ABSTRACT

TITLE OF DISSERTATION: ESSAYS ON OPTIMAL AID AND FISCAL POLICY IN DEVELOPING ECONOMIES

Ryan Niladri Banerjee, Doctor of Philosophy, 2010

Dissertation directed by: Professor Enrique G. Mendoza
Department of Economics

Essay I: *Which countries receive aid as insurance and why? A theory of optimal aid policy*

Empirical evidence shows that developing countries with opaque institutions receive procyclical Official Development Aid (ODA) while developing countries with transparent institutions receive acyclical or countercyclical ODA. This paper provides a dynamic equilibrium model of optimal aid policy that quantitatively accounts for this fact. In the model, the donor wants to (a) encourage actions by the aid receiving government that increase output and (b) smooth out economic fluctuations. The transparency of institutions in the country affects the donor's ability to distinguish downturns caused by exogenous shocks, from those caused by government actions. The solution to the donor's mechanism design problem is dependent on the transparency of government actions. If the donor has good information about government actions, aid policy is countercyclical and aid acts as insurance. However, if the donor is unable to infer perfectly the cause of the downturn, aid policy

is procyclical to encourage unobservable good actions. The model predicts a similar pattern for ODA commitments for the following year which is supported by the data. For countries with opaque institutions procyclical aid is the result of optimal policies given the information constraints of donors.

Essay II: *New Evidence on the Relationship Between Aid Cyclicality and Institutions*

This paper documents a new fact: the correlation between official development assistance (ODA) and GDP is negatively related to the quality of institutions in the receipient country. Differences in institutional indicators that measure corruption, rule of law, government effectiveness and government transparency are particularly important. The results are robust to several modifications. The results hold for both pooled and within regressions specifications and for different sources of institutional quality measures. This fact also reconciles conflicting empirical results about the correlation between ODA and GDP in the literature. For instance, Pallage and Robe (2001) find a positive correlation in two thirds of African economies and half of non-African developing economies, but Rand and Tarp (2002) find no correlation in a different set of developing countries. First, once institutions are accounted for, African economies are not treated differently by donors. Second, the sample in Rand and Tarp (2002) comprises developing economies which have relatively good institutions, therefore, those countries receive acyclical or countercyclical aid.

Essay II: *Optimal Procyclical Fiscal Policy Without Procyclical*

Government Spending

Procyclical fiscal policy can be caused by either procyclical government expenditure, countercyclical taxes or both. The majority of models which try to explain procyclical fiscal policy as the result of optimal policy have procyclical government expenditures. This paper develops a model which optimally generates procyclical fiscal policy while keeping government expenditures acyclical. Instead, taxes are optimally countercyclical. The model uses endogenous sovereign default to generate an environment where interest rates are lower in booms than in recessions. If household's have insufficient access to financial instruments it is optimal for the government to lower taxes and borrow during booms. This enables impatient households to benefit from the lower interest rates in booms by helping the consumer bring consumption forward.

ESSAYS ON OPTIMAL AID AND FISCAL POLICY IN DEVELOPING ECONOMIES

by

Ryan Niladri Banerjee

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Advisory Committee:
Professor Enrique G. Mendoza Chair/Advisor
Professor John Rust
Professor Pablo N. D'Erasmo
Professor Carlos A. Vegh
Professor Carol Graham

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Chapter 1

Which countries receive aid as insurance and why? A theory of optimal aid policy

1.1 Introduction

Official Development Assistance (ODA) is one of the most important instruments with which developing countries finance their current account deficits. This observation has prompted a number of papers to suggest that welfare in developing countries could be improved if aid flows were countercyclical or less volatile, in order to smooth the consumption of households in developing countries (Bulir and Hamann, 2003; Pallage, Robe and Berube, 2006, Arellano, Bulir, Lane and Lipschitz, 2009). This reasoning stands in sharp contrast to the empirical findings of Pallage and Robe (2001) who show that ODA is predominantly procyclical. This raises a critical question: Why are aid flows not given countercyclically?

In Banerjee (2010), I provide an empirical insight into this question. I show that developing countries with weak institutions (in particular, institutional measures related to government transparency) receive strongly procyclical ODA while developing countries with good institutions receive acyclical or countercyclical ODA. For ODA disbursements (actual aid given) the inverse relationship between institutional quality and the procyclicality of aid is strongest for *bilateral* ODA and weaker

for *multilateral* ODA. However, for ODA commitments (aid promises for the next year) the inverse relationship between institutional quality and aid procyclicality is strongest for *multilateral* donors but insignificant for *bilateral* donors.

Section 1.3 examines the impact of institutions on donor behaviour in a case study to understand why some countries receive aid as insurance while others do not. It contrasts the nature of aid flows to Malawi and Zaire. Although both Malawi and Zaire went through structural adjustment in the early 1980s, Malawi, which had relatively good institutions, received strongly countercyclical aid, whilst Zaire with weak institutions received strongly procyclical aid. The case study finds that for Malawi, donors worked closely with the government and trusted that the government had implemented reforms effectively. Donors therefore attributed downturns to exogenous events. This prompted donors to give aid as insurance to Malawi. However, in Zaire donors inferred that government actions were at least partially responsible for the downturns, while the government claimed the downturns were caused by donor policy. The case study concludes that the transparency of actual government policies and the credibility of announced policies being implemented influences donor decisions to provide aid as insurance or not. The paper also shows that the measures of institutions that are most negatively related to the correlation between aid and GDP are those which contain information about the transparency of government actions, such as the level of corruption, transparency of public institutions and rule of law.

The main part of the paper provides a calibrated dynamic moral hazard model

that accounts for these facts. The model considers an altruistic donor that cares about the utility of the poor in a developing country. The donor wants to (a) increase the level of consumption and (b) smooth out economic fluctuations of the poor. There is a recipient government that can divert some of the aid to a favoured subgroup. The recipient government can undertake costly actions that increase expected output, which benefits society at large. However, the donor's ability to monitor government actions depends on government transparency.

In countries with transparent institutions, recipient government actions are observable, which allows donors to distinguish downturns caused by exogenous shocks from those cause by recipient government actions. Therefore, with full information, the donor's optimal policy is to condition aid on observable actions and give aid countercyclically as insurance against economic fluctuations.

In contrast, in countries with less transparent institutions, it is harder for the donor to monitor recipient government actions. Because the donor is unable to distinguish perfectly downturns caused by exogenous shocks from those caused by government actions. Thus the recipient government faces a moral hazard problem. With moral hazard, the donor solves the mechanism design problem by conditioning disbursed aid (and aid commitments for the next period) on observable output and other observable signals, to encourage actions that increase expected output. The mechanism rewards high output states with more aid and low output states with less. If the donor were to give aid as insurance in downturns, there would be no incentive for the government to incur the cost of higher effort because actions that

increase GDP are not rewarded by more aid, while actions that decrease GDP are rewarded with more aid. Therefore, with moral hazard, the donor is unable to encourage government effort to increase GDP while simultaneously smoothing out economic fluctuations. Thus the optimal aid policy for the donor is procyclical if the donor cannot perfectly observe the source of the shocks and the benefits from higher government effort outweigh the costs of not smoothing consumption.

The dynamic dimension of the model provides an explanation for the different behaviour of aid flows from *multilateral* and *bilateral* donors. In the model, this difference in the behaviour can be explained if we assume that *multilateral* donors are forward looking and use not only aid disbursements but also aid commitments to encourage good actions while *bilateral* donors are myopic and rely entirely on aid disbursement alone. There is some evidence to support this assumption. In the data there is evidence that *bilateral* ODA commitments are used to stabilise countries which have had coups rather than encouraging good policy (Banerjee, 2010). Therefore, it appears that *bilateral* ODA disbursements alone are used to encourage good actions. This can also explain the stronger relation between institutional transparency and the procyclicality of *bilateral* aid *disbursements* in the data.

Alesina and Dollar (2000) and Alesina and Weder (2002) empirically examine the impact of institutions on the level of aid a country receives. Both studies do not find a significant relationship between institutions and the level of aid. Any model which attempts to match the cyclical properties of aid in Banerjee (2010) must also simultaneously match this fact about the level of aid. The model in this paper uses

a realistic mechanism to allow the level of aid to be independent of institutional quality, while at the same time maintaining the inverse relationship between institutional quality and the correlation between aid and GDP. The model assumes there is a separate branch of the donor government/organisation which exogenously promises a level of utility to the recipient government perhaps for political reasons. This promise determines the expected level of aid in equilibrium. Actual aid disbursements are administered by a separate aid agency which is altruistic in the sense of the donor described above. This paper shows that it is still optimal for the altruistic aid agency to give countercyclical aid to countries with good institutions and procyclical aid to countries with weak institutions, over all empirically relevant levels of aid.

The results from this paper directly address the policy debate about whether aid flows are welfare inefficient and destabilising in developing countries (Bulir and Hamann, 2003; Pallage, Robe and Berube, 2006; Chauvet and Guillaumont, 2008; Arellano, Bulir, Lane and Lipschitz, 2009). This paper shows that conditional on having good institutions, aid does act as insurance for developing countries during downturns. In the model, as the quality of institutions deteriorates, aid becomes more procyclical under the optimal policy. Therefore, the fact that some developing countries receive procyclical aid could be a conscious decision on the part of donors. The paper shows that if aid were given countercyclically to countries with weak institutions, welfare would be reduced. With moral hazard, countercyclical aid removes the incentive for recipient governments to incur effort. This reduces the level

of GDP in the developing country, reducing welfare. Some of this GDP reduction is mitigated by the countercyclical aid which smooths consumption, but this positive welfare effect is dominated by the negative welfare cost from lower GDP. To achieve the same welfare of the donor's target group with countercyclical aid, the aid to GDP ratio would need to be increased from 10% to 20% of GDP.

The model is closest to Svensson (2000) and follows the literature on optimal aid contracts with an altruistic donor and a recipient government that favours the welfare of a subset of agents in the economy (Adam and O'Connell, 1999, Svensson, 2000, Azam and Laffont, 2003). This paper extends the analysis by solving a calibrated intertemporal moral hazard problem using the techniques of Spear and Srivastava (1988) and Phelan and Townsend (1991). It then goes onto show how this model can quantitatively explain the dynamics of aid flows to developing countries.

Section 1.2 examines the empirical relationship between aid, GDP and institutions. Section 1.3 examines a two country case study to illustrate how donors treat different types of governments. Section 1.4 presents the theoretical model and describes the solution method, section 1.5 discusses the calibration and section 1.6 compares the model to the data. Finally section 1.7 concludes.

1.2 Stylised facts on the cyclical relationship between aid and GDP

Banerjee (2010) presents five stylised facts that any model of the cyclical behaviour of ODA must explain:

1. The comteporaneous correlation between institutional quality and the correlation between aid *disbursements* and GDP is negative. Countries with weak institutions receive strongly procyclical aid while countries with good institutions receive countercyclical aid.

2. The correlation between institutional quality and the correlation between *multilateral aid commitments* in period $t+1$ and GDP in period t is negative. For *multilateral* ODA, countries with weak institutions receive procyclical aid *commitments* while countries with good institutions receive countercyclical aid *commitments*.

3. The volatility of GDP is independent of institutional quality.

4. The volatility of aid is independent of institutional quality.

5. The level of aid per capita is uncorrelated with institutional quality.

The model should be able to generate both procyclical and countercyclical aid for the same level of aid per capita. Furthermore the model must provide a plausible explanation for the different properties of multilateral and bilateral aid flows.

In Banerjee (2010), I generates these stylised facts using a dataset composed of annual data from 1974 to 2007. A country is excluded if it is not in Africa, Asia, South America, the Carribean or Central America. A recipient country is also excluded from the sample if it had not achieved independence by the end of 1975. Furthermore, countries are dropped if aid or national accounts data are unavailable prior to 1988. Countries are also dropped due to country coverage of institutional

quality measures. The final sample for the main regression results reported here consists of 61 developing countries.

The data on aid flows come from the Official Development Assistance (ODA) figures published by the OECD's DAC database. The OECD collects information on aid disbursements (actual aid given in a year) and aid commitments (promises of aid for the year)[1]. ODA disbursements are measured as the net value of grants and concessional loans[2]. ODA commitments are measured on a gross basis because net figures are not published.

GDP per capita is taken from the World Bank's World Development Indicators (WDI). All series are deflated by the purchasing power parity (PPP) GDP deflators from the Penn World Tables prior to 2000 and thereafter using the WDI PPP deflators. Capital flow data are also taken from the WDI. Capital flows are measured as the sum of net foreign direct investment (FDI), equity investment portfolio flows and portfolio investment bond flows to both the private and government sectors.

To compute the cyclical properties of ODA and GDP per capita, I detrend the data using the Hodrick-Prescott filter and drop the endpoints. For my main results I use a weighting parameter of 10, as suggested by Baxter and King (1995) for annual data. The results are also robust to using the Baxter-King (1999) band pass filter as an alternative filtering mechanism.

[1]Celasun and Walliser (2008) provide a detailed statistical analysis of the relationship between ODA commitments and disbursements. They find that commitments are predictors of disbursements, but a large unexplained component remains.

[2]Loans must have a concessional nature to qualify as ODA. For example IMF, standby agreement credits are not considered ODA because they are given at interest rates sufficiently close to market rates.

The International Country Risk Guide (ICRG) ratings are used as the main source for institutional quality data. The International Country Risk Guide (ICRG) ratings provide the longest time series with broad country coverage starting in 1982 with further improvements in the coverage of developing countries in 1985. The ICRG provides quantitative assessments of countries provided by a group of unidentified private experts not necessarily resident in the country. For the main results, I use the mean of scores from (a) corruption, (b) rule of law/law and order tradition and (c) private expropriation risk as my main measure of institutional quality.[3] A higher score implies higher quality institutions.[4]

1.2.1 ODA disbursements

Figure 1.1 plots institutional quality against the correlation between detrended total ODA disbursements and detrended GDP.[5] The inverse relationship between the quality of institutions and the correlation between ODA disbursements and GDP is clear. The correlation between ODA disbursements and GDP ranges from 0.9 to -0.55. Figures 1.2 and 1.3 plot the same graph for multilateral and bilateral ODA disbursements respectively.[6] The inverse relationship between institutions and the aid-GDP correlation is still evident.

[3] I re-scale the private exproptiation risk scores onto a [0,6] scale to conform with the scale of the corruption and rule of law scores.

[4] These measures of institutions come from Knack and Keefer (1995) who used the underlying ICRG data to construct the IRIS 3 dataset which measures: corruption, ethnic tension, rule of law, quality of bureaucracy, repudiation of government contracts and expropriation risk. Since Knack and Keefer (1995) these measures of institutions have been used in many studies e.g. Acemoglu, Johnson and Robinson (2001) to analyse the impact of institutions on economic development and Alfaro, Kalemli-Ozcan and Volosovych (2005) to explain why capital does not flow from rich to poor countries.

[5] See Banerjee (2010) for details further details about the data used.

[6] Bilateral aid constitutes around two thirds of ODA and multilateral around one third.

Table 1.1: Determinants of the correlation between ODA disbursements and GDP

Corr (aid, GDP)	Total	Multilateral	Bilateral
Institutions	-0.107***	-0.080**	-0.103***
	(0.033)	(0.031)	(0.029)
Obs	122	122	122
Adj. R^2	0.083	0.046	0.078

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 1.1 summarises Banerjee's (2010) results from regressing the correlation between ODA and GDP on institutional quality. The coefficient on institutions is significant at the 1% level for total and bilateral ODA disbursements and significant at the 5% level for multilateral disbursements. Banerjee (2010) also shows that these results are robust to including both country and time fixed effects.[7]

Countries that had relatively poor institutions in the 1970s, but improved them by the 1990s (e.g. Ghana and Uganda) had a high correlation between aid and GDP in the 1970s and early 1980s, but a relatively low correlation in the 1990s and beyond. On the other side, countries which had relatively good institutions in the 1970s and early 1980s but declining institutional quality thereafter (e.g. Cote d'Ivoire and Sierra Leone) show the opposite trend. Countries which had poor institutions throughout had a high correlation between aid and GDP in all decades (e.g. Democratic Republic of Congo), while countries with relatively good institutions throughout had a low correlation between aid and GDP in all decades (e.g. Malawi).

[7]This implies that the changes in aid procyclicality are also negatively correlated with changes in institutional quality.

Table 1.2: Determinants of the correlation between ODA disbursements and GDP, with controls

Corr(aid, GDP)	Total	Multilateral	Bilateral
Institutions	-0.077 *	-0.030	-0.103***
	(0.041)	(0.038)	(0.038)
Aid/GDP	0.386	0.131	0.721
	(0.510)	(1.374)	(0.855)
Average(GDP)	-0.036	-0.029	-0.036
	(0.062)	(0.065)	(0.067)
SD(Aid)	0.078	0.028	0.150
	(0.098)	(0.100)	(0.096)
SD(GDP)	1.231	1.191	0.930
	(1.022)	(1.075)	(1.222)
Conflict dummy	-0.090	-0.044	-0.154*
	(0.093)	(0.091)	(0.087)
Coup dummy	-0.057	-0.036	-0.033
	(0.072)	(0.066)	(0.073)
Polity IV	-0.000	-0.002	0.001
	(0.002)	(0.002)	(0.002)
Civil War dummy	-0.013	-0.004	-0.011
	(0.025)	(0.020)	(0.025)
Inflation Crisis	0.000	-0.000	-0.001
	(0.016)	(0.017)	(0.016)
SD(Terms of Trade)	0.217	0.239	0.068
	(0.349)	(0.383)	(0.381)
Capital Flows/Aid	0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)
Obs	122	122	122
Adj R^2	0.126	0.109	0.119

Note: White standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

For *total* and *bilateral* ODA, the negative relationship between institutions and the aid-GDP correlation is robust to controlling for a multitude of other possible explanatory variables (Table 1.2), although, this is not true for *multilateral* aid. Table 1.2 shows that neither the volatility of GDP, the volatility of aid nor the aid to GDP ratio are significant in explaining the correlation between aid and GDP for Total and Bilateral ODA. These results are in line with Pallage and Robe (2001) and Bulir and Hamann (2003), who do not find significant relationships between these variables and the correlation of aid with the business cycle. Any model which attempts to explain differences across countries in the correlation between aid and GDP must be capable of doing so independent of these variables. The negative relationship between institutions and the correlation between aid and GDP is also robust to controlling for other plausible explanatory variables such as the prevalance of coups in a country, armed conflicts, the political structure, civil liberties and inflation crises and the capital flows to aid ratio (table 1.2).

These results indicate that countries with weaker institutions receive more procyclical aid on average. As institutions improve, aid becomes acyclical or countercyclical on average. For those countries with good institutions, aid often does act as insurance during downturns. The results of a robust significant relationship between institutions and aid cyclicality is striking because the previous literature failed to find any relationship between the level of aid and the quality of policy (World Bank, 1998, Dollar and Svensson, 2000, Alesina and Dollar, 2000 and Alesina and Weder, 2002).

Table 1.3: Which institutions are negatively related to the correlation between aid and GDP?

Significant	Insignificant
ICRG	
Corruption	Ethnic Tension
Rule of law	Quality of bureaucracy
Expropriation risk	Repudiation of government contracts
Kaufmann Kraay	
Government Effectiveness	Regulatory Quality
Voice and accountability	
Political Stability, No Violence	
Control of Corruption	
Rule of Law	
CPIA	
Public sector management and institutions	Equity of public resource use
Structural policies cluster	Financial sector rating
Debt Policy	Fiscal policy rating
Property rights and rule base governance	Budgetary and financial management
Efficiency of revenue mobilisation	Quality of public administration
Economic management cluster	Trade rating

All regressions run will controls

Table 1.4: Determinants of the level of aid

Aid per capita	(1)	(2)
Institutions	-0.259*	-0.140
	(0.155)	(0.148)
GDP per capita		-0.252*
		(0.162)

Note: White standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

In Banerjee (2010), I also use the 1996 Kaufmann and Kraay (2008) governance indicators and the 2006 World Bank CPIA institutional quality measures as alternatives to the measure constructed from the ICRG. Table 1.3 lists the institutional quality measures which are significantly related to the correlation between aid and GDP. For the Kaufmann and Kraay indicators, control of corruption, rule of law and government effectiveness are significant. The CPIA measures for the quality of structural policy, public sector management and institutions and efficiency of revenue mobilistion appear most strongly correlated with the correlation between aid and GDP. Overall, these alternative measures of institutions suggest that transparency and trust in the quality of decision-making of the government, property rights and the ability of the government to carry out announced plans influence whether a country receives procyclical or countercyclical aid. Note that measures of institutions unrelated to transparency and credibility such as ethnic tension and equality, are not related to the correlation between aid and GDP.

Turning to the relationship between the *level* of ODA and institutions, Table 2.15 confirms the results of Alesina and Weder (2002) that the level of ODA a country receives is not influenced by institutional quality. The results show that

Table 1.5: Determinants of the correlation between ODA commitments and GDP

Corr(aid com., GDP)	Total	Multilateral	Bilateral
Institutions	-0.014	-0.060**	0.026
	(0.023)	(0.026)	(0.028)

Note: White standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

once GDP per capita is controlled for, the institutional quality variable is not a significant explanatory variable for the level of aid. Thus institutions matter for the cyclical characteristics of aid but not the level of aid a country receives. This is an important fact that any theory of aid cyclicality must replicate.

1.2.2 ODA Commitments

Motivated by the model in this paper, Banerjee (2010) also examines the cyclical relationship between GDP and ODA commitments for the following year. Table 1.5 shows the results from regressing the correlation between aid commitments and GDP on institutional quality. The correlation between institutional quality and the correlation between ODA commitments for period $t+1$ and GDP in period t is negative and significant at the 1% level for multilateral ODA commitments. Figure 2.9 also shows that the correlation between multilateral ODA commitments and GDP is negatively correlated to my measure of institutional quality. These results are also robust to including both country and time fixed effects.

In Banerjee (2010), I also show that the results in Table 1.5 are robust to including additional control variables. Interestingly coups are a significant explanatory variable for the cyclicality of total and bilateral ODA *commitments* (Table 1.6).

Table 1.6: Determinants of the correlation between ODA commitments and GDP, with controls

ODA Commitments	Total	Multilateral	Bilateral
Institutions	0.000	-0.099**	0.046
	(0.039)	(0.040)	(0.040)
Coups	-0.140***	-0.084	-0.135**
	(0.052)	(0.061)	(0.055)
	plus control variables		

Note: White standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 1.7: Determinants of the volatility of aid and GDP

Dependent variable	SD(aid)	SD(aid)	SD(GDP)	SD(GDP)
Institutions	0.389*	0.251	-0.0165***	-0.010
	(0.218)	(0.170)	(0.006)	(0.006)
Average(GDP)		0.282		-0.013*
		(0.269)		(0.007)

Note: White standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

The sign is negative, which suggests that countries that experience a coup have less procyclical ODA commitments than countries that do not. It would appear that bilateral donors use ODA commitments for other purposes (e.g. stabilising a country) rather than using aid commitments to encourage better government policies.

1.2.3 Institutions and volatility of aid and GDP

Table 1.7 examines the relationship between institutional quality and the volatility of aid and the volatility of GDP. While there is a positive relationship between the volatility of aid and institutional quality, it is not significant once the level of GDP in the country is accounted for. There is also a negative relationship between the volatility of GDP and institutional quality but once the level of GDP

Table 1.8: Business cycle moments

	Total		Multilateral		Bilateral	
	Good	Weak	Good	Weak	Good	Weak
SD(GDP)	0.043	0.064	0.043	0.064	0.043	0.064
SD(ODA dis.)	0.235	0.261	0.358	0.305	0.306	0.248
SD(ODA com.)	0.282	0.299	0.432	0.429	0.315	0.304
corr(GDP, ODA dis.)	-0.209	0.418	-0.082	0.245	-0.158	0.378
corr(GDP, ODA com.)	-0.158	0.020	-0.235	0.122	0.007	-0.069
(ODA dis.)/GDP %	1.3	6.1	0.5	2.0	2.4	4.6
min(ODA dis./GDP) %	0.03	0.07	0.00	0.01	0.01	0.06
max(ODA dis./GDP) %	18.1	44.8	7.26	17.2	12.9	25.5

Note:(1) Sample split into good and weak institutions by the median value in the sample.

Note:(2) ODA dis. are ODA disbursements, ODA com. are ODA commitments.

Note: (3) Correlations are taken from the trend line in tables 1.1 and 1.5

is accounted for, this relationship is also not significant. Therefore, there does not appear to be a strong relationship between institutional quality in a country and the volatility of aid or the volatility of GDP in that country.

1.2.4 Business cycle statistics

Table 3.1 shows cross country averages of key business cycle moments from my dataset which I will use to calibrate the model. The countries are divided into those with good and weak institutions, defined as those with above and below median institutional quality. As expected from the results above, the correlation between aid and GDP is lower in the group with better institutions. The median volatility of aid is approximately similar across groups, which which is not surprising given the results from table 1.2. GDP is slightly more volatile in countries with weaker institutions. The median aid to GDP ratio is higher for countries with weaker

institutions. However, the maximum and minimum aid to GDP ratios for countries with good and weak institutional quality show there is very little correlation between institutional quality and the amount of aid a country receives. Furthermore table 2.15 that the correlation between quality and the level of aid is not significant once one controls for the level of GDP.

1.3 A case study: Aid flows to Malawi and The Democratic Republic of the Congo

Given the empirical relationship between institutional quality and the correlation between aid and GDP, I compare the contrasting aid experiences of Malawi and Zaire[8] to better understand which aspects of institutional quality influence donor behaviour. Malawi traditionally had better institutions than Zaire. During the early 1980s, when both countries faced difficult economic adjustments, they both cooperated with donor conditions and met donor targets. However, during the 1980s Malawi received strongly countercyclical aid flows (Figure 2.1) while Zaire received strongly procyclical aid flows (Figure 2.2). Why were the aid experiences so different?

By 1979 both countries had adopted stabilisation plans and standby agreements with the IMF due to balance of payments difficulties. By 1982 Malawi had made more progress meeting the objectives of the plan than Zaire (Gulharti, 1989

[8]I refer to the Democratic Republic of the Congo by its former name since I am focussing on that period of its history.

and Kiakwama and Chevallier, 2001) but Zaire *"adopted a comprehensive and far reaching reform program in 1983 ... [t]he adjustment during 1983-85 was substantial ... [d]ebt service payments were made on schedule and external arrears were substantially reduced, but [this] failed to generate additional donor support"* (p.632 para 5 Kiakwama and Chevalier, 2001). This account of events is reflected in Figure 2.2, where GDP per capita is decreasing after 1980, while aid flows remain below 1980 levels. Despite following donor plans closely, Zaire did not receive aid as insurance against the downturn.

Malawi suffered a financial crisis in 1985 (Harrigan, 1991). The government resorted to domestic borrowing and the pace of inflation accelerated (Gulharti, 1991). The drop in GDP can be seen in Figure 2.1, but in contrast to the experience of Zaire, aid to Malawi clearly increased during the downturn.

In Zaire, with opaque institutions, donors had very little information about government actions. To encourage beneficial government actions, donors increased aid only after observable variables improved because they could not monitor the actions themselves.

Wrong (2001) indicates that the donors clearly had very little information about actual government actions: *" 'We never had solid data, because they [the Zairian authorities] weren't willing to provide it,' admitted a senior World Bank economist. 'We could never get a good grasp of what was happening.'"* (p.209 para. 1, Wrong, 2001).

Young and Turner (1985) argue that donors had not only very little infor-

mation about government actions, but also that official flows were dependent on information about government actions: *"... the IMF had rescinded Zaire's eligibility for higher tranche credit, noting that the country was not meeting arrears, and that indeed it had no notion of what Zaire was doing."* (p.383 para. 4, Young and Turner, 1985).

Given this lack of information about government actions, Young and Turner (1985) show that the donor community instead conditioned aid on observable outcomes: *"In mid-1981 this temporary improvement [in macro variables] led to another - and larger - IMF advance of approximately $950 million. Soon thereafter Zaire was again out of compliance with the agreement, and by 1982 further advances had again been cut off."* (p. 384, para. 3, Young and Turner, 1985).

Furthermore, Wrong (2001) argues that donors understood the incentive effect of withholding aid in downturns on government actions: *"... the first structural adjustment programme went into action, at the end of 1982. [...] there was also a feeling in Washington that with national bankruptcy now a concrete threat and this regime unchallenged on the political front, Mobutu might see the need to knuckle down. For three years the calculation seemed the right one as, under the tutelage of Prime Minister Kengo Wa Dondo, Zaire set in place a reform program regarded as a model of its kind."* (p.210 para. 1, Wrong, 2001).

In contrast, in Malawi, there were few areas of asymmetric information between the donors and the government about the implemented policy because *" [s]taff of these international organizations undertook the bulk of the analysis (or*

helped the government to define, supervise and finance expatriate consultants who did the policy analysis) that underpinned the reforms." (p.39 para. 3, Gulharti, 1991). Gulharti (1991) concludes that Malawi's poor economic performance in the 1980s was a case of 'promising reforms, bad luck'. It appears that because of the close working relationship with the government, the donors could monitor reform implementation more clearly in Malawi than in Zaire. This is arguably why donors were willing to give more aid to Malawi during downturns, because donors could more clearly evaluate that the downturn due to exogenous shocks and not due to the government not fulfilling promised actions. Meanwhile, in Zaire, donors had very little information about the government's actual actions, they could not observe the cause of the downturn, but realised the incentive effect on reforms from withholding aid in downturns.

1.4 Model

1.4.1 Environment

I consider a developing economy inhabited by two groups, called rich and poor. The economy is closed except for foreign aid flows, to capture the fact that the majority of developing countries in my sample have very limited access (if any) to international capital markets. There is a government of the developing country and a foreign donor. To capture the fact that aid is given for both political and economic purposes, I assume that independent of the donor administering the aid disbursements (e.g. USAID), there is another branch of the donor organisation/government

(e.g. The State Department) which exogenously promises a level of utility w_0 to the developing country at $t = 0$. This separates the level of aid from the cyclical behaviour.[9] The promise w_0 will determine the expected level of aid a country receives in equilibrium. The donor administering the aid disbursement would like to ensure the recipient government exerts effort to improve the welfare of the poor, subject to the political constraint of delivering welfare w_0 to the recipient government. The donor administering the aid cares about the welfare of the poor and pays a constant marginal cost for each unit of aid disbursed[10]. The donor's expected utility function is

$$U = E_0 \sum_{t=0}^{\infty} \beta^t [u(c_t^p) - \phi a_t] \tag{1.1}$$

where β is the discount rate of the donor, $u(.)$ is the period utility function of the poor in the country, with $u'(.) > 0$ and $u''(.) < 0$, c_t^p is the consumption of the poor, a_t is the amount of aid disbursed in period t and ϕ is the marginal cost of aid.

The government of the country cares about the welfare of both the rich and the poor. Actions (policy) by the government can increase the expected output of the economy. However, these actions are costly to the government. The recipient government's expected utility function is

$$V = E_0 \sum_{t=0}^{\infty} \gamma^t \left[\theta v(c_t^r) + (1-\theta) u(c_t^p) - g(e_t)\right] \tag{1.2}$$

[9] Alesina and Dollar (2000) showed that the level of aid is determined independent of institutions, while political alliances were found to be an important determinant of the level of aid.

[10] This can be thought of as a constant marginal cost for the use of funds for other purposes/countries.

where γ is the discount factor of the government, θ measures the degree of favouritism of the government towards the rich, $v(.)$ is the period utility function of the rich and is concave with $v'(.) > 0$ and $v''(.) < 0$ and c_t^r is the consumption of the rich in period t. The function $g(.)$ is convex with $g'(.) > 0$ and $g''(.) > 0$ and measures the cost of effort e_t by the government.

Effort by the government increases output y_t in the developing country. Output is determined by a set of conditional probability distribution functions of y conditional on e and is denoted by $f_1(y|e)$. It is assumed that it is impossible to perfectly infer the government's effort perfectly from output outcomes:

$$f_1(y|e) > 0 \ \forall e \tag{1.3}$$

Also for any $e^{high} > e^{low}$, $f_1(y|e^{high})$ first order stochastic dominates $f)1(y|e^{low})$.

The donor also receives a signal s_t of the government's effort. The distribution of s_t conditional on y_t and e_t is denoted by

$$f_2(s_t|e_t, y_t) \tag{1.4}$$

Applying the definition of a conditional probability, the probability of observing y_t and s_t conditional on effort e_t is given by

$$f(y_t, s_t|e_t) = f_1(y_t|e_t)f_2(s_t|y_t, e_t) \tag{1.5}$$

The government runs a balanced budget and chooses the distribution of output between the rich and poor. The donor can give aid directly to the poor in order to increase the welfare of the poor, but the aid is subject to diminishing returns. Thus the economy faces the following resource constraints,

$$c_t^r = y_t - d_t \tag{1.6}$$

and

$$c_t^p = d_t + h(a_t) \tag{1.7}$$

where d_t is the amount of output given to the poor by the government. Following the empirical results from Clemens, Radelet and Bhavani (2004) about the short-run impact of aid, there are decreasing returns to aid, $h'(.) > 0$, $h''(.) \leq 0$ and $h(0) = 0$.

1.4.2 Recipient government's problem in Autarky

In autarky, the government receives no aid. The solution to this problem provides a lower bound on the donor's aid problem. The donor must at least give the autarky level of utility to government. If the donor does not, it is optimal for the government to choose autarky and not follow the donor's plan. The government's problem in autarky is to choose both effort and the optimal division of output between the rich and poor conditional on the level of aid a. For tractability, I assume no storage. Under this condition the government's dynamic problem reduces to a

sequence of static problems

$$V = \max_{\{e_t, d_t\}} \int \left[\theta v(y_t - d_t) + (1-\theta)u(d_t) - g(e_t)\right] dF_1(y_t|e_t) \tag{1.8}$$

The first order condition of the government for the optimal choice of d equates the ratio of the marginal utilities of the rich and poor to the ratio of their weights in the utility function. While the parameter θ indexes the inequality in the country the government completely shares aggregate risk between the two groups.

$$\frac{\theta}{1-\theta} = \frac{u'(d_t)}{v'(y_t - d_t)} \tag{1.9}$$

Assuming that effort e is discrete (as done in the numerical section), the optimal choice of e in autarky is obtained by computing the level of e which generates the highest value for V given the first order condition (1.12) and a. For example suppose for two levels of effort e^h and e^l there are two conditional distributions functions $F_1(y|e^h)$ and $F_1(y|e^l)$. The government evaluates expected utility from each level of effort

$$V^i = \int \left[\theta v(y - d(y,a)) + (1-\theta)u(d(y,a) + h(a)) - g(e^i)\right] dF_1(y|e^i) \text{ for } i = h, l \tag{1.10}$$

If $V^h > V^l$ then the benefit from the high level of effort outweigh the costs and the higher level of effort e^h is chosen. Else if $V^h < V^l$ the costs of the higher level of effort outweigh the benefits and the low level of effort is chosen. This method

avoids the need to check the conditions in Rogerson (1985) when using the first order approach.

Let V^{aut} denote the solution to the autarky problem. This is the solution to (1.11) when aid equals zero.

1.4.3 Recipient government's problem with Aid

With positive aid flows, the government's problem is reduced to only choosing the optimal division of output between the rich and poor conditional on the level of aid a. The government's effort e is effectively 'chosen' by the donor when the donor solves its mechanism design problem. The government's problem is given by

$$V = \max_{\{e_t, d_t\}} \int \left[\theta v(y_t - d_t) + (1-\theta)u(d_t + h(a_t)) - g(e_t)\right] dF_1(y_t|e_t) \tag{1.11}$$

The first order condition of the government for the optimal choice of d is similar to (1.9) except that total resources available to the government includes aid a.

$$\frac{\theta}{1-\theta} = \frac{u'(d_t + h(a_t))}{v'(y_t - d_t)} \tag{1.12}$$

The optimal choice of d is a function of y and a, denoted as $d(y, a)$. The share of output going to the poor is decreasing in aid, $\partial[d(y,a)]/\partial a < 0$. Therefore, with higher aid, the government has less incentive to transfer resources to the poor and

less incentive to do higher effort to increase total output y[11].

1.4.4 Donor

The donor's ability to monitor the recipient government's effort is dependent on the transparency of institutions. In countries where government institutions are transparent, the donor receives perfect signals about government effort. However, as the transparency of government institutions deteriorates, the donor receives increasingly noisy signals about actual government actions until the signals are so noisy that they contain no information about government effort. The quality of information affects the donor's optimal aid contract. In the following sections I will first examine the two extreme cases, when the donor has a perfect signal about government effort and when the donor has a completely uniformative signal of government effort and then examine the case when the donor has a partially informative signal of government effort. Holmstrom (1979) shows that when the signal is partially informative the optimal policy is to use information from all available signals in the optimal policy. When solving for the optimal aid contract the donor also takes into account the recipient government's $d(y, a)$ function and the return to aid function $h(a)$.

[11]For example, if $\theta = 0.5$ and $u(.) = v(.)$ then the optimal division of output for the government $d_t(y, a) = 0.5[y_t - h(a)]$.

1.4.4.1 Donor's problem with full information

With very good institutions the donor receives informative signals about the recipient government's effort. I concentrate on the full information case in which s_t is so precise that it allows the donor perfectly observes recipient government effort. Aid can be made conditional on both output y and effort e. I assume that aid cannot be conditioned on the allocation of output given to the poor by the recipient government, d.[12] With no storage, the solution to the donor's dynamic problem with full information is equivalent to solving a sequence of static problems with full information. Therefore, the donor's problem reduces to

$$\max_{a,e} \int [u(d(y,a) + h(a)) - \phi a] dF(y, s|e) \tag{1.13}$$

$s.t.$

$$\int [\theta v(y - d(y,a)) + (1-\theta)u(d(y,a) + h(a)) - g(e)]\, dF(y, s|e) \geq w_0 \geq V^{aut} \tag{1.14}$$

where equation (1.14) is the individual rationality constraint of the government, which ensures that the government receives at least the utility it would have received in autarky.

The preferences of the donor are specified such that the donor wants to (a) increase output in the developing country (through encouraging recipient govern-

[12]The problem described here where the ability to observe effort depends on institutional quality is isomorphic to a problem where the ability to observe and contract upon d depends on institutional quality.

ment effort) and (b) smooth out economic fluctuations. The optimal aid policy with full information is an aid contract conditional on effort, output and w_0. The ability to condition aid on observable effort will enable the donor to attain these dual objectives simultaneously. I describe the properties of the optimal aid policy later in section 3.5.

1.4.5 Donor's problem with hidden government effort

In countries with weak institutions the donor has noisy signals about the level of effort the government exerts. Because the donor cannot observe effort e the optimal contract can no longer be conditioned on e. The donor observes output y and the additional signal s and can condition the optimal contract on y and s outcomes. The donor uses the revelation principle to ensure the government selects the level of effort prescribed by the donor in the optimal contract.

I follow Spear and Srivastava (1987) and introduce the concept of promised utility w as a state variable to make the problem recursive. Let w_0 be the exogenous initial utility promised at $t = 0$. The donor's problem with incomplete information is similar to the full information problem, with additional incentive compatibility constraints to ensure that the government selects the level of effort prescribed by the donor.

At the beginning of each period the donor takes as given the utility w promised to the recipient government in period $t - 1$. Given w the donor selects functions for effort $e(w)$, aid $a(w, y)$ and next period promised utility $\tilde{w}(w, y)$ to maximise

(1.1) subject to delivering the promised level of utility and ensuring the government selects the level of effort prescribed by the donor. The Bellman equation for the donors problem is

$$J(w) = \max_{e(w),a(w,y),\tilde{w}(w,y))} \int [u(d(y,a) + h(a)) - \phi a + \beta J(\tilde{w})] dF(y,s|e(w)) \quad (1.15)$$

s.t. the promise keeping constraint

$$w = \int \{[\theta v(y - d(y,a)) + (1-\theta)u(d(y,a) + h(a(w,y))) - g(e(w))] + \gamma \tilde{w}(w,y)\} dF(y,s|e(w)) \quad (1.16)$$

and incentive compatibility constraints

$$\int [\theta v(y-d) + (1-\theta)u(d + h(a(w,y))) - g(e(w)) + \tilde{w}(w,y)]] dF(y,s|e(w))$$

$$\geq \int [\theta v(y-d) + (1-\theta)u(d + h(a(w,y))) - g(\hat{e}) + \tilde{w}(w,y)]] dF(y,s|\hat{e}) \ \forall \hat{e} \quad (1.17)$$

Constraint (1.16) says that the value of the aid contract to the government must be equal to the promised utility w coming into the period. The incentive com-

patibility constraints (1.17) state that the value to the government of selecting the level of effort prescribed by the donor must be greater than the returns from any deviation in each state. The incentive compatibility constraint is the key differentiating feature in the model with unobservable government effort compared to the model with observable government effort.

Remember that the preferences of the donor are specified such that the donor wants to both increase output in the developing country and smooth out economic fluctuations. Ideally the donor would like to give aid as insurance against downturns, but because the donor is unable to observe effort directly, it cannot distinguish whether the downturn is exogenous or due to low government effort. Because output is a noisy signal of government effort, the donor can condition aid on observable output. The donor can also condition aid on the signal s. If effort increases output, a contract which gives more aid when output is high rewards high effort on average. On the other hand, if the donor were to give more aid in downturns, there would be no incentive for the government to incur the cost of higher effort because actions that increase GDP are not rewarded with more aid. If the benefits from government effort are small relative to the welfare benefit of smoothing consumption, it is possible that the optimal contract would give aid to smooth consumption without increasing government effort.

1.4.6 Solution Method

In moral hazard problems, the revelation principle requires a large number of incentive compatibility constraints to be satisfied. This can potentially make the constraint set non-convex. I follow Phelan and Townsend (1991) and use randomisation which overcomes this problem by convexifing the constraint set of the donor. Phelan and Townsend (1991) show that this enables dynamic programming theorems to be applied to moral hazard problems. Note that deterministic rules are just a subset of probabilistic rules with degenerate distributions. Furthermore, applying randomisation to the donor's problem presented in this paper is also a very realistic description of historical donor behaviour. Consider the following quote from Mosley et. al. (1991b, p.2):

"*We encountered a number of cases where weak recipients gambled, sometimes correctly and sometimes not, that they could nonetheless get away with high levels of slippage.*"

The randomisation works as follows. The government selects effort e from a finite set $E \subset R_+$. For a given effort $e \in E$, output y is determined by a probability density function, $P_1(y|e)$ which is analogous to the continuous probability distribution function $f_1(y|e)$ in section 1.4. The probability $P_1(y|e)$ is assumed to be strictly positive for all e so that any level of output is possible given any effort level. I denote this set of possible outputs as Y. The additional signal $s \in S$ is determined by the probability density function, $P_2(s|y,e)$ is analogous the $f_2(s|y,e)$ in section 1.4. The joint density function of y and s conditional on e is given by

$P(y,s|e) = P_1(y|e)P_2(s|y,e)$ Foreign aid gives the government some level of aid $a \in A$ where A is a finite subset of R_+. w is the utility promised to the government and can take any value from the set $W = [V^{aut}, w_{max}]$, where V^{aut} is the utility of the government in autarky and w_{max} is the highest level of utility attainable (i.e. the lowest effort and maximum aid).

The donor's problem with randomisation is to choose a probability distribution $\Pi(e,y,a,w',s)$ to maximise the Bellman equation

$$J(w) = \max_{\Pi}\{u(d(y,a)+h(a)) - a + \beta J(w')\}\Pi(e,y,a,w',s) \tag{1.18}$$

subject to the the promise keeping constraint,

$$w = \sum_{E\times Y\times A\times W\times S}\{\theta v(y-d(y,a))+(1-\theta)u(d(y,a)+h(a))-g(e)+\gamma w'\}\Pi(e,y,a,w',s) \tag{1.19}$$

and for the hidden action problem, the incentive compatibility constraints for each e, $\hat{e}$ pair:

$$\sum_{Y\times A\times W\times S}\{\theta v(y-d(y,a))+(1-\theta)u(d(y,a)+h(a))-g(e)+\gamma w'\}\Pi(a,w',y,e,s)P(y,s|e)$$

$$\geq \sum_{Y\times A\times W\times S} \{\theta v(y-d(y,a))+(1-\theta)u(d(y,a)+h(a))-g(\hat{e})+\gamma w'\}\Pi(a,w',y,e,s)\frac{P(y,s|\hat{e})}{P(y,s|e)} \tag{1.20}$$

Note that (1.19) is the discrete counterpart to (1.16) and the discrete counterpart to the set of incentive compatibility constraints is equation (1.20). Also the donor internalises the government's division of resources function $d(y,a)$ when solving its problem.

The final conditions with probabilistic decision rules are that the implied conditional probabilities must coincide with those imposed by nature, $P(y,s|e)$. For each $(\bar{e},\bar{y})$ pair the following condition must hold

$$\sum_{A\times W} \Pi(\bar{e},\bar{y},\bar{s},a,w') = P(\bar{y},\bar{s}|\bar{e}) \sum_{Y\times A\times W\times S} \Pi(\bar{e},y,a,w',s) \tag{1.21}$$

Finally the probabilities from the probabilistic optimal policy must follow the laws of probability

$$\Pi(e,y,a,w',s) \geq 0 \tag{1.22}$$

and

$$\sum_{E\times Y\times A\times W\times S} \Pi(e,y,a,w',s) = 1 \tag{1.23}$$

The model is solved using value function iteration with the Howard improvement algorithm until convergence of value functions. The steps of the algorithm are

the following:

1. Guess an initial function $v^0(w)$

2. For each w solve a linear programming[13] problem using equations (1.18) through (1.23) to obtain policy functions, which consist of probabilities $\Pi^1(e, y, c, w')$ that maximise the Bellman equation (1.18).

3. Compute $v^{i+1}(w)$ as the discounted present value of following policy Π^1.

4. Use $v^{i+1}(w)$ as the guess in step 2 until convergence ($v^i = v^{i+1}$).

1.5 Calibration

I calibrate parameters so that the dynamic model with unobserved effort matches three moments estimated from countries with the least transparent institutions: the volatility of GDP, the volatility of disbursed aid and the correlation between ODA and GDP. Informative signals are then introduced to test whether the model can reproduce the differences between countries with transparent and opaque institutions in tables 1.1 and 1.5, holding all structural parameters fixed aside from the transparency of information.

1.5.1 Functional Forms

I now describe the procedure used to select benchmark parameter values. The period utility function of the poor is $u(c) = c^\sigma/\sigma$ and $u(c) = v(c)$. The period utility

[13]The linear programming problem is written in Python and solved using the GNU Linear Programming Kit (GLPK), both of which are free open source software (FOSS).

function of the government is $\theta v(c_r)+(1-\theta)u(c_p)-g(e) = \theta c_r^{\sigma}/\sigma+\theta c_p^{\sigma}/\sigma+\chi(e^{max}-e)^{\delta}$. Aid has decreasing returns to scale, where a units of aid produce $h(a) = a^{\alpha}$ units of consumption goods.

The technology specifying the conditional probability density functions $P_1(y|e)$ is given by

$$P_1(y = y^{high}|e) = 0.1 + e^{\psi} \tag{1.24}$$

$$P_1(y = y^{low}|e) = 1 - P_1(y = y^{high}|e) \tag{1.25}$$

where e is suitably bounded [0,1] such that the probability density functions are well defined. Output takes two discrete values and the ratio of y^h/y^l equals 20% to match the standard deviation of annual GDP of 6.5%.

In the results section I examine the model with the two extremes of full information about government effort and hidden government effort. I also examine the model properties with a partially informative signal about government actions. The density function $P_2(s|y,e)$ is given by

$$P_2(s = s^{high}|y,e) = 0.25y + 0.05e \tag{1.26}$$

$$P_2(s = s^{low}|y,e) = 1 - P_2(s = s^{high}|y,e) \tag{1.27}$$

The signal is informative in that the probability of receiveing a signal that the governemt does higher effort is increasing in government effort e. However, the signal is only partially informative. Furthermore, probability of receiving a signal that the government is doing higher effort is contaminated with the output state where high output outturns are positively correlated with high output signals.

In my baseline model, I set the discount factors β and γ equal to 0.7 for both the donor and government in order to match the standard deviation of annual aid, 28.8%. The discount factors are on the low end of the usual estimates. Mechanically, if β were set to 0.9 in the model, the volatility of disbursed aid would become very small. This is because the donor mostly uses aid promises (commitments) to encourage government effort instead of aid disbursements (see section 1.6.5). The low discount factor can be justified by assuming a constant probability x of regime change or break in the relationship between government and donor with a mean $(1/x)$ of around 5 years, along with a utility discount rate of $\beta = 0.9$ which implies an effective discount factor of $(1 - x)\beta = 0.7$. Given estimates for the average duration of regimes in Africa, Asia and Latin America with a mean of 8 years and median of 4.5 years, (Stier and Mundt, 1998) this is not an unrealistic calibration.

I calibrate σ, the parameter governing the curvature of utility, to 0.8 in order to match the correlation between ODA disbursements and GDP taken from the trend line in table 1.1 with a transparency score of 1.0 constructed from the ICRG data. I set the returns to scale in aid parameter α to 0.5. This number is derived from fitting the Cobb-Douglas returns to aid function to the estimates of the short-run

Table 1.9: Parameter Values

			Target
Ratio of Output	y^{high}/y^{low}	20%	SD(GDP) = 0.064
Curvature parameter	σ	0.8	Corr(Aid, GDP) = 0.436
Discount factor	$\beta = \gamma$	0.7	SD(Aid) = 0.288
Returns to aid	α	0.5	Short-run returns to aid (Clemens et. al., 2004)
Weight on effort	χ	0.2	$e^{aut} = 0$
Weight on rich	θ	0.5	
Marginal cost of aid	ϕ	1	

Table 1.10: Matched moments

Moment	Data	Model (hidden actions)
SD(GDP)	0.064	0.067
SD(Aid)	0.261	0.255
Corr(Aid, GDP)	0.418	0.377

impact of aid provided in Clemens, Radelet and Bhavani (2004).

The weight on effort in the utility function is mechanically set to 0.2 in order to make the autarky level of effort in the model equal zero. Finally, I parameterise the weight on the rich in the government's utility function θ to 0.5.

Table 1.10 shows that the baseline model with hidden effort does a good job at matching the data moments for countries with the weakest institutions. To test the model, I keep all other parameters constant and add information about government effort to the donor's information set to capture the increase in transparency of government actions as institutions improve. I then evaluate the ability of the model to match the observed moments for countries with the most transparent institutions.

1.6 Results

The results section is structured as follows. I first examine the policy functions of the calibrated model assuming (1) full information and (2) completely hidden actions (i.e. with a completely uninformative signal). I then examine the ability of the model to match the moments of both countries with transparent and opaque institutions only using differences in the informativeness of signals.

I show that the model can explain four of the five stylised facts presented in section 1.2. The model can explain the negative relationship between institutional quality and the correlation between *disbursed* ODA and GDP as well as the negative relationship between institutional quality and the correlation between ODA *commitments* and GDP. The model can match these facts for all empirically relevant levels of aid. Furthermore, the volatility of GDP is uncorrelated with institutional quality. However, in the model the volatility of aid is not independent of institutional quality. Instead, the model predicts a counterfactual decrease in the volatility of aid as institutions improve. The model also over predicts the correlation between GDP and ODA *commitments*.[14]

[14]Unfortunately, I do not have data for *net* ODA commitments. My model does not have a measure of *gross* ODA commitments, therefore, it is difficult to attribute the inability to fit the moments to model or data issues. Comparing data from *net* ODA disbursements to *gross* ODA disbursements, there is a deterioration in the model fit with *gross* ODA disbursements which suggests that the use of *gross* ODA commitments is partially attributable to some of the poor fit.

1.6.1 Full information - transparent institutions

Figure 1.7 plots the equilibrium aid policy function conditional on an initial promised government utility w_0, output y and effort e. The solid line is expected aid in high output states and the dashed line expected aid in low output states. The key point to note is that the solid line is always below the dashed line[15]. This shows that with full information, aid is given as insurance against bad states because more aid is disbursed in low output states than in high output states for any given initial promise w. Figure 1.7 also shows that aid is countercyclical for aid to GDP ratios between 0% to 200%.

Figure 1.8 plots the equilibrium effort level conditional on promised utility w. It shows that the optimal level of effort is a negative function of the initial promise. Therefore, as the exogenous promised utility w_0 increases, the effort the donor can optimally extract from the recipient government decreases. Under full information, the level of effort is a weakly monotonically decreasing function of the promised level of utility.

Figure 1.9 plots the equilibrium utility of the donor $J(w)$, conditional on the government's promised utility w. If w_0 were set optimally by the donor distributing the aid, it would be the maximum point on the curve. On the left hand side of the maximum, the utility function is upwards sloping because the marginal utility of the poor is greater than the cost of aid, while the promise is still sufficiently low to ensure that the government exerts the maximum effort. Therefore, in this region

[15]While the difference in aid disbursements between high and low output states is visually small, the simulation results below, show that this sufficiently large to match the data moments.

increasing aid is a Pareto improvement.

1.6.2 Hidden effort - opaque institutions

In stark contrast to the full information model, figure 1.10 shows that a positive relationship between aid and output is obtained when the donor cannot observe effort directly. The solid and dashed lines plot optimal aid conditional on high and low output respectively. In contrast to the full information equilibrium, the solid line is almost always above the dashed line, except for very high exogenous promises w_0. Aid becomes countercyclical only for values of w_0 corresponding to aid to GDP ratios greater than 200%, far in excess of maximum aid to GDP ratios observed in the data. The average aid to GDP ratios is around 6%. Therefore, in equilibrium the donor disburses less aid in low output states than in high output states for all empirically relevant regions (Table 3.1).

For all but the highest utility promises w, because the donor is unable to condition aid on effort directly, the donor must reward periods of high output in order to encourage the government to select the effort prescribed by the donor. However, for the highest initial promises w_0 the only way the donor can attain those promises is by allowing the government to exert the lowest level of effort and then giving aid as insurance.

Figure 1.11 plots government effort as a function of promised utility w. When the donor promises the lowest level of utility (the autarky level) then the government

Table 1.11: Benchmark Model Moments: Total ODA

	Data	Model	Data	Model
	Weak institutions	Hidden action	Good institutions	Full information
$\sigma(y)$	0.043	0.067	0.064	0.063
$\sigma(a)$	0.261	0.252	0.235	0.159
$\sigma(a')$	0.299	0.169	0.282	0
$\rho(a, y)$	0.418	0.377	-0.209	-0.468
$\rho(a', y)$	0.096	0.518	-0.158	0
$\rho(e, y)$		0.150		0.021

exerts the lowest effort level[16]. Therefore, unlike the full information problem, the level of effort is not monotonically decreasing with promised utility w.

Figure 1.12 plots the equilibrium policy functions for next period's promised utility w'. Note that these functions straddle the 45 degree line, with high output states above and low output states below. Thus promised utility is also procyclical for countries with weak institutions. Combining the aid policy functions in figure 1.10 with those for promised utility in figure 1.12, promised utility w' can be mapped into expected aid (aid commitments) for the next period. Figure 1.13 shows that aid commitments are also procyclical in countries with weak institutions, as found in the multilateral aid data.

1.6.3 Business Cycle Moments

I simulate the model by averaging moments from 1000 simulations of 15 periods each, because the empirical moments are also computed over 15 year windows. The simulation moments are computed using the same method as the data moments.

[16]I calibrate the model such that the autarky effort level is the lowest level of effort.

For the results below, the initial value of w_0 for each simulation is the value which maximises the donor's utility. Changing initial promise has very little impact on the results. This property enables the model to match the fact that the cyclical properties of aid flows are independent of the level of aid a country receives because the initial promise determines the level of aid a country receives.

Table 1.11 presents the simulated moments of the benchmark model with hidden effort and compares them to the model with full information. The introduction of information causes the correlation between aid disbursements and GDP in the model to switch from procyclical (0.377) to countercyclical (-0.468). As institutions improve and the donor has better information about the actual effort of the recipient government, the correlation between aid and GDP decreases. In the data meanwhile, the correlation between aid and GDP is 0.418 for the countries opaque institutions and -0.209 for the countries with transparent institutions. The model with hidden effort predicts a positive relationship between aid commitments and GDP, as in the data. However, the predicted correlation between aid commitments and GDP is far too high, being 0.518 in the model and only 0.095 in the data. Also the model is unable to generate a negative correlation between aid commitments and GDP under full information. This is due to the tractability assumption of $i.i.d.$ shocks. If shocks were persistent, then the correlation between aid commitments and GDP would also be negative for countries with transparent institutions.

The volatility of output is approximately equal in both the full information and the hidden effort models, consistent with the empirical finding that output

Table 1.12: Benchmark Model Moments: Quality of Signal

	Hidden action	Partially informative signal	Full information
$\sigma(y)$	0.067	0.066	0.063
$\sigma(a)$	0.252	0.186	0.159
$\sigma(a')$	0.169	0.158	0
$\rho(a, y)$	0.377	0.182	-0.468
$\rho(a', y)$	0.518	0.420	0
$\rho(e, y)$	0.150	0.069	0.021

volatility is similar in countries with strong and weak institutions. However, aid flows are more volatile in the models with hidden effort. In the data, aid is also more volatile in countries with weak institutions, but not to the degree predicted by the model.

Table 1.12 examines the impact of the informativeness of the signal about government actions on the model moment. The key result is that with partially informative signals the moments are between the two extremes of information. With a partially informative signal $\rho(a, y) = 0.182$ which is between the values with hidden actions and full information. Therefore, the model can potentially explain the negative relationship between institutional transparency and the correlation between aid and GDP from Figure 1.1.

1.6.4 Matching Bilateral and Multilateral Aid Dynamics

Section 1.2 showed that there are important differences between bilateral and multilateral aid flows. Bilateral flows show a strong negative relationship between institutions and the aid *disbursement*-GDP correlation but show no relationship between institutions and the correlation between aid *commitments* and GDP. On

Table 1.13: Model Moments to Match Bilateral and Multilateral Aid

	Full information	Hidden action		
		$\beta = 0$	$\beta = 0.7$	$\beta = 0.9$
$\sigma(y)$	0.063	0.063	0.065	0.065
$\sigma(a)$	0.159	0.468	0.252	0.143
$\sigma(w')$	0	0	0.011	0.013
$\rho(a, y)$	-0.468	0.921	0.377	0.037
$\rho(w', y)$	0	0	0.518	0.554
$\rho(e, y)$	0.021	0.019	0.150	0.152

the other hand, multilateral flows show a weaker negative relationship between institutional transparency and the aid *disbursement*-GDP correlation but a strong negative correlation between institutional transparency and the correlation between aid *commitments* and GDP. If we allow the discount rates of bilateral and multilateral donors to differ, the model can explain the different cyclical properties of aid flows observed in the data.

The cyclical properties of bilateral aid flows in the data can be matched by the model by shutting down the mechanism which makes GDP outcomes in period t affect expected aid for period $t+1$. This can be achieved by making bilateral donors myopic (setting $\beta = 0$). There is some evidence for this explanation in the data.

Table 1.6 shows that bilateral donors use aid commitments to try to stabilise countries which have had coups. However, the model does not model the desire of bilateral donors to use aid commitments to stabilise countries which have coups, instead the model only uses aid commitments to encouraging good actions in countries with opaque institutions. Therefore, to capture an alternative use of aid commitments which is not explicitly modelled, I can shut down the aid commitment

instrument in the model by setting $\beta = 0$.

Table 1.13 shows that the model with hidden action and myopia has a stronger positive correlation between aid and GDP compared to the benchmark hidden action model. This corresponds to the finding in the data showing that bilateral donors have a stronger negative relationship between institutions and the correlation between aid and GDP than multilateral donors.

The moments from multilateral aid can be matched by making the donor less impatient. Table 1.13 shows that the correlation between aid and GDP gets close to zero if $\beta = 0.9$. Therefore, increasing β makes the negative slope between institutions and the correlation between aid *disbursements* and GDP almost zero while still maintaining the negative slope between institutions and the correlation between aid *commitments* and GDP. For very low discount rates, the donor only uses aid promises to encourage effort and does not use actual aid disbursements.

1.6.5 Sensitivity Analysis

This section conducts sensitivity analysis to study how the benchmark hidden effort model's quantitative predictions change when baseline parameters are changed. Table 1.14 shows the results.

Decreasing the marginal cost of aid, ϕ from 1 to 0.8 increases both the correlation of aid disbursements and commitments with GDP and the volatility of aid from the baseline. Because the marginal cost of aid is lower, more aid is given in high output states to encourage effort.

Table 1.14: Sensitivity Analysis

	$Corr(a,y)$	$Corr(w',y)$	$Corr(e,y)$	$SD(a)$	$SD(y)$	$SD(w')$
Baseline	0.377	0.518	0.150	0.252	0.065	0.011
$\phi = 0.8$	0.454	0.565	0.356	0.232	0.074	0.012
$\chi = 0.3$	0.419	0.561	0.379	0.188	0.075	0.012
$\theta = 0.52$	0.238	0.493	0.166	0.329	0.068	0.010
$\alpha = 0.6$	0.340	0.545	0.143	0.245	0.065	0.012
$\sigma = 0.85$	0.512	0.508	0.125	0.275	0.065	0.011
$\delta = 0.85$	0.374	0.506	0.160	0.227	0.067	0.011
$\beta = 0.5$	0.382	0.493	0.144	0.221	0.066	0.010
$\beta = 0.9$	0.037	0.554	0.152	0.143	0.065	0.013
$\beta = 0$	0.921	0	0.019	0.468	0.063	0

Increasing the weight on the cost of effort in the utility function χ from 0.2 to 0.3 increases the correlation between aid and GDP and the correlation between aid commitments and GDP. Because the cost of effort is higher for the recipient government, the donor must use the incentive mechanism of procyclical aid more strongly to encourage recipient government effort.

As the weight θ on the utility of the rich in the recipient government preferences increases from 0.5 to 0.52, the correlation between aid and GDP decreases relative to the benchmark. This is because the government has more incentive to choose higher effort, so that the donor does not need to use the incentive mechanism so strongly to encourage effort. This result is somewhat counterintuitive, in that one might think that a government that places a higher weight on the favoured subgroup would require a greater incentive to choose effort that benefits the poor.

Increasing the curvature parameter on consumption σ from 0.8 to 0.85 causes the correlation between aid and GDP to increase, while the correlation between aid commitments and GDP decreases. The decrease in the correlation of aid commit-

ments and GDP is a direct result of the greater need to smooth the consumption of the poor over time given that they are more risk averse. However, in order to simultaneously maintain incentives for effort for the government, the correlation between disbursed aid and GDP increases.

Decreasing the discount rate of the donor, β from 0.7 to 0.5 has very little impact on the correlation between aid and GDP and the correlation between aid commitments and GDP. Once the donors have a $\beta > 0$ they use aid commitments and disbursements by a roughly similar degree to encourage effort. However, moving β closer to one does have a significant impact on the model moments. Also table 1.14 show that for $\beta = 0.9$ the correlation between aid and GDP decreases to almost zero. All the incentive effects are being generated by changes in aid commitments. At the other extreme setting $\beta = 0$, only uses aid disbursements to encourage effort.

Finally increasing the returns to aid α from 0.5 to 0.6 causes the correlation between aid and GDP to decrease, as each unit of aid goes further in terms of creating incentives.

1.6.6 Hidden effort with countercyclical aid

The optimal aid policy with hidden effort is to reward high output states with more aid in order to encourage more effort. This section analyses the impact on welfare from forcing donors to give countercyclical aid to countries with weak institutions, as suggested by Pallage, Robe and Berube (2006).

When effort is not observable and aid is not conditioned on observable output,

Table 1.15: Welfare analysis: Aid to GDP ratios required to give the same utility to the poor, with optimal and countercyclical aid

Aid to GDP ratio	
Optimal Aid	Countercyclical aid
6.1%	13.2%
10%	19.1%

the recipient government will exert the autarky level of effort. This is because the government is not rewarded for high output states, so it has no incentive to choose costly actions which increase the probability of high output states over the autarky effort level. Figure 1.14 plots the welfare of the donor from the optimal aid policy and the welfare from the optimal aid policy conditional on aid being non-procyclical. There is a welfare loss to the donor of around 8% from following countercyclical aid policies, for the empirically relevant region of promise utility.

I compute a compensated variation measure of welfare to give metric of the welfare costs of giving countercyclical aid to countries with opaque institutions. Table 1.15 shows the aid to GDP ratio required to give the poor the same level of welfare under the two policies. If a country has a 6.1% aid to GDP ratio (the average of below median transparency) the countercyclical aid policy requires the aid to GDP ratio to more than double in order to give the poor the same welfare. For an aid to GDP ratio of 10% the aid to GDP ratio required to deliver the same level of welfare is slight less than double at 19.1%.

This model suggests that giving countercyclical aid to countries with opaque institutions would actually be welfare reducing rather than welfare improving, and

that it would be substantially more costly for the donor provide a given level of welfare to the poor under countercyclical policy. This is because the welfare benefits of smoothing out business cycle fluctuations is small relative to the welfare loss from the government exerting lower effort.

1.6.7 Explaining Outliers

Figure 1.15 shows that there are four data points where countries with opaque institutions received countercylical/acyclical aid instead of procyclical aid. The four outlying observations are Guyana, the Philippines, Bangladesh and Haiti all from the Early (1976-1989) sample period. The interaction between the political and altruistic reasons for giving aid provide a plausible explanation for these countries being outliers.

After the Cuban Missile Crisis in 1962, recently released CIA records reveal that in 1963 John F. Kennedy ordered the CIA to destabilise the first democratically elected government of Guyana which was led by the socialist leaning Cheddi Jagan (Waters and Daniel, 2005). The actions by the US government in Guyana caused a diplomatic rift between the US and the UK government of Harold Wilson. The UK was keen to maintain influence in Guyana and provided countercyclical aid for political purposes despite the poor governance record during this period. Countercyclical ODA to the Philippines is another example of the conflict between political and altruistic motives for giving aid. Despite the poor governance record during Ferdinand Marcos' regime, because of important US military bases in the

Table 1.16: Explaining countercyclical aid to countries with opaque institutions

	Dependent variable aid/GDP
$Corr(aid_t, GDP_t)$	-0.006
	(0.047)
Average(GDP)	-0.053*
	(0.026)

Countries where the average of ICRG corruption, rule of law and expropriation score less than 2

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Philippines it was important for the US to maintain good ties with Marcos. Not only did the Philippines receive countercyclical aid, Marcos visited the White House on several occasions. Furthermore, all the outlying observations in the ellipse in Figure 1.15 are from the Cold War sample period. The competition between the West and the Soviet Union often resulted in aid allocations decisions which were strongly influenced by political motives.

Figure 1.16 illustrates how political promises affect optimal aid policy in the model. As the political promise, w_0, increases aid becomes less procyclical; eventually becoming countercyclical for very high w_0. Because the political use of aid gives utility to the government. The altruistic donor is only able to satisfy the political constraint w_0 by giving less procyclical aid but this implies that the altruistic donor is unable to extract high levels of effort from the government. To reach the highest feasible w_0 the altruistic donor is unable to extract any effort from the government and uses aid to smooth out downturns.

Figure 1.16 also implies that opaque countries which receive countercyclical aid also receive more aid *ceteris paribus*. There is some evidence for this, for example

Table 1.16 regresses the aid/GDP ratio against the correlation between aid and GDP while controlling for the level of GDP in the country for countries which have an institutional opacity score of 2 or below.[17] The sign on the correlation is negative, but is not significant.

Today it is possible to see a similar episodes occurring. For example in the Democratic Republic of the Congo, there is pressure on Western donors to disburse aid despite evidence that governance is getting worse, due to the competition with China over access to the DRC's vast natural resources (The Economist, March 13th 2008, "China's quest for resources"). Thus the model provides a natural way to understand the interaction between the political and altruistic motives for giving development aid.

1.7 Conclusion

I have investigated why some countries receive procyclical ODA while others receive countercyclical ODA. I showed that the donor's ability to monitor the effort of the aid recipient government affects the cyclicality of aid using a case study and empirical results discussed at greater length in Banerjee (2009). In countries where government effort is transparent, aid is acyclical or countercyclical, while in countries where government effort is opaque, aid is procyclical.

I show that a dynamic model in which donor's use aid to elicit government effort can quantitatively explain many of the stylised facts of aid cyclicality. The

[17]The institutional opacity scores are between 0 and 6 with 0 being the most opaque.

model can explain why countries with transparent institutions receive countercyclical aid while countries with opaque institutions receive procyclical aid. The model is also consistent with the fact that the level of aid is uncorrelated with institutional quality.

The main failing of the model is that it predicts that the volatility of aid declines as institutions become more transparent. In the data, there is no relationship between aid volatility and institutional transparency. This result could be related to Celasun and Walliser (2008), who find that aid is unpredictable in countries with stable relationships with donors. The correlation between aid commitments and GDP is also too high in the model. Because aid commitments are measured in gross terms while the model measure is for net aid commitments, this shortcoming could potentially be due to the data. However, it could also be due to the assumption in the model of $i.i.d$ shocks. If the conditional distributions functions for output were affected by persistent shocks, there would be a motive for donors to use aid commitments as insurance over persistent negative shocks, which would decrease the positive correlation between aid commitments and GDP for all countries, transparent and opaque.

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1.8 Figures

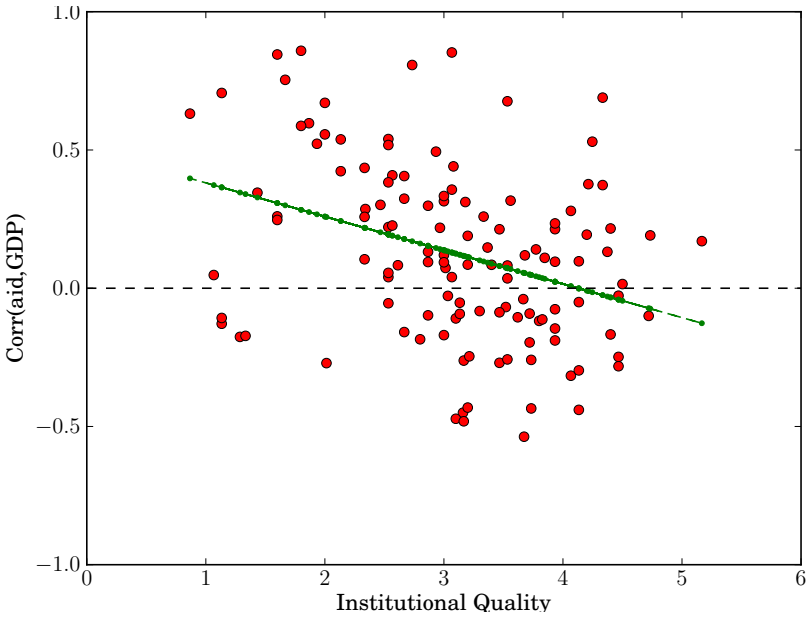

Figure 1.1: Total aid: Institutions plot against $\rho(aid, GDP)$

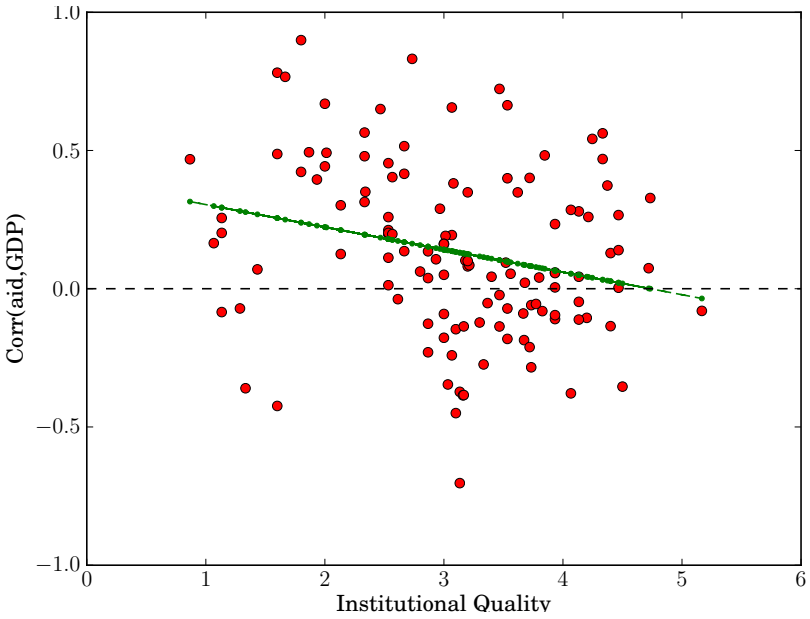

Figure 1.2: Multilateral aid: Institutions plot against $\rho(aid, GDP)$

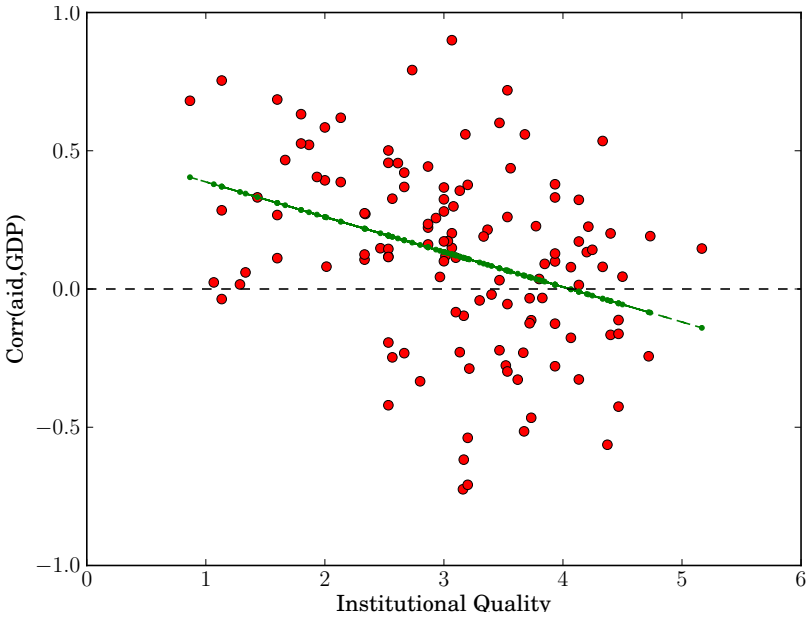

Figure 1.3: Bilateral aid: Institutions plot against $\rho(aid, GDP)$

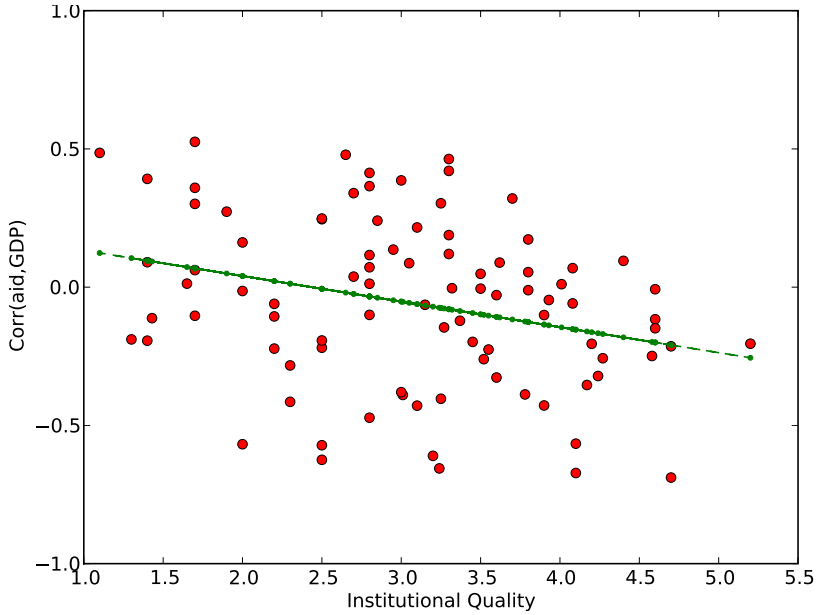

Figure 1.4: Multilateral commitments: Institutions plot against $\rho(aid_{t+1}, GDP_t)$

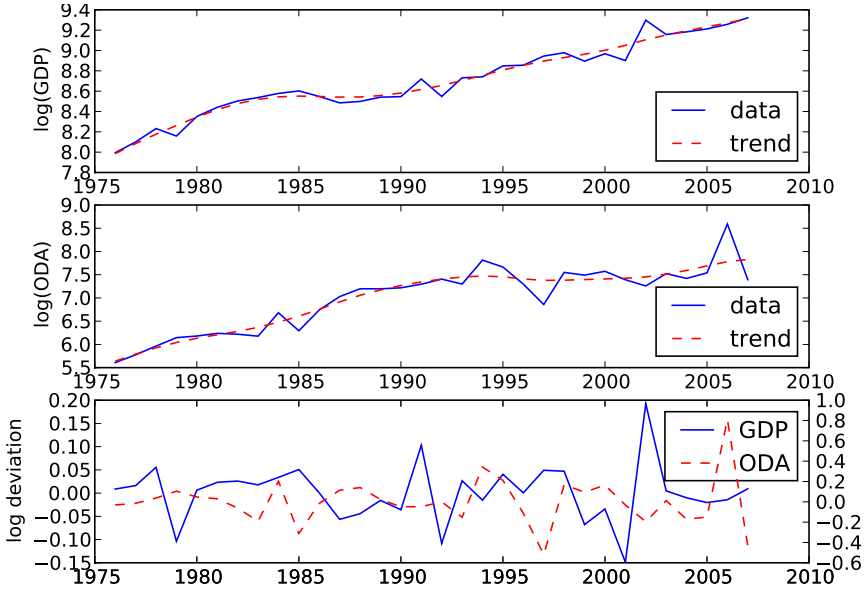

Figure 1.5: Malawi: GDP and ODA series with HP trend

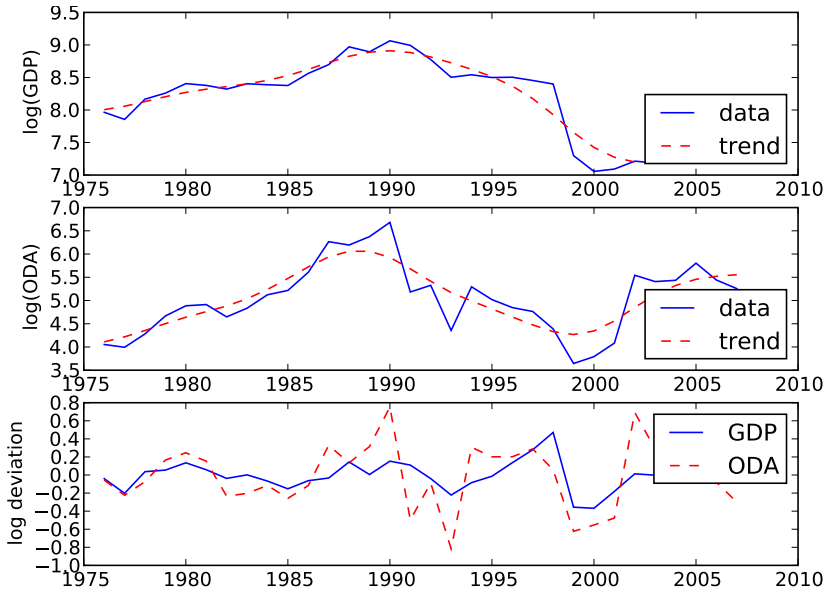

Figure 1.6: The Democratic Republic of the Congo: GDP and ODA series with HP trend

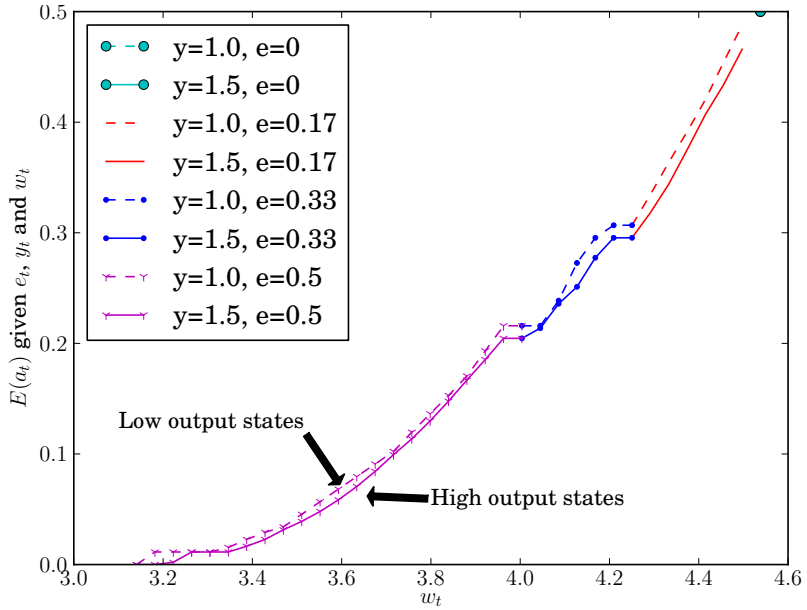

Figure 1.7: Optimal aid policy: Full information
Solid line: high output states, *Dashed* line: low output states

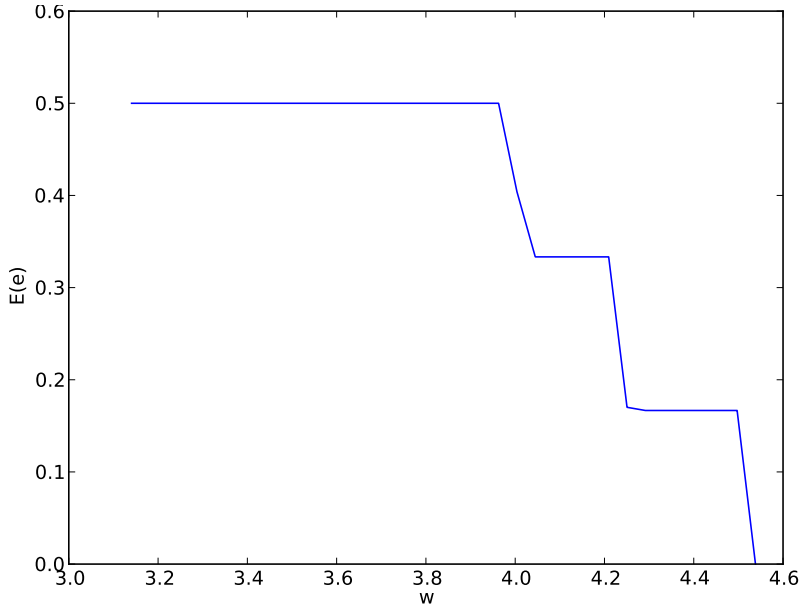

Figure 1.8: Effort: Full information

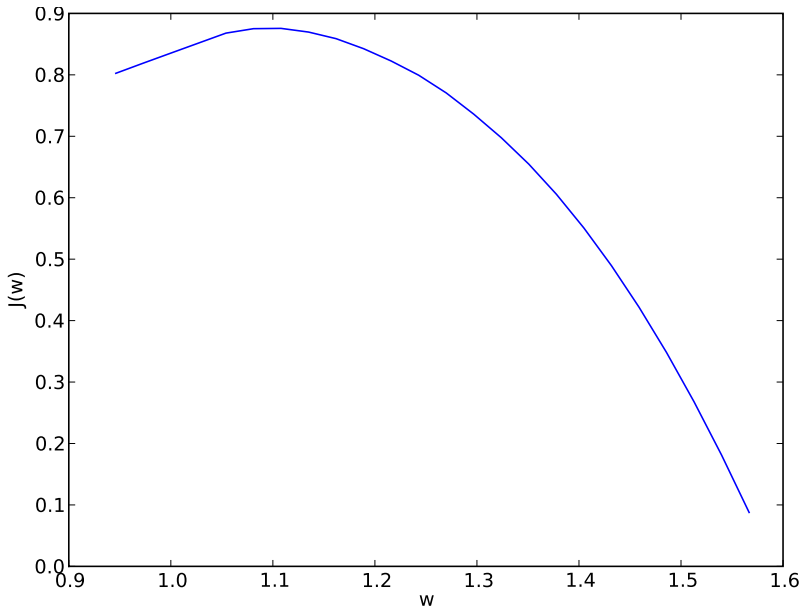

Figure 1.9: Donor utility: Full information

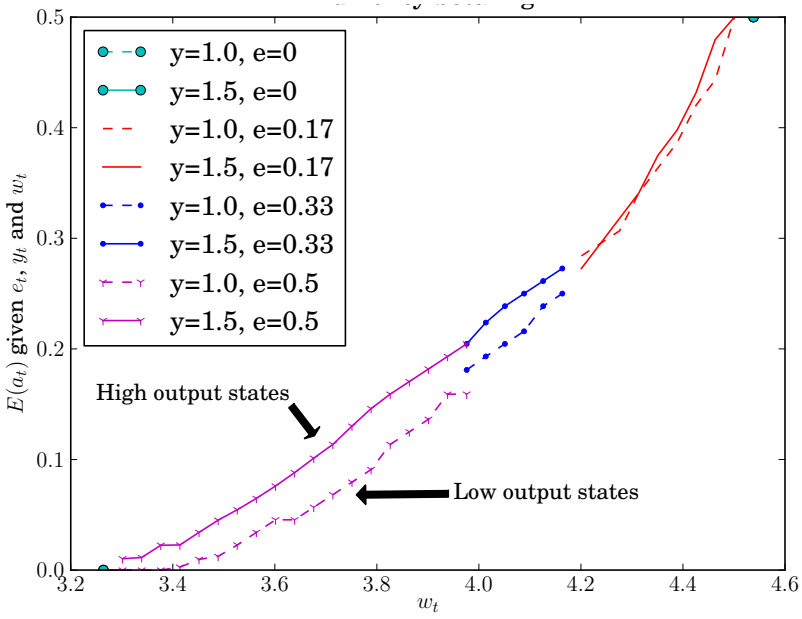

Figure 1.10: Optimal aid policy: Hidden action
Solid line: high output states, *Dashed* line: low output states

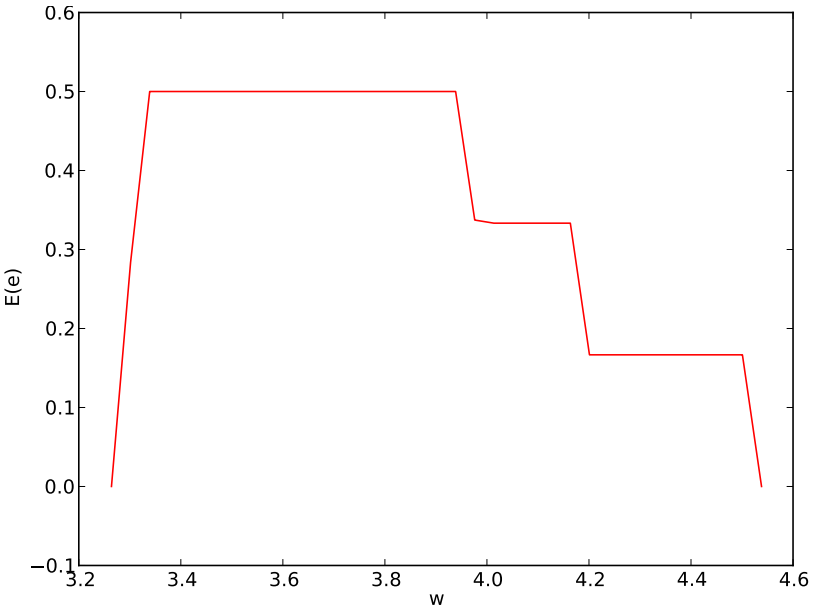

Figure 1.11: Effort: Hidden action

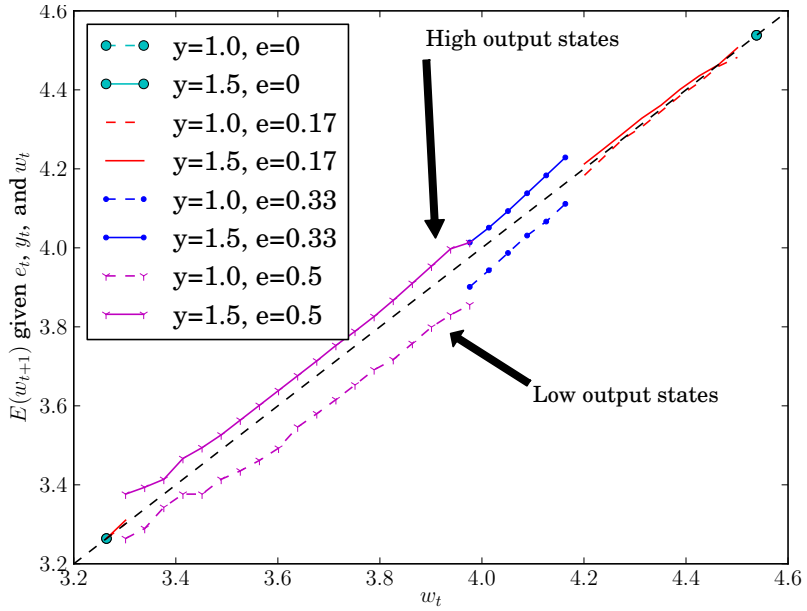

Figure 1.12: Promised utility: Hidden action
Solid line: high output states, *Dashed* line: low output states

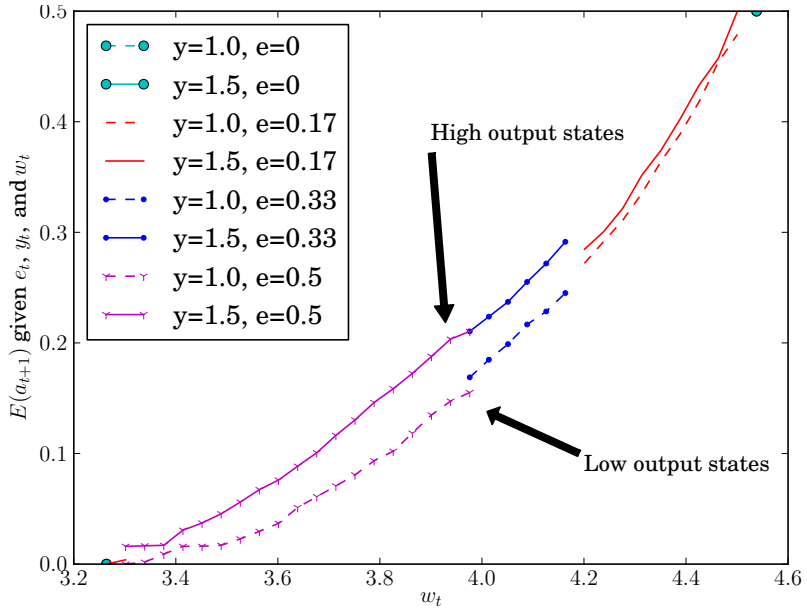

Figure 1.13: Promised aid: Hidden action
Solid line: high output states, *Dashed* line: low output states

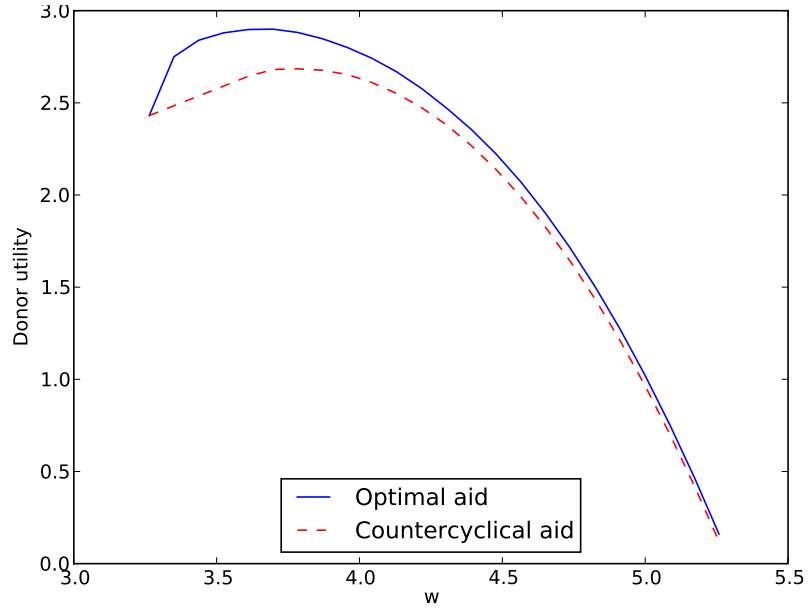

Figure 1.14: Donor utility, optimal vs. countercyclical aid

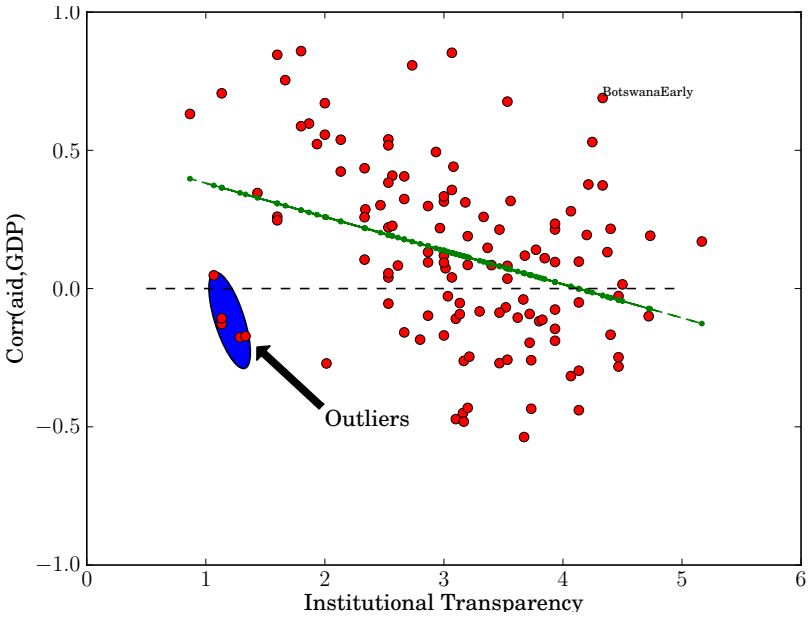

Figure 1.15: Explaining Outliers: Institutions plot against $\rho(aid, GDP)$

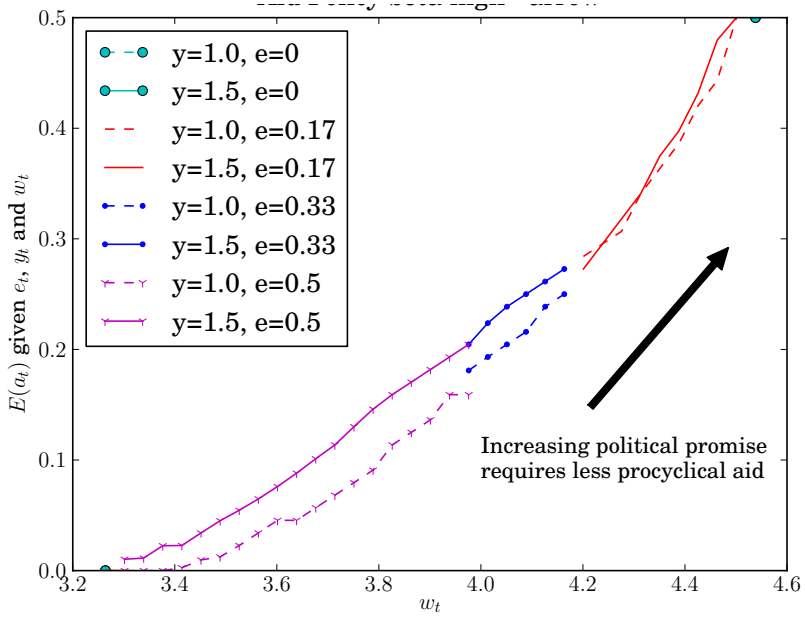

Figure 1.16: Explaining Outliers: Optimal aid policy with hidden action
Solid line: high output states, *Dashed* line: low output states

Chapter 2

New Evidence on the Relationship Between Aid Cyclicality and Institutions

2.1 Introduction

Why do some countries receive countercyclical aid while others receive procyclical aid? This paper documents a new fact which sheds new light on this question: the correlation between official development assistance (ODA) and GDP is negatively related to the quality of institutions in that country. As the quality of institutions in a country deteriorate, they are more likely to receive procyclical rather than countercyclical aid. In particular institutional measures related to corruption, rule of law, property rights, quality of the public sector and government transparency display a robust negative correlation with aid procylicality.

The previous empirical literature which analysed the links between institutional quality and aid only considered the relationship between *level* of aid and institutions (Alesina and Dollar, 2000; Alesina and Weder, 2002). They found almost no relationship between institutional quality and the *level* of aid a country received, instead they found that the level of aid a country receives is determined by political or colonial interests. This paper provides evidence that donors do differentiate aid flows based on the quality of institutions in a country. However, they

differentiate aid on the *cyclicality* dimension rather than the *level*. In particular, donors differentiate the *timing* of aid flows based on the institutional quality of a government.

The relationship between institutional quality and the cyclicality of aid also reconciles conflicting empirical results about the properties of aid cyclicality in the literature. Pallage and Robe (2001) find aid to be procyclical in two thirds of African economies and half of non-African developing countries. They conclude that aid is predominantly procyclical and that Africa is perhaps treated differently than non-African developing countries. This paper shows that Africa is not treated differently by donors once institutional quality is accounted for. The greater incidence of procyclical aid in Africa is driven by the fact that the average quality of institutions in Africa is lower than in non-African developing economies.

Using a different sample, Rand and Tarp (2002) find no evidence that aid is procyclical in developing countries. Their result appears to be at odds with Pallage and Robe's (2001) finding of predominantly procyclical aid. This paper shows that the sample in Rand and Tarp (2002), comprises developing countries which have relatively good institutions compared to the average developing country.[1] The empirical finding from this paper suggests such countries with good institutions should receive acyclical or countercyclical aid. Once institutional quality is accounted for, the Rand and Tarp (2002) sample is not treated differently than other developing

[1]Rand and Tarp (2002) chose to analyse developing countries which have long time-series of data. Historically countries with good institutions have produced national accounts data for longer, therefore, the desire to compute the cyclical properties of aid from long-time series data lend to Rand and Tarp (2002) choosing countries with better institutions.

countries. Thus the empirical findings of predominantly procyclical aid in Pallage and Robe (2001) and acyclical and countercyclical aid in Rand and Tarp (2002) are consistent with each other once institutional quality in their samples are accounted for.

The new empirical regularity documented in this paper directly addresses the policy debate about whether aid flows are welfare inefficient and destabilising in developing countries (Bulir and Hamann, 2003; Pallage, Robe and Berube, 2006; Chauvet and Guillaumont, 2007, Arellano, Bulir, Lane and Lipschitz, 2009). Because the costs of business cycles in developing countries are substantially greater than in developed countries (Pallage and Robe, 2003), the ability of households in developing countries to smooth their consumption is very important. However, instruments used by developed economies to smooth aggregate shocks, e.g. access to international capital markets and foreign direct investment (FDI), are either cutoff or reduced during downturns in many developing countries and for the poorest countries both are virtually non-existent. Thus aid becomes an important instrument for developing countries to finance their current accounts. This observation prompted a number of papers to suggest that welfare in developing countries could be improved if aid flows were countercyclical or less volatile (Bulir and Hamann, 2001; Pallage, Robe and Berube, 2006, Arellano, Bulir, Lane and Lipschitz, 2009).

This paper shows that conditional on having good institutions, aid does act as insurance for developing countries during downturns. This is exactly the policy advice from Pallage, Robe and Berube (2006). Furthermore, the fact that the pro-

cyclicality of aid increases as the quality of institutions deteriorates suggests that donors systematically differentiate aid flows between developing countries and procyclical aid is a concious decision on the part of donors. In Banerjee (2010) I show that moral hazard concerns can make it optimal for donors to give procyclical aid if donors cannot monitor government actions. However, if government actions are observable it is optimal to give countercyclical aid to smooth out economic fluctuations. Thus observability of government actions can explain why countries with good institutions tend to receive countercyclical aid while countries with weak institutions receive procyclical aid. The model presented in Banerjee (2010) can quantitatively explain many of the empirical results in this paper.

The paper is closest to Pallage and Robe (2001), Rand and Tarp (2002) and Bulir and Hamann (2003) who examine the business cycle properties of aid. This paper extends their analysis by analysing how institutional quality in a country affects the cyclical properties of aid flows a country receives.

Section 2.2 examines the empirical relationship between aid, GDP and institutions. Section 2.3 examines how the relationship between institutions and aid cyclicality can reconcile previous empirical studies of aid cyclicality. Section 2.4 examines the phase shift of this relationship, section 2.5 examines aid cyclicality from individual bilateral donors, section 2.6 analyses the relationship between the cyclicality of aid commitments and institutions. Finally section 2.8 concludes.

2.2 Some new stylised facts on the relationship between aid and GDP

The data set is composed of annual data from 1974 to 2007. A country is excluded if it is not in Africa, Asia, South America, the Carribean or Central America. A recipient country is also excluded from the sample if it had not achieved independence by the end of 1975. Furthermore, countries are dropped if aid or national accounts data are unavailable prior to 1988. Countries also dropped due to country coverage of institutional quality measures. The final sample for the main regression results reported here consists of 61 developing countries (see Table 2.1).

2.2.1 Data

I measure actual aid flows using the total net Official Development Assistance (ODA) disbursement figures published by the OECD Development Assistance Committee (DAC). The OECD measure of aid includes the value of grants and concessional loans.[2] I convert the aid data into per capita units using total population figures from the World Bank's World Development Indicators (WDI). The aid per capita series are deflated by the purchasing power parity (PPP) GDP deflators from the Penn World Tables[3] prior to 2000 and thereafter using the WDI GDP PPP deflators. I also examine total ODA commitments. ODA commitments are an official pledge (i.e. with parliamentary backing) for aid to be disbursed at some point in

[2]Loans must have a concessional nature to qualify as ODA. For example IMF standby agreement credits are not considered ODA because they are given at interest rates sufficiently close to market rates.

[3]PWT 6.2 Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006

the future. It is not possible to construct a directly equivalent measure of ODA commitments to net ODA disbursements.[4]

I report results for total aid, which is the sum of multilateral and bilateral aid. I also report results for multilateral aid, total bilateral aid and bilateral aid by donor country. Table 2.2 lists the major bilateral donors. Bilateral donors contribute approximately two thirds of ODA and multilateral donors one third.

GDP per capita is taken from the World Bank's World Development Indicators (WDI). All series are deflated by the purchasing power parity (PPP) GDP deflators from the Penn World Tables prior to 2000 and thereafter using the WDI PPP deflators. Capital flow data are also taken from the WDI. Capital flows are measured as the sum of net foreign direct investment (FDI), equity investment portfolio flows and portfolio investment bond flows to both the private and government sectors.

To compute the cyclical properties of aid and GDP per capita, I take natural logarithms of the per capita PPP series and compute the detrended series as the difference between the data and the Hodrick-Prescott filtered series. I then drop the end points from the detrended series. From now on, when I refer to aid or GDP, I refer to detrended aid and detrended GDP unless otherwise specified. For my main results I use a weighting parameter of 10, as suggested by Baxter and King (1995) for annual data. The results are also relatively robust to using the Baxter-King (1999) band-pass filter as an alternative filtering mechanism.[5] Following Pallage

[4]Celasun and Walliser (2008) provide a detailed statistical analysis of the relationship between gross ODA commitments and disbursements. They find that commitments are predictors of disbursements, but a large unexplained component remains.

[5]For the Band-Pass filter I use window of 3 leads and lags, a low frequency of 3 and high

and Robe (2001) and Bulir and Hamann (2003) I measure the procyclicality of aid by computing the correlation between detrended aid and detrended GDP.

Figures 2.1, 2.2 and 2.3 plot the raw GDP and ODA data, fitted HP trends and the deviations from trend for Malawi, Democratic Republic of the Congo (DRC) and Uganda. Malawi has clearly received countercyclical aid flows since 1976 with increases of aid often occuring during downturns and vice versa. On the other hand, the DRC clearly received strongly procyclical aid. Finally, Uganda received procyclical aid during the 1980s but from the early 1990s aid flows became more countercyclical.

I measure institutions using a number of different measures. The International Country Risk Guide (ICRG) ratings provide the longest time series with broad country coverage starting in 1982 with further improvements in the coverage of developing countries in 1985. The ICRG provides quantitative assessments of countries provided by a group of unidentified private experts not necessarily resident in the country. For the main results, I use the mean of scores from (a) corruption, (b) rule of law/law and order tradition and (c) private expropriation risk as my main measure of institutional quality. I also report results for the individual series.[6] A higher score implies higher quality institutions.[7]

frequency of 8.

[6]I re-scale the private exproptiation risk scores onto a [0,6] scale to conform with the scale of the corruption and rule of law scores.

[7]These measures of institutions come from Knack and Keefer (1995) who used the underlying ICRG data to construct the IRIS 3 dataset which measures: corruption, ethnic tension, rule of law, quality of bureaucracy, repudiation of government contracts and expropriation risk. Since Knack and Keefer (1995) these measures of institutions have been used in many studies e.g. Acemoglu, Johnson and Robinson (2001) to analyse the impact of institutions on economic development and Alfaro, Kalemli-Ozcan and Volosovych (2005) to explain why capital does not flow from rich to

Between 1989 and 1994, the institutional quality measures in my sample experienced a historically high amount of churning. Figure 2.4 plots the correlation of the cross section of the rule of law measure against the cross section two years ahead. During the period from 1989 to 1994, the two-year ahead correlation drops from values of greater than 0.90 to 0.66.[8]. A potential explanation for this churning is that at the end of the cold war, developing countries were no-longer able to play off the Western donors against the USSR and hence Western donors were able to extract greater changing in governance in return for aid.[9] In this paper, I exploit this variation by splitting the sample in 1991 and compute the correlation between aid and GDP in each subsample, the sample prior to 1991 I denote as 'early' and post 1991 as 'late'. This historically higher degree of churning coincides with a step increase in in average institutional quality across my sample which has not been repeated since (Figure 2.5).

As a robustness check, I use alternative measures of institutions from other sources. I first cross check my results using institutional measures from Kaufmann and Kraay (2008). These measures have broader country coverage than the ICRG data, but have the disadvantage of a shorter time series, which only starts in 1996. Second, I use the World Bank's Country Policy and Institutional Assessment (CPIA) measures which have the advantage of measuring more specific aspects of institutions but with the disadvantage that published figures are only available from 2005 and

poor countries.

[8]Even though my sample does not contain any Eastern Bloc countries, the end of the cold war does appear to coincide with this one-off change in institutional quality.

[9]In Banerjee (2010) I show how the interaction between political *vs* altruistic motives for giving aid can affect the ability of the donor to extract better policies from the recipient government.

for a narrower set of developing economies than the ICRG.

The methodology controls for the impact of the OECD business cycle on aid flows. During any window over which the correlation between aid and GDP is computed, the donors are facing the same shocks but some countries receive procyclical aid while others receive countercyclical aid. There are a multitude of other macroeconomic, political economy and institutional variables which could potentially explain the correlation of ODA flows with GDP. I use the following control variables to test the robustness of the results: GDP per capita because once GDP per capita is accounted for, Alesina and Weder (2002) find that institutional quality in a country does not affect the *level* of aid a country receives. I control for the aid to GDP ratio and aid as a fraction of capital flows because aid inflows could potentially cause a boom, and this effect will be greatest for those countries where aid is most important, either in terms of GDP or as a fraction of capital flows.[10] I also control for the volatility of aid, the volatility of GDP and the volatility of real terms of trade shocks defined by Mendoza (1992). The political structure of a country or conflicts and coups may potentially affect aid flows. To control for this I use data on the political system from Polity IV, armed conflicts from the UCDP/PRIO Armed Conflict Dataset and the coups from the Center for Systemic Peace, Coups d'Etat dataset. To isolate the particular institutional characteristic which influences aid flows I also control for measures of civil liberties and political rights. I take measures of civil liberties and political rights from the Freedom House, Freedom in the

[10]Reducing the sample to those countries where ODA is greater than capital flows does not change the results.

World dataset. Crises could also influence aid flows, I therefore follow Drazen and Easterly (2001) to construct measures of inflation crises. Finally, one should note that similar to the growth regression literature there are an infinite number of right hand side variables that one could consider but only a finite number of degrees of freedom.

2.2.2 Empirical tests

I run three different regressions to test the relationship between the cyclicality of aid and institutional quality.

2.2.2.1 Pooled regression

The first regression pools data from the early and late periods and treats between country variation of institutional quality identically to within country variation over the early and late sample periods

$$corr(aid_t, gdp_s)_{n,i} = \alpha + \beta Institutions_{n,i} + X_{n,i}\eta + \epsilon_{n,i} \tag{2.1}$$

where $corr(aid_t, gdp_s)_{n,i}$ is the correlation between detrended aid in year t and detrended gdp in year s over the sample period $n = \{early, late\}$ for country i. $Institutions_{n,i}$ is the institutional measure for country i in sample period n. $X_{n,i}$ is a vector of country characteristics, α and β are constants, η is a vector of constants and $\epsilon_{n,i}$ is white noise. I denote regression (2.1) as the 'pooled' regression.

2.2.2.2 Within regression

The second regression is a two way error component model which controls for both country and time fixed effects. Fixed effects control for variables such as colonial past which Alesina and Dollar find to be important determinants of the level of aid a country receives. Since I have only two periods, pre and post the end of the cold war this regression is equivalent testing whether the *change* in institutional quality between the two sample periods is correlated with the *change* in $corr(aid_t, gdp_s)$.

$$corr(aid_t, gdp_s)_{n,i} = \alpha_i + \beta Institutions_{n,i} + \lambda Time_n + X_{n,i}\eta + \epsilon_{n,i} \tag{2.2}$$

where α_i and λ are constants and $Time_n$ is a time dummy variable for period n. The $Time_n$ dummy is important because this controls for the trend increase in institutional quality shown in Figure (2.5). In this regression I am exploiting the unusually high degree of 'churning' in institutional quality at the end of the cold war. I denote regression (2.2) as the 'within' regression because it tests whether the impact of changes in institutional quality *within* a country are significant, controlling for country and time fixed effects.

2.2.2.3 Between regression

Finally, for completeness I test whether between country variation in institutional quality is an important determinant of aid cyclicality by running the following

regression

$$corr(aid_t, gdp_t)_{n,i} - \overline{corr(aid_t, gdp_t)_i} = \alpha + \beta \left(Institutions_{n,i} - \overline{Institutions_i}\right) + \left(X_{n,i} - \overline{X_i}\right) \eta + \epsilon_{n,i} \quad (2.3)$$

where $\overline{corr(aid_t, gdp_t)_i}$ is the mean of $corr(aid_t, gdp_t)_{n,i}$ over the two periods n. I denote regression (2.3) as the 'between' regression. Due to the averaging over time in the between regression, has fewer degrees of freedom compared to the pooled and within regressions.

2.2.3 ODA disbursements

Figure 2.6 plots the contemporaneous correlation of total net disbursed ODA and GDP computed over the two subsamples against the mean of the corruption, the rule of law and expropriation risk of private investment indices from the ICRG. For the early period I use the earliest complete set of observations which are 1985 due to data availability and for the late sample the 1993 observation.[11]. The inverse relationship between the quality of institutions and the correlation of ODA disbursements and GDP is clear. To the best of my knowledge this is the first time this fact has been documented. In countries with the most procyclical aid, the correlation is around 0.90, ranging down to -0.55 for the least. Figures 2.7 and 2.8 plot the same graph for multilateral and bilateral ODA disbursements respectively. The inverse relationship between institutions and the aid-GDP correlation is still evident.

[11]The results are robust to using averages over the 1985-1991 and 1992 onwards instead of the 1985 and 1993 observations.

Table 2.3 regresses the contemporaneous correlation of detrended total net ODA disbursements and detrended GDP against the quality of institutions in a country. The significant negative coefficient in all specifications shows that as institutional quality improves, countries receive less procyclical aid. This results holds for the pooled, within and between regression specifications. The estimated β coefficients from the three specifications not significantly different from each other suggesting that the influence of institutional quality on the cyclicality of aid are similar for both within and between country variation. The within regression results show that fixed effects such as colonial past or distance from the equator are not explanations for this correlation.

Countries which had relatively poor institutions in the 1970s, but improved them by the 1990s (e.g. Ghana and Uganda) had a high correlation between aid and GDP in the 1970s and early 1980s however, they had a relatively low correlation in the 1990s and beyond. On the other side, countries which had relatively good institutions in the 1970s and early 1980s but the quality declined thereafter (e.g. Sierra Leone) showed the opposite trend. Countries which had poor institutions throughout had a high correlation between aid and GDP in all decades (e.g. Democratic Republic of Congo), while countries with relatively good institutions throughout had a low correlation between aid and GDP in all decades (e.g. Malawi). The results predict that if the Democratic Republic of the Congo improved its institutional quality to that of Ghana in 1993, aid would go from being strongly procyclical ($Corr(Aid, GDP) = 0.48$) to acyclical ($Corr(Aid, GDP) = 0.061$).

Table 2.4 shows that the relationship between aid cyclicality and institutional quality is robust to all the control variables across both the pooled and within regression specifications, but not the between specification. This illustrates that the change in institutional quality over time is an important source of variation when explaining the cyclicality of aid flows. In terms of possible control variables, the model of Arellano et al. (2009) suggests that countries which receive volatile aid flows and aid flows are a significant fraction of GDP or a significant fraction of capital flows, there should be a positive correlation with aid procyclicality. Table 2.4 shows that the volatility of aid is not significant in any specification, that the aid to GDP ratio is significant only in the between specification and capital flows as a fraction of aid is never significant. This result is in line with the empirical results in Pallage and Robe (2001) and Bulir and Hamann (2003), who do not find a significant relationship between the cyclicality of aid and the aid to GDP ratio, the volatility of aid and the volatility of GDP. There is also no relationship between the cyclicality of aid and the level of GDP in a country which is line with results in Pallage and Robe (2001). Table (2.4) also shows that the aid to GDP ratio and the volatility of GDP are positively correlated with aid procyclicality but this result only holds for the between regression specification.

Alternatively, aid flows could be affected by armed conflicts or coups, which also cause reductions in GDP. For the within regression specification, if a country experienced armed conflict in one period, then in that period they received more countercyclical aid. However, armed conflicts are not significant in the pooled or

between regressions. Dollar and Svensson (2000) find evidence that the political structure in a country temporarily affects aid flows. I therefore, use the Polity IV scores to test whether the political structure affects aid. This variable is also not significant. Measures of civil liberties or political rights used by Isham, Kaufmann and Pritchett (1997) to explain the success of development projects are also not significant. These results accord with the *a priori* expectation in Banerjee (2010) where the domestic political system should not affect the donors' ability to monitor government actions or affect the credibility of announced policies. Finally, monetary crises as measured by Drazen and Easterly (2001) could cause to aid fall in times of crisis as donor targets are missed. Again these crisis variables are not significant.

Tables 2.3 and 2.4 show that countries with more corruption, weaker rule of law and greater expropriation risk of private investment receive more procyclical aid on average. As these institutions improve, aid becomes acyclical or countercyclical on average. This result is robust to numerous control variables and regression specifications. For countries with good institutions, aid does acts as insurance during downturns or is at least acyclical. This relationship suggests that at the business cycle level, aid flows are influenced by the quality of these institutions in recipient countries. This is a striking finding given that the previous literature failed to find any relationship between the level of aid and the quality of institutions in a country (World Bank, 1998, Dollar and Svensson, 2000, Alesina and Dollar, 2000 and Alesina and Weder, 2002).

2.2.3.1 Alternative detrending filter

The HP-filter is known to potentially induce cycles in acyclical data. Therefore I use an alternative detrending technique to test the robustness of the results. Tables 2.5 and 2.4 present results using a band-pass filter (Baxter and King 1999). Detrending with the Band-Pass filter there is still a negative relationship between institutions and aid procyclicality. The results are robust to individually adding the controls (not shown) but with all controls simultaneously, institutions only remain significant in the Within regression (Table 2.6).[12] For the pooled regression none of the controls are significant either. In the between regression, countries which have had on average more volatile GDP receive more procyclical aid. This is consistent with the results in Table 2.4.

2.2.3.2 Multilateral and Bilateral Aid

The results presented above are for total aid flows. Tables 2.8 and 2.9 break down aid flows into flows from multilateral and bilateral donors. Tables 2.8 and 2.8 show a similar negative relationship between institutional quality in a country and the procyclicality of aid. Table 2.9 shows that for total bilateral aid all regression specifications are negative and significant at the 5% level. However, the negative relationship between aid cyclicality and institutional quality is not robust for multilateral aid. On the other hand, below I show that the relationship between the cyclicality of multilateral aid *commitments* is significant, but not for total bilateral

[12]For the pooled regression with controls the P-value on institutional quality equals 0.1017.

aid *commitments*. In Banerjee (2010) I show that the differing behaviour of aid cyclicality between multilateral vs. bilateral donors can be attributed to conflict between altruistic and political reasons for giving aid. If there are frequent stochastic political motives for giving aid, this limits the ability to use aid commitments to influence recipient government behaviour and instead variation in actual aid flows are instead used to influence recipient government behaviour.

2.2.3.3 Individual institutional quality measures

Table 2.10 shows that for the pooled regression model, all series except Ethnic Tension show a significant negative correlation between institutional quality and the correlation of detrended aid and GDP. With controls only Corruption and Expropriation of private investment remain significant. Table 2.11 shows the results for total multilateral and total bilateral aid flows. For Bilateral aid flows, Corruption, Expropriation of Private Investment and Rule of Law are all negative and significant in the regressions with controls.

The results from Table 2.10 and Table 2.4 show that several institutional quality variables have a strong negative relationship between institutional quality and the correlation between detrended aid and GDP. This suggests that there is probably a latent variable which influences the timing of donor aid flows and that variable is partially captured by the individual institutional quality variables. In Banerjee (2010) I argue using a case study that this latent variable is the donor's ability to monitor government actions and hence differentiate exogenous from endogenous

downturns.

2.2.4 Alternative institutional quality measures

As a further robustness check and also to learn more about the particular institutions driving this relationship, I use the 1996 Kaufmann and Kraay (2008) governance indicators and the 2006 World Bank CPIA institutional quality measures as alternatives to the measure constructed from the ICRG. The Kaufmann and Kraay (2008) indicators have the advantage of broader country coverage, 71 as opposed to 61 for the ICRG given the sample selection process. The CPIA indicators have the benefit of more specific measures of institutions but has narrower country coverage, 37 as opposed to 61 for the ICRG. Countries in the CPIA sample tend to have lower GDP per capita because they tend to be World Bank International Development Association (IDA) countries which provides aid to the poorest countries. Unfortunately both these measures have relatively short time series. The Kaufmann and Kraay data start in 1996 while the publicly available CPIA data start in 2005 thus both miss the large 'churning' at the end of the cold war. I therefore only compute regressions for the 'Late' sample period for these measures.

Table 2.12 show results from the pooled regression specifications for the individual institutional measures from Kaufmann and Kraay (2008) and the CPIA. For the Kaufmann and Kraay indicators political stability and control of corruption are significant in the regressions with the control variables. Tables 2.13 and Table **??** show that government effectiveness is negative and significant for multilat-

eral and bilateral aid flows while bilateral aid flows also show a significant negative relationship with voice and accountability and political stability.

For the CPIA measures Tables 2.12, 2.13 and 2.14 show that the Public Sector Management cluster, Structural Policies cluster are negative and significantly correlated with aid cyclicality for total and multilateral aid flows. Out of the 4 main CPIA clusters, policies for social exclusion and equity shows the weakest relationship. The fit is particularly good for the Public Sector Management and Institutions cluster. Therefore, countries with better Public sector management and institutions receive less procyclical aid. Examining the more specific CPIA indicators, revenue management appears to be an important factor in determining the cyclicality of aid.

2.2.5 Aid Levels

This section confirm the results of Alesina and Weder (2002) who find that the level of aid a country receives is not influenced by the quality of institutions in that country. In Table 2.15 I confirm these results using my dataset. The regressions show that once GDP per capita is controlled for, institutions are no longer a significant explanatory variable for the level of aid. The fact that institutions do not influence the level of aid is an important fact that any model which attempts to explain aid cyclicality must reproduce.

2.3 Reconciling the existing empirical literature on aid cyclicality

This section shows that the relationship between institutional quality and aid cyclicality can reconcile some conflicting results in the existing literature on aid cyclicality.

Pallage and Robe (2001) find that 71% of sub-Saharan African economies receive procyclical aid while 48% of non-African developing countries receive procyclical aid. They conclude that,

'Another message from these results is that Africa is special in many respects. That region of the world is the one for which aid matters most. It is also the region for which aid receipts are most often and most strongly procylical.'

Sub-Saharan Africa is also the region of the world with the weakest institutions (Table (2.16).[13] In sub-Saharan Africa the mean is 3.02 while in non-African developing countries the mean is higher at 3.364. I conduct the following test to determine is sub-Saharan Africa is treated differently than other developing countries or whether the higher incidence of procyclical aid in Africa is due to having weaker institutions on average. First, I run the following regression

$$corr(aid_t, gdp_t)_{n,i} = \alpha + \theta SubSaharan\ Africa\ dummy + \epsilon_{n,i} \tag{2.4}$$

where $SubSaharan\ Africa\ dummy$ is an indicator variable for sub-Saharan African countries in my sample and θ is a constant. This regression tests whether

[13]Institutional quality is measured as the mean of corruption, rule of law and expropriation risk but this fact holds for other institutional measures too.

sub-Saharan Africa receives more procylical aid on average. If it does, then θ will be positive and significant. Table 2.17 shows that this is indeed the case. However, sub-Saharan Africa could receive more procylical aid on average simply because it has weaker institutions on average. I run the following regression to test this hypothesis

$$corr(aid_t, gdp_t)_{n,i} = \alpha + \beta Institutions_{n,i} + \theta SubSaharanAfricadummy + \epsilon_{n,i} \quad (2.5)$$

If θ is no longer significant once the $Institutions$ variable is included,then sub-Saharan Africa is not treated differently conditional on institutional quality.

Table 2.17 indicates that the sub-Saharan Africa dummy is not significant once one controls for institutional quality. Therefore, on average, sub-Saharan African countries are not treated differently. Instead, sub-Saharan Africa has weaker institutions on average and thus receives more procyclical aid.

A similar test can be conducted when comparing the finding from Pallage and Robe (2001) that aid is 'predominantly' procyclical to the findings from Rand and Tarp (2002) where '[they] find no evidence of procyclical aid'. Table (2.16) shows that the Rand and Tarp (2002) sample has countries with above average institutional quality. The following regression tests whether the countries in the Rand and Tarp (2002) sample receive more countercyclical aid than the other countries in my sample

$$corr(aid_t, gdp_t)_{n,i} = \alpha + \theta Rand\,Tarp\ sample\ dummy + \epsilon_{n,i} \quad (2.6)$$

where *Rand Tarp sample dummy* is an indicator variable for countries in the Rand and Tarp (2002) sample and θ is a constant. The institutions variable is then added to the regression. If the Rand and Tarp dummy variable is not significant with the addition of the Institutions variable then the Rand and Tarp (2002) finding is due to using a sample of countries with above average institutional quality

$$corr(aid_t, gdp_t)_{n,i} = \alpha + \beta Institutions_{n,i} + \theta Rand\,Tarp\,sample\,dummy + \epsilon_{n,i} \quad (2.7)$$

The first column of Table (2.18) shows that the Rand and Tarp (2002) sample receives more countercyclical aid on average than the rest of the sample. However, once institutional quality is added, then the *Rand Tarp sample dummy* is no longer significant. This result shows that Rand and Tarp's (2002) result of 'no evidence for procyclical aid' can be reconciled with Pallage and Robe (2001) result of 'predominantly' procyclical aid, once the quality of institutions in the samples are considered. Indeed, Rand and Tarp (2002) chose developing countries which have long time series of data. Countries which traditionally have better institutions tend to have better national accounts data. By selecting countries with long times data, Rand and Tarp (2002) selected a sample of developing countries which had higher institutional quality.

2.4 Leads and Lags of aid disbursements

Section 3.3 discussed the relationship between institutional quality and the contemporaneous correlation between aid and GDP. This section examines the phase shift of this relationship.

There is a similar relationship between the correlation between aid disbursements in $t-1$ and GDP in period t and institutions. In both Table 2.19 and 2.20 the institutions variable is negative and significant in all specifications. Therefore, in countries with weak institutions, detrended aid *leads* GDP while in countries with good institutions, aid flows increase before downturns in GDP. However, as institutional quality improves, then the correlation between aid in $t-1$ and GDP in period t becomes more countercyclical.

Interestingly there is no significant relationship between $corr(aid_{t+1}, gdp_t)$ and institutions (not reported here).

2.5 Bilateral donors

In section 2.2 there was a significant negative relationship between aid cyclicality and institutions for bilateral donors. This section drills down deeper and examines the cyclicality of aid flows for individual OECD donors. Table 2.21 shows pooled regression results for all donors where aid flows comprise at least 1% of total aid flows over my sample period. Aid flows from the United States, United Kingdom, Germany, France, Canada, Japan, Netherlands, Switzerland, Belgium and

Australia all show a negative relationship between aid cyclicality and institutional quality. This negative relationship is robust to the control variables for the United Kingdom, Germany, Japan, Netherlands, Belgium and Australia. Interestingly Italy is alone in have a positive relationship between aid cyclicality and institutional quality and this positive relationship is robust to the control variables.

The cyclicality of aid flows from Scandinavian countries do not show a significant relationship with institutions. Alesina and Dollar (2000) find that aid from Scandinavia is directed to countries with the better institutions unlike other countries. Therefore, the lack of a significant relationship between institutional quality and aid cyclicality could be because Scandinavian countries are already targeting the level of aid to countries with good institutions and do not differentiate the cyclicality of aid flows across institutional quality.

2.6 Aid commitments

The OECD's aid data has an nice feature in that it not only collects information about actual aid flows, *aid disbursements*, but also firm promises of aid for the future, *aid commitments*. Celasun and Walliser (2008) examine the relationship between aid commitments and aid disbursements. They find that aid commitments are an unbiased forecast for aid disbursements but there is a large unexplained component. This section tests whether there is a relationship between the cyclicality of aid commitments and institutional quality.

In Banerjee (2010) I show that the negative relationship between aid cyclicality

and institutional quality can be explained within a dynamic moral hazard framework. One of the predictions from the model is that commitments for aid in the future can also be used by donors as an instrument to encourage good policies. The prediction states that aid commitments for the following year should also be procyclical in countries with weak institutions while countries with higher institutional quality should have acyclical or countercyclical aid commitments.

Indeed for Multilateral aid, there is such link between institutional quality and the correlation between GDP in year t and aid commitments for $t+1$. Figure 2.9 plots the correlation between GDP in year t and aid commitment in year $t+1$ and presents a negative relationship. Table 2.22 shows that the negative relationship between institutional quality and the cyclicality of aid commitments in the next year is significant for multilateral aid flows. Table 2.23 shows that the pooled and within regressions are robust to the control variables. There is however, no relationship between the cyclicality of Total aid and bilateral aid with institutional quality. In Banerjee (2010) I show that this result can be explained if bilateral donors are myopic, have a stochastic political demands for aid or the duration of relationships with recipient countries are lower.

2.7 Causality

The results presented thus far only imply a correlation between institutional quality and the cyclicality of aid flows, they do not necessarily imply causality. It is possible that the causation could run from the cyclicality of aid flows to institutional

quality in a country. However, this does not seem plausible. For example, if causality did run in this direction, it would be very easy for donors to improve the quality of institutions in a country. Donors could improve institutional quality by giving countercyclical aid flows instead of procyclical aid. If changing institutional quality in developing countries were so easy, it would surely have been considered by now. It also seems unlikely that institutional quality measures would be influenced by the donor community's decision about the cyclicality of aid. I consider it highly unlikely that assessments of institutional quality are determined by the cyclicality of aid flows to the country. Furthermore in the main results I use the first observations of institutional quality available in each subsample. Thus it is a stretch of the imagination that institutional quality in 1993 would have been influenced by the cyclicality of aid from 1993 to 2007 (Late period). Unfortunately, for the Cold-war period, the first institutional quality observations with wide developing country coverage is in 1985 so it is possible that the cyclicality of aid influenced institutional quality measures, though given the arguments above I would expect this to be unlikely.

A more subtle possibility is that the factors which influence assessments by external observers of institutional quality are the same as those which influence donor behaviour. It is therefore possible that a third omitted variable is determining the correlation between institutional quality and the cyclicality of aid flows. However, the robustness of the results to both the *pooled* and *within* specifications require that strict conditions to be imposed on any omitted variable. In particular, both

the *level* of the variable would have to be correlated with institutional quality and the *change* would also have to be correlated with the change in institutional quality and is not one of the control variables used in the regressions.

Ideally one would use an instrument which is not subject to reverse causality and can account for the level and change in institutional quality over the sample. La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997, 1998) emphasize the importance the legal origins of a country's institutions. Unfortunately, the historical legal system will not be a good instrument for institutions in this paper. Because the results hold for both the *pooled* and *within* models but not the *between* model, any instrument which is a static over time will not be a good instrument. This problem with static instruments is most stark in the *within* regression specification where the *change* in institutional quality is the source of the variation.[14]

Nonetheless, I report instrument variable regressions which use the settler mortality estimates from Acemoglu, Johnonson and Robinson (2001, 2006) as an instrument for institutional quality. These estimates have been used by a number of papers to instrument institutions (e.g. Alfaro, Kalemli-Ozcan and Volosovych, 2008). Table 2.24 reports the first-stage estimates from regressing institutional quality on settler mortality. In my dataset settler mortality is a weak instrument for institutional quality, where the first stage regression coefficient on settler mortality is insignificant.[15][16] The sign on settler mortality is negative, but the first stage

[14]Typically papers which examine the impact of institutional quality only consider *pooled* regressions and not the *within* specification, e.g. Alfaro, Kalemli-Ozcan and Volosovych (2008).

[15]$P - value = 0.169$

[16]Results reported here use the updated settler mortality estimates in Acemoglu, Johnson and

coefficients are not significant at standard significance levels. In Table 2.25 I report the instrument variable estimates, however, given the weak first stage results one should interpret the results considering the problems with weak instruments. The instrumental variable estimates find a negative correlation between institutional quality and the correlation between aid and GDP but the estimated coefficient is not significant.[17]

There are two reasons why settler mortality is a weak instrument for institutional quality in this paper, (a) settler mortality will not capture the change in institutional quality overtime and hence fails to capture an important source of variation for the results and (b) as Albouy (2008) notes, settler mortality is a weak instrument for institutional quality once the neo-Europeans (USA, Canada, Australia and New Zealand) are excluded.

2.8 Conclusion

This paper documents a new fact: the correlation between official development assistance (ODA) and GDP is negatively related to the quality to institutions. As the quality of institutions in a country deteriorate, they are more likely to receive procyclical rather than countercyclical aid. In particular institutional measures related to corruption, rule of law, property rights and public sector management and structural policies display a robust negative correlated with aid procylicality.

Robinson (2006). Higher $P - value$ results from the original Acemoglu, Johnson and Robinson (2001) estimates.

[17] $P - value = 0.168$.

This result is robust to numerous specifications and control variables.

The relationship between institutional quality and the cyclicality of aid also reconciles conflicting empirical results about aid cyclicality in Pallage and Robe (2001) and Rand and Tarp (2002).

There appear to be important differences between the aid cyclicality from bilateral donors and multilateral donors. Bilateral donors give more procyclical aid disbursements to countries with weak institutions, while multilateral donors give more procyclical aid commitments for the following year. In Banerjee (2010) I show that a dynamic moral hazard model can explain many of these empirical facts about aid flows.

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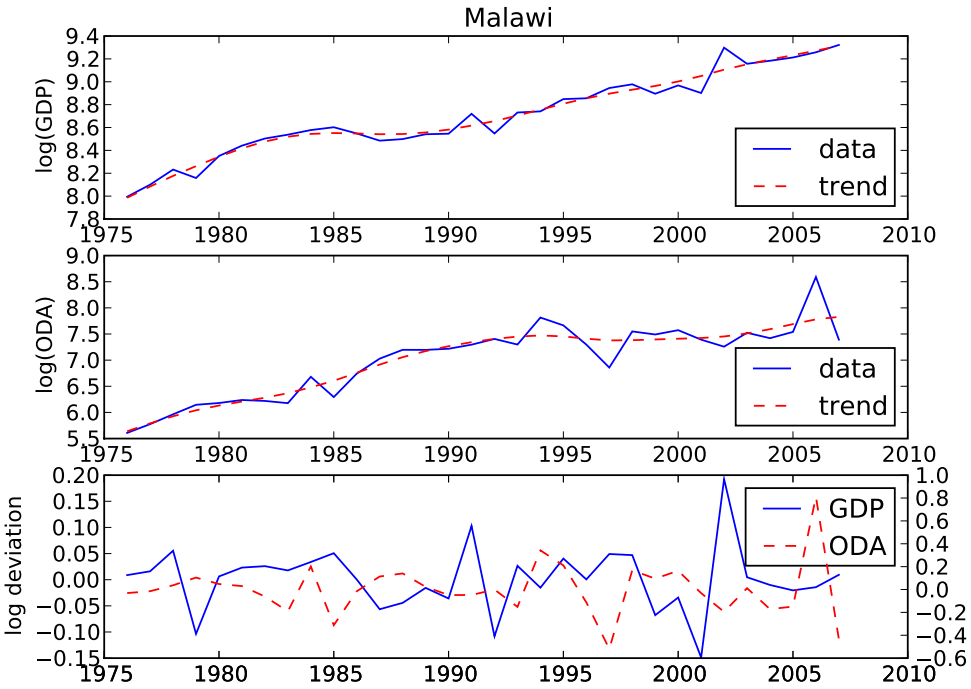

Figure 2.1: Malawi: GDP and ODA series with HP trend

2.9 Figures

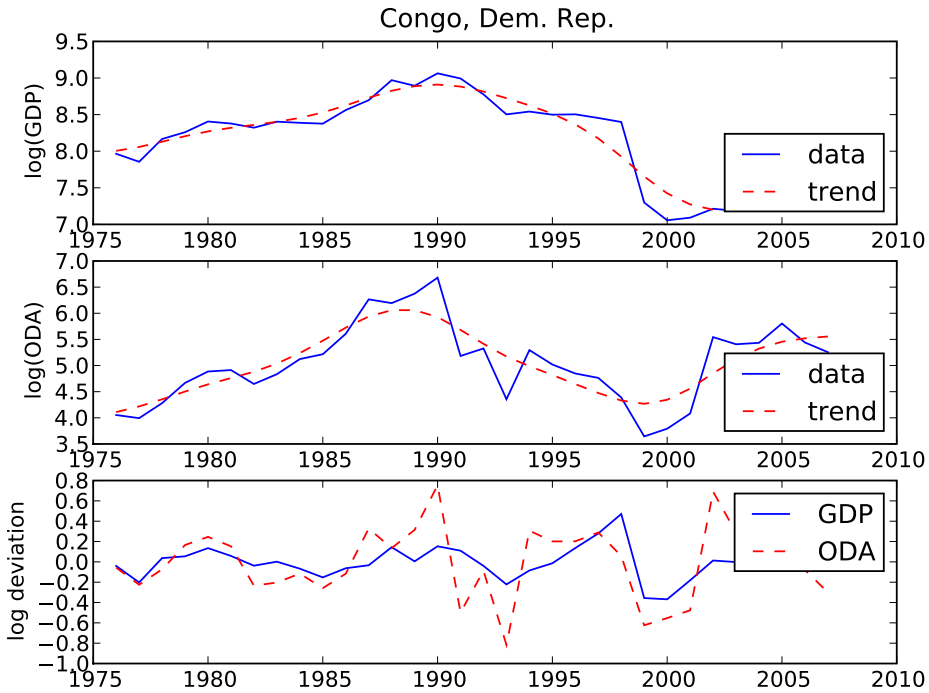

Figure 2.2: The Democratic Republic of the Congo: GDP and ODA series with HP trend

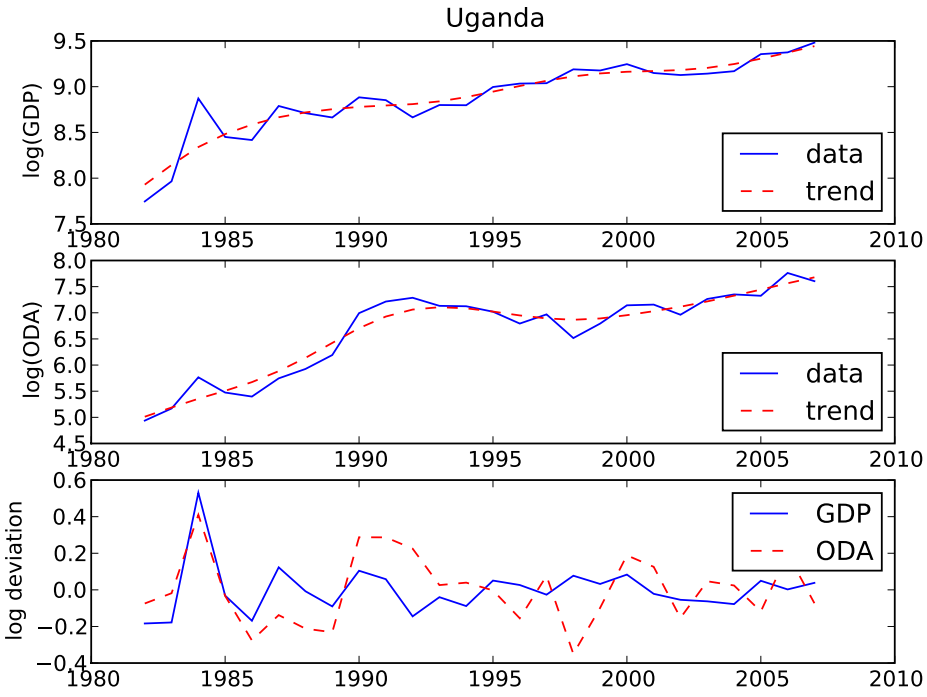

Figure 2.3: Uganda: GDP and ODA series with HP trend

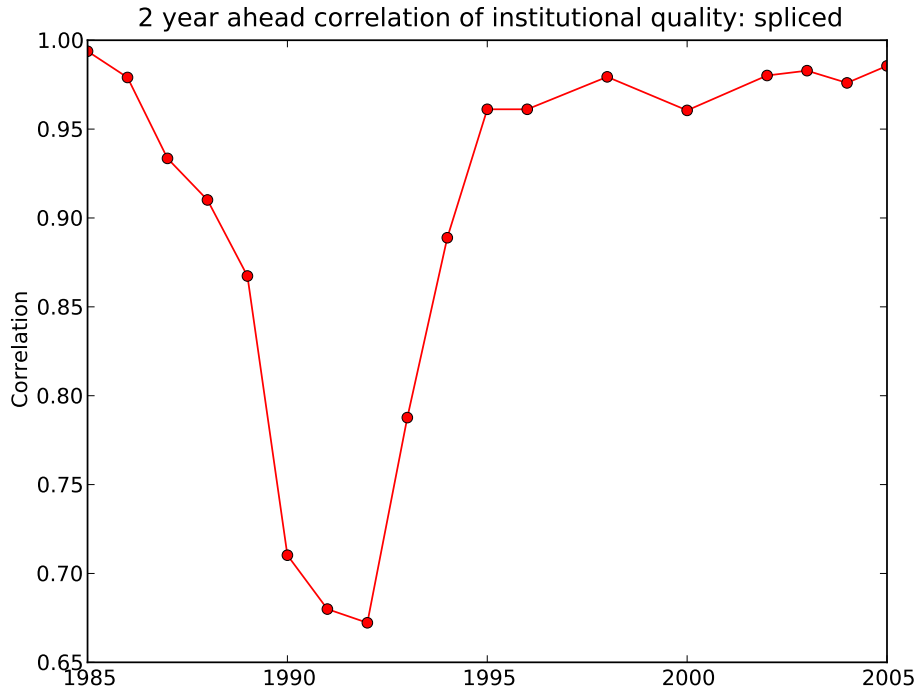

Figure 2.4: 2 year ahead correlation of institutions

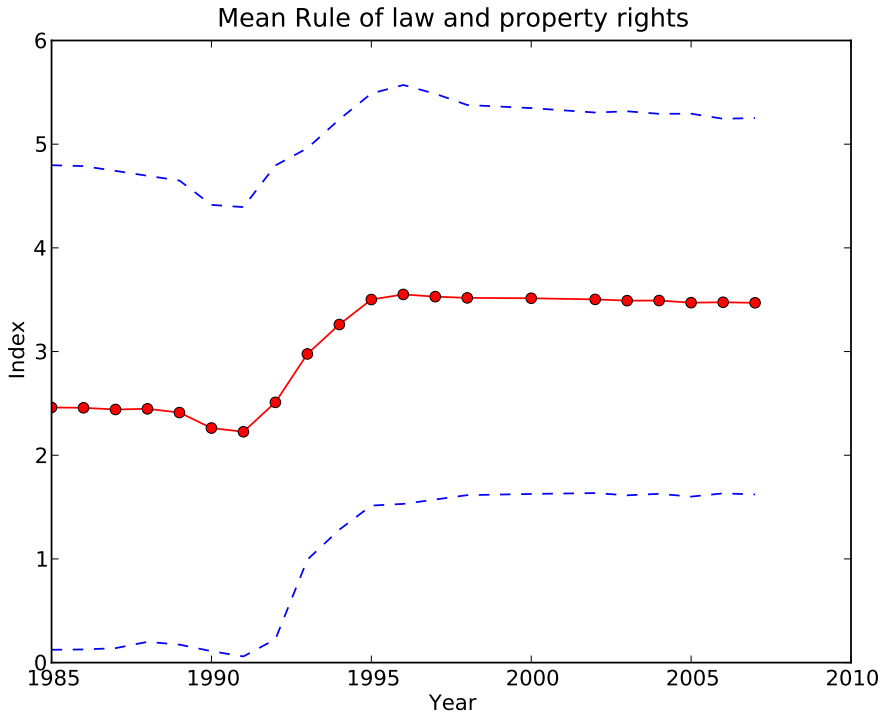

Figure 2.5: 2 year ahead correlation of institutions

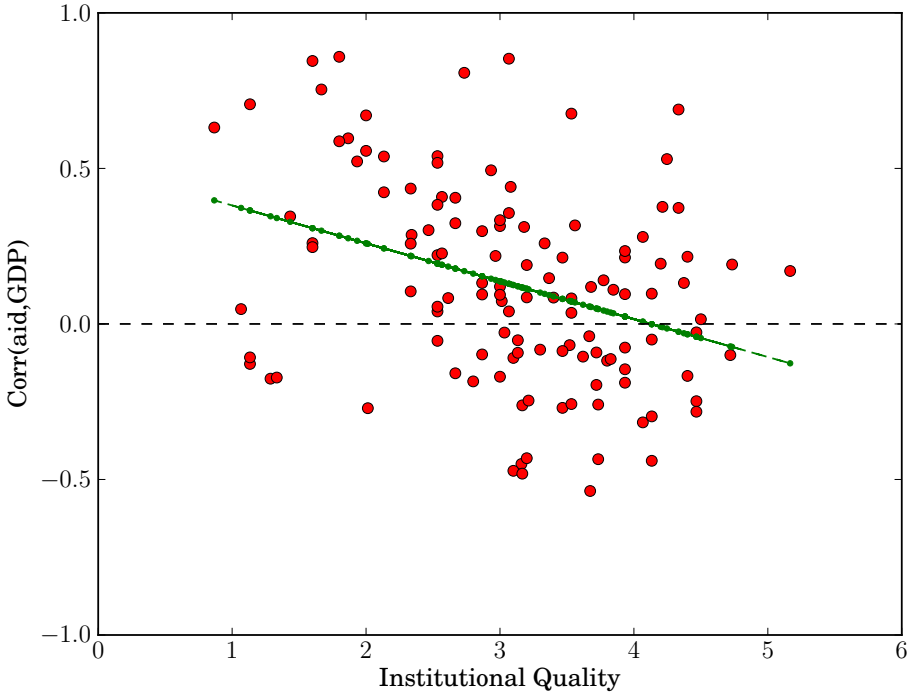

Figure 2.6: Total aid: Institutions plot against $\rho(aid, GDP)$

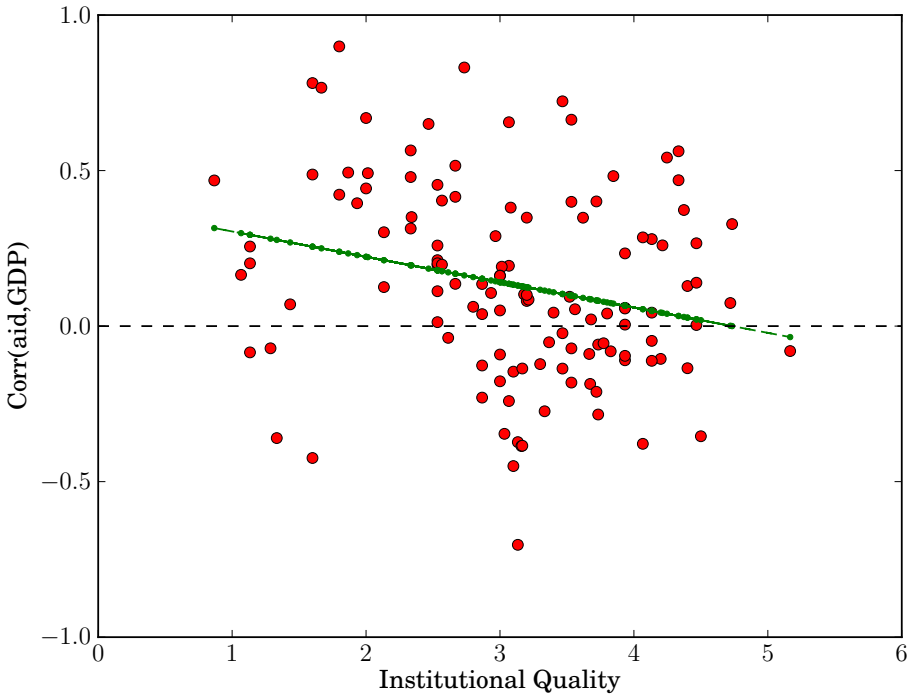

Figure 2.7: Multilateral aid: Institutions plot against $\rho(aid, GDP)$

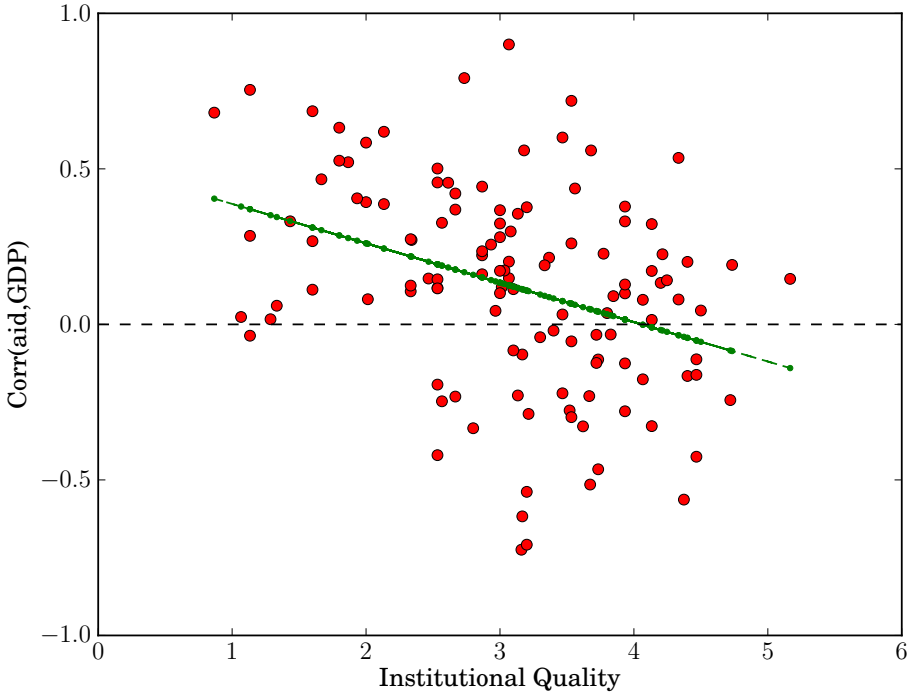

Figure 2.8: Bilateral aid: Institutions plot against $\rho(aid, GDP)$

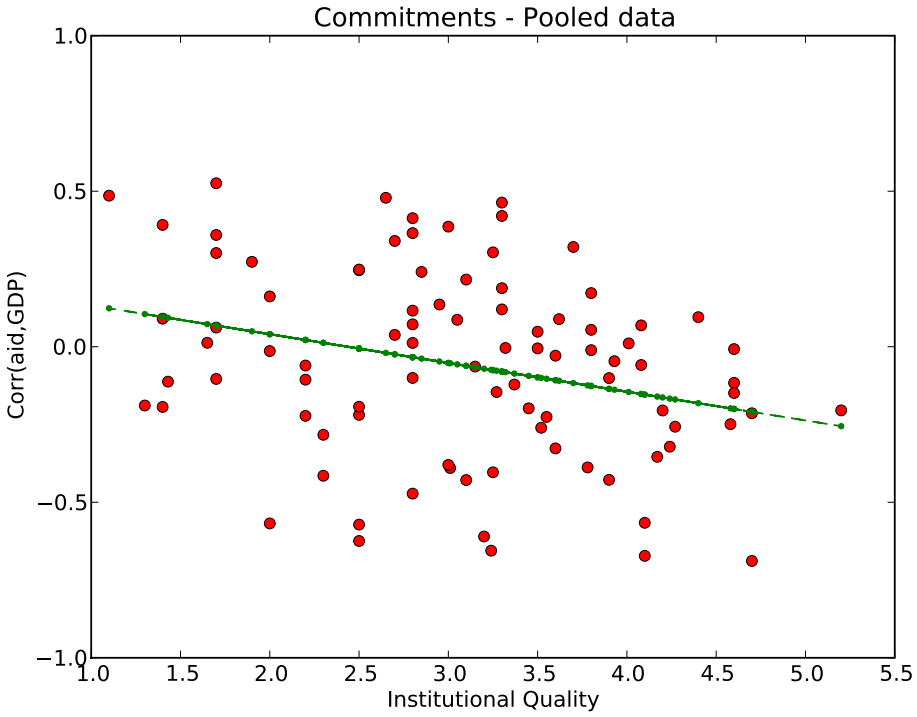

Figure 2.9: Multilateral commitments: Institutions plot against $\rho(aid_{t+1}, GDP_t)$

2.10 Tables

Table 2.1: Aid Receiving Countries, Moments 1974-2007

Country	$corr(aid_t, gdp_t)$	Aid/GDP	SD(GDP)	SD(Aid)	Government Effectiveness in 2006
Algeria	0.388	0.004	0.058	0.188	-0.395
Argentina	0.322	0.001	0.188	0.307	0.423
Bangladesh	0.057	0.066	0.067	0.103	-0.643
Benin	0.504	0.087	0.057	0.150	0.008
Bolivia	0.103	0.052	0.030	0.202	0.073
Botswana	0.628	0.087	0.077	0.108	0.244
Botswana	0.628	0.087	0.077	0.108	0.244
Brazil	0.405	0.001	0.074	0.260	-0.299
Burkina Faso	-0.004	0.111	0.041	0.086	-0.680
Burundi	-0.008	0.141	0.044	0.070	-0.974
Cameroon	0.257	0.031	0.074	0.183	-1.166
Central African Republic	-0.043	0.133	0.060	0.148	-0.907
Chad	0.703	0.119	0.084	0.263	-0.646
Chile	0.134	0.001	0.058	2.581	0.956
China	-0.449	0.003	0.116	0.355	0.136
Colombia	0.668	0.002	0.019	0.160	0.253
Congo, Dem. Rep.	0.743	0.044	0.101	0.287	-1.702
Congo, Rep.	0.360	0.057	0.135	0.208	-1.221
Costa Rica	0.327	0.030	0.041	0.235	-0.007
Cote d'Ivoire	-0.217	0.024	0.034	0.133	0.080
Dominican Republic	0.270	0.017	0.063	0.288	-0.780
Ecuador	-0.216	0.011	0.061	0.200	-0.896
El Salvador	0.235	0.061	0.095	0.139	-0.252
Ethiopia	0.127	0.058	0.076	0.165	-1.037
Ethiopia	0.127	0.058	0.076	0.165	-1.037
Gabon	0.078	0.019	0.094	0.163	-0.987
Gambia, The	0.042	0.040	0.084	0.672	-0.381
Ghana	0.835	0.052	0.278	0.515	-0.372
Guatemala	0.293	0.016	0.046	0.234	-0.485
Guinea	-0.390	0.055	0.352	0.214	-1.073
Guinea-Bissau	0.851	0.448	0.183	0.229	-0.632
Guyana	-0.160	0.090	0.048	0.413	-0.137
Haiti	-0.083	0.078	0.041	0.123	-1.031
Honduras	0.408	0.063	0.068	0.318	-0.821
India	-0.456	0.008	0.023	0.149	-0.205
Indonesia	0.283	0.012	0.047	0.182	0.142
Jamaica	0.091	0.050	0.031	0.331	-0.224
Jordan	0.107	0.180	0.041	0.319	0.228
Kenya	0.107	0.068	0.029	0.146	-0.257

Country	$corr(aid_t, gdp_t)$	Aid/GDP	SD(GDP)	SD(Aid)	Government Effectiveness in 2006
Madagascar	-0.230	0.070	0.046	0.170	-0.975
Malawi	-0.443	0.153	0.041	0.119	-0.669
Malaysia	0.225	0.006	0.043	0.347	0.875
Mali	0.625	0.176	0.068	0.171	-0.686
Mauritania	0.200	0.269	0.048	0.165	0.204
Mexico	-0.153	0.001	0.054	0.376	-0.038
Morocco	0.034	0.036	0.027	0.334	-0.050
Mozambique	0.508	0.170	0.070	0.485	-0.272
Nepal	0.001	0.086	0.034	0.102	-0.253
Nicaragua	0.512	0.080	0.406	0.420	-0.920
Niger	-0.085	0.121	0.049	0.153	-1.075
Nigeria	0.641	0.003	0.187	1.487	-1.363
Pakistan	0.412	0.035	0.047	0.203	-0.517
Panama	0.206	0.011	0.054	0.292	-0.293
Papua New Guinea	0.006	0.125	0.041	0.078	-0.342
Paraguay	1.000	0.016	0.002	0.266	-0.766
Peru	0.481	0.013	0.146	0.217	-0.166
Philippines	-0.130	0.015	0.039	0.162	-0.019
Rwanda	0.309	0.114	0.094	0.121	-1.235
Senegal	0.188	0.103	0.030	0.156	-0.158
Sierra Leone	0.041	0.073	0.061	0.279	-0.588
Sri Lanka	0.199	0.083	0.031	0.178	-0.443
Sudan	0.514	0.068	0.200	0.269	-1.491
Syrian Arab Republic	-0.317	0.069	0.149	0.335	-0.153
Thailand	0.179	0.011	0.027	0.133	0.464
Togo	0.010	0.119	0.065	0.188	-0.680
Trinidad and Tobago	-0.212	0.002	0.068	0.677	0.119
Tunisia	-0.203	0.031	0.034	0.116	0.509
Uganda	0.561	0.068	0.236	0.296	-0.572
Uruguay	0.117	0.003	0.065	0.336	-0.079
Venezuela, RB	0.516	0.000	0.038	3.262	-0.931
Zambia	0.273	0.096	0.112	0.344	-0.589

Table 2.2: Major OECD Bilateral Donors

Country	Average fraction of total aid (1974-2007)
United States	22.89
Japan	15.94
France	11.36
Germany	11.34
United Kingdom	7.07
Netherlands	5.32
Canada	4.35
Italy	4.10
Sweden	3.55
Denmark	2.29
Norway	2.28
Australia	2.19
Belgium	1.83
Spain	1.75
Switzerland	1.42

Table 2.3: Aid cyclicality and institutional quality; all donors

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
	Pooled	Within	Between
Institutions	-0.107 ***	-0.126 ***	-0.096 **
	(0.033)	(0.046)	(0.041)
Obs	122	122	61
Adj. R^2	0.083	0.091	0.056

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.4: Aid cyclicality and institutional quality with control variables; all donors

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
	Pooled	Within	Between
Institutions	-0.077*	-0.140*	-0.069
	(0.041)	(0.072)	(0.051)
Aid/GDP	0.386	-1.240	0.874*
	(0.510)	(1.502)	(0.481)
Average(GDP)	-0.036	-0.297	0.016
	(0.062)	(0.186)	(0.058)
SD(Aid)	0.078	0.018	0.138
	(0.098)	(0.095)	(0.141)
SD(GDP)	1.231	0.488	1.630 ***
	(1.022)	(0.817)	(0.577)
Conflict dummy	-0.090	-0.267*	-0.052
	(0.093)	(0.137)	(0.088)
Coup dummy	-0.057	-0.044	-0.022
	(0.072)	(0.111)	(0.084)
Polity IV	-0.001	0.001	-0.003
	(0.002)	(0.002)	(0.003)
Civil war dummy	-0.013	-0.007	-0.015
	(0.025)	(0.052)	(0.030)
Inflation crisis	0.000	-0.002	0.001
	(0.016)	(0.017)	(0.015)
SD(Terms of trade)	0.217	0.333	-0.013
	(0.349)	(0.634)	(0.357)
Capital Flows/Aid	0.000	-0.001	0.001
	(0.001)	(0.001)	(0.002)
Obs	122	122	61
Adj. R^2	0.126	0.124	0.196

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.5: Aid cyclicality and institutional quality; all donors, Band-pass Filter

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
	Pooled	Within	Between
Institutions	-0.117 ***	-0.131 **	-0.108 **
	(0.039)	(0.053)	(0.051)
Obs	122	122	61
Adj. R^2	0.067	0.074	0.039

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.6: Aid cyclicality and institutional quality with control variables; all donors, Band-pass filter

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
	Pooled	Within	Between
Institutions	-0.080†	-0.143*	-0.062
	(0.048)	(0.078)	(0.064)
Aid/GDP	0.446	-1.427	0.965*
	(0.578)	(1.736)	(0.570)
Average(GDP)	-0.084	-0.425 **	-0.043
	(0.073)	(0.210)	(0.072)
SD(Aid)	0.206	0.130	0.188
	(0.176)	(0.242)	(0.235)
SD(GDP)	1.374	0.761	1.938 **
	(1.268)	(0.848)	(0.933)
Conflict dummy	-0.088	-0.198	-0.116
	(0.110)	(0.146)	(0.109)
Coup dummy	-0.066	-0.028	-0.019
	(0.089)	(0.138)	(0.113)
Polity IV	-0.001	0.002	-0.008 **
	(0.002)	(0.002)	(0.004)
Civil war dummy	-0.046	-0.048	-0.069*
	(0.033)	(0.061)	(0.039)
Inflation crisis	-0.003	-0.014	-0.002
	(0.020)	(0.017)	(0.018)
SD(Terms of trade)	0.400	0.911*	-0.089
	(0.378)	(0.543)	(0.486)
Capital Flows/Aid	0.001	-0.001	0.004*
	(0.001)	(0.001)	(0.002)
Obs	122	122	61
Adj. R^2	0.102	0.130	0.187

Note: †P-value=0.1017, Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.7: Aid cyclicality and institutional quality; multilateral and bilateral aid

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
Independent variable	Pooled	Within	Between
Multilateral Aid			
Institutions	-0.080 **	-0.092*	-0.074*
	(0.031)	(0.046)	(0.041)
Obs	122	122	61
Adj. R^2	0.046	0.049	0.019
Bilateral Aid			
Institutions	-0.103 ***	-0.106 **	-0.101 **
	(0.029)	(0.045)	(0.040)
Obs	122	122	61
Adj. R^2	0.078	0.064	0.067

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.8: Aid cyclicality and institutional quality; multilateral aid

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
Independent variable	Pooled	Within Time	Between
Multilateral Aid			
Institutions	-0.030	-0.077	-0.031
	(0.038)	(0.067)	(0.052)
Aid/GDP	0.131	-2.300	0.814
	(1.374)	(3.664)	(1.261)
Average(GDP)	-0.029	-0.262*	0.019
	(0.065)	(0.137)	(0.062)
SD(Aid)	0.028	0.008	0.082
	(0.100)	(0.088)	(0.147)
SD(GDP)	1.191	0.286	1.806 ***
	(1.075)	(0.708)	(0.625)
Conflict dummy	-0.044	-0.271*	0.031
	(0.091)	(0.138)	(0.090)
Coup dummy	-0.036	0.070	-0.063
	(0.066)	(0.094)	(0.086)
Polity IV	-0.002	-0.001	-0.002
	(0.002)	(0.003)	(0.003)
Civil war dummy	0.004	-0.030	0.023
	(0.020)	(0.051)	(0.033)
Inflation crisis	-0.000	0.002	-0.003
	(0.017)	(0.016)	(0.015)
SD(Terms of trade)	0.239	0.034	0.174
	(0.383)	(0.774)	(0.368)
Capital Flows/Aid	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
Obs	122	122	61
Adj. R^2	0.093	0.109	0.134

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.9: Aid cyclicality and institutional quality; bilateral aid

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
Independent variable	Pooled	Within Time	Between
Bilateral Aid			
Institutions	-0.103 ***	-0.134 **	-0.103 **
	(0.038)	(0.063)	(0.048)
Aid/GDP	0.721	-3.186	1.380*
	(0.855)	(2.824)	(0.764)
Average(GDP)	-0.036	-0.389	0.014
	(0.067)	(0.237)	(0.055)
SD(Aid)	0.150	-0.005	0.233*
	(0.096)	(0.142)	(0.117)
SD(GDP)	0.930	-0.113	1.402 **
	(1.222)	(1.001)	(0.558)
Conflict dummy	-0.154*	-0.129	-0.178 **
	(0.087)	(0.135)	(0.083)
Coup dummy	-0.033	-0.011	-0.025
	(0.073)	(0.126)	(0.082)
Polity IV	0.001	0.002	-0.002
	(0.002)	(0.002)	(0.003)
Civil war dummy	-0.011	-0.004	-0.016
	(0.025)	(0.047)	(0.029)
Inflation crisis	-0.001	0.003	-0.003
	(0.016)	(0.016)	(0.014)
SD(Terms of trade)	0.068	-0.457	0.040
	(0.381)	(0.484)	(0.348)
Capital Flows/Aid	-0.000	-0.000	-0.000
	(0.000)	(0.001)	(0.001)
Obs	122	122	61
Adj. R^2	0.119	0.084	0.233

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.10: Aid cyclicality and individual institutional quality measures; all donors

	Dependent variable $corr(aid\ disbursements_t, gdp_t)$		
Institutional measure	Simple	With Controls	Obs
Corruption	-0.065 **	-0.056*	122
	(0.031)	(0.029)	
Rule of Law	-0.080 ***	-0.046	122
	(0.027)	(0.033)	
Quality of Bureaucracy	-0.063 **	-0.020	122
	(0.028)	(0.032)	
Ethnic Tension	-0.027	-0.010	122
	(0.021)	(0.031)	
Repudiation of Government Contracts	-0.067 ***	-0.005	122
	(0.024)	(0.037)	
Expropriation of Private Investment	-0.096 ***	-0.058*	122
	(0.023)	(0.030)	

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Results from Pooled Regression. Simple regression run with intercept and constant only

Controls: Aid/GDP, Average(GDP), SD(Aid), SD(GDP), Conflict Dummy, Coup Dummy, Polity IV,

Civil War Dummy, Inflation Crisis, SD(Terms of Trade), Capital Flows/Aid

Table 2.11: Aid cyclicality and institutional quality individual measures with controls; multilateral and bilateral aid

	Dependent variable $corr(aid\ disbursements_t, gdp_t)$		
Institutional measure	Simple	With Controls	Obs
Multilateral Aid			
Corruption	-0.046	-0.032	122
	(0.028)	(0.030)	
Rule of Law	-0.056 **	-0.024	122
	(0.026)	(0.032)	
Quality of Bureaucracy	-0.039	-0.003	122
	(0.026)	(0.030)	
Ethnic Tension	-0.033*	-0.018	122
	(0.017)	(0.026)	
Repudiation of Government Contracts	-0.036*	0.032	122
	(0.020)	(0.030)	
Expropriation of Private Investment	-0.060 **	-0.012	122
	(0.024)	(0.031)	
Bilateral Aid			
Corruption	-0.092 ***	-0.089 ***	122
	(0.027)	(0.031)	
Rule of Law	-0.072 ***	-0.064 **	122
	(0.025)	(0.030)	
Quality of Bureaucracy	-0.061 **	-0.034	122
	(0.031)	(0.036)	
Ethnic Tension	-0.027	-0.023	122
	(0.021)	(0.030)	
Repudiation of Government Contracts	-0.061 **	-0.016	122
	(0.024)	(0.039)	
Expropriation of Private Investment	-0.090 ***	-0.072 **	122
	(0.023)	(0.031)	

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Results from Pooled Regression. Simple regression run with intercept and constant only

Controls: Aid/GDP, Average(GDP), SD(Aid), SD(GDP), Conflict Dummy, Coup Dummy, Polity IV, Civil War Dummy, Inflation Crisis, SD(Terms of Trade), Capital Flows/Aid

Table 2.12: Aid cyclicality and institutional quality; all donors, alternative measures

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
Kaufmann and Kraay Measures			
Institutional measure	Simple	With Controls	Obs
Voice and Accountability	-0.120 **	-0.092	71
	(0.053)	(0.130)	
Political Stability	-0.101*	-0.166*	71
	(0.053)	(0.085)	
Government Effectiveness	-0.146 **	-0.110	71
	(0.069)	(0.107)	
Regulatory Quality	-0.145 **	-0.123	71
	(0.064)	(0.137)	
Rule of Law	-0.171 **	-0.151	71
	(0.066)	(0.106)	
Control of Corruption	-0.101*	-0.166*	71
	(0.053)	(0.085)	
CPIA measures			
Debt Policy	-0.132*	-0.164*	37
	(0.072)	(0.094)	
Economic Management Cluster	-0.155	-0.239*	37
	(0.110)	(0.131)	
Revenue Mobilisation	-0.358 ***	-0.309 **	37
	(0.093)	(0.134)	
Equity of Resources	-0.213	-0.221	37
	(0.140)	(0.151)	
Financial Sector	-0.361 ***	-0.265	37
	(0.102)	(0.207)	
Fiscal Policy	-0.082	-0.141	37
	(0.119)	(0.127)	
Macroeconomic Management	-0.138	-0.259*	37
	(0.104)	(0.148)	
Property Rights	-0.255 **	-0.315*	37
	(0.102)	(0.153)	
Public Sector Management Cluster	-0.383 ***	-0.414 **	37
	(0.108)	(0.186)	
Budgetary Management	-0.223 **	-0.242	37
	(0.085)	(0.152)	
Public Administration	-0.332 **	-0.271	37
	(0.156)	(0.185)	
Structural Policies Cluster	-0.523 ***	-0.553 ***	37
	(0.122)	(0.178)	
Trade Rating	-0.192	-0.168	37
	(0.122)	(0.166)	
Corruption	-0.240 **	-0.309	37
	(0.110)	(0.186)	

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Results from Pooled Regression. Simple regression run with intercept and constant only

Controls: Aid/GDP, Average(GDP), SD(Aid), SD(GDP), Conflict Dummy, Coup Dummy, Polity IV,

Civil War Dummy, Inflation Crisis, SD(Terms of Trade), Capital Flows/Aid

Table 2.13: Aid cyclicality and institutional quality; multilateral donors, alternative measures

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
Kaufmann and Kraay Measures			
Institutional measure	Simple	With Controls	Obs
Voice and Accountability	-0.064 **	-0.050	71
	(0.029)	(0.059)	
Political Stability	-0.017	-0.003	71
	(0.030)	(0.041)	
Government Effectiveness	-0.086 **	-0.116 **	71
	(0.037)	(0.053)	
Regulatory Quality	-0.075 **	-0.109	71
	(0.033)	(0.069)	
Rule of Law	-0.095 **	-0.125 **	71
	(0.037)	(0.051)	
Control of Corruption	-0.017	-0.003	71
	(0.030)	(0.041)	
CPIA measures			
Debt Policy	-0.099*	-0.079	37
	(0.053)	(0.073)	
Economic Management Cluster	-0.125	-0.098	37
	(0.077)	(0.110)	
Revenue Mobilisation	-0.205 **	-0.171	37
	(0.082)	(0.117)	
Equity of Resources	-0.126	-0.130	37
	(0.078)	(0.104)	
Financial Sector	-0.373 ***	-0.433 **	37
	(0.087)	(0.193)	
Fiscal Policy	-0.059	-0.007	37
	(0.078)	(0.146)	
Macroeconomic Management	-0.136*	-0.125	37
	(0.074)	(0.107)	
Property Rights	-0.295 ***	-0.331 ***	37
	(0.075)	(0.112)	
Public Sector Management Cluster	-0.292 ***	-0.296*	37
	(0.099)	(0.147)	
Budgetary Management	-0.199 ***	-0.144	37
	(0.063)	(0.107)	
Public Administration	-0.239 **	-0.267*	37
	(0.115)	(0.149)	
Structural Policies Cluster	-0.471 ***	-0.536 ***	37
	(0.129)	(0.179)	
Trade Rating	-0.108	-0.064	37
	(0.092)	(0.166)	
Corruption	-0.127	-0.110	37
	(0.094)	(0.173)	

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.
Results from Pooled Regression. Simple regression run with intercept and constant only
Controls: Aid/GDP, Average(GDP), SD(Aid), SD(GDP), Conflict Dummy, Coup Dummy, Polity IV,
Civil War Dummy, Inflation Crisis, SD(Terms of Trade), Capital Flows/Aid

Table 2.14: Aid cyclicality and institutional quality; total bilateral donors, alternative measures

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$		
Kaufmann and Kraay Measures			
Institutional measure	simple	with controls	Obs
Voice and Accountability	-0.091 **	-0.116*	
	(0.045)	(0.069)	
Political Stability	-0.053	-0.150 ***	
	(0.039)	(0.044)	
Government Effectiveness	-0.206 ***	-0.156 **	
	(0.058)	(0.076)	
Regulatory Quality	-0.087*	-0.057	
	(0.049)	(0.068)	
Rule of Law	-0.142 ***	-0.084	
	(0.049)	(0.053)	
Control of Corruption	-0.160 ***	-0.031	
	(0.051)	(0.063)	
CPIA measures			
Debt Policy	-0.091	-0.080	37
	(0.072)	(0.110)	
Economic Management Cluster	-0.128	-0.113	37
	(0.113)	(0.159)	
Revenue Mobilisation	-0.354 ***	-0.341*	37
	(0.088)	(0.179)	
Equity of Resources	-0.178	-0.117	37
	(0.158)	(0.192)	
Financial Sector	-0.297 ***	-0.126	37
	(0.093)	(0.229)	
Fiscal Policy	-0.125	-0.092	37
	(0.130)	(0.181)	
Macroeconomic Management	-0.108	-0.104	37
	(0.101)	(0.153)	
Property Rights	-0.208*	-0.138	37
	(0.107)	(0.175)	
Public Sector Management Cluster	-0.351 ***	-0.321	37
	(0.121)	(0.237)	
Budgetary Management	-0.226 **	-0.196	37
	(0.100)	(0.183)	
Public Administration	-0.288	-0.173	37
	(0.174)	(0.253)	
Structural Policies Cluster	-0.368 **	-0.327	37
	(0.146)	(0.245)	
Trade Rating	-0.015	0.051	37
	(0.145)	(0.253)	
Corruption	-0.194*	-0.196	37
	(0.112)	(0.195)	

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Results from Pooled Regression. Simple regression run with intercept and constant only

Controls: Aid/GDP, Average(GDP), SD(Aid), SD(GDP), Conflict Dummy, Coup Dummy, Polity IV, Civil War Dummy, Inflation Crisis, SD(Terms of Trade), Capital Flows/Aid

Table 2.15: Determinants of the level of aid, dependent variable aid to GDP ratio

Aid per capita	(1)	(2)
Institutions	-0.0254***	-0.001
	(0.008)	(0.007)
GDP per capita		-0.048***
		(0.009)

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.16: Average institutional quality

sample	A verage institutional quality	
	Mean	Median
Sub-Saharan Africa	3.032	3.185
Non sub-Saharan Africa	3.364	3.558
Rand-Tarp sample	3.460	3.579
Not Rand-Tarp sample	3.185	3.319

Note that institutional quality is measured on a 0-6 scale.

Table 2.17: Is Africa treated differently?

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$	
	Regression (2.4)	Regression(2.5)
Africa Dummy	0.125**	0.087
	(0.064)	(0.060)
Institutions		-0.122 ***
		(0.032)

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.18: Reconciling Rand and Tarp (2002) with Pallage and Robe (2001)

	Dependent variable $corr(aid\,disbursements_t, gdp_t)$	
	Regression (2.6)	Regression(2.7)
Rand and Tarp Dummy	-0.165**	-0.128
	(0.084)	(0.081)
Institutions		-0.123 ***
		(0.033)

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.19: Aid cyclicality and institutional quality

	Dependent variable $corr(aid\ disbursements_{t-1}, gdp_t)$		
	Pooled	Within	Between
Institutions	-0.061 **	-0.074 ***	-0.045
	(0.026)	(0.027)	(0.043)
Obs	120	120	60
Adj. R^2	0.035	0.077	-0.016

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.20: Aid cyclicality and institutional quality with control variables; all donors

	Dependent variable $corr(aid\ disbursements_{t-1}, gdp_t)$		
	Pooled	Within	Between
Institutions	-0.099 **	-0.106*	-0.122*
	(0.040)	(0.056)	(0.067)
Aid/GDP	0.173	1.030	-0.346
	(1.086)	(1.816)	(1.675)
Average(GDP)	0.005	-0.234*	-0.005
	(0.060)	(0.129)	(0.069)
SD(Aid)	-0.000 **	-0.000	-0.001
	(0.000)	(0.000)	(0.000)
SD(GDP)	-0.096	-0.368	0.314
	(0.581)	(0.492)	(0.647)
SD(Conflict)	-0.017	0.019	-0.067
	(0.073)	(0.080)	(0.095)
Coup dummy	-0.084	-0.086	-0.105
	(0.061)	(0.076)	(0.094)
Conflict dummy	0.005	-0.001	0.005
	(0.007)	(0.009)	(0.011)
Civil war dummy	0.018	0.014	0.022
	(0.036)	(0.042)	(0.059)
Inflation crisis	-0.012	-0.013	-0.020
	(0.022)	(0.017)	(0.017)
SD(Terms of trade)	0.184	0.500	0.003
	(0.358)	(0.530)	(0.393)
Capital Flows/Aid	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
Obs	120	120	60
Adj. R^2	0.014	0.122	-0.092

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.21: Aid cyclicality and institutional quality with control variables; bilateral donors

	Dependent variable $corr(aid\ disbursements_t, gdp_t)$		
Country	Institutions	Institutions (with Controls)	Obs
United States	-0.068*	-0.048	120
	(0.036)	(0.050)	
United Kingdom	-0.077 **	-0.084*	120
	(0.034)	(0.046)	
Germany	-0.066 **	-0.079 **	120
	(0.027)	(0.038)	
France	-0.081 **	-0.030	120
	(0.036)	(0.047)	
Canada	-0.082 **	-0.012	120
	(0.033)	(0.039)	
Japan	-0.075 ***	-0.106 ***	120
	(0.028)	(0.038)	
Netherlands	-0.114 ***	-0.088 **	120
	(0.029)	(0.039)	
Italy	0.053*	0.108 ***	118
	(0.029)	(0.039)	
Switzerland	-0.052*	-0.047	116
	(0.028)	(0.038)	
Belgium	-0.126 ***	-0.117 ***	116
	(0.025)	(0.035)	
Scandinavia	-0.021	0.030	116
	(0.032)	(0.046)	
Australia	-0.082 ***	-0.107 **	106
	(0.031)	(0.049)	

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Results from Pooled Regression. Simple regression run with intercept and constant only

Controls: Aid/GDP, Average(GDP), SD(Aid), SD(GDP), Conflict Dummy, Coup Dummy, Polity IV, Civil War Dummy, Inflation Crisis, SD(Terms of Trade), Capital Flows/Aid

Table 2.22: Cylicality of aid commitments and institutional quality

	Dependent variable $corr(aid\,commitments_{t+1}, gdp_t)$		
	Pooled	Within	Between
Total aid commitments			
Institutions	-0.012	-0.001	-0.024
	(0.023)	(0.034)	(0.036)
Multilateral aid commitments			
Institutions	-0.061 **	-0.074 ***	-0.045
	(0.026)	(0.027)	(0.043)
Bilateral aid commitments			
Institutions	0.027	0.045	0.008
	(0.027)	(0.036)	(0.039)

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.23: Aid cyclicality and institutional quality with control variables; Multilateral aid

	Dependent variable $corr(aid\,commitments_{t+1}, gdp_t)$		
	Pooled	Within	Between
Institutions	-0.088 **	-0.097 **	-0.107
	(0.036)	(0.047)	(0.070)
Aid/GDP	-0.929	0.012	-1.408
	(0.791)	(1.437)	(1.132)
Average(GDP)	-0.020	-0.255 **	-0.019
	(0.057)	(0.125)	(0.067)
SD(Aid)	-0.031	-0.160	-0.069
	(0.135)	(0.172)	(0.217)
SD(GDP)	-0.005	-0.045	0.334
	(0.589)	(0.437)	(0.648)
Conflict dummy	0.025	0.052	-0.013
	(0.070)	(0.071)	(0.099)
Coup dummy	-0.086	-0.079	-0.103
	(0.063)	(0.074)	(0.095)
Polity IV	0.003	0.003 **	0.002
	(0.003)	(0.001)	(0.003)
Civil War dummy	0.006	0.009	0.006
	(0.028)	(0.037)	(0.035)
Inflation Crisis	-0.008	-0.006	-0.017
	(0.015)	(0.014)	(0.017)
SD(Terms of Trade)	0.258	0.332	0.150
	(0.348)	(0.542)	(0.400)

Note: Robust standard errors in parentheses. ***,**,* indicates significance at the 1%, 5% and 10% levels.

Table 2.24: Settler mortality as an instrumental variable, first stage estimates

Dependent variable mean of ICRG corruption, Rule of Law and Expropriation risk	
Settler Mortality	-0.115
	(0.169)
Intercept	3.59
	(0.000)
Obs	96
Adj. R^2	0.020

Note: $P - values$ in parentheses.

Settler mortality data from Acemoglu, Johnson and Robinson (2005)

Table 2.25: Instrumental variable estimates

First Stage Dependent variable: mean of ICRG corruption, Rule of Law and Expropriation risk.	
Second Stage Dependent variable: $Corr(aid_t, GDP_t$	
Institutions	-0.547
	(0.168)
Intercept	1.787
	(0.137)
Obs	96

Note: $P - values$ in parentheses.

Settler mortality data from Acemoglu, Johnson and Robinson (2005)

Chapter 3

Optimal Procyclical Fiscal Policy Without Procyclical Government Spending

3.1 Introduction

Procyclical fiscal policy,[1] can be caused by either procyclical government expenditure, countercyclical taxes of both. Within the class of models where procyclical fiscal policy is the outcome of optimal policy, the majority of models explain procyclical fiscal policy as the result of procyclical government expenditures. For example, Riascos and Vegh (2003), Mendoza and Oviedo (2006) and Cuadra, Sanchez and Sapriza (2009) consider imperfections in either international credit markets while Tornell and Lane, (1998), Talvi and Vegh (2005) and Ilzetzki (2007) consider from political economy distortions. Indeed as Ilzetzki and Vegh (2009) show procyclical government expenditure is an important explanation for procyclical fiscal policy. However, the purpose of this paper is to highlight the mechanism through which sovereign default affects optimal tax policy.

Gavin and Perotti (1997) made the influential insight that imperfections in international credit markets might cause procyclical fiscal policy,

"Our view is that fiscal policymakers in Latin America have typically faced a

[1]Procyclical fiscal policy is defined as fiscal policy which is expansionary during booms and contractionary during recessions.

loss of confidence and thus intensified borrowing constraints during bad macroeconomic times. The loss of market access makes it impossible to run countercyclical fiscal policy, at least in bad times. A full description of Latin American fiscal outcomes needs to account for this ***precarious creditworthiness****".* Gavin and Perotti (1997) p.39 (emphasis in original text).

This paper uses an endogenous sovereign default framework to endogenously generate **precarious creditworthiness** as the outcome of the government's incentives to default. It then combines the endogenous sovereign default literature (e.g Eaton and Gersovitz, 1981, Arellano, 2008) with the Ramsey taxation literature (e.g. Chari, Christiano and Kehoe, 1996) to analyse the impact of the option of government default on optimal taxation. Following the Ramsey taxation literature, I assume that government expenditure is exogenous and the government's problem is to determine the tax policy which maximises household welfare subject to financing exogenous government expenditures. In the model even though government expenditures are acyclical, fiscal policy is procyclical when the government has the option to default.

Direct information about the cyclicality of actual government tax rates are not readily available for a comprehensive study, therefore, most empirical studies focus on tax revenues. However, as Kaminsky, Reinhart and Vegh (2004) argue it only makes sense to measure fiscal policy with *instruments* rather than *outcomes*. There are a number of papers which provide historical examples of countercyclical *tax rates*. Talvi and Vegh (2005), provide evidence that during the economic boom

in 1991 to 1994 in Argentina, tax rates were reduced and that when the economy went into recession in 1995, tax rates were increased. Also, Vincente and Rial (2007) provide evidence that in the middle of the recession during the Uruguayan debt crisis of 2002-2003 the government dramatically increased taxes, which were later reduced during the expansionary period. Futhermore, Cuadra, Sanchez and Sapriza (2009) provide similar evidence of procyclical value added tax rates for Mexico during the 1990s.

In the model there are domestic households, a domestic government and foreign lenders. Households value consumption and leisure and do not have access to storage assets. To finance the fixed stream of government expenditures, the government can levy consumption taxes on households or borrow from international capital markets. The government can only borrow by issuing a one period non-state contingent bond. When the government has access to international capital markets, it has the option to default on existing debt. Default enables the government to lower taxation because it no-longer has to repay existing debts. However, if the government defaults it then unable to access capital markets for a stochastic period of time.

The key assumption of the model is that if the government defaults there is an exogenous loss in productivity which is higher in booms than in recessions. Arrellano (2008) showed that this structure of procyclical default costs combined with persistent shocks enable models of sovereign default to fit many of the empirical regularities about sovereign default episodes. Arteta and Hale (2006), Rose (2005)

and Dooley (2000) provide empirical evidence that output losses from default are higher in booms than recessions. Mendoza and Yue (2008) provide a mechanism which endogenously generates default costs which are higher in recessions than in booms by add working capital to an endogenous sovereign default model.

There is perfect competition in International capital markets which are populated by risk neutral foreign lenders. The foreign lenders are willing to lend to the government until borrowing reaches levels at which the government will default with certainty. When the probability of default is less than 100% foreign lenders charge a risk premium to compensate for the risk of government default. In the model because the exogenous loss of productivity from default are lower in recessions than booms, the government is more likely to default in recessions for a given level of debt because it is less costly. To compensate financial markets for the higher probability of default in recessions, financial markets charge higher interest rate spreads for borrowing during recessions. It is therefore, costly for the government to use borrowing during recessions to smooth tax rates. Instead the government optimally increases tax rates in recessions to finance government expenditures while during booms, the government decreases taxes and increases borrowing. Thus the optimal tax policy is countercyclical.

If the option to default is excluded in the model, and government must repay past borrowing in all states, the optimal taxation policy is acyclical. The result without default is consistent with Ramsey tax models with state contingent debt (Lucas and Stokey, 1984 and Chari, Christiano and Kehoe, 1996). In those models,

the optimal tax policy is to smooth the tax distortion over states. Aiyagari, Marcet, Sargent and Seppala (2002) show that similar results hold for a Ramsey model with only risk-free debt. Therefore, the default friction significantly changes the optimal Ramsey tax policy.

A crucial assumption in the model is that households are credit constrained. If households are able to borrow without increasing cost (or at a lower cost than the government) then households can use their own borrowing in recessions to pay higher taxes, while also smoothing consumption.

Cuadra, Sanchez and Sapriza (2009) follow a similar approach where they analyse the impact of sovereign default on optimal fiscal policy, however, in their model government expenditures are also endogenous. The contribution of this paper is to show that endogenous default causes optimal fiscal policy to be procyclical without procyclical government expenditures. Also confining the analysis to exogenous government expenditures enables comparisons between this paper and the existing literature on Ramsey taxation. Aizenman, Gavin and Hausmann (2000) consider a similar two period model, however, default in their model occurs when the economy hits an exogenous credit ceiling rather than the credit ceiling being endogenously determined. Instead this paper utilises the endogenous sovereign default framework of Eaton and Gersovitz (1981) and in particular the insights from Arellano (2008) that the cost of default must be higher in booms than recessions and that output shocks must be persistent to quantitatively match sovereign debt and interest rate dynamics.

3.2 The model

The model consists of a small open economy with households, a government and foreign lenders. Household's have preferences over the present discount stream of consumption and do not have access to a storage asset. The government must finance a constant stream of wasteful expenditures in each period. The government can finance these expenditures through either a consumption tax or by borrowing from abroad. Subject to financing this exogenous stream of government expenditures, the government cares about households and seeks to maximise their utility. The only asset traded by the government is a one period non-contingent bond. The government can hold both negative and positive amounts of this asset. Debt contracts are not enforceable since the government has the option to default on existing debts. There is a productivity cost to the economy if the government defaults on its debt, which is higher in booms than in recessions.

3.2.1 Households/Firms

There is an infinitely lived representative household with preferences over the stream of consumption and leisure. Households own the firms. They also receive a transfer from the government, γG_t where $(1-\gamma) \in [0,1]$ indexes the wastefulness of government spending,

$$\max_{(c_t, 1-h_t)_{t=0}^{\infty}} E_0 \sum^{\infty} \beta^t u(c_t, 1-h_t) \tag{3.1}$$

s.t.

$$e^{z_t} f(h_t) + \gamma G_t \geq (1 + \tau_t) c_t \tag{3.2}$$

Where, $0 < \beta < 1$ is the household discount factor, c is consumption and h is labour input, the production function has non-increasing returns to scale, $f'(.) > 0$ and $f''(.) \leq 0$ and τ is the consumption tax[2]. Note that households are unable to access international capital markets. The log productivity shock, z_t follows an AR(1) process,

$$z_t = \rho z_{t-1} + \epsilon_t \tag{3.3}$$

Where ϵ_t is an i.i.d. $N(0, \sigma^2)$ process.

Since the household does not have access to intertemporal assets, the household's optimisation problem is equivalent to solving a sequence of static problems from $t = 0, ...\infty$,

$$\max_{(c_t, 1-h_t)} E_t u(c_t, 1 - h_t) \tag{3.4}$$

s.t.

$$e^{z_t} f(h_t) + \gamma G_t \geq (1 + \tau_t) c_t \tag{3.5}$$

[2]Using either consumption or labour taxes do not affect my results, because households do not have access to intertemporal assets.

The first order conditions from the households optimisation are,

$$\frac{u_c(c_t, 1-h_t)}{u_h(c_t, 1-h_t)} = \frac{(1+\tau_t)}{e^{z_t} f'(h_t)} \tag{3.6}$$

and

$$e^{z_t} f(h_t) + \gamma G_t = (1+\tau_t)\, c_t \tag{3.7}$$

The FOCs yield consumption and labour demand functions which are functions of the tax rate, τ and the productivity shock z,

$$c(\tau_t, z_t)$$

$$h(\tau_t, z_t)$$

3.2.2 International Capital Markets

Foreign creditors are risk-neutral and face a constant opportunity cost of funds, R, which is the gross risk-free interest rate. There is no information asymmetry. Foreign creditors choose the amount of one-period bonds to sell to the government B_{t+1} in order to maximise expected profits π taking the discount price of the bonds, q as given,

$$\pi_t = q_t B_{t+1} - \frac{(1-\delta_t)}{(R)} B_{t+1} \tag{3.8}$$

Where δ is the probability of default by the government. If the government is a net creditor, the probability of default is zero. If the government is a net debtor,

the price is adjusted for the default risk, $q = \frac{(1-\delta)}{(R)}$. Since $0 \leq \delta \leq 1$ the price is bounded $[0 < q < 1/(R)]$. The gross interest rate for the debtor government is, $1 + r^c = 1/q$.

3.2.3 Government

3.2.3.1 The Government's Optimisation Problem

The government has pledged to make an exogenous stream of expenditures, G_t, $(t = 0, 1, 2, ...)$. Assuming the country has access to international capital markets, the government comes into the period with B_t assets, it observes, z_t and chooses whether to repay (r) or default (d) and and chooses the tax rate in each state, τ^r or τ^d in order to maximise the household's indirect utility function, subject to financing government expenditure, G. When the government has access to international capital markets, the government also chooses the asset holdings in the next period, B_{t+1}, and faces the following optimisation problem,

$$V(z_t, B_t) = \max_{r, B_{t+1}, \tau^r, d, \tau^d} \{V^r(z_t, B_t), V^d(z_t)\} \tag{3.9}$$

Where, $V(.)$ is the household's value function when the government has access to international capital markets, $V^r(.)$ is the household's value function if it decides to repay the existing debt $-B_t$, and V^d is the household's value function if it decides to default on the debt.

If the government decides to repay the debt, it can choose to borrow from international capital markets to pay for any temporary shortfalls in tax receipts. Of

course, these borrowings must be paid back in the future. The government chooses B_{t+1} and τ^r to maximise the household's indirect utility,

$$V^r(z_t, B_t) = \max_{B_{t+1}, \tau^r} u(c(\tau_t^r, z_t), 1 - h(\tau_t^r, z_t)) + \beta E_t V(z_{t+1}, B_{t+1}) \tag{3.10}$$

s.t.

$$\tau^r c(\tau_t^r, z_t) + B_t - q(z_t B_{t+1}) B_{t+1} \geq G_t \tag{3.11}$$

The government collects $\tau_t c_t$ in tax revenue and chooses B_{t+1} taking the bond discount price schedule, $q(z_t, B_{t+1})$, as given in order to finance government spending and maximise household utility.

If the government defaults, the government can no-longer borrow from international capital markets. The country enters a period of autarky and must finance all government spending with contemporaneous taxation. Once in autarky, the country can re-enter capital markets with probability θ in each period. During default, there is a loss in productivity in autarky which is greater in booms than recessions. Arellano (2008) shows that a specification of the productivity cost from default of the following form can fit observed interest rate spreads and the default frequency simultaneously

$$k(z) = \begin{cases} \phi E(z) & \text{if } z > \phi E(z) \\ z & \text{if } z \leq \phi E(z) \end{cases} \tag{3.12}$$

The government's problem in default takes the following form,

$$V^d(k(z_t)) = \max_{\tau^d} + u(c(\tau_t^d, k(z_t)), 1 - h(\tau_t^d, k(z_t))) + \theta\beta E_t V^d(k(z_{t+1})) + (1-\theta)\beta E_t V^r(z_{t+1}, 0) \tag{3.13}$$

s.t.

$$\tau_t^d c(\tau_t^d, k(z_t)) \geq G_t \tag{3.14}$$

Thus in autarky, the government's problem is to choose the tax rate such that (3.14) holds with equality. In autarky the tax wedge changes mechanically with the shocks (z_t). This hinders the household's ability to smooth labour supply and consumption, hence potentially reducing expected utility relative to the case there the government has access to international capital markets.

The trade balance (TB) in this model is given by government saving; the difference between government revenues minus expenditures,

$$TB(t) = \tau_t^d c(z_t, \tau_t^d) - G(t) \tag{3.15}$$

3.2.4 Recursive Competitive Equilibrium

The definition of a recursive competitive equilibrium is a Ramsey equilibrium. The government optimally chooses tax rates in both repayment and default states and then decides whether it is optimal to default or not.

Definition 3.2.1 *Ramsey Equilibrium*

Table 3.1: Business cycle statistics

	Mexican data (1980-2007)	Benchmark model
σ(y)	2.37	2.52
σ(c)	2.90	2.61
σ(tax rate)	0.57	0.71
σ(tb)	2.04	2.72
ρ(y, c)	0.92	0.89
ρ(y, tax rate)	-0.33	-0.34
ρ(y, r)	-0.63	-0.17
ρ(y, tb)	-0.72	-0.21

Note: Statistics for the interest rate are reported as percentage points. Trade balance as a percentage of GDP

The Ramsey equilibrium for this economy is defined as a set of policy functions for (i) households c, h (ii) government B_{t+1}, r, τ^r, d, τ^d *and (iii) the price functions for bonds q such that:*

1. *Taking as given government policies, the household's consumption c and labour supply h policy functions satisfies the household optimisation problem.*

2. *Taking as given the bond price function* $q(z_t, B_{t+1})$*, the government's policy functions for* B_{t+1}, r, τ^r d, τ^d *satisfy the government's optimisation problem.*

3. *Bond prices q reflect the government's default probabilities and are consistent with creditor's expected zero profits.*

3.3 Data

The data in Table 3.1 is taken from Cuadra, Sanchez and Sapriza (2009) for Mexico between 1980 and 2007. They compute an effictive consumption tax rate using the methodology in Mendoza et. al (1994). The key moment for this paper is

the estimated effective tax rate which is countercyclical, ρ(y, tax rate) = -0.33.

3.4 Solution Method and Calibration

3.4.1 Solution Method

1. I use the first order condition (3.6) and the budget constraint (3.7) to solve for the optimal consumption and labour supply conditions over a grid of taxes, τ and productivity states p to give the policy functions,

$$c(\tau_t, z_t), h(\tau_t, z_t) \tag{3.16}$$

2. For default states, calculate the minimum tax rate required to fund G over the grid of z. These are the optimal tax rates whilst in default.

3. For repayment states, calculate the minimum tax rate required to fund G over the grid of z_t, B_t, B_{t+1} triplets. These are the optimal tax rates for each z_t, B_t, B_{t+1} triplet, (we still need to choose optimal asset position B_{t+1} for each z_t, B_t pair).

4. Assume an initial price function $q^0(z, B)$

5. Use the initial guesses for $q^0(z, B)$, $V^{0,d}(p)$ and $V^{0,r}(z, B)$ to iterate and find the optimal $V^{1,r}(z, B)$, choosing the B_{t+1}, τ^r pair and $V^{1,d}(z)$ given $q^0(z, B)$.

6. Set $V^1(z, B) = \max_{r,d} \{V^{1,r}(z_t, B_t), V^{1,d}(p)\}$

7. Estimate the expected probability of default δ in each state and use a Gauss-Jacobi updating scheme to find $q^1(p, B)$,

8. Check if $q^{i+1}(z, B)$ is sufficiently close to $q^i(z, B)$, if yes, STOP, if not return to step 5 using $q^{i+1}(z, B)$ and $V^{1+1}(z, B)$ as the new guesses.

3.4.2 Functional Forms

In order to show that endogenous sovereign default can cause procyclical fiscal policy through procyclical tax policy alone, I use a similar calibration as Cuadra, Sanchez and Sapriza (2009) with the only modification that government expenditures are exogenous. This helps to highlights the marginal contribution of this paper relative to the literature.

The period utility function is

$$u = \frac{(c - \frac{h^{1+\gamma}}{1+\gamma})^{1-\sigma}}{1-\sigma} \tag{3.17}$$

The linear production where labour is the only input,

$$f(h) = h \tag{3.18}$$

3.4.3 Parameters

Table 3.2 shows the baseline calibration for the model. The risk aversion parameter, is set equal to 2 as in Arellano (2008). The Frisch elasticity of labour supply is set to 0.455 following Mendoza (1991). The risk-free rate r is sent to 1%

Table 3.2: Parameter Values

Risk aversion	σ	2
Labour elasticity	$1/\gamma$	2.2
Discount factor	β	0.9
Risk free interest rate	r	1%
Probability of redemption	λ	10%
SD of productivity shocks	σ_ϵ	0.008
Persistence of productivity shocks	ρ	0.86
Government expenditure/GDP	G	16%
Default penalty threshold	ϕ	95% of mean productivity

which corresponds to the US annual interest rate. To ensure the model has a finite level of wealth in the steady-state $\beta(1+r) < 1$. The probability of redemption (probability of re-entering capital markets after default) is calibrated for a mean duration of autarky of around 3.5 years. Government expenditures are calibrated to match the mean level of government expenditures as a fraction of consumption in Mexico between 1980 to 2005. The default penalty threshold, ϕ calibrates the level of GDP above which the country pays a productivity cost upon default. The parameter ϕ is calibrated to match the external debt service to GDP ratio of 4.5%.

3.5 Results

Figure 3.1 plots the bond price function $q(z_t, B_{t+1})$ for low and high productivity shock states. For low levels of debt less than 2% of GDP, there is no default risk. For levels of debt greater than 2% the discount rate on bonds in low productivity states increases at a faster rate than for high productivity states. This makes borrowing more expensive in low productivity states than high productivity states.

In Figure 3.2 the optimal tax function is plotted as a function of the level of borrowing for a high and low productivity states. For debt levels of less than 2% of GDP, where the interest rates are the risk-free rate (Figure 3.1) the optimal tax rate decreases as the debt increases. This shows that both debt and or taxes can be used to finance the fixed stream of government expenditures. However, in low productivity states for debt levels greater than 2% of GDP the optimal tax rate increases for higher levels of government debt. From the government's budget constraint (3.11) the government receives qB funds from international capital markets in the current period. As q decreases, for every dollar that the government should repay in the next period, the government receives less from international capital markets in the current period. Therefore, the government must tax at a higher rate to finance exogenous government expenditures. This explains the upward sloping part of the tax functions. For levels of debt greater than 6% of GDP in low productivity states, it is optimal to default. For high productivity states the optimal tax function only becomes upward sloping at higher debt levels (around 6% of GDP).

In stark contrast, Figure 3.3 plots the bond price function in the model without an option to default. The q functions are effectively on top of each other with (note the y axis scale). Thus without a default option for the government, for a given level of debt there is no difference in the cost of borrowing across productivity states. The effect of this on the optimal tax rate is shown in Figure 3.4. For both high and low productivity states the tax function is decreasing as debt increases. Also unlike the optimal tax function with default, there is no upward sloping portion. The absence

Table 3.3: Model moments with and without default

	With default	Without default
σ(y)	2.37	1.52
σ(c)	2.60	1.34
σ(tax rate)	0.57	0.58
σ(tb)	2.04	2.72
ρ(y, c)	0.92	0.98
ρ(y, tax rate)	-0.33	0.05
ρ(y, r)	-0.63	-0.14
ρ(y, tb)	-0.72	0.38

Note: Statistics for the interest rate are reported as percentage points. Trade balance as a percentage of GDP

of an upward sloping tax function will explain why the tax rate dynamics are so different in the two models.

If the government can default on its debt, Table 3.1 shows thhat the tax rate is countercyclical without procyclical government expenditures. This shows that without procyclical government expenditures, the reason why tax policy is countercyclical can be completely attributed to the countercyclical cost of borrowing (i.e. *credit precariousness* in recessions). Because the interest rate is higher in recessions, the government chooses to finance g using tax revenue, while in booms because borrowing is cheaper the government borrows to finance g. Also note that consumption is more volatile than output. With acyclical government expenditures, the tax rate is more volatile than that in Cuadra, Sanchez and Sapriza where they find $\sigma(\text{tax rate}) = 0.22$.

Table 3.3 compares the momemts from the model with default to the same model without default risk. The model without default risk is closed assuming an

ad-hoc upward sloping interest rate function is debt, $1/q = 1/\beta + \varphi(e^{(B_{t+1}-\bar{B})} - 1)$ (Schmitt-Grohe and Uribe, 2003). Table 3.3 shows that in the model without default risk taxes are acyclical. This corresponds to the results from Chari, Christiano and Kehoe (1996) and Aiygari et. al. (2002) who find that in a Ramsey model with exogenous government spending (and no default), the optimal tax policy is acyclical because it is optimal to smooth the tax distortion over states. Without default, the trade balance is procyclical because with an acyclical tax policy, the government repays debt during booms and accumulates deficits during recessions also generates interest rates to be countercyclical. This also explains why output and consumption are less volatile in the the model without default risk.[3]

The comparison of the models with and without default clearly shows the link between the cyclicality of the interest rate spreads and the tax rate. Without default, the bond price function depends on only the level of debt in the next period $q(B_{t+1})$. However, if governments have the option to default, the bond price function, $q(z_t, B_{t+1})$ depends on both future borrowing B_{t+1} and also on the productivity state z_t. Figures 3.1 and 3.3 show this graphically. If the possibility of default is precluded, borrowing in low productivity states is not more costly than during high output states. Therefore it is optimal to borrow more in recessions to smooth out the tax distortion and hence consumption. However, if the government has the option to default, then this increases the cost of borrowing during recessions for sufficiently high levels of debt relative to booms to make tax policy countercyclical.

[3]With the GHH functional form, labour supply is $h = \left(\frac{e^z}{1+\tau}\right)^{1/\gamma}$.

3.6 Conclusion

This paper develops a model where the option for a government to default on its debt produces procyclical fiscal policy even though government expenditures are acyclical. Instead fiscal policy is procyclical because the optimal tax policy is countercyclical. The optimal tax policy is contrasted with an identical model without a default option. Without a default option the optimal tax policy is acyclical as found in the Ramsey taxation literature (Chari, Christiano and Kehoe, 1996 and Aiyagari et. al. 2002).

The model however, has a number of shortcomings. In particular the tractibility assumption that households do not have access to a storage asset unlike the government. Cuadra, Sanchez and Sapriza (2009) present a two-period model with household savings and household default and show that their results go through. The critical assumption is that households' are credit constrained in their borrowing.

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3.7 Figures

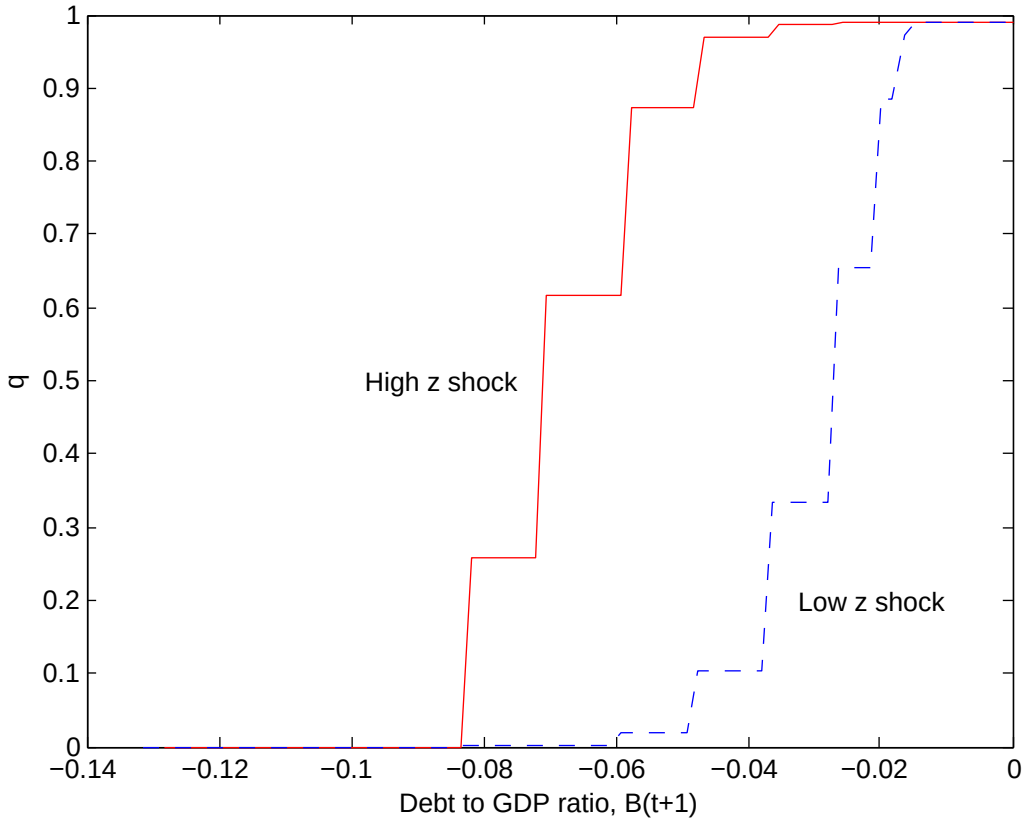

Figure 3.1: Bond price functions

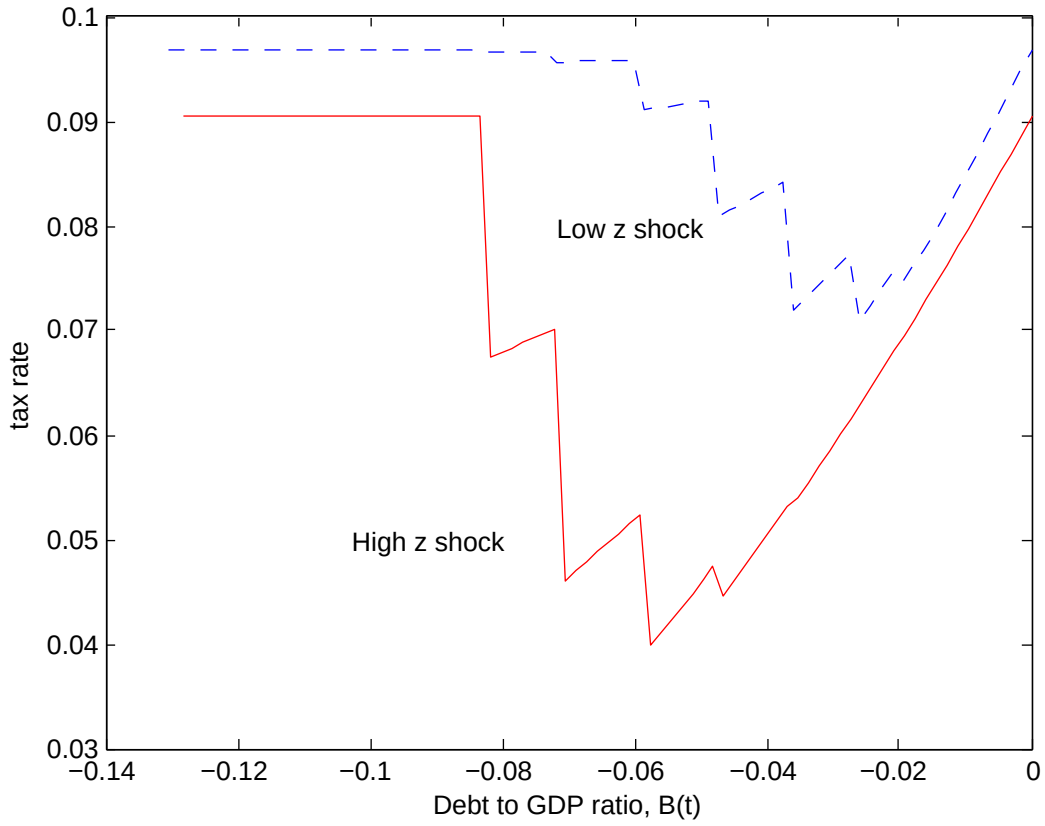

Figure 3.2: Optimal tax functions

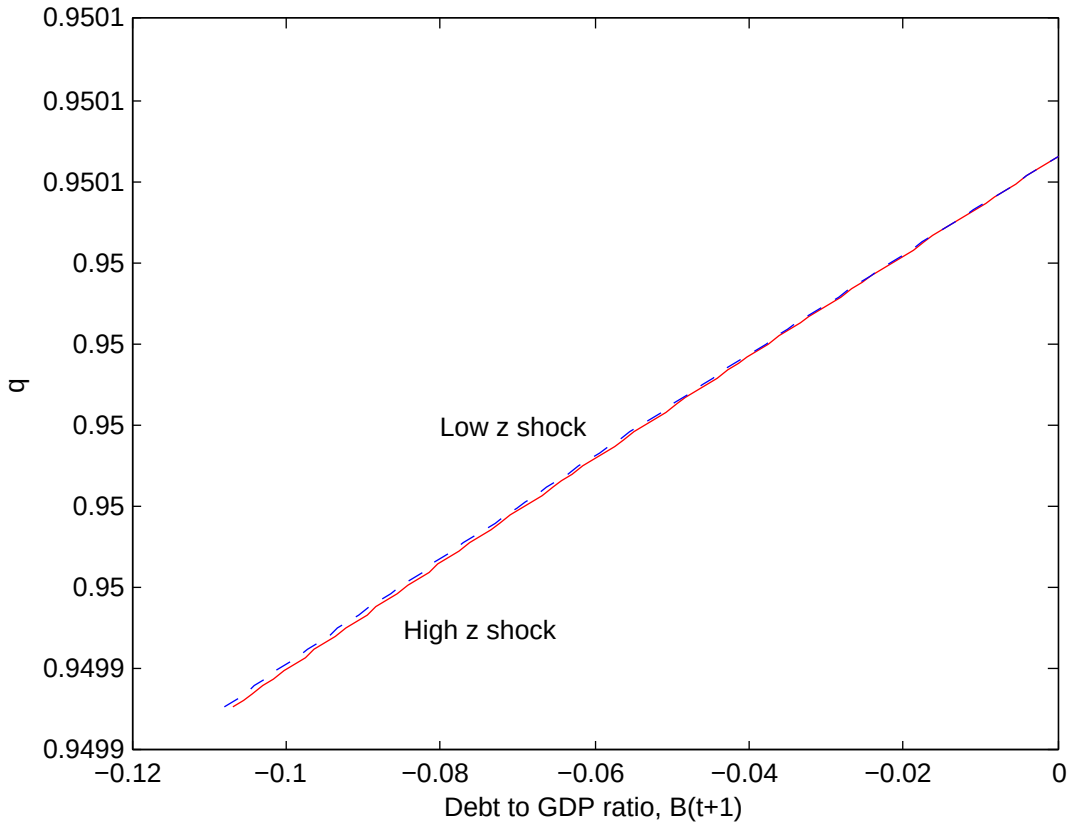

Figure 3.3: Bond price functions: Without default option

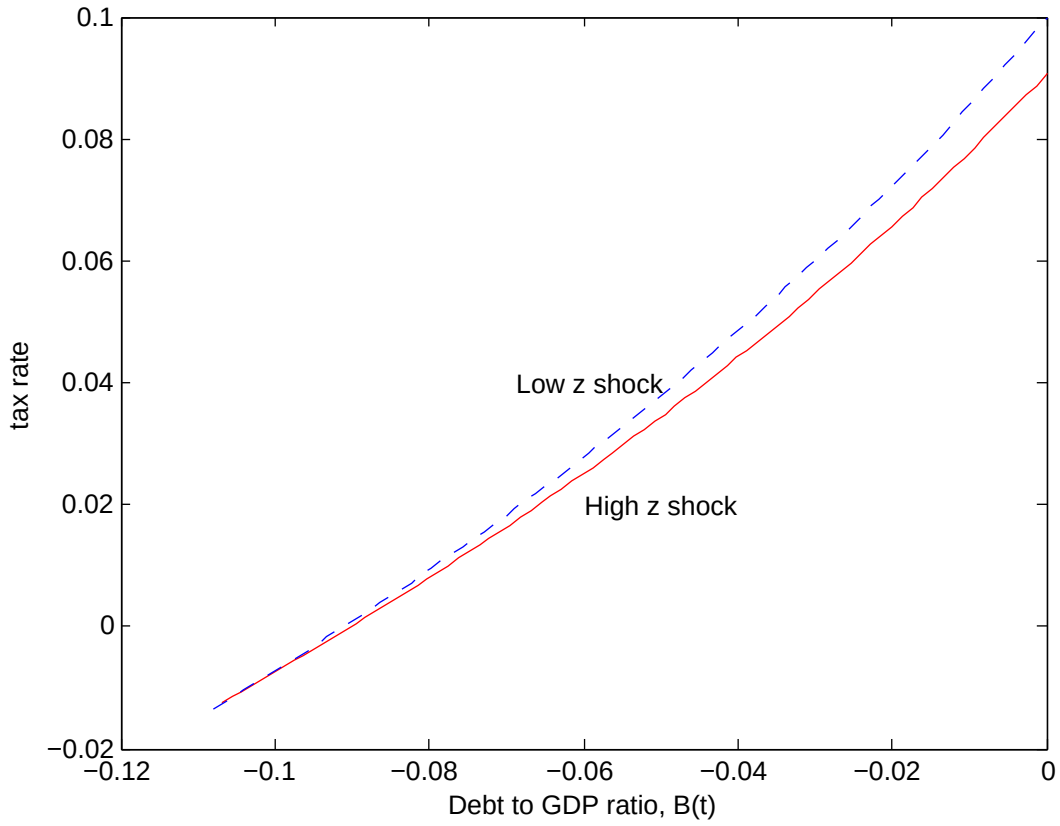

Figure 3.4: Optimal tax functions: Without default option

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