indirect and income tax rates and measures of the labour market skills mismatch. The bargaining position of a firm is also determined by the degree of a firm's monopoly power, payroll and indirect taxes (Layard et al., 1991), and non-labour input costs such as oil and power prices (Bårdsen et al., 2003b). Generally, however, these variables are complex to measure and while they may be extremely essential in building a comprehensive labour market model, they are not necessary in the core wage-price system developed.

Bårdsen et al. 92007) argue that controversy still abounds about whether to include or exclude certain variables from the estimation of wage-price models, for instance, the inclusion or exclusion of petrol prices and, income and payroll taxes. Normally, each researcher just comes up with a justification as to why certain variables are included or omitted from the analysis. The theoretical model discussed in this section patently shows that all the four variables of interest in the current study are intertwined, and their relationships have been comprehensively explained. This, points to the fact that, it is possible to develop macroeconometric models in which the simultaneity of the four variables is investigated using contemporary econometric methodologies. The next section

discusses the generalised efficiency wage model of productivity, unemployment and wages, which is also very relevant to the current study.

4.2.3 The efficiency wage model of productivity, unemployment and wages

In the traditional Keynesian framework, changes in wages are assumed to precede changes in prices and that wages are determined in the labour market. More specifically, this implies that wages depend on the employment rate, and a decrease in the employment rate, for example, reduces the rate of growth of wages. After wages are determined, firms set prices by adding a mark-up, which determines the margin of their profit. In such a model when wages rise faster than productivity, employers inevitably face higher costs to produce the same number of goods; and they usually pass on higher costs to consumers in the form of higher prices. In addition, it should be noted that in conventional macroeconomic thinking productivity growth drives wage growth. This means that when output per worker (labour productivity) increases workers' contributions to the firms' revenue also increase, which in turn causes employment to increase. This, therefore, implies that the traditional growth theory has a causality running from productivity growth to wage growth.

Baffoe-Bonnie and Gyapong (2012) and Danthine and Kurmann (2004) contended that the relationship among wages, productivity and employment is better understood in terms of efficiency wage models, where higher wages boost productivity because of adverse selection and incentive effects. The relationship between productivity, employment and wages in less developed countries (LDCs) is explained by the generalised model of the efficiency wage theory, which expresses worker productivity as a function of the wage rate. The model, however, applies to LDCs in different variants according to the peculiar conditions of particular sectors of the labour market in the LDC in question.

The generalised efficiency wage model of productivity, employment and wages is now widely accepted as a powerful theory (if not the most convincing theory) to model activities in the labour market. The theory is tacked on the Stiglitz-Solow effort function:

$e = e\ (w)$, with the effort sensitivity functions (to the wage rate) given as:

(i) $\frac{de}{dw} = e'(w) > 0$, for the high technology sector (e.g., manufacturing/primary) of the labour market

(ii) $\frac{de}{dw} = e'(w) = 0$. Stands for the low technology sector, for example, informal and agricultural sectors of the labour market.

This implies that within the context of segmented labour market situation in an LDC effort sensitivity functions are positive for workers employed in permanent or semi-permanent labour contracts, namely, primary sector workers. This category of workers has less incentive to shirk, and the employer may use higher wages to get self-enforcing monitoring of employees that maximise profits. However, for the secondary sector workers, work effort is insensitive to the wage rate due to the casual nature of employment contracts for such workers and their jobs involve no disincentive to shirk. Hence, worker effort or productivity (*e*) is driven by the real wage rate (*w*) in such a way that the employers tend to base their employment decisions on the desire to maximise profits by minimising their wage costs per efficient unit obtained from the workforce employed. For a typical firm employing labour in the market wage sector (both manufacturing and agriculture), the Solow condition of optimal employment level and productive labour was obtained as:

$Min\ c = \frac{w}{e}(w)$, giving the optimal wage rate as the efficiency wage, for which:

$$\frac{de}{dw} \times \frac{w}{e}(w) = 1.$$

This indicates that the wage elasticity of effort is unity under optimal conditions. To find the employment level, the Akerlof and Yellen (1990) effort-augmented production function is applied. The augmented function expresses output as a function of work effort derived from labour time employed. This implies:

$$q = Tql.e(w).q'(.) > 0$$

where, q = output, l = labour employed, and T = technology. The profit function Z is, thus given by:

$$Z(l,w) = p\left[Tq\left(Le(w)\right)\right] - w(l).L$$

From this equation, the following two first order conditions are obtained:

$$p(.)Tq(.)e(w) - w + w'(l).l = 0$$

$$[p(.)Tq'(.)e'(w) - 1]l = 0$$

These are solved for the optimal employment level (l^*), wage rate (w^*) and output (q^*) as represented below:

$$l^* = f(T,w,e,q) \quad [4.34]$$

$$w^* = f(l,T,e,q) \quad [4.35]$$

$$q^* = f(T,l,w,e) \quad [4.36]$$

This principally establishes the parameters of productivity (q), employment (l) and wage rate (w), in the manufacturing and wage agricultural sectors of an LDC.

Price is introduced in the model by assuming that firms set individual prices by making up the average cost of producing one unit of output. This basic price mark-up model is not compatible with the profit maximising behaviour. The mark-up on cost pricing system is given by:

$$p = w(1 + \pi) \quad [4.37]$$

where p is the price of the product, w wage to a worker and π is the mark-up on cost. In this basic price structure, influences of exogenous changes in relative price of internationally traded goods and other factors are ignored because the main objective of the study is to focus on the impact of changes in wages on the aggregate price level in a closed economy. The technology variable is usually dropped due to unavailability of such information in LDCs so that the model that is estimated has four key series (w, q, i, p) (Bonnie and Gyangpong, 2012). Equations [4.34] to [4.37] therefore, can be summarised in their stochastic form as follows:

$$l = l(w, q) + \varepsilon_l \quad [4.38]$$

$$w = w(l, q) + \varepsilon_w \quad [4.39]$$

$$q = q(l, w) + \varepsilon_q \quad [4.40]$$

$$p = p(w) + \varepsilon_p \quad [4.41]$$

It should be noted that there are some variants to the model discussed in this section, which are not going to be discussed because they are not entirely applicable to the developing economy environment and for the sake of brevity. Examples of these variants include the internal wage reference theory, the external wage reference theory, the reciprocity-based model of efficiency wages with internal references, just to name but a few. The next section discusses the wage-price model in an open economy.

4.2.4 The wage-price model in an open economy

The simple model for the determination of wages and prices discussed in this subsection has also been used in selected empirical work by some authors (Pétursson, 2002; Marques, 2008; Duarte and Marques, 2013). This model is made up of a wage setting, production, price formation, rate of unemployment and import prices (in domestic currency) equations. As a way to simplify the discussion concerning the long run properties of the model, these equations incorporate a minimum of dynamics.

The model assumes that production of the economy may be described by a Cobb-Douglas function, which exhibits constant returns to scale[7].

$$gdp - emp = \eta + (1 - \gamma)(k - emp) \quad [4.42]$$

where, gdp is amount produced (output), emp is total workers, k is capital stock and η a stochastic variable denoting technology. The production function may further be simplified by writing it as:

$$prd = gdp - emp = \xi_{prd} \quad [4.43]$$

where, prd is labour productivity and ξ_{prd} is the stochastic technology trend which shifts the productivity of labour in the long term. Technology is assumed exogenous and also that it follows a random walk stochastic process, i.e. $\xi_{prd} = \xi_{prd-1} + \phi_{prd}$ where $\phi_{prd}$is pure technological innovation[8].

As regards the wage formation, wages are assumed to be determined through a bargaining practice among firms and employees (or employee unions) (Bårdsen et al., 2005). This model predicts that the bargaining solution depends on real producer wage and productivity on the firm's side, and on the real consumer wage on the workers side (Layard et al., 1991; Lindbeck, 1993; and Bårdsen et al., 2005). The wage equation corresponding to the bargaining solution in log linear form is denoted as:

$$wag - ppr = k_1 + \mu(pce - ppr) + \delta prd - \theta uem,\ 0 \leq \mu, \delta \leq 1, \theta \geq 0 \quad [4.44]$$

Where wag is the nominal wage rate, ppr is the producer price level, pce is the consumer price index, and uem is the degree of unemployment measured in percentage terms.

[7] The lower case letters in this case and in the rest of the thesis denote logarithms.
[8] ϕ_{prd} is assumed to follow a random walk process, rather than a more general I(1) process.

Equation [4.44] indicates that the real producer wage the firms face is influenced by $(pce - ppr)$, ppr and uem. The relative price $(pce - ppr)$, which measures the gap between the consumer real wage and the producer real wage (commonly referred to as the *price wedge)*, plays a key function in the theoretical models of wage bargaining. Its coefficient, μ, is construed as a gauge of "real wage resistance", which measures the union's ability to obtain higher wages to compensate for exogenous changes in workers' living standards (increases in pce brought about, for example, by changes indirect taxes) (Layard et al., 1991). The bargaining solution implies that an increase in labour productivity (prd) increase wages since higher productivity increases the firms' profitability, which makes them more inclined to accept requests for higher wages by the unions. The unemployment rate, uem, stands for the tightness of the labour market, which has a bearing on the bargaining process outcome through the relative bargaining power of the labour unions and employers organisations.

The wage equation sometimes includes additional terms not explicitly considered in equation [4.44] that may affect the bargaining outcome, namely some institutional features of the labour market (Nickell and Andrews, 1990; Layard et al., 1991 and Blanchard and Kartz, 1999). However, these aspects will not be explicitly modelled or taken into account in the present study. Here, the study focuses on the responses of wages and prices to different shocks, assuming that the institutional features of the labour market are given.

For the process of price formation, the study assumes an economy with imperfect competition where producers target their prices, ppr, as a mark-up, ω, over and above marginal costs. Blanchard and Kartz (1999) further contend that in cases where there are constant returns to scale, marginal costs remain constant and this implies that prices are set as a mark-up over unit labour costs:

$$ppr = \omega + (wag - prd) \qquad [4.45]$$

Layard et al. (1991), Marques (2008) and Duarte and Marques (2013) argue that mark-up is not of necessity constant and also added that in an open economy, it is sometimes a function of the international competitiveness degree. Hence, the thesis assumes that the mark-up may be written as:

$$\omega = k_2 + \lambda(imp - ppr) \qquad k_2, \lambda \geq 0, \qquad [4.46]$$

where, imp, are imports denominated in local currency terms and λ denotes the exposure of local firms to international competition. Thus, the smaller is the pass-through from foreign price or exchange rate shocks to domestic producer prices. Substituting [4.46] into [4.45] gives the producer price level as a mark-up over unit labour costs and import prices:

$$ppr = \frac{k_2}{1+\lambda} + \frac{1}{1+\lambda}(wag - prd) + \frac{\lambda}{1+\lambda} imp \qquad [4.47]$$

Further, assume that consumer prices are a weighted average of producer and import prices:

$$pce = (1 - \rho)ppr + \rho imp, \qquad 0 < \rho < 1, \qquad [4.48]$$

The consumer prices long-run solution can be written as:

$$pce = \frac{(1-\rho)k_2}{1+\lambda} + \frac{1-\rho}{1+\lambda}(wag - prd) + \frac{\rho+\lambda}{1+\lambda} imp \qquad [4.49]$$

where, consumer prices are shown as a weighted average of import prices and unit labour costs.

This equation shows that there are two channels through which exchange rate and foreign price shocks affect domestic consumer prices. The first channel is the direct channel

through imported goods prices given by ρ. The second channel shows that a rise in import prices reduces the competitiveness of foreign firms, allowing domestic producers to increase their mark-up and thus the price of their products.

Substituting [4.48] into [4.44] and using the price equation in [4.49], the long run wage is obtained which ignores constants for simplicity:

$$wag = (1 + \alpha)pce - \alpha imp + \delta prd - \theta uem + \tau_{wag}, \quad [4.50]$$

$$pce = \beta(wag - prd) + (1 - \beta)imp + \tau_{pce}, \quad [4.51]$$

where $\alpha = \frac{\rho(1-\mu)}{1-\rho}$ and $\beta = \frac{1-\rho}{1+\lambda}$.

Workers and firms regard wage and price equations [4.50] and [4.5] as long runs or equilibrium targets that are not necessarily achieved in a specific period. Thus, under the assumption that the two relations are stationary, the stochastic variables τ_{pce} and τ_{pce}can be interpreted as exogenous wage and price shocks that follow stationary stochastic processes, i.e. $\tau_i = \sigma_i \tau_{i-1} + \epsilon_i$ where $0 \leq \sigma_i < 1,$ and $i = ag, pce$.

For the unemployment rate, it is assumed to be the result of the difference between the labour supply and labour demand so that, in the long run, unemployment may be affected by both real wages, $(wag - pce)$, and productivity prd:

$$uem = \pi_1(wag - pce) + \pi_2 prd + \xi_{uem}, \quad [4.52]$$

where ξ_{uem} is an exogenous stochastic variable. Equation [4.52] being a reduced form equation, has the implication that ξ_{uem} is a combination of labour supply and demand shocks. If equation [4.53] turns out to be a cointegrating relation, ξ_{uem} would be interpreted as a stationary shock, while in the absence of cointegration, ξ_{uem} would be

seen as a stochastic random-walk process, i.e. $\xi_{uem} = \xi_{uem-1} + \phi_{uem}$, where ϕ_{uem} is a pure unemployment shock.

Thus, the theoretical model expressed in terms of the variables we consider in the empirical analysis $(wag, pce, uem, prd, imp)$ is composed of equations [4.43], [4.49], [4.50], [4.51], and [4.52], which can be written compactly as a structural VAR: $Ae_t = B\xi_t$

$$\begin{bmatrix} 1 & -(1+\alpha) & \theta & -\delta & \alpha \\ -\beta & 1 & 0 & \beta & -(1-\beta) \\ -\pi_1 & \pi_1 & 1 & -\pi_2 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & -\gamma_1 & -\gamma_2 & 1 \end{bmatrix} \begin{bmatrix} wag \\ pce \\ uem \\ prd \\ imp \end{bmatrix} = \begin{bmatrix} \xi_{wag} \\ \xi_{pce} \\ \xi_{uem} \\ \xi_{prd} \\ \xi_{imp} \end{bmatrix} \qquad [4.54]$$

The model specified above has been estimated by some researchers using the VAR and structural VAR modelling techniques (Schmidt, 2000; Marques, 2008; and Duarte and Marques, 2013). This model captures all the variables of interest in the current thesis and the way they relate from a macroeconomic point of view. However, modelling these variables for a small Least Developed Country (LDC) like Namibia, literally, adds value to labour market macroeconomic literature. The information discussed from this section will be combined with the information from Figure A1 to develop the small macroeconometric model for this study. The next section comprehensively outlines the methodology used in this study.

4.3 THE STRUCTURAL VECTOR AUTOREGRESSION METHODOLOGY

According to Kim et al. (2010) the vector auto regression (VAR) methodology developed into a powerful tool for studying the interaction and forecasting among economic and financial variables after (Sims, 1980) seminal work. In addition, Lütkepohl (2006), Lin (2006), Enders and Prodan (2008) argue that the basic VAR models focus on the statistical representations of the dynamic behaviour of time series data but without much restriction on the underlying economic structure. They are also easily estimated. This section, explains the basic VAR model used in the current study. Additionally, Stock and Watson (2001) argue that there are four functions performed by econometricians, and these are to:

(i) describe and summarise macroeconomic data,

(ii) make macroeconomic forecasts,

(iii) quantify what is known about the true structure of the macroeconomy, and,

(iv) offer policy advice to policy makers.

To achieve this, the researchers employed a variety of techniques, which include large models with hundreds of equations, single equation models that focus on links among a few variables and a simple univariate time series models that only have a single variable. Researchers and policy makers alike lost faith in these approaches after the macroeconomic chaos of the 1970s mainly sparked by the oil price increases (Kim et al., 2010).

However, more than two decades ago Sims (1980) came up with a novel macroeconometric system (vector auto regression-VAR) regarded as highly promising then. The study defines a univariate auto regression as a single equation with a single variable in which own lagged values of the variable explain the current value of the variable. In addition, a multivariate VAR is an *n*-equation, *n*-variable linear model in which own lagged values and, the current and past values of other *n*-1 variables in the model explain the individual variables. This basic framework offer a systematic approach to account for the rich dynamics in multivariate time series and the statistical toolkit developed with the VARs was straightforward to use, interpret and understand. Sims (1980) argued repeatedly in a series of leading papers that VARs promised a lot optimism of offering a sound and reliable method to data description, forecasting, structural inference and policy analysis. In the next section, the study briefly discusses the three varieties of VARs found in literature, namely: the reduced, recursive and structural forms.

4.3.1 Types of VARs

The VARs take on three forms briefly discussed in this section. The present study uses some of these forms of VARs, and it is, therefore, of critical importance that the study defines them before they are employed in developing the VAR and SVAR models that are used in this study. Most of the information used in this section is from articles by Sims et

al. (1990), Stock and Watson (1996), Stock and Watson (2001) and Lütkepohl (2012). These explanations certainly further the understanding of mathematical representations that the study comes up with in later sections.

A reduced form VAR expresses each variable as a linear function of its own previous values, the previous values of the rest of the variables in the function and an error term, which is free from serial correlation. Thus, if one assumes a model made up of three variables, such as wages, inflation and unemployment, the reduced VAR involves three equations: current wages as a function of past values of wages, inflation and unemployment; inflation as a function of past values of inflation, wages and unemployment; and similarly for the unemployment equation. To estimate each equation the researcher employs the Ordinary Least Squares (OLS) regression method. Various methods included in the different estimation software available determine the number of lags to include in the model. The most significant relationship considered in this model is the relationship between the error terms in these regressions and the "surprise" dynamics in the variables after accounting for the previous values of the variables. If there is a relationship among the variables, as is the case in most macroeconomic applications, then the reduced form equation error terms correlate across the equations.

A recursive VAR creates residual terms in individual equations in such a way that they are uncorrelated with residuals in previous equations. To do this, researchers include some contemporaneous values as regressors in the equations estimated. This can be illustrated by considering a three variable VAR, ordered as: (1) wages, (2) inflation and (3) unemployment. The first equation's corresponding recursive VAR has wage as its dependent variable and the independent variables are the lagged values of all the three variables. In the second equation, inflation is the dependent variable and regressors are the lagged values of the three variables *plus* the current wages value. Unemployment is the dependent variable in the third equation, and the lags of the three variables are the regressors *plus* the current value of inflation. OLS estimation of each of these equations produces uncorrelated residuals across the equations. The results, in this case, are

dependent upon the way the variables are ordered, and a change of this order apparently alters the VAR equations, coefficients and error terms in this *n!* recursive VAR representation. All the possible orderings have to be taken into account.

A structural VAR employs economic theory to sort out contemporaneous links among the variables. Structural VARs require utilisation of identifying assumptions, and this makes it possible interpret causally the correlations. As these various authors argued, identifying assumptions sometimes involve the whole VAR so that the researcher indicates all causal relationships in the model, or just an individual equation, to identify a specific causal link. This results in instrumental variables, which allow the contemporaneous relationships to be estimated by invoking instrumental variable regression. As mentioned in the introduction to this chapter, the number of structural VARs a researcher can come up with can only be limited by the ingenuity of the researcher. The first step in using this method is to estimate the reduced form VAR and the recursive VAR to summarise the co-movements of the three series in the example. The next step is to use the results of the reduced form VAR to predict the variables. The third and final step is to estimate the structural VAR model whose results are relevant for policy analysis and simulation purposes. In the next section, the study discusses the specifications, and the relationship between the VAR and SVAR models, which are invoked.

4.3.2 Modelling the relationship between VAR and the SVAR

This section provides a description of the empirical model whose forecast performance is evaluate in this study. As mentioned earlier on, VARs provide a number of advantages for estimating and forecasting economic time series, namely: that they are flexible, easy to estimate and also do not require the researcher to have knowledge of underlying theoretical concepts. In VAR modelling, one variable is expressed as a function of the lagged values of that variable and all the other variables included in the model. The explanation given in this section shows how one derives an SVAR from a VAR. This is crucial because these are the methods used in this study.

Following Enders (2004: p.321), consider the one-lag representation of the bivariate VAR below:

$$y_t = b_{10} - b_{12}z_t + \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \varepsilon_{yt} \quad [4.55]$$

$$z_t = b_{20} - b_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \varepsilon_{zt} \quad [4.56]$$

where both y_t and z_t are assumed to be stationary and the error terms are white noise. Equations [4.55] and [4.56] are known as the structural form of the VAR where the term **structural** refers to that something can be said about the underlying dynamics and links among the included variables. According to Enders (2004: p. 322) equation [4.55] and [4.56] can be compactly rewritten as:

$$\begin{bmatrix} 1 & b_{12} \\ b_{20} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$$

or,

$$Bx_t = \Gamma_0 + \Gamma_1 x_{t-1} + \varepsilon_t \quad [4.57]$$

where,

$$B = \begin{bmatrix} 1 & b_{12} \\ b_{20} & 1 \end{bmatrix}, \; x_t = \begin{bmatrix} y_t \\ z_t \end{bmatrix}, \quad \Gamma_0 = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix}, \; \Gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix}, \text{ and } \varepsilon_t = \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$$

Pre-multiplying both sides of equation [4.57] by B^{-1} one obtains the following reduced form vector autoregressive model:

$$x_t = A_0 + A_1 x_{t-1} + e_t \quad [4.58]$$

where: $A_0 = B^{-1}\Gamma_0$, $A_1 = \mathrm{B}^{-1}\Gamma_1$, $e_t = B^{-1}\varepsilon_t$

Thus, system [4.55] and [4.56] can be written as:

$$y_t = a_{10} + a_{11}y_{t-1} + a_{12}z_{t-1} + e_{1t} \quad [4.59]$$

$$z_t = a_{20} + a_{21}y_{t-1} + a_{22}z_{t-1} + e_{2t} \quad [4.60]$$

which is alternatively represented as:

$$\begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} a_{10} \\ a_{20} \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} e_{yt} \\ e_{zt} \end{bmatrix} \quad [4.61]$$

Note that $e_t = B^{-1}\varepsilon_t$ and this means that:

$$e_{1t} = (\varepsilon_{yt} - b_{12}\varepsilon_{zt})/(1 - b_{12}b_{21}) \quad [4.62]$$

$$e_{2t} = (\varepsilon_{zt} - b_{21}\varepsilon_{yt})/(1 - b_{12}b_{21}) \quad [4.63]$$

According to (Enders, 2004: p. 321) it is necessary to emphasise the following given the foregoing analysis:

(i) The errors in the typical VAR are composites of the two shocks as $e_t = B^{-1}\varepsilon_t$ and since ε_{yt} and ε_{zt} are white noise processes it can be shown that e_{1t} and e_{2t} have zero mean, and constant variance and are not correlated. It is essential to note that the two errors e_{1t} and e_{2t} are composites of the underlying shocks ε_{yt}, and ε_{zt}. Although these combined shocks are one-step-ahead forecast errors in y_t, and z_t, they do not have a structural interpretation.

(ii) Because there are feedback effects on the structural VAR, since both y_t, and z_t, appear in both equations, the structural VAR cannot be estimated. Nevertheless, the typical VAR can be estimated since the feedback effects disappear in the system and therefore the ordinary least squares (OLS) method can be utilised.

(iii) Since there are four (4) parameters to be estimated in each equation of the structural VAR but only three (3) in each equation of the standard VAR, the last is under-

identified since it since it is not possible to recover all information in the structural VAR.

One method utilised to solve the problem of under-identification is to use the Choleski system (Sims, 2007; Enders, 2004 p. 326-327; Kilian, 2011). To obtain impulse response functions or the variance decompositions it is necessary to use the structural shocks i.e., ε_{yt} and ε_{zt} and not the forecast errors (e_{1t}, and e_{2t}). The main objective of a structural VAR is to use economic theory instead of the Choleski decomposition to recover the structural innovations from the residuals e_{1t} and e_{2t} (Perron and Yamamoto, 2015; Kaminska, 2013). They further argue that this approach imposes restrictions on the structural VAR such as the coefficient that accounts for the feedback (b_{12}, and b_{21}). The latter equate to zero 0, so that equations [4.62] and [4.63] give a triangular matrix. Suppose the selected ordering is such that $b_{21} = 0$. In this case, two pure innovations are recovered as:

$$e_{1t} = \varepsilon_{yt} - b_{12}\varepsilon_{zt} \quad [4.64]$$

$$e_{2t} = \varepsilon_{zt} \quad [4.65]$$

Equations [4.63] and [4.64] imply that $b_{21} = 0$, and this is tantamount to assuming that an innovation in y_t does not have a contemporaneous effect on z_t. In this case, the impulse response and variance decomposition results are misleading due to the fact that there is no theoretical basis for the latter assumption, and this also improperly identifies underlying shocks (Enders, 2004: p.324).

Enders (2004: p. 322) also added that in cases where the correlation coefficient between e_{1t} and e_{2t} is low, the ordering of the series is not essential. Nevertheless, in a VAR with several variables it is most unlikely that all correlations will be small. This, he argued, mainly comes from the fact that when choosing the variables to include in the model one is most likely to choose strongly correlated series. It is essential to note that when the errors

of a VAR are correlated it is not reasonable to consider different orderings. This is because, in a four variable model, there are 24 (4!) alternative orderings possible, which are too many. This is the main reason that spurred Bernanke (1986) and Sims (1986) to propose the modelling of the innovations by using economic analysis. They, therefore, proposed the estimation of the relationships among the structural shocks using an economic model.

4.4 THE SVAR MODEL

4.4.1 Introduction to vector auto regression (VAR)

According to Krolzig (2003) and Enders (2004: p.321) VAR estimates the parameters in vector autoregressive models. A VAR (p) is a model in which N variables are specified as linear functions of p of their own lags, p lags of the other $N-1$ variables, and possibly additional exogenous variables. Algebraically, a p^{th} order vector autoregressive model with exogenous variables X_t is given by:

$$Y = v + A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + BX_t + e_{t,} \qquad t\epsilon\{-\infty, \infty\} \quad [4.66]$$

where $Y_t = (Y_{1t}, \ldots, Y_{kt})$ is an $N \times 1$ random vector, the A_i are fixed $N \times N$ matrices of parameters, X_t is an $M \times 1$ vector of exogenous variables, B is an $N \times M$ matrix of coefficients, v is an $N \times 1$ vector of fixed parameters, and e_t is assumed to be white noise; that is $E(e_t) = 0$, $E(e_t e_t') = \Xi$, and $E(e_t e_t') = 0$ for $t \neq s$.

There are $N \times N \times p + N \times (M + 1)$ parameters in the functional form for y_t, and there are $\{N \times (N + 1)\}/2$ parameters in the covariance matrix Ξ.

4.4.2 Reduced form VAR

As Amisano and Gianini (1997) cited in Tashrifov (2010) show the first phase of structural VAR analysis could end with the estimate of the parameters of an unrestricted reduced form such as:

$$A(L)y_t = e_t, \qquad E(e_t e_t') = \Xi$$

The matrix Ξ is the variance/covariance of the estimated residuals, e_t of the standard VAR.

4.4.3 Short- run restrictions SVAR model

A short run SVAR model with only endogenous variables can be written as:

$$A\big(I_n - A_1 L - A_2 L^2 - A_3 L^3 - \ ... - A_p L^p\big) y_t = A e_t = B\varepsilon_{t.} \qquad [4.67]$$

where L is the lag operator. A, B, and $A_i (i = 1, \dots p)$ are $n \times n$ matrices of parameters e_t is an $n \times 1$ vector of innovations (disturbances) with $e_t \sim N(0, \Sigma)$ and $\Xi\big[e_{t,} e_s'\big] = 0_n$ for all $s \neq t$, and ε_t is an $n \times 1$ vector of uncorrelated shocks, which means that $\varepsilon_t \sim N(0, I_n)$ and $\Xi[\varepsilon_t \varepsilon_s'] = 0_n$ for all $s \neq t$.

So it can be shown as:

$$AY_t = AA_1 Y_{t-1} + AA_2 Y_{t-2} + \ ... + AA_p Y_{t-p} + B\varepsilon_t \qquad [4.68]$$

The matrices A and B are assumed to be invertible and ε_t is an $n \times 1$ vector of structural shocks with covariance matrix $\Xi[\varepsilon_t \varepsilon_s'] = \Omega$. This includes all models considered by Amisano and Gianini (1997).

The dynamic effect of the structural disturbances is analysed by taking into consideration the moving average representation:

$$Y = e_t + \phi_1 e_{t-1} + \phi_2 e_{t-2} + \ ... \equiv \phi(L) e_t$$
$$Y = A_{-1} B\varepsilon_t + \phi_1 A^{-1} B\varepsilon_{t-1} + \phi_2 A^{-1} B\varepsilon_{t-2} + \ ... = \varphi(L)\varepsilon_t$$

where $\phi(L) = A(L)^{-1}$ and $\varphi(L) = A(L)^{-1} A^{-1} B$.

Using [4.67] it is easy to explain the short run model of analysing the dynamics of the system, in terms of a change to a parameter of ε_t in the model. In equation [4.67] there is an assumption, $P_{sr} = A^{-1}B$, where P_{sr} is the P matrix identified by a particular short-term SVAR model. The final equality in equation 4.67 indicates that:

$$Ae_t e_t' A' = B\varepsilon_t \varepsilon_t' B' \qquad [4.69]$$

After taking the expectations from both sides of 4.69 changes to $\Sigma = P_{sr}P_{sr}'$. If the underlying VAR is stable, then it is easy to change 4.67 to the form:

$$Y_t = \delta + \sum \Omega_s^{sr} Y_{t-s}.$$

This is called an infinite order moving average representation. The Y_t is shown in terms of the joint uncorrelated, identity variance structural shocks ε_t. The Ω_s^{sr} includes the structural impulse response functions at ranges. Notice that in order to identify the parameters, restrictions on the following matrices are required: $A, B, A_i, \ldots, A_p$, and Ω.

The basic framework of the structural VAR (SVAR) model is as follows: Let Y_t be an n dimensional time series with $(n \times 1)$ vector of endogenous variables, $Y_y = (Y_{1t}, \ldots\ldots, Y_{nt})'$, and ε_t be a n$\times$ 1 vector of structural innovation with a mean of zero (Fry et al., 2008; Abu-Qarn and Abu-Bader, 2008; Mertens and Ravn, 2010). These authors argue that p^{th} -order VAR is described as:

$$AY_t = A_1^* Y_{t-1} + A_2^* Y_{t-2} + \ \ldots\ A_p^* Y_{t-p} + B\varepsilon_t = \sum_{i-1}^{p} A_i^* Y_{t-1} + B\varepsilon_t \qquad [4.70]$$

They go on to add that researchers should ignore the following for the purposes of simplicity: constant terms, deterministic terms and the exogenous variables. As Tashrifov (2010) expressed it matrix A is an *(n$\times$ n)* invertible matrix, which summarises the contemporaneous (instantaneous) links among the variables. The A_i^*'s in [4.70] are $n \times n$ coefficient matrices. In addition, he states that structural shocks are properly identified from the error terms of the estimated reduced form with appropriate identifying restrictions

and also that non-zero off-diagonal elements of an $n \times n$ matrix B allow some shocks to affect more than the endogenous variable in the system directly. The normal practice is to assume their linear combinations to be white noise processes with zero means and constant variances and that they are not serially correlated. The variance-covariance matrix of ε_t's is normally restricted to be diagonal (Enders, 2004: p.323).

According to Tashrifov (2010) to get the reduced form model, which corresponds with the structural form, pre-multiply [4.66] with A^{-1}, provided that A is non-singular.

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ ... + A_p Y_{t-p} + e_t, \qquad [4.71]$$

where, $A_j = A^{-1} A_j^*$ $(j = 1, \dots, p)$. $e_t = A^{-1} B \varepsilon_t$ describes the relationship between the reduced form residuals (e_t) and the underlying structural shocks (ε_t). Thus, the following relationship is obtained:

$$E(e_t e_t') = A^{-1} B E(\varepsilon_t \varepsilon_t') B' A^{-1}.$$

In addition, assuming the standardised variance of each disturbance, the variance/covariance matrix Σ can be estimated using OLS:

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \dots & \sigma_{1n} \\ \sigma_{21} & \sigma_2^2 & \dots & \sigma_{2n} \\ \vdots & \vdots & \dots & \vdots \\ \sigma_{n1} & \sigma_{n2} & \dots & \sigma_n^2 \end{bmatrix}$$

where each constructed element of Σ is the sum shown below:

$$\sigma_{ij} = \left(\frac{1}{T}\right) \sum_{t=1}^{T} e_{it} e_{jt}$$

The number of restrictions set should be such that the number of variables and that of equations should be equal, so that the degrees of freedom is equal to zero, as we are able to estimate the system of equations using SVAR if their degrees of freedom is equal to zero (Enders, 2004: p. 323). For example, if there is one equation with two variables this gives one degree of freedom. In addition, two equations and two variables give zero degrees of freedom.

Enders (2004: p. 323) also argued that since Σ is symmetric, it contains $\frac{n\,(n+1)}{2}$ distinct elements. He adds that there are *n* elements along the principal diagonal, *n-1* along the first off diagonal, *n-2* along the next off diagonal, etc., and the corner element for a total of $\frac{n\,(n+1)}{2}$ free elements. Given that the diagonal elements of B are all unity, B contains $n^2 - n$ unknown values. Furthermore, there are *n* unknown values $[var(\varepsilon_{it})]$ for a total of n^2 unknown values in the structural model. Alternatively, this means that there are $n^2 - n$ values of B plus the n values $[var\ (\varepsilon_{it})]$. To identify the n^2 unknowns from the known $\frac{n\,(n+1)}{2}$ independent elements of Σ, it is necessary to impose an additional $n^2 - [(n^2 + n)/2] = (n^2 - n)\ /2$ restrictions on the system. This outcome can be generalised to a model with *p* lags. To identify the structural model from an estimated VAR, it is necessary to impose $(n^2 - n)\ /2$ restrictions on the structural model.

Enders (2004: p.323) argues that the main purpose of SVAR estimation is to get non-recursive orthogonalisation of the error terms for the purposes of impulse response analysis. He also adds that the main purpose of SVAR estimation is to get non-recursive orthogonalisation of the error terms for impulse response analysis. This is because Cholesky orthogonalisation requires the user to impose enough restrictions to identify the structural components of the error terms.

Let y_t be the *n*-element vector of endogenous variables and let $\Sigma = E(e_t e_t')$ be the residual covariance matrix. Following Amisano and Giannini (1997), and Fragetta and Melina

(2011), the class of SVAR models that a statistical package like Eviews estimates are written as:

$$Ae_t = B\varepsilon_t \quad [4.72]$$

Where:

e_t and ε_t are vectors of lag length p,

e_t are the observed reduced form residuals,

ε_t are the unobserved structural innovations, and,

A and B is $n \times n$ matrices to be estimated.

The structural innovations ε_t are assumed orthonormal, that is, its covariance matrix is an identity $E[\varepsilon_t \varepsilon_t'] = I$. The assumption of orthonormal innovation ε_t imposes the following identifying restrictions on A and B:

$$A\Sigma A' = BB' \quad [4.73]$$

It can be observed that the expressions on either side [4.73] are asymmetric, and this imposes $\frac{n\,(n+1)}{2}$ restrictions on $2n^2$ unknown elements in A and B. Therefore, in order to identify A and B, at least $2n^2 - \frac{n(n+1)}{2} = \frac{n(3n-1)}{2}$ elements need to be provided (Enders, 2004: p.323; Fragetta and Melina, 2012). This means that identification necessitates the imposition of some identifying restrictions on the parameters A and B, which results in three possible cases: under-identification, just-identification and over-identification. The statistic distributed as χ^2 (Chi-square) examines the validity of the over-identified case with the number of degrees of freedom equal to the numbers of over-identifying restrictions. The four most popular patterns of identifying restrictions usually used are: (a) $B = I_n$, (b) $A = I_n$, (c) $Ae_t = B\varepsilon_t$ (AB model) developed by Amisano and Giannini (1997), and (d) the structure with prior information on the long run effects of some of the shocks, like that of Blanchard and Quah (1989).

Section 4.4.4., below discusses some of the problems and weaknesses that are associated with the SVAR methodology since no econometric method used thus far can be deemed flawless.

4.4.4 Long run SVAR Model

For estimating the long run SVAR model it is easy to remember a typical short term SVAR model from equation 4.68 and simplify the notation.

$$\bar{\mathrm{A}}(I_n - A_1 - A_2L^2 - A_3L^3 - \cdots - A_pL^p). \qquad [4.74]$$

Since the model is assumed to be stable constraining A to be an identity matrix allows rewriting of this equation as: $Y_t = \bar{\mathrm{A}}^{-1}B\varepsilon_t$ where $\bar{\mathrm{A}}^{-1}$ is the matrix of the estimated long run model that can identify the effects of the reduced form VAR shocks, since A is set to be an identity matrix, $\Sigma = BB'$. Hence, $C = \bar{\mathrm{A}}^{-1}B$ is the matrix of long run responses to the uncorrelated disturbances, and, $Y_t = C\varepsilon_t$.

The long run restrictions allow for recovery of the underlying structural disturbances, which can be used to find impulse response functions and variance decomposition to evaluate dynamic responses of variables to different shocks.

As in the short run model, the P_{lr} matrix identifies structural impulse response functions. Notice that $P_{lr} = C$ and, where the constraints are placed on the parameters in C, free parameters are estimated. Furthermore, there n^2 parameters in C and the order condition for identification require that there be at least $n^2 - n\,(n+1)\,/2$ restrictions imposed on those parameters (Amisano and Gianini, 1997).

4.4.5 Impulse response functions (IRF)

Initially IRFs technique was introduced in VAR modelling by Sims (1980). The IRF is an illustrative method representing the response of each variable to shocks in the different

equations of the VAR system. Sims (1980) also noticed that shocks must be uncorrelated. In the SVAR model, as soon as a structure is identified and estimated, then *n* impulse response functions for each independent shock need to be observed.

Stock and Watson (2001) and Christianno et al. (1998) used the IRF to examine the monetary policy shocks impact on other macroeconomic variables.

Consider a VAR (p) with endogenous variables only:

$$Y_t = v + A_1 y_{t-1} + A_2 y_{t-2} + \ ... + A_p y_{t-p} + \varepsilon_t \qquad [4.75]$$

Here the VAR (p) represents the variables in y_t as functions of its own lags and serially uncorrelated disturbances $\varepsilon_{t.}$ The most direct way to learn how disturbances affect the variables in y_t after, for example, some periods is to re-write the model in its moving average form as:

$$Y_t = \delta + \sum_{i=0}^{\infty} \Phi_i \varepsilon_{t-i} \qquad [4.76]$$

where δ is the $n \times 1$ time-invariant mean of y_t, and,

$$\Phi = \begin{cases} \text{In} & \text{if i} = 0 \\ \sum_{\text{j}=1}^{\text{i}} \phi_{\text{i}=1} & \text{if i} = 1, 2, 3, ... \end{cases}$$

Here the basic impulse response functions and the j, n element of Φ_{i}, give the effect of the one-time unit increase in the n^{th} element of ε_t on the j-the element of y_t after some i periods, holding everything else constant.

Usually the SVAR approach integrates the need to identify the causal IRF into the model estimation process. Sufficient identification restrictions can be obtained by placing either

short-term or long-term restrictions on the model (Amisanno and Gianini, 1997). The easy way is to start with the short run restrictions. If this is done, [4.75] can be rewritten as:

$$Y_t - v - A_1 y_{t-1} - \cdots - A_p y_{t-p} = \varepsilon_t \quad [4.77]$$

In this case, the short run SVAR model can be written as:

$$(A(Y_t - v - A_1 y_{t-1} - \cdots - A_p y_{t-p}) = Ae_t = B\varepsilon_t. \quad [4.78]$$

In 4.78, A and B are non-singular matrices of parameters to be estimated and ε_t is an $n \times 1$ vector of shocks with $\varepsilon_t \sim N(0, I_n)$, and $\Xi[\varepsilon_t \varepsilon_s'] = 0_n$ for all $s \neq t$.

4.4.6 Forecast error variance decomposition (FEVD)

Sims (1980) first introduced the FEVD method, and since that time FEVD methods have been applied in a large number of SVAR studies, such as in Bernanke (1986), Blanchard (1989), Blanchard and Quah (1989), Shapiro and Watson (1988), and a major study by Lutkepohl (1990, 1993), including some results on the estimation of FEVD coefficients and their asymptotic distribution.

Following Lutkepohl (1993), the *h*-step forecast error is shown as:

$$y_{t+h} - \hat{y}_t(h) = \sum_{i=0}^{h-1} \Phi_i \varepsilon_{t+h-i}. \quad [4.79]$$

In 4.79, y_{t+h} is the value observed at time $t = h$ and $\hat{y}_t(h)$ is the *h*-step ahead predicted value for y_{t+h} that was made at time t.

Since $\varepsilon_t s$ are contemporaneously correlated, their specific contribution to the prediction error cannot be ascertained. However, if P is going to be chosen and $\Sigma = PP'$, then it is possible to orthogonalise the ε_t into $\Gamma_t = P^{-1}\varepsilon_t$. On this basis, 4.79 can be rewritten as:

$$y_{t+h} - \hat{y}_t(h) = \sum_{i=0}^{h-1} \Phi_i P P^{-1} \varepsilon_{t+h-i}.$$

$$y_{t+h} - \hat{y}_t(h) = \sum_{i=0}^{h-1} \Omega_i \Gamma_{\mathrm{t+h-i}} \qquad [4.80]$$

As forecast errors can be written in terms of the uncorrelated errors, it follows that the forecast error variance can be written in terms of uncorrelated error variances also. The FEVD measures the proportion of the absolute forecast error variance that is caused by each of the uncorrelated shocks or disturbances.

4.4.7 Assessment of SVARs

SVARs offer an attractive proposition to the estimation of relationships among variables. They promise to establish fascinating patterns from the data, which is collected, and this may even be true across a set of incompletely specified dynamic economic systems, which require a small number of identifying assumptions. In addition, SVARs are uncomplicated to estimate and evaluate, being possible to do so even with commercial software and readily available routines from the World Wide Web. If an expert researcher employs SVARS they have the potential to contribute meaningfully to the comprehension of gross changes of the series, and may assist to explain the significance of different shocks to the economy, and they may lead to extensive and constructive debates among macroeconomists. Moreover, SVARs also have their own flaws, which have led to the criticism mentioned below. In this section, the study mentions only three flaws. First, it is contended that shocks to the economy recovered for the use of an SVAR are not comparable to the shocks that are found when other mechanisms, such as, market expectations incorporated in future prices are used. Second, the SVAR recovered shocks may be a reflection of the variables omitted from the model. If these omitted variables are correlated with included variables, estimated economic shocks are biased. Third, the results of numerous SVAR evaluations, even simple ones, are predisposed to identification restrictions. Aligned to this criticism is the notion that the majority of the identification

schemes come about because of specification investigations in which researchers attempt to look for answers. In cases where an identification scheme is in line with conventional wisdom, it is deemed successful; if it does not, it is an irksome puzzle at best or, a failure at worst. Consequently, there is a dangerous possibility that economists will be stuck in an a priori view of data under the veil of formal statistical inference.

Without some restrictions, the parameters in the SVAR are not identified. That is, given the values of the reduced form parameters, it is not possible to solve uniquely for structural parameters. Apparently, restrictions on the parameters of SVAR are required in order to identify all of the structural parameters. Sims (1986) argues that economic theory is not rich enough to suggest proper identification restrictions on the SVAR. However, the number of restrictions is calculated on the structural parameters to identify all of them from the reduced form VAR (p). The minimum number of restrictions equals the difference between unique parameters of SVAR and that of VAR. This means that at least n^2 restrictions on the structural parameters must be imposed to identify them.

The best that can be done is to estimate the reduced form VAR. There is considerable debate about what constitutes appropriate identifying restrictions. Typical identifying restrictions include:

(i) Zero (exclusion) restrictions on the elements of B, for example, $b_{12} = 0$.

(ii) Linear restrictions on the elements of B, for example, $b_{12} + b_{21} = 1$.

(iii) In some applications, identification of the parameters of SVAR is achieved through restrictions on the parameters of the SMA representation. For example, suppose that ε_{2t} has no contemporaneous impact on y_{1t}. Then $\theta_{12(0)} = 0$ and so Θ_0 becomes a lower triangular matrix

4.5 IMPORTANT ISSUES IN ECONOMETRIC ESTIMATION

4.5.1 Unit Root Test

Most empirical investigations begin with an analysis of the time series properties of the series and determine the order of integration for multivariate series. There are a number of variations of the unit root test, namely the Augmented Dickey Fuller Test (ADF) (1979, 1981), Phillips-Perron (PP) (1988), Kwiatkowski, Schmidt and Shin (1992) among others. Stationarity implies that consideration of two different time intervals means that the sample mean and the sample covariance of the time series over the two time intervals will be nearly the same. In other words, a time series is said to be stationary if its statistical properties remain constant over time.

The Augmented Dickey Fuller test (ADF) has been the most common test used to verify data stationarity in empirical research. This test is applied in higher order and models where the error terms are serially correlated. The first thing done is to determine the order of integration of each variable since cointegration requires that the variables be integrated of the same order. To test the stationarity of the series, the study uses the Augmented Dickey Fuller (ADF) unit root testing procedure (Dickey and Fuller, 1979). The size of the coefficient λ is the one that is needed to determine the following equation:

$$\Delta Z_t = \propto_0 + \mu t + \lambda Z_{t-1} + \alpha_i \sum_{i=1}^{n} \Delta Z_{t-i} + \varepsilon_t \qquad [4.70]$$

where: *t* denotes the time trend and *Z* is the variable of interest being tested. If the null hypothesis is accepted, in this case it implies that $|\lambda| = 0$, which would buttress the presence of a non-stationary process. The unit root is carried out under the hypothesis:

H_0: series contains a unit root, versus,

H_1: series is stationary

Therefore, if the null hypothesis is rejected (if the coefficient of the lag of $Z\,[\lambda]$ is significantly different from zero) then the series is non-stationary.

Phillips and Perron (1988) propose an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root. The PP method estimates the non-augmented Dickey Fuller test equation 4.72 below and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The PP tests are based on the following equations:

$$Y_t = \mu + \alpha^* Y_{t-1} + v_t \qquad [4.71]$$

$$Y_t = \mu + \beta\left(1 - \frac{T}{2}\right) + \alpha^{\sim} Y_{t-1} + v_t \qquad [4.72]$$

Where Y_t represents all the variables of interest, T are the number of observations, μ is a non-zero mean term and β is the linear trend term. When performing the PP test, a decision has to be made about whether to include a constant, a constant and a linear trend, or neither, in a test regression. However, modern researchers point out that the standard ADF test is not suitable for variables that may have undergone structural changes. Perron (1989) showed that the existence of structural changes biases the standard ADF tests towards the non-rejection of the null of a unit root. Perron (1989) demonstrated that if observations corresponding to unique events like the great depression (1929) and first oil crises (1973) isolated from Nelson and Plosers' (1982) data, the results derived from Nelson and Ploser could be reversed for most of the variables.

4.5.2 Lag Length Selection

In order to embark on cointegration analysis, it is imperative to determine the optimal lag length for a VAR. Lag length selection is important for VAR specification because choosing too few lags result in misspecification and choosing too many lags results in unnecessary loss of degrees of freedom. To avoid this, lag lengths are selected using statistical tests, which include the modified Likelihood Ratio (LR) test, Akaike Information

Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQ).

The Akaike Information Criterion (AIC) developed by Akaike (1974) is given by:

$$AIC = TlogL + 2N \quad [4.73]$$

Schwarz (1978) developed the Schwarz information Criterion (SIC) which is denoted by:

$$SIC = Tlog\ L + NlogT \quad [4.74]$$

where, L denotes the likelihood or the sum of squared errors N is the number of parameters in the estimated model and T is the number of observations in the series.

4.5.3 Johansen Cointegration Approach

The next step is the Johansen cointegration approach, used to evaluate the long run relationship amongst variables in the models. To realise this goal, the maximum likelihood based cointegration approach introduced by Johansen (1988, 1990) is used, but only after determining whether there is a unit root or not for each series individually. If the integrated time series is of the same order after unit root tests, then these variables may be cointegrated. Cointegration deals with the relationship among a group of variables, where unconditionally each has a unit root.

The procedure begins by expressing the stochastic variables in an $(n \times 1)$ vector Y_t as the unrestricted vector autoregressive (VAR) involving up to k-lags of Y_t :

$$Y_t = A_1 Y_{t-1} + \cdots + A_k Y_{t-k} + C + \mu_t \quad [4.75]$$

This can be summarised as:

$$Y_t = C + \sum_{i=1}^{k} A_1 Y_{t-i} + \mu_t \qquad \mu_t \sim IN(0, \Sigma) \qquad [4.76]$$

If the variables under consideration are cointegrated, the cointegration vector is normalised with respect to the variables included in the models. In addition, it is feasible to verify the short run dynamics of the variables through vector error correction model. In order to use the Johansen test, the VAR above needs to be turned into a vector error correction model (VECM) that can be written in its first difference form:

$$\Delta Y_t = \Pi Y_{t-k} + \Gamma_1 \Delta Y_{t-t} + \Gamma_2 \Delta Y_{t-2} + \cdots + \Gamma_{k-1} \Delta Y_{t-(k-1)} + \mu_t \qquad [4.77$$

This can be summarised as:

$$\Delta Y_t = \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \Pi Y_{t-k} + \mu_t \qquad [4.78]$$

where, $\Pi = \left(\sum_{j=1}^{k} A_i \right) - I_g$ and $\Gamma_i = \left(\sum_{j=1}^{i} A_j \right) - I_g$,

I_g is an identity matrix, and ΠY_{t-k} contains information regarding the long run equilibrium relationship between variables in Y_t.

The long run relationship between wages, price inflation, productivity and unemployment is suggested by the rank of Π matrix, r, where $0 < r < n$, and two matrices **α** and **β** with dimensions $(n \times r)$ are such that $\alpha\beta' = \Pi$. The matrix $\beta' Y_t$ is stationary, and it is a matrix of long run coefficient. α is a matrix of the error correction presentation that measures the speed of adjustment in ΔY_t, or it represents the speed of adjustment to disequilibrium.

There are two test statistics for cointegration under the Johansen approach:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} ln(1 - \lambda) \qquad [4.79]$$

$$\lambda_{max} = (r, r+1) = -T \, ln(1 - \lambda_{r+1}) \qquad [4.80]$$

where r is the number of cointegrating vectors under the null hypothesis and λ_i is the estimated value of the i^{th} ordered Eigen value from the Π matrix. It is self evident that the larger λ_i the larger and negative will $ln(-\lambda_i)$ be; hence the larger the test statistics will be where T is the number of observations. The λ -trace test statistic, tests the existence of at least r cointegration vectors against a general alternative, while the null hypothesis of r against r +1 cointegrating vectors is tested by λ_{max}.

4.6 DATA DESCRIPTION AND ANALYSIS

4.6.1 Sources of the data and the variables

The study uses annual data and the estimation covers the period 1980 to 2013 giving 34 annual observations. Data from the study is sourced from, Ministry of Labour and Social Welfare (1993/94, 1997, 2000, 2004, 2008, 2012, and 2014), Bank of Namibia (1990-2014), Namibia Statistical Agency (NSA) (2012-2014) and the World Bank Database. Chapter 5 uses SVAR to estimate for the sources of unemployment in Namibia and the estimated model is summarised as $X_t' = [PRD_t, EMP_t, RWG_t, PCE_t, UEM_t]$. Moreover, Chapter 6 also utilises SVAR to develop and estimate the following small macroeconometric model from the basic model made up of real wage (RWG), productivity (PRD), unemployment (UEM) and interest rates (LER): $X_t' = [PRD_t, RWG_t, UEM_t, MPP_t, CDT_t, NEX_t, LER_t]$. The variables described and discussed in this section are obtained from the above-mentioned two models that are central to the current study. Additionally, for variables such as employment and unemployment, where the data is not available before 1993 backward extrapolation had to be employed to generate the data. In the same vein, where there were gaps in the data, particularly, for unemployment, interpolation methods were employed to fill the gaps. The methods used for both interpolation and extrapolation are described in section 5.6.3 of the current chapter.

All the variables in the current study are transformed to logarithms and the summary statistics in Table A2 in Appendix A indicate the variables in logarithmic form. The statistics show that the means and medians of all the variables are not very different from each other, which is a sign that the data may possibly not have outliers. This is

authenticated by standard deviations, which are generally less than one except for the gross domestic product and the real wage. The Jarque-Bera statistics summarised for each variable in Table A2 show that all variables are individually distributed normally and this is a good sign because variables that are distributed normally behave very well in the estimations. Figure A3 in Appendix A shows the trend diagrams of the variables, and Figure A4 shows the first differences of the variables (which appear to suggest that the variables become stationary after first differencing). This is confirmed by stationarity tests in Tables A2 and A3 in Appendix A. Lastly, the evolutions of the variables against unemployment and interest rates for the unemployment and the macroeconometric models are shown in Figures B1 and C2 in appendices B and C, respectively.

4.6.2 Descriptions and derivations of variables

Labour force (LFC)

Due to lack of data on the labour force for the period 1980 to 1989, the main method used to generate the values of the labour force for the period 1980 to 1989 is the linear extrapolation method also used by Smith and Sincich (1988), Chow and Lin (1971), Smith (1987), Chang et al. (2007) and Tsonis and Austin (1981). Given the fact that labour force data for the period 1990 to 2013 is available, the study did backward extrapolation to generate data for the period 1980 to 1980.

Unemployment (UEM)

Unemployment is the difference between the total labour force and total employment. Unemployment rate is total unemployment as a percentage of the total labour force using the national estimate. In the past, labour force surveys were carried out after every four years and starting in the year 2012, they are now being conducted annually. The unemployment figures for the period 1990 to 2013 were obtained from the labour surveys and the gaps were filled by using a linear interpolation method (Gil, 2012). The study also used the linear backward extrapolation method described under labour force to generate the figures for the period before 1990 (see Smith and Sincich (1988), Chow and Lin (1971), Smith (1987), Chang et al. (2007) and Tsonis and Austin (1981)).

Employment (EMP)

Total employment is equivalent to labour force minus total unemployment. Labour force and unemployment are as described above. Once the figures for labour force and unemployment are available, it is easy to calculate the figures for total employment.

Price inflation (PCE)

This is the consumer price index with base year 2005. Linzert (2001) used the same measure for the German economy.

Real gross domestic product (GDP)

Real gross domestic product (GDP) is defined as nominal GDP in local currency units (LCU) adjusted for inflation, which is found as a ratio of GDP in local currency units and the CPI. This data is available in the NSA database and IMF world Economic Outlook (2013).

Productivity (PRD)

Productivity: is the ratio of real GDP over total employment$[\text{Real GDP}/\text{EMP}]$. In this case, GDP is the nominal Gross Domestic Product measure in millions of national currency. Real GDP is calculated by deflating the nominal measure of GDP using the CPI measure and EMP is the measure of total employment.

Capital stock (KST)

This is gross fixed capital formation expressed in real terms and in millions of local currency with a base year of 2005 dollars. This data is available in the Namibia Statistical Agency database. This is the same definition used by Akanbi and Du Toit (2010) and Karanassou et al. (2010) for Nigeria and Australia, respectively.

Real wage (RWG)

Note that capital stock and labour are the major inputs in the production process. To derive wages, the following identity is used:

$$\frac{\mathrm{KST_T}}{\mathrm{GDP_T}} + \frac{\mathrm{EMP_T}}{\mathrm{GDP_T}} = \frac{\mathrm{GDP_T}}{\mathrm{GDP_T}} = 1$$

$$\text{Thus, } \frac{\mathrm{KST_T} * \mathrm{LER_T}}{\mathrm{GDP_T}} + \frac{\mathrm{EMP_T} * \mathrm{RWG_T}}{\mathrm{GDP_T}} = \frac{\mathrm{GDP_T}}{\mathrm{GDP_T}} = 1$$

where $\mathrm{GDP_T}$ is GDP, $\mathrm{EMP_T}$ is employed labour, LER_t is the interest rate (lending rate), and $\mathrm{RWG_T}$ is the real wage rate. $\mathrm{KST_T} * \mathrm{LER_T}$ represents the total value of capital in the economy and $\mathrm{EMP_T} * \mathrm{RWG_T}$ represents the total wage bill of the economy.

This implies that:

$$\mathrm{RWG_T} = \left[1 - \left(\frac{\mathrm{KST_T} * \mathrm{LER_T}}{\mathrm{GDP_T}}\right)\right] * \left(\frac{\mathrm{GDP_T}}{\mathrm{EMP_T}}\right) = \frac{\mathrm{GDP_T} - \mathrm{KST_T} * \mathrm{LER_T}}{\mathrm{EMP_T}}$$

This is the calculation Akanbi and Du Toit (2010) used in their study on Nigeria.

Lending rate (LER)

Lending rates are the rate at which, commercial banks lend money to their clients. This is also referred to as the cost of money. Note that this rate is frequently influenced through the repo rate (rate at which the banks borrow money from the central bank) in Namibia. Interest rates data were obtained from the South African Reserve Bank and Bank of Namibia Quarterly Bulletins. Data for the period 1980 to 1990 was obtained from the South African Reserve Bank since Namibia was considered a province of SA then and that for the period 1990 to 2013 was obtained from the Bank of Namibia. Shiimi and Kadhikwa (1999) also used this strategy in their study on Namibia.

Bank credit (CDT)

This is bank credit to the private sector. The study uses financial intermediation as a proxy for bank credit in Namibia. Financial intermediation refers to lending to the productive

sector of the economy. The role of financial intermediaries is to channel funds from lenders to borrowers by intermediating between them. This data is available for the period 1980 to 2013 in the NSA database.

Nominal exchange rate (NEX)

The nominal exchange rate of the Namibian dollar (N$) against the United States Dollar (USD) is used as proxy for the NEX. The source of these statistics is the Bank of Namibia.

Import prices (MPP)

Import value indices measure the overall change in prices of imports of goods and services between the residents of an economic territory and residents of the rest of the world (IMF, 2010). The study uses the import value index with the base year 2000 as a proxy for import prices and the data is obtained from the World Bank Database. Backward extrapolation was used to generate data for the period before 1990.

5.6.3 Comments on interpolation and extrapolation methods applied

As pointed out in Chapter 2, unemployment rates are only available after every four years. During the time, the labour force surveys were conducted after every four years and interpolation is used to calculate values for the years that have missing values. The study follows the standard linear interpolation procedure. The time series for unemployment rate is only available after every four years. In this case, the formulation is as follows:

Assume the study wants to interpolate the values of unemployment for the years between the labour force survey years 2008 and 2012. These latter two years are some of the years in which the labour force surveys were conducted in Namibia. Using this information, the unemployment rates for the intervening years 2009, 2010 and 2011 can be interpolated. The formulae indicated below are the ones that were used to interpolate the unemployment figures for all the years that had no figures.

$$\mathrm{UEM}_{2009} = \mathrm{UEM}_{2008} + \frac{\mathrm{UEM}_{2012} - \mathrm{UEM}_{2008}}{4}$$

$$\mathrm{UEM}_{2010} = \mathrm{UEM}_{2009} + \frac{\mathrm{UEM}_{2012} - \mathrm{UEM}_{2008}}{4}$$

$$\mathrm{UEM}_{2011} = \mathrm{UEM}_{2010} + \frac{\mathrm{UEM}_{2012} - \mathrm{UEM}_{2008}}{4}$$

On the other hand, extrapolation is the process of estimating beyond the original observation range. Note that numerous methods are used to extrapolate a series. These techniques include linear extrapolation, exponential extrapolation, and regression extrapolation, among others. The main method used to generate the values of the labour force and unemployment for the period 1980 to 1989 is the linear extrapolation method used by Smith and Sincich (1988), Smith (1987), Chang et al. (2007) Tsonis and Austin (1981). The following terminology used below is partly adopted from Smith and Sincich (1988) and Cohen (1986) is used to describe the labour force (unemployment) extrapolations. Since the study extrapolates backwards (a previous period), the definition for the base year and the launch year are the opposite of what they would normally be if we were extrapolating into the future.

Base year:	the year of the latest observed labour force (unemployment) size used to make a projection
Launch year:	the year of the earliest, observed labour force (unemployment) size used to make the projection
Target year:	the year for which labour force (unemployment) is projected
Base period:	the interval between base year and launch year
Projection horizon:	the interval between launch year and target year

For example, in the current study, the data for the period 1990 to 2013 is available and the study wants to extrapolate the data for the period 1980 to 1989. In this case, the base year is 2013, the launch year is 1990, the first target year is 1989, the base period is 2013-1990 and the extrapolation horizon is 1990-1980. The linear extrapolation method assumes that

labour force (unemployment) will increase (decrease) by the same magnitude in each future (previous) year as the average annual increase (decrease) during the base period:

$$P_t = P_l + \frac{x}{y}(P_l - P_b)$$

where P_t = labour force (unemployment) extrapolation for the target year, P_l = labour force (unemployment) in the launch year, P_b = labour force (unemployment) in the base year, x = number of years in the extrapolation horizon, and y = number of years in the base period.

The other simple technique applied but whose figures are not shown in the study, is the exponential extrapolation technique that assumes that labour force (unemployment) will increase (decline) at the same annual rate in each future year as during the base period:

$$P_t = P_l * \exp(rx)$$

where r = average annual growth rates of labour force (unemployment) during the base period.

The advantages of using simple interpolation and extrapolation are obvious; they allow the researcher to expand the sample size, little base data, can be applied at low cost, and can be applied retrospectively to produce a large number of consistent extrapolations that are comparable over time. However, there are also disadvantages associated with these techniques that need to be taken into account. The main problem associated with the use of interpolation and extrapolation is that the researcher introduces an element of artificiality into the variables insofar as the researcher attributes the same share on the year on year change to each year, which may be at variance with reality. Extrapolation is similar to interpolation, which produces estimates between known observations, but extrapolation is subject to greater uncertainty and a higher risk of producing meaningless results. This

alternatively means that the researcher is introducing some degree of measurement error. Besides, researchers argue that linear interpolation and extrapolation ought to introduce little noise into the data (Stockhammer, 2004a). Note should be taken that extrapolation means creating a tangent line at the end of the known data and extending it beyond that limit. Linear extrapolation will only provide good results when used to extend the graph of an approximately linear function or not too far beyond the known data (Arestis et al., 2007 and Stockhammer and Strurn, 2008). In the context of the time series techniques that are employed in this dissertation, there are two caveats that need consideration. First, in attributing the same change to each year, the study is imposing a constant trend within each year, which may artificially increase the probability of finding these variables to be I(*1*) or even I(*2*). In the case of the ADF-GLS test, interpolation and extrapolation might increase the probability of not rejecting the null hypothesis of a unit root, i.e., reduce the power of this test (Gil, 2012). In addition, Gil (2012) argues that in the case of the KPSS test, interpolation might increase the probability of rejecting the null hypothesis of stationarity, i.e., increase the size of the test. Second, interpolation increases the probability of having serial correlation in the VAR equations, although this problem is accounted for by using a sufficiently rich lag structure in the model (Gil, 2012). Despite the problems alluded to above, the current study makes use of the interpolation and extrapolation method to generate relevant labour market data that is only available in full from the year 2012 onwards.

It must be noted that the simplicity of the techniques selected does not negate their usefulness. A number of studies have concluded that the simple extrapolation techniques produce short to medium term forecasts of demographic and economic series that are at least as accurate as the ones produced by sophisticated techniques (Smith 1987; Smith and Sincich 1988). They further argue that the more sophisticated techniques themselves are typically based on extrapolations of one type or another (e.g. employment/unemployment trends for economic based projections). Further, they state that the functional forms of these extrapolations are often similar to those of the simpler techniques. Smith (1987) also

adds that if the simpler and sophisticated techniques are applied to the same base periods, the projections from both will be more or less the same.

4.7 CONCLUDING REMARKS

The chapter reviews theoretical wage-price models, which are applicable in an imperfectly competitive environment for labour, and other markets in the developing countries are imperfectly competitive. The theories reviewed include, the new Keynesian wage-price model, the competing claims model of a unionised economy, the wage price model of an open economy, and the generalised efficiency wage-price model of productivity, unemployment and wages. All these theories concur on the fact that the wage-price relationship, either is influenced, or influences other variables like, labour productivity and unemployment, among others, and this is what forms the crux of the current research. So, in a way, these theoretical models aid in the justification of the specification of the extended contemporaneous wage-price model. Most of the above-mentioned theories have been duly subjected to empirical tests using different econometric methodologies. In addition, the chapter also discussed in detail the relationship between that VAR and SVAR methodologies since these are going to be used in the empirical analysis of this study. The chapter also discussed the other important econometric considerations, which are employed in this thesis, namely: unit root tests, cointegration tests, determination of the lag length, impulse response functions and variance decomposition among others. Further, the chapter discussed variable description and analysis and the sources of the data used in the study.

The next two chapters are purely dedicated to empirical analysis where the study commences by developing and estimating the unemployment model for Namibia after which the wage-price-productivity-unemployment models are developed and estimated in an open economy. Finally, the chapter 6 also develops the small macroeconometric model for Namibia.

CHAPTER 5

THE SOURCES OF UNEMPLOYMENT FLUCTUATIONS

5.1 INTRODUCTION

Unemployment is one of the most discussed macroeconomic indicators in Namibia, and its development attracts a lot of attention from both the media and the public. The average unemployment rate in Namibia, as discussed in Chapter 2, is the highest among the SACU countries and the other middle-income countries that were compared with it. The government of Namibia attempted to reduce the unemployment scourge since independence in 1990 by using various macroeconomic development frameworks to no avail, since the unemployment rate steadily increased to reach a maximum of 37.6 percent in 2008, after which it started to fall. The chapter attempts to analyse the effects of macroeconomic shocks on unemployment using structural vector autoregression (SVAR) by employing impulse response functions (IRFs) and forecast error variance decompositions (FEVD). The current chapter, therefore, analyses the impact of shocks to productivity, wages, prices, demand (employment) and labour supply (unemployment) on unemployment and their relative importance in accounting for the rise in the unemployment rate. The structural VAR model is suitable as it explicitly takes into account the interactions among the variables. Unlike the traditional VAR approach, the SVAR model utilises macroeconomic restrictions, which assist to give a distinct behavioural interpretation of the dynamics of the system. It allows examination of the ways in which particular macroeconomic shocks are propagated in the economy. As alluded to in section 5.2, a limited number of studies has attempted to distinguish between productivity shocks, labour supply shocks and labour demand shocks within the VAR framework consisting of labour productivity, real wages, price inflation, labour demand and labour supply. One of the very first studies using this framework was conducted by Balmaseda et al. (2000). In this study, Balmaseda et al. (2000) stated that "the contributions of the identified structural shocks to the evolution of the mentioned variables enlightens the forces driving unemployment and output in Germany and are therefore an

alternative to the traditional Phillips curve estimates." Given the brief background thus covered, the purpose of this chapter is threefold:

(i) to derive a theoretical model of unemployment.

(ii) to specify and estimate the SVAR model.

(iii) to analyse the dynamic effects of different macroeconomic shocks on unemployment in Namibia.

5.2 UNEMPLOYMENT IN NAMIBIA

The Namibian unemployment performance has deteriorated since the 1980s. Before independence, unemployment can be attributed to the war of independence, which destroyed infrastructure and caused despondence in the economy. Although there were mild declines in unemployment in the 1990s, the evolution of the Namibian unemployment rate over the last three decades is characterised by a persistent upward trend. At independence in 1990, Namibia inherited an unemployment rate that was already high, which stood at around 19 percent. After independence, unemployment in Namibia continued to increase to reach a maximum of 37.6 percent in 2008, after which it started to decline. The decline is mainly attributed to a combination of both expansionary monetary and fiscal policies adopted from 2008 onwards. It should be noted that high unemployment is common in most countries in Southern Africa, and it has not received much attention from economic researchers, mainly due to the unavailability of relevant statistical data on key variables such as wage rates and unemployment. The persistent high unemployment rate in Namibia is undoubtedly one of the major macroeconomic evils that worry economists and policy makers currently.

Stimulated by the need to investigate the sources of unemployment more closely, economists have carried out a large number of researches, particularly in the developed countries, attempting to explain what is responsible for the evolution of unemployment. However, a consistent and generally accepted framework of the development of unemployment has not been developed yet due to the intrinsic complexity and significance of this issue. Although a diversity of factors has been pointed out as possible culprits of high unemployment, two strands of explanations can be identified which emphasise

institutions and shocks respectively (Linzert, 2001; Su, 2006). The dominant view attributes high unemployment to labour market rigidities. These include strict labour market regulations, high unemployment benefits, high labour taxes, strong employment protection, trade union strengths, etc. To eliminate these institutional rigidities, one possible remedy is to conduct labour market reforms. The other view focusses on adverse macroeconomic shocks. From this perspective, it could be possible that the various shocks that have hit the Namibian economy are responsible for the sustained increase in unemployment. To this effect, oil price shocks, productivity deceleration and inadequate aggregate demand due to restrictive monetary and fiscal policies are quite often cited shocks. In addition, appropriate macroeconomic policies to stimulate aggregate demand are thought to be necessary in the fight against unemployment.

Considered individually, these views have not provided answers on some European economies like Spain and Germany, and they fail to provide plausible explanations that can account for the persistence of unemployment (Linzert, 2001; Maidorn, 2003; Su, 2006). These two positions should be regarded as complementary. The effects of adverse shocks and labour market institutions, which prevent the proper working of self-equilibrating mechanisms, should be considered. In fact, the apparent increasing proportion of long term unemployment has promoted the opinion that the interaction between negative shocks hitting the economy and structural elements in the labour market hindering a self-equilibrating process have possibly resulted in the persistently high unemployment rate in Namibia. Due to the existence of labour market rigidities, the hysteresis mechanism can be blamed for the long-lasting effects of adverse shocks influencing the unemployment rate. In a developing country like Namibia, poor business environment and poor infrastructure are also critical factors that affect unemployment even though they are not part of the current analysis.

Based on such a theoretical framework, the study provides a thorough analysis concerning the sources of persistently high unemployment rates in Namibia by investigating macroeconomic shocks and their persistent effects because of structural rigidities. Since the study focusses on macroeconomic shocks, the structural vector autoregressive (SVAR)

method is appropriate. SVARs were promoted by the inability of economists to agree on the true underlying structure of the economy in the 1970s. VAR models, first discovered by Sims (1980), have become popular in empirical macroeconomics. To avoid incredible identification restrictions in traditional macroeconometric models, particularly the determination of exogenous variables, the VAR approach regards all variables as endogenous. Concentrating on shocks, VAR models are well suited to ascertain the relative contribution and propagation mechanisms of certain shocks hitting the economy.

However, this traditional VAR method, which is of a reduced-form, has been criticised as being a-theoretic and having no sensible economic interpretation. Such criticisms inspired the structural approaches to VAR modelling to recover the underlying structural shocks. The SVAR analysis is an extension of the traditional unstructured VAR analysis, which imposes a certain structure derived from economic theory.

5.3 UNEMPLOYMENT BRIEF LITERATURE

The sources of unemployment have been analysed using variance decompositions by several researchers who include Jacobson *et al.* (1997), Dolado and Jimeno (1997), Carstensen and Hansen (2000) among others. Dolado and Jimeno (1997) studied the Spanish unemployment situation and established that the main sources of unemployment variability in Spain are productivity shocks followed by labour supply and demand shocks, respectively. In addition, Maidorn (2003) established that demand shocks explain the greater part of fluctuations in Australian unemployment, while Gambetti and Pistoresi (2004) found long lasting effects of demand shocks on the Italian economy. Christoffel and Linzert (2005) as well as Karannassou and Sala (2012) among others, found long lasting effects on European unemployment rates using other approaches instead of VAR models. Additionally, Carstensen and Hansen (2000) and Fabiani *et al*. (2001) found that technology and labour supply shocks account for the greater portion of long-run fluctuations in German and Italian unemployment, respectively, and also that the goods market shocks are significant in the short run. Algan *et al*. (2002) found that the standard model works well for the United States of America but performs poorly in capturing the rise of unemployment in France. In addition, Amisano and Serati (2003) also found that

unemployment rates in several European countries are affected permanently by demand shocks. Furthermore, Jacobson *et al* (1997) found that transitory labour demand shocks negligibly affected unemployment in Scandinavian nations. Jacobson *et al*. (1997) also established that monetary policy has permanent effects on Swedish unemployment. They obtained this result because they modelled the rate of unemployment as an I(1) process, which implies that all shocks would automatically have long lasting effects. The current study analyses the sources of unemployment for a small developing economy that was ranked a middle-income country in 2009, despite its persistently high unemployment rate.

5.4 THE UNEMPLOYMENT MODEL FOR NAMIBIA

The study analyses the sources of unemployment in the Namibian labour market for the period 1980 to 2013. The primary aim is to disentangle structural shocks as main causes behind the rise in the Namibian unemployment rate and their propagation mechanism. A small macroeconomic model serves as the theoretical basis, which is in line with the approach of Dolado and Jimeno (1997)[9]. The model contains an aggregate demand function, a production function, a price setting relation, a wage setting relation, a labour supply function and a definition equation of unemployment. In accordance with the insider-outsider model, the wage-setting rule states that nominal wages are chosen one period in advance and are set to make expected employment to be a weighted combination of lagged labour supply and employment. Full hysteresis corresponds to the extreme case where exclusively lagged employment (insiders) is considered in the wage bargaining process. These relations are influenced by exogenous variables, capturing the effects of various structural shocks. Institutional rigidities strengthen the power of insiders and thus exacerbate the inertia in the wage bargaining framework. Such labour market institutions have set the conditions to make the effects of adverse shocks persistent and produce a long-lasting rise in the unemployment rate.

The SVAR analysis with long run restrictions, which originated from Blanchard and Quah (1989), is employed. As compared with previous SVAR analyses of labour markets, novelties of this empirical work are the assumption of full-hysteresis in the unemployment

[9] The theoretical model is shown Section 5.4.1 below.

rate, which is supported by the presence of a unit root in the unemployment series according to ADF and Perron tests, and the identification of price shocks as one further structural shock.

Using long-run identifying restrictions achieved from the theoretical model, five structural shocks (price, real wages, productivity, aggregate demand and labour supply shocks) are recovered. With the help of the impulse response analysis and forecast error variance decompositions, the contributions of various shocks to unemployment evolution in Namibia are evaluated and the part of institutional rigidities is captured by a hysteresis mechanism.

5.4.1 The model

The section explains the theoretical framework discussed in Blanchard and Quah (1989) which outlines particular behavioural equations that assist in identifying a wide variety of shocks in the hysteresis context. The information discussed in this section makes it possible to identify five different types of shocks, which are important in explaining unemployment in Namibia. These include productivity, price push, wage push, aggregate demand (employment) and labour supply (unemployment) shocks. It is to be noted that that this is a standard model made up of five equations, which incorporate minimum dynamics to simplify the analysis. However, the long run performance of the model is consistent more with the general dynamic patterns considered in the empirical analysis (Maidorn, 2003). The development of this model starts from the three equations below:

$$gdp_t = \phi(d_t - pce_t) \quad [5.1]$$

$$gdp_t = emp_t + prd_t \quad [5.2]$$

$$pce_t = nwg_t - prd_t + \mu_t \quad [5.3]$$

where gdp_t denotes the natural log of output, d_t log of an index of nominal expenditure, pce_t log of prices, emp_t log of employment and nwg_t log of nominal wages, prd_t and μ_t denote productivity (labour amplifying technical growth) and price setting shift factors respectively. Equation 5.1 is the aggregate demand function where $\phi > 0$, Equation 5.2 is

the long run production function under the constant returns to scale (CRS) technology and Equation 5.3 sets up the simple price-setting rule, which is just a mark-up on labour cost per unit. The supply side of the labour market is characterised by adding the subsequent three equations to the model:

$$lfc_t = c(nwg_t - pce_t) - buem_t + \tau \quad [5.4]$$

$$nwg_t = nwg^* + \varepsilon_{nwg_t} + \gamma_1 \varepsilon_{d_t} + \gamma_2 \varepsilon_{pce_t} \quad [5.5]$$

$$nwg^*: \arg\{nwg_t^e = (1-\lambda) nwg_{t-1} + \lambda lfc_{t-1} \quad [5.6]$$

where lfc_t denotes log of the labour force, nwg_t^e the expected value of log of nominal wage, $uem_t = lfc_t - emp_t$ is the unemployment rate and τ is a stochastic labour supply shift parameter; and ε_{nwg}, ε_d, and ε_p represent shocks to nominal wages, demand and prices. Equation [4] is the labour supply function expressed in terms of the real wage ($nwg_t - pce_t$), and the unemployment rate (uem). The unemployment rate captures the supply side shift factors like variations in the participation rates, etc., and the 'discouragement' effect. The parameters c and b are expected to be greater than zero and this denotes the demoralisation of the long term unemployed. Equations [5.5] and [5.6] describe the wage-setting rule, in which the wages illustrate backward looking components. Just like in the insider-outsider model developed by Blanchard and Summers (1986) cited by Dolado and Jimeno (1997) and Gambetti and Pistoresi (2004) nominal wages are selected one period in advance and equated to the anticipated nominal wage rate (nwg_t^e) weighted by combination of lag nominal wage and labour supply. In Equation 5.5, effectively bargained wages are partly indexed to price and demand shocks through the following coefficients of indexation γ_i (i = 1,2) which imply that if $\gamma_i = 0$ ($\gamma_i = 1$) indexation is incomplete. In addition, there is an independent and identically distributed (i.i.d.) wage shock, reflecting changes in union bargaining power, etc. The subjects of indexation used are ε_{pce_t} and ε_{d_t}, instead of the whole spectrum of shocks since under different identification restrictions, which allowed for that possibility, it cannot be rejected that long run effects of ε_{prd_t} and ε_{lfc_t} on nwg_t are all zero. Generally, the micro foundations of Equation 5.5 characteristically follow from an insider-outsider framework (Blanchard and Summers, 1986) which usually fits the characteristic of the wage-setting

practice for many countries. This parameterisation results in full hysteresis when $\lambda < 0$ and partial hysteresis hypothesis when $0 < \lambda < 1$.

To close the model, the stochastic processes governing the evolution of the exogenous shift factors defined earlier need to be specified (Dolado and Jimeno, 1997). For illustrative purposes, it is assumed that $d, prd, \mu \; and \; \tau$ evolve following simple random walks.

$$\Delta d_t = \varepsilon_{d_t} \quad [5.7]$$

$$\Delta prd_t = \varepsilon_{prd_t} \quad [5.8]$$

$$\Delta \mu_t = \varepsilon_{pce_t} \quad [5.9]$$

$$\Delta \tau_t = \varepsilon_{lfc_t} \quad [5.10]$$

where ε_{dt}, ε_{prdt}, ε_{pcet} and ε_{lfct} are i.i.d., uncorrelated shocks to demand, productivity, prices and labour supply. Nonetheless, in the empirical application of the model allow for richer dynamics and the presence of deterministic trends while upholding the assumptions in Equations 5.7 to 5.10. According to Dolado and Jimeno (1997), if Equations 5.1 - 5.10 are solved for unemployment, they yield:

$$(1 - \rho L)uem_t = (1 + b)^{-1}\{-\phi(1 - \gamma_i)\varepsilon_{d_t} + [\phi(1 + \gamma_2) - c]\varepsilon_{pce_t} + (1 + c - \phi)\varepsilon_{prd_t} + \varepsilon_{lfc_t} + \phi\varepsilon_{nwg_t}\} \quad [5.11]$$

In Equation 5.11, L is the lag operator and ρ is equal to $(1 + b - \lambda)/(1 + b)$. It implies that the persistence of unemployment is an increasing function of both the discouragement effect (b) and the influence of lagged employment on wage determination (λ) in a partial hysteresis framework (Dolado and Jimeno, 1997). They further noted that for finite values of b, $\rho = 1$ is the same as $\lambda = 0$, and this means that a full hysteresis framework is equivalent to the I(1) unemployment rate. Execution of a formal unit root test confirms the need for the unit root restriction. Dolado and Jimeno (1997) further argued that the assumption that unemployment is I(1) or ($\lambda = 0$), is realistic, at least as a localised

approximation for the current period and the economy at hand, and is used in the next section.

Assuming full hysteresis ($\lambda = 0$) when solving the model yields variables purely expressed through structural shocks as represented in the following system (Linzert, 2001; Dolado and Jimeno, 1997):

$$\Delta emp_t = \phi(1-\gamma_1)\varepsilon_{d_t} + (\phi - 1)\varepsilon_{prd_t} - \phi(1+\gamma_2)\varepsilon_{pce_t} - \phi\varepsilon_{nwg_t} \quad [5.12]$$

$$\Delta gdp_t = \phi(1-\gamma_1)\varepsilon_{dt} + \phi\varepsilon_{prd_t} - \phi(1+\gamma_2)\varepsilon_{pce_t} - \phi\varepsilon_{nwg_t} \quad [5.13]$$

$$\Delta rwg_t = \gamma_1\varepsilon_{d_t} + \gamma_2\varepsilon_{pce_t} + \varepsilon_{nwg_t} \quad [5.14]$$

$$\Delta pce_t = \gamma_1\varepsilon_{d_t} - \varepsilon_{prd_t} + (1+\gamma_2)\varepsilon_{pce_t} + \varepsilon_{nwg_t} \quad [5.15]$$

$$\Delta uem_t = (1-b)^{-1}\{-\phi(1-\gamma_1)\varepsilon_{d_t} + [\phi(1+\gamma_2) - c]\varepsilon_{pce_t} + (1 + c - \phi)\varepsilon_{prd_t} + \varepsilon_{lfc_t} + \phi\varepsilon_{nwg_t}\} \quad [5.16]$$

The information summarised below explains the probable effects of the shocks represented in equations 5.12 to 5.16. The aggregate demand shocks (ε_{d_t}) have the effect of either increasing or decreasing employment, output or unemployment if there is complete indexation (Maidorn, 2003). Maidorn (2003) goes on to argue that the aggregate demand shocks also equally increase wages and prices if there is no complete rigidity.

Besides, Maidorn (2003) also argues that the equations indicate that price shocks (ε_{pce_t}) decrease employment and output and increase wages and prices. He also stated that price shocks increase unemployment if the labour supply schedule is relatively inelastic, that is, when c is small. In the same vein Maidorn also suggests that wage shocks (ε_{rwg_t}) decrease employment and output, and increase wages, prices and unemployment. Maidorn added that productivity shocks (ε_{prd_t}) increase output and employment, and reduce prices and

unemployment. It is to be noted that under full hysteresis all shocks have long lasting effects on unemployment.

5.4.2 Identification of structural shocks

The study follows the econometrics procedure developed by Maidorn in 2003. In order to identify structural shocks, the study uses the reduced form VAR as stated below:

$$A(L)\Delta X_t = \eta_t \qquad [5.17]$$

In Equation [5.17], X_t is a 5×1 vector encompassing $(\Delta PRD_t,\ \Delta EMP_t, \Delta RWG_t, \Delta PCE_t, U\Delta EM_t)$; *A(L)* is a k order polynomials matrix, with lag operator L, $A_0 = I$ with roots outside the unit circle, and η_t is a vector of zero mean *i.i.d* innovations with covariance matrix Σ (Maidorn 2003). This study follows common practice in that many authors who have studied the determinants (sources) of unemployment have used have used both price inflation (PCE) and real wages (RWG) in the same model (see Dolado and Jimeno, 1997; Linzert, 2001; Brüggemann, 2006; Welfe and Majsterek 2002; Pétursson 2002). However, other authors use real wage (wage-price) only in their models (see Balmaseda et al., 2000; Su, 2007) In addition, other authors have also used nominal prices and nominal wages in their models (Blanchard and Quah, 1989 and Baffoe-Bonnie and Gyapong, 2012). The preceding literature shows that there is no consensus as yet on whether real wages and price inflation or nominal wages and price inflation should be used together in labour market models. The model adopted for the current study attempts to establish the effects of both real wages and nominal prices on the real variables even though real wages are derived by subtracting nominal prices from nominal wages. Equation [5.17] summarises the corresponding structural form of the model:

$$S(L)\Delta X_t = \varepsilon_t, \qquad [5.18]$$

In Equation [5.17], ε_t is assumed to be a vector of uncorrelated *i.i.d* shocks having unit variance, and implying that $E[\varepsilon_t \varepsilon_t'] = I$. The moving average representations of the reduced and structural forms are respectively used to derive restrictions used in the study:

$$\Delta X_t = D(L)\eta_t$$

and,

$$\Delta X_t = C(L)\varepsilon_t, \qquad [5.19]$$

where $D(L) = A^{-1}(L)$, $D(0) = I$ and $C(L) = S^{-1}(L)$.

Thus, we have:

$$D(L)\eta_t = C(L)\varepsilon_t \qquad [5.20]$$

and, $\eta_t = C(0)\varepsilon_t$.

Employing the relationship between η_t and ε_t, it can be noted that the covariance matrix Σ justifies $\Sigma = \mathrm{C}(0)C(0)'$ which allows for an imposition of 15 nonlinear restrictions, leaving 10 elements of $C(0)$ free. To get additional restrictions required to identify completely the structural system, it is assumed that some structural shock ε_{it} does not permanently affect one of the x_{jt}'s. This is equivalent to setting equal to zero the structural moving average representation of the entry in i^{th} column and j^{th} row of the matrix of long run multipliers $C(1)$.

5.4.3 Non-stationarity and cointegration

The unit root test results, using the Augmented Dickey Fuller (ADF) and the Phillips Peron (PP) tests, in Tables 5-1 and 5-2, respectively, indicate that all series incorporated in the model are non-stationary in levels, but they become stationary after first differencing. This means that they are integrated of order one $[I(1)]$ processes.

Table 5-1: ADF and the PP non-stationarity tests in levels 1990 - 2013

		ADF	PP
Variable	**Model**	$\tau_{tc}, \tau_c\ \tau_n$	$\phi_{tc}\ \phi_c\ \phi_n$
$LNRWG$	Trend	-1.718	-2.751
	Constant	0.507	-1.187
	None	2.670	5.590
$LNPCE$	Trend	-0.563	-1.187
	Constant	-1.647	-6.146***
	None	0.735	4.316
$LNUEM$	Trend	-2.737	-3.143
	Constant	-2.383	-2.972**
	None	-0.016	-0.584
$LNPRD$	Trend	-1.680	-0.923
	Constant	0.319	0.764
	None	1.190	2.045
$LNGDP$	Trend	-2.246	-0.695
	Constant	1.679	0.216
	None	2.861	7.512

*** (**) [*] represent significance at the 1% (5%) [10%] levels, respectively. $\tau_{tc}, \tau_c\ \tau_n$ and $\phi_{tc}\ \phi_c\ \phi_n$ represent ADF and PP results using trend and constant, constant and none, respectively

Source: Authors' calculation from Eviews 8

Table 5-2 ADF and the PP non-stationarity tests in first differences 1990 - 2013

		ADF	PP
Variable	**Model**	$\tau_{tc},\ \tau_c, \tau_n$	$\phi_{tc}\ \phi_c\ \phi_n$
$\Delta LNRWG$	Trend	-3.435*	-4.162***
	Constant	-3.472**	-4.307***
	None	-2.250**	-3.096***
$\Delta LNPCE$	Trend	-3.354*	-4.992***
	Constant	-2.016	-3.044**
	None	-1.674*	-1.743*
$\Delta LNUEM$	Trend	-3.169*	-5.617***
	Constant	-3.149**	-5.646***
	None	-3.182***	-5.684***
$\Delta LNPRD$	Trend	-3.558**	-4.932***
	Constant	-3.029**	-4.791***
	None	-2.788***	-4.539***
$\Delta LNGDP$	Trend	-3.665**	-5.066***
	Constant	-3.486**	-5.081***
	None	-1.255	-2.957***

*** (**) [*] represent significance at the 1% (5%) [10%] levels, respectively. $\tau_{tc}, \tau_c\ \tau_n$ and $\phi_{tc}\ \phi_c\ \phi_n$ represent ADF and PP results using trend and constant, constant and none, respectively

Source: Authors' calculation from Eviews 8

This information leads to the issue of selecting the appropriate estimation methodology. The current study follows existing literature, which typically estimates VARs in levels even when variables are $I(1)$ processes. The unwillingness to impose possibly incorrect restrictions in the model leads to the preference of VARs that are partially explained by Sims *et al*. (1990), Berkelmans (2005) and Alom *et al*. (2013). They argue that even with $I(1)$ variables, residuals are stationary because of the inclusion of lagged levels of variables in the VAR. This means that, the likelihood of spurious influences between the $I(1)$ variables remains. Confirming that the relationships summarised by the SVAR are plausible on economic grounds is the only way to ensure that the relationships are not spurious. Sims *et al.* (1990) demonstrated that it is unnecessary to transform models to stationary forms by difference or cointegration operators when it appears likely that data are cointegrated. Sims *et al.* (1990) added that this is because statistics of interest frequently have distributions that are not affected by non-stationarity, and this implies that it is possible to test the hypothesis even without initially converting series to stationarity.

The above findings by Sims *et al*. (1990) have been widely accepted and embraced in literature (see Jacobs and Wallis, 2005; Sonedda, 2006; Dungey and Pagan, 2009; Bhuiyan, 2008; Berkelmans, 2005; Ngalawa and Viegi, 2011; Bernanke, 1986; Bernanke and Mihov, 1998). The preference of SVAR in levels according to Kim and Roubini (2000) and Becklemans (2005) is explained, in part, by an unwillingness to impose possibly incorrect restrictions on the model. Kim and Roubini (2000) emphasize the fact that the resulting inferences are incorrect if false restrictions are imposed. In addition, Bernanke and Mihov (1998) bolstered this argument by saying that levels specification lead to consistent estimates irrespective of whether cointegration exists or not, whereas a differences specification yields inconsistent estimates if some of the variables are cointegrated.

5.4.4 Imposition of Restrictions

The study adopts a structural model expressed as Equation [5.18] above: $\Delta X_t = C(L)\varepsilon_t$, where $\Delta X_t = (\Delta PRD_t,\ \Delta EMP_t,\ \Delta RWG_t,\ \Delta PCE_t\ \Delta UEM_t)'$. To be consistent with literature, all variables used in the model are assumed stationary and not cointegrated in

levels. In Equation 5.18, C(L) is defined as an infinite order matrix of lag polynomial defined as $C(L) = C_0 + C_1 L + C_1(L) + \cdots$ in the lag operator L, and C_0 is an identity matrix. Note that the observed fluctuations in the vector of five variables $\Delta X_t = (\Delta PRD_t,\ \Delta EMP_t,\ \Delta RWG_t,\ \Delta PCE_t\ \Delta UEM_t)'$ are because of five uncorrelated structural shocks $\varepsilon_t = (\ \varepsilon_t^{PRD} \varepsilon_t^{EMP}, \varepsilon_t^{RWG},\ \varepsilon_t^{PCE}, \varepsilon_t^{UEM})'$ with $E[\varepsilon_t \varepsilon_t'] = I$. The model identifies five structural shocks.

Consider long run effects of structural shocks by setting $L = 1$ in [5.18]:

$$C(1) = \begin{bmatrix} C_{11}(1) & C_{12}(1) & C_{13}(1) & C_{14}(1) & C_{15}(1) \\ C_{21}(1) & C_{22}(1) & C_{23}(1) & C_{24}(1) & C_{25}(1) \\ C_{31}(1) & C_{32}(1) & C_{33}(1) & C_{34}(1) & C_{35}(1) \\ C_{41}(1) & C_{42}(1) & C_{43}(1) & C_{44}(1) & C_{45}(1) \\ C_{51}(1) & C_{52}(1) & C_{53}(1) & C_{54}(1) & C_{55}(1) \end{bmatrix} \qquad [5.21]$$

The structural model in Equation 5.21 is just identified when 10 long run restrictions are imposed in the above matrix (see Blanchard and Quah, 1989). Additionally, to choose the set of just-identifying assumptions needed, the study follows a practical approach where the model is estimated under a given set of identifying assumptions to generate impulse response functions. If impulse response functions are not reasonable or fail the over-identifying restrictions test, a different set of identifying assumptions is utilised (see Blanchard and Quah, 1989). It is possible to select identifying restrictions that can be easily derived from the theoretical model consistent with 11 long run restrictions, using this procedure. The long run restrictions employed in the current study are enumerated below. First, only productivity shocks have a long lasting effect on productivity. This implies that $C_{12}(1) = C_{13}(1) = C_{14}(1) = C_{15}(1) = 0$. Employment is affected by productivity shocks, implying that $C_{23}(1) = C_{24}(1) = C_{25}(1) = 0$. Real wages are affected by productivity and employment shocks, implying that $C_{34}(1) = C_{35}(1) = 0$. Price inflation is influenced by productivity, employment and real wage shocks, also implying that $C_{45}(1) = 0$. It should be noted that the most endogenous variable (unemployment) comes last in the model. Labour supply shocks only permanently affect unemployment according to the hysteresis hypothesis (Maidorn 2003). Incorporating the ten restrictions explained above on a 25×25 matrix $C(1)$, the long run effects of the five shocks on endogenous variables are given by:

$$\begin{bmatrix} PRD_t \\ EMP_t \\ RWG_t \\ PCE_t \\ UEM_t \end{bmatrix} = \begin{bmatrix} C_{11}(1) & 0 & 0 & 0 & 0 \\ C_{21}(1) & C_{22}(1) & 0 & 0 & 0 \\ C_{31}(1) & C_{32}(1) & C_{33}(1) & 0 & 0 \\ C_{41}(1) & C_{42}(1) & C_{43}(1) & C_{44}(1) & 0 \\ C_{51}(1) & C_{52}(1) & C_{53}(1) & C_{54}(1) & C_{55}(1) \end{bmatrix} \begin{bmatrix} \varepsilon_t^{PRD} \\ \varepsilon_t^{EMP} \\ \varepsilon_t^{RWG} \\ \varepsilon_t^{PCE} \\ \varepsilon_t^{UEM} \end{bmatrix} \quad [5.22]$$

To estimate the sources of unemployment in Namibia, the study uses Equation 5.22. According to Blanchard and Quah (1989) and also Dolado and Jimeno (1997), the requisite restrictions are formulated from the theoretical model. Maidorn (2003) argues that if a shock is absent in one of the above equations, it can be assumed that its structural form coefficients add to zero. The current study achieves over identification in the system by employing more than 10 restrictions. Maidorn (2003) adds that if over-identification exists, the structural form covariance matrix, Σ, varies from the covariance matrix of the reduced form $\hat{\Sigma}$. He argues that this permits the testing of the restricted model against the reduced form model by employing a likelihood ratio test which is based on $LR = 2lnL(\hat{\Sigma}) - 2lnL\ (\tilde{\Sigma})$, with $\chi^2_{(r)}$ distributed under the null hypothesis (H_0) (the full set of identifying restrictions are valid). In this case, r represents the total of the overidentifying restrictions and $lnL\hat{\Sigma}$ and $lnL\ (\tilde{\Sigma})$ are the concentrated log likelihood reduced and the structural forms of the functions respectively (see Amisano and Giannini, 1997 and Lütkepohl, 2012). The set of restrictions selected and utilised in this study give $\chi^2_{(1)}$ of 0.680045 (p-value = 0.4096)[10]. The Chi-square and its probability indicate that the set of restrictions imposed is undoubtedly accepted, and it consists of 11 long-term restrictions. These are the restrictions imposed on the estimated SVAR, whose results are discussed in the next section. The next section explains the impulse response (IR) functions and the forecast error variance (FEV) decompositions embedded within the SVAR.

The next section outlines the approach used for the investigation of the sources of unemployment in Namibia. The empirical results derived from the impulse response analysis of shocks and their variance decompositions are presented in the subsequent section.

[10] The detailed SVAR results of the study are in Appendix B

5.5 DATA AND ESTIMATION RESULTS

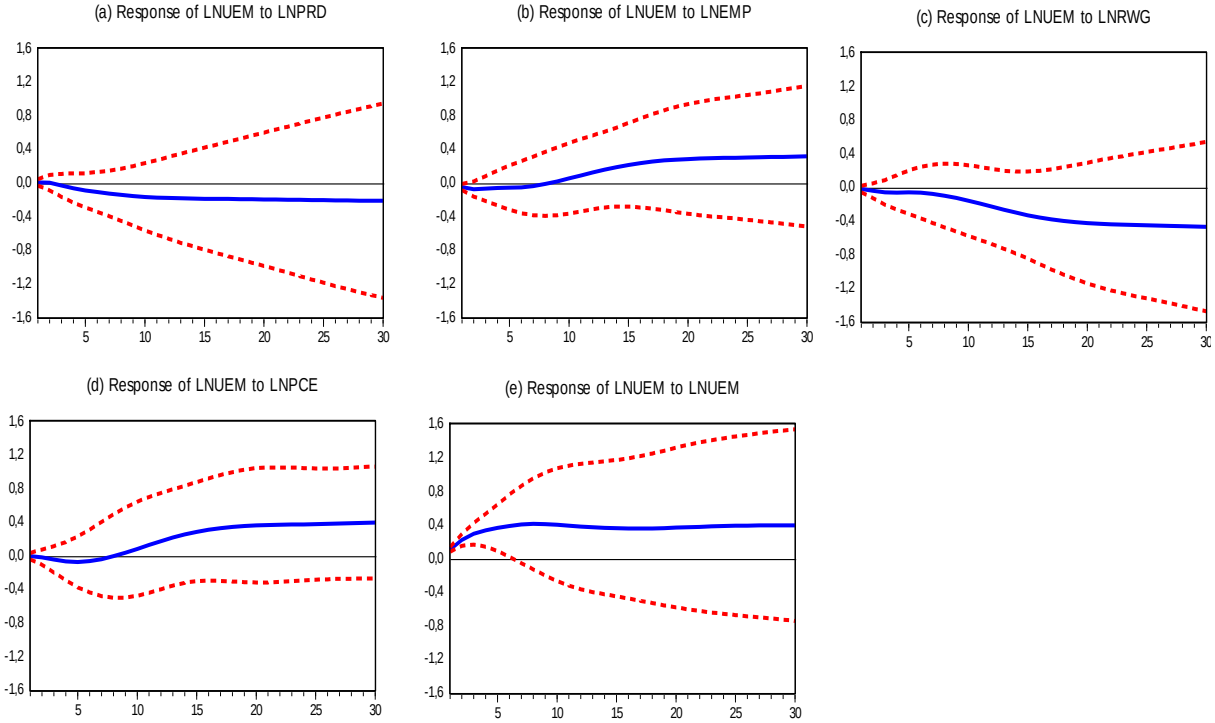
5.5.1 Impulse-response functions and variance decomposition

The impulse response analysis shown here traces out the reaction of unemployment to particular shocks at time t. Furthermore, the impulse response functions of the unemployment rate shown in Figure 1 allow for sensible economic interpretation.

According to Panel (a) in Figure 5-1, positive productivity shocks decreased unemployment significantly in the first 5 years. This means that productivity shocks have a favourable effect of decreasing unemployment in Namibia in the short run and this is consistent with most empirical studies (see Lindbeck, 1993). The effects of technology shocks on economic fluctuations have been discussed a lot in recent VAR literature. For example, Dolado and Jimeno (1997) found that technology shocks increased unemployment for Spain. Carstensen and Hansen (2000)'s results compare favourably with the current study since they found that productivity shocks have a long run negative effect on unemployment in the West Germany economy. On the other hand, Linzert (2001) found that technology shocks decrease unemployment in the short run with no long run effect. Moreover, Brüggemann (2006) established that a technology shock decreases unemployment in the short run, whereas in the long run the effect is borderline significant.

Panel (b) in Figure 5-1 shows that a demand shock significantly lowers unemployment in the short run, that is, up to the 8^{th} year, which is consistent with the standard economic theory. Between the 8^{th} and the 11^{th} year, the unemployment response to a demand shock becomes insignificant. After the 11^{th} year, the response of unemployment becomes positive and it reaches equilibrium, which is above the pre-shock level on the 17^{th} year. Unemployment falls in the short run after a positive aggregate demand shock and this is at variance with Dolado and Jimeno (1997) as well as von Li Su (2006), who found that unemployment permanently decreases after an aggregate demand shock.

Figure 5-1: Response to Generalized One Standard Deviation Innovations



Source: Authors' calculation from Eviews 8

In addition, Panel (c) in shows that a positive shock to real wage leads to a negative response in Namibian unemployment. From a theoretical perspective, a positive shock to real wages leads to an increase in unemployment, since it becomes costly for the employers to hire new employees or even maintain the existing number of employees. Linzert (2001) and also Casternsen and Hansen (2000) found that unemployment responds positively to a real wage shock in the short run and then responds negatively in the long run. Real wage shocks significantly affect unemployment in the short run and in the long run the effect becomes insignificant. This means that wage shocks are fully compensated by variations in productivity without an effect on employment in the long run. However, Dolado and Jimeno (1997) found that wage-push shocks permanently increased the Spanish unemployment rates.

Panel (d) shows that unemployment decreases and then rises to reach its pre-shock level after 7 years. A positive price inflation shock may be caused by increased prices of imported inputs or higher mark-up. The response of unemployment becomes positive and

reaches equilibrium at a level above its pre-shock level in the 17th year. It appears that price inflation shocks are a critical factor for increased and persistent unemployment as its effects on unemployment are important in the long run. This implies that increased prices translate into higher costs in the long run in Namibia; therefore, firms need to adjust demand. The results of price inflation shocks established here are similar to what Dolado and Jimeno (1997) found for the Spanish economy. Gambetti and Pistoresi (2004) also drew the conclusion that mark-up shocks increase unemployment in the long run.

Finally, as shown in Panel (e), the unemployment rate positively responds to a positive labour supply shock. Therefore, labour supply shocks have a permanent effect on the unemployment rate, which is in line with the findings by Dolado and Jimeno (1997) as well as Carstensen and Hansen (2000). Balmalseda *et al*. (2000), on the other hand found that labour supply shocks do not have a permanent effect on the unemployment rate.

In brief, impulse responses concerning the reaction of the unemployment rate are consistent with economic theory and allow a plausible economic interpretation. From the preceding analysis, shocks to productivity, aggregate demand, real wages and labour supply seem to be critical factors affecting unemployment, while price shocks correctly affect unemployment in the long run only.

Forecast error variance decompositions of the variables in the over-identified SVAR are given in Table 5-3. The forecast error variance decomposition of the unemployment rate is critical to the analysis because they provide insight into the importance of different structural shocks in accounting for the unemployment rate.

Table 5-3 shows that aggregate demand shocks, real wage shocks and labour supply shocks appear to be the driving forces of unemployment. In the short run, labour supply shocks play an important role in explaining the forecast error variability of the unemployment variable. They explain the largest part of about 56 percent in the first year, which increases to about 71 percent in the second year of the forecast error variance of the

unemployment rate. Their importance declines to about 60 percent in the 10th year and they account for about 46 percent in the long run.

Shocks to aggregate demand are the other important factors for the forecast error variance of the unemployment rate. They account for about 22 percent of the forecast error variance of unemployment in the first year. Their importance decreases with an increase in the forecast horizon up to the fifth year, after which it increases with an increase in the forecast horizon. In the long run, shocks to aggregate demand are the second most important factor accounting for about 20 percent of the forecast error variability of the unemployment rate.

The importance of the real wage in accounting for the unemployment rate variability falls from about 21 percent in the first year to about 13 percent in the long run. It should also be noted that although price inflation appears insignificant in explaining the unemployment rate variability in the short run, it accounts for about 15 percent in the long run. Of all the factors used in the SVAR model, productivity is the least important in accounting for the unemployment rate variability, accounting for about 0.4 percent in the first year and only 6 percent in the long run.

Table 5-3 Variance decomposition of unemployment

Period	S.E.	Productivity shocks	Aggregate demand shocks	Real wage shocks	Price inflation shocks	Labour supply shocks
1	0.042214	0.391481	22.33826	20.72288	0.630631	55.91675
2	0.046635	0.211374	13.18890	14.77725	0.377605	71.44488
5	0.061861	7.027335	9.037238	10.54646	1.420842	71.96812
10	0.076351	7.913174	11.77213	9.885523	10.80736	59.62181
15	0.086437	6.546376	18.39169	11.50943	15.39748	48.15503
20	0.094690	6.294684	19.57118	12.43478	15.43980	46.25956
25	0.101308	6.293922	19.55062	12.52425	15.39313	46.23808
30	0.106733	6.295318	19.56599	12.53208	15.43432	46.17229

Cholesky Ordering: LNPRD LNEMP LNRWG LNPCE LNUEM
Source: Authors' calculation from Eviews 8

As demonstrated above, the forecast error variance of the unemployment rate in this model is determined by labour supply shocks, aggregate demand shocks, real wage shocks and price inflation shocks, respectively. Note that such strong permanent effects of aggregate

demand are quite reasonable due to the non-neutrality features of the model. In contrast, productivity shocks explain only a small fraction of the forecast error variance of unemployment in both the short and long run, in spite of the moderate rise of their importance with increasing forecast horizons. This finding is consistent with the controversy of uncertain effects of productivity shocks on the unemployment rate. Labour supply shocks have the most important impact on the forecast error variance of unemployment at any time horizon.

4.2 Robustness of the results

In this section, the study reports the robustness checks of the sources of unemployment model. The summarised statistics of individual variables indicate that all variables are normally distributed individually and this is important in that it also helped ensure that the estimated model was also normally distributed (see Table 5-4). Additionally, the structural VAR results indicate that all the coefficients in the two models have standard errors with values less than the ones suggesting that they are efficient and hence they form a solid basis for measuring shocks. In addition, inverse roots of the characteristic AR polynomial for the determination of stability and stationarity show that all inverse roots of the characteristic AR polynomials have moduli less than one and lie inside the unit circle, implying that at the chosen lag length of order two, the estimated model is stable (see Table 5-5). Lastly, serial correlation test results reported indicate that there is no evidence of any serious serial correlation in the models (see Appendix B)[11].

Table 5-4: Normality Test Results

Component	Jarque-Bera	df	Prob.
1	0.688936	2	0.7086
2	1.629047	2	0.4429
3	7.355666	2	0.0253
4	0.785331	2	0.6753
5	3.582441	2	0.1668
Joint	14.04142	10	0.1711

Source: Authors' calculation from Eviews 8

[11] The summary statistics and structural VAR results mentioned in section 4.2 are in Appendix B.

Table 5-5: VAR lag order selection

Endogenous variables: LNPRD LNRWG LNPCE LNEMP LNUEM
Exogenous variables: C
Date: 05/20/16 Time: 14:50
Sample: 1980 2013
Included observations: 32

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-24.02014	NA	1.64e-08	1.938758	2.259388	2.045038
1	199.4178	335.1569	3.26e-13	-8.963612	-6.398574	-8.113374
2	269.3742	74.32868*	1.42e-13*	-10.27339*	-5.463941*	-8.679192*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

5 CONCLUSION AND POLICY RECOMMENDATIONS

Empirical results show that no single factor has caused the rise in unemployment on its own. The persistently high unemployment is instead the result of a combination of various shocks as well as the hysteresis mechanism.

As regards the structural shocks under investigation, labour supply shocks are shown to be dominant in accounting for the unemployment evolution even in the long run, followed by aggregate demand shocks. Deficient labour supply and aggregate demand are no doubt important reasons for the miserable unemployment development in Namibia. Although price shocks do not influence unemployment in the short run, they lead to a rise in the unemployment rate in the medium to long term. Since the impact of price shocks is significant and long-lasting, they can explain to some degree the unemployment persistence in Namibia. Just like many theoretical and empirical literature about the effect of productivity shocks on the unemployment rate, this study does not provide a clear-cut picture concerning productivity shocks, either. However, productivity shocks seem to slightly influence unemployment in the long run. Finally, labour supply shocks are shown to have an important effect on the unemployment rate. It can be concluded from the empirical work that it might be too simplistic blaming solely insufficient effective demand or labour market rigidities for persistently high unemployment in Namibia.

The empirical results provide strong implications for economic policy. Since unemployment is the result of interactions of several structural shocks (impulse mechanism) and hysteresis effects (propagation mechanism), policy implications involve both aspects. As far as structural shocks are concerned, the role of aggregate demand shocks and price shocks in influencing the Namibian unemployment evolution provides a rather important insight for macroeconomic policy designs. Starting from the role of aggregate demand shocks, the findings offer new evidence on the strong long run relationship between demand policies and unemployment. If hysteresis is a relevant phenomenon, the analysis implies that demand-side policies matter for output and unemployment, not only in the short run, but also in the long run. This finding is in line with other recent empirical evidence stating that aggregate demand affects unemployment even in the long run (see Linzert, 2001; Dolado and Jimeno, 1997; and Maidorn, 2003).

Since price shocks play a role in explaining high unemployment rates in the long run, policies that lower mark-up contribute to reducing the unemployment rate. The deregulation policies operate primarily through the regulation of the product market with the aim of increasing the degree of competition among firms. In the context of the Southern African Customs Union, of which Namibia is a member, such policies may include, for example, the reduction of tariff barriers or standardization measures. Deregulation policies that are intended to reduce entry costs may consist of the elimination of state monopolies or the reduction of red tape associated with the creation of new firms. If the number of firms is not fixed in the long run, a reduction in entry costs leads to an entry of new firms, unemployment will hence be lowered, and a higher real wage may be realised.

In addition, this empirical analysis has also important policy implications concerning hysteresis effects as a propagation mechanism. Since hysteresis effects arising from the insider-outsider framework make adverse shocks to have quite long lasting influences, the insider-outsider theory plays a crucial role in eliminating unemployment persistence. Despite the diversity of political implications in this respect, the common emphasis is the creation of a more level playing field in the labour market. As long as insiders have

favourable opportunities than outsiders, policies that guarantee a more level playing field between insiders and outsiders can improve efficiency and equity. Generally, two broad types of policies can be identified in this context: power-reducing policies that reduce insiders' market power and enfranchising policies that strengthen outsiders' voice in the wage bargaining process. Power-reducing policies range from restrictions on strikes to relaxing job security legislation. For example, laws simplifying firing procedures, reducing litigation costs and reducing severance pay. These policies tend to reduce insiders' welfare. Therefore, insiders may resist these policies, which will limit the effectiveness of power-reducing policies. The general form of enfranchising policies are vocational training programs and job counselling for the unemployed, schemes to convert wage claims into equity shares, policies to reduce the occupational, industrial, and geographic coverage of union wage agreements and again policies to reduce barriers to the entry of new firms.

Indeed, within a theoretical framework where the labour market is rigid and structural reforms can play a role, certain monetary and fiscal policies are powerful. The reason why such policies are important instruments for the reduction of unemployment, namely the rigidity in the labour market, exactly justifies structural reforms. Hysteresis in the unemployment rate makes economic policies effective, not only in the short run but also in the long run. Therefore, aggregate demand policies should be considered as useful instruments to tackle unemployment and they are complementary rather than contrasting with structural labour market reforms. This means that the expansion of demand will make labour market policies more effective.

CHAPTER 6

THE SMALL MACRO-ECONOMETRIC MODEL FOR NAMIBIA

6.1 INTRODUCTION

The current chapter develops a small macro-econometric model for Namibia from the simultaneous wage-price, productivity, unemployment relationship explained in sections 3.3.3 and 3.3.4 of Chapter 3 of the thesis. As explained earlier, both theoretically and empirically in Chapter 3, many studies have simultaneously modelled the wage-price; wage, price, productivity growth; unemployment, productivity growth and labour productivity growth, wage-price, unemployment rate relationships. In addition, a study by McHugh (2004) on the core wage-price system and its feedback variables discovered contemporaneous relationships between wages, price inflation and productivity growth; unemployment rate and productivity growth; and labour productivity growth, real wages and unemployment. These findings were not particularly surprising since labour market theories, which theories related to the behaviour of workers and firms, explain the detailed relationships that exist among these four variables (wages-prices [real wages], labour productivity and the unemployment rate). As explained in Chapter 3, four popular theoretical explanations advanced for this relationship are:

(v) Unit labour costs in the form of nominal wages and labour productivity are the key arguments of the firms' total costs of production and, hence, the consumer general price level in the economy (Carlin and Soskice, 1990).

(vi) Real wage level affects the levels of worker productivity taking into consideration that real wages are an essential determinant of worker effort (Lindbeck and Snower, 1986, 1987 and 1988 and Lindbeck, 1993).

(vii) There are generally two views concerning the association between labour productivity growth and unemployment. The first view asserts that productivity growth due to technological improvements increases unemployment. Proponents of

this view argue that technological shocks in the US increase unemployment (Blanchard, 1989; Blanchard and Quah, 1989). Evans (1989) also added that technological shocks that instantly decrease unemployment have a favourable positive long-term effect on output. In addition, Jacobs (2005) demonstrates that the above result is still relevant for total hours worked which decreases after a positive technological shock. The second view says that productivity growth reduces unemployment. This accounts for the boom experienced in the US in the 1990s. Studies by Ball and Moffitt (2002) and Staiger et al. (2002) both describe the extremely low unemployment rate and the exceptionally high productivity growth experienced in the 1990s. The first view means that there are positive co-movements, while the second view means negative co-movements.

(viii) Real wages affect unemployment in the economy in two ways. First, the real wage level can affect the workers' decisions to quit if, for instance, the real wage levels are lower than their reservation wage (Lindbeck, 1993). Second, increasing wages influence the decisions of firms' to recruit new workers or to maintain existing number of workers in view of the significance of labour costs in the total production costs of the firm (Carlin and Soskice, 1990).

It is against this background that the current study develops and simultaneously estimates a system comprised of wages-price (real wage), labour productivity and the unemployment rate. This system becomes a major component of the basic model for the current study. The additional variable in the basic model is interest rate, which helps in establishing if the demand and exchange rate channel variables have additional information, which explains the monetary transmission process in Namibia. The bank-lending channel of monetary policy suggests that banks play a special role in the transmission of monetary policy[12]. The same authors also contend that bank lending rates respond immediately to monetary policy tightening and with a lag to monetary policy loosening. Therefore, in the final analysis the tightening and loosening of monetary policy leads to an increase or a decrease in bank lending rates, respectively. It is against this background that the current chapter uses bank lending rates as a proxy for monetary policy. In other words, the interest rate addition

[12] See Das (2015), Black et al. (2010) and Amidu (2006)

enables the study of the link between the labour market and monetary variables in Namibia. In addition, inclusion of interest rates is further justified by using the stylised illustration of the complete macro-econometric model in Figure A1 in Appendix A. In the figure the lending rate is directly explained by unemployment and exchange rates, and that, it directly explains bank credit to the private sector, real gross domestic product and exchange rates. It is also significant that the demand, exchange rate and labour market channels in Figure A1 are all connected either directly or indirectly. The latter is what spurred the specification of the basic model used in this study. Additionally, the chapter specifies all the models it discusses as Structural Vector Autoregression models with the ultimate aim of deriving impulse response functions and forecast error variance decomposition functions. To validate the authenticity of the results, the chapter uses relevant diagnostic tests, such as, autocorrelation tests and stability tests, among others. The purpose of this chapter, therefore, is to establish whether the demand channel (output, import prices, and credit lending, exchange rates) variables and monetary policy affect labour market macroeconomic variables in Namibia. In addition, the chapter also establishes whether the demand variables have important additional information that explain the monetary transmission process in Namibia. Unravelling such information, implies consideration of appropriate policy prescriptions and the relationship between these variables and the labour market macroeconomic variables in Namibia. The aim of this chapter is thus:

(i) To empirically test the impact of shocks in the basic real wage, productivity, unemployment and interest rates model.

(ii) To analyse empirically the dynamic effects of demand shocks on the monetary policy transmission process.

(iii) To specify, estimate and evaluate the macro-econometric model with an interest rate reaction function.

6.2 THE SMALL MACRECONOMETRIC MODEL FOR NAMIBIA

This section of the study attempts to develop the SVAR framework for the Namibian small macro-econometric model. The section employs short run restrictions in an attempt to

provide a brief review of SVAR identification Scheme. The scheme follows from Blanchard and Quah, (1989) for systems without cointegration and it was applied by Gali (2005). In their evaluation of the VAR procedure twenty years after Sims (1980) original article, Stock and Watson (2001) conclude that VARs effectively capture the rich interdependent dynamics of data comprehensively, and that the structural implications are only as sound as their identification schemes. For explanations of the methodology employed in the current chapter, refer to Chapters 4.

6.2.1 The SVAR Methodology

Suppose the labour market model for Namibia is given by the dynamic system whose structural equation is given by:

$$AX_t = \Omega + \Phi_1 X_{y-1} + \Phi_2 X_{t-2} + \cdots + \Phi_p X_{t-p} + \mathrm{B}\mu_t \qquad [6.1]$$

where A is an invertible $(n \times n)$ matrix describing contemporaneous relations among the variables; X_t is an $(n \times 1)$ vector of endogenous variables such that $X_t = (X_{1t}, X_{2t}, \ldots X_{nt})$; Ω is a vector of constants; Φ_i is an $(n \times n)$ matrix of coefficients of lagged endogenous variables $\forall_i = 1,2,3,I,p$; B is an $(n \times n)$ matrix whose non-zero off-diagonal elements allow for direct effects of some shocks on more than one endogenous variable in the system and μ_t are uncorrelated or orthogonal white-noise structural disturbances.

The SVAR presented in the primitive system of equation [6.1] cannot be estimated directly due to the feedback inherent in a VAR process (Enders, 2004). Nonetheless, the information in the system can be recovered by estimating a reduced form VAR implicit in the two equations. Pre-multiplying equation [6.1] by A^{-1} yields a reduced form VAR of order p, which in standard matrix form is written as:

$$X_t = \Psi_0 + \sum_{i=1}^{p} \Psi_i X_{t-i} + \varepsilon_t \qquad [6.2]$$

where $\Psi_0 = A^{-1}\Omega$; $\Psi_i = A^{-1}\Phi_i$ and $\varepsilon_t = A^{-1}\mathrm{B}\mu_t$. The term ε_t is an $(n \times 1)$ vector of error terms assumed to have zero means, constant variances and to be serially uncorrelated with all the right hand side variables as well as their own lagged values, though they may be contemporaneously correlated across equations. Given the estimates of the reduced form VAR in equation [6.2], the structural economic shocks are separated from the estimated reduced form residuals by imposing restrictions on the parameters of matrices *A* and *B* in equation [6.3]:

$$A\varepsilon_t = B\mu_t \qquad [6.3]$$

which derives from equation [6.2]. The orthogonality assumption of the structural innovations, *i.e.* $E(\mu_t, \mu_t') = 1$, and the constant variance–covariance matrix of the reduced-form equation residuals, *i.e.* $\Sigma = E(\varepsilon_t, \varepsilon_t')$ impose identifying restrictions on A and B as presented in equation [6.4]:

$$A\Sigma A' = BB' \qquad [6.4]$$

Since matrices A and B are both $(n \times n)$, a total of $2n^2$ unknown elements can be identified upon which $n(n+1)/2$ restrictions are imposed by equation (4). To identify A and B, therefore, at least $2n^2 - n(n+1)/2$ or $n(3n-1)/2$ additional restrictions are required. These restrictions can be imposed in a number of ways. One approach is to use Sims (1980) recursive factorisation based on Cholesky decomposition of matrix A. The implication of this relationship is that identification of the structural shocks is dependent on the ordering of variables, with the most endogenous variable ordered last (Favero, 2001). Furthermore in this framework, the system is just (exactly) identified.

Christiano et al. (1998) contend that while there are numerous models consistent with the recursiveness assumption, the approach is controversial. The assumptions justifying the ordering of series are frequently dissimilar in various studies utilising the same series, and since estimation results, in a VAR identified by Cholesky factorisation vary with the ordering of variables. These studies tend to be incomparable. Note that changing the order of the series changes the VAR equations, coefficients and residuals; and that there are $n!$

Recursive VARs representing all potential orderings (Stock and Watson, 2001). The validity of Cholesky factorisation is also questioned when a simultaneity problem exists between macroeconomic variables. Following apparent shortfalls in the approach, many authors have adopted alternative approaches to the identification of structural shocks (see, for example, Bernanke, 1986; Sims, 1986; Bernanke and Mihov, 1998; Eichenbaum and Evans, 1995; Sims and Zha 2006; Basher et al. 2010). However, Christiano et al. (2006) argue that short-run SVARs perform remarkably by way of relatively strong sampling properties of the IRFs they produce.

Restrictions can also be employed contingent on assumptions about what information is available to agents at the time of a shock (see Sims 1986). Opinions regarding short-run restrictions are mixed. Faust and Leeper (1997) assert that there is frequently an insufficient number of tenable contemporaneous restrictions to achieve identification. Literature that is more recent used structural factorisation, an approach that uses relevant economic theory to impose restrictions on the elements of matrices A and B (Bernanke, 1986; Sims, 1986; Bernanke and Mihov, 1998; Sims and Zha, 2006). This current study adopts a similar approach. The underlying structural model is identified by assuming orthogonality of the structural disturbances, μ_t (Favero, 2001:166).

The seven variables included in small macroeconomic model SVAR are real wages $(RWG_t) = (NWG_t - (PCE_t))$, productivity (PRD_t), unemployment (UEM_t), import prices (MPP_t), exchange rates (NEX_t), bank credit to the private sector (CDT_t) and lending rates (LER_t). Real wages (wage-price), productivity and unemployment are included in the SVAR as labour market variables; import prices as demand variables, and bank lending rates as a monetary variable. As noted in Section 5.4.2, literature shows that there is no consensus yet on whether real wages and price inflation or nominal wages and price inflation should be used together in labour market models. Taking advantage of this lack of consensus, the current chapter uses real wages only when developing the macroeconometric model. From equation [6.3], we get the following equations using matrix notation:

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ a_{41} & 0 & a_{43} & 1 & 0 & 0 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 & 0 & 0 \\ a_{61} & 0 & a_{63} & a_{64} & a_{65} & 1 & 0 \\ a_{71} & 0 & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^{PRD} \\ \varepsilon_t^{RWG} \\ \varepsilon_t^{UEM} \\ \varepsilon_t^{MPP} \\ \varepsilon_t^{NEX} \\ \varepsilon_t^{CDT} \\ \varepsilon_t^{LER} \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} \end{pmatrix} \begin{pmatrix} \mu_t^{PRD} \\ \mu_t^{RWG} \\ \mu_t^{UEM} \\ \mu_t^{MPP} \\ \mu_t^{NEX} \\ \mu_t^{CDT} \\ \mu_t^{LER} \end{pmatrix} \quad [6.5]$$

Equation [6.5] shows that the non-zero coefficients a_{ij} and b_{ij} in matrices A and B, respectively indicate that any residual j in matrices ε_t and μ_t, has an instantaneous effect on variable i. This section discusses the SVAR model identifying assumptions and the estimation procedure. The study identifies seven structural shocks: technology shock, real wage shock, labour supply shock, import price shock, bank credit shock, exchange rate shock and monetary policy shock. To achieve identification, the study makes use of structural factorisation assumption and short run restrictions.

The first equation in the small macro-econometric model assumes that productivity is the most exogenous variable in the model; and that it is not contemporaneously affected by shocks to all the other variables in the model. The second equation implies that real wages are not contemporaneously affected by all other shocks to the other variables included in the system (see similar placement in Dolado et al., 1997 and Maidorn, 2003). The third equation indicates that unemployment is not contemporaneously affected by all shocks to the variables included in the model.

The fourth equation indicates that import prices are contemporaneously affected by shocks to productivity and unemployment and, not by shocks to real wages, nominal exchange rates, bank credit and lending rates. Additionally, the fifth equation indicates that nominal exchange rates are contemporaneously affected by shocks to productivity, unemployment and import prices and not by shocks to real wage, bank credit and lending rates. It is to be noted that in all short run models, the treatment of contemporaneous responses of exchange rates to other variables in an SVAR is comparatively standard in the majority of the studies. Kim and Roubini (2000) contend that most studies assume that all variables have contemporaneous effects on the exchange rate since it is a forward-looking asset

price. Exchange rate variable and foreign related variables are closely connected to one another. However, given the large dimensionality problem and the small size of the study period, the study avoids the temptation to add more variables to the SVAR to capture external factors. The complete SVAR analysed in this study has seven variables, which is already large by SVAR standards and increasing the number of variables without proper justification would only decrease the power of the model without making meaningful additions to the output. In addition, the current study is not concerned with the immediate responses of the exchange rate to shocks in other variables since it is making use of annual data and, not monthly or quarterly data. This means that the study can treat the exchange rate variable in the same way as the other variables are treated.

The sixth equation indicates that shocks to productivity, unemployment, import prices and nominal exchange rates, contemporaneously affect commercial bank lending rates and that real wage, lending rates do not. Lastly, the seventh equation shows that lending rates are contemporaneously affected by shocks to all other variables except real wages. The ordering suggested above is in line with general SVAR theory in that nominal variables have no effects on real variables but the real variables affect the nominal variables.

Despite the fact that researchers regard the SVAR methodology as superior to the complicated traditional simultaneous equation methodologies, particularly in their forecasting power, the approach has its own weaknesses. The first weakness is that the individual coefficients in SVARs are a lot more difficult to interpret. For this reason, the majority of studies do not analyse SVAR results beyond impulse response functions and variance decomposition. The second weakness is that researchers do not agree on a uniform approach for the determination of the appropriate lag length. Consequently, different studies justify their choice of lag lengths in a different ways, making the known standard criteria like Akaike, Hannan-Quinn and Schwartz Information Criteria non-standard. The third weakness as stated earlier is that there is still serious disagreement on whether the appropriate method to be used (whether to estimate SVARs in first differences or in levels). Our analysis shows that the literature is largely in favour of estimation in levels (see section 6.2.3). Note that this debate is still far from being over. The fourth

weakness is that unlike simultaneous equation models SVARs are not very much dependent on theory, which renders them a-theoretic for the reason that they do not use prior information (Gujarati, 2003). In addition, inclusion or exclusion of a particular series plays an essential part in the identification of simultaneous equation models (Gujarati, 2003).

6.2.2 Analysis technique

To analyse the SVAR the study uses three modular experiments. First, the study estimates a basic model comprising the country's real wage, productivity, unemployment and bank interest rates relationship. The essence of this basic model that incorporates interest rates to key variables of the study is to establish which labour market variables are affected by lending rates the most. At the second level of analysis, the study separately appends demand and exchange rate channel variables to the basic model and estimates the resultant model. If the shocks to the appended variables are important in explaining the variables in the basic model, it is necessary to incorporate them in the small macro-econometric model. Additionally, two sets of impulse responses are estimated in each case: one with the variable of interest calculated endogenously, while the other calculates the variable of interest exogenously (Disyatat and Vongsinsirikul, 2003; Morsink and Bayoumi, 2001; Ngalawa and Viegi, 2011). The latter procedure generates an SVAR comparable to the former, even though it blocks off any responses within the SVAR that pass through the variable of interest (Disyatat and Vongsinsirikul, 2003). The next stage in the second modular experiment is to compare the two sets of impulse responses. Therefore, the size difference in the impulse responses is an indicator of the level of additional information contained in the series of interest, which explains a particular transmission channel. Large differences indicate that there is more information in the variable of interest and suggest that the related transmission channel is of great importance. In particular, the current study investigates the level of additional information contained in the individual series of interest, which explain the monetary policy transmission process.

At the third and final level of analysis, pool all variables found to have important additional information in explaining the country's monetary transmission process and

append them to the basic model to create composite SVAR, which the study labels the small macroeconometric model. The ultimate aim of the study is to find out if lending rates (proxy for monetary policy) has a role to play in influencing labour market variables. This implies that only the short run analysis of the study conforms to the subject matter under examination. There is, therefore, little value in extending the study of macro-econometric monetary transmission process to cover the long run since economists generally agree that monetary policy affects only the price level in the long-run and not the other variables (Disyatat and Vongsinsirikul, 2003).

6.2.3 Properties of the Variables

For this type of study, it is convenient to use monthly or quarterly data, and most of the studies summarised under literature review made use of quarterly data. However, in the case of Namibia quarterly data is unavailable. This is the reason why the current study utilises annual data for the period 1980 to 2013. The sources of the data and the variable definitions used are outlined in Table A1 in Appendix A.

The variables are subjected to stationarity tests, which reveal that they are all integrated of, order one [I(1)] (See Tables A2 and A3 in Appendix A). The study proceeds to estimate the SVAR in levels, and this is what is consistent with standard practice based on the canonical article by Sims et al. (1990). In addition, the Sims et al. (1990) article reveals that the common practice of trying to transform models to stationary form by difference or cointegration operators whenever the data appears cointegrated is unnecessary because statistics of interest, frequently have distributions that are not affected by non-stationarity, implying that hypotheses can be tested without first transforming regressors to stationarity. According to this study, the issue is not whether the data are integrated, but instead whether the test statistics or estimated coefficients of interest have distributions, which are nonstandard if the regressors are integrated. The SVAR literature has generally accepted and adopted the Sims et al. (1990) findings.

Bernanke and Mihov (1998) explained that the levels specification of the SVAR produces estimates that are consistent irrespective of whether cointegration exists or not. However, a

differences specification is unreliable when some of the variables are cointegrated. The other studies that used this method of estimating SVARs in levels even when the variables are I(1) include Berkelmans (2005), Dungey and Pagan (2000), Dungey and Pagan (2009), Brischetto and Voss (1999), Bernanke and Mihov (1998), Ngalawa and Viegi (2011), Baffoe-Bonnie and Gyapong (2012), among many others. Kim and Roubini (2000) and Becklemans (2005), explained that what partly explains preference of SVARs is an unwillingness to impose conceivably wrong restrictions on the model. Kim and Roubini (2000) argued that the imposition of wrong restrictions result in inferences that are wrong. Other studies opt to convert non-stationary information before estimating SVARs. In addition, a large number of studies concentrate on dominant relationships in the series of interest in the long run. The standard approach that has emerged from literature is to model I(1) series and co-integrating relationships in the data by imposing cointegrating restrictions on the levels VAR. Johansen (1988) and Davidson (1998) further argue that when complemented with cointegration analysis, the VAR technique permits rigorous modelling of the long term relationship of non-stationary variables. The following are some of the studies that have used cointegration analysis to identify long-run relationships in a linear cointegrating model with I(1) variables Garratt et al. (2003), King, Plosser, Stock and Watson (1991)and Brüggemann (2006) among others.

Note that debate regarding whether to transform models to stationary form by difference or cointegration operators or not, when dealing with I(1) variables, seem to heavily lean towards the Sims et al. (1990) conclusion. In addition, Amisano and Giannini (1997) and Enders (2004) argue that other authors support the traditional method of converting the data to stationary regressors before estimation, irrespective of whether their studies focus on the long run or short run relationships. The current study is not going to experiment with this method. However, previous studies did not find significant differences between the variables in levels and the differenced variables on cointegrated relationships (Ngalawa and Viegi, 2011). An exploratory analysis of the data aimed at getting insights into the movements, and structure of the variables used in the model is summarised Figures A3, A4 and Table A4.

6.3 ESTIMATION AND ANALYSIS OF RESULTS

6.3.1 The basic model

The specification of the small macro-econometric model commences with a simple four variable basic model justified in sections 3.3.3, 3.3.4 and 6.1. Equation below gives a vector of endogenous variables in the basic model:

$$X_t' = [PRD_t, RWG_t, UEM_t, LER_t] \quad [6.6]$$

Using the identification scheme in the system of equations [6.5] the equations separating structural shocks from the reduced form residuals for the basic model is presented as:

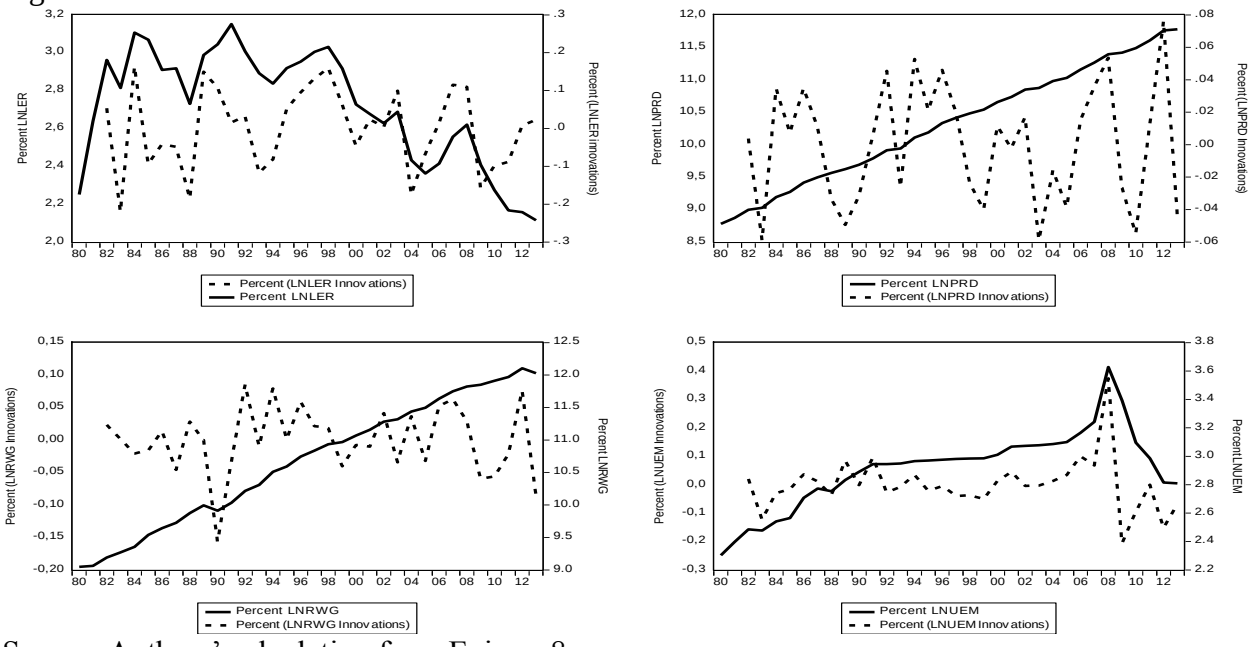
$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ a_{41} & 0 & a_{43} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^{PRD} \\ \varepsilon_t^{RWG} \\ \varepsilon_t^{UEM} \\ \varepsilon_t^{LER} \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{pmatrix} \begin{pmatrix} \mu_t^{PRD} \\ \mu_t^{RWG} \\ \mu_t^{UEM} \\ \mu_t^{LER} \end{pmatrix} \quad [6.7]$$

Figure A1 in Appendix A indicate that there is a relationship between unemployment and labour productivity, gross domestic product, real wages and lending rates. This is what led to specification of the equation in [6.7]. To select the optimal lag length, the study uses the established criteria, which include the Akaike, Hannan-Quinn, and Schwatz Information Criteria. These criteria chose a lag length of two, which resulted in the inverse roots of the characteristic autoregressive (AR) polynomial with a modulus of less than one (lying inside the unit circle) depicting that the estimated VAR is stable and stationary (see Table C3 in Appendix C). All models estimated in this chapter apply the same lag length techniques and all their lag lengths are equal to two. Table C2 in Appendix C indicate that the VAR lag exclusion Wald test reveals that all endogenous variables in the model are jointly significant at each lag length for all equations collectively. Separately, at lag length of order one, all equations except productivity are significant while at lag two, productivity unemployment and lending rates are insignificant.

Figures 6.1 shows the analysis of the correlation between movements in the variables included in the basic model and their corresponding recovered structural shocks to verify if the analysis of shocks in the basic model is reasonable. The figures plot the variables

lending rates and productivity on the primary axis and their recovered innovations on the secondary axis. In the case of real wages and unemployment, the primary axis denotes recovered innovations and secondary axis denote the variables. The figures indicate that there is some correlation in the movements of productivity, unemployment, real wage and lending rates and their respective recovered innovations. However, the correlations appear to be stronger between unemployment and lending rates and their recovered innovations, compared to productivity and real wage, and their recovered innovations. The study confirms the reliability of the structural innovations by analysing efficiency of the structural coefficients estimated in the SVAR. Table C1 in Appendix C shows that all structural estimates in matrices A and B of the basic model have standard errors that are smaller than one, and this implies that these coefficients are efficient. This further implies that structural shocks determined are reliable and, therefore, a true reflection of reality. This analysis also allows the researcher to carry out impulse response and variance decomposition analyses, which give reasonable results.

Figure 6-1: Variables and their related recovered structural innovations



Source: Authors' calculation from Eviews 8

Subsequently, the study analyses the behaviour of shocks to the basic model variables and resultant impulse responses, this will indicate whether the results make sense or not. Additionally, Figure 6.2 presents impulse responses of the productivity, real wages,

unemployment and interest rates to structural one standard deviation innovations over a thirty-year time horizon. The primary horizontal axis measures the time scale in years and the solid lines represent responses to generalised one standard deviation innovations, which are not affected by the way variables are ordered (see Fonseca, 2008).

6.3.1.1 Impulse response functions of the basic model

Since study identified the structural VAR, impulse response functions depict responses to structural shocks. It is significant that the results of the impulse response analysis are often more informative than the estimated structural parameters. In addition, impulse response functions trace the effect of a shock to one endogenous variable onto other variables in the SVAR. In fact, Figures 6-2 and 6-3 show point estimates of the impulse responses of the generalised one-standard deviation innovations, which are not affected by the ordering of variables. All the impulse responses in the entire thesis are determined using the generalised one standard deviation innovations.

Figure 6-2 shows the impulse response functions of technology and real wage shocks. The responses of productivity, real wages, unemployment and lending rates to a technology shock are significantly different from zero. Moreover, unemployment significantly rises on impact from 2.5 percent to 3.8 percent in the first year after which it falls, but remains positive. This result for the first year should be interpreted cautiously because a positive productivity shock theoretically increases the marginal product of capital. This means that the real rate of return increases which encourages savings. Therefore, output and employment should increase. This would imply that unemployment responds with a lag to a technology shock since it commences to fall after the first year. In the long run, that is, after 15 years unemployment equilibrates at 1 percent above the baseline. Additionally, the lending rate increases in the first four years after a technology shock and then significantly decreases from then onwards. A positive productivity shock implies that the economy is performing at its best and this leads to an increase in interest rates in the first four years. There are situations where if the economy is growing, so will demand for loans, which in turn increases the price of money. As an illustration, lending rates fall from 3 percent to zero percent in three years after a technology shock; and then fall to equilibrate at about

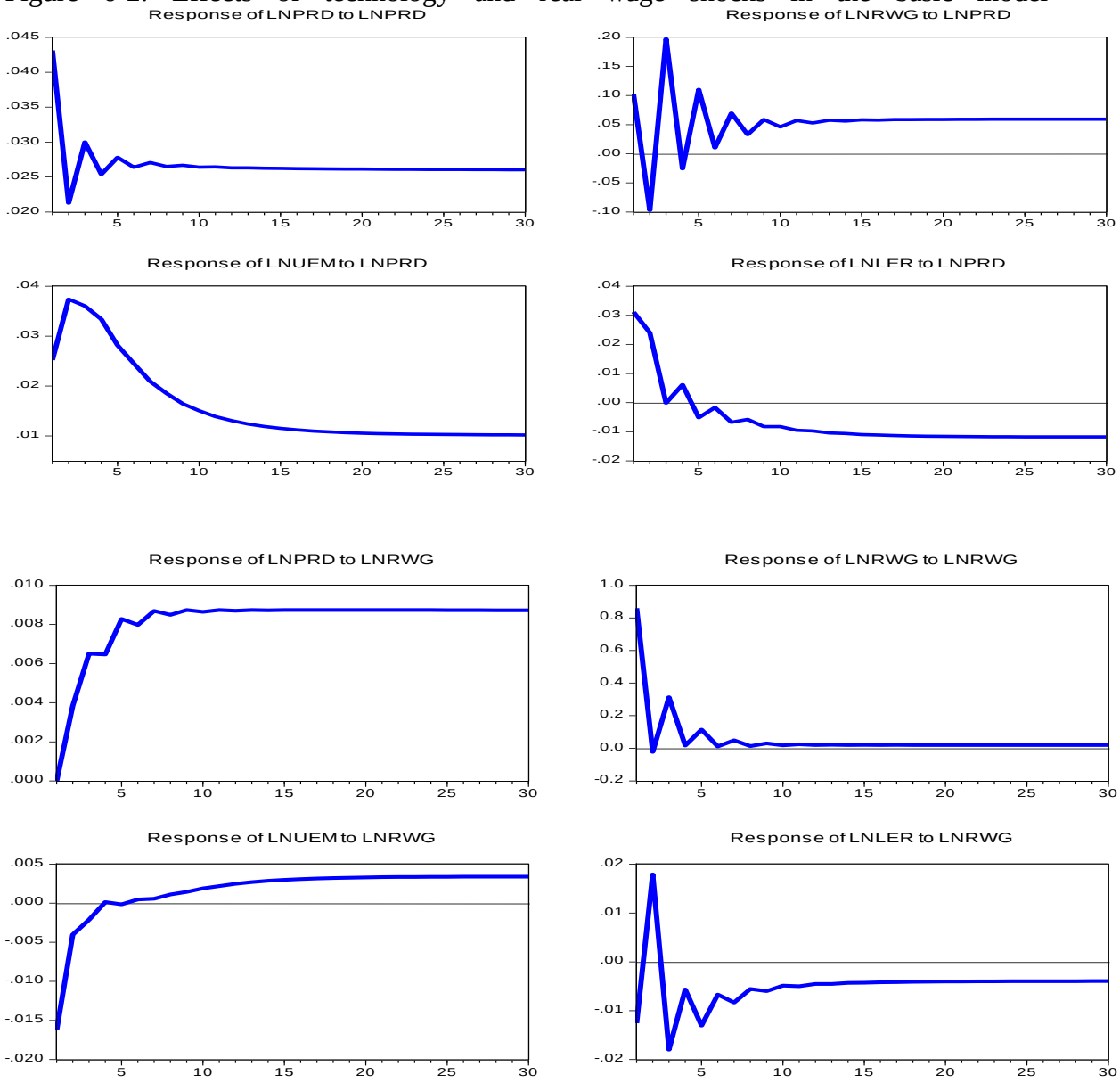
1.2 percent below the baseline after ten years. Next, the study looks at the response of productivity to a technology shock. As expected, productivity responds positively to a technology shock. During the entire period, the response of productivity to technology shocks is positive, falling from 4.5 percent in the first year to 2.2 percent at the end of the first year. The next impulse response analysed is the real wage. Figure 6-2 shows that in the first half of the first year, real wage responds positively to a productivity shock and then negatively in the second half of the first year. Despite the brief negative response of real wages to a technology shock, they generally respond positively and equilibrate at about 5 percent above the baseline after ten years. Naturally, an economy whose productivity is increasing is expected to have increasing real wages if the nominal wages are rising faster than the average prices in the economy. Therefore, productivity shock has both short and long run effects on itself and the other variables included in the basic model in Namibia during the period studied. The evidence presented here is similar to the results obtained by, Watzka (2006), Christiano et al. (2006) Carstensen and Hansen (2000) and Marques (2008).

Figure 6-2 also illustrates the impact of the shocks to real wage on the other variables that are in the basic model. Productivity increases insignificantly after a positive real wage shock as workers increase the work effort they put in their work. In the first half year of the real wage shock, lending rates decrease and then increase in the next half year, and then, permanently decrease from the beginning of the second year and equilibrate at about -0.5 percent below the baseline.

As far as the response of unemployment to real wage shocks is concerned, employers start experiencing the negative effects of real wage shocks after five years and this makes them cut back on employment, which consequently increases unemployment. In the first five years, unemployment actually decreases as people who previously considered the existing wages low start looking for jobs after the positive wage shock. In addition, the response of the lending rates to real wage shocks is generally negative and equilibrates at negative 0.5 percent after approximately seven years. Additionally, real wage responds positively (increases) in the first six years to a real wage shock and equilibrates on the baseline from

the seventh year onwards. The explanation for this fluctuation could be linked to the fact that real wages are closely linked with nominal wages, which can also not have permanent long run effects on other variables. However, this interpretation needs to be considered with caution mainly due to the way the real wages used in this study were generated (see Table A1 in Appendix A).

Figure 6-2: Effects of technology and real wage shocks in the basic model



Source: Authors' calculation from Eviews 8

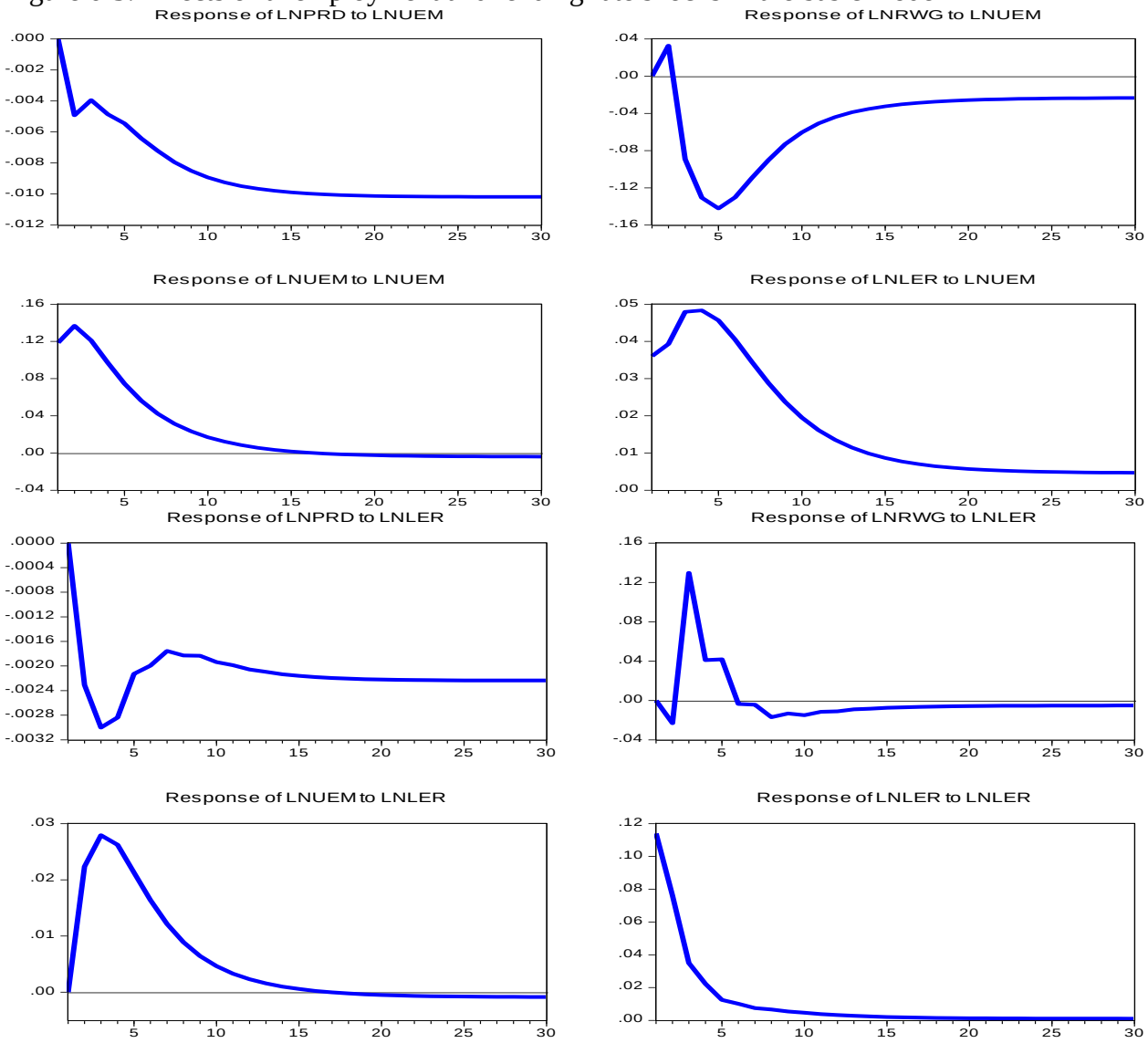
Figure 6-3 shows the effects of positive shocks to labour supply and interest rates in the basic model. The study analyses the effects of the shocks to unemployment first and then the effects of the shocks to the interest rates. First, the figure shows that a positive shock to labour supply leads to a decrease in productivity. This means that when there is a positive shock to labour supply, the economy is not performing at its best leading to a decrease in gross domestic product and hence, productivity. Second, a positive shock to unemployment, leads to a decrease in real wages to reach a minimum of approximately 14 percent after five years. This is explained by the fact that an increase in unemployment leads to an increase in the number of people looking for jobs having the effect of pushing down the nominal wages and hence, the real wages. Third, a positive shock to labour supply increases interest rates. This means that demand for loans may go up as more and more people attempt to get loans to cushion themselves against loss of income through loss of employment. However, a counter argument can also be advanced that the less the people who are working, the less the people who are eligible to be advanced loans in the economy. The former argument appears to be the one applicable to the Namibian situation. Lastly, a positive shock to labour supply, as expected, leads to an increase in unemployment. Overall, the figure shows that all the four variables significantly respond to labour supply shocks.

In the case of shocks to lending rates, Figure 6-3 indicates that productivity declines when there is a positive interest rate shock in the economy of Namibia. A shock that increases the cost of money, negatively affects the entire economy in that, less people and businesses are prepared to borrow leading to a fall in production and hence, affecting the gross domestic product. However, it is to be noted that the response of productivity to the interest rate shocks in Namibia is insignificant as it falls from 0 percent to negative 0.28 percent.

Second, a positive shock to interest rates leads to a decline in real wages in the first year, after which, it becomes positive up to the sixth year. The positive response of real wages to a positive interest rate shock is not surprising because sometimes when the economy is growing the demand for both real wages and loans increases. Third, unemployment

responds positively to a sudden increase in interest rate and it reaches its optimum of approximately 3 percent after three years. This can be explained by an argument advanced earlier that an increase in interest rates, leads to a decrease in production and gross domestic product and consequently, an increase in unemployment. Lastly, as expected, lending rates respond positively to a positive interest rate shock.

Figure 6-3: Effects of unemployment and lending rate shocks in the basic model



Source: Authors' calculation from Eviews 8

As demonstrated, real wages, unemployment and lending rates respond significantly to lending rate shocks and only productivity responds insignificantly, but in the correct

direction. The results clearly indicate that both lending rates and unemployment shocks are important in the basic model specified and estimated. Additionally, these results favourably compare with those obtained by Linzert (2001), Watzka (2006) and Marques (2008) and Robalo Marques et al. (2010) even though only Watzka (2006) incorporated interest rates in his model.

6.3.1.2 Variance decomposition of the basic model

Another important device for interpreting SVAR models is the variance decomposition method, which separates the variation in an endogenous series into contributions explained by component shocks in the SVAR. In other words, variance decomposition informs about the proportion of movements in a variable due to its own shocks, versus shocks to other variables. As a result, variance decomposition provides information about relative significance of each shock in influencing variables in the SVAR.

Table 6-1 illustrates the variance decomposition of variables that are in the basic model. Variance decomposition of productivity shows that technology shocks explain a large proportion of the movements in productivity throughout the thirty-year horizon considered. To illustrate, technology shocks explain 100 percent of the movements in productivity in the first year and about 85 percent in the thirtieth year, implying that technology shocks become increasingly less important with time. However, all the shocks to the other series become increasing more important with time in accounting for movements in productivity. As an illustration, in the first year real wages, unemployment and lending rates shocks all account for zero percent of the movements in productivity, while they account for 8, 9 and 1 percent, respectively in the thirtieth year. Further, the study notes that lending rates are the ones that are contributing insignificantly to the movements in productivity. Thus, productivity shocks are the most important shocks accounting for the movements in productivity followed by unemployment and then the real wages.

Table 6-1, also illustrates that the real wage shocks are more important in accounting for movements in real wages since they account for 99 percent in the first year, and about 75 percent in the thirtieth year. While real wage shocks become increasingly less important in explaining movement in real wages, shocks to productivity and unemployment become

increasingly more important and shocks to interest rates decrease from their highest of 2.1 percent in the fifth year to approximately 2 percent in the thirtieth year. Besides, in the first year, productivity explains 1 percent of the movements in real wage and both unemployment and lending rates explain zero percent of the movements. In addition, in the thirtieth year productivity, unemployment and lending rates explain 13, 10 and 2 percent of the movements in real wage, respectively. Consequently, real wage shocks are the most important shocks explaining movements in real wage followed by productivity and unemployment shocks, respectively.

The variance decomposition of interest rates shows that in the first year productivity, real wage, unemployment and interest rates explain about 6, 1, 8 and 84 percent of variation in interest rates, respectively. Moreover, interest rate shocks become increasingly less significant in accounting for movements in interest rates, while productivity, real wage and unemployment become increasingly more significant. Specifically, in the thirtieth year productivity, real wage, unemployment and interest rates explain about 10, 4, 36 and 50 percent of the variation in interest rates, respectively. As a result, lending rates, labour productivity and technology shocks are the important shocks explaining interest rates, respectively.

The variance decomposition of unemployment indicates that the labour supply shocks are the most important shocks in explaining movements in unemployment throughout the thirty-year period studied. As an illustration, labour supply shocks explain 94 percent of the variation in unemployment in the first year and approximately 84 percent in the thirtieth year. On the other hand, productivity, real wage and interest rate shocks explain 4, 2, and 0 percent of the variation in unemployment in the first year; and 12, 1, and 4 percent of the same variation in the thirtieth year. Furthermore, the results illustrate that labour supply shocks become increasingly less important in explaining unemployment variation with time, whereas productivity, real wage and interest rate shocks become increasingly more important. As a final point, the shocks explaining the variation in unemployment are labour supply, productivity and lending rates, according to their order of importance.

Table 6-1: Variance decomposition for the basic model

Variance Decomposition of LNPRD

Period	S.E.	LNPRD	LNRWG	LNUEM	LNLER
1	0.043132	100.0000	0.000000	0.000000	0.000000
5	0.070138	94.15952	3.401199	1.892606	0.546679
10	0.095655	89.33850	5.784889	4.391371	0.485244
15	0.116093	86.34303	6.750488	6.415480	0.491007
20	0.133467	84.54845	7.249730	7.694109	0.507709
25	0.148807	83.40276	7.554245	8.522258	0.520741
30	0.162675	82.62098	7.758924	9.089954	0.530147

Variance Decomposition of LNRWG

Period	S.E.	LNPRD	LNRWG	LNUEM	LNLER
1	0.865406	1.386836	98.61316	0.000000	0.000000
5	0.994637	7.241555	85.97779	4.679393	2.101262
10	1.025503	7.920946	81.25109	8.782799	2.045165
15	1.038588	9.197980	79.42994	9.334981	2.037102
20	1.049748	10.56362	77.93660	9.487874	2.011907
25	1.060531	11.91445	76.53845	9.562833	1.984270
30	1.071118	13.21930	75.20629	9.617422	1.956991

Variance Decomposition of LNUEM

Period	S.E.	LNPRD	LNRWG	LNUEM	LNLER
1	0.122274	4.248074	1.765660	93.98627	0.000000
5	0.265233	7.445695	0.404659	88.71075	3.438895
10	0.282072	8.943683	0.367169	86.94666	3.742486
15	0.284038	9.800301	0.405843	86.07794	3.715918
20	0.285184	10.44429	0.465931	85.40307	3.686706
25	0.286319	11.01698	0.530986	84.79162	3.660418
30	0.287461	11.56246	0.596454	84.20560	3.635485

Variance Decomposition of LNLER

Period	S.E.	LNPRD	LNRWG	LNUEM	LNLER
1	0.124241	6.288665	1.022898	8.412762	84.27567
5	0.181250	4.905439	3.057678	29.11962	62.91727
10	0.195270	4.795991	3.172169	37.15850	54.87334
15	0.198869	5.953421	3.318170	37.71541	53.01300
20	0.201277	7.411831	3.447232	37.36025	51.78069
25	0.203508	8.901111	3.564732	36.86638	50.66778
30	0.205680	10.34956	3.675151	36.35919	49.61610

Source: Authors' calculation from Eviews 8

6.3.2 Possible channels of monetary transmission in the macro-econometric model

This section, analyses the specific monetary transmission channels that relate to labour market variables as illustrated in Figure A1 in Appendix A. The study determines the strength of each channel by first appending to the basic model the variable that captures the particular channel of interest and calculating two sets of impulse responses: one with the variable treated as endogenous in the SVAR and another, where it is treated as an exogenous variable. Comparison of the impulse response functions of these two models provides a measure of the importance of that particular channel in acting as a conduit for monetary policy to the real economy. The study investigates two channels, which influence labour market variables, that is, the demand channel and the exchange rate channel. As we identify these transmission channels for Namibia, the study establishes the significance of each channel in the transmission process by looking at the significance of each channel shocks in affecting the labour variables in the basic model. If the channel shock is significant in influencing the labour market variables and itself, then it is considered as a candidate to be included in the small macro-econometric model. Concerning the demand channel, the study experimented with three variables, namely imports prices, bank credit to the private sector and output establishing that import prices and bank credit had a greater influence on labour market variables as compared to output. For this reason, the import prices and bank credit results are the demand channel variables discussed in this section. Additionally, the section also discusses results of the exchange rate channel.

6.3.2.1 The demand channel model using import prices

As alluded to earlier, the study experimented with output, bank lending to the private sector and import prices in the demand channel, but output was found insignificant in the model and was therefore dropped. The Namibian economy is highly dependent on imports of both consumer and capital goods from both developed and developing countries. In this context, one can interpret the import price shock as a shock to the terms of trade. A change in the terms of trade could emanate from a rise in the price of exports or a fall in the price of imports and vice versa. In addition, emphasis in Namibia is placed on the import price changes for the latter reason. Appending import prices to equation [6.6] transforms the basic model and the corresponding vector of endogenous variables becomes:

$$X_t' = [PRD_t, RWG_t, UEM_t,\ MPP_t, LER_t] \quad [6.8]$$

Using the identification scheme in the system of equations [6.5] the equations separating structural shocks from the reduced form residuals for the basic model is presented as:

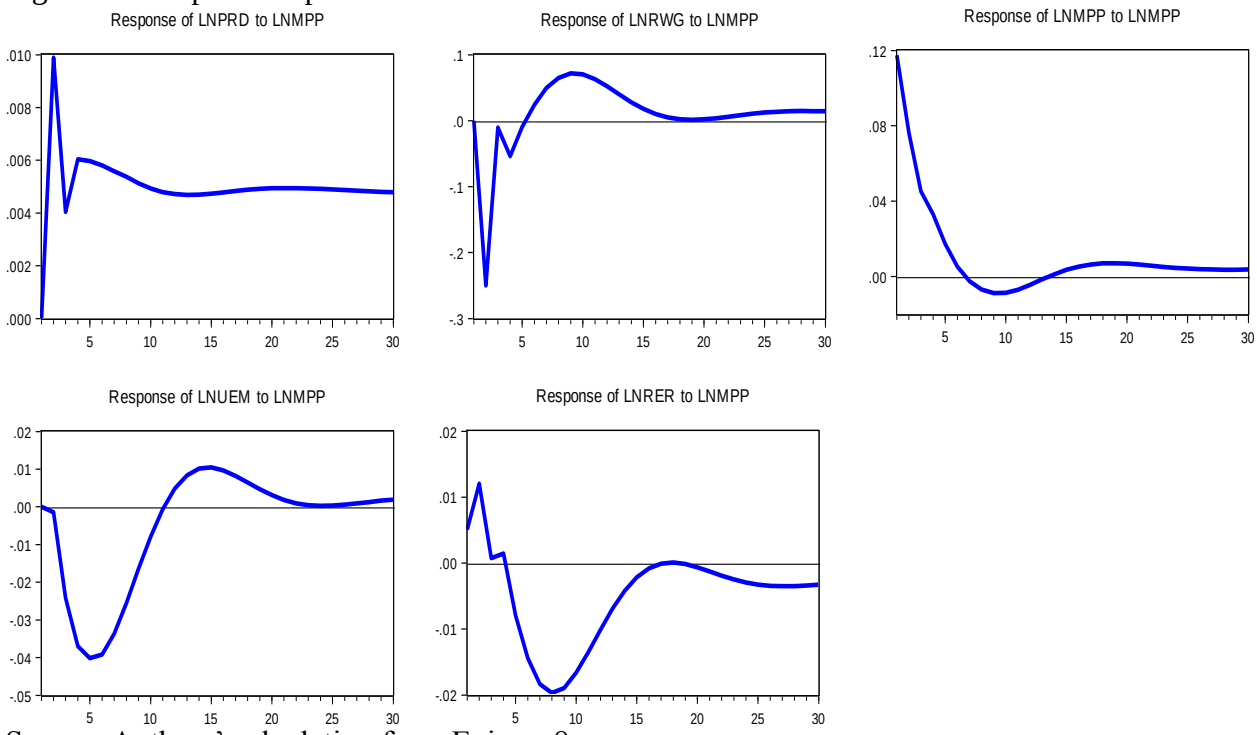
$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^{PRD} \\ \varepsilon_t^{RWG} \\ \varepsilon_t^{UEM} \\ \varepsilon_t^{MPP} \\ \varepsilon_t^{LER} \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{pmatrix} \begin{pmatrix} \mu_t^{PRD} \\ \mu_t^{RWG} \\ \mu_t^{UEM} \\ \mu_t^{MPP} \\ \mu_t^{LER} \end{pmatrix} \quad [6.9]$$

Figure 6-4 presents the impulse response functions of productivity, real wage, unemployment, import prices and interest rates to import price shocks. The results depict that the responses of productivity to an import price shock are insignificant, while the responses of the other three variables are significant. Moreover, a positive shock to import prices reduces real wages in Namibia in the first five years. The relationship between the latter two is not direct, but import prices affect real wages through their effect on nominal wages and nominal prices. Further, it appears that in the short run, prices in Namibia increase faster than nominal wages so that real wage decreases during the first five years or so, before returning to their pre-shock equilibrium, which coincides with the baseline.

Figure 6-4 also depicts that a positive shock to import prices indirectly affects the lending rates through its effects on the nominal exchange rate and prices. In fact, a positive shock to import prices leads to an increase in lending rates. From a theoretical viewpoint, a positive shock to import prices leads to a depreciation of the exchange rate, which, in turn, leads to inflation resulting in an increase in the nominal interest rates. It can also be argued that import prices would deteriorate the terms of trade, hence causing demand pressures and this would be met with a higher policy rate. The response of the lending rates to an import price shock becomes zero after about fifteen years after the shock. Lastly, import prices increase after an import price shock, as expected. In brief, higher import prices hurt the manufacturing sector since Namibian companies heavily rely on imported machines, equipment and raw materials from both the developed and developing countries. These

results compare favourably with the results obtained by Duarte and Marques (2013) and Marques et al. (2010).

Figure 6-4: Impulse responses of the demand channel model



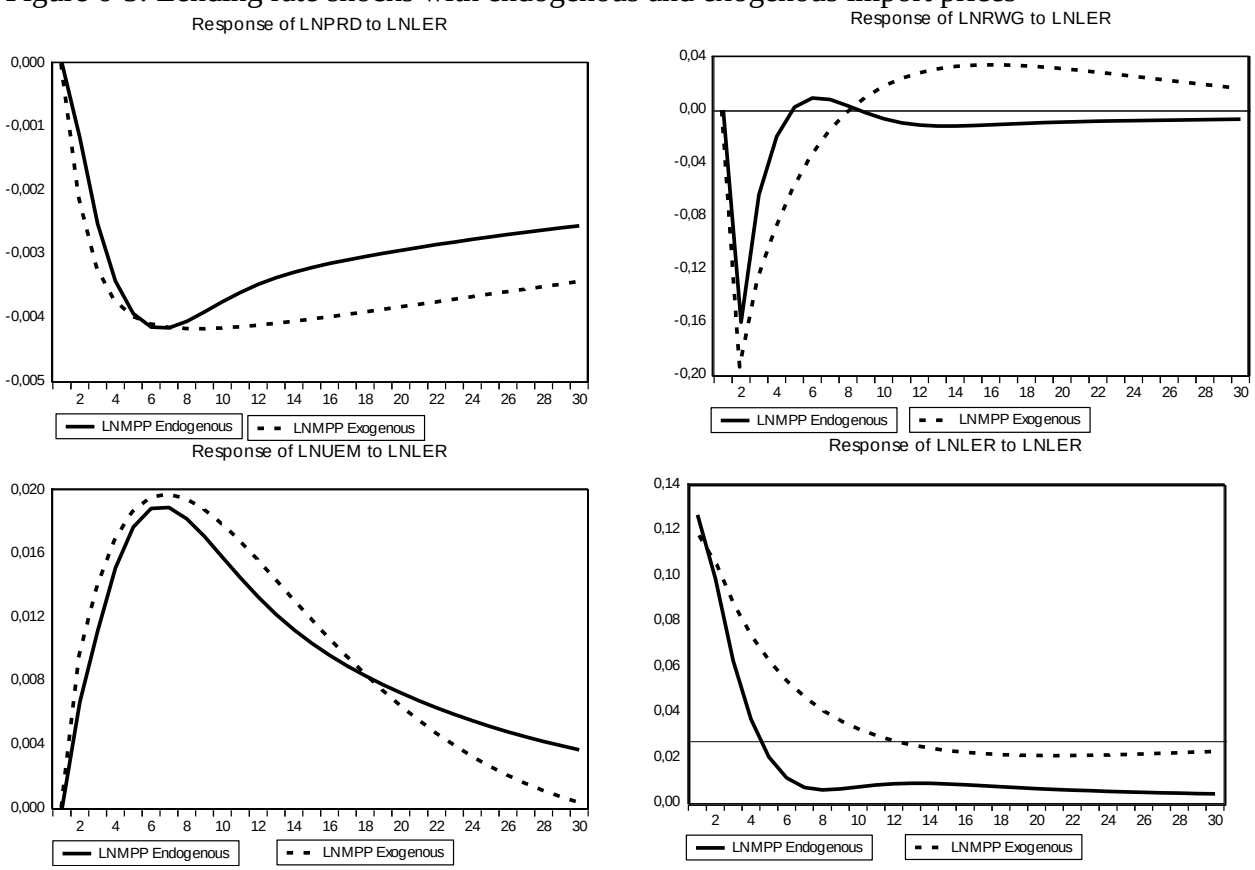
Source: Authors' calculation from Eviews 8

To establish the importance of the demand channel to the monetary transmission process in Namibia, impulse responses of productivity, real wage, unemployment and lending rates are plotted with two scenarios in each case: endogenous and exogenous import prices. In this case, exogenous import prices block responses that pass through interest rates while the case of endogenous import prices allows interest rates to transmit monetary policy shocks.

Figure 6-5 indicates that in all four cases, there is significant difference in the magnitude of impulse responses when import price is endogenous and when it is exogenous. Essentially, this provides evidence that import prices contain important additional information that relate to the country's monetary transmission process. A positive lending rate shock means that the Central Bank is tightening monetary policy, which limits activity in the loans market. As expected, a positive shock to lending rates causes productivity and real wages

respond negatively, initially in both cases where import prices are endogenous and exogenous. In addition, both unemployment and lending rates increase after a positive shock to lending rates and this is applicable to both endogenous and exogenous cases. Note that all the responses here are in line with the theoretical predictions.

Figure 6-5: Lending rate shocks with endogenous and exogenous import prices



Source: Authors' calculation from Eviews 8

6.3.2.2 The demand channel using the bank credit model

The bank credit lending is the other variable from the demand channel, which is appended to the basic model [6.6]. As explained above, the first thing done here is to estimate equation [6.11] using SVAR and then determine how all the variables in the basic VAR respond to bank credit shocks. The next stage is to determine the responses of the variables in the basic model when bank credit is endogenous and exogenous.

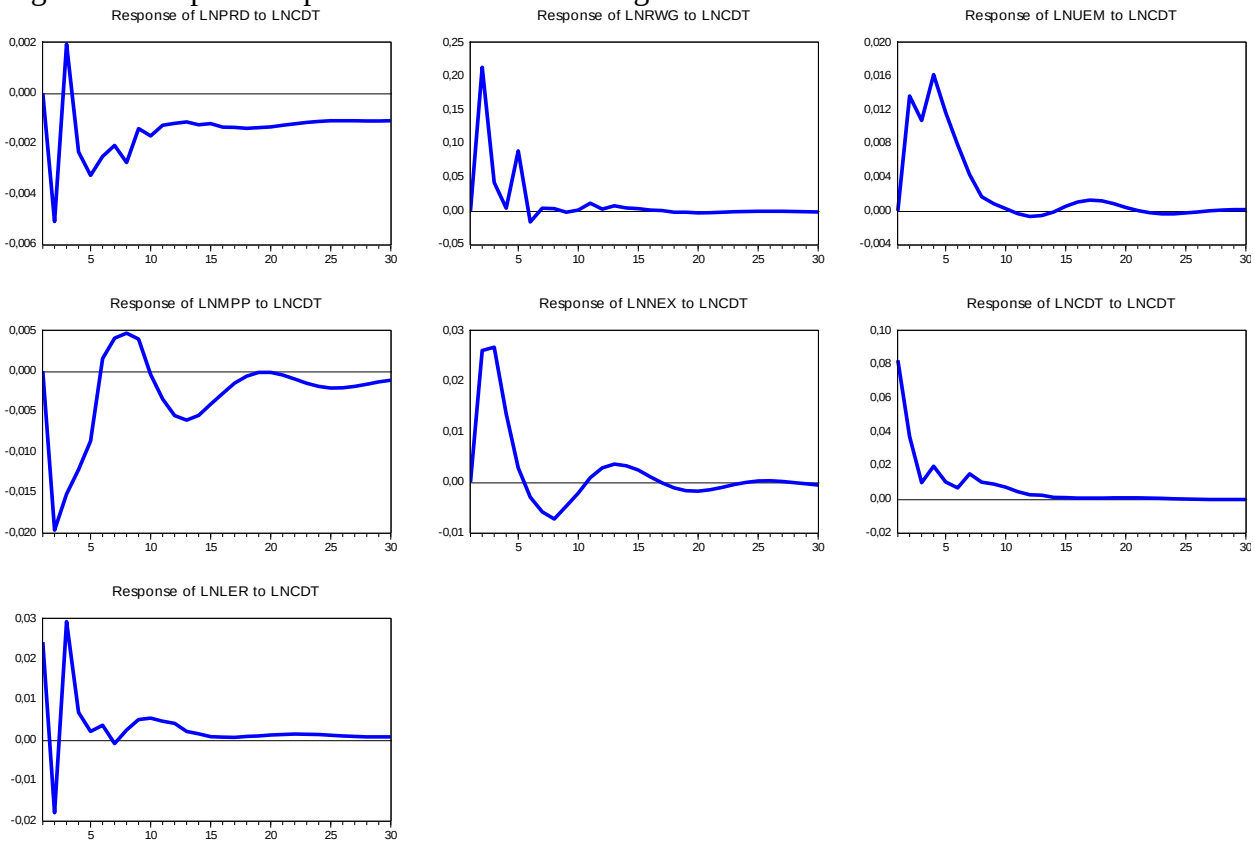
The model estimated here is: $X_t' = [PRD_t, RWG_t, UEM_t,\ CDT_t, LER_t]$. [6.10]

Using the identification scheme in the system of equations [6.5] the equations separating structural shocks from the reduced form residuals for the basic model is presented as:

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^{PRD} \\ \varepsilon_t^{RWG} \\ \varepsilon_t^{UEM} \\ \varepsilon_t^{CDT} \\ \varepsilon_t^{LER} \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{pmatrix} \begin{pmatrix} \mu_t^{PRD} \\ \mu_t^{RWG} \\ \mu_t^{UEM} \\ \mu_t^{CDT} \\ \mu_t^{LER} \end{pmatrix} [6.11]$$

As explained earlier, we append the bank credit (CDT_t) variable to the basic model to get this equation. According to Figure 6-6, a positive shock to bank credit leads to an increase in bank credit causing it to remain positive and well above the baseline for the entire period. When bank credit suddenly increases, this shows that the economy is performing at its best and, many people and businesses seek loans because they can afford them. This increases aggregate demand and the economy's gross domestic product.

Figure 6-6: Impulse responses of the bank-lending channel

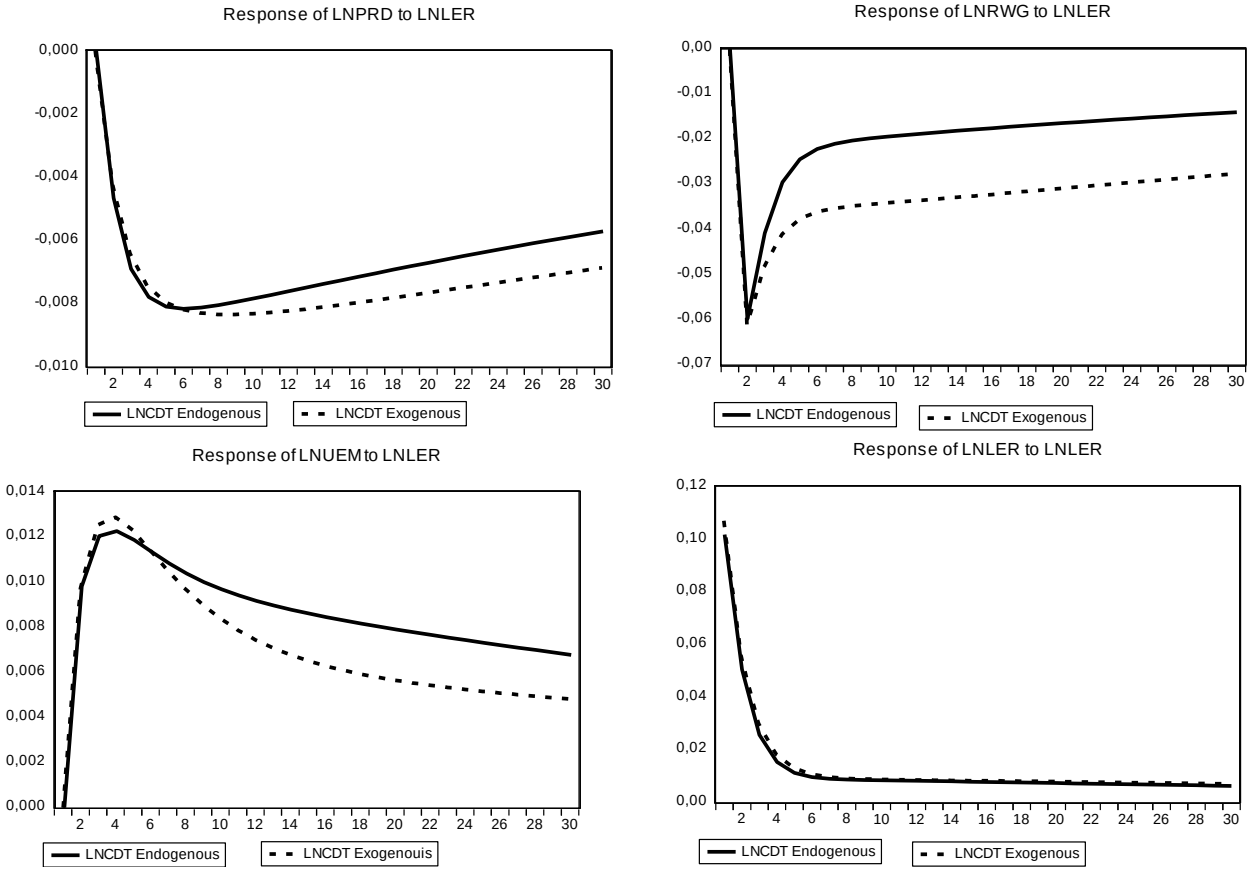


Source: Authors' calculation from Eviews 8

In addition, real wages in Namibia increase from zero percent to a maximum of 20 percent after a positive shock to bank credit in in the first year. Overall, real wages increase after an interest rate shock in the first five years after the shock.

To determine the significance of the bank credit model to the monetary transmission process, Figure 6-7 presents impulse responses of productivity, real wages, unemployment and interest rates to sudden tightening of monetary policy in two scenarios: endogenous and exogenous bank credit. First, productivity decreases after a positive shock to lending rates since it increases the cost of borrowing in the economy. The response of productivity when bank credit is exogenous commences to diverge from the response of productivity when bank credit is endogenous after the fifth year. Second, the responses of real wage to a tight lending rate shock are almost the same for endogenous and exogenous bank credit in the first two years. After the second year, they start to diverge.

Figure 6-7: Lending rate shocks with endogenous and exogenous bank credit



Source: Authors' calculation from Eviews 8

Third, unemployment increases after a positive tight lending rate shock for both the case where bank credit is endogenous and when it is exogenous. The two responses commence to diverge from each other after the third year. Lastly, lending rates respond positively to lending rates shocks in both cases where bank credit is endogenous and exogenous. Both responses closely follow each other throughout the entire period studied. The figure confirms that bank credit contains important supplementary information in the monetary transmission process, which is more pronounced in the responses of real wage, unemployment and productivity, respectively.

6.3.2.3 The exchange rate channel model

For a small open economy, a potentially important channel through which lending rates may affect real economic activity is through its effects on exchange rate. Precisely, monetary easing combined with sticky prices, results in a depreciation of the exchange rate in the short run and higher net exports (see Fragetta, 2010; Fragetta and Melina, 2011; Ajilore and Ikhide, 2013). The strength of the exchange rate channel is dependent on the sensitivity of the exchange rate to monetary shocks, the level of openness of the economy, and the sensitivity of net exports to exchange rate variations. According to Disyatat and Vongsinsirikul (2003), substantial unanticipated exchange rate depreciation can reduce output when a significant share of debt in the economy is foreign currency denominated[13].

In Equation [6.12], nominal exchange rates are appended to the basic model represented by equation [6.6] and this gives the following vector of endogenous variables:

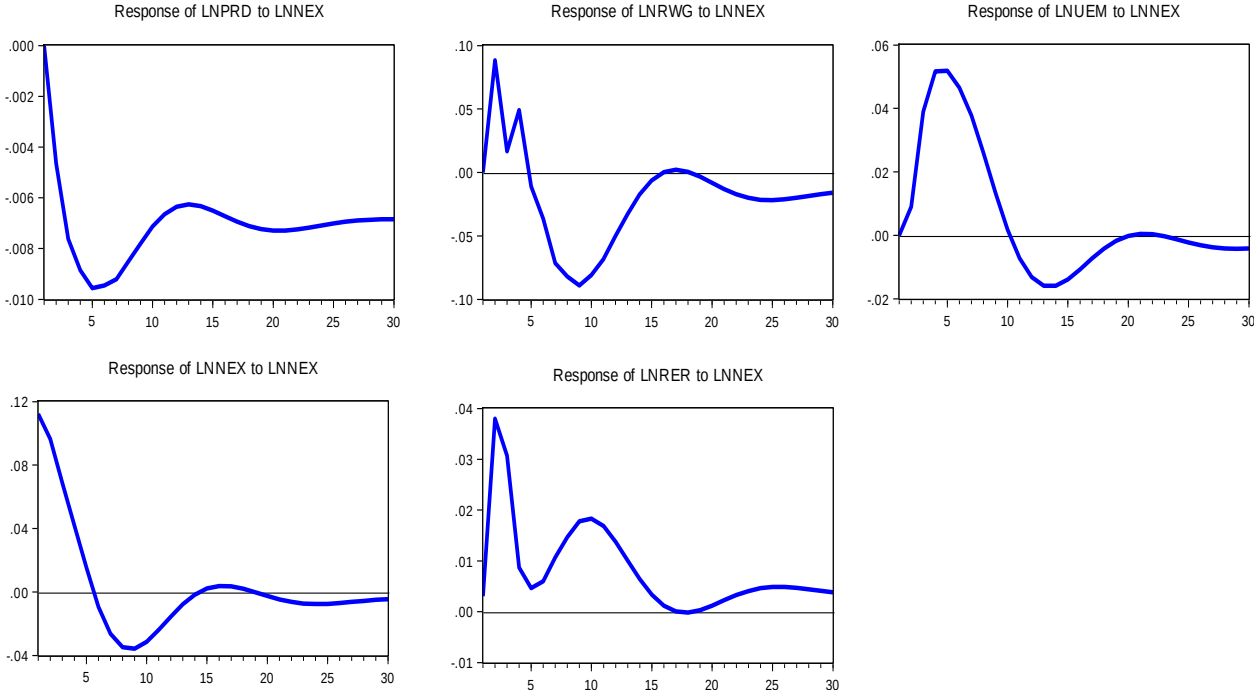
$$X_t' = [PRD_t, RWG_t, UEM_t, NEX_t, LER_t] \qquad [6.12]$$

Using the identification scheme in the system of equations [6.5] the equations separating structural shocks from the reduced form residuals for the basic model is presented as:

[13] This may not be relevant to Namibia because its foreign debt is still very small.

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ a_{41} & 0 & a_{43} & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_t^{PRD} \\ \varepsilon_t^{RWG} \\ \varepsilon_t^{UEM} \\ \varepsilon_t^{NEX} \\ \varepsilon_t^{LER} \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{pmatrix} \begin{pmatrix} \mu_t^{PRD} \\ \mu_t^{RWG} \\ \mu_t^{UEM} \\ \mu_t^{NEX} \\ \mu_t^{LER} \end{pmatrix} \quad [6.13]$$

Figure 6-8: Impulse responses of the exchange rate channel

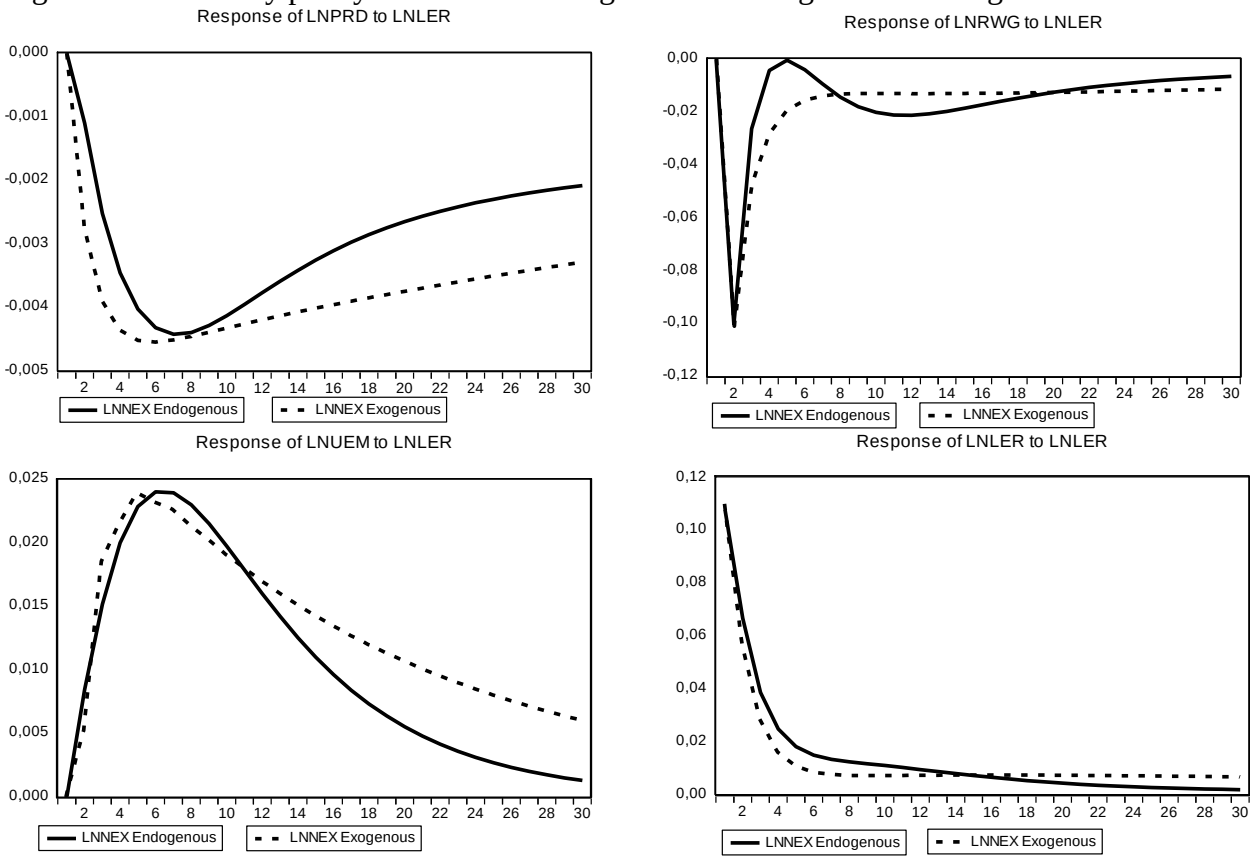


Source: Authors' calculation from Eviews 8

Figure 6-8 shows the impulse responses of variables in the exchange rate channel model to shocks in the exchange rate. First, a sudden increase in exchange rates implies that the local currency has depreciated. This increases the import prices in local currency terms and makes imports more expensive, which negatively affects local producers and eventually gross domestic product and productivity. Second, a sudden increase in nominal exchange rates leads to an increase in real wages in the first five years in Namibia. A possible explanation for this increase is that the nominal exchange rate increases nominal wages by a greater margin than they increase the prices so that the real wage increases. It must be noted that after five years, real wages decrease after a positive shock to the exchange rate relating to the fact that exchange rates increases affect economic activity negatively. Third, a sudden increase in nominal wages leads to an increase in unemployment and this is because increases in nominal wages decrease gross domestic product and productivity as

explained above, which are closely connected with the behaviour of unemployment. Fourth, a positive shock to nominal exchange rates leads to an increase in lending rates, through its effects on prices and output. Lastly, a positive shock to nominal exchange rate leads to an increase in nominal exchange rates. As shown in the figure, the only response that is insignificant to a sudden increase in nominal exchange rates in Namibia is that of productivity even though it responds in the correct direction.

Figure 6-9: Monetary policy shocks with endogenous and exogenous exchange rates



Source: Authors' calculation from Eviews 8

To determine the significance of nominal exchange rates in the monetary transmission process, Figure 6-9 presents impulse responses of productivity, real wages, unemployment and interest rates to lending rate shock under two scenarios: endogenous and exogenous nominal exchange rates. The responses of productivity, real wages, unemployment and lending rates are all in line with the a priori expectations after a sudden positive exchange rate shock under both cases where exchange rates are endogenous or exogenous. To

demonstrate, productivity decreases after a positive lending rate shock irrespective of whether nominal exchange rates are endogenous or exogenous. Both responses remain below the baseline for the entire period. The response of real wages in both cases where the nominal exchange rate is endogenous and exogenous is a decrease in real wages throughout the period studied. In addition, the response of unemployment to a tight lending rate shock, in both cases, is positive. In other words, a sudden increase in interest rates increases unemployment. The figure, therefore, confirms that exchange rates contain important supplementary information in the monetary transmission process, which is more pronounced in the responses of productivity, unemployment and real wages, respectively.

6.4.1 The small maroeconometric model for Namibia

The results from the preceding section indicate that variables in the basic model largely influence each other correctly and significantly. This corroborates the findings by McHugh (2004) that wages, prices, productivity and unemployment can be estimated simultaneously and gives meaningful results. Furthermore, preliminary indications from the previous section also suggest that the demand (import prices, bank lending to the private sector) and exchange rates (nominal exchange rates) channels contain important additional information for the monetary transmission process in Namibia. Incorporating information from the basic model and the possible transmission channels discussed, result in a composite small macro-econometric model for Namibia with the following vector of endogenous variables:

$$X_t' = [PRD_t, RWG_t, UEM_t,\ MPP_t, CDT_t, NEX_t, LER_t] \qquad [6.14]$$

which is identified in accordance with the system of equations in [6.5]. As explained in section 6.3.4, the Akaike, Hannan-Quinn and Schwatz Information criteria were used to determine that the lag length is two. These lag length results give inverse roots of the characteristic autoregressive (AR) polynomial with a modulus of less than one (lying inside the unit circle) depicting that the estimated VAR is stable and stationary (see Table C6 and Figure C3 in Appendix C). Table C8 in Appendix C indicate that the VAR lag

exclusion Wald test reveals that all endogenous variables in the model are jointly significant at each lag length for all equations.

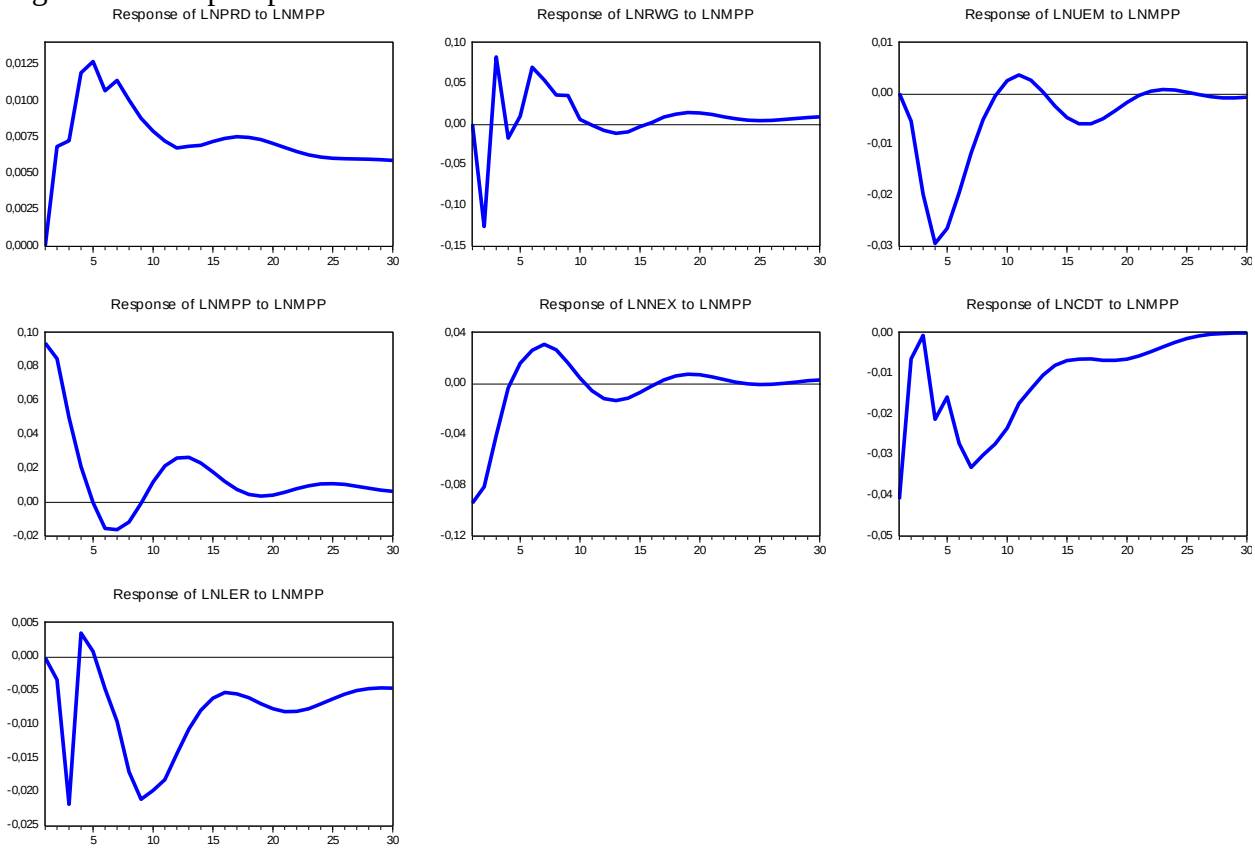
It is to be noted that the study experimented with many possible variables and the ones whose results were discussed are the ones that gave significant and meaningful results. The impulse response functions of the small macro-econometric model over a thirty-year period are presented in Figures 6-10 to 6-13 and in Figure C4 in Appendix C. The information contained in these figures indicates that import prices, bank lending to the private sector and exchange rates are important channels of monetary transmission in Namibia. Furthermore, most of the responses of variables in the small macro-econometric model to shocks in these variables are significant.

6.4.1.1 Impulse response functions for the macro-econometric model

The discussion of impulse response functions of the small macro-econometric model commences by analysing the impulse responses caused by positive shocks to import prices. Figure 6-10 and Figure C4 in Appendix C illustrate that the responses of productivity to a sudden increase in import prices are the only ones that are insignificant and responding in a way that is contrary to what is expected. Moreover, lending rates are significant but their response is not correct. The initial response of real wages to a shock in import prices is to fall bottoming at 13 percent below the baseline. In the second year, the response of real wages sharply reverses to attain a maximum of approximately 9 percent at the end of the second year, after which, it largely remains positive and then becomes insignificant after the tenth year. Unemployment responds negatively to a positive import price shock; the possible explanation for this is that sudden increases in import prices are associated with depreciation of the local currency, increases in export performance, increases in the level of economic activity and hence, a decrease in unemployment in the economy. More specifically, unemployment falls from the baseline to a minimum of three percent after four years. The pre-shock level of exchange rates is approximately 10 percent below the baseline and it takes approximately four years before nominal exchange rates start to increase after a sudden increase in import prices. After the tenth year, the response of exchange rates generally becomes insignificant. In addition, bank credit decreases after a

positive import price shock and this is due to the effect of import prices on local prices and lending rates. When local prices of goods and services increase, interest rates in the economy also increase and this decreases the volume of loans accessed in the entire economy. This underlines the importance of import prices in influencing monetary policy in Namibia.

Figure 6-10: Import price shocks in the small macro-econometric model

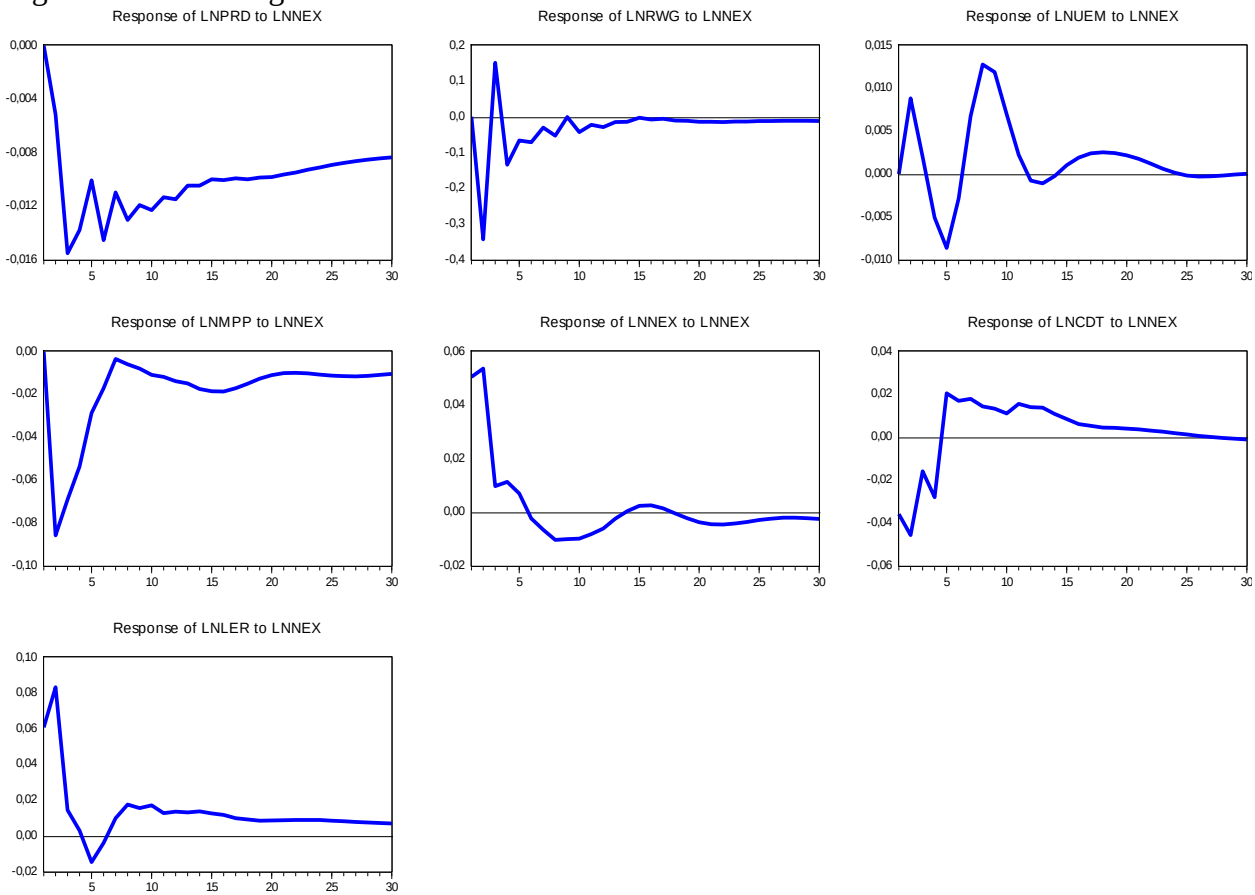


Source: Authors' calculation from Eviews 8

A positive shock to exchange rates is just the same as depreciation of the local currency or an appreciation of the currency like the United States Dollar, which most countries use when trading with other countries. First, the response of real wage to a positive exchange rate shock is that it falls and becomes insignificant after ten years. In addition, it responds positively between the second and the third year and then falls sharply back to a level below the baseline before the end of the third year. Second, unemployment increases if the local currency is losing value in Namibia. It is noteworthy that the currency of Namibia is one of the strongest currencies in Africa and this is thanks to the fact that the Namibian

dollar is pegged to the South African Rand. Under this system, the Namibia economy has grown at an average of 4 percent per annum since its independence in 1990. Third, it is to be noted that the initial responses of bank credit, lending rates and exchange rates to a sudden depreciation of the Namibian dollar are theoretically correct. For instance, exchange rate increases, bank credit decreases and lending rates increase after depreciation of the exchange rate. The fact that both labour market variables and monetary variables respond to exchange rate depreciation in Namibia as theoretically anticipated underscores the importance of the flexible exchange rate system in both the labour and the monetary sectors.

Figure 6-11: Exchange rate shocks in the small macro-econometric model

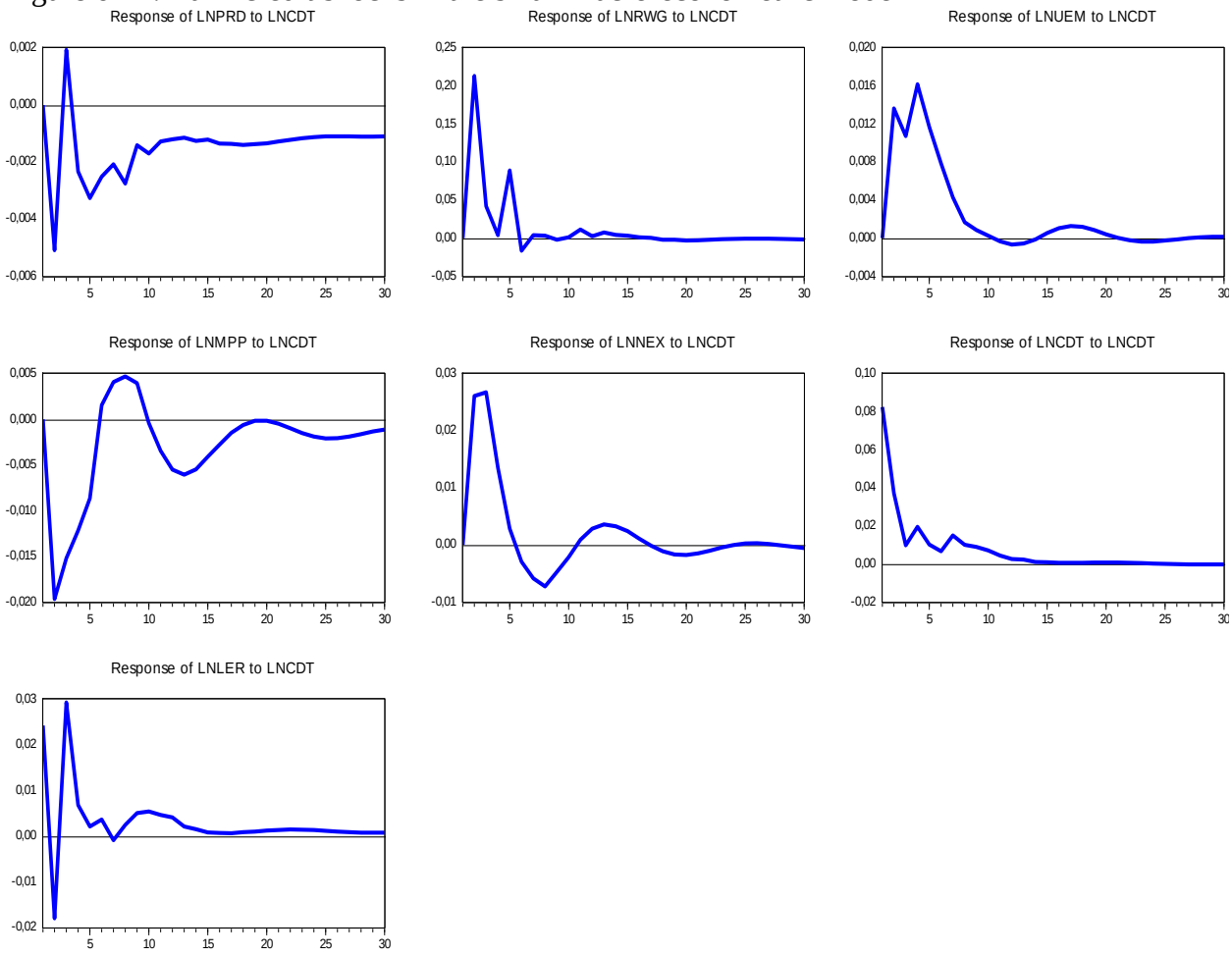


Source: Authors' calculation from Eviews 8

Figure 6-12, illustrates the effects of bank lending shocks in the small macro-econometric model. It is to be noted that all the three labour market variables respond in ways that are contrary to what is expected. However, the response of the monetary variables to the

sudden increase in bank lending is in line with theoretical expectations. For example, a sudden increase in bank credit is a result of a fall in lending rates. The results show that bank lending falls after a positive shock to bank credit, which is in line with what theory says. In the long term, this response is close to zero. In addition, bank credit increases to a sudden increase in bank credit and the long-term equilibrium is equal to the baseline.

Figure 6-12: Bank credit shocks in the small macro-econometric model

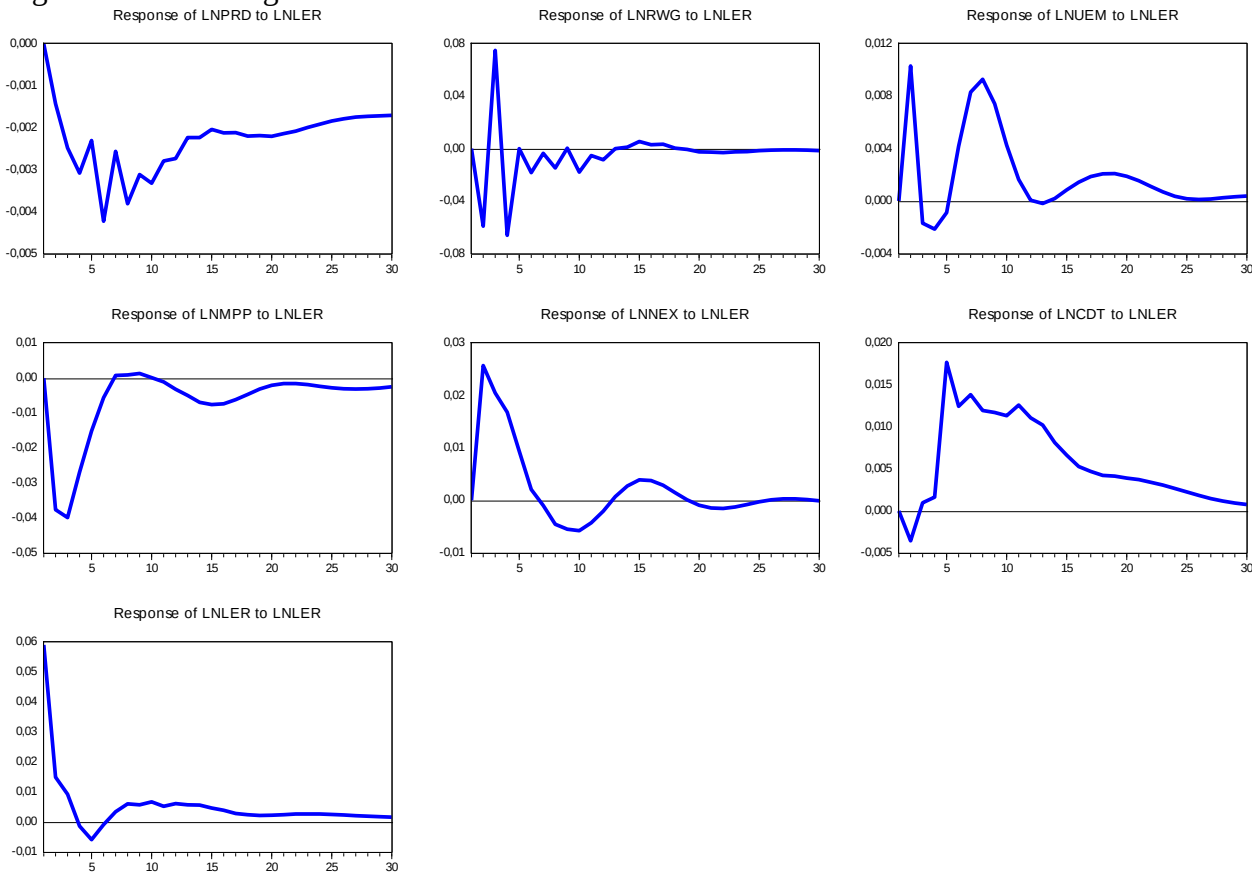


Source: Authors' calculation from Eviews 8

The fact that the responses of the labour market variables did not perform well in these results means that they should be treated with caution even though Figure 6-7 seems to suggest that bank credit has important additional information to the monetary transmission process.

Figure 6-13 illustrates the effects of bank lending rate shocks in the small macro-econometric model. It is important that both the labour and monetary variables respond as expected to the positive bank lending rate shocks. Specifically, productivity unambiguously falls after a lending rate shock bottoming at about 0.4 percent after five years. In addition, productivity sluggishly increases after five years, but essentially remaining in the negative territory. As mentioned earlier, an increase in interest rates decreases volumes of bank loans and the gross domestic product and hence, productivity. Following from the latter, nominal and real wages are expected to decline and Figure 6-13 confirms this, despite the fact that the real wages increase in the second year only.

Figure 6-13: Lending rate shocks in the small macro-econometric model



Source: Authors' calculation from Eviews 8

Also linked to the information above, is the unemployment rate, which increases after a positive increase in interest rates. Unemployment increases to a maximum of about 1 percent above the baseline after a year, and then sharply falls in the second year bottoming

at an insignificant 0.2 percent below the baseline. After the second year, the response of unemployment is entirely positive. The figure also illustrates that the nominal exchange rate increases after a sudden increase in interest rates attaining its maximum point at 2.6 percent after just a year. The fact that bank credit increases after a sudden increase in lending rates is an indication that the economy is growing and, therefore, gross domestic product and demand for bank credit is going up and hence, the interest rates. Lastly, as expected, a sudden increase in lending rates increases the lending rates in Namibia. The explanation here indicates that interest rates are of critical importance to the small macro-econometric model specified and estimated. This also assists to corroborate the rational for using the interest rate equation to close macro-econometric model. However, caution should be exercised when interpreting the effects of shocks on the lending rate since the Namibian dollar is pegged to the Rand, since this would imply that monetary policy would be impotent, that is a monetary expansion would be reversed.

6.4.1.2 Variance decompositions for the macro-econometric model

As alluded to earlier, variance decomposition provides information about the relative significance of each shock in influencing the variables in the SVAR. In this section, the study therefore determines the proportion of fluctuations caused by different shocks. In other words, the study determines the variance decompositions of each variable in the macro-econometric model with forecast horizons of 1 to 30 years (see Table 6-2 and Figure C4 in Appendix C). The table shows that productivity fluctuations are 100 percent attributed to technology shocks in the first year; and in the fifth year, they are attributed to productivity, exchange rates, unemployment and import prices according to their order of importance. In the thirtieth year, the order becomes productivity, exchange rates and import prices and unemployment is no longer important in explaining productivity fluctuations.

The real wage fluctuations are largely attributed to real wages, exchange rates, productivity and unemployment in the fifth year. The same variables explain real wage fluctuations even in the thirtieth year. In addition, unemployment fluctuations are largely accounted for by labour supply shocks, real wage, import prices and productivity in the fifth year and the

same variables influence fluctuations in unemployment in the thirtieth year. In the case of import price fluctuations, after five years, productivity, unemployment, import and exchange rates account for approximately, 8, 16, 35 and 29 percent respectively. In the thirtieth year, the fluctuations in import prices are still accounted for by the same shocks except that the importance of real wages has also become increasingly more important at approximately 6 percent. Additionally, in the fifth year exchange rates can be attributed to unemployment shocks (36 percent), import price shocks (36 percent), exchange rates (11 percent) and real wage (11 percent). However, in the thirtieth year, the most important shock accounting for the fluctuations in exchange rates is unemployment accounting for approximately 43 percent. The other important shocks in explaining the exchange rate fluctuations in the thirtieth year include, import prices, real wage, exchange rates and exchange rates (which become increasingly important at approximately 6 percent). In the case of bank credit, excluding own shocks, the important shocks explaining it after five years include real wage, unemployment, productivity and exchange rates. However, after thirty years only real wage, unemployment and productivity are important in that respective order.

The variance decomposition of the monetary policy reaction function indicates that fluctuations in interest rates are attributed to shocks to all other variables except import prices after five years. In addition, the most important shocks explaining fluctuations in interest rates in the first five years are the exchange rate shocks followed by interest rate, productivity, real wage, unemployment and bank credit in order of importance. In the thirtieth year, only bank credit shocks appear unimportant in explaining the fluctuations in interest rates at about 4 percent and all the other shocks explain at least 6 percent of the fluctuations in interest rates. It is noteworthy that the top four shocks that account for lending rates are exchange rates, unemployment, productivity and real wage accounting for approximately, 28, 23, 17 and 14 percent, respectively. These results confirm that monetary policy has important effects on real (labour market) variables and monetary variables in the economy and this is in line with the impulse response results in Figure C3 in Appendix C.

Table 6-2: Variance decomposition for the small macro-econometric model

Variance Decomposition of LNPRD

Period	S.E.	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER
1	0.042520	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.078264	72.63743	2.575091	7.966083	6.580702	9.117261	0.746825	0.376612
10	0.104204	71.13674	1.568209	5.256806	8.179471	12.46203	0.633446	0.763301
15	0.121876	72.90730	1.171617	4.014126	7.627067	13.01072	0.512979	0.756196
20	0.135967	73.66392	1.089277	3.334836	7.590929	13.12392	0.462565	0.734558
25	0.147433	74.38207	1.111309	2.837272	7.381343	13.14625	0.425251	0.716505
30	0.156934	74.92325	1.156063	2.507542	7.234055	13.08555	0.399855	0.693687

Variance Decomposition of LNRWG

Period	S.E.	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER
1	0.828305	3.809994	96.19001	0.000000	0.000000	0.000000	0.000000	0.000000
5	1.143498	11.88354	56.92145	11.69569	1.771642	12.47142	4.223772	1.032493
10	1.178780	12.03826	54.22276	13.79985	2.411692	12.49591	3.996405	1.035121
15	1.188579	12.72425	53.46904	14.02747	2.393839	12.41186	3.946218	1.027329
20	1.193338	13.20337	53.16462	13.92828	2.416883	12.34945	3.916294	1.021103
25	1.198316	13.63880	52.83129	13.90470	2.417589	12.30798	3.884943	1.014690
30	1.201586	14.00926	52.57793	13.83465	2.420786	12.28342	3.864356	1.009603

Variance Decomposition of LNUEM

Period	S.E.	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER
1	0.129282	4.115461	5.538139	90.34640	0.000000	0.000000	0.000000	0.000000
5	0.224637	3.244972	5.815228	84.99582	3.965839	0.361442	1.389579	0.227121
10	0.230552	3.671459	7.362596	80.89601	4.803822	1.110188	1.476566	0.679360
15	0.238435	3.818876	10.01331	78.51479	4.577248	1.051821	1.382618	0.641339
20	0.240903	3.974027	10.38980	77.86397	4.674029	1.076035	1.363033	0.659102
25	0.241599	4.071285	10.64801	77.53420	4.649678	1.078289	1.355846	0.662701
30	0.242063	4.148732	10.73012	77.39900	4.636119	1.074495	1.350760	0.660776

Variance Decomposition of LNMPP

Period	S.E.	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER
1	0.110636	14.76038	0.768346	12.55506	71.91622	0.000000	0.000000	0.000000
5	0.233480	8.466581	2.920689	16.13066	34.62103	29.03645	1.545420	7.279163
10	0.272610	11.24470	7.898226	25.77805	26.47784	22.00402	1.211166	5.385995
15	0.295691	13.03389	7.270204	28.18747	25.52017	20.07715	1.172821	4.738294
20	0.304534	16.04956	6.928560	26.81479	24.31671	20.16824	1.116723	4.605429
25	0.311897	18.37555	6.656360	26.09276	23.59977	19.78756	1.076125	4.411875
30	0.318182	20.52187	6.425994	25.08554	23.00848	19.62965	1.047098	4.281371

Variance Decomposition of LNNEX

Period	S.E.	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER
1	0.111929	1.997575	0.215560	6.249670	71.19174	20.34546	0.000000	0.000000
5	0.225441	1.686001	10.52091	36.07514	34.51721	11.20940	3.129734	2.861599
10	0.261035	2.568164	12.87231	41.30742	29.59021	8.879713	2.515457	2.266718
15	0.273889	3.743738	12.54478	43.42115	27.61247	8.221570	2.336278	2.120010
20	0.276247	4.422914	12.61113	43.08876	27.33346	8.118373	2.307720	2.117645
25	0.278767	5.099942	12.71302	42.86183	26.88961	8.076437	2.270856	2.088302
30	0.279716	5.635218	12.66347	42.59176	26.72452	8.054492	2.256104	2.074443

Variance Decomposition of LNCDT

Period	S.E.	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER
1	0.105081	0.341663	10.90085	0.041861	15.28207	11.66444	61.76912	0.000000
5	0.280194	7.642478	49.31024	22.18457	3.103312	6.152759	11.18580	0.420836
10	0.401296	7.096695	44.22121	34.51772	4.034029	3.692266	5.762013	0.676066
15	0.436364	7.692025	45.24876	33.99394	3.789367	3.553013	4.889858	0.833031
20	0.453133	8.056354	45.26382	34.34869	3.620955	3.353150	4.535616	0.821417
25	0.458683	8.407350	45.21757	34.26517	3.569794	3.288893	4.426996	0.824225
30	0.461162	8.681445	45.16156	34.17144	3.531913	3.254634	4.379689	0.819319

Variance Decomposition of LNLER

Period	S.E.	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER
1	0.097071	2.557356	0.338413	14.51674	0.000452	39.24823	6.254491	37.08432
5	0.159474	12.12718	10.39517	9.766074	1.973010	43.45742	7.182883	15.09826
10	0.198837	9.384209	14.89334	26.09847	4.419355	30.36622	4.809384	10.02902
15	0.208543	11.44515	14.83612	24.42309	5.754514	29.60212	4.477418	9.461599
20	0.215443	13.34737	14.75624	24.17264	5.833438	28.73905	4.203928	8.947328
25	0.220451	15.26640	14.18486	23.50563	6.148843	28.24643	4.033852	8.613984
30	0.224186	17.15340	13.72434	22.77937	6.189966	27.87829	3.907505	8.367132

Source: Authors' calculation from Eviews 8

6.5 VALIDATING THE ROBUSTNESS OF THE MODELS

Given the relatively small number of observations, the study checks the robustness of the reduced form VAR results by analysing the stability of parameters using the CUSUM and the CUSUM of squares. This is because when using SVAR, the starting point is the estimation of the reduced form VAR. Figure A5 in Appendix A, shows the parameter stability tests for the reduced form VAR necessary for the estimation of SVAR. The results indicate that in spite of minor episodes of instability the residual variance of each equation is largely stable (the test statistics remain within the 5% critical bands). In addition, Table

A2 in Appendix A shows that the individual variables are normally distributed and this is a critical property when using VAR and SVAR. Figure 6-1 shows the variables in the basic model and their recovered structural innovations. This further corroborates that structural shocks determined are reliable and, therefore, a true reflection of reality. All the preceding tests results indicate that the data being applied is robust and is therefore likely to give reliable and authentic results.

Despite the fact that all models are subjected to robustness checks, the study reports the results of the basic and the small macro-econometric models only. For both models, structural estimates of the coefficients in matrices A and B are presented in Tables C1 and C5 in Appendix C, respectively. The tables indicate that all the coefficients in the two models have standard errors with values less than one suggesting that they are efficient and hence form a solid basis for measuring shocks. In addition, Table C5 also shows that 4 out of 14 structural coefficients have the correct signs revealing that the model is performing remarkably. Inverse roots of the characteristics AR polynomial for the determination of stability or stationarity of the models are reported in Tables C3 and C6, and Figures C1 and C3 for the basic and the small macro-econometric models, respectively. These tables and figures show that all inverse roots of the characteristic AR polynomials have moduli less than one and lie inside the unit circle, implying that at the chosen lag length of order two the estimated models are stable or stationary. Lastly, serial correlation test results are reported in Tables C4 and C7 for the basic and the small macro-econometric models, respectively. There is no evidence of any serious serial correlation in the models. Therefore, both the basic and the small macro-econometric models are robust and their inferences are reliable.

6.6 CONCLUDING REMARKS

This chapter set out to develop and estimate a small macro-econometric model for Namibia from the basic real wage, productivity, unemployment and interest rate model. The first step in the development of the small macro-econometric model was the estimation and analysis of the basic model. The second step was to append the individual demand and exchange rate channel variables to the basic model and then analyse the responses of the

variables in the basic model to sudden increases in the appended variable. The third step was to analyse the responses of the variables in the basic model to shock in lending rates under situations where each of the appended variable was first treated as endogenous and then as exogenous. The latter enabled the researcher to establish if each appended variable contained important additional information that explains the monetary transmission process in Namibia. The results of the basic model reveal that productivity increases after a sudden increase in technology and real wage, and decreases after a sudden increase in unemployment and interest rates. In addition, the results show that real wage generally responds positively to sudden increase in real wage, and productivity and, negatively to a sudden increase in unemployment. However, unemployment increases in the first year after a sudden increase in productivity and then decreases as expected after the first year. However, unemployment decreases after a positive real wage shock and increases after a sudden increase in labour supply and a sudden tightening of monetary policy. The results also show that the interest rates respond to sudden increases in other variables in the expected manner. It is concluded that lending rates in Namibia, largely influence both labour market and monetary variables in a way that is consistent with theoretical expectations.

The results also indicate that import prices, bank lending to the private sector, and the nominal exchange rates all contain important additional information, which explain the monetary transmission process in Namibia. Using the basic model and latter information mentioned above, a small macro-econometric model was specified and estimated. Additionally, using the small macroeconometric model, the study investigated the effects of shocks to import prices, bank credit, nominal exchange rates and lending rates. The results of the small macro-econometric model show that import prices largely influence both the labour (real) variables and other variables significantly. The results also show that the labour market variables and monetary variables respond to exchange rate depreciation as theoretically anticipated and this underscores the importance of a flexible exchange rate system in both labour and monetary sectors in Namibia. Although the bank credit variable was found to have important additional information that explain the monetary transmission process in Namibia, effects of its shocks on productivity, unemployment and nominal

exchange rate is contrary to what is deemed logical. However, the other four variables respond in the correct manner. This simply means that some of these results need to be treated with caution so as not to make wrong inferences and conclusions. Largely, the labour market and monetary variables respond as expected and significantly to the shock in interest rates. This means that our choice of the interest rates equation as the monetary policy reaction function to close the small macro-econometric model is both theoretically and empirically valid.

These results are also confirmed by the variance decomposition results, which show that the fluctuations in lending rates are explained by all the variables in the small macro-econometric model except bank credit, which was previously found to perform poorly. In addition, bank credit also performed poorly as far as explaining the fluctuations in all the other variables in the macro-econometric model. However, the study maintained bank credit in the model simply because its shocks performed well in explaining four of the seven responses in the macro-econometric model.

CHAPTER 7

CONCLUSION, POLICY IMPLICATIONS AND FUTURE RESEARCH

7.1 INTRODUCTION

This chapter concludes the study, proffers policy suggestions based on results obtained in previous chapters and points out areas for future research focus. Section 7.2 presents a brief summary of the thesis. Additionally, Section 7.3 briefly discusses the major empirical findings and conclusions of the study, whereas Section 7.4 presents policy suggestions of the study. Lastly, Section 7.5 discusses the limitations of the study and identifies areas of future research focus.

7.2 SUMMARY OF THE STUDY

The main purpose of this study was to develop a small macro-econometric model for Namibia with special emphasis on the simultaneous modelling of the wage-price, productivity unemployment relationship taking into account that majority of the previous studies only concentrated on simultaneous wage-price relationship. Therefore, the contribution of this thesis is to build a small macro-econometric model of the Namibian economy, which indicates that there is significant statistical support for the hypothesis and that there is a contemporaneous relationship between real wage, productivity and unemployment in Namibia. This phenomenon has not yet been exploited in Namibia using macro-econometric modelling in Namibia, and thus represents a significant contribution to the modelling literature in Namibia. The other ancillary purpose of the study was to determine sources of unemployment in Namibia, given the fact that Namibia has endured long periods of high unemployment rates. The results of the study reinforce previous studies that find evidence of a long run link between unemployment and variables such as productivity, real wages, prices and employment. The results also contribute by raising

further questions about the robustness of time series study by Eita and Ashipala (2010) which found that when wages go up in Namibia, unemployment increases.

In a bid to realise these broad objectives, the study pursued six specific objectives, viz:

(i) To review the macroeconomic environment and provide an overview of the labour market in Namibia for the period 1980 to 2013.

(ii) To determine the sources of unemployment in Namibia using the SVAR methodology.

(iii) To empirically test the impact of shocks in the basic real wage, productivity, unemployment and interest rates model.

(iv) To analyse empirically the dynamic effects of demand shocks on the monetary policy transmission process.

(v) To specify, estimate and evaluate the macro-econometric model with a lending rate reaction function.

(vi) To proffer some policy recommendation based on obtained results.

The study also analysed the performance of the macroeconomy of Namibia with special emphasis on the labour market highlighting key challenges that the country faces. In particular, the performance of the Namibian labour market was compared with the performance of the SACU countries. Using both theoretical and empirical literature, the study justified the extension of the simultaneous wage-price model to a simultaneous wage-price, productivity unemployment model. The theoretical models discussed are applicable in imperfectly competitive environments since markets in developing countries are imperfectly competitive. These include the new Keynesian wage-price model, the competing claims model of a unionised economy, the wage price model of an open economy, and the generalised efficiency wage-price model of productivity, unemployment and wages.

Following from the objectives, the study used two SVAR models to investigate the sources of unemployment and to develop the small macro-econometric model for Namibia. The first model discussed in Chapter 5 is the model for the sources of unemployment based on

Dolado and Jimeno (1997) and Linzert (2001). In this model, the study estimates and analyses IRFs and FEVDs of a five variable SVAR comprised of productivity, real wages, prices, employment and unemployment.

The macro-econometric model of the Namibian economy was developed using three SVAR modular experiments and it borrows ideas from studies by Watzka (2006), Disyatat and Vongsinsirikul (2003) and Ngalawa and Viegi (2011). First, the study estimates a basic model comprising the country's real wage, productivity, unemployment and interest rate relationship (Watzka, 2006). The essence of this basic model that incorporates the interest rate to the key variables of the study is to establish which labour market variables are affected by lending rates. At the second level of analysis, the study separately appends demand and exchange rate channel variables to the basic model and estimate the resultant model. If shocks to the appended variables are important in explaining variables in the basic model, there is need to incorporate them in the small macro-econometric model. Additionally, two sets of impulse responses are estimated in each case: one with the variable of interest calculated endogenously, while the other calculates the variable of interest exogenously (Disyatat and Vongsinsirikul, 2003; Morsink and Bayoumi, 2001; Ngalawa and Viegi, 2011). The latter procedure generates an SVAR comparable to the former even though it blocks off any responses within the SVAR that pass through the variable of interest (Disyatat and Vongsinsirikul, 2003). The next stage in the second modular experiment was to compare these two sets of impulse responses. Therefore, the size differences in the impulse responses are an indicator of the level of additional information contained in the series of interest, which explains a particular transmission channel. Large differences indicate that there is more information in the variable of interest and suggest that the related transmission channel is of great importance. In particular, the current study investigated the level of additional information contained in the individual series of interest, which explains the monetary transmission channel. At the third and final level of analysis, the study pooled all variables found to have important additional information in explaining the country's monetary transmission process and appended them to the basic model to create a composite SVAR referred in this study as the small macro-

econometric model. The ultimate aim of the study was to find out if lending rates have a role to play in influencing macroeconomic and labour market variables. This implied that only the short run analysis of the study conformed to the subject matter investigated. There was, therefore, little value in extending the study of the monetary transmission process to cover the long run since economists generally agree that monetary policy affects only the price level in the long-run and not the other variables (Disyatat and Vongsinsirikul, 2003).

7.3 SUMMARY OF EMPIRICAL FINDINGS

7.3.1 The sources of unemployment model

The empirical findings of the sources of unemployment model reveal that:

1. Unemployment permanently decreases after a technology shock. The explanation for this is that a technology shock leads to a permanent increase in output, which in turn leads to a permanent increase in employment, and hence a permanent decrease in unemployment. The results discussed here are in conformity with the results obtained by Maidorn (2003), Dolado and Jimeno (1997) for the Austrian and Germany economies, respectively.

2. The initial response of unemployment after a positive labour demand shock is to decrease which makes theoretical and empirical sense.

3. In the first seven years, unemployment is not significantly affected shocks to real wages. However, after seven years unemployment decreases after a shock in real wages. This outcome is contrary to Eita and Ashipala (2010) who found that wage increases cause unemployment to increase in Namibia. The conflicting results suggest that the results need to be considered cautiously and indicate that there is still need for further research in this area of study in Namibia

4. Unemployment significantly decreases with a lag of one year after a sudden increase in price in the short run and then increases permanently in the long run. The rationale behind this is that an increase in price affects output and real wages negatively in the short run and this in turn leads to an increase in unemployment in the long run.

5. The labour supply shocks permanently increase unemployment and significantly and correctly affect the other variables in the model. Since all shocks to variables in the model have long lasting effects on unemployment, the economy is experiencing full hysteresis.

6. The variance decomposition results show that the fluctuations in unemployment are explained by all shocks, except the price inflation shock in the short run. However, in the long run, all shocks are significant in explaining fluctuations in unemployment. In addition, labour supply shocks account for a greater proportion of fluctuations in unemployment followed by labour demand, price inflation, real wage and productivity shocks, respectively. The variance decomposition results seem to bolster the IRFs results.

7.3.2 The small macro-econometric model

The empirical findings of the small macro-econometric model reveal that:

7. Real wages, productivity, unemployment in Namibia can be jointly determined: models, which estimate these variables separately, are potentially mis-specified and are ignoring a recent trend in other open economies that highlight the contemporaneous relationship between these variables. In this study, labour market variables were combined with the interest rate variable to create a basic model whose variables significantly affect each other contemporaneously as illustrated by the IRFs. These findings paved way for further analysis to be executed.

8. The results show that the demand channel variables, particularly import prices and bank credit to the private sector have important additional information, which affects the monetary transmission process in Namibia. In addition, shocks to import prices in the macro-econometric model affected all labour market and monetary variables significantly. However, shocks to bank credit gave results that were theoretically partially correct.

9. The results show that the exchange rate in the exchange rate channel has important additional information, which affect the monetary transmission process in Namibia. In addition, shocks to the exchange rate in the macro-econometric model affected all labour market and monetary variables significantly, which helped to confirm their significance. This underscores the importance of the flexible exchange rate system used in Namibia in both the labour and monetary sectors. The exchange rate can also be regarded as a demand channel variable since it affects exports.

10. The study also investigated the effect of lending rate shocks on the labour and other variables in the macro-econometric model and found that lending rate shocks affect all variables correctly and significantly. It is noteworthy that shocks to the demand channel and exchange rate channel variables also correctly and significantly affected lending rates. Largely, the labour market and monetary variables respond as expected and significantly to shock in lending rates. There is definitely no ambiguity between the way lending rate shocks affects or is affected by other variables.

11. Fluctuations in lending rates are explained by all variables in the small macro-econometric model except bank credit, which previously performed poorly. In addition, bank credit also performed poorly as far as explaining the fluctuations in all the other variables in the macro-econometric model. The study therefore highlights that bank credit results need to be treated cautiously as alluded to earlier.

7.4 CONCLUSIONS AND POLICY IMPLICATIONS

Although the recommendations resulting from this study may be used with caution because of the limited data and generated data set used, the following conclusions and recommendations are reached based on the findings of the study.

7.4.1 The sources of unemployment model

1. The empirical results provide strong implications for economic policy. Since unemployment is the result of interactions of several structural shocks (impulse mechanism) and hysteresis effects (propagation mechanism), policy implications involve both aspects. As far as structural shocks are concerned, the role of aggregate demand shocks and price shocks in influencing the Namibian unemployment evolution provides a rather important insight for macroeconomic policy designs. Starting from the role of aggregate demand shocks, the findings offer new evidence on the strong long run relationship between demand policies and unemployment. If hysteresis is a relevant phenomenon, the analysis implies that demand-side policies matter for output and unemployment, not only in the short run, but also in the long run.

2. Since price shocks play a role in explaining high unemployment rates in the long run, policies that lower mark-up contribute to reducing the unemployment rate. The deregulation policies operate primarily through the regulation of the product market with the aim of increasing the degree of competition among firms. In the context of the Southern African Customs Union, of which Namibia is a member, such policies may include, for example, the reduction of tariff barriers or standardization measures. Deregulation policies that are intended to reduce entry costs may consist of the elimination of state monopolies or the reduction of red tape associated with the creation of new firms. If the number of firms is not fixed in the long run, a reduction in entry costs leads to an entry of new firms, unemployment will hence be lowered, and a higher real wage may be realised.

3. Empirical analysis has also important policy implications concerning hysteresis effects as a propagation mechanism. Since hysteresis effects arising from the insider-outsider framework make adverse shocks to have quite long lasting influences, the insider-outsider theory plays a crucial role in eliminating unemployment persistence. Despite the diversity of political implications in this respect, the common emphasis is the creation of a more level playing field in the labour market. As long as insiders have favourable opportunities than outsiders, policies that guarantee a more level playing field between insiders and outsiders can improve efficiency and equity. Generally, two broad types of policies can be identified in this context: power-reducing policies that reduce insiders' market power and enfranchising policies that strengthen outsiders' voice in the wage bargaining process. Power-reducing policies range from restrictions on strikes to relaxing job security legislation. For example, laws simplifying firing procedures, reducing litigation costs and reducing severance pay. These policies tend to reduce insiders' welfare. Therefore, insiders may resist these policies, which will limit the effectiveness of power-reducing policies. The general form of enfranchising policies are vocational training programs and job counselling for the unemployed, schemes to convert wage claims into equity shares, policies to reduce the occupational, industrial, and geographic coverage of union wage agreements and again policies to reduce barriers to the entry of new firms.

4. Within a theoretical framework where the labour market is rigid and structural reforms can play a role, certain monetary and fiscal policies are powerful. The reason why such policies are important instruments for the reduction of unemployment, namely the rigidity in the labour market, exactly justifies structural reforms. Hysteresis in the unemployment rate makes economic policies effective, not only in the short run but also in the long run. Therefore, aggregate demand policies should be considered as useful instruments to tackle unemployment and they are complementary rather than contrasting with structural labour market

reforms. This means that the expansion of demand will make labour market policies more effective.

7.4.2 The small macro-econometric model

5. Real wages, productivity, unemployment in Namibia can be jointly determined: models, which estimate these variables separately, are potentially mis-specified and are ignoring a recent trend in other open economies that highlight the contemporaneous relationship between these variables. In this study, the labour market variables were combined with the interest rate variable to create a basic model whose variables contemporaneously and significantly affect each other as illustrated by the IRFs previously.

6. The results show that the demand channel variables, particularly import prices and bank credit to the private sector have important additional information, which affects the monetary transmission process in Namibia. In addition, shocks to import prices in the macroeconometric model affected all the labour market and monetary variables significantly. However, shocks to bank credit gave results that were theoretically partially correct. The results also show that the exchange rate has important additional information, which affect the monetary transmission process in Namibia. In addition, shocks to the exchange rate in the macroeconometric model affected all the labour market and monetary variables significantly, which helped to confirm their significance. This underscores the importance of the flexible exchange rate system used in Namibia to both the labour and monetary sectors. As demonstrated both IRFs and variance decomposition results confirm that real (labour market) shocks have important effects on monetary variables in Namibia.

7. The study also investigated the effect of lending rate shocks on labour and other variables in the macroeconometric model and found that lending rate shocks affect all variables correctly and significantly. Additionally, shocks to the demand

channel and exchange rate channel variables also correctly and significantly affected interest rate. Largely, the labour market and monetary variables respond as expected and significantly to the sudden a positive shock in interest rates. There is definitely no ambiguity between the way interest rate affects or is affected by the real variables. Fluctuations in lending rates are explained by all the real variables in the small macro-econometric model. The only variable that performed poorly in explaining lending rates is bank credit, which needs to be treated cautiously in this study.

8. Contractionary interest rate policy in a small open economy with a freely floating exchange has a sustained downward impact on real domestic activity over the short to medium term. Specifically, contractionary monetary policy reduces productivity and real wage and, increases unemployment implying that expansionary interest rate policy results in favourable outcomes. This suggests that money is non-neutral in Namibia. If the central bank is able to modify long run interest rates, then monetary authorities can reduce unemployment using expansionary lending policy. However, sometimes the central bank is unable to affect the long-term interest rates since they depend on the effect of fiscal policy over long-term cost of borrowing. This issue is beyond the scope of this study. The current study only notes that demand policies which affect long-term interest rates can reduce unemployment, though it is unclear what form these polices need to take.

9. The impact of rising world import prices on the economy (or the negative terms of trade shock), assuming the BoN attempts to keep inflation and output at particular levels, a fall in the exchange rate is cushioned by a rise in the lending rate. The latter controls inflation, but does not allow for a large and sustained decrease in output and an increase in unemployment. The study therefore concludes that higher import prices hurt the manufacturing sector since Namibian companies heavily rely on imported machines, equipment and raw materials from both the developed and developing countries. The country has to ensure that it comes up with policies that

ensure stability of the exchange rate so as not to hurt the manufacturing sector. The fact that demand, and exchange rate channel variables were found to have important additional information that explain the monetary transmission channel, implies that monetary policy can be influenced through these channels.

7.5 LIMITATIONS OF THE STUDY AND AREAS OF FUTURE RESEARCH

In spite of the efforts to make the current study analytically plausible, it has a few limitations just like many other scientific empirical studies.

First, the thesis is likely to suffer from the problem of inadequate data and generated data. The choice of annual data for the period 1980 to 2013 for the study was mainly dictated by the availability of macroeconomic data. It is to be noted that unemployment data is not readily available in many countries, particularly developing countries. Although, the SVAR diagnostic tests appear to suggest that the data does not have any problems, it may also be argued that a longer research period could positively influence the results. It is most likely that the use of annual data could have negatively affected the precision of parameter estimates, because in studies of this nature, as explained earlier, quarterly data is preferable. Use of annual data limited the number of lags that could be employed for all the models to only two. Annual data had to be analysed given the fact that quarterly data for most variables were not available. It would indeed be more fascinating to compare these results with future studies employing more data points.

Second, it may be argued that the macro-econometric model may likely be underspecified, a constraint that may be related to data limitation. However, it was pointed out earlier that a seven variable SVAR is already large by SVAR standards and that increasing the number of variables without proper justification would only decrease the power of the model without making meaningful additions to the output. A more credible limitation of the study relates to the treatment given to exchange rate in the current study because of the fact that the study employs annual and not quarterly and/or monthly data. In fact, the exchange rate was treated just like any other variable in the macro-econometric model. In most similar

studies that use quarterly and monthly data, the exchange rate is assumed contemporaneously affected by all variables in the model. With the availability of quarterly and/or monthly data in future, it would be more interesting to compare the current results with results that consider the immediate responses of the exchange rate to shocks in all the other variables in the model.

Third, future research can also incorporate variables, such as capital stock and a proxy for skills mismatch in the unemployment model and see if their shocks are important in explaining unemployment in Namibia. Since capital stock is a demand side variables, this would help further prove the finding that lack of effective demand causes unemployment in Namibia. The current study could not include it because the theoretical model adopted has no provision for capital stock variable. In addition, an SVAR study that considers a sectoral analysis distinguishing agriculture and manufacturing can be used and this is because agriculture remains the biggest employer in Namibia. Such a study will provide answers on how changes in wages influence the short-run and long run dynamics of labour productivity, prices, employment and unemployment in the agricultural and manufacturing sectors.

In spite of the fact that these limitations could have negatively affected the empirical results in the current thesis, it is assumed that their impacts are nominal and that they do not significantly affect the theoretical and empirical findings of the current study.

REFERENCES

Ajilore, T., & Ikhide, S., 2013. Monetary policy shocks, output and prices in South Africa: a test of policy irrelevance proposition. *The Journal of Developing Areas*, *47*(2), 363-386.

Akanbi, O.A., & Du Toit, C.B., 2011. Macro-econometric modelling for the Nigerian economy: A growth–poverty gap analysis. *Economic Modelling*, *28*(1), 335-350.

Akerlof, G.A., & Yellen, J.L., 1990. The fair wage-effort hypothesis and unemployment. *The Quarterly Journal of Economics*, 105, 255-283.

Alessi, L., Barigozzi, M., & Capasso, M., 2011. Non-fundamentalness in structural econometric models: A review. *International Statistical Review*, *79*(1), 16-47.

Allen, C., Hall, S., 1997. *Macroeconomic modelling in a changing world*, eds. ed. John Wiley and Sons, England.

Alom, F., Ward, B.D., & Hu, B., 2013. Macroeconomic effects of world oil and food price shocks in Asia and Pacific economies: application of SVAR models. *OPEC Energy Review*, *37*(3), 327-372.

Amidu, M., 2006. The Link between Monetary Policy and Banks Lending Behavior: The Ghanaian Case. Banks and Bank Systems 1, 38–48.

Amisano, G., Giannini, C., 1997. *Topics in structural VAR econometrics*. Springer Publishing House, Berlin.

Ando, A., & Brayton, F., 1993. *Prices, wages and employment in the US economy: a traditional model and tests of some alternatives* (No. w4568). National Bureau of Economic Research.

Andrews, M.J., Bell, D.N.F., Fisher, P.G., Wallis, K.F., & Whitley, J.D., 1985. Models of the UK economy and the real wage-employment debate. *National Institute Economic Review*, *112*(1), 41-52.

Annicchiarico, B., & Pelloni, A., 2013. Productivity growth and volatility: how important are wage and price rigidities?. *Oxford Economic Papers*, gpt013.

Arango, L.E., Iregui, A.M., & Melo, L.F., 2003. Recent behaviour of output, unemployment, wages and prices in Colombia: What went wrong? *Borradores de Economía*, *249*.

Arestis, P., Baddeley, M., & Sawyer, M., 2007. The relationship between capital stock, unemployment and wages in nine EMU countries. *Bulletin of Economic Research*, *59*(2), 125-148.

Ashenfelter, O., & Card, D., (1982). Time series representations of economic variables and alternative models of the labour market. *The Review of Economic Studies*, *49*(5), 761-782.

Baffoe-Bonnie, J., & Gyapong, A.O., 2012. The dynamic implications for wage changes on productivity, prices, and employment in a developing economy: a structural VAR analysis. *The Journal of Developing Areas*, *46*(2), 397-417.

Balcilar, M., & Tuna, G., 2009. Sources of macroeconomic fluctuations in a volatile small open economy. *Turkish Studies*, *10*(4), 613-629.

Ball, L., Moffitt, R., 2002. *Productivity growth and the Phillips curve. In A. Krueger Y R. Solow, Eds., the roaring nineties: Can full employment be sustained? New York: Russell Sage Foundation* (No. 8421). Also NBER Working Paper.

Balmaseda, M., Donaldo, J., Lopez-Salido, D., 2000. The dynamic effects of shocks to labour markets: evidence from OECD countries. *Oxford Economic Papers*, 52, 3–23.

Bank of Namibia., 1991-2013. Annual reports. Bank of Namibia: Windhoek.

Bårdsen, G., & Fisher, P.G. 1999. Economic theory and econometric dynamics in modelling wages and prices in the United Kingdom. *Empirical Economics*, *24*(3), 483-507.

Bårdsen, G., Eitrheim, ø., Jansen, E.S., Nymoen, R., 2005. *The econometrics of macroeconometric modelling*. Oxford University Press, Oxford.

Bårdsen, G., Hurn, S., & McHugh, Z., 2007. Modelling Wages and Prices in Australia*. *Economic Record*, *83*(261), 143-158.

Bårdsen, G., Jansen, E.S., & Nymoen, R., 2003. Econometric inflation targeting. *The Econometrics Journal*, *6*(2), 430-461.

Bårdsen, G., Jansen, E.S., & Nymoen, R., 2004. Econometric evaluation of the New Keynesian Phillips Curve. *Oxford Bulletin of Economics and Statistics*, *66*(s1), 671-686.

Barlevy, G., 2011. Evaluating the role of labour market mismatch in rising unemployment. Economic Perspectives 35.

Batini, N., & Greenslade, J.V. 2006. Measuring the UK short-run NAIRU. *Oxford Economic Papers, 58*(1), 28-49.

Berkelmans, L., 2005. Credit and monetary policy: an Australian SVAR. *Reserve Bank of Australia Canberra*, ACT, p1-32.

Bernanke, B.S., & Mihov, I., 1998, December. The liquidity effect and long-run neutrality. In *Carnegie-Rochester Conference Series on Public Policy* (Vol. 49, pp. 149-194). North-Holland.

Bernanke, B.S., 1986. Alternative Explorations of the Money Income Correlation. *Carnegie Rochester Conference Series on Public Policy,* 25, 49–99.

Bernanke, B.S., Gertler, M., Watson, M., Sims, C.A., & Friedman, B.M., 1997. Systematic monetary policy and the effects of oil price shocks. *Brookings Papers on Economic Activity*, 91-157.

Bernanke, B.S., Mihov I., 1998. Measuring monetary policy. *Quarterly Journal of Economics,* 113: 869–902.

Bhattacharyya, S., & Hatton, T.J., 2011. Australian Unemployment in the Long Run, 1903–2007. *Economic Record*, *87*(277), 202-220.

Bhuiyan, R., 2008. *Monetary transmission mechanism in a small open economy: A Bayesian structural VAR approach* (No. 1183). Queen's Economics Department Working Paper.

Black, L., Hancock, D., Passmore, S.W., 2010. The bank lending channel of monetary policy and its effect on mortgage lending.

Blanchard, O., Kartz, L., 1999. Wage dynamics: reconciling theory and evidence. *American Economic Review,* 89, 69–74.

Blanchard, O., Watson, M.W., 1986. *Are business cycles All Alike in the American business cycle?* Chicago University Press, Chicago.

Blanchard, O.J., & Summers, L.H., 1986. Hysteresis and the European unemployment problem. In *NBER Macroeconomics Annual 1986, Volume 1* (pp. 15-90). MIT Press.

Blanchard, O.J., 1989. A traditional interpretation of macroeconomic fluctuations. *The American Economic Review*, 79, 1146-1164.

Blanchard, O.J., Quah, D., 1989. The dynamic effects of aggregate demand and aggregate supply disturbances. *American Economic Review,* 79: 655–673.

Blangiewicz, M., & Bołt, T.W., 1993. Specification of dynamic wage-price relations in Poland (1980–1991). *Economics of Planning*, *26*(1), 15-38.

Brischetto, A., & Voss, G., 1999. *A Structural vector autoregression model of monetary policy in Australia*. Economic Research Department, Reserve Bank of Australia.

Brüggemann, R., 2006. Sources of German unemployment: a structural vector error correction analysis. *Empirical Economics*, *31*(2), 409-431.

Bryson, A., & Forth, J., 2008. *The theory and practice of pay setting* (pp. 491-512). Sage Publishing.

Calvo, G.A., 1983. Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics*, *12*(3), 383-398.

Carlin, W., Soskice, D., 1990. *Macroeconomics and the wage bargain: A modern approach to employment, inflation and exchange rate*. Oxford University Press, Oxford.

Carstensen, K., Hansen, G., 2000. Cointegration and common trends on the West German labour market. *Munich Reprints in Economics*, University of Munich, Department of Economics 19947.

Chang, C.C., Chung, S.L., & Stapleton, R.C., 2007. Richardson extrapolation techniques for the pricing of American-style options. *Journal of Futures Markets*, *27*(8), 791.

Chen, P., & Flaschel, P., 2005. Keynesian dynamics and the wage–price spiral: identifying downward rigidities. *Computational Economics*, *25*(1-2), 115-142.

Chen, P., & Hsiao, C.Y., 2010. Causal Inference for Structural Equations: With an Application to Wage-Price Spiral. *Computational Economics*, *36*(1), 17-36.

Cheng, M.K.C., 2006. *A VAR analysis of Kenya's monetary policy transmission mechanism: How does the Central Bank's REPO rate affect the economy?* (No. 6-300). International Monetary Fund.

Chow, G.C., & Lin, A.L., 1971. Best linear unbiased interpolation, distribution, and extrapolation of time series by related series. *The review of Economics and Statistics*, 372-375.

Christiano, L.J., Eichenbaum, M., & Evans, C.L., 1999. Monetary policy shocks: What have we learned and to what end?. *Handbook of macroeconomics*, *1*, 65-148.

Christiano, L.J., Eichenbaum, M., & Evans, C.L., 2005. Nominal rigidities and the dynamic effects of a shock to monetary policy. *Journal of political Economy*, 113(1), 1-45.

Christiano, L.J., Eichenbaum, M., & Vigfusson, R., 2004. The response of hours to a technology shock: evidence based on direct measures of technology. *Journal of the European Economic Association*, *2*(2-3), 381-395.

Christopoulos, D.K., & León-Ledesma, M.A., 2010. Revising the real wages-unemployment relationship: New results from non-linear models. *Bulletin of Economic Research*, *62*(1), 79-96.

Clarida, R., Gali, J., Gertler, M., 1999. The science of monetary policy: a new Keynesian perspective. *Journal of Economic Literature*, 37, 1661–707.

Cochrane, J.H., 1994. Permanent and transitory components of GNP and stock prices. *The Quarterly Journal of Economics*, 109, 241-265.

Cohen, J.E., 1986. Population forecasts and confidence intervals for Sweden: A comparison of model-based and empirical approaches. *Demography*, *23*(1), 105-126.

Collard, F., & De la Croix, D. (2000). Gift exchange and the business cycle: the fair wage strikes back. *Review of economic dynamics*, *3*(1), 166-193.

Cuong, N.V., 2011. Do minimum wage increases cause inflation?: evidence from Vietnam. *ASEAN Economic Bulletin*, *28*(3), 337-359.

Cutler, H., Davies, S., & Schmidt, M., 1997. The demand for nominal and real money balances in a large macroeconomic system. *Southern Economic Journal*, 947-961.

Danthine, J.P., & Kurmann, A., 2004. Fair wages in a New Keynesian model of the business cycle. *Review of Economic Dynamics*, *7*(1), 107-142.

Danthine, J.P., Donaldson, J., 1990. Efficiency wages and real business cycles. *European Economic Review*, 34, 1275–301.

Darrat, A.F., 1994. Wage growth and the inflationary process: A re-examination. *Southern Economic Journal*, 181-190.

Das, S., 2015. Monetary Policy in India: Transmission to Bank Interest Rates.

Davidson, J., & Hall, S.. (1991). Cointegration in recursive systems. *The Economic Journal*, 239-251.

De la Croix, D., de Walque, G., & Wouters, R., 2009. A note on inflation persistence in a fair wage model of the business cycle. *Macroeconomic Dynamics*, *13*(05), 673-684.

Di Pietro, G., Urwin, P., 2006. Education and skills mismatch in the Italian graduate labour market. Applied Economics 38, 79–93.

Disyatat, P., & Vongsinsirikul, P., (2003). Monetary policy and the transmission mechanism in Thailand. *Journal of Asian Economics*, *14*(3), 389-418.

Dixon, H., & Le Bihan, H., 2012. Generalised Taylor and Generalised Calvo price and wage setting: Micro-evidence with macro implications. *The Economic Journal*, *122*(560), 532-554. doi:10.1111/j.1468-0297.2012.02497.x

Dolado, J. J., & Jimeno, J.F., 1997. The causes of Spanish unemployment: A structural VAR approach. *European Economic Review*, *41*(7), 1281-1307.

Dolado, J.J., Felgueroso, F., Jimeno, J.F., 1997. The effects of minimum bargained wages on earnings: Evidence from Spain. *Working Papers*, 97-04, FEDEA.

Dos Santos Ferreira, R., & Michel, P., 2013. Keynes' wage-price dynamics. *Metroeconomica*, *64*(1), 44-72. doi:10.1111/j.1467-999X.2012.04165.x

Downes, A. S., Holder, C., & Leon, H. (1990). The wage-price-productivity relationship in a small developing country: the case of Barbados. *Social and Economic Studies*, 39, 49-77.

Duarte, R., & Marques, C.R., 2013. The dynamic effects of shocks to wages and prices in the United States and the Euro Area. *Empirical Economics*, *44*(2), 613-638.

Dufour, J.M., Khalaf, L., & Kichian, M., 2009. Structural multi-equation macroeconomic models: Identification-robust estimation and fit (No. 2009, 19). *Bank of Canada Working Pape*r.

Dungey, M., & Pagan, A., 2000. A structural VAR model of the Australian economy. *Economic Record*, *76*(235), 321-342. doi:10.1111/j.1475-4932.2000.tb00030.x

Dungey, M., & Pagan, A., 2009. Extending a SVAR model of the Australian economy. *Economic Record*, *85*(268), 1-20. doi:10.1111/j.1475-4932.2008.00525.x

Eita, J.H., & Ashipala, J.M., 2010. Determinants of unemployment in Namibia. *International Journal of Business and Management*, *5*(10), p92.

Eita, J.H., & Du Toit, C.B., (2009). Explaining long-term growth in Namibia: economics. *South African Journal of Economic and Management Sciences*, *12*(1), 48-62.

Enders, W., 2004. *Applied econometric time series*, Second Edition. John Wiley and Sons, United Kingdom.

Enders, W., Prodan, R., 2008. Forecasting persistent data with possible structural breaks: old school and new school lessons using OECD unemployment rates. *Frontiers of Economics and Globalization*, 3, 231–269.

Espinosa-Vega, M.A., & Russell, S., 1997. History and theory of the NAIRU: a critical review. *Economic Review-Federal Reserve Bank of Atlanta*, *82*(2), 4-25.

Espinosa-Vega, M.A., 1998. How powerful is monetary economics in the long run? *Federal Reserve Bank of Atlanta Economic Review*, 83, 12–31.

European Commission 2012b. *Employment and social developments in Europe 2012*. Luxembourg: Publications Office. http://dx.doi.org/10.2767/86080

Evans, G.W., 1989. Output and unemployment dynamics in the United States: 1950–1985. *Journal of Applied Econometrics*, *4*(3), 213-237.

Faust, J., & Leeper, E.M. 1997. When do long-run identifying restrictions give reliable results?. *Journal of Business & Economic Statistics*, *15*(3), 345-353. doi:10.1080/07350015.1997.10524712

Favero, C.A., & Favero. 2001. *Applied macroeconometrics*. Oxford: Oxford University Press.

Fonseca, J.R., 2008. The application of mixture modelling and information criteria for discovering patterns of coronary heart disease. *Journal of Applied Quantitative Methods*, *3*(4), 292-303.

Forslund, A., Gottfries, N., & Westermark, A., 2008. Prices, productivity and wage bargaining in open economies. *The Scandinavian Journal of Economics*, *110*(1), 169-195. doi:10.1111/j.1467-9442.2008.00531.x

Fragetta, M., & Melina, G. (2011). The effects of fiscal policy shocks in SVAR models: a graphical modelling approach. *Scottish Journal of Political Economy*, *58*(4), 537-566.

Fragetta, M., 2010. Monetary policy and identification in SVAR models: A data oriented perspective.

Friedman, M., 1968. The role of monetary policy. *The American Economic Review*, 58, 1–17.

Fritsche, U., & Logeay, C., 2002. *Structural unemployment and the output gap in Germany: Evidence from an SVAR analysis within a hysteresis framework* (No. 312). DIW-Diskussionspapiere.

Galí, J., & Rabanal, P., 2005. Technology shocks and aggregate fluctuations: How well does the real business cycle model fit post-war US data?. In *NBER Macroeconomics Annual 2004, Volume 19* (pp. 225-318). MIT Press.

Gambetti, L., & Pistoresi, B., 2004. Policy matters. The long run effects of aggregate demand and mark-up shocks on the Italian unemployment rate. *Empirical Economics*, *29*(2), 209-226.

García-Cintado, A., Romero-Ávila, D., & Usabiaga, C., 2014. *Spanish regional unemployment: Disentangling the sources of hysteresis*. Imprint: Springer.

Garratt, A., Lee, K., Pesaran, M. H., & Shin, Y., 2012. *Global and national macroeconometric modelling: A long-run structural approach*. Oxford University Press.

Genberg, H., & Pauwels, L., 2005. Wage-price dynamics and deflation in Hong Kong. *Pacific Economic Review*, *10*(2), 191-216.

Ghali, K.H., 1999. Wage growth and the inflation process: A multivariate cointegration analysis. *Journal of Money, Credit and Banking*, 417-431.

Gil, A.R., 2012. *Causes of unemployment and the effectiveness of demand policies.* Doctoral Dissertation, Leeds University.

Glocker, C., 2012. Unemployment compensation and aggregate fluctuations. *International Review of Economics*, *59*(1), 21-39. doi:10.1007/s12232-011-0136-7.

Gordon, R.J., 1986. Productivity, wages and prices: Inside and outside of manufacturing in the US, Japan and Europe. NBER Working Paper No. 2070, 1986.

Gordon, R.J., 2011. The history of the Phillips curve: Consensus and bifurcation. *Economica*, *78*(309), 10-50. doi:10.1111/j.1468-0335.2009.00815.x

Gottschalk, J., 2007. *Monetary policy and the German unemployment problem in macroeconomic models: theory and evidence* (Vol. 334). Springer Science & Business Media.

Granger, C.W., 1988. Some recent development in a concept of causality. *Journal of econometrics*, *39*(1), 199-211.

Green, P., 1987. "Cutting the wire": Labour control and worker resistance in Namibia. *Southern African Perspectives*, 2, 1–6.

Gwin, C., VanHoose, D.D., 2012. Price and wage stickiness, inflation and profits. *The Manchester School*, 80(3), 263-278.

Hakkio, C.S., & Rush, M., 1989. Market efficiency and cointegration: an application to the sterling and deutschemark exchange markets. *Journal of international money and finance*, *8*(1), 75-88.

Hammersland, R., & Traee, C.B., 2014. The financial accelerator and the real economy: A small macroeconometric model for Norway with financial frictions. *Economic Modelling, 36*, 517-537.

Hendry, D.F., 1986. Econometric modelling with cointegrated variables: an overview. *Oxford bulletin of economics and statistics*, *48*(3), 201-212.

Hoxha, A., 2010. Causality between prices and wages: VECM analysis for EU-27. *The Romanian Economic Journal*, *13*(37), 3-38.

Hu, L., & Toussaint-Comeau, M., 2010. Do labour markets activities help predict inflation? *Economic Perspectives*, *34*(2).

Jacobs, J.P., Wallis, K.F., 2005. Comparing SVARs and SEMs: two models of the UK economy. *Journal of Applied Econometrics,* 20, 209–228.

Jacobs, J.P.A.M., Kuper, G.H., & Sterken, E., 2003. A structural VAR model of the euro area. In *CPB Workshop on Economic Policy Modelling, The Hague, November*.

Johansen, S., 1992. Cointegration in partial systems and the efficiency of single-equation analysis. *Journal of econometrics*, *52*(3), 389-402.

Johasen, S., Mosconi, R., Nielsen, B., 2000. Cointegration in the presence of structural breaks in the deterministic trend. *Econometrics Journal* 3, 216–49.

Kaminska, I., 2013. A no-arbitrage structural vector autoregressive model of the UK yield curve. *Oxford Bulletin of Economics and Statistics*, *75*(5), 680-704. doi:10.1111/obes.12001.

Kanyenze, G., & Lapeyre, F., 2012. *Growth, employment and decent work in Namibia: A situation analysis* (No. 468662). International Labour Organization.

Karanassou, M., & Sala, H. 2012. Productivity growth and the Phillips curve: a reassessment of the US experience. *Bulletin of Economic Research*, *64*(3), 344-366.

Karanassou, M., Sala, H., & Snower, D.J., 2010. Phillips curves and unemployment dynamics: a critique and a holistic perspective. *Journal of Economic Surveys*, *24*(1), 1-51. doi:10.1111/j.1467-6419.2009.00598.x

Kilian, L., 2011. *Structural vector autoregressions*. CEPR.

Kim, K.H., Zhou, Z., & Wu, W.B., 2010. Non-stationary structural model with time-varying demand elasticities. *Journal of Statistical Planning and Inference*, *140*(12), 3809-3819.

Kim, S., & Roubini, N., 2000. Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach. *Journal of Monetary Economics*, *45*(3), 561-586.

King, R.G., Plosser, C.I., Stock, J.H., & Watson, M.W. 1991. Stochastic trends and economic fluctuations. *The American Economic Review*, 81(4), 819.

Kolsrud, D., & Nymoen, R., 2012. Modelling the heuristic dynamics of the wage and price curve model of equilibrium unemployment.

Kolsrud, D., Nymoen, R., 1998. Unemployment and the open economy wage-price spiral. *Journal of Economic Studies*, 25, 450–467.

Kolsrud, D.O., & Nymoen, R., 2015. Heuristic vs formal dynamics of the wage-and price-curve model of equilibrium unemployment. *Journal of Economic Studies*, *42*(2), 186-206.

Krolzig, H.M., 2003. General-to-specific model selection procedures for structural vector autoregressions. *Oxford Bulletin of Economics and Statistics*, *65*(s1), 769-801.

Langton, D., 2008, July. United States-Southern African Customs Union (SACU) Free Trade Agreement negotiations: background and potential issues. *Library of congress Washington DC Congressional Research Service*.

Layard, R., Nickell, S., Jackman, R., 1991. *Unemployment: macroeconomic performance and the labour market*. Oxford University Press, Oxford: United Kingdom.

Lemos, S., 2007. Minimum wage effects on wages, employment and prices in Brazil, in: Aspects of worker well-being in labour economics. *Emerald Group Publishing Limited*, pp. 397–413.

Leshoro, T.L., 2013. Does economic growth lead employment in South Africa?. *Journal of Economics and Behavioural Studies*, *5*(6), 336-345.

Lin, J.L., 2006. Teaching notes on impulse response function and structural VAR. *Institute of Economics, Academia Sinica, Department of Economics, National Chengchi University*, 1-9.

Lindbeck, A., & Snower, D. J. (1987). Union activity, unemployment persistence and wage-employment ratchets. *European Economic Review*, *31*(1), 157-167.

Lindbeck, A.L., 1993. *Unemployment and macroeconomics*. The MIT Press, Cambridge United Kingdom.

Lindbeck, A.L., Snower, D.J., 1986. Wage setting, unemployment and insider-outsider relations. American Economic Review 76, 235–39.

Lindbeck, A.L., Snower, D.J., 1988. *The insider-outsider theory of employment and unemployment*. The MIT Press, Cambridge UK.

Linzert, T., 2001. Sources of German unemployment: evidence from a structural VAR model. *ZEW Discussion Papers*.

Linzert, T., 2001. Sources of German unemployment: evidence from a structural VAR model. ZEW Discussion Papers.

Lipsey, R.G., 1960. The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1862-1957: a further analysis. *Economica*, 1-31.

Lucas Jr, R.E., 1975. An equilibrium model of the business cycle. *The Journal of Political Economy*, 1113-1144.

Lucas, R.E., 1972. Expectations and the neutrality of money. *Journal of Economic Theory*, *4*(2), 103-124.

Lucas, R.E., 1976, December. Econometric policy evaluation: A critique. In *Carnegie-Rochester conference series on public policy* (Vol. 1, pp. 19-46). North-Holland.

Lucas, R.E., Sargent, T.J., 2006. After the Keynesian macroeconomics in Federal Reserve Bank of Boston Edition: After the Phillips Curve: persistence of high inflation and unemployment. Boston.

Lütkepohl, H., 1982. Non-causality due to omitted variables. *Journal of Econometrics*, *19*(2), 367-378.

Lütkepohl, H., 2006. *Structural vector autoregressive analysis for cointegrated variables* (pp. 73-86). Springer Berlin Heidelberg.

Lütkepohl, H., 2012. *Vector autoregressive and vector error correction models in H Lutkepohl and Kratzig, Eds, applied time series econometrics.* Cambridge University Press: Chapter 3, Cambridge UK.

Maidorn, S., 2003. The effects of shocks on the Austrian unemployment rate–a structural VAR approach. *Empirical Economics*, *28*(2), 387-402.

Majsterek, M., & Welfe, A., 2012. Price-wage nexus and the role of a tax system. *Economic Change and Restructuring*, *45*(1-2), 121-133. doi:10.1007/s10644-011-9112-1

Malumo, R., 2012. Vision 2030-Namibia's roadmap to industrialisation: will NDP4 achieve greater heights?

Manacorda, M., Petrongolo, B., 1999. Skill Mismatch and Unemployment in OECD Countries Marco Manacorda. Economica 66, 181–207.

Marcellino, M., & Mizon, G.E., (2000). Modelling shifts in the wage–price and unemployment–inflation relationships in Italy, Poland and the UK. *Economic Modelling*, *17*(3), 387-413.

Marcellino, M., & Mizon, G.E., (2001). Small-system modelling of real wages, inflation, unemployment and output per capita in Italy 1970–1994. *Journal of Applied Econometrics*, *16*(3), 359-370.

Marques, C.R., 2008. Wage-price dynamics in Portugal. Wage Dynamics Network: Working Paper Series October. Paper No. 945.

Matlanyane, R.A., (2005). *A macroeconometric model for the economy of Lesotho: policy analysis and implications,* Doctoral dissertation, University of Pretoria.

Mchugh, Z., 2004. *A small macroeconometric model of the Australian economy: with emphasis on modelling wages and prices*. Doctoral Dissertation, Queensland University of Technology, Australia.

Meeusen, W., Stavrevska, V., & Rayp, G., 2011. Efficiency wages, unemployment benefits and union-firm wage bargaining: The issue of the choice of the outside option. *Journal of Labour Research*, *32*(1), 75-86. doi:10.1007/s12122-011-9103-z.

Mehra, Y.P., 1991. Wage growth and the inflation process: An empirical note. *The American Economic Review*, 81, 931-937.

Menezes, A.G., Sciulli, D., & Vieira, J.C., 2011. Wage persistence and labour market institutions: an analysis of young European workers. *Applied Economics Letters*, *18*(9), 823-828.

Mertens, K., & Ravn, M.O. 2010. Measuring the impact of fiscal policy in the face of anticipation: A structural VAR approach. *The Economic Journal*, *120*(544), 393-413. doi:10.1111/j.1468-0297.2010.02361.x

Ministry of Labour and Social Welfare, 1997, 2000, 2004, 2008, 2012, and 2013. Namibia labour force survey. Windhoek Directorate of Labour Market Services.

Misati, R.N., Nyamongo, E.M., & Mwangi, I., 2013. Commodity price shocks and inflation in a net oil-importing economy. *OPEC Energy Review*, *37*(2), 125-148.

Modigliani, F., & Papademos, L., 1978. Optimal demand policies against stagflation. *Weltwirtschaftliches Archive*, *114*(4), 736-782.

Møller, N.F., 2013. Understanding unemployment hysteresis: A system-based econometric approach to changing equilibria and slow adjustment. *Univ. of Copenhagen Dept. of Economics Discussion Paper*, (13-06).

Morsink, J., & Bayoumi, T., 2001. A peek inside the black box: the monetary transmission mechanism in Japan. *IMF Staff Papers*, 22-57.

Mwinga, M.S., 2012. Unemployment in Namibia: Measurement problems, causes & policies. *Windhoek: First Capital Treasury Solutions. URL: http://www. firstcapitalnam. com/First% 20Capital% 20Reports/First% 20Capital% 20Namibia*, *20*.

Mwinga, M.S., 2012. Unemployment in Namibia: Measurement Problems, Causes & Policies. First Capital Working Paper Series.

Namibia Statistical Agency, 2012-2014. National accounts: 1980-2013. *Windhoek Central Bureau of Statistics.*

Namibia, Commission, N.N.P., 2008. Third national development plan (NDP3): 2007/2008-2011/12. *Office of President National Planning Commission*.

Namibia, National Planning Commission, 2012. Namibia's fourth national development plan: NDP_4 : 2012/13 to 2016/17. *National Planning Commission*, Windhoek.

National Planning Commission, 1999-2011. National accounts: 1980-2013. Windhoek Central Bureau of Statistics.

Ngalawa, H., & Viegi, N., 2011. Dynamic effects of monetary policy shocks in Malawi. *South African Journal of Economics*, *79*(3), 224-250.

Nickell, S., Andrews, M., 1990. Unions Real Wages and Employment in Britain 1951-79. *Oxford Economic Papers*, 35, 183–206.

Nickell, S., Nunziata, L., & Ochel, W., 2005. Unemployment in the OECD since the 1960s. What do we know?. *The Economic Journal*, *115*(500), 1-27.

Nymoen, R., 1991. A small linear model of wage-and price-inflation in the Norwegian economy. *Journal of Applied Econometrics*, *6*(3), 255-269.

Ojapinwa, T.V., & Esan, F., 2013. Does Philips relations really exist in Nigeria? Empirical evidence. *International Journal of Economics and Finance*, *5*(9), p123. doi:10.5539/ijef.v5n9p123.

Olivier Blanchard & Jordi Galí, 2010. "Labour Markets and Monetary Policy: A New Keynesian Model with Unemployment," *American Economic Journal: Macroeconomics, American Economic Association*, vol. 2(2), pages 1-30, April.

Perron, P., & Yamamoto, Y., 2015. Using OLS to estimate and test for structural changes in models with endogenous regressors. *Journal of Applied Econometrics*, *30*(1), 119-144.

Perry, G.L., 1964. The determinants of wage rate changes and the inflation-unemployment trade-off for the United States. *The Review of Economic Studies*, 287-308.

Pesaran, M.H. and Smith, R., 1995. Estimating long-run relationships from dynamic heterogeneous panels. *Journal of econometrics*, *68*(1), pp.79-113.

Pétursson, P.G., 2002. Wage and price formation in a small open economy: Evidence from Iceland. *Central Bank of Iceland*, Economics Department.

Pétursson, Þ.G., 2002. Wage and Price Formation in a Small Open Economy: Evidence from Iceland. Central Bank of Iceland, Economics Department.

Phelps, E.S., 1967. Phillips curves, expectations of inflation and optimal unemployment over time. *Economica*, 34, 254-281.

Phelps, E.S., 1968. Money wage dynamics and labour market equilibrium. *Journal of Political Economy*, 76, 678–711.

Phillips, P.C., 1991. Optimal inference in cointegrated systems. *Econometrica: Journal of the Econometric Society*, 283-306.

Podrecca, E., 2011. Labour market institutions and wage setting: evidence for OECD countries. *Applied Economics*, *43*(25), 3671-3686.

Riggi, M., 2010. Nominal and real wage rigidities in New Keynesian models: a critical survey. *Journal of Economic Surveys*, *24*(3), 539-572.

Roa, R., Ernst, B., & Tapia, F., 1999. Estimation of size at sexual maturity: an evaluation of analytical and resampling procedures. *Fishery Bulletin*, *97*(3), 570-580.

Robalo Marques, C., Martins, F., Portugal, P., 2010. Price and wage formation in Portugal. *European Central Bank, Working Paper Series*.

Roberts, J.M., 1995. New Keynesian economics and the Phillips Curve. *Journal of Money, Credit and Banking*, 27, 975-984.

Romer, D., 1996. *Advanced macroeconomics*. McGraw Hill, New York, United States.

Rotemberg, J.J., 1982. Sticky prices in the United States. *The Journal of Political Economy*, 1187-1211.

Rudd, J., & Whelan, K., 2005. New tests of the new-Keynesian Phillips curve. *Journal of Monetary Economics*, *52*(6), 1167-1181.

Sahinler, S., & Topuz, D., 2007. Bootstrap and jack-knife resampling algorithms for estimation of regression parameters. *Journal of Applied Quantitative Methods*, *2*(2), 188-199.

Salop, S.C., 1979. A model of the natural rate of unemployment. *The American Economic Review*, 117-125.

Samuelson, P.A., & Solow, R.M., 1960. Analytical aspects of anti-inflation policy. *The American Economic Review*, 50, 177-194.

Schmidt, M.B., 2000. The dynamic behaviour of wages and prices: Cointegration tests within a large macroeconomic system. *Southern Economic Journal*, 67, 123-138.

Shanon, R., Myles, W.S., 1986. Wages and inflation: An investigation into causality. *Journal of Post-Keynesian Economics* 8, 183–91.

Shapiro, C., & Stiglitz, J.E., 1984. Equilibrium unemployment as a worker discipline device. *The American Economic Review*, 74, 433-444.

Sims, C.A., 1980. Macroeconomics and reality. *Econometrica: Journal of the Econometric Society*, 48, 1-48.

Sims, C.A., 1986. Are forecasting models usable for policy analysis?. *Federal Reserve Bank of Minneapolis Quarterly Review*, *10*(1), 2-16.

Sims, C.A., 2007. Monetary policy models. *Brookings Papers on Economic Activity*, *2007*(2), 75-87.

Sims, C.A., Stock, J.H., & Watson, M.W., 1990. Inference in linear time series models with some unit roots. *Econometrica: Journal of the Econometric Society*, 58, 113-144.

Smith, S.K., & Sincich, T., 1988. Stability over time in the distribution of population forecast errors. *Demography, 25*(3), 461-474. doi:10.2307/2061544.

Smith, S.K., 1987. Tests of forecast accuracy and bias for county population projections. *Journal of the American Statistical Association*, *82*(400), 991-1003. doi:10.2307/2289369

Sonedda, D., 2006. A structural VAR approach on labour taxation policies. Appl. Econ 38: 95–114. doi:10.1080/00036840500166415

Staiger, D., Stock, J.H., Watson, M.W., 2002. *Prices, wages and the US NAIRU in the 1990s, in Krueger a. Solow R (eds), the roaring nineties.* Russell Sage Foundation, New York 3–59.

Stiglitz, J., 1997. Reflections on the natural rate hypothesis. *The Journal of Economic Perspectives*, 11, 3-10.

Stock, J.H., & Watson, M.W., 1996. Evidence on structural instability in macroeconomic time series relations. *Journal of Business & Economic Statistics*, *14*(1), 11-30.

Stock, J.H., & Watson, M.W., 2001. *Forecasting output and inflation: The role of asset prices* (No. w8180). National Bureau of Economic Research.

Stock, J.H., & Watson, M.W., 2001. Vector autoregressions. *Journal of Economic Perspectives*, 15, 101-115.

Stockhammer, E., & Sturn, S., 2012. The impact of monetary policy on unemployment hysteresis. *Applied Economics*, *44*(21), 2743-2756.

Stockhammer, E., 2004. Explaining European unemployment: testing the NAIRU hypothesis and a Keynesian approach. *International Review of Applied Economics*, *18*(1), 3-23.

Strand, J., 1988. The short-run Phillips Curve with monopoly unions. *The Scandinavian Journal of Economics* 90, 63–74.

Strauss, J., & Wohar, M.E., 2004. The linkage between prices, wages and labour productivity: A panel study of manufacturing industries. *Southern Economic Journal*, 70, 920-941.

Su, L., 2007. The causes of German unemployment: a structural VAR approach. Universität Oldenburg.

Sunde, T., 2013. Financial development and economic growth: Empirical evidence from Namibia (1990q1-2011q4). *Journal of Emerging Issues in Economics, Finance, and Banking (JEIEFB): An Online International Monthly Journal* 1, 52–65.

Tashrifov, M.Y., 2005. Monetary policy model of Tajikistan: A structural vector autoregression approach. *Made available in DSpace on 2010-12-20T06: 04: 37Z (GMT). No. of bitstreams: 1 Tashrifov_Monetary2005. Pdf: 591481 bytes, checksum: a01d9a86af0e514bc030b61c78384cac (MD5) Previous issue date: 2010-10-27T01: 29: 25Z.*

Taylor, J.B., 1980. Aggregate dynamics and staggered contracts. *The Journal of Political Economy*, 88, 1-23.

Taylor, J.B., 2001. An Interview with Milton Friedman. *Macroeconomic Dynamics*, *5*(01), 101-131.

Tinbergen, J., 1937. *An econometric approach to business cycle problems*. Hermann and Cie, Paris, France.

Tjipe, T., Nielsen, H., & Uanguta, E., 2004. Namibia macroeconometric model (NAMEX). *Bank of Namibia*.

Tobin, J., 1993. Price flexibility and output stability: an old Keynesian view. *The Journal of Economic Perspectives*, 7, 45-65.

Tsonis, A.A., & Austin, G.L., 1981. An evaluation of extrapolation techniques for the short-term prediction of rain amounts. *Atmosphere-Ocean*, *19*(1), 54-65.

Tsoukis, C., Kapetanios, G., & Pearlman, J., 2011. Elusive persistence: wage and price rigidities, the New Keynesian Phillips curve and inflation dynamics. *Journal of Economic Surveys*, *25*(4), 737-768.

Uribe, M., & Schmitt-Grohé, S., 2012. Open economy macroeconomics. *Columbia University. Unpublished Manuscript, August*.

Van Hoa, T., 1981. Causality and wage price inflation in West Germany 1964–1979. *Weltwirtschaftliches Archive*, *117*(1), 110-124.

Van Montfort, K., den Butter, F.A., Wittenberg, G.T., 2003. Unemployment dynamics and propagation of aggregate and reallocation shocks in the Netherlands. *De Economist* 151, 253–270.

Van Zyl, G., 2010. Does employee remuneration dispersion in the South African economy enhance labour productivity? The Gauteng manufacturing industry as a case study: original research. *SA Journal of Human Resource Management*, *8*(1), 1-5.

Vanderkamp, J., 1966. Wage and price level determinants: An empirical model for Canada. *Economica,* 33 (May): 194-218.

Wakeford 1.J., 2004. The productivity-wage relationship in South Africa: an empirical investigation. *Development Southern Africa*, *21*(1), 109-132.

Wallis, K.F., 1993. Macroeconomic policy and macroeconomic models. *The Economic Record*, 69, 113–30.

Walsh, C.E., 2010. *Monetary theory and policy*. MIT Press, Cambridge, Mass.

Wang, J.H., & LI, H.T., 2013. The dynamic impact of wage increase on employment, commodity price and labour productivity-empirical analysis based on PVAR model. *Journal of Yunnan University of Finance and Economics*, *1*, 012.

Watzka, S., 2006. *Dynamic Beveridge and Phillips Curves: A macroeconometric analysis of the US labour market*. PhD Dissertation, European University Institute.

Welfe, A., & Majsterek, M., 2002. Wage and price inflation in Poland in the period of transition-The cointegration analysis. In *East European Transition and EU Enlargement* (pp. 291-303). Physica-Verlag HD.

Yusof, A.S., 2008. The long-run and dynamic behaviours of wages, productivity and employment in Malaysia. *Journal of Economic studies*, *35*(3), 249-262.

Zhao, H., & Hogan, V., 2011. Measuring the NAIRU-A structural VAR approach. *Frontiers of Economics in China*, *6*(1), 76-91.

Žumer, T., 2004. Modelling prices and wages in Slovenia based on the supply side. *Prikazi In Analize.*

APPENDIX A: GENERAL APPENDICES

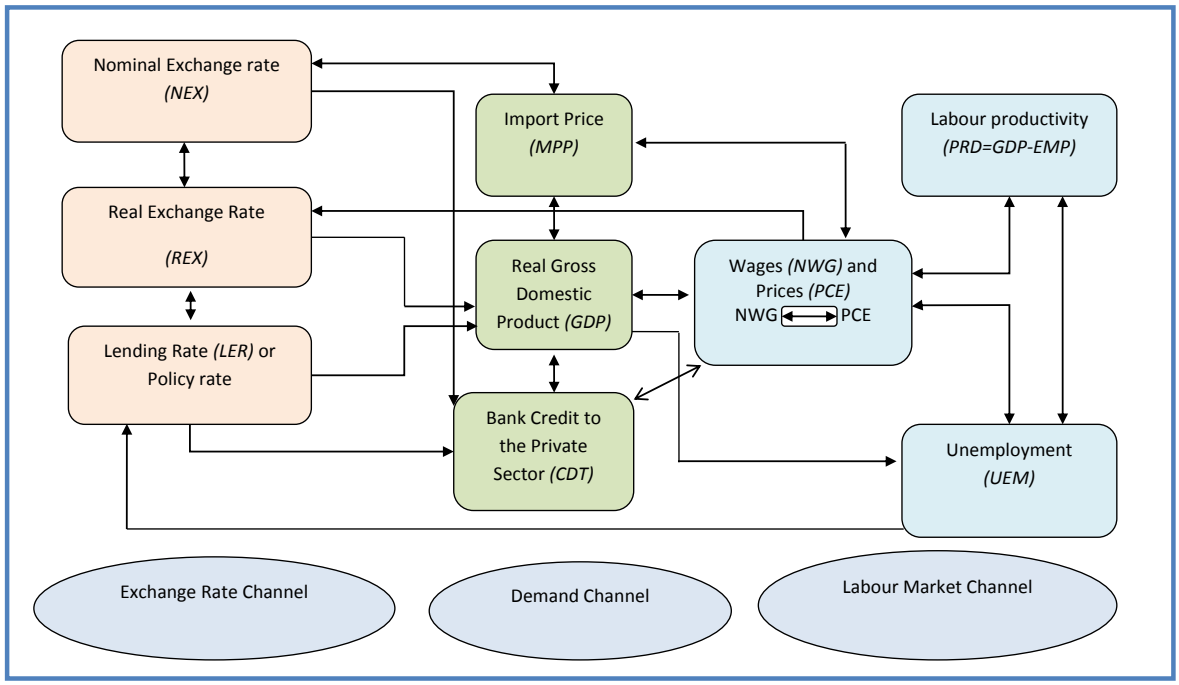
Table A 1: Data definitions and sources

NAME	DESCRIPTION	VARIABLE DESCRIPTIONS	DATA SOURCE
UEM	Unemployment rate	Due to lack of data on the labour force for the period 1980 to 1989, the main method used to generate the values of the labour force for the period 1980 to 1989 is the linear extrapolation method also used by Smith and Sincich (1988), Chow and Lin (1971), Smith (1987), Chang et al. (2007) and Tsonis and Austin (1981). Given the fact that the labour force data for the period 1990 to 2013 is available, the study did backward extrapolation to generate data for the period 1980 to 1980.	MLSW and NSA
EMP	Employment	Total employment is equivalent to labour force minus total unemployment. Labour force and unemployment are as described above. Once the figures for the labour force and unemployment are available, it is easy to calculate the figures for total employment.	MLSW and NSA
KST	Capital stock	This is gross fixed capital formation expressed in real terms and in millions of local currency with a base year of 2005 dollars. Akanbi and Du Toit (2010) apply a similar measure and a similar definition was utilised by Karanassou et al. (2010).	NSA
RWG	Real wage	Note that capital stock and labour are the major inputs in the production process. To derive wages, the following identity is used: $\frac{\mathrm{KST_T}}{\mathrm{GDP_T}} + \frac{\mathrm{EMP_T}}{\mathrm{GDP_T}} = \frac{\mathrm{GDP_T}}{\mathrm{GDP_T}} = 1$ Thus, $\frac{\mathrm{KST_T} * \mathrm{LER_T}}{\mathrm{GDP_T}} + \frac{\mathrm{EMP_T} * \mathrm{RWG_T}}{\mathrm{GDP_T}} = \frac{\mathrm{GDP_T}}{\mathrm{GDP_T}} = 1$ where $\mathrm{GDP_T}$ is GDP, $\mathrm{EMP_T}$ is employed labour, $\mathrm{LER_T}$ is the interest rate (lending rate), and $\mathrm{RWG_T}$ is the real wage rate. $\mathrm{KST_T} * \mathrm{LER_T}$ represents the total value of capital in the	Calculated using, KST, GDP, EMP, and LER using the indicated formula

		economy and $\mathrm{EMP_T} * \mathrm{RWG_T}$ represents the total wage bill of the economy. This implies that: $\mathrm{RWG_T} = \left[1 - \left(\frac{\mathrm{KST_T} * \mathrm{LER_T}}{\mathrm{GDP_T}}\right)\right]\left(\frac{\mathrm{GDP_T}}{\mathrm{EMP_T}}\right)$ $= \frac{\mathrm{GDP_T} - \mathrm{KST_T} * \mathrm{LER_T}}{\mathrm{EMP_T}}$ This is the calculation Akanbi and Du Toit (2010) used in their study.	
PRD	Productivity	Productivity: is the ratio of real GDP over total employment $[(GDP/CPI)/EMP]$. In this case, GDP is the nominal Gross Domestic Product measure in millions of national currency. Real GDP (GDP) is calculated by deflating the nominal measure of GDP using the CPI measure and EMP is the measure of total employment (see Linzert, 2001).	Calculated using GDP and CPI
LFC	Labour force	Due to lack of data on the labour force for the period 1980 to 1989, the main method used to generate the values of the labour force for the period 1980 to 1989 is the linear extrapolation method also used by Smith and Sincich (1988), Chow and Lin (1971), Smith (1987), Chang et al. (2007) and Tsonis and Austin (1981). Given the fact that the labour force data for the period 1990 to 2013 is available, the study did backward extrapolation to generate data for the period 1980 to 1980.	NSA, MLSW & author calculations
PCE	Price inflation	This is the consumer price index with base year 2005. Linzert (2001) used the same measure for the German economy.	NSA
INF	Inflation rate	Annual inflation rate	NSA
GDP	Real gross domestic product	Real gross domestic product (GDP) is defined as nominal GDP in local currency units (LCU) adjusted for inflation, which is found as a ratio of GDP in local currency units and the CPI. This data is available in the NSA database and IMF world Economic Outlook (2013).	NSA
NEX	Nominal exchange rate	The nominal exchange rate of the Namibian dollar (N$) against the United States Dollar (USD) is used as a	BoN

		proxy for the NEX. The source of these statistics is the Bank of Namibia.	
MPP	Import prices	Import value indices measure the overall change in the prices of imports of goods and services between the residents of an economic territory and residents of the rest of the world (IMF, 2010). The study uses the import value index with the base year 2000 as a proxy for import prices and the data is obtained from the World Bank Database. Backward extrapolation was used to generate data for the period before 1990.	WBS
LER	Lending rates	The rate at which, commercial banks lend money to their clients. This is also referred to as the cost of money. Note that this rate is frequently influenced through the repo rate (rate at which the banks borrow money from the central bank) in Namibia. Interest rates data were obtained from the South African Reserve Bank and Bank of Namibia Quarterly Bulletins. Data for the period 1980 to 1990 was obtained from the South African Reserve Bank since Namibia was considered a province of SA then and that for the period 1990 to 2013 was obtained from the Bank of Namibia. Shiimi and Kadhikwa (1999) also used the same strategy in their study on Namibia.	RBSA and BoN
CDT	Bank credit	This is bank credit to the private sector. The study uses financial intermediation as a proxy for bank credit in Namibia. Financial intermediation refers to lending to the productive sector of the economy. The role of financial intermediaries is to channel funds from lenders to borrowers by intermediating between them. This data is available for the period 1980 to 2013 in the NSA database.	NSA

Figure A1: A stylised illustration of the complete macro-econometric model



Adaptation from McHugh (2004)

Figure A2: Regional map of Namibia

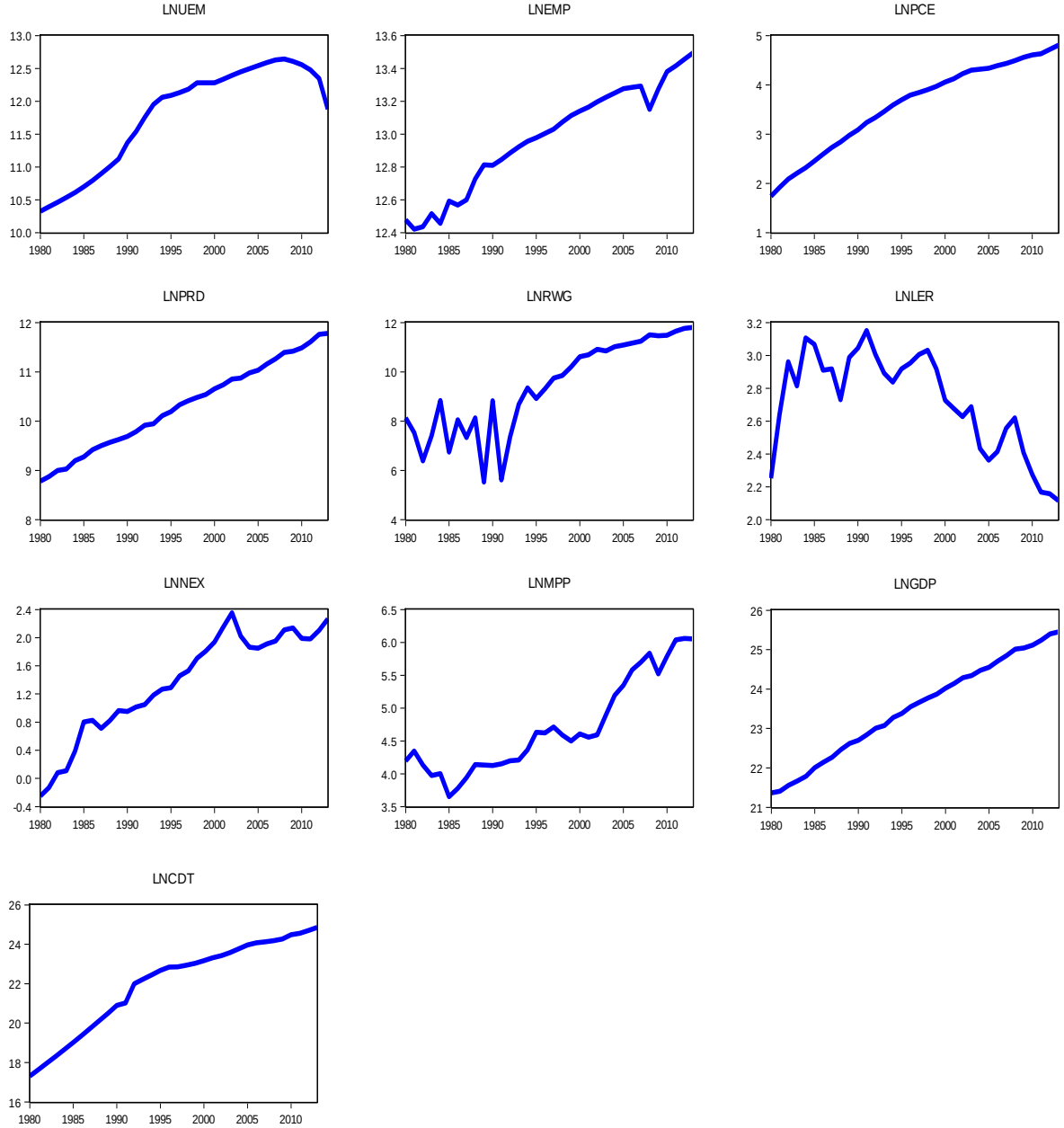
Source: From the World Wide Web (Internet)

Table A 2: Variable statistics

	LNUEM	LNEMP	LNPCE	LNGDP	LNPRD	LNRWG	LNLER	LNCDT	LNNEX	LNMPP
Mean	11.78524	12.97671	3.579546	23.50333	10.31284	9.385459	2.716535	22.00217	1.359622	4.71022
Median	12.11094	13.01622	3.816995	23.60915	10.37414	9.543321	2.77172	22.84708	1.493125	4.572506
Maximum	12.64272	13.49425	4.802321	25.45351	11.77778	11.80037	3.151168	24.86428	2.355248	6.059628
Minimum	10.32427	12.42036	1.736856	21.36316	8.780615	5.520282	2.114949	17.30898	-0.24996	3.65128
Std. Dev.	0.789938	0.324317	0.909373	1.271505	0.903028	1.890174	0.305136	2.312034	0.740393	0.724098
Skewness	-0.641396	-0.291955	-0.50824	-0.14243	-0.03738	-0.43885	-0.53011	-0.65962	-0.61489	0.628233
Kurtosis	1.860102	1.907559	2.008944	1.798798	1.820074	2.034516	2.068591	2.102619	2.309318	2.099779
Jarque-Bera	4.171975	2.173704	2.855165	2.15905	1.980235	2.411918	2.821429	3.606399	2.818293	3.384563
Probability	0.124184	0.337277	0.239888	0.339757	0.371533	0.299405	0.243969	0.164771	0.244352	0.184099
Sum	400.6983	441.2082	121.7046	799.1133	350.6367	319.1056	92.3622	748.0738	46.22713	160.1475
Sum Sq. Dev.	20.59208	3.471	27.28967	53.35195	26.91018	117.9011	3.072555	176.4015	18.09002	17.30248
Observations	34	34	34	34	34	34	34	34	34	34

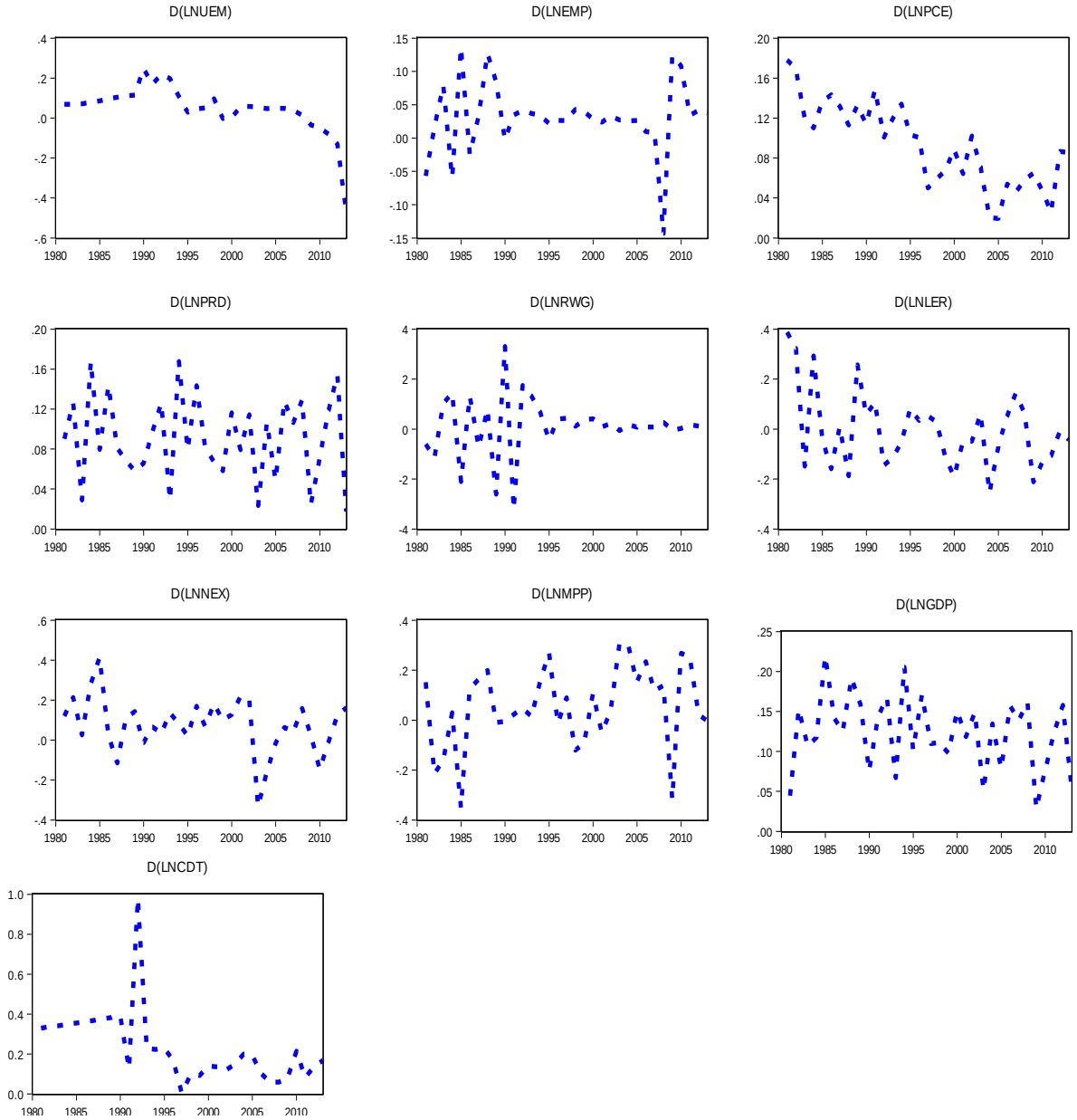
Source: Authors' calculation from Eviews 8

Figure A 3: Trend diagrams of the variables



Source: Authors' calculation from Eviews 8

Figure A 4: First differences of the data used in the estimations



Source: Authors' calculation from Eviews 8

Table A 3: ADF and the PP non-stationarity tests in levels 1990 - 2013

		ADF	**PP**
Variable	**Model**	$\tau_{tc}, \tau_c\ \tau_n$	$\phi_{tc}\ \phi_c\ \phi_n$
$LNNWG$	Trend	-1.737	-2.783
	Constant	0.479	-1.217
	None	2.674	5.650
$LNRWG$	Trend	-1.718	-2.751
	Constant	0.507	-1.187
	None	2.670	5.590
$LNPCE$	Trend	-0.563	-1.187
	Constant	-1.647	-6.146***
	None	0.735	4.316
$LNUEM$	Trend	-2.737	-3.143
	Constant	-2.383	-2.972**
	None	-0.016	-0.584
$LNPRD$	Trend	-1.680	-0.923
	Constant	0.319	0.764
	None	1.190	2.045
$LNMPP$	Trend	-1.466	-1.297
	Constant	0.033	1.234
	None	1.936	3.859
$LNGDP$	Trend	-2.246	-0.695
	Constant	1.679	0.216
	None	2.861	7.512
$LNLER$	Trend	-3.524**	-2.422
	Constant	-0.895	-0.639
	None	-1.683*	-2.064**
$LNNEX$	Trend	-2.099	-1.791
	Constant	-1.642	-1.436
	None	0.056	0.0832
$LNREX$	Trend	-2.598	-2.151
	Constant	-2.312	-2.216
	None	-0.262	0.026

*** (**) [*] represent significance at the 1% (5%) [10%] levels, respectively. $\tau_{tc}, \tau_c\ \tau_n$ and $\phi_{tc}\ \phi_c\ \phi_n$ represent ADF and PP results using trend and constant, constant and none, respectively

Source: Authors' calculation from Eviews 8

Table A 4: ADF and the PP non-stationarity tests in first differences 1990 - 2013

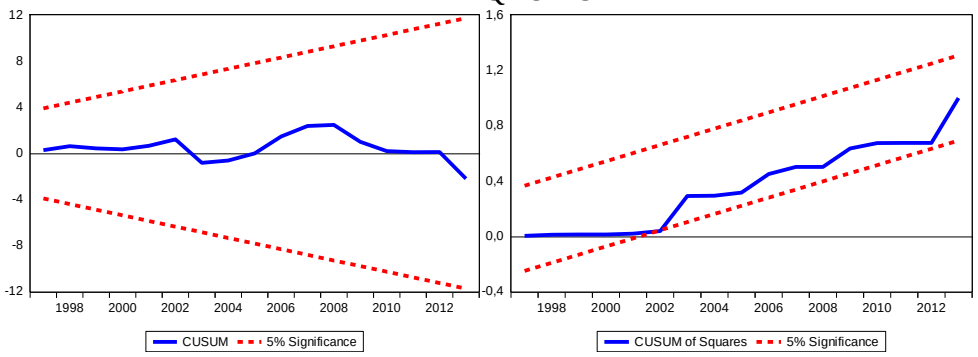
		ADF	**PP**
Variable	**Model**	$\tau_{tc},\ \tau_c, \tau_n$	$\phi_{tc}\ \phi_c\ \phi_n$
$\Delta LNNWG$	Trend	-3.421*	-4.135***
	Constant	-3.468**	-4.282***
	None	-2.235**	-3.058***
$\Delta LNRWG$	Trend	-3.435*	-4.162***
	Constant	-3.472**	-4.307***
	None	-2.250**	-3.096***
$\Delta LNPCE$	Trend	-3.354*	-4.992***
	Constant	-2.016	-3.044**
	None	-1.674*	-1.743*
$\Delta LNUEM$	Trend	-3.169*	-5.617***
	Constant	-3.149**	-5.646***
	None	-3.182***	-5.684***
$\Delta LNPRD$	Trend	-3.558**	-4.932***
	Constant	-3.029**	-4.791***
	None	-2.788***	-4.539***
$\Delta LNMPP$	Trend	-2.744	-4.254***
	Constant	-2.741*	-4.149***
	None	-1.873*	-3.146***
$\Delta LNGDP$	Trend	-3.665**	-5.066***
	Constant	-3.486**	-5.081***
	None	-1.255	-2.957***
$\Delta LNLER$	Trend	-3.190*	-4.377***
	Constant	3.206**	-4.400***
	None	-2.810***	-4.051***
$\Delta LNNEX$	Trend	-2.697	-4.280***
	Constant	-2.642*	-4.292***
	None	-2.142**	-3.936***
$\Delta LNREX$	Trend	-2.632	-4.494***
	Constant	-2.650*	-4.460***
	None	-2.700***	-4.484***

*** (**) [*] represent significance at the 1% (5%) [10%] levels, respectively. $\tau_{tc}, \tau_c\ \tau_n$ and $\phi_{tc}\ \phi_c\ \phi_n$ represent ADF and PP results using trend and constant, constant and none, respectively

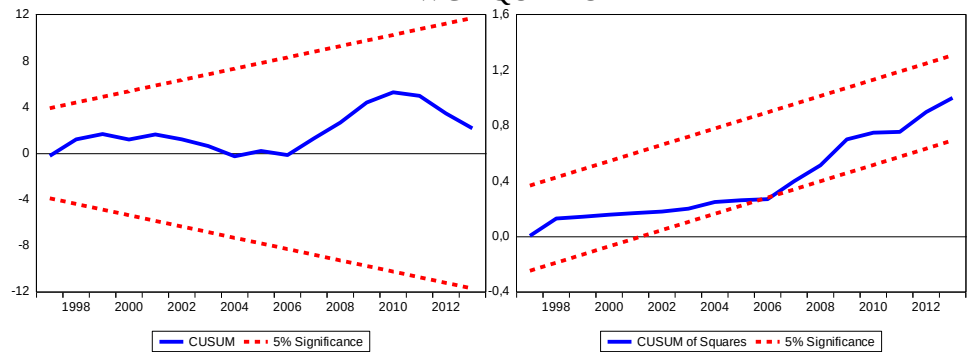
Source: Authors' calculation from Eviews 8

Figure A 5: Macro-econometric reduced form VAR equations: parameter stability tests

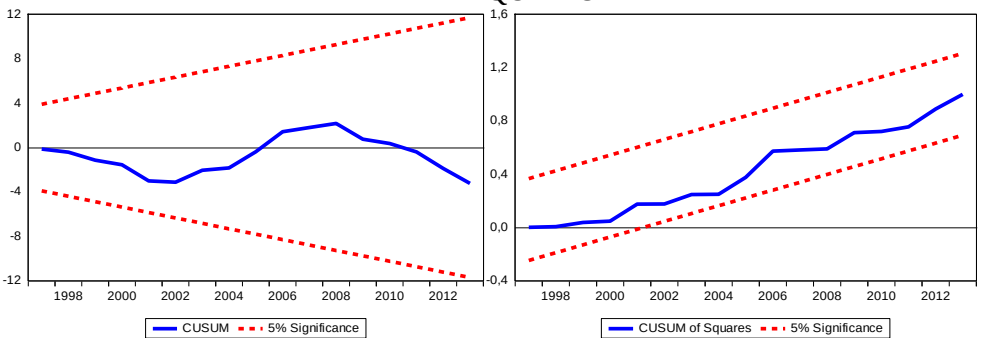
LNPRD EQAUTION



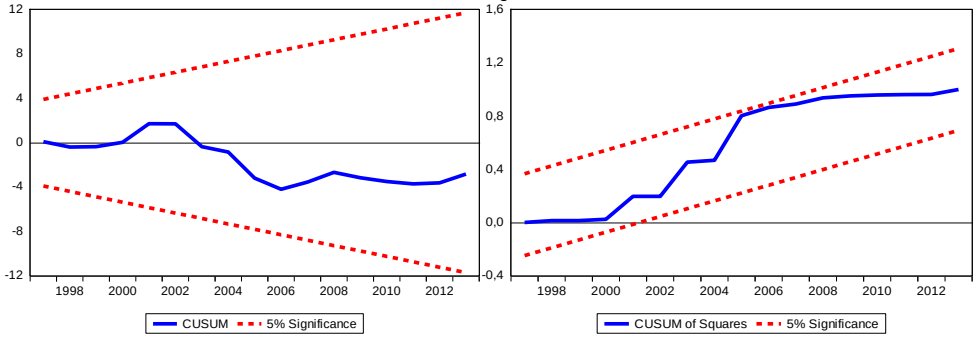
LNRWG EQUATION



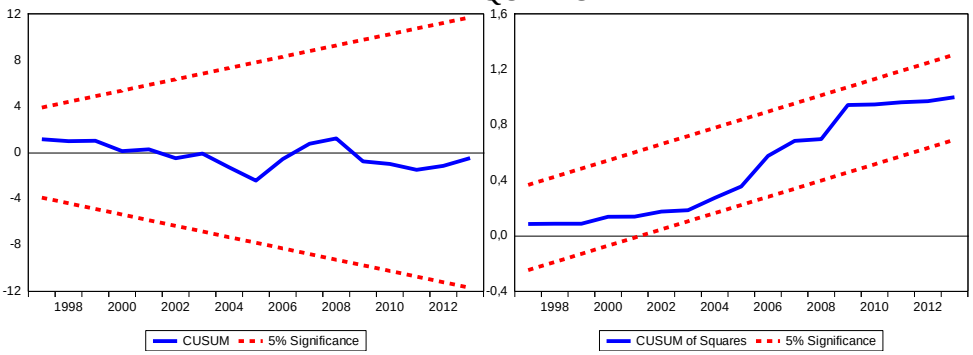
LNMPP EQUATION



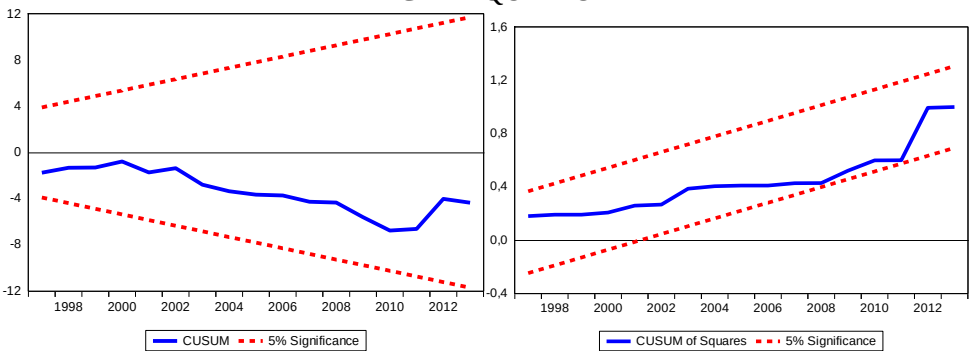
LNNEX EQUATION



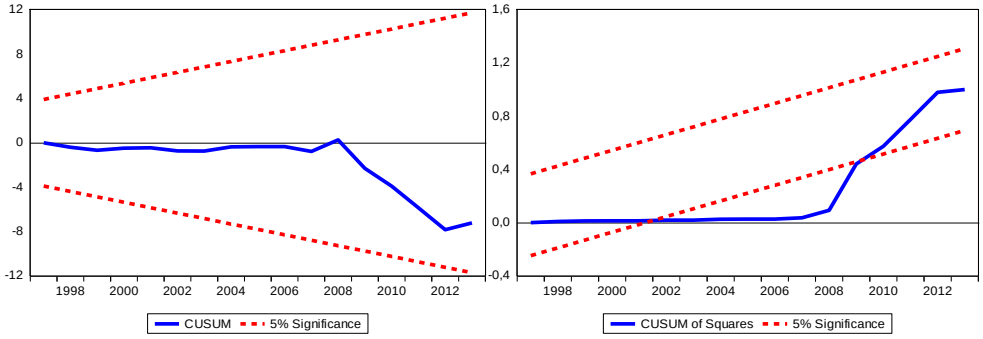
LNLER EQUATION



LNCDT EQUATION



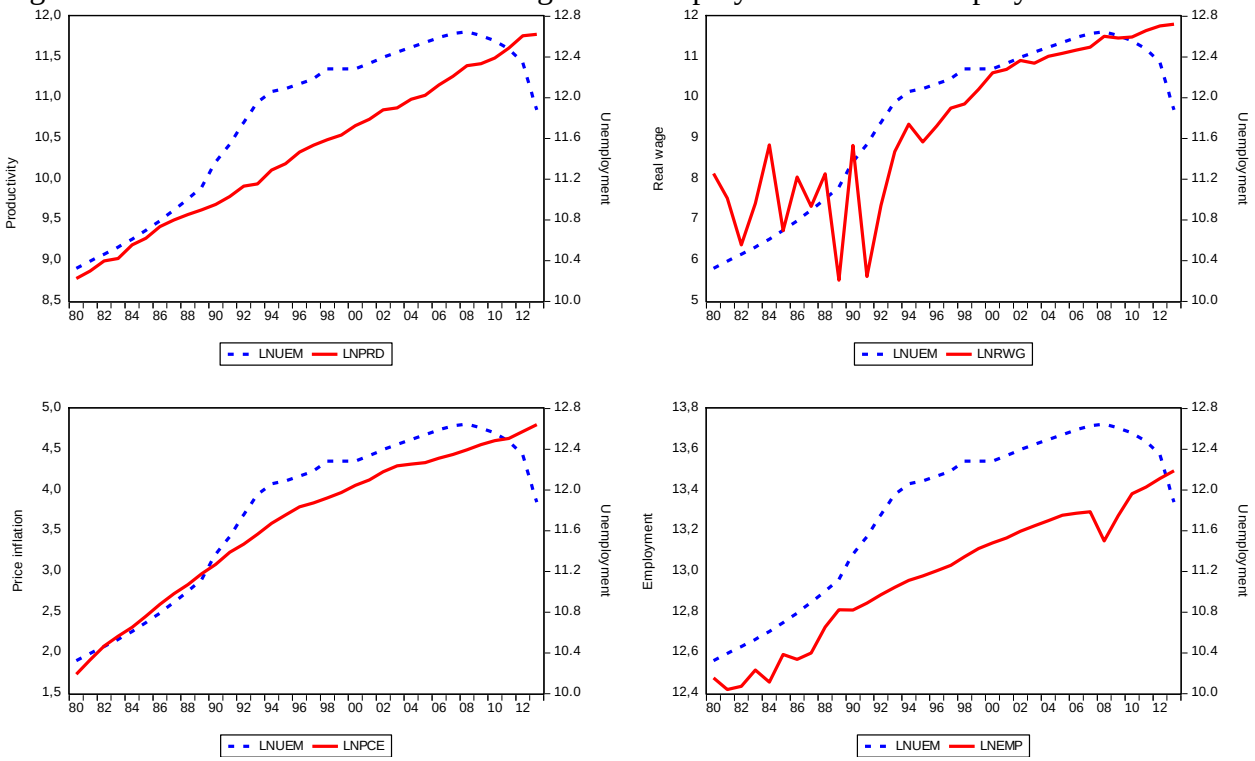
LNUEM EQUATION



Source: Authors' calculation from Eviews 8

APPENDIX B: APPENDIX TO CHAPTER 5

Figure B 1: Evolution of other variables against unemployment in the unemployment model



Source: Authors' calculation from Eviews 8

Table B 1: Structural estimates of the A and C matrices of the unemployment model

Long-run response pattern				
C(1)	0	0	0	0
C(2)	C(5)	0	0	0
C(3)	C(6)	C(9)	0	0
C(4)	C(7)	C(10)	C(12)	0
0	C(8)	C(11)	C(13)	C(14)
	Coefficient	**Std. Error**	**z-Statistic**	**Probabilities**
C(1)	1.767214	0.220902	8.000000	0.0000
C(2)	0.533652	0.069694	7.657025	0.0000
C(3)	5.577042	0.712481	7.827633	0.0000
C(4)	1.354117	0.175194	7.729223	0.0000
C(5)	0.178799	0.022350	8.000000	0.0000
C(6)	-1.398422	0.305740	-4.573889	0.0000
C(7)	0.491594	0.065751	7.476641	0.0000
C(8)	0.609021	0.117397	5.187700	0.0000
C(9)	1.418970	0.177371	8.000000	0.0000
C(10)	-0.049970	0.022542	-2.216790	0.0266
C(11)	-0.409499	0.073257	-5.589935	0.0000

C(12)	0.122521	0.015315	8.000000	0.0000
C(13)	0.233410	0.043533	5.361677	0.0000
C(14)	0.182767	0.022846	8.000000	0.0000
Log likelihood	189.6067			
LR test for over-identification:				
Chi-square(1)	0.602619		Probability	0.4376
Estimated A matrix				
1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.000000
Estimated B matrix				
0.037310	-0.013142	-0.009431	0.005769	-0.006598
0.000143	0.037648	0.008986	-0.022270	0.013119
-0.031220	-0.656735	0.408395	0.147601	0.419364
0.013294	0.015147	0.001654	0.013444	0.001461
-0.019789	-0.016638	-0.094329	0.043820	0.009300

Source: Authors' calculation from Eviews 8

Table B 2: Roots of characteristic polynomial of the unemployment model
Endogenous variables: LNPRD LNEMP LNRWG LNPCE LNUEM

Root	Modulus
0.988180	0.988180
0.901788	0.901788
0.832591 - 0.258656i	0.871843
0.832591 + 0.258656i	0.871843
-0.658334	0.658334
0.269536 - 0.539442i	0.603031
0.269536 + 0.539442i	0.603031
-0.218656	0.218656
-0.091144 - 0.106081i	0.139858
-0.091144 + 0.106081i	0.139858

No root lies outside the unit circle.
VAR satisfies the stability condition
Source: Authors' calculation from Eviews 8

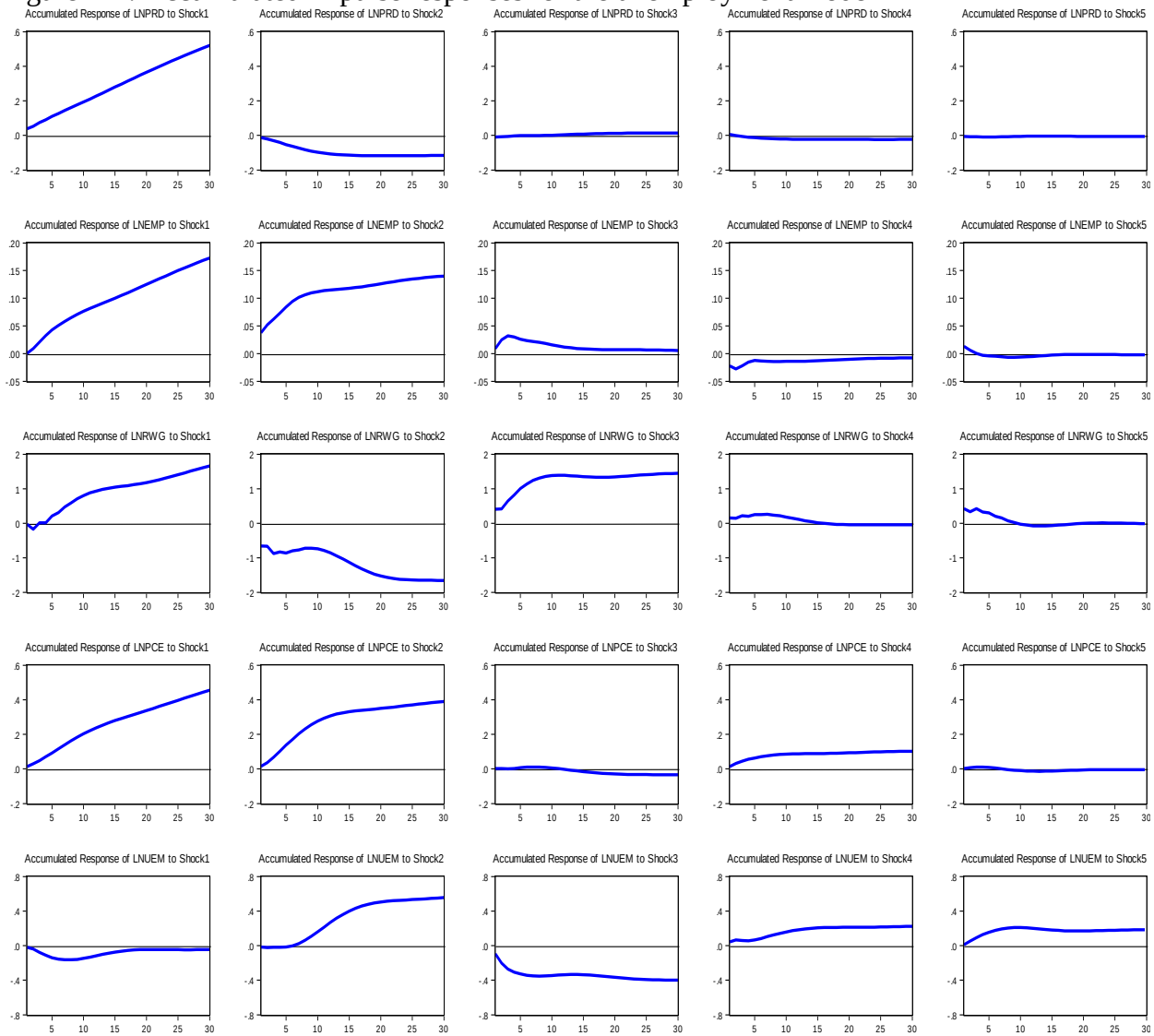
Table B 3: VAR residual serial correlation tests of unemployment

Lags	LM-Statistics	Probability
1	28.75634	0.2742
2	25.07673	0.4581
3	23.04405	0.5750
4	31.91679	0.1604
5	34.79634	0.0920
6	24.11304	0.5129
7	13.47445	0.9701
8	27.73205	0.3203
9	12.06638	0.9860
10	22.71222	0.5944
11	19.69098	0.7628
12	22.44651	0.6098

Probabilities from chi-square with 25 degrees of freedom

Source: Authors' calculation from Eviews 8

Figure B 2: Accumulated impulse responses for the unemployment model



Source: Authors' calculation from Eviews 8

APPENDIX C: APPENDIX TO CHAPTER 6

Table C 1: Structural VAR estimates for the basic model

Matrix A =				
1	0	0	0	
0	1	0	0	
0	0	1	0	
C(1)	0	C(2)	1	
Matrix B =				
C(3)	0	0	0	
0	C(4)	0	0	
0	0	C(5)	0	
0	0	0	C(6)	
	Coefficient	Std. Error	z-Statistic	Probability
C(1)	-0.097493	0.067075	-1.453502	0.1461
C(2)	-0.507557	0.193704	-2.620271	0.0088
C(3)	0.346776	0.043347	8.000000	0.0000
C(4)	0.057997	0.007250	8.000000	0.0000
C(5)	0.120079	0.015010	8.000000	0.0000
C(6)	0.131578	0.016447	8.000000	0.0000
Log likelihood	76.11044			
LR test for over-identification:				
Chi-square(4)	4.527453		Probability	0.3393
Estimated A matrix				
1.000000	0.000000	0.000000	0.000000	
0.000000	1.000000	0.000000	0.000000	
0.000000	0.000000	1.000000	0.000000	
-0.097493	0.000000	-0.507557	1.000000	
Estimated B matrix				
0.346776	0.000000	0.000000	0.000000	
0.000000	0.057997	0.000000	0.000000	
0.000000	0.000000	0.120079	0.000000	
0.000000	0.000000	0.000000	0.131578	

Source: Authors' calculation from Eviews 8

Table C 2: VAR lag exclusion Wald tests for the basic model

Chi-squared test statistics for lag exclusion:

Numbers in [ ] are p-values

	LNPRD	LNRWG	LNUEM	LNRER	Joint
Lag 1	0.109790	216.1910	36.30441	19.56130	3316.201
	[0.998547]	[0.000000]	[0.000000]	[0.000609]	[0.000000]
Lag 2	0.105354	1155.047	2.077715	4.652113	1311.535
	[0.998660]	[0.000000]	[0.721467]	[0.324890]	[0.000000]
df	4	4	4	4	16

Source: Authors' calculation from Eviews 8

Table C 3: Roots of characteristic polynomial for the basic model

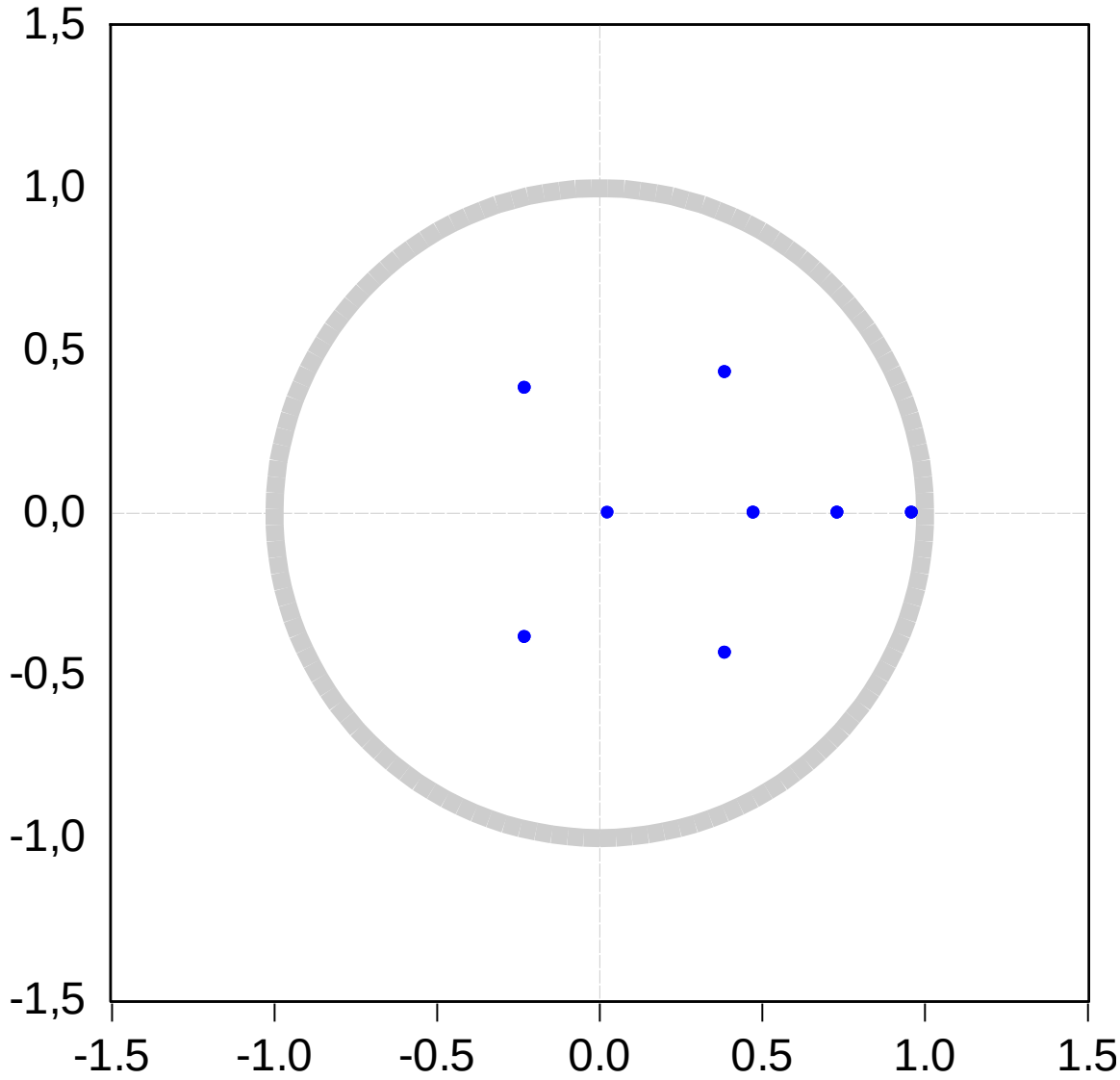
Root	Modulus
0.961193	0.961193
0.732484	0.732484
0.387423 - 0.432207i	0.580430
0.387423 + 0.432207i	0.580430
0.475350	0.475350
-0.229109 - 0.383625i	0.446832
-0.229109 + 0.383625i	0.446832
0.026678	0.026678

No root lies outside the unit circle.

VAR satisfies the stability condition.

Source: Authors' calculation from Eviews 8

Figure C 1: Inverse roots of AR characteristics polynomial



Source: Authors' calculation from Eviews 8

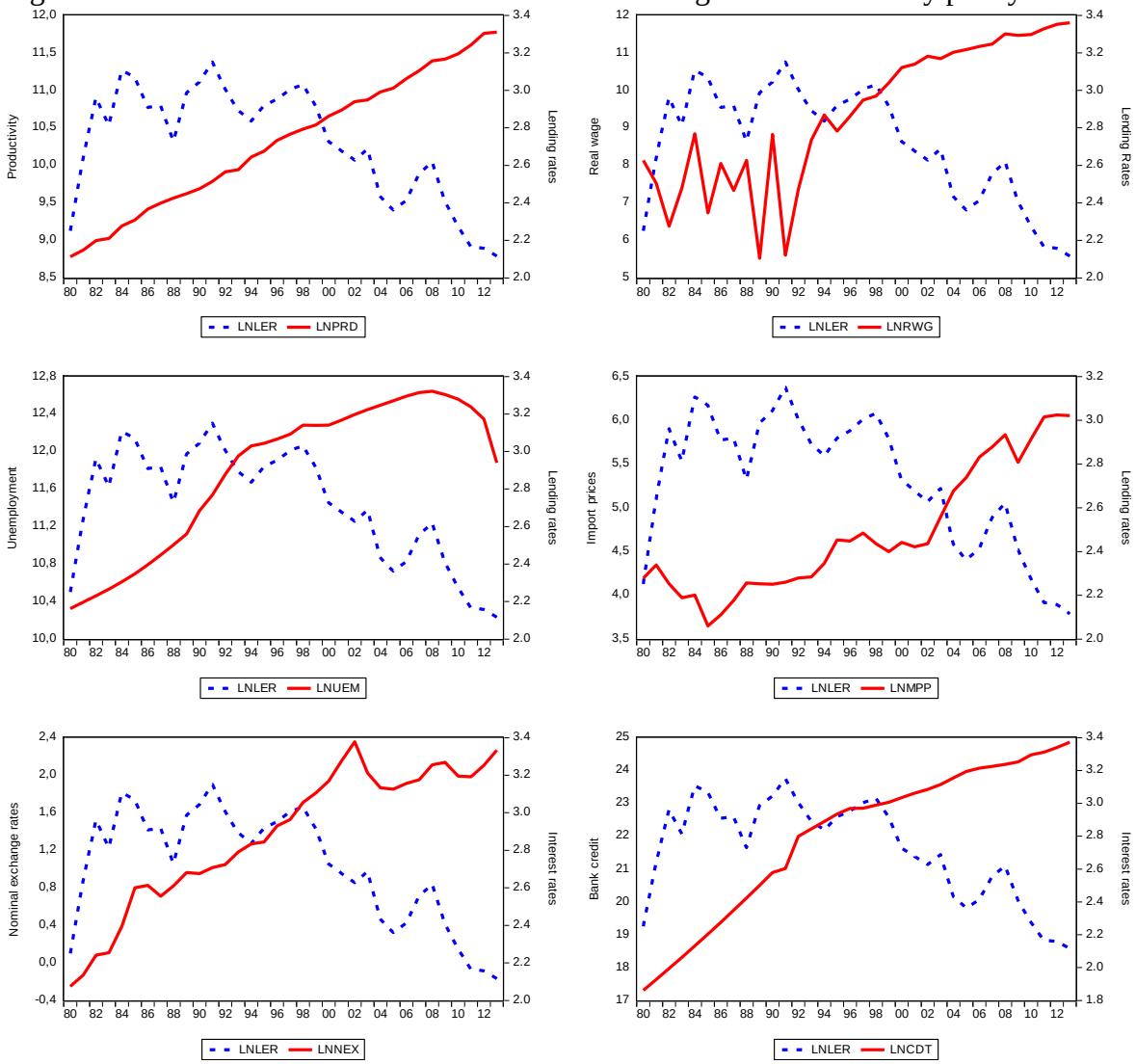
Table C 4: VAR residual serial correlation LM tests for the basic model

Lags	LM-Stat	Probability
1	11.80986	0.7570
2	13.39222	0.6439
3	24.09589	0.0874

Probabilities from chi-square with 16 degrees of freedom

Source: Authors' calculation from Eviews 8

Figure C 2: Evolution of macro-econometric variables against the monetary policy variable



Source: Authors' calculation from Eviews 8

Table C 5: Structural VAR estimates for the small macro-econometric model

Matrix A =						
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
C(1)	0	C(5)	1	0	0	0
C(2)	0	C(6)	C(9)	1	0	0
C(3)	0	C(7)	C(10)	C(12)	1	0
C(4)	0	C(8)	C(11)	C(13)	C(14)	1
Matrix B =						
C(15)	0	0	0	0	0	0
0	C(16)	0	0	0	0	0
0	0	C(17)	0	0	0	0
0	0	0	C(18)	0	0	0
0	0	0	0	C(19)	0	0
0	0	0	0	0	C(20)	0
0	0	0	0	0	0	C(21)
	Coefficient	Std. Error	z-Statistic	Prob.	Expected sign	Right Sign
C(1)	-0.701080	0.405473	-1.729042	0.0838	-	✓
C(2)	-1.168080	0.219902	-5.311811	0.0000	-	✓
C(3)	-0.889802	0.584791	-1.521572	0.1281	+	×
C(4)	0.008666	0.569140	0.015227	0.9879	+/-	✓
C(5)	-0.256113	0.162798	-1.573194	0.1157	-	✓
C(6)	-0.439267	0.087657	-5.011181	0.0000	-	✓
C(7)	-0.192912	0.227124	-0.849370	0.3957	-	✓
C(8)	-0.154656	0.216000	-0.716003	0.4740	+	×
C(9)	0.882897	0.090402	9.766313	0.0000	+	✓
C(10)	0.414340	0.348153	1.190107	0.2340	+	✓
C(11)	-0.046947	0.334495	-0.140352	0.8884	+/-	✓
C(12)	0.305161	0.339892	0.897817	0.3693	-	×
C(13)	-0.163669	0.323650	-0.505698	0.6131	+	×
C(14)	0.006464	0.163771	0.039470	0.9685	+/-	✓
C(15)	0.046052	0.005669	8.124038	0.0000		
C(16)	0.936229	0.115242	8.124038	0.0000		
C(17)	0.114699	0.014118	8.124038	0.0000		
C(18)	0.107267	0.013204	8.124038	0.0000		
C(19)	0.055706	0.006857	8.124038	0.0000		
C(20)	0.108768	0.013388	8.124038	0.0000		
C(21)	0.102328	0.012596	8.124038	0.0000		

Log likelihood	164.8339					
LR test for over-identification						
Chi-square(7)	18.66458		Probability	0.0932		
Estimated A matrix						
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000
-0.701080	0.000000	-0.256113	1.000000	0.000000	0.000000	0.000000
-1.168080	0.000000	-0.439267	0.882897	1.000000	0.000000	0.000000
-0.889802	0.000000	-0.192912	0.414340	0.305161	1.000000	0.000000
0.008666	0.000000	-0.154656	-0.046947	-0.163669	0.006464	1.000000
Estimated B matrix						
0.046052	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.936229	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.114699	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.107267	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.055706	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.108768	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.102328

Source: Authors' calculation from Eviews 8

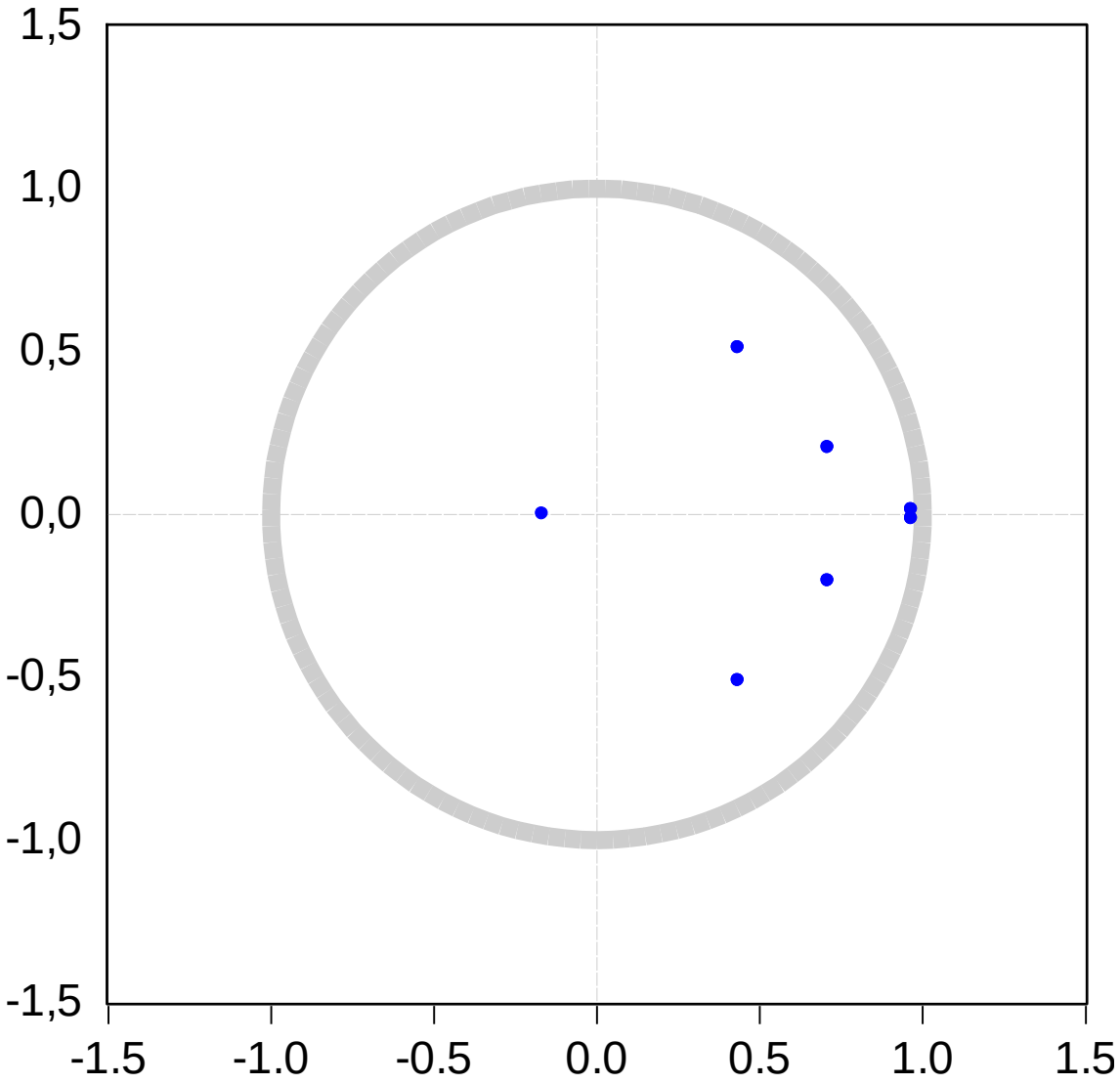
Table C 6: Roots of characteristic polynomial for the composite macro-econometric model

Root	Modulus
0.965933 - 0.013865i	0.966033
0.965933 + 0.013865i	0.966033
0.709631 - 0.204366i	0.738473
0.709631 + 0.204366i	0.738473
0.433189 - 0.511588i	0.670355
0.433189 + 0.511588i	0.670355
-0.167594	0.167594

No root lies outside the unit circle.
VAR satisfies the stability condition.

Source: Authors' calculation from Eviews 8

Figure C 3: Inverse roots of AR characteristics polynomial for macro-econometric model



Source: Authors' calculation from Eviews 8

Table C 7: VAR residual serial correlation LM tests for the macro-econometric model

Lags	LM-Stat	Probability
1	53.12965	0.3181
2	49.53025	0.4520
3	56.00400	0.2287
4	35.91865	0.9181
5	62.63443	0.0913
6	63.04885	0.0856
7	37.51662	0.8843
8	53.76249	0.2969
9	44.03825	0.6741
10	56.53247	0.2143
11	55.12380	0.2542
12	32.61280	0.9654

Probabilities from chi-square with 49 degrees of freedom

Source: Authors' calculation from Eviews 8

Table C 8: VAR lag exclusion Wald tests for the composite macro-econometric model

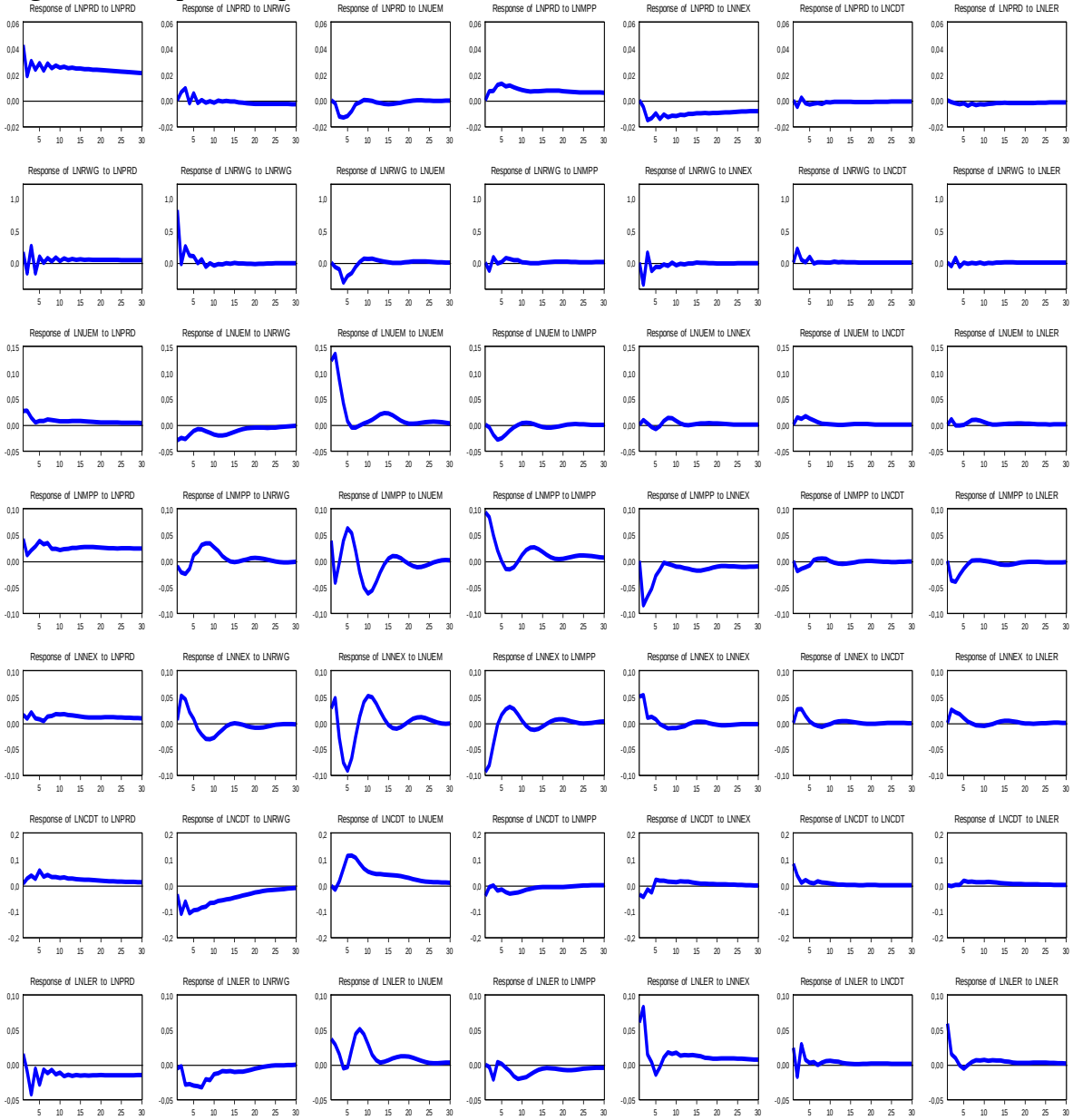
Chi-squared test statistics for lag exclusion

Numbers in [ ] are p-values

	LNPRD	LNRWG	LNUEM	LNMPP	LNNEX	LNCDT	LNLER	Joint
Lag 1	5.172896	6.410514	23.05186	31.72542	27.67126	46.41796	16.44181	455.2891
	[0.638873]	[0.492714]	[0.001670]	[4.57e-05]	[0.000252]	[7.25e-08]	[0.021373]	[0.000000]
Lag 2	11.44258	13.82102	2.564792	10.78906	9.817119	11.82673	12.16768	184.5432
	[0.120445]	[0.054458]	[0.922140]	[0.148088]	[0.199176]	[0.106403]	[0.095178]	[0.000000]
Degrees of freedom	7	7	7	7	7	7	7	49

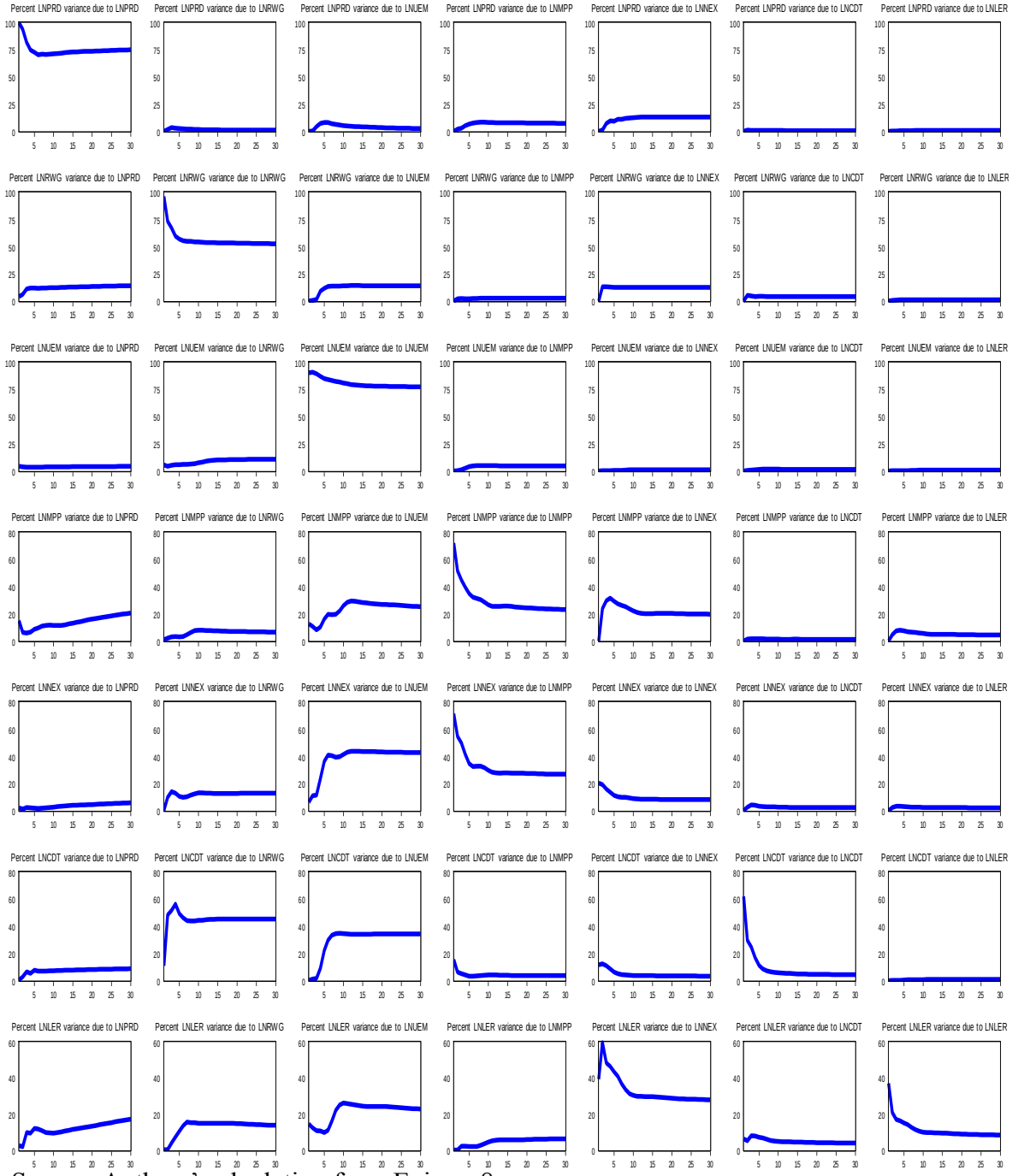
Source: Authors' calculation from Eviews 8

Figure C 4: Impulse responses for the small macro-econometric model



Source: Authors' calculation from Eviews 8

Figure C 5: Variance decomposition of the small macro-econometric model



Source: Authors' calculation from Eviews 8