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THREE ESSAYS ON FINANCIAL DEVELOPMENT

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THREE ESSAYS ON FINANCIAL DEVELOPMENT

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Business and Economics
at the University of Kentucky

By
Biniv K. Maskay
Lexington, Kentucky

Director: Dr. Jenny Minier, Professor of Economics
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ABSTRACT OF DISSERTATION

THREE ESSAYS ON FINANCIAL DEVELOPMENT

My dissertation investigates three separate issues pertaining to a country's financial development. The first essay provides an introduction to the three essays. The second essay examines the combined effect of financial development and human capital on economic growth. While both financial development and human capital are individually positively correlated with growth, the literature has not emphasized their combined effect on growth. In this essay, I analyze the extent to which the effect of financial development on growth depends on a country's level of human capital. Using dynamic panel difference and system GMM, as well as the pooled OLS, I find that an increase in human capital decreases the impact of financial development on growth and that countries that lack financial development can achieve greater economic growth through an improvement in human capital.

The third essay analyzes how currency unions affect the financial development of a country. This essay tests two forms of asymmetries on the effect of currency unions on financial development; I analyze if currency unions have an equal effect on various forms of financial development, and whether high-income and low-income countries are impacted differently. I find some evidence in favor of both forms of asymmetries with pooled OLS and fixed effect estimation using data on 152 countries and territories over the 1970-2006 time period.

The fourth essay tests how financial development affects firms' export market participations and the volume of exports utilizing a firm-level data set which incorporates about 43,500 firms from 80 countries for the time period 2002-2009. Using an instrumental variable approach, I find that a country's financial development negatively affects the extensive margin of trade and positively affects the intensive margin of trade. Furthermore, this study finds that financial development has a disproportionate positive affect on firms with a higher level of external dependence for both margins of trade. Finally, I find that financial development exerts an asymmetric effect on young and mature firms in their export participations but not on the volume of exports.

KEYWORDS: Financial development; Economic growth; Currency unions; Extensive and intensive margins of trade.

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July 30, 2012
Date

THREE ESSAYS ON FINANCIAL DEVELOPMENT

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Director of Dissertation

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Director of Graduate Studies

July 30, 2012
Date

For my grandparents, Keshar Bahadur Maskay and Bishnu Devi Maskay, my parents, Bishwa Keshar Maskay and Noor Maskay, my sister, Aniva Shrestha, my brother, Aniv Keshar Maskay, and all my loved ones.

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1

Introduction to Dissertation

This dissertation consists of three essays on financial development. Financial development is defined as an improvement in the quality, quantity, or efficiency of the financial systems that are comprised of financial markets, banks and other financial intermediaries. The progresses of financial systems are believed to reduce information and transaction costs, and improve the allocation of resources. In the second essay, I examine the combined effect of financial development and human capital on economic growth. In the third essay, I analyze how currency unions affect the financial development of a country. Finally, in the fourth essay, I investigate how financial development affects the export market participation and the volume of exports. I find that for low-income countries, currency unions bring about increases in the size of the formal intermediary sector which expands the availability of credit. This, in turn, is most positively associated with economic growth where a country's education level is low. Countries perhaps attain this economic growth through higher export volumes among firms that are already exporting.

The second essay of my dissertation is titled "*Financial Development, Human Capital, and Economic Growth.*" In this essay, I examine the extent to which the effect of financial development on growth depends on a country's level of human capital. Many studies have demonstrated the importance of financial development and human capital in economic growth. While both financial development and human capital are individually positively

correlated with growth, the literature has not emphasized their combined effect on growth. The role of financial development in mobilizing savings, providing for the evaluation of projects, and managing risk is well established. These functions allow for increased technological innovation as firms can finance longer-term, high-risk projects. However, this increased innovation also depends on a supply of researchers or entrepreneurs which varies widely across countries. Given the variations in human capital across countries, I analyze if the effect of financial development differs for countries with different levels of human capital.

I use a neo-classical Cobb-Douglas production function to motivate my estimating equation. The main variables that I use as proxies of financial development are called liquid liabilities and market capitalization. Liquid liabilities captures the financial depth of a country, defined as the size of the formal financial intermediary sector relative to the GDP of a country. Market capitalization captures the size of the stock market relative to economic activity. I use the percentage of people above 25 years of age who have successfully completed secondary education as a proxy for the number of researchers. The data comprises of 89 countries for the years from 1960-2009, which are averaged to five year panels. I estimate a reduced form growth equation with the economic growth rate as the dependent variable, and financial development variables, human capital and a host of other control variables as the independent variables.

I use system GMM as my main estimator as this estimation method can potentially account for various problems that afflict growth studies such as omitted variable bias, endogeneity, and temporary measurement errors. Using the system GMM estimator, I find that increases in human capital decrease the effect of financial development on growth. This paper also shows that countries that lack financial development can achieve greater economic growth through improvement in human capital. The robustness of the results is checked

through the use of alternate measures of financial development, namely private credit and market value, which measure credit allocated to the private sector by money deposit banks, and stock market liquidity, respectively. The results are also robust to difference GMM, one-step system GMM, and pooled OLS.

In the third essay, titled "*Analyzing the Effect of Currency Unions on Financial Development,*" I look at how currency unions affect the financial development of a country. Currency unions are thought to have a positive impact on international financial integration (IFI) but the effect of IFI on an economy is inconclusive. Given the controversies surrounding the effect of IFI on growth, this essay empirically tests if forming or joining a currency union affects financial development. As the finance-growth literature finds a positive correlation between financial development and economic growth, analyzing this relationship between currency unions and financial development allows me to explore a channel through which currency unions may affect an economy, in addition to through an increase in trade and price co-movement among the member nations.

In addition to testing the direct effect of currency unions on financial development, this essay checks for two types of asymmetries in estimating the impact of currency unions on financial development. First, given that financial development literature utilizes several measures of financial development to capture various services provided by the financial systems, I test if currency unions impact these measures differently. Second, using median level of income as a threshold value, this paper estimates if currency unions affect financial development of high-income and low-income countries equally.

Using data on 152 countries and territories over the 1970-2006 time period, I find some evidence in favor of both forms of asymmetries. Using pooled OLS, the results show that currency unions negatively affect the size of the overall financial systems but positively affect

the liquidity of stock markets. Furthermore, using fixed effects estimation, this paper finds a strong asymmetric effect of currency unions on financial development of high-income and low-income countries. Although the coefficient estimate on the effect of currency unions on liquid liabilities is statistically insignificant on the full sample, I find the effect on liquid liabilities to be negative and significant for high-income countries, and positive and significant for low-income countries. In contrast, the results indicate a negative relationship between currency unions and stock market liquidity for low income countries.

In the fourth essay, titled *"Financial Development, External Dependence and the Margins of Trade: A Firm-level Analysis,"* I examine how financial development affects firms' export market participations (the extensive margin of trade) and the volume of exports (the intensive margin of trade) given the industry specific common measure of the firms' dependence on external finance. Furthermore, exploiting Rajan and Zingale's (1998) measure of external dependence for young and mature firms in an industry, I test if financial development affects the extensive and intensive margins of trade of these firms differently. I use private credit as a measure of financial development, which is defined as the credit to the private sector by deposit money banks as a share of GDP. Because of the potential endogeneity concerns in the export regression, this paper uses an instrumental variable approach to account for the problem. Property rights index is used to instrument the endogenous measure of financial development. The validity of the instruments are tested in various ways.

Using firm-level data of approximately 43,500 firms from 80 countries for the 2002-2009 time period, I find that while dependence on external finance of firms negatively affects both the export market participation and the volume of exports, a country's financial development negatively affects the extensive margin of trade and positively affects the intensive

margin of trade. Furthermore, this study finds that financial development disproportionately promotes the export activities of firms with higher levels of external dependence. Finally, I find that young and mature firms are affected differently by financial development on their export participations. However, the results do not support such asymmetric effect for the volume of exports. These findings contend that examining the effect of financial development using the overall industry-level measure of external dependence may mask an important asymmetric effect of a country's financial development on young and mature firms.

2

Financial Development, Human Capital and Economic Growth

titletopskip

2.1 Introduction

Many studies have highlighted the importance of financial development and human capital on economic growth. While both financial development and human capital are positively correlated with growth, their combined effect has not been emphasized in the literature. The role of financial development in mobilizing savings, providing for the evaluation of projects, and managing risk is well established (Levine, 1997, 2005). These functions allow for increased technological innovation, as firms can finance longer-term, high-risk projects. However, this increased innovation depends on a supply of researchers or entrepreneurs that tends to vary widely across countries. For example, in 2007, South Korea had 4,627 researchers in research and development (R&D) per million people, while Mexico had 353. The OECD countries had an average of 3,012 researchers per million people, whereas Latin American and Caribbean countries had 487 (World Development Indicators, 2009). Does financial development affect the economic growth process of these countries equally? To what extent does the effect of financial development on growth depend on a country's level of human capital?

Financial development is defined as an improvement in the quality, quantity, or effi-

ciency of the financial systems that are comprised of financial markets, banks and other financial intermediaries. Advances in the services provided by the financial system are believed to reduce information and transaction costs, which allow for increased innovation and productivity of a country.

A significant amount of work has been done regarding financial development of a country given the theoretical appeal of the roles of financial systems. Numerous studies have looked at exogenous factors that contribute to financial development such as geography (Levine et al., 2000), technology (Merton, 1995), legal systems (LaPorta et al., 1998), and fiscal policies (Bencivenga and Smith, 1991). Many studies have analyzed the effect of financial development on economic growth and variables conducive to growth such as total factor productivity, efficiency, private savings, investments, capital accumulation, and productivity growth.[1] Apart from a few notable exceptions (e.g., Robinson, 1952; Lucas, 1988), the general consensus in the empirical literature is that there exists a positive relationship between financial development and economic growth.

These findings are robust to various econometric specifications. King and Levine (1993), and Levine and Zervos (1998) use OLS estimation in their study. Rousseau and Vuthipadadorn (2005), and Luitel and Khan (1999), among others, use time series data to analyze the effect of financial development and find that financial development affects economic growth through factor accumulation. The use of panel data fixed effects (e.g., Beck and Levine, 2004; Rousseau and Wachtel, 2000) and dynamic panel GMM estimation (e.g., Levine et al., 2000; Rioja and Valev, 2004) are also fairly common in the literature. While many studies use cross-country data, Rajan and Zingales (1998a) carry out an industry level examination and find that industries that rely more on external finance for capital expenditures,

[1]For example, see King and Levine (1993); Levine and Zervos (1998); Rousseau and Vuthipadadorn (2005); Atje and Jovanovic (1993); Benhabib and Spiegel (1997).

measured as a ratio of the difference between capital expenditures and cash flow to capital expenditures, benefit more from financial development.

Even though a large number of empirical studies have analyzed this issue, the channel through which financial development affects growth is still unclear. Levine (1997) points out that the proximate causes of growth that financial systems affect are capital accumulation and total factor productivity. Total factor productivity is found to have a larger effect on growth among the two variables as shown in the influential studies by Solow (1957), Mankiw et al. (1992), Hall and Jones (1999), and Aghion et al. (2005).[1] An important link that the finance literature has not emphasized is the role of human capital in achieving higher levels of innovation or technological progress. Human capital is one of the variables that is consistently found to have a positive effect on growth. Barro (1991) and Mankiw et al. (1992), among others, find a substantial effect of human capital on growth. Levine and Renelt (1992) find human capital as one of the few variables that passes the rigid robustness tests in their famous extreme-bounds analysis.

One channel through which financial development may affect growth is through an interaction with human capital. The finance-growth literature emphasizes the fact that some investment is needed at first for innovation to take place. This comes with pooling of resources from households, a service that financial systems provide. New technology is produced and innovation is achieved once there is adequate investment. However, having a high level of financial development may not be enough to achieve innovation. An economy needs researchers with high levels of human capital to facilitate innovation and technological progress. Similarly, a certain level of human capital is required for an economy to adopt technologies of another country or close the gap with the technological leader. This

[1]Some studies, such as Howitt and Aghion (1998), however, argue that there is a complementary relationship between capital accumulation and innovation.

role of human capital suggests a complementarity between human capital and financial development as both factors seem to be relevant in the growth process.

This line of reasoning leads one to believe that a country with a high level of human capital would benefit more from financial development by mobilizing the resources to their best use. An increase in financial development would allow the scientists and engineers of a country to take advantage of the pooling of resources that are needed for research and development, and for innovation purposes. Along the same line, it can be argued that a country with a low level of human capital would not be able to make the best use of financial development. A country with a low number (or sub-par quality) of researchers may not be able to innovate and increase productivity as much, even when the country experiences advancement in financial development. This hypothesis postulates that the impact of financial development on growth increases as the human capital of a country increases.

A competing hypothesis is advanced by Kendall (2009) on the combined effect of human capital and financial development on growth. Using disaggregated data at the sub-national level in India, he empirically tests how the effect of financial development, measured by banking sector development, on growth differs in districts with different levels of human capital (measured by literacy rate). He finds that the growth of net domestic product in many districts is inhibited by a lack of financial development. However, some of the hindrances are negated in districts with human capital above the median level, where growth is achieved through development of the less finance-intensive service sector. His results are in contrast to conventional wisdom on the relationship between human capital and financial development in affecting growth, suggesting that financial development and human capital are substitutes in the growth process.

Although Kendall (2009) also examines the combined effect of financial development and human capital on economic growth, my study differs from his in several ways. First, while his paper focuses on sub-national data from India, I use cross-country data to analyze a larger sample of countries. Using such a dataset allows me to see whether the relationship between the combined effect of human capital and financial development and growth holds across countries, in addition to what Kendall (2009) finds for one particular country. Second, while Kendall (2009) uses one measure of financial development, proxied by the size of the banking sector, I use several measures of financial development to capture varied services provided by the financial systems. The inclusion of stock market variables in addition to banking variables is particularly pertinent given the voluminous literature on the relative importance of banks and stock markets in affecting growth.[1] Third, Kendall (2009) uses a dummy variable to identify districts with high levels of human capital based on median literacy rates to see how financial development affects those districts. I look at the entire distribution of human capital across countries and test how the effect of financial development changes with the changing level of human capital. Finally, I use a number of econometric techniques such as pooled OLS (POLS), and dynamic panel difference and system GMM estimators to analyze the combined effect of financial development and human capital on growth. In doing so, I find that increase in human capital decreases the effect of financial development on growth. The result is robust to all estimation methods and all measures of financial development, suggesting that countries that lack financial development can achieve greater economic growth through improvements in human capital.

The remainder of the paper is organized as follows: Section 2.2 provides a brief model. Section 4.3 discusses the measures of financial development, human capital, and several

[1] For example Rajan and Zingales (1998b), Boot and Thakor (1997) and Levine (2002).

control variables and presents a preliminary analysis of the data using the quantile regression. Section 4.4 outlines the methodologies and their corresponding results. Section 4.6 concludes the paper along with suggestions for further studies.

2.2 A brief model

Consider the following traditional Cobb-Douglas production function:

$$Y_{it} = A_{it} L_{it}^{\beta} K_{it}^{\gamma} \tag{2.1}$$

where i and t index country and time respectively. Y, L, and K represent real per capita GDP, labor, and capital respectively. Total factor productivity (TFP), A, is a complement to other factors of production, and is expressed in the following form:

$$A_{it} = A_{i,1} F_{i,t}^{\phi} H_{i,t}^{\psi} (F \times H)_{i,t}^{\delta} e^{(\lambda t + u_{it})} \tag{2.2}$$

where F and H denote financial development and human capital respectively. Here, TFP is a function of financial development, human capital, and the interaction of the two. $A_{i,1}$ represents the initial level of technology, λt captures the time trend in innovation and technological progress, and u is a stochastic composite error term.[1] Hence, from equations (2.1) and (2.2), we have,

$$Y_{it} = A_{i,1} L_{it}^{\beta} K_{it}^{\gamma} F_{i,t}^{\phi} H_{i,t}^{\psi} (F \times H)_{i,t}^{\delta} e^{(\lambda t + u_{it})} \tag{2.3}$$

Accounting for the "convergence" effect as per the Solow-Swan model (Solow, 1956; Swan, 1956), and other variables as deemed important by various growth studies, equation (2.3)

[1] $u_{it} = \gamma_i + v_{it}$, where γ_i is the time-invariant country-fixed effects.

is converted to the following estimable reduced form growth equation:

$$\begin{aligned} \Delta y_{it} &= D + \lambda_t + (\alpha - 1) y_{i,t-1} + \beta_l L_{i,t} + \beta_k K_{i,t} \\ &\quad + \beta_f F_{i,t} + \beta_h H_{i,t} + \beta_{fh} (F \times H)_{i,t} + \beta_c C_{it} + u_{it} \end{aligned} \tag{2.4}$$

$$\alpha < 1 \qquad \text{for i = 1,.....,N} \quad \text{and} \quad \text{t = 2,.....,T}$$

where y_{it} is the log of real GDP per capita, D is a constant, and C is a vector of control variables discussed in the following section. β_f shows the direct effect of financial development on economic growth, and β_{fh} shows the combined effect of human capital and financial development. Given the competing hypotheses on how the interaction variable affects growth (as discussed in Section 2.1), the sign of β_{fh} would allow me to see which effect offsets the other. A positive sign on β_{fh} would suggest that financial development and human capital are net complements, while a negative sign on β_{fh} would imply that the variables are net substitutes in the growth process. Finally, equation (2.4) allows me to compute the marginal effect of financial development on growth, which depends on the level of human capital. Evaluating this effect at various points on the distribution of human capital across countries allows me to see how the total marginal effect of financial development changes with the level of human capital.

2.3 Data

2.3.1 Indicators of financial development

I use four variables as the indicators of financial development, of which two are the main variables and the other two are used to test the robustness of the results. The first measure captures "financial depth," defined as the size of the formal financial intermediary sector relative to the GDP of a country. King and Levine (1993) use this variable in a seminal study in the empirical finance and growth literature, who argue that the size of

financial systems is positively related to the services they provide. M3 is used to measure the size of the financial sector which consists of demand and interest bearing assets of financial intermediaries and currency held outside the country. I refer to this variable as liquid liabilities (LLY) and it is computed as a ratio of M3 to GDP.

The second measure I use as an indicator of financial development is the size of the stock market relative to economic activity. This measure is computed as a ratio of value of listed domestic shares (capitalization) on domestic exchanges divided by GDP, and is referred to as market capitalization (CAP). This variable is used in many other studies as a measure of financial development, including by Levine and Zervos (1998), who point out that large stock markets are not necessarily efficient, but can provide additional services that small markets cannot.

I use two additional measures of financial development to evaluate the robustness of the results. They are referred to as private credit (PRIVY) and market value (VALUE). Private credit estimates credit allocated to the private sector by the deposit money banks as a proportion of GDP. A high value of private credit indicates a deep credit market as it shows that private sector has more access to credit from banks as a percentage of GDP. A high value of PRIVY potentially encourages economic growth as banks exercise their functions of risk-pooling, evaluating managers, acquiring information and selecting projects when the credit is extended to the private sector.

Market valuation (VALUE) captures stock market liquidity which is computed as the value of the trades of domestic shares on domestic exchanges divided by GDP. High market value indicates higher efficiency and lower transaction costs, that may not be captured by the size of a stock market.

The data for all of the financial development variables are obtained from Beck, Demirguc-

Kunt, and Levine (2009). Table 4 in Appendix .1.2 reports pairwise correlations between the measure of financial development.

2.3.2 Measures of Human Capital

Data on the number of researchers and developers across countries over time would be ideal for the purposes of this study. These data would show the number of researchers and developers that are working towards adoption and creation of knowledge and technology in a given economy. Given the level of financial development in these countries, one could use the data on researchers and developers to see if financial development and human capital are substitutes or complements in achieving growth. However, only a short time series of such data are available for a limited number of countries. As a result, I resort to using education data.

Various measures of education have been used in the literature to estimate human capital. They can be broadly categorized into stock and flow measures (levels vs first differences) of human capital. Lucas (1988) argues that economic growth depends on the rate of accumulation of human capital and hence falls under the flow concept. Mankiw et al. (1992) choose the flow measure of human capital as well by using primary and secondary school enrollment rates.

Even though there is, conceivably, a high correlation between a flow and a stock measure of human capital, Nelson and Phelps (1966) argue that the stock of human capital is a better measure as it determines a country's ability to innovate and catch up to more advanced countries with creation and diffusion of knowledge. A widely used stock measure of human capital is average years of schooling. However, this measure is not without flaws. Mulligan and Sala-i Martin (2000) refute the use of the variable on the following grounds: first, workers of two different educational backgrounds are considered perfect substitutes for each

other. Second, the marginal effect of one year of schooling is typically assumed to be constant, and productivity differentials among workers with different levels of education are proportional to their years of schooling. Finally, the elasticity of substitution across workers of different groups is assumed to be constant across countries and over time. Barro and Lee (2000) also mention the drawbacks of the variable; the measure only accounts for the level of education and does not consider skills or training acquired after formal schooling or at work, and it does not account for differences in school quality within and across countries.

Aghion and Howitt (1998), however, discuss an important advantage of using a stock measure of human capital. They argue that the measure that separates the percentage of people having different levels of education serves as a proxy for researchers and developers. In particular, they argue that using information on secondary and higher education better reflects the number of potential researchers and developers in an economy. Benhabib and Spiegel (1994) use stock measures of human capital as well as flow measures. They use the percentage of people who have successfully completed primary, secondary and tertiary levels as stock measures. The authors find that these measures of human capital positively and statistically significantly affect growth, whereas flow measures of human capital do not.

In conjunction with the literature, the stock measure of human capital is the most relevant for this paper, as the variable proxies for the number of researchers and developers in an economy. I use the percentage of people, above 25 years of age, who have successfully completed secondary education as a proxy for the number of researchers, and I call this measure HC. The pairwise correlation between HC and number of researchers in R&D per million for years 2001-2005 is 0.53. The data for HC are obtained through Barro and Lee (2010).

2.3.3 Control variables

Various control variables are used in a typical empirical growth study. Levine, Loayza, and Beck (2000) group these variables into three categories. The basic conditioning information set includes a constant term, the logarithm of initial per capita GDP and initial educational attainment. The policy conditioning information set includes inflation, measures of government size, population growth and trade openness, and the variables in the basic conditioning information set. The full conditioning information set includes measures of political stability, ethnic diversity, and the variables in the policy conditioning set.

In this study, I restrict my control variables to the policy conditioning information set due to the instrument proliferation problem that arises as the number of independent variables increases. The problem of instrument proliferation, which is especially a cause of concern in GMM estimation, is discussed further in Section 2.4.2.2. For POLS, I use initial income at the beginning of each period, which is referred to as *Initial*. For GMM estimation, however, instead of using measures of initial income and education attainment, I use lagged values of measures of income and education attainment as instruments for contemporaneous ones.

The data set covers 89 countries in 5-year panels from 1960-2009. The list of countries is reported in Appendix .1.1. Appendix .1.2 presents data descriptions and sources of these variables, along with summary statistics which are presented in Table 4.

2.3.4 Quantile Regression

I use quantile regression for a preliminary analysis of the data. Quantile regression provides parameter estimates at different quantiles of the conditional distribution, which allows me to see if there is a heterogeneous relationship between the dependent and the

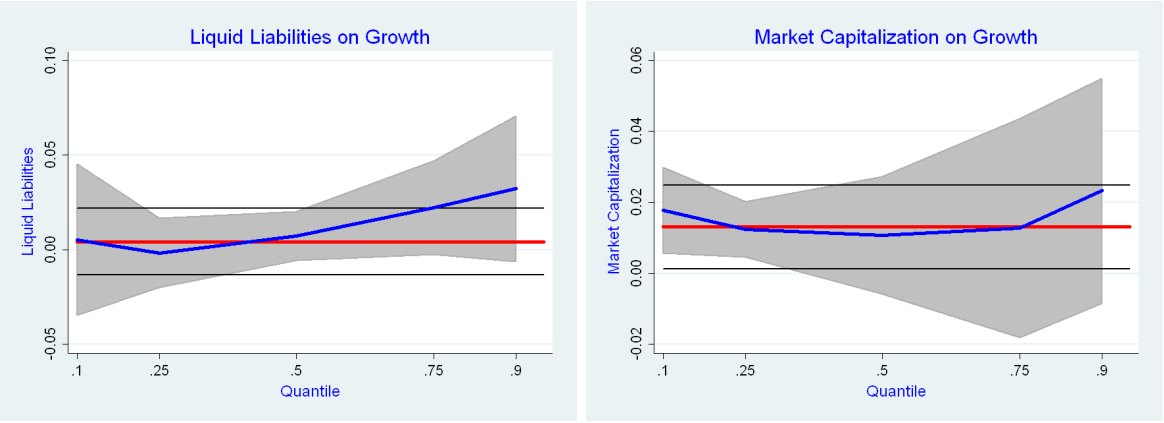
independent variables. In the context of this paper, quantile regression allows me to analyze how financial development and the interaction variable of financial development and human capital affect the countries that vary in growth rates. Such analysis would indicate how important each variable is to a fast growing economy.

Figures 2.1 and 2.2 depict the quantile regression results. The thick slanted lines show the marginal effect of the independent variables on the growth rate based on various quantiles of the conditional distribution. The shaded areas show the 95% confidence bands, generated with the bootstrapped standard errors. The OLS estimates are shown by the middle horizontal line.

Figure 2.1a shows the marginal effect of LLY on growth based on various quantiles of the conditional distribution of growth rates. Similarly, Figure 2.1b shows the marginal effect of CAP on growth at different quantiles. Both figures show that the effect of financial development is higher for countries with high growth rates.

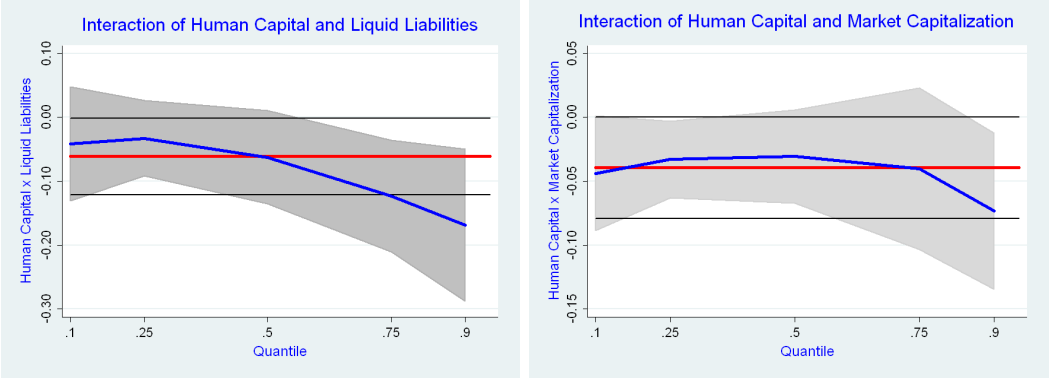
Figure 2.2 displays the marginal effect of the interaction of human capital and financial development on economic growth at various quantiles of the conditional distribution. For the interaction of LLY and HC, as shown in Figure 2.2a, the effect of the interaction variable on growth increases with the growth rate at the lower tail of the distribution (up to about the 25^{th} percentile). However, for countries that have higher growth rates, the effect on growth is lower. Figure 2.2b shows the effect of interaction of CAP and HC. The effect is fairly constant up to about the 75^{th} percentile of the conditional distribution, and is lower for countries with higher growth rates.

The cursory analyses based on quantile regression implies that the effect of financial development is higher for countries with high growth rates. However, the effect of financial development on growth also depends on the level of human capital, and the marginal effect of



(a) (b)

Figure 2.1: Quantile Regression (I)



(a) (b)

Figure 2.2: Quantile Regression (II)

the interaction variable on growth is lower for countries with high growth rates. This result suggests that the high value on the interaction variable is not as important for countries with high growth rates.

2.4 Methodologies and Results

2.4.1 Pooled OLS (POLS)

For an initial look at the data, the results of POLS are presented in Panel A of Table 2.1. The POLS results can be viewed as the contemporaneous association between the dependent variable and regressors as I examine the variables that are averaged over the same period.[1] Here, the coefficients on human capital are positive and statistically significant for all but one specification. These results show that human capital has a positive effect on growth, as shown by numerous studies including Barro (1991) and Mankiw et al. (1992). The omitted variable bias in specifications (1) and (3) causes the coefficient on LLY to be biased downwards, which causes the coefficients to be negative. Here, the omitted variable is the interaction of LLY and HC. The results also show that the estimates of the interaction variables are negative for all specifications and statistically significant when the interaction variables are considered one at a time. The negative signs on the interaction variables indicate that the effect of financial development on growth decreases with an increasing level of human capital. These results are similar to what Kendall (2009) finds for sub-national regions in India.

To estimate the precise nature of the relationship between the variables, I evaluate the magnitude of marginal effects of financial development and their respective standard errors by examining the interaction term at various points of the distribution of human capital

[1] King and Levine (1993) define the contemporaneous relationship synonymously.

Table 2.1: Pooled OLS results

VARIABLES	(1)	(2)	(3)	(4)
Panel A:				
LLY	-0.0109***	0.0043	-0.0099***	-0.0002
	(0.004)	(0.009)	(0.004)	(0.010)
CAP	0.0034	0.0038	0.0131**	0.0097
	(0.003)	(0.003)	(0.006)	(0.007)
HC	0.0113	0.0477*	0.0312*	0.0480*
	(0.012)	(0.025)	(0.017)	(0.025)
HC_LLY		-0.0006**		-0.0004
		(0.000)		(0.000)
HC_CAP			-0.0004**	-0.0002
			(0.000)	(0.000)
Initial GDP	-0.7719***	-0.7769***	-0.7947***	-0.7894***
	(0.156)	(0.153)	(0.155)	(0.154)
Pop. Growth	-0.7822***	-0.7268***	-0.7421***	-0.7202***
	(0.142)	(0.141)	(0.142)	(0.142)
Govt. Share	-0.0060	0.0002	-0.0080	-0.0031
	(0.041)	(0.040)	(0.041)	(0.040)
Inflation	0.0368***	0.0346***	0.0350***	0.0342***
	(0.009)	(0.009)	(0.009)	(0.009)
Open	0.0085***	0.0070***	0.0070***	0.0066***
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	5.9014***	5.3147***	5.9039***	5.5111***
	(1.534)	(1.474)	(1.527)	(1.507)
Panel B: Implied marginal effect of financial development				
at Q25 of HC		-0.0016	0.0093***	
		(0.006)	(0.004)	
at Q50 of HC		-0.0064	0.0062*	
		(0.004)	(0.004)	
at Q75 of HC		-0.0129***	0.0020	
		(0.004)	(0.003)	
Observations	372	372	372	372
R-squared	0.246	0.254	0.254	0.256

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
All variables are in percentages
Distribution of HC: at Q25=9.56 ; at Q50=17.44; at Q75=28.14

across countries. These results are shown in Panel B of Table 2.1.[1] The results indicate an economically large effect of the interaction variable on growth. As an illustrative example, as shown in column (3), the coefficient on the marginal effect of CAP on 5-year average growth of a country with HC at the 25^{th} percentile value is 0.0093, and 0.0062 at the 50^{th} percentile value. This finding implies that for a 10% decrease in CAP, the country with the 25^{th} percentile HC grows more slowly by 3.1% than the country with the 50^{th} percentile HC. This result shows that lack of financial development hurts countries with low human capital more than countries with high human capital.

Furthermore, the results show that for a country with the 25^{th} percentile HC, an economy grows by 13% more when financial development of the country increases from the 25^{th} percentile to the 50^{th} percentile.[2] However, for a country with the 50^{th} percentile HC, an increase in the growth rate achieved from an equal change in financial development is only 8.96%.[3] The results show that improvement in financial development helps countries with low levels of human capital more than those with high levels.

Appendix .1.5 presents the POLS results of two additional measures of financial development, PRIVY and VALUE, that are used as robustness checks. These results also indicate that the effect of financial development decreases with increasing levels of human capital.

2.4.2 GMM

In this section, I use the generalized method of moments (GMM) estimators developed for dynamic panels by Holtz-Eakin, Newey, and Rosen (1988), Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). There are several advantages of using GMM estimators over simple cross-section regression and other panel data models

[1] The partial F-tests reject the null hypotheses that the marginal effects of financial development are the same at three different levels of human capital as presented in the table.
[2] From column (3), Δ growth rate = .0093 $\times\Delta$ CAP
[3] From column (3), Δ growth rate = .0062 $\times\Delta$ CAP

(such as fixed effects). As outlined in Bond et al. (2001), GMM estimators account for various problems that afflict growth studies such as (1) omitted variable bias, (2) endogeneity, and (3) temporary measurement errors. First, time-invariant country fixed characteristics such as geography may be correlated with explanatory variables and will be a part of the error term if omitted. Omission of such variables can lead to biased estimates. Through first differencing, the estimates obtained with GMM estimators can be free of such a bias. Second, GMM estimators use lagged variables as instruments in the presence of endogenous independent variables. Using such instruments extracts the exogenous component of the independent variables which allows for consistent estimation of the parameters. Finally, as argued by Bond et al. (2001), the estimation of parameters is potentially consistent through the use of lagged levels of independent variables for variables in differences as instruments in the presence of temporary measurement errors.

The level of financial development is endogenous in the model described in Section 2.2. Several time series studies have tested the direction of causality between finance and growth. Although many of them find that financial development granger causes economic growth, several studies have failed to rule out that causality runs from growth to financial development.[1] Various studies, such as Levine and Zervos (1998), have resorted to using the initial value of financial development because of the possibility of simultaneity between financial development and growth. Using initial values as proxies for current values results in information and efficiency loss, even though the technique addresses some of the simultaneity problem associated with estimation. Beck and Levine (2004) comment that "using proper instruments for the contemporaneous values of the explanatory variables is therefore preferable to using initial values." The GMM estimators, as mentioned above, correct

[1]For example, Calderon and Liu (2003), and Ang and McKibbin (2007).

this problem of endogeneity by using lagged realizations of explanatory variables that are exogenous to the dependent variable.

As in the case with financial development, human capital is endogenous in the model. The effect of human capital on growth rates is well documented and the literature generally finds a positive correlation between the variables.[1] However, there is some support in the literature for a bi-direction causality between human capital and growth. For example, based on time series analysis from Greece, Asteriou and Agiomirgianakis (2001) show that economic growth and the level of education affect each other. As discussed in the previous paragraph, using initial levels of human capital in growth regressions because of bi-directional causality between the variables results in information and efficiency loss. Hence, I adopt a GMM estimator to utilize internal instruments through the use of lagged realizations of the explanatory variables to account for endogeneity.

The rest of my analysis focuses on GMM estimators because of the aforementioned advantages that GMM estimators have over POLS and other panel data models. The GMM estimation procedure and some issues with the estimation are discussed in the following subsections. The GMM results immediately follow.

2.4.2.1 GMM estimation

The dynamic panel GMM regressions are available in two forms: the difference and the system GMM estimators. The difference GMM instruments the right-hand-side variables in differences using levels of lagged dependent variables. The system GMM utilizes both lagged differences and levels of regressors as instruments to estimate the equation. In this paper, I use the system GMM estimator because of several advantages it has over the difference GMM estimator. Blundell and Bond (1998), and Bond et al. (2001) show that

[1] For example, Barro (1991), Ciccone and Papaioannou (2009).

the difference GMM estimator is subject to downward bias given a small number of time periods in the data. These authors argue that the lagged levels of explanatory variables are only weakly exogenous when the variable shows persistence and the bias is aggravated by differencing weakly exogenous dependent variables observed for a small number of time periods. The system GMM, on the other hand, exploits the assumption that the first differences of the endogenous variables are uncorrelated with the initial condition, which allows for additional moment conditions to be used in coefficient estimation. Bond et al. (2001) show that system GMM has superior finite sample properties with less bias and more precision when the variables show more persistence.

Two tests are necessary to ensure consistency of GMM estimates as suggested by Arellano and Bover (1995) and Blundell and Bond (1998). The Sargan and Hansen tests of over-identifying restrictions examine the overall validity of instruments. The Sargan test is not sensitive to the number of instruments used but is not robust to heteroskedasticity or serial correlation, whereas the Hansen test is sensitive to the number of instruments but is robust. These test of overidentifying restrictions tests the null hypothesis that instruments are exogenous. In this study, preference is given to the Hansen test because system GMM is particularly sensitive to instrument proliferation and the Hansen test can detect such a problem. For an instrument to be valid, we want a high p-value (to fail to reject the null hypothesis that variables are exogenous), but not "too high" which would indicate a weakened Hansen test as a result of instrument proliferation.

The second test inspects autocorrelation in the error term v_{it}. Here I test whether the error term v_{it} is second-order serially correlated in differences. For the instruments to be valid, the null of no serial correlation in the second order cannot be rejected (the error terms are, however, first-order serially correlated in differences by construction). Additionally,

since system GMM uses additional moment conditions to difference GMM, the difference-in-Hansen test is employed to test if those moment conditions are valid. The validity of these additional moment conditions would provide support for the use of the system GMM estimator.

2.4.2.2 Instrument proliferation and missing observations

Instrument proliferation is a serious problem in GMM estimation, especially in system GMM. If there are three time periods, first difference GMM uses one instrument whereas system GMM uses two, both in level and differences. As the number of time periods increases the instruments used in a model increases rapidly which may cause some problems. Roodman (2007) argues that a large collection of instruments might be individually valid but can collectively overfit endogenous variables and hence can be invalid in finite samples. He also points out that the Hansen test of overidentifying restrictions is weakened as a result of instrument proliferation and is particularly problematic for system GMM.

I use two strategies to account for the instrument proliferation problem. First, I use only a limited number of independent variables in the growth regression. I restrict the estimating equation to only two financial development variables that measure different services provided by the financial systems. I also restrict the control variables to the policy conditioning information set as discussed in Section (4.3). Second, I "collapse" instruments to somewhat suppress instrument proliferation. The dimension of an un-collapsed matrix of instruments is quadratic in the number of time periods (T) as each instrument generates a new column for itself and its lagged realizations. Collapsing of the instrument matrix reduces the instrument count by lessening the number of columns in the instrument matrix.

A problem this paper shares with many cross country growth studies is that of missing values. This problem is magnified when taking the first-difference transformation because

if z_{t-1} is missing, for example, then the transformation creates missing values for both Δz_t and Δz_{t-1}. To address this problem, I use "forward orthogonal deviation" transformation as suggested by Arellano and Bover (1995).[1] This transformation subtracts the average of all future observations that are available for a variable, which minimizes data loss.

2.4.3 GMM results

Table 2.2 presents the results of two-step system GMM using Windmeijer correction.[2,3] The results show that the coefficient estimates on human capital (HC) and market capitalization (CAP) are positive and statistically significant across all specifications. The coefficients on liquid liabilities (LLY) are negative in specifications (1) and (3). As in the results of POLS, the negatives estimates on LLY could be driven by the omitted variable bias, where the interaction of LLY and HC is omitted in those specifications. The results also show that the estimates of the interaction of LLY and HC are negative and statistically significant for all specifications. The interaction of CAP and HC is negative in all specifications as well, but statistically significant only when it is the only interaction variable considered. These findings are consistent with the POLS results as shown in Table 2.1 and indicate that effect of financial development depends on the level of human capital. The Hansen and the difference-in-Hansen tests of overidentifying restrictions show that the instruments are correctly specified. Together with the test of autocorrelation, the diagnostic tests certify that the estimates are consistent.

Panel B of Table 2.2 computes the marginal effect of financial development on growth computed at various levels of human capital.[4] The results show that the effect of LLY on

[1] Some papers that have used forward orthogonal deviation in the growth context are Brown et al. (2009), and Kremer et al. (2010).

[2] Two-step GMM is always more efficient that one-step GMM but has biased asymptotic standard errors. Windmeijer (2000) provides a finite-sample correction to address this problem.

[3] The results of one-step GMM are available upon request from the author.

[4] The partial F-tests reject the null hypotheses that the marginal effects of financial development are the same at three different levels of human capital as presented in the table.

Table 2.2: System GMM results

VARIABLES	(1)	(2)	(3)	(4)
Panel A:				
LLY	-0.0122***	0.0484***	-0.0059**	0.0463***
	(0.004)	(0.013)	(0.003)	(0.009)
CAP	0.0080***	0.0065***	0.0102**	0.0063*
	(0.003)	(0.002)	(0.004)	(0.004)
HC	0.0380***	0.1615***	0.0458***	0.1560***
	(0.011)	(0.031)	(0.008)	(0.023)
HC_LLY		-0.0020***		-0.0019***
		(0.000)		(0.000)
HC_CAP			-0.0004***	<-0.0001
			(0.000)	(0.000)
L.LOG_rgdpch	-1.4873***	-1.2671***	-0.9544***	-1.2713***
	(0.182)	(0.156)	(0.134)	(0.110)
Pop. Growth	-1.0810***	-0.7698***	-0.8937***	-0.8152***
	(0.083)	(0.088)	(0.077)	(0.069)
Govt. Share	-0.0070	0.0122	0.0044	0.0025
	(0.030)	(0.032)	(0.019)	(0.016)
Investment share	0.0983***	0.0434***	0.0760***	0.0559***
	(0.013)	(0.015)	(0.007)	(0.010)
Inflation	0.0285***	0.0223***	0.0277***	0.0223***
	(0.007)	(0.004)	(0.004)	(0.003)
Open	0.0065***	0.0026	0.0043***	0.0015
	(0.001)	(0.002)	(0.001)	(0.001)
Constant	10.2849***	6.7726***	6.0087***	6.9007***
	(1.730)	(1.685)	(1.347)	(1.137)
Panel B: Implied marginal effect of financial development				
at Q25 of HC		0.0296***	0.0066**	
		(0.009)	(0.003)	
at Q50 of HC		0.0141**	0.0035	
		(0.006)	(0.002)	
at Q75 of HC		-0.0069**	-0.0005	
		(0.002)	(0.002)	
Observations	371	371	371	371
Number of country	88	88	88	88
AR(2)	0.861	0.766	0.948	0.808
Hansen test	0.236	0.221	0.161	0.270
Sargan test	0.418	0.570	0.533	0.789
Difference-in-Hansen	0.105	0.127	0.112	0.263
Number of instruments	58	64	70	80

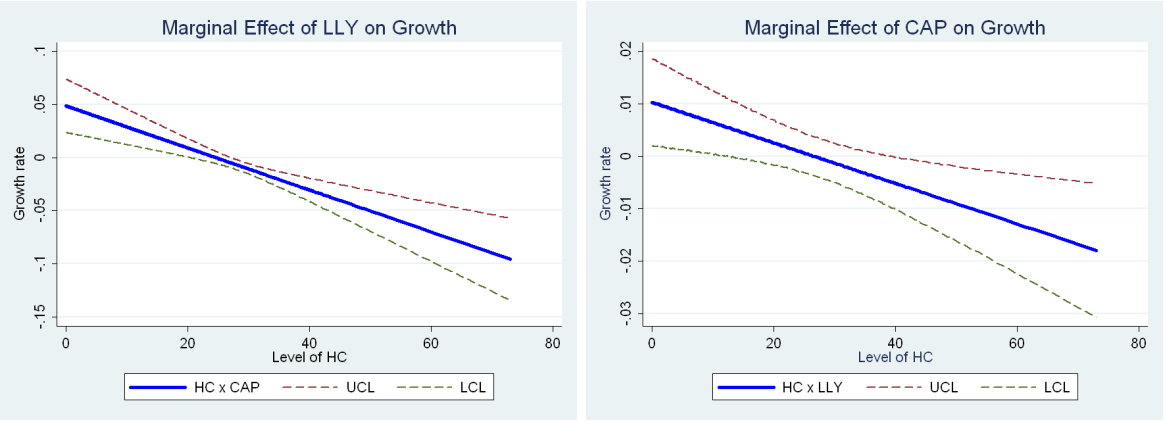
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
All variables are in percentages
Distribution of HC: at Q25=9.56 ; at Q50=17.44; at Q75=28.14

growth depends on all three levels of HC, as shown by statistically significant estimates. The effect of CAP, however, is statistically significant only at the low level of HC, as shown in column (3). I find economically significant effects of the interaction variable on growth. As an illustrative example, the results as shown in column (2) indicate that for a country with the 25^{th} percentile level of human capital, an economy grows by 5.5% more when finanical development of the country increases from 25^{th} percentile to 50^{th} percentile. However for a country with human capital at the 50^{th} percentile, an increase in the growth rate from an equal change in financial development is only 2.96%. The system GMM results reinforce the POLS results, and indicates that the improvement in financial development helps countries with low levels of human capital more than those with high levels. The economics effects derived from system GMM estimates, however, are lower than those from POLS estimates, which fits well with other studies that find OLS estimates to be biased upwards.[1]

Figure 2.3 gives visual illustrations of how the marginal effect of financial development changes with the level of human capital. In particular, Figure 2.3a shows the marginal effect of liquid liabilities (LLY) and Figure 2.3b depicts the marginal effect of market capitalization (CAP) along the various levels of human capital. Both figures show that the marginal effect of financial development on growth diminishes as human capital increases. These results indicate that the marginal effect of financial development is higher in countries with lower human capital and lower in countries with higher human capital.

I also compute the predicted growth rates implied by the estimates in the third column of the system GMM results. Here, all the control variables are evaluated at their means. The measures of human capital and financial development, on the other hand, are considered at their 25^{th}, 50^{th}, and 75^{th} percentile values. The results presented in Table 2.3, hence,

[1]For example, Bond (2002).



(a) (b)

Figure 2.3: Marginal Effect of Financial Development

show the predicted growth rates of countries at various quantiles of financial development and human capital, which allows me to see how the growth rates of countries would differ solely based on their levels of financial development and human capital.

Table 2.3: Predicted growth rates

		HC		
		Q25	Q50	Q75
CAP	Q25	2.35	2.68	3.13
	Q50	2.44	2.73	3.12
	Q75	2.65	2.83	3.08

The table shows that the predicted five year growth rate of a country with the 25^{th} percentile human capital and 25^{th} percentile market capitalization is 2.35%, with other variables held to their respective averages. The growth rate is higher for countries with both higher levels of human capital and financial development. As can be seen from the relative changes in magnitude of the predicted growth rates, the table shows that the effect of financial development is higher for countries with low levels of human capital than for high levels of human capital. The table also displays that while an increase in the level of human capital always has a positive effect on growth, an increase in financial development in countries with high levels of human capital decreases the growth rate, although the effect

is small. Finally, the table shows that countries that lack financial development can achieve economic growth through an increase in human capital.

The robustness of the results are tested using difference GMM. The results are similar to system GMM in that the coefficient estimates of human capital are positive for most specifications, and the interaction variables are negative and statistically significant across all specifications. Table 7 in Appendix .1.6 presents these results.

The system GMM for alternate measures of financial development using private credit (PRIVY) and market value (VALUE) are also used to check robustness of the results. These results, which are presented in Appendix .1.7, also show that the effect of financial development decreases with increasing levels of human capital.

2.5 Conclusion

In this paper, I analyze whether the effect of financial development depends on the level of human capital of a country in the growth process. I discuss two competing hypotheses on the role of the interaction of human capital and financial development in achieving growth. One argues that a country needs high levels of both human capital and financial development to attain high growth. The other postulates that an increase in human capital can make up for a lack of financial development, and hence the importance of financial development decreases with increasing human capital. I test to see which effect dominates.

Using panel data over the 1960-2009 time period and several different estimation techniques, I find that the effect of financial development on growth is lower for countries with high human capital and vice versa. This finding implies that countries that lack financial development can achieve greater economic growth through improvements in human capital. Many countries still have low levels of financial development which impede innovation and productivity. This study shows that the countries that do not have sound financial devel-

opment can still attain economic growth through investment in human capital. The result is both statistically and economically significant, and is robust across various definitions of financial development and estimation techniques.

Future studies can look at how the interaction of financial development and human capital would affect more proximate causes of growth, such as innovation or technological progress. The financial development literature consists of studies that analyze the relationship between financial development and total factor productivity but, to my knowledge, no studies have directly investigated the relationship between the interaction variable and the measures of technological progress. Exploring this type of association would allow us to better understand the channels through which financial development affects economic growth.

.1 Appendix A

.1.1 List of countries

Argentina
Armenia
Australia
Austria
Bahrain
Bangladesh
Belgium
Bolivia
Botswana
Brazil
Bulgaria
Canada
Chile
China
Colombia
Costa Rica
Cote d‘ Ivoire
Croatia
Czech Republic
Denmark
Ecuador
Egypt
El Salvador
Estonia
Finland
France
Germany
Ghana
Greece
Guatemala
Honduras
Hungary
India
Indonesia
Iran
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Korea, South (R)
Kuwait
Kyrgyzstan
Latvia
Lithuania
Malawi
Malaysia
Moldova, Rep. of
Mauritius
Mexico
Mongolia
Morocco
Nepal
Netherlands
New Zealand
Norway
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Romania
Russia
Saudi Arabia
Singapore
Slovak Republic
Slovenia
South Africa
Spain
Sri Lanka
Swaziland
Sweden
Switzerland
Tanzania, United Rep. of
Thailand
Trinidad &Tobago
Tunisia
Turkey
Uganda
United Kingdom
United States
Uruguay
Vietnam
Zambia

.1.2 Data

.1.3 Description and Sources

LLY	Currency plus demand and interest bearing liabilities of banks and other financial intermediaries divided by GDP. Source: Beck, Demirguc-Kunt, and Levine (2009)
BANK	Deposit money bank domestic assets divided by deposit money bank domestic assets plus central bank domestic assets. Source: Beck, Demirguc-Kunt, and Levine (2009)
CAP	Value of listed domestic shares on domestic exchange divided by GDP. Source: Beck, Demirguc-Kunt, and Levine (2009)
VALUE	Value of trades of domestic shares on domestic exchange divided by GDP. Source: Beck, Demirguc-Kunt, and Levine (2009)
HC	% of "higher school completed" of total population. Source: Barro and Lee (2010)
Real GDP per capita	Real GDP per capita (Constant Prices: Chain series) Source: Heston, Summers, and Aten (2011) (Penn World Tables 7.0)
GDP Growth	Difference in log GDP per capita at the end of a period and log GDP per capita at the beginning of a period. Source of Real GDP per capita: Heston, Summers, and Aten (2011) (Penn World Tables 6.3)
Initial GDP per capita	GDP per capita in 1960. Source: Heston, Summers, and Aten (2011) (Penn World Tables 7.0)
Inflation	Annual growth rate of the GDP implicit deflator. Source: World Development Indicators (2011)
Govt. Share	Government Share of Real GDP per Capita, current price. Source: Heston, Summers, and Aten (2011) (Penn World Tables 7.0)
Population Growth	Percentage change between end of the period and the beginning of the period. Source: World Development Indicators (2011)
Open	Sum of Real exports and imports as share of real GDP. Source: World Development Indicators (2011)

.1.4 Descriptive Statistics

Table 4: Summary Statistics

Variable	Observations	Q25	Q50	Q75	Mean	S.D.
LLY	372	30.124	48.336	71.245	55.498	32.819
CAP	372	8.443	23.072	56.080	41.346	47.603
PRIVY	371	21.790	37.254	70.358	49.978	38.981
VALUE	366	0.780	5.155	27.855	27.852	55.692

Table 5: Pairwise Correlations

	Growth	HC	LLY	CAP	PRIVY	VALUE	Pop Gr	Govt	Inv	Inf
HC	0.110	1.00								
LLY	-0.075	0.200	1.00							
CAP	-0.032	0.264	0.574	1.00						
PRIVY	-0.115	0.286	0.825	0.61	1.00					
VALUE	-0.075	0.277	0.457	0.754	0.567	1.00				
Pop. Gr.	-0.232	-0.468	-0.159	-0.078	-0.231	-0.133	1.00			
Govt.	0.046	0.168	-0.005	-0.096	-0.037	-0.037	-0.167	1.00		
Inv.	0.179	-0.005	0.267	0.159	0.187	0.089	0.184	-0.098	1.00	
Inf.	0.196	0.403	0.334	0.414	0.365	0.317	-0.244	0.039	0.059	1.00
OPEN	0.151	0.236	0.216	0.257	0.194	0.089	-0.047	0.173	0.249	0.315

Govt, Inv and Inf indicate Government share, investment and inflation respectively

.1.5 Robustness Check (I)

Table 6: POLS Results with PRIVY and VALUE

VARIABLES	(1)	(2)	(3)	(4)
Panel A:				
PRIVY	-0.0130***	-0.0020	-0.0132***	-0.0076
	(0.003)	(0.007)	(0.003)	(0.008)
VALUE	0.0026	0.0033*	0.0132**	0.0109**
	(0.002)	(0.002)	(0.005)	(0.005)
HC	0.0102	0.0357*	0.0240*	0.0333
	(0.012)	(0.021)	(0.014)	(0.021)
HC_PRIVY		-0.0005**		-0.0002
		(0.000)		(0.000)
HC_VALUE			-0.0003**	-0.0003*
			(0.000)	(0.000)
Initial	-0.6443***	-0.6756***	-0.6942***	-0.6972***
	(0.178)	(0.179)	(0.181)	(0.181)
Pop. Growth	-0.7043***	-0.6605***	-0.6897***	-0.6714***
	(0.147)	(0.146)	(0.146)	(0.147)
Govt. Share	-0.0409	-0.0351	-0.0428	-0.0394
	(0.043)	(0.042)	(0.042)	(0.042)
Inflation	0.0431***	0.0420***	0.0421***	0.0418***
	(0.009)	(0.010)	(0.009)	(0.010)
Open	0.0076***	0.0068***	0.0068***	0.0066***
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	4.5742***	4.3619***	4.8370***	4.6637***
	(1.657)	(1.618)	(1.676)	(1.648)
Observations	375	375	375	375
R-squared	0.241	0.248	0.250	0.251

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1; All variables are in percentages

.1.6 Robustness Check (II)

Table 7: Difference GMM Results

VARIABLES	(1)	(2)	(3)	(4)
Panel A:				
LLY	-0.0047	0.0367***	-0.0012	0.0181***
	(0.003)	(0.007)	(0.001)	(0.005)
CAP	0.0050***	0.0102***	0.0284***	0.0147***
	(0.002)	(0.001)	(0.001)	(0.003)
HC	-0.0295***	0.1332***	0.0201**	0.1296***
	(0.008)	(0.018)	(0.009)	(0.011)
HC_LLY		-0.0010***		-0.0009***
		(0.000)		(0.000)
HC_CAP			-0.0005***	-0.0002***
			(0.000)	(0.000)
L.LOG_rgdpch	-4.9869***	-8.6654***	-5.4626***	-8.5959***
	(0.242)	(0.291)	(0.222)	(0.307)
Pop. Growth	-0.6479***	-0.5200***	-0.6742***	-0.5475***
	(0.047)	(0.031)	(0.042)	(0.037)
Govt. Share	-0.0719***	-0.0204	-0.0441*	-0.0469
	(0.026)	(0.033)	(0.025)	(0.031)
Investment Share	0.1200***	0.1170***	0.1088***	0.1182***
	(0.006)	(0.007)	(0.005)	(0.007)
Inflation	0.0322***	0.0284***	0.0294***	0.0234***
	(0.002)	(0.003)	(0.003)	(0.002)
Open	0.0329***	0.0296***	0.0273***	0.0349***
	(0.002)	(0.002)	(0.002)	(0.003)
Observations	283	283	283	283
Number of cntry	84	84	84	84
AR(2)	0.465	0.218	0.494	0.181
Hansen test	0.804	0.421	0.992	0.687
Sargan test	0.0558	0.626	0.172	0.574
Number of instruments	86	86	113	95

Note: Estimates obtained using two-step difference GMM with Windmeijer correction. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
All variables are in percentages

.1.7 Robustness Check (III)

Table 8: System GMM Results with PRIVY and VALUE

VARIABLES	(1)	(2)	(3)	(4)
Panel A:				
PRIVY	-0.0146***	-0.0002	-0.0187***	-0.0180***
	(0.004)	(0.003)	(0.003)	(0.003)
VALUE	0.0030**	0.0047***	0.0202***	0.0163***
	(0.001)	(0.001)	(0.004)	(0.002)
HC	0.0295***	0.0744***	0.0463***	0.0438***
	(0.007)	(0.007)	(0.007)	(0.008)
HC_PRIVY		-0.0007***		-0.0001
		(0.000)		(0.000)
HC_VALUE			-0.0005***	-0.0004***
			(0.000)	(0.000)
L.LOG_rgdpch	-0.8453***	-0.8593***	-0.8582***	-0.8099***
	(0.219)	(0.074)	(0.152)	(0.125)
Pop. Growth	-0.8564***	-0.7974***	-0.8565***	-0.8362***
	(0.063)	(0.031)	(0.069)	(0.044)
Govt. Share	-0.0127	-0.0270	-0.0261	-0.0373**
	(0.030)	(0.020)	(0.028)	(0.016)
Investment Share	0.0725***	0.0767***	0.0712***	0.0827***
	(0.009)	(0.005)	(0.009)	(0.005)
Inflation	0.0345***	0.0318***	0.0310***	0.0327***
	(0.005)	(0.003)	(0.005)	(0.003)
Open	0.0051***	0.0050***	0.0054***	0.0054***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	5.1538***	4.5931***	5.5556***	4.8251***
	(1.833)	(0.600)	(1.306)	(1.136)
Observations	372	372	372	372
Number of cntry	88	88	88	88
AR(2)	0.726	0.778	0.675	0.716
Hansen test	0.251	0.372	0.216	0.223
Sargan test	0.189	0.413	0.322	0.454
Difference-in-Hansen	0.121	0.191	0.153	0.189
Number of instruments	63	82	63	80

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
All variables are in percentages

3

Analyzing the Effect of Currency Unions on Financial Development

3.1 Introduction

Events like the ongoing euro zone crisis have increased the importance of understanding how currency unions affect macroeconomic variables. The currency union literature focuses on the effect of currency unions on bilateral trade, price co-movements, and shock co-movements among member nations. The general finding is that currency unions increase bilateral trade and price co-movements among member nations. There is no conclusive evidence to support that currency unions lead to higher shock co-movements (Glick and Rose, 2002; Frankel and Rose, 2002; Barro and Tenreyro, 2007, among others). In this paper, I analyze the impact of currency unions on a country's financial development (the quality, quantity and efficiency of the financial system that is comprised of financial markets, banks and various other financial intermediaries). Since the empirical finance-growth literature finds a positive relationship between financial development and economic growth,[1] analyzing the relationship between currency unions and financial development allows me to explore additional channels through which currency unions affect an economy. To my knowledge, this relationship has not been studied in the literature.

A variable that is frequently mentioned in the currency union literature is international financial integration among member countries. International financial integration (IFI) is

[1] For example, King and Levine (1993); Levine and Zervos (1998); Benhabib and Spiegel (2000); and Rousseau and Vuthipadadorn (2005). See Levine (2005) for a survey study.

defined as a state where there are few restrictions on capital transactions. Guiso et al. (2004) define full integration as "a situation where availability of funds for any user located within the geographical boundaries [...] is unconstrained by the size of the local (national or regional) financial markets." Guiso et al. (2004) and Allen and Song (2005) show a positive correlation between the formation of a currency union and IFI. Although IFI can potentially positively affect financial development,[1] the effect of IFI on an economy is inconclusive.[2] To this effect, I account for IFI so as to explore direct channels through which currency unions affect financial development of a country.

In addition, I examine two types of asymmetries in estimating the impact of currency unions on financial development. First, given that the financial development literature utilizes several measures of financial development to capture various services provided by financial systems, I test if currency unions impact these measures differently. Second, I examine whether currency unions affect financial development of rich and poor countries differently.

Using data on 152 countries and territories over the 1970-2006 time period, I find that currency unions negatively affect the size of the overall financial systems but positively affect the liquidity of stock markets. These relationships between currency unions and financial development are robust to the inclusion of volume-based and equity-based measures of IFI of a country. This result suggests that the effect of a currency union goes beyond its effect on IFI, and that currency unions can affect financial development through channels other than IFI. Moreover, this paper finds strong asymmetric effects of currency unions on financial development of high-income and low-income countries. Although the coefficient estimate on the effect of currency unions on liquid liabilities is statistically insignificant on the full

[1] as argued by Levine (2002), for example.
[2] For example, Agenor (2003) and Mishkin (2007) discuss both the costs and benefits of IFI on an economy.

sample, I find the effect on liquid liabilities to be negative for high-income countries and positive for low-income countries. In contrast, the results indicate a negative relationship between currency unions and stock market liquidity for low income countries. The coefficient estimate for high-income countries, however, is statistically indistinguishable from zero.

The paper proceeds as follows: Section 4.2 discusses currency unions, international financial integration and financial development, and the predicted relationship between the variables. This section also discusses channels through which currency unions may affect a country's financial development. Section 3.3 presents the econometric specifications and describes the data utilized in the study. Section 4.5 presents and discusses results. Section 4.6 concludes.

3.2 Background on currency unions, international financial integration, and financial development

Many studies have analyzed the effect of forming or joining currency unions on various economic variables. Such studies have been timely given recent developments in international monetary arrangements. The Euro, which is the most well-known example of a currency union, is currently used by 17 Western European countries and is commonly used as a medium of exchange in international trade today. Other countries such as El Salvador, Guatemala, and Ecuador use the dollar as a legal tender; eight Eastern Caribbean countries have been using a common currency since 1983; six Central African countries and eight Western African countries have formed a CFA franc zone and use a common currency. There are a number of countries considering currency unions. For example, several Eastern European countries are contemplating unilateral adoption of the Euro as their legal tender; 11 members of the Southern African Development Community (SADC) are weighing the possibility of forming a currency union. According to Rose (2006), as of May 5, 2005, 52

out of 184 International Monetary Fund (IMF) member countries were participating in a currency unions.

Three economic variables that are frequently analyzed in relation to currency unions are bilateral trade, price co-movements and output co-movements among member nations. The general consensus in the literature is that the formation of currency unions increases both bilateral trade and price co-movement among the member countries. However, the evidence on the relationship between formation of currency unions and output co-movements is inconclusive.[1] The currency union literature often discusses IFI among the member nations. One way currency unions affect IFI is through decreases in exchange rate uncertainties. Lower exchange rate uncertainties promote capital flows across boundaries, which improves IFI between countries.

Even though economists generally agree that formation of a currency union leads to higher IFI, the effect of IFI on an economy is not clear. There are some studies that contend that IFI positively affects the economy, while others argue otherwise. Agenor (2003), for example, outlines several benefits of IFI. He argues that IFI increases consumption smoothing as a country can borrow in recessions and lend in expansions. IFI also increases domestic investment as households and firms have access to a larger pool of resources that is not limited to domestic savings. Bekaert et al. (2010) argue that financial liberalization (integration) improves the quality of institutions and promotes better corporate governance as foreign investors may require stronger institutions. Bonfiglioli (2008), using both de facto and de jure measures of IFI, shows that IFI positively affects country-level productivity. Similarly, Bekaert et al. (2010) show that IFI has both temporary and permanent effects on economic growth through its effect on factor productivity and capital accumulation.

[1] See Rose (2000); Rose and Engel (2002); Frankel and Rose (2002); Barro and Tenreyro (2007).

The other channel through which IFI affects an economy is by its effect on financial development.[1] Agenor (2003) argues that IFI increases the degree of banking system efficiency and financial stability, and hence promotes financial development. Bekaert et al. (2010) point out that higher IFI can spur both equity market efficiency and banking sector development. Higher IFI translates to increased foreign investments and ownership of assets in a home country which may lead to technological spillovers, increased competition, and regulatory oversight that positively affect a country's financial development (Bekaert et al., 2010). Similarly, Levine (2001) posits that increased competition due to foreign presence could put downward pressure on profit and overhead expenses, and promote efficiency through better supervision and regulation in the financial services.

While the aforementioned studies argue that IFI has a positive effect on the economy, there are others who are skeptical of its effect. For example, Mishkin (2007) argues that IFI may lead to fiscal imbalances which lead to a currency crisis and ultimately may turn into a fully fledged financial crisis. Agenor (2003) also mentions some of the costs associated with IFI. He argues that IFI increases concentration and volatility of capital flows that can lead to monetary imbalances and domestic misallocation of capital flows. Furthermore, he points out that the pro-cyclical nature of short term flows can negatively affect macroeconomic stability. Eichengreen and Leblang (2003) show that IFI has a positive effect only if financial openness benefits capital allocation and efficiency, and there are no domestic financial crises or distortions in the international financial market. Similarly, Bonfiglioli (2008) shows that IFI increases the chance of banking crises in developed countries, although he finds the net effect of IFI to be positive. Edison et al. (2002) conduct an extensive empirical study that analyzes the relationship between IFI and economic growth. They fail to find evidence in

[1]Finanacial development of a country is generally found to be positively correlated with higher economic growth (King and Levine, 1993; Levine, 2005, etc.).

favor of the hypothesis that IFI accelerates economic growth, casting some doubts on the role of IFI in promoting economic growth.

Given the uncertain effects of IFI on an economy, I analyze the direct effects of currency unions on the financial development of a country. Following the early works of Schumpeter (1911), numerous researchers have analyzed the relationship between financial development and growth. Apart from a few notable exceptions (Robinson, 1952; Lucas, 1988), the general consensus in the empirical literature is that a positive relationship between financial development and economic growth exists.[1] A significant effect of currency unions on financial development would imply that currency unions affect an economy through channels in addition to increasing bilateral trade and price co-movements among member countries. Analyzing the relationship between currency unions and financial development gives this study another dimension that has traditionally been overlooked in the literature.

Although currency unions affect IFI, it is not necessarily implied that they also affect financial development. In addition, some studies show that local financial development is vital for economic growth even when there are limited frictions to capital movements across borders. For example, using data on 103 provinces of Italy, Guiso, Sapienza, and Zingales (2004) demonstrate that local financial development plays an important role even in an integrated market where, in theory, the geographical boundaries should not matter. They find that financial development within a province increases the probability that one starts a business, and increases market entry and competition in the same province. Just as local financial institutions matter within a country, I argue that the national institutions matter within an internationally integrated financial system. A valuable policy implication can be deduced by examining the direct effects of currency unions on financial development rather

[1] For example, King and Levine (1993); Levine and Zervos (1998); Benhabib and Spiegel (2000); and Rousseau and Vuthipadadorn (2005). See Levine (2005) for a survey study.

than on IFI as financial development, unlike IFI, is more certain to have positive effect on growth.

3.2.1 How does forming (or joining) a currency union affect financial development of a country?

There are two competing hypotheses on how forming or joining currency unions may affect the financial development of a country. The objective of this paper is to empirically test these two competing hypotheses.

Forming or joining a currency union erases a large degree of exchange rate uncertainty. If an investor wants to invest somewhere outside a country but within the currency union, he/she does not have to worry about risks that are brought about by exchange rate fluctuations. A domestic market can entice investors from foreign markets with higher rates of return and not have the investors worry about uncertainties in real rates of return. Reduced exchange rate frictions that result in capital inflows could potentially promote a country's financial development.

It is also possible that the elimination of exchange rate uncertainties create an environment where the outflow of capital exceeds the inflow, thereby decreasing certain measures of financial development. With fewer exchange rate uncertainties and more flexibility in capital flows, funds may flow to countries that have good institutions and better laws that protect shareholders' and creditors' rights. Such an idea is advanced by LaPorta et al. (1998), who show that countries with better legal systems have more developed financial systems. Poor countries, on average, have inferior legal systems and hence tend to suffer from capital outflows which decrease the level of financial development.

While it is a valid argument, a counter argument could be made that countries with poor legal systems may benefit as they import financial regulations, accounting standards,

securities law, bank supervision and corporate governance of their richer currency union partners (Guiso et al., 2004). Furthermore, the firms in such financial systems may attain efficiency gains through increased competition as a larger number of firms compete against each other for funds in both domestic and foreign markets. Guiso et al. (2004) argue that competitive pressures from intermediaries reduce the cost of providing financial services to businesses and households, and hence make borrowing more affordable and lending more efficient.

The next section presents the empirical framework that is used to (1) estimate how currency unions affect financial development of a country, (2) analyze if currency unions affect various measures of financial development differently, and (3) examine if currency unions have asymmetric effect on financial development of high-income and low-income countries.

3.3 Methodology and Data

3.3.1 Estimating equation

The econometric specification to analyze the effect of currency unions on financial development takes the following functional form which is estimated using pooled OLS and fixed effects methodologies:[1]

$$f_{it} = \alpha + \gamma\, CU_{i,t} + \psi_t + \beta_1(open_{it}) + \beta_2(inflation_{it}) + \beta_3(income_{it}) + \beta_4(ifi_{it}) + \epsilon_{it} \quad (3.1)$$

where i and t index country and time respectively. f represents logs of various forms of financial development that are described in the next subsection. $CU_{i,t}$ is a dummy variable which, if unity, indicates that the country i has at least one currency union partner in

[1] A Hausman test is conducted in each instance a fixed effects model is used to ensure the appropriate use of fixed effects over random effects.

time t. ψ_t are the year-specific fixed effects which control for common shocks or trends across countries. The three other variables that are included in all specifications are the logs of trade openness ($open$), inflation ($inflation$), and real GDP per capita ($income$). These variables control for the time variant country-level factors that can potentially affect a country's financial development.[1]

As shown by Guiso et al. (2004) and Allen and Song (2005), currency unions facilitate IFI among countries. As this paper aims to estimate the direct effect of forming or joining currency unions on financial development rather than through an indirect channel via change in IFI, I control for IFI of a country. The log of various forms of international financial integration (ifi) in the equation captures this effect.

The causal relationship between financial development and income level of a country given the specification in the paper can potentially pose an endogeneity problem. One solution to such a problem is to use the initial value of income as opposed to contemporaneous values as the control variable. This method somewhat deals the endogeneity problems associated with the estimation, although according to Beck and Levine (2004), it results in efficiency and information loss. As a robustness check, I use initial income per capita of a country using the first available income measure of the country (1970 or later). The main findings of the paper, however, are unaltered with the modified specification.[2]

3.3.2 Data

The data include annual observations for 152 countries and territories, which are referred to as "countries" for simplicity. Appendix .1.1 lists the countries in the sample. The countries are observed for the years between 1970 and 2006.

[1] For example, as shown by Baltagi et al. (2009); Ang and McKibbin (2007); Calderon and Liu (2003); Boyd et al. (2001); Kim et al. (2010).

[2] The results, although not presented in the paper, are available from the author upon request.

Currency Union data

The data for currency unions are obtained from Rose and Spiegel (2011). In their paper, Rose and Spiegel treat "common currencies," "monetary unions" and "currency unions" alike and hence this paper applies the same definition of currency union. Here, two countries are in a currency union if "money was interchangeable between the two countries at a 1:1 par for an extended period of time, so that there was no need to convert prices when trading between a pair of countries" (Rose and Spiegel, 2011). Out of 152 countries in the data set, 28 countries have always been a part of a currency union whereas 97 countries are never a part of any currency unions. The remaining 27 countries are sometimes in and sometimes out of a currency union.

The data set used in the paper contains many "anchor-client" relationships. "Anchors" are high-income countries with a sound record of low and stable inflation (for example, the United States) whose currencies are adopted by relatively lower-income "client" countries (El Salvador, for example) (Alesina and Barro, 2002). The anchors do not expend much resources to maintain currency unions they have with clients where clients may unilaterally adopt a currency of an anchor as a legal tender. Barro and Tenreyro (2007) identify six countries as anchor countries; they are Australia, France, Germany, Japan, the United Kingdom, and the United States. As a robustness check, I exclude the anchors from the analysis to verify that the large anchors are not driving the results.[1]

Further, I conduct a robustness check analysis by dropping the Economic and Monetary Union of the European Union (EMU) countries from the sample. The EMU is different than other currency unions in that EMU is the largest currency union, and is comprised of mostly high-income countries. This method ascertains that results indicate the effect of

[1]France and Germany are considered as anchors only in the pre-Euro time period in this paper.

currency unions on a country's financial development is not masked by EMU's effect.

Indicators of financial development

I use four different variables as the indicators of financial development. These variables capture varied services provided by the financial systems.[1] Here, the two variables are used as the main proxies of financial development, and the other two are used to check the robustness of the results. The first measure, which is referred to as liquid liabilities (LLY) is measured as the ratio of the size of the formal financial intermediary sector (M3) relative to the GDP of a country. King and Levine (1993) use this measure of "financial depth" in their seminal paper in the empirical financial development-growth study, and argue that the size of financial systems is positively related to the services provided.

The second measure of financial development, market liquidity (STLIQ) is computed as the value of the trades of domestic shares on domestic exchanges divided by GDP. Levine and Zervos (1998), among several other studies, use this variable as a measure of financial development. Levine and Zervos point out that higher market liquidity indicates higher efficiency and lower transaction costs, which may not be captured by the size of a stock market.

The two other measures of financial development that are used as robustness checks are stock market size and private credit. Market capitalization (STCAP) captures the size of the stock market relative to economic activity. This measure is computed as ratio of the total value of listed domestic shares (capitalization) on domestic exchanges to GDP. Levine and Zervos (1998) point out that large stock markets may not necessarily be efficient, but can provide additional services that small markets cannot. Private credit (PRIVY) is the other measure of financial development and captures the part of mobilized savings that

[1]For example, Rajan and Zingales (1998a), Boot and Thakor (1997) and Levine (2002).

is channeled to private firms. This measure excludes credit to the government sector and credit by the central bank. Private credit measure is computed as a ratio of credit to private sector by private sector banks to GDP.

The data for all the financial development variables are obtained through Beck, Demirguc-Kunt, and Levine (2009).

Control variables

The two measures of IFI that are commonly used in the literature are utilized in the paper.[1] The first measure is a volume-based measure of financial openness which is computed as the ratio of the sum of foreign assets and foreign liabilities to GDP. This measure is referred to as IFIGDP.[2] The second measure of IFI that is adopted in this study is an equity-based measure, which is computed as the ratio of the sum of portfolio and FDI assets and portfolio and FDI liabilities to GDP. This second measure is referred to as GEQGDP.[3] The data for these measures of IFI are obtained from Lane and Milesi-Ferretti (2007).

In addition to IFI variables, I include measures of trade openness (OPEN), inflation (INFLATION) and real GDP per capita (INCOME) of a country as control variables. These variables control for some of the country-specific time-variant effects that can potentially affect a country's financial development (Baltagi et al., 2009; Ang and McKibbin, 2007; Calderon and Liu, 2003; Boyd et al., 2001; Kim et al., 2010).[4] The sum of imports and exports of a country as a share of GDP is used as the measure of openness. Consumer price index is used as the measure of inflation. The data for trade openness and inflation are obtained from World Development Indicators (2010). The data for income per capita of

[1] These measures are used by Edison et al. (2002), Baltagi et al. (2009), Bonfiglioli (2008) etc.
[2] $\text{IFIGDP}_{it} = (FA_{it} + FL_{it})/GDP_{it}$
[3] $\text{GEQGDP}_{it} = (PEQA_{it} + FDIA_{it} + PEQL_{it} + FDIL_{it})/GDP_{it}$
[4] Baltagi et al. (2009) show the relationship between trade openness and financial development. Similarly, Calderon and Liu (2003), and Ang and McKibbin (2007), among others, show that a country's income affects financial development. Boyd et al. (2001) and Kim et al. (2010) find a correlation between inflation and financial development.

countries are obtained from Heston, Summers, and Aten (2011) (Penn World Tables 7.0).

The purpose of this study is not only to test how currency unions affect financial development but also to examine whether currency unions affect financial development differently based on a country's level of income. To investigate this, I classify countries as high-income and low-income countries using the median level of income as the threshold value. The median level of income per capita in the data set is $5,186, which is approximately the income of Malaysia in 1988.

Table 3.1 reports key summary statistics for all of the variables. The table shows that countries that are in currency unions tend to have higher level of financial development than the ones not in a currency union. The difference in stock market measures is especially noticeable. The countries in currency unions are also richer, tend to be more open, have lower inflation and are more financially integrated. The ANOVA tests reveal that means of each of the variables are statistically different for the two income groups.[1] Table 6 in Appendix 4.3 shows pairwise correlations between the variables for all countries. Table 7 provides pairwise correlations between the variables for countries in a currency union, and Table 8 shows pairwise correlations between the variables for countries that are not in a currency union.

3.4 Results

To examine the effect of currency unions on the overall financial system, Table 3.2 presents the results with liquid liabilities as a measure of financial development. Here, the regression specifications include contemporaneous measures of income and volume-based measure of international financial integration (IFIGDP) as control variables, among others. The regressions using initial income and equity-based measure of financial integration

[1] The results are not reported in the paper but are available upon request from the author.

Table 3.1: Summary Statistics

Variable	Currency Union			Not in Currency Union		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
LLY	995	0.49	0.38	2781	0.44	0.33
STLIQ	308	0.48	0.57	1435	0.15	0.37
STCAP	295	0.76	0.56	1336	0.32	0.48
PRIVY	991	0.43	0.35	2752	0.32	0.30
OPEN	995	91.71	68.59	2781	71.64	39.08
INFLATION	991	6.06	10.13	2754	30.27	311.12
IFIGDP	995	3.48	15.60	2781	1.47	4.62
GEQGDP	995	1.31	8.86	2717	0.38	1.63
INCOME*	995	11.24	13.65	2781	8.71	9.50

*Income measured in thousands of dollars

(GEQGDP), although not presented, yield qualitatively similar results.

I begin by estimating the effect of currency unions on liquid liabilities using pooled OLS (POLS) estimation. Column (1) of Table 3.2 presents the result of the baseline specification. Here, all the control variables have statistically significant effect on liquid liabilities. The results imply that being a member of a currency union is negatively correlated with liquid liabilities. In column (2), I include the volume-based measure of IFI in the regression. This measure of IFI is found to have a positive effect on liquid liabilities. Even after controlling for IFI, the coefficient on the currency union variable remains negative and statistically significant. This suggests that currency unions affect liquid liabilities through additional channels than IFI. The POLS results suggest that belonging to a currency union reduces liquid liabilities by as much as about 11.7%, all other things equal.[1]

In columns (3) and (4) of Table 3.2, I use the fixed effects methodology to estimate the

[1]From column (2), exp(-0.124)-1=-11.7%

Table 3.2: Currency Unions and Liquid Liabilities (I)

VARIABLES	(1) POLS	(2) POLS	(3) FE	(4) FE
CU	-0.066***	-0.124***	-0.021	-0.045
	(0.0208)	(0.021)	(0.052)	(0.055)
inflation	0.132***	0.166***	-0.051	-0.022
	(0.0104)	(0.010)	(0.036)	(0.038)
open	0.096***	-0.009	0.107**	0.096*
	(0.017)	(0.0183)	(0.052)	(0.056)
income	0.297***	0.267***	0.204*	0.218*
	(0.007)	(0.007)	(0.119)	(0.118)
ifi		0.291***		0.127**
		(0.022)		(0.061)
Constant	2.319***	2.611***	2.680***	2.610***
	(0.080)	(0.084)	(0.259)	(0.263)
Observations	3,917	3,776	3,917	3,776
R-squared	0.451	0.474	0.265	0.265
No. of countries			152	148

Note: Dependent variable: Log of liquid liabilities. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

effect of currency unions on liquid liabilities. The results show that the effect of currency unions on liquid liabilities, while still negative, is statistically indistinguishable from zero, with or without the inclusion of IFI. These results suggest that forming or joining a currency union does not have statistically significant effect on liquid liabilities once the time-invariant country characteristics are taken into consideration.

Next, I split the sample into high-income and low-income countries to investigate whether currency unions affect financial development differently based on the level of income.[1] Table 3.3 presents the fixed effects results which demonstrate a strong asymmetric effect of currency unions on liquid liabilities. Accounting for the control variables from Table 3.2, the results display that currency unions reduce liquid liabilities of high-income countries

[1] I also test whether it matters if the currency union is with a "rich" country, defined as countries in top income quartile. The fixed effects results indicate that forming currency unions with a richer country does not exert additional effect on the financial development of a country.

Table 3.3: Fixed Effects: Currency Unions and Liquid Liabilities (II)

VARIABLES	(1) High-income	(2) Low-income
CU	-0.122*	0.139*
	(0.062)	(0.073)
inflation	-0.042	0.026
	(0.042)	(0.071)
open	-0.169	0.125*
	(0.105)	(0.066)
income	0.323**	0.362***
	(0.125)	(0.118)
ifi	0.114	0.215**
	(0.081)	(0.107)
Constant	3.666***	2.141***
	(0.487)	(0.218)
Observations	1,832	1,944
R-squared	0.317	0.285
No. of countries	87	87

Note: Dependent variable: Log of liquid liabilities. High-income countries have income of more than $5,186. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

by about 11.5%.[1] In contrast, I find that currency unions improve liquid liabilities of low-income countries by about 14.9%.[2] A Chow test on the coefficients of the currency union variable of the two regressions show that the coefficients are statistically different from one another for two income groups. The low-income countries perhaps benefit from efficiency gains where they import better accounting standards and financial regulations that promote financial development of the countries. The statistical significance (at 10% level) of the results with the split sample suggest that the statistically insignificant coefficient on the full-sample estimation may be due to nonlinear effects based on income levels.

For the control variables, Table 3.3 reports that both trade openness and IFI have different effect on liquid liabilities based on the income levels of countries. The results show that trade openness and IFI do not have statistically significant effect on financial development

[1] exp(-.0122)-1=11.5%
[2] exp(0.139)-1=14.9%

of high-income countries. However, both the variables are positively and statistically significantly correlated with liquid liabilities of low-income countries. The results, hence, reveal that trade openness and IFI matter in affecting liquid liabilities of low-income countries, but not of high-income countries. However, a Chow test on the coefficients fails to show that coefficients on openness and IFI are statistically different between the two regressions.[1]

Another form of asymmetry this paper examines is if currency unions have different effect on various forms of financial development. To this end, I employ a measure of stock market liquidity which captures stock market efficiency. Tables 3.4 and 3.5 present these results. As with liquid liabilities, I begin by estimating the effect of currency unions on market liquidity using POLS. Column (1) of Table 3.4 presents the results of the baseline specification. Unlike for liquid liabilities, the results show that currency union have positive effect on market liquidity. The results hold when IFI is included in the specification as shown in column (2). This result supports the finding in Table 3.2 that currency unions affect financial development through channels other than IFI. Further, the effect of currency unions is economically large; the results show that currency unions cause as much as about 130.2% increase in market liquidity of a country, all other things equal.[2] Using fixed effects methodology, however, dismisses the statistical significance of the results, as it does when liquid liabities is used.

Next, using the median level of income to split the sample, I analyze if there exists an asymmetric effect of currency unions on financial development. Table 3.5 presents the fixed effects results which again exhibit some asymmetry in the effect of currency unions on market liquidities. For the control variables, the results show that the effect of IFI on financial development varies based on the income level of the countries. The coefficient esti-

[1] Note, however, that the Chow test show that coefficients of the two income groups are jointly statistically different from one another.

[2] exp(0.834)-1 = 130.2%

Table 3.4: Currency Unions and Stock Market Liquidity (I)

VARIABLES	(1) POLS	(2) POLS	(3) FE	(4) FE
CU	0.864***	0.834***	0.150	-0.0276
	(0.131)	(0.139)	(0.258)	(0.245)
inflation	0.275***	0.281***	0.054	0.101
	(0.072)	(0.073)	(0.134)	(0.135)
open	-0.524***	-0.468***	-0.089	-0.262
	(0.090)	(0.105)	(0.379)	(0.401)
income	0.974***	1.004***	1.378***	1.524***
	(0.047)	(0.051)	(0.488)	(0.502)
ifi		-0.055		0.778**
		(0.122)		(0.373)
Constant	-0.520	-1.040	-3.616**	-3.750**
	(0.648)	(0.646)	(1.503)	(1.513)
Observations	1,768	1,743	1,768	1,743
R-squared	0.365	0.374	0.510	0.522
No. of countries			109	106

Note: Dependent variable: Log of stock market liquidities. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

mate on IFI for high-income countries is positive and statistically significant. The coefficient estimate for low-income countries, on the other hand, although positive, is not statistically significant. A Chow test, however, reports that these coefficient estimates are not statistically different for two income groups. The results also indicate that while the coefficient estimate on the currency union variables is not statistically significant for the high-income countries, it is statistically and economically significant for the low-income countries. The results show that currency unions reduce market liquidities of a low-income country by as much as about 70.2%, holding all else constant including IFI.[1] Although the Chow test on the currency union variable coefficients fails to prove that two estimates are statistically different for the two income groups, the test provides overwhelming evidence to support that the coefficients are jointly significantly different for two groups.

[1] exp(-1.212)-1 = -70.2%

Table 3.5: Fixed Effects: Currency Unions and Stock Market Liquidity (II)

VARIABLES	(1) High	(2) Low
CU	0.062	-1.212**
	(0.274)	(0.508)
inflation	0.023	0.113
	(0.177)	(0.196)
open	0.289	-0.807
	(0.551)	(0.657)
income	1.683**	2.532***
	(0.820)	(0.929)
ifi	1.027**	0.818
	(0.480)	(0.863)
Constant	-7.054**	-1.898
	(3.012)	(2.191)
Observations	1,138	605
R-squared	0.535	0.584
No. of countries	75	46

Note: Dependent variable: Log of stock market liquidities. High-income countries have income of more than $5,186. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The robustness of the results is tested using market capitalization and private credit as the measures of financial development. Tables 9 and 10 in Appendix .1.4 present these results. The results show that, with POLS estimation, both these measures of financial development are positively related with the currency union variable even when a measure of IFI in included in the regression. The fixed effects estimation, however, removes the statistical significance of the results. Additionally, as a robustness check, Tables 11 and 12 present the results without the "anchor" countries and without the EMU countries respectively in the regressions.[1] The results ascertain that the relationship between currency unions and financial development is neither driven by large countries that are parts of currency unions nor by the largest currency union.

[1]Only the results with liquid liabilities as the dependent variable are presented in the paper.

3.5 Conclusion

Forming or joining a currency union is thought to have a positive impact on international financial integration (IFI), but the effect of IFI on an economy is inconclusive. In this paper, I examine how forming or joining a currency union affects a country's financial development. There are competing hypotheses on currency unions might affect a country's financial development. Currency unions erase a large degree of exchange rate uncertainty and make it easier for countries to import better laws and regulations of other currency unions members. These two factors may improve a country's financial development. On the other hand, investors may easily transfer funds to countries with better institutions and laws that protect shareholders' and creditors' rights, which would decrease a country's financial development. This paper tests if one hypothesis offsets the other.

This paper also tests for two forms of asymmetries. First, using different measures of financial development that capture various services provided by the financial system, I examine if currency unions affect different measures of financial development differently. Second, I analyze if high-income and low-income countries are impacted differently by currency unions. As the economic growth literature finds a positive correlation between financial development and growth, analyzing the relationship between currency unions and financial development allows me to explore channels other than trade and price co-movements through which currency unions affect an economy.

Using data on 152 countries and territories over the 1970-2006 time period, I find that currency unions negatively affect the size of the overall financial systems (liquid liabilities) but positively affect the liquidity of stock markets. I find these results using pooled OLS. The results clearly indicate that currency unions affect the two forms of financial development differently. These relationships between currency unions and financial development

are robust to the inclusion of volume-based and equity-based measures of a country's IFI. These results suggest that the effect of a currency union goes beyond its effect on IFI. The results are also robust to the exclusion of "anchor" countries, and the members of Economic and Monetary Union of the European Union (EMU) which certify that the results are not driven by large currency union members and the largest currency union.

Moreover, this paper finds a strong asymmetry in the effect of currency unions on financial development of high-income and low-income countries. The coefficient estimate on belonging to a currency union is statistically insignificant for its effect on liquid liabilities on the full sample. However, I find the effect on liquid liabilities to be negative and statistically significant for high-income countries, and positive and statistically significant for low-income countries. The results suggest that the low-income countries find it easy to import financial regulations, and other standards and regulations of their richer currency union partners which, in effect, increases the funds flowing in through various forms such as long-term deposits. This effect helps improve the financial depth of a country. In contrast, the results indicate a negative relationship between currency unions and stock market liquidity for low income countries. The coefficient for high-income countries, however, is statistically indistinguishable from zero. Since the effect on high-income countries is not statistically significant, the results suggest that it is not that funds flow from low-income countries to high-income countries, but perhaps that other forms of financial development improves at the cost of declining stock market efficiency in the low-income countries.

Barro and Tenreyro (2007) criticize the use of currency union indicator variable as given as it treats the formation of monetary arrangements as random assignments. The estimation produces biased coefficient estimates, according to Barro and Tenreyro, because of the endogeneity problems. I, however, argue that the critique is not valid for this study.

The currency union literature finds a robust correlation between formation of currency unions and trade growth. Studies additionally show that currency unions, although reduce monetary policy flexibility, improve price and business cycle stability if the union is formed with a country that has stable currency and has similar business cycle patterns (Alesina and Barro, 2002; Rose and Engel, 2002, among others). It is easy to conceive that currency unions are primarily formed for these reasons, but not to boost financial development. Nonetheless, an avenue for future research would be to identify exogenous components of currency union, as Barro and Tenreyro advocate, and use them as instruments to examine how a currency union affects a country's financial development.

.1 Appendix B

.1.1 List of countries

Albania
Algeria
Angola
Argentina
Armenia
Australia
Austria
Bahamas
Bahrain
Bangladesh
Barbados
Belgium
Belize
Benin
Bhutan
Bolivia
Botswana
Brazil
Brunei
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Canada
Cape Verde
Central African Rep.
Chad
Colombia
Congo,Dem. Rep.
Congo, Republic
Costa Rica
Croatia
Czech Republic
Côte d'Ivoire
Denmark
Dominica
Dominican Rep.
Ecuador
Egypt
El Salvador
Equatorial Guinea
Estonia
Ethiopia
Fiji
Finland
France
Gabon
Gambia, The
Georgia
Germany
Ghana
Greece
Grenada
Guatemala
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong
Hungary
Iceland
India
Indonesia
Iran
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Korea, Rep.
Kuwait
Kyrgyzstan
Laos
Latvia
Lesotho
Libya
Lithuania
Luxembourg
Macao
Macedonia
Madagascar
Malawi
Malaysia
Mali
Mauritania
Mauritius
Mexico
Moldova
Mongolia
Morocco
Mozambique
Nepal
Netherlands
New Zealand
Niger
Nigeria
Norway
Oman
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Romania
Russia
Rwanda
Samoa
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
South Africa
Spain
Sri Lanka
St. Kitts & Nevis
St. Lucia
St.Vincent & Gren.
Sudan
Suriname
Swaziland
Sweden
Switzerland
Syria
Tanzania
Thailand
Togo
Tonga
Trinidad & Tobago
Tunisia
Turkey
Uganda
United Kingdom
United States
Uruguay
Vanuatu
Venezuela
Vietnam
Yemen
Zambia
(152)

.1.2 Description and Sources

LLY	Currency plus demand and interest bearing liabilities of banks and other financial intermediaries dividend by GDP. Source: Beck, Demirguc-Kunt, and Levine (2009)
STLIQ	Value of trades of domestic shares on domestic exchange divided by GDP.Source: Beck, Demirguc-Kunt, and Levine (2009)
STCAP	Value of listed domestic shares on domestic exchange divided by GDP. Source: Beck, Demirguc-Kunt, and Levine (2009)
PRIVY	Credit to private sector by private sector banks divided by GDP. Source: Beck, Demirguc-Kunt, and Levine (2009)
IFIGDP	Sum of foreign assets and foreign liabilities divided by GDP. Source: Lane and Milesi-Ferretti (2007)
GEQGDP	Sum of portfolio equity assets and liabilities, and foreign direct investment assets liabilities divided by GDP. Source: Lane and Milesi-Ferretti (2007)
INCOME	Real GDP per capita: PPP Converted GDP Per Capita (Chain Series), at 2005 constant prices. Measure in thousand if US $'s. Source: Heston et al. (2011)
CU	Rose and Spiegel (2011)
INFLATION	Consumer price index (2005 = 100). Source: World Development Indicators (2011)
OPEN	Sum of real exports and imports as share of real GDP. Source: World Development Indicators (2011)

.1.3 Pairwise Correlations

Table 6: Pairwise Correlation for all countries

	LLY	STLIQ	STCAP	PRIVY	OPEN	INFLATION	IFIGDP	GEQGDP
STVAL	0.367	1						
STCAP	0.620	0.740	1					
PRIVY	0.783	0.538	0.632	1				
OPEN	0.365	0.182	0.477	0.260	1			
INFLATION	-0.064	-0.037	-0.054	-0.056	-0.027	1		
IFIGDP	0.491	0.033	0.247	0.212	0.296	-0.007	1	
GEQGDP	0.457	0.025	0.227	0.187	0.261	-0.008	0.968	1
INCOME	0.597	0.490	0.550	0.666	0.224	-0.036	0.343	0.316

Table 7: Pairwise Correlation for Countries in Currency Unions

	LLY	STLIQ	STCAP	PRIVY	OPEN	INFLATION	IFIGDP	GEQGDP
STVAL	0.070	1						
STCAP	0.430	0.658	1					
PRIVY	0.776	0.300	0.402	1				
OPEN	0.433	-0.027	0.462	0.336	1			
INFLATION	-0.200	-0.148	-0.135	-0.214	-0.069	1		
IFIGDP	0.630	-0.122	0.196	0.235	0.298	-0.035	1	
GEQGDP	0.623	-0.112	0.198	0.217	0.267	-0.033	0.982	1
INCOME	0.624	0.381	0.466	0.651	0.224	-0.109	0.416	0.392

Table 8: Pairwise Correlation for Countries not in Currency Unions

	LLY	STLIQ	STCAP	PRIVY	OPEN	INFLATION	IFIGDP	GEQGDP
STVAL	0.421	1						
STCAP	0.639	0.742	1					
PRIVY	0.790	0.556	0.635	1				
OPEN	0.331	0.238	0.459	0.185	1			
INFLATION	-0.071	-0.031	-0.048	-0.059	-0.028	1		
IFIGDP	0.462	0.123	0.305	0.219	0.295	-0.005	1.000	
GEQGDP	0.488	0.165	0.370	0.243	0.329	-0.013	0.972	1
INCOME	0.587	0.456	0.506	0.675	0.208	-0.041	0.277	0.294

.1.4 Robustness Checks

Table 9: Currency Unions and Stock Market Capitalization (I)

VARIABLES	(1) POLS	(2) POLS	(3) FE	(4) FE
CU	0.678***	0.539***	0.063	-0.027
	(0.062)	(0.068)	(0.145)	(0.141)
inflation	0.154***	0.164***	0.229*	0.230**
	(0.054)	(0.050)	(0.118)	(0.102)
open	0.224***	-0.007	0.091	0.108
	(0.049)	(0.058)	(0.288)	(0.278)
income	0.449***	0.359***	1.507***	1.584***
	(0.027)	(0.028)	(0.456)	(0.467)
ifi		0.476***		0.394*
		(0.059)		(0.217)
Constant	-0.102	0.619**	-1.882*	-2.319**
	(0.274)	(0.293)	(0.996)	(0.951)
Observations	1,695	1,674	1,695	1,674
R-squared	0.401	0.423	0.566	0.576
No. of countries			111	109

Note: Dependent variable: Stock market capitalization. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 10: Currency Unions and Private Credit (I)

VARIABLES	(1) POLS	(2) POLS	(3) FE	(4) FE
CU	0.178***	0.131***	0.136*	0.103
	(0.024)	(0.026)	(0.077)	(0.075)
inflation	0.143***	0.162***	-0.085**	-0.046
	(0.012)	(0.013)	(0.043)	(0.046)
open	0.087***	0.020	0.214**	0.177
	(0.019)	(0.023)	(0.107)	(0.114)
income	0.482***	0.462***	0.416**	0.441**
	(0.008)	(0.009)	(0.207)	(0.205)
ifi		0.204***		0.244***
		(0.029)		(0.089)
Constant	1.596***	1.772***	1.511***	1.469***
	(0.101)	(0.112)	(0.525)	(0.532)
Observations	4,039	3,876	4,039	3,876
R-squared	0.534	0.536	0.231	0.239
No. of countries			154	150

Note: Dependent variable: Private credit. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11: Currency Unions and Liquid Liabilities (III): Without anchor countries

VARIABLES	(1) POLS	(2) POLS	(3) FE	(4) FE
CU	-0.073***	-0.125***	-0.029	-0.055
	(0.023)	(0.023)	(0.054)	(0.057)
inflation	0.112***	0.144***	-0.056	-0.025
	(0.011)	(0.010)	(0.037)	(0.039)
open	0.169***	0.0659***	0.117**	0.106*
	(0.018)	(0.019)	(0.052)	(0.056)
income	0.275***	0.247***	0.203*	0.217*
	(0.007)	(0.007)	(0.120)	(0.118)
ifi		0.277***		0.131**
		(0.022)		(0.062)
Constant	2.085***	2.377***	2.617***	2.548***
	(0.084)	(0.0879)	(0.256)	(0.261)
Observations	3,752	3,611	3,752	3,611
R-squared	0.438	0.456	0.264	0.264
No. of countries			148	144

Note: Dependent variable: Private credit. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Anchor countries: Australia, France, Germany, Japan, the United Kingdom, the United States.

Table 12: Currency Unions and Liquid Liabilities (IV): Without EMU countries

VARIABLES	(1) POLS	(2) POLS	(3) FE	(4) FE
CU	-0.087***	-0.136***	0.006	-0.001
	(0.022)	(0.022)	(0.059)	(0.0628)
inflation	0.136***	0.168***	-0.054	-0.024
	(0.011)	(0.010)	(0.037)	(0.039)
open	0.099***	-0.005	0.109**	0.096*
	(0.017)	(0.018)	(0.052)	(0.056)
income	0.292***	0.264***	0.201*	0.218*
	(0.007)	(0.007)	(0.120)	(0.119)
ifi		0.291***		0.146**
		(0.022)		(0.068)
Constant	2.317***	2.602***	2.662***	2.583***
	(0.080)	(0.0846)	(0.258)	(0.261)
Observations	3,836	3,695	3,836	3,695
R-squared	0.439	0.460	0.259	0.260
Number of cc			152	148

Note: Dependent variable: Private credit. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4

Financial Development, External Dependence and the Margins of Trade: A Firm-level Analysis

4.1 Introduction

A country's financial development is widely acknowledged to be an important determinant of international trade patterns. Several augmentations of the standard trade models include services provided by financial systems which are found to be critical in affecting exports. For example, in the extensions of the Heckscher-Ohlin trade framework, financial development is shown be a source of comparative advantage in industries that depend more on external finance (Kletzer and Bardhan, 1987).[1] Similarly, in the "New New trade theory" framework, financial development is demonstrated to explain the variance of trade in the presence of liquidity constraints (Melitz, 2003; Chaney, 2005). A number of empirical studies have followed to analyze the role of financial development in affecting trade flows. These studies generally ascertain the positive role of financial development on exports (Beck, 2002; Berman and Héricourt, 2010, among others).

As firms face trade barriers in their exporting activities such as fixed sunk-costs and variable trade costs, firm-level exports studies have focused on firm's financial constraints to explain exports (Chaney, 2005; Berman and Héricourt, 2010; Greenaway et al., 2007, among others). A firm must meet fixed sunk-costs in order to export to a foreign market and hence

[1] Rajan and Zingales (1998a) define external dependence as "the difference between investments and cash generated from operations."

fixed costs affect the decision to export. Variable costs, on the other hand, constrain how much a firm exports. Given the presence to two different types of costs associated with exports, the trade literature increasingly divides firm's export decisions into the extensive margin (the probability of exporting) and the intensive margin (the volume of exports) of trade. I examine if financial development facilitates firms to cover their fixed and variable costs proportionately with the provision of funds given their dependence on external finance. Put differently, I analyze if a country's financial development has heterogeneous effect on the two margins of trade.

In their influential paper, Rajan and Zingales (1998a) estimate the overall industry-level dependence on external finance. Furthermore, Rajan and Zingales argue that young and mature firms have different level of dependence on external finance as most firms rely on initial public offerings for funds early in their lives. As this trend is consistent in different industries, Rajan and Zingales further devise an age-based measure of dependence on external finance for young and mature firms in different industries.[1] Utilizing the alternate measure of external dependence, I examine whether financial development affects exports of young and mature firms differently.[2] Incorporating such a differentiated measure allows me to consider an additional source of firm heterogeneity that has not been studied in the literature.

Financial development implies deepening and/or widening of credit markets. A deepening of credit market is where a firm has an easier access to additional credit, and widening credit market is where more firms have increased access to external finance. A deep and a wide credit market would positively affect firms' both extensive and intensive margins of

[1] Rajan and Zingales (1998a) classify young firms as those that are listed for less than 10 years.

[2] Studies such as Beck (2002) and Berman and Héricourt (2010) that use Rajan and Zingales' (1998a) measure of external dependence do not exploit that fact that Rajan and Zingales provide separate measures of external dependence for young and mature firms.

trade as financially constrained firms find it easier to finance their fixed and variable trade costs (Chaney, 2005). While deepening and widening of credit markets enhance exports, financial development can disproportionately benefit certain firms if financial development only deepens the credit market. A deep but narrow financial system implies that certain firms have easy access to additional credit, whereas others find it difficult to finance their costs. I examine if firm age is the defining characteristics of firms based on which financial development has the heterogeneous effect on different firms.

This paper utilizes firm-level data of approximately 43,500 firms from 80 countries that vary significantly in their income levels for the 2002-2009 time period. Using an instrumental variable approach, I find that the overall industry-level measure of dependence on external finance negatively influences both the export market participation and the volume of exports. The results also show that a country's financial development negatively affects the export market participation and positively affects the volume of exports. Further, I find that financial development disproportionately benefits firms with higher level of external dependence. For both margins of trade, the results indicate that financial development helps firms with higher levels of external dependence more than the ones with lower levels in their exporting activities. Finally, while I find that young and mature firms are affected differently by financial development on their export participations, such asymmetry is not shown by the results on the volume of exports. These findings assert that examining the impact of financial development using the overall industry-level measure of external dependence may mask an important asymmetric effect of financial development on young and mature firms' margins of trade.

The remainder of the paper is organized as follows. Section 4.2 discusses the related literature. Section 4.3 discusses the data utilized in the study. Section 4.4 presents the

econometric methodologies and discusses the potential endogeneity problem in estimating exports with financial development. Section 4.5 presents and discusses results. Section 4.6 concludes.

4.2 Background Literature

The studies in the finance-trade nexus largely follow two strands of literature. One views financial development as a source of comparative advantage, which makes engaging in exports profitable to firms. A theoretical model developed by Kletzer and Bardhan (1987) falls into this category. Kletzer and Bardhan show that countries with fewer credit market frictions have comparative advantage in industries and sectors that rely more on external finance. Countries with high credit market frictions, on the other hand, specialize in industries and sectors that do not require as much external finance. Beck (2002) builds on this model and shows that countries with high levels of financial development have comparative advantage in sectors with high scale economies. Beck shows that the firms in a well-developed financial system can better utilize financial services to exploit scale economies, and hence the country becomes the net exporter of goods that exhibit increasing returns to scale in production. While this paper by Beck is a cross-country study, he confirms his findings with a follow-up cross-industry study. Using the industry measure of external dependence as formulated by Rajan and Zingales (1998a), Beck (2003) demonstrates that countries with high levels of financial development have larger export shares in industries that show higher dependence on external finance.

In contrast to the literature that supports the notion that financial development of a country provides comparative advantage to firms, the second strand in the literature comes from the "New New Trade Theory" which explains trade through within-sector productivity differences between firms (Melitz, 2003; Helpman et al., 2004). Melitz (2003) shows that

only productive firms export to foreign markets due to the presence of trade costs. The less-productive ones are unable to meet trade costs which prevent them from exporting. Helpman et al. (2004) corroborate the idea of within-sector firm heterogeneity and show that only the most efficient ones serve foreign markets.

Chaney (2005) augments Melitz's model with financial constraints as the source of firm heterogeneity. Chaney argues that financially constrained firms are less likely to cover fixed costs, and hence are less likely to be exporters. A host of studies have followed to empirically test Chaney's theoretical predictions in the context of the "New New Trade Theory" framework. Many of these studies support his claim. For example, Greenaway et al. (2007), using a panel of 9292 UK manufacturing firms from 1993-2003, demonstrate that start-up costs are important factors in determining firms' export status, since new exporters tend to have lower liquidity and higher leverage than continuous exporters. In the presence of such start-up costs, Manova (2008), using data on 91 countries from 1980-1997, shows that credit constraints play an important role in international trade. She exhibits that, in the presence of credit constraints, equity market liberalization produces a more pronounced impact on the sectors that are more dependent on external finance. Similarly, Berman and Héricourt (2010) underline the importance of firms' access to finance in their exporting behaviors. They study firms' export status (the extensive margin of trade) and the amount exported by firms (the intensive margin of trade) using data on about 5000 firms from nine developing and emerging economies. They find that firms' access to finance affects their initial entry decision, but not subsequent participation decisions. This finding lends support to the start-up cost hypothesis that the cost of remaining in the market is much lower after incurring the initial fixed cost, which generates what Berman and Héricourt refer to as "export hysteresis." Berman and Héricourt also show that the exporting firms are more

productive and hence export larger quantities in more financially developed countries, thus affecting the volume of exports.

While improvements in financial health of firms and financial development of countries are shown to have positive effect on trade flows, Amiti and Weinstein (2011), motivated by the recent global financial crisis, analyze if deteriorations in financial development have negatively affected international trade. Using a data set that covers Japanese financial crises from 1990 to 2010, Amiti and Weinstein find a strong relationship between the negative shocks in bank health and decline in exports of Japanese firms. This finding highlights the importance of country-level financial development in determining trade flows.

While many studies, including the aforementioned ones, show that financial development positively affects both margins of trade, these findings are not uncontested. For example, Greenaway et al. (2007) underplay the role of finance in affecting trade. They show that exporters are better off financially than the non-exporters, but the difference occurs ex post as an outcome of exporting, not before the decision is made. Similarly, after accounting for observed and unobserved firm characteristics, Stiebale (2011) fails to find evidence in favor of the claim that financial constraints matter for exporting behaviors.

Even with some inconclusive findings, two broad conclusions can be drawn from the extant literature about the relationship between finance and trade. First, financial constraints faced by firms decrease their ability to export. Firms that depend more on external finance, as a result, export less, whether that is measured on the extensive or intensive margin (i.e., they are less likely to export, and export less when they do, compared to less constrained firms). Second, country-level financial development and the availability of external finance facilitate firms' participations in export markets and the volume of trade. Both the comparative advantage and the sunk cost strands of the literature reach such conclusions.

This paper makes several contributions to the existing literature. First, in addition to the widely-studied heterogeneity in productivity across firms, I investigate whether the relationship between financial development and exports varies based on the age of the firm. Many studies use Rajan and Zingales' (1998a) measure of overall industry-level dependence on external finance as financial constraints.[1] Rajan and Zingales, however, also estimate the measure of external dependence based on the age of firms as the authors believe that firms in their early lives are more dependent on external finance than in the subsequent periods. Although several studies use the overall industry-level measure of dependence on external finance, they do not utilize the age-based measure of external dependence. I adopt this aspect of heterogeneity among firms, and analyze if country-level financial development affects young and mature firms differently. Second, I employ an instrumental variable approach in the estimation of the role of financial development in influencing exports. Financial development and exports may be simultaneously determined as argued by Beck (2002). Failure to account for simultaneity between variables may lead to biased estimates. The use of instrumental variable estimation, which can potentially correct the endogeneity problem, has not been emphasized in the firm-level analysis in the financial development-trade literature. These extensions are discussed in more detail in the following sections.

4.3 Data

This paper employs data of approximately 43,500 firms from 80 countries for the 2002-2009 time period. The firm-level data are obtained from the World Bank Enterprise Surveys (WBES) database.[2] The data is in a cross-section form, and the countries in the sample whose firms are examined are observed at different points in time between 2002-2009. Some

[1] For example, Beck (2003), Berman and Héricourt (2010) etc.

[2] The following link provides a detailed description of the sample design of the WBES: www.enterprisesurveys.org

firms may have been surveyed more than once if a country appears on the data set in multiple points in time, but I cannot identify such firms as a unique identifier is not available for the data set utilized. While the firm-level data provided by the WBES includes a sample of firms in manufacturing and service sectors that is representative of the entire private economy, I consider only the firms in manufacturing sector. I do so because the measure of external dependence derived from Rajan and Zingales (1998a) is only available for firms in the manufacturing sector. About 25% of the firms in the data used in this paper are exporters.

Appendix .1.1 provides descriptions and sources of data for all the variables employed in the study. Table 5 in Appendix .1.2 presents a list of countries in the sample.[1] As shown in the table, the data include sample firms from countries that vary widely in their incomes. For example, real GDP per capita ranges from $220 (Democratic Republic of Congo in 2006) to $37,032 (Ireland in 2005). The dependent variables are whether or not a firm exports (the extensive margin) and the exports as a percentage of total sales (the intensive margin). Firms' decisions to export measure the extensive margin of trade, and the fraction of revenue from exports measures the intensive margin of trade. I test how an industry's dependence on external finance and country-level financial development affect the two margins of trade controlling for other firm characteristics widely believed to affect exports at the firm level. The control variables are described next.

Firm characteristics

The data includes several measures of firm characteristics such as firm size, firm age, and foreign ownership. These variables are used as the control variables to account for various firm characteristics that are believed to affect a firm's exporting behaviors.[2]

[1] The table also presents a country's average real GDP and the average level of financial development in the sample.

[2] See Wagner (2010) for detailed analysis of firm characteristics and exports.

Larger firms supposedly have comparative advantages due to scale economies (because of the presence of fixed costs in exporting), benefits from management specialization and are less credit constrained than smaller firms (Guiso et al., 2004; Wagner, 2010). The empirical evidences support this view.[1] In this study, I use the number of full-time workers to measure firm size (SIZE). The firms are classified into small, medium, and large, as defined by the WBES database, where small firms have fewer than 20 full-time workers, 20-100 full-time workers for medium firms, and large firms consists of more than 100 full-time workers.

The ownership variable (OWNERSHIP) shows the percentage of shares of domestic firms held by foreign owners. Firms with higher share of foreign ownership are likely to export more than firms with higher share of domestic ownership (Manova et al., 2011). The owners of the former types are more accustomed to foreign markets, and have easier access to foreign financial markets which could make exporting more profitable.

Firm age (FIRMAGE) captures the experience of firms in the market, and can be interpreted as a sign of learning of skills and knowledge that are specific to a foreign market, if firms are exporters. Although seemingly firm age would have a positive effect on exporting behavior, Wagner (1996) fails to find any significant correlation between the variables. Besides being a control variable, firm age allows me to categorize firms into young and mature firms, where young firms are of less than 10 years.[2]

Tables 6, 7 and 8 in Appendix .1.3 present the descriptive statistics of the firm level data. As can be seen from the tables, firms that export tend to be larger (based on number of full time workers), older and have higher share of foreign ownership compared to their non-exporting counterparts.

External Dependence

[1] For example, Wagner (1996) for the extensive margin of trade, and Wagner (2006) for the intensive margin of trade

[2] Rajan and Zingales (1998a) define young firms as those that have been *listed* for less than ten years.

Rajan and Zingales (1998a) argue that some industries depend more on external finance than others because of "technical differences," such as differences in initial investment and continual investment required, and the timing of expenses outlay and revenue inflow. Rajan and Zingales further point out that these technological differences between industries carry over across countries to a large extent, which imply that dependence on external finance of one industry is similar in all countries. With this assumption, Rajan and Zingales use data on Unites States manufacturing firms to compute a firm's dependence on external finance, which is defined as the difference between capital expenditures and cash flow from operations divided by capital expenditures.[1,2] After computing external dependence of several firms, an industry median is used to obtain an industry-level measure of external dependence. Rajan and Zingales choose the dependence of U.S. firms because the capital market in the U.S. is relatively frictionless, and hence a desired amount of external funds can be raised by firms. The measure of external dependence of firms in a particular industry is represented by RZ.

As an example, the median external dependence in the data based on Rajan and Zingales' computation is for the metals and machinery industry. The metals and machinery industry has RZ of .345, which implies the industry must finance 34.5% of the aggregate capital expenditure. The rest is internally generated through cash inflows. While most industries rely on external sources to finance part of their capital expenditure, industries such as the leather industry generate enough capital inflows to more than cover their capital expenditures. Specifically, RZ of the leather industry is -0.14, which implies that its generated capital flow is 14% higher than its capital expenditure outlay.

[1] To be precise, Rajan and Zingales (1998a) sum a firm's use of external finance over the 1980's and then divide by the sum of capital expenditures in the 1980's to obtain a firm's dependence on external finance.
[2] Rajan and Zingales (1998a) use only publicly traded firms in their computation of external dependence. I, however, have private firms in my data set as well.

Furthermore, Rajan and Zingales (1998a) observe that firms in their early life are more dependent on external finance as they raise substantial capital through equity financing. After approximately ten years, the firm's net equity decreases to zero and hovers around zero. Hence, using ten years since first listed as a cut off value, Rajan and Zingales estimate the external dependence of young and mature firms. This age-based external dependence of firms is denoted by RZAGE.

To illustrate, the Chemicals and Pharmaceutical industry, as shown in Table 9 in Appendix .1.4, has an overall industry-level external dependence (RZ) of 1.49. However, the external dependence (RZAGE here) of young firms is 2.06, while it is 0.03 for mature firms. In general, younger firms tend to rely more on external finance as shown in the table. The classification of firms as young and mature is important for this study as I test if financial development affects the exporting behavior of young and mature firms differently.

Financial Development

A high level of financial development is believed to relieve financial constraints faced by firms, and help meet fixed start-up costs and variable trade costs required of firms, enabling them to export to foreign markets and increase the volume of export (Beck, 2002; Manova et al., 2011, for example). I use private credit, which is defined as credit to the private sector by deposit money banks as a share of GDP, as the indicator of financial development. Private credit captures a part of mobilized savings that is channeled to private firms. The funds to the private sector can be utilized to cover fixed or variable costs that are required for exports. This measure excludes credit to the government sector and by the central bank. Several studies in the finance-trade literature such as Beck (2002) and Berman and Héricourt (2010), among others, use private credit as a measure of financial development. Private credit is denoted by FD

The data on private credit are obtained through Beck, Demirguc-Kunt, and Levine (2009). Table 5 in Appendix .1.2 presents data on private credit for countries along with the average real GDP per capita (INCOME) and the measures of property rights index (PRI).[1] Real GDP per capita, a country-level measure, is included to account for country-level determinants of exports. A country's income can potentially affect if and how much a firm in the country exports. The next sub-section discusses the property rights index.

Instrumental Variables

Endogeneity between the dependent variables (the extensive and the intensive margins of trade) and private credit can potentially arise from two sources. First, one of the dependent variables and private credit may be simultaneously determined. I discuss how financial development may affect exports in Section 4.2. At the same time, exports may affect a country's financial development. Financial development here can be demand-driven in a sense that exporting firms or the firms that want to export may demand more services from the financial sector to ease their liquidity constraints. This leads to a state where countries with higher export share have more advanced financial systems (Beck, 2002). Second, some omitted variables may be correlated with both financial development and the measures of exports. For example, the investment climate or the business environment of a country may be correlated with both the exports variables and private credit. As the use of endogenous regressors may lead to biased estimates, I approach the problem by using an instrumental variable strategy which can potentially correct the endogeneity problem in estimation of firms' export behaviors.

I use property rights index to instrument for financial development in estimating the effect on exports. The index is computed based on various aspects of the protection of

[1]Real GDP per capita is measured in thousands of dollars.

property rights; they include a country's legal protection of private property, enforcement of laws to protect property rights by the government and the probability that the government will expropriate private property. The index ranges from 1 to 5 where better protections receive a higher score. The property rights index is obtained from LaPorta et al. (1999).

Several other predetermined variables have been used as instruments for the endogenous measures of financial development. The use of a country's legal origin to instrument financial development is fairly common.[1] For this study, however, property rights index serves as a better instrument than legal origin in the exports regression. An efficient instrumental variable estimator utilizes an instrument that has high variation with the endogenous variable (Murray, 2005; Wooldridge, 2009). Table 10 in Appendix .1.5 shows that property rights index has a much higher correlation with private credit (FD) than legal origin, a commonly used variable to instrument financial development.[2] COMMON in the table denotes a dummy variable that indicates common law as the legal origin. Second, property rights index is predetermined (at least) in the model as the index is computed for the periods before 1997 (Holmes et al., 1997), and my sample begins in 2002. These two reasons make property rights index a relevant instrument. The validity of the instrument, of course, is tested in several ways which are described in the next section.

4.4 Empirical Methodology

4.4.1 The extensive margin of trade

I estimate the following probit specification to examine how a country's financial development affects a firm's probability of being an exporter given the financial constraints a

[1] For example, Levine et al. (2000). These studies are influenced by LaPorta et al. (1998) who demonstrate that legal origin has a significant effect on the financial development of the country through its influence on protection of creditors and shareholders rights, and accounting standards, etc.

[2] Note also that the correlation between property rights index and export variables is higher than the correlation between legal origin and export variables.

firm faces and a host of other firm characteristics:

$$Prob(X_{ijkt} > 0) = \begin{cases} 1 & \text{if} \quad \psi_t + \beta_1 \text{SIZE}_{it} + \beta_2 \text{OWNERSHIP}_{it} + \beta_3 \text{FIRMAGE}_{it} \\ & \quad +\beta_4 \text{INCOME}_{kt} + \alpha \text{RZ}_{jt} + \gamma \text{FD}_{kt} + \Theta \text{FD}_{kt} \times \text{RZ}_{jt} + \epsilon_{ijkt} > 0 \\ 0 & \text{otherwise} \end{cases} \tag{4.1}$$

where i, j, k and t index firm, industry, country and time respectively. X_{ijkt} denotes exports as a fraction of total sales. Hence, $Prob(X_{ijkt} > 0)$ indicates the probability that firm i in industry j, country k and time t is an exporter. ψ_t is the year-specific fixed effects which account for the common shocks or trend across countries. SIZE, OWNERSHIP and FIRMAGE are the firm-level determinants of exports, as discussed in Section 4.3. RZ denotes the industry-level external dependence of firms and INCOME denotes real GDP per capita. FD represents financial development of a country which is proxied by private credit. Real GDP per capita and financial development are the proxies for all the country-level determinants of exports.[1] Finally, FD $\times$ RZ denotes the interaction term of external dependence and financial development which allows me to analyze if financial development relieves constraints on firms given their dependence on external finance. The coefficients in the probit model are estimated using maximum likelihood estimation.

Given Rajan and Zingales' (1998a) age-based measure of external finance, I replace RZ with RZAGE in an another specification. I further split the age-based measure of external dependence into RZAGE_*young* and RZAGE_*mature* which allows me to examine if external dependence affects young and mature firms differently. In addition, in order to analyze if financial development affects young and mature firms differently, I divide the interaction of financial development and age-based measure of external dependence (FD $\times$ RZAGE) into

[1]The country fixed effects, when included in the regression, drops because of the collinearity between the country-level determinants of exports and country fixed effects. As such, country fixed effects are not included in the regressions.

FD × RZAGE_*young* and FD × RZAGE_*mature*. Estimating the coefficients on these variables separately allows me to test their joint significance and the equality of coefficients to examine the asymmetric effect of financial development on young and mature firms.

4.4.2 The intensive margin of trade

I use pooled OLS to examine how financial development affects the volume of exports if the firms trade, given the financial constraints firms face and other firm characteristics. The pooled OLS specification takes the following form:

$$X_{ijkt} = \beta_0 + \psi_t + \beta_1 \text{SIZE}_{it} + \beta_2 \text{OWNERSHIP}_{it} + \beta_3 \text{FIRMAGE}_{it} + \beta_4 \text{INCOME}_{kt} + \alpha \text{RZ}_{jt} + \gamma \text{FD}_{kt} + \Theta \text{FD}_{kt} \times \text{RZ}_{jt} + \epsilon_{ijkt} \ , \quad \text{if } X_{ijkt} > 0. \tag{4.2}$$

As for the intensive margin of trade, I replace RZ with RZAGE given the age-based measure of external dependence. I further split RZAGE into RZAGE_*young* and RZAGE_*mature*, and FD × RZAGE into FD × RZAGE_*young* and FD × RZAGE_*mature*. This strategy provides testable hypotheses on the joint significance of young and mature firms' variables, and the equality of the coefficients.

A potential endogeneity concern arises if equations (4.1) and (4.2) are estimated with probit and pooled OLS models respectively. The presence of endogeneity may lead to biased estimates of the parameters. For this reason, I estimate the two equations using the instrumental variable approach. Here, private credit is potentially endogenous in both the models. Private credit enters the specification independently and through its interaction with the measure of external dependence. Hence, I use the property rights index, and the interaction of property rights index and external dependence as instruments. Amemiya (1974) shows that the interaction term of two exogenous regressors can be used to instrument an interaction term with one exogenous and one endogenous variable to obtain consistent

estimates.

Several tests are in order to attest the proper use of instruments. For the probit models, in order to certify that the instruments used are exogenous, the error term of each specification is regressed on the instruments used. The error terms must be uncorrelated with the instruments for the instruments to be valid which denotes exogeneity of instruments.

For the pooled OLS model, three tests are carried out to ensure the proper use of instruments. The first one is an underidentification test which tests the null hypothesis that the excluded instruments are not correlated with the endogenous regressors. A model that is identified rejects the null hypothesis. Kleibergen and Paap's (2006) heteroskedastic-robust version of the LM test is used as the underidentification test.

The second test is the weak identification test in which the null hypothesis is that the coefficients of instruments used have a magnitude of zero in the first-stage auxiliary regression of two stage least square (2SLS) regression (Murray, 2005). Put differently, the null assumes that the excluded instruments are correlated with the endogenous regressors but only weakly. A well-specified model that uses proper instruments rejects the null hypothesis. The F-test version of the Cragg and Donald (1993) Wald statistic is used in the paper, and the critical values are obtained from Stock and Yogo (2005).

Finally, the third test is the overidentification test which is used if the model is not exactly identified. This test checks the joint null hypotheses that the the instruments are uncorrelated with the error term and correctly excluded from the specification. The use of valid instruments fails to reject the null hypothesis. The Hansen J test for overidentification is used in this paper.

4.5 Results

4.5.1 The extensive margin of trade

The extensive margin of trade results are presented in Tables 4.1 and 4.2. The reported coefficients are the marginal effects computed at means of the control variables, and median levels of private credit (.32) and external dependence (.345). These tables report how financial development affects a firm's probability of being an exporter given its dependence on external finance. Private credit is used as a measure of financial development. The measure, however, is instrumented with property rights index to address endogeneity in the export regressions. Exogeneity tests of the instruments show that the instruments used are correctly specified.

I start with the overall industry-level measure of external dependence (RZ). Because of the potential simultaneity between a country's real GDP per capita and the exports variables, the baseline specification excludes the measure of income. Column (1) presents the result of the baseline specification. Column (2) presents the results with real GDP per capita included in the specification. Both results point to the same general conclusions. For the control variables, the results indicate that larger firms, firms with higher foreign ownership and more experienced firms have higher probabilities of being exporters. Column (2) indicates that firms in a richer country have higher probabilities of being exporters.[1] With the inclusion of the interaction term of measures of financial development and external dependence (FD×RZ), the effect of financial development depends on the measure of external dependence. As a simulation of results, I consider the metals and machinery industry whose external dependence (of .345) represents the median level in the sample. For a firm in this industry, the results show that an advancement in private credit from the 25^{th} percentile

[1] With income included in the specification, the magnitude on FD decreases sharply, potentially because of the collinearity between a country's income and a country's financial development.

Table 4.1: Financial development and Extensive margin of trade using overall industry-level measure

VARIABLES	(1)	(2)
RZ	-0.450***	-0.449***
	(.044)	(.030)
FD	0.010	-1.037***
	-0.065	(.059)
FD × RZ	1.190***	1.195***
	(.119)	(.082)
Medium size	0.075***	0.076***
	(.002)	(.002)
Large size	0.105***	0.103***
	(.002)	(.003)
OWNERSHIP	0.002***	0.001***
	(.000)	(.000)
FIRMAGE	0.001***	0.001***
	(.000)	(.000)
Real GDP/capita		0.022***
		(.002)
Observations	43,510	43,510
psuedo R2	0.188	0.192
Chi2	8088	8292

Dependent variables: Probability that a firm is an exporters. Marginal effects computed at means of the control variables, and median on RZ and FD. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Instruments: PRI & PRI×RZ. Firm size omitted category: small sized firms. Real GDP per capita measured in thousands of dollars. Exogeneity of instruments are checked by regressing the error term of each specification on the instruments used. The instruments are uncorrelated with the error terms indicating validity of the instruments.

(value of .18) to the 50^{th} percentile level (value of .32) reduces the probability of being an exporter by as much as 7.6%, ceteris paribus.[1] Additionally, for a firm in the same industry, further progress of private credit from the 50^{th} percentile to the 75^{th} percentile level (value of .58) reduces the extensive margin by an additional 1.8%, ceteris paribus. These results suggest that, for a median level of external dependence, improvement in

[1]For the sample as a whole, the 25^{th} percentile of private credit is .18, the median in 0.32, and the 75^{th} percentile is .58. For easier comparisons, the same values are used everywhere else in simulations.

financial development hurts a firm's probability of being an exporter.

The results also point out that while an improvement in financial development reduces the probability of being an exporter given the median level of external dependence on firms, financial development disproportionately helps firms with higher levels of external dependence. As an illustration, for a firm in an industry at the 25^{th} percentile level of external dependence (the food industry with the external dependence of .14), an increase in financial development from the 25^{th} percentile to the 50^{th} percentile reduces the probability of being an exporter by as much as 13.5%, ceteris paribus. Comparing to 7.6% reduction in probability of being an exporter of a firm with a higher level of external dependence (the metal and machinery industry, as shown above), the result suggests that financial development hurts firms with lesser external dependence more than firms with higher external dependence.

Next, I examine whether financial development affects young and mature firms differently as their dependence on external finance are different as shown by Rajan and Zingales (1998a). Here, instead of using the overall industry-level measure of external dependence (RZ), I use the age-based measure of external dependence (RZAGE). Table 4.2 presents the marginal effects evaluated at the means of control variables and the median level of financial development. In addition, in column (1), RZAGE is evaluated at young firms' external dependence in the metals and machinery (.81). In column (2), mature firms' external dependence in the same industry is considered (.31).[1] First, the table demonstrates similar results for the control variables as in Table 4.1. Second, both columns (1) and (2) show that improvement in a country's financial development is shown to have negative effect on the probability of being an exporter. These results show that financial development has a negative effect on the probability of being an exporter using both the young and mature

[1] As noted before, the metals and machinery industry has the median level of overall industry-level external finance.

Table 4.2: Financial development and Extensive margin of trade using age-based measure

VARIABLES	(1)	(2)	(3)
RZAGE	0.048*	0.046*	
	(.028)	(.026)	
RZAGE_*young*			0.188***
			(.053)
RZAGE_*mature*			-0.134
			(.037)
FD	-0.722***	-0.701***	-0.587***
	(.062)	(.060)	(.143)
FD × RZAGE	-0.204***	-0.198***	
	(.071)	(.066)	
FD × RZAGE_*young*			-0.593***
			(.143)
FD × RZAGE_*mature*			0.222***
			(.081)
Medium size	0.093***	0.090***	0.096***
	(.003)	(.002)	(.003)
Large size	0.129***	0.126***	0.133***
	(.002)	(.001)	(.003)
OWNERSHIP	0.002***	0.002***	0.002***
	(.000)	(.000)	(.000)
FIRMAGE	0.001***	0.001***	0.001***
	(.000)	(.000)	(.000)
Real GDP/Capita	0.030***	0.029***	0.028***
	(.002)	(.002)	(.002)
Observations	43,510	43,510	43,510
psuedo R2	0.188	0.188	0.192
Chi2	8088	8088	8292

Dependent variables: Probability that the firms are exporters. Marginal effects computed at means of the control variables, RZAGE evaluated at .81 and .31 in columns (1) and (2) respectively. RZAGE_young evaluated at .81 and RZAGE_mature at .31 in column (3). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Instruments for column (1): PRI & PRI×RZ. Instruments for column (3): PRI, PRI×RZAGE_young & PRI×RZAGE_mature. Firm size omitted category: small sized firms. Real GDP per capita measured in thousands of dollars. Exogeneity of instruments are checked by regressing the error term of each specification on the instruments used. The instruments are uncorrelated with the error terms indicating validity of the instruments.

firm's level of external dependence.

Third, in order to test if the effect of financial development is significantly different for young and mature firms, column (3) of Table 4.2 presents the results with separate estimates for young and mature firms. Here, the interaction term is further split into the interaction term for young firms (FD × RZAGE_*young*) and the interaction term for mature firms (FD × RZAGE_*mature*). Similarly, the coefficient on the age-based measure of external dependence is estimated for young and mature firms (RZAGE_*young* and RZAGE_*mature*) separately. This method allows me to test the asymmetric effect of financial development on young and mature firms' exports and provides testable hypotheses on their joint significance and the equality of the coefficients. For a firm in the metals and machinery industry (at the median level of overall external dependence), the results reveal that an advancement in private credit from the 25^{th} percentile to the 50^{th} percentile (the value of .18 to .32) reduces the probability of being an exporter by 14.1% for young firms. Mature firms, on the other hand, are affected by only 7.1% for the same amount of change in private credit.[1,2] The joint significance tests of the coefficients on both RZAGE_*young* and RZAGE_*mature*, and FD × RZAGE_*young* and FD × RZAGE_*mature* show that inclusion of the variables are valid.[3] Similarly, I test to see if the coefficient estimates are significantly different for young and mature firms. The results present that external dependence constraints young and mature firms differently in their export participations.[4] Similarly, the results indicate that a country's financial development affects young and mature firms differently given their external dependence.[5]

The results of the extensive margin of trade hence indicate that the dependence on ex-

[1] The same values of private credit are chosen to make comparisions easier.
[2] As private credit increases to .32 from .58, the probability of being an exporter decreases by 16.4% for young firms, and by 14.6% for matuure firms.
[3] χ^2 statistics of 20.13 and 21.26 respectively.
[4] χ^2=19.98
[5] χ^2=21.03.

ternal finance significantly affects firms' export participations, and the negative effect varies for young and mature firms. Similarly, financial development is found to have a negative effect on firms' probabilities of being exporters, and this effect too varies based on the age of a firm. Although, overall, financial development hurts firms' export participations, the results indicate that financial development disproportionately affects firms with different level of external dependence. I find that financial development hurts firms with higher level of financial development to a lesser extent than firms with lower level of external dependence. Moreover, evaluated at the median level of external dependence, young firms are shown to be hurt more by the advancement in financial development in their export participation than the mature ones. These findings contend that analyzing the effect on export participation by examining the overall industry-level measure of external dependence masks an important asymmetry in the effect of financial development; given the dependence on external finance, a country's financial development affects young and mature firms differently in their probabilities of being exporters.

4.5.2 The intensive margin of trade

The intensive margin of trade results are presented in Tables 4.3 and 4.4. These tables show how financial development affects the volume of exports of firms, if they export, given their dependence on external finance. As before, private credit is used as a measure of financial development. I, however, instrument the measure with property rights index to address endogeneity in the export regressions. The tests of the under, weak and over-identification of the model in both the tables confirm that the instruments used are correctly specified.[1]

[1]The instrument fails the weak exogeneity test in column (2) of Table 4.2. This implies that excluded instruments are only weakly correlated with the endogenous regressors. The underidentification and overidentification tests, however, are fine.

Table 4.3: Financial development and Intensive margin of trade of all firms

VARIABLES	(1)	(2)
RZ	-86.692***	-72.116***
	(11.663)	(14.905)
FD	-126.875***	27.976
	(17.866)	(30.159)
FD × RZ	158.767***	123.492***
	(26.407)	(33.408)
Medium size	1.359**	0.243
	(0.679)	(0.695)
Large size	3.940***	2.749***
	(0.453)	(0.509)
OWNERSHIP	0.148***	0.126***
	(0.010)	(0.010)
FIRMAGE	-0.273***	-0.273***
	(0.024)	(0.023)
Real GDP/capita		-3.263***
		(0.658)
Constant	88.314***	87.842***
	(6.573)	(6.653)
Observations	10,824	10,824
F-stat	95.00	98.79
rk LM stat	60.05	42.52
rk F stat	28.74	22.35
Excluded Instruments	2	2

Dependent variables: Volume of exports if the firms export. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Instruments: PRI & PRI×RZ. Firm size omitted category: small sized firms. Real GDP per capita measured in thousands of dollars.

Table 4.3 shows the results based on the overall industry-level measure of external dependence (RZ). As before, the baseline specification in column (1) excludes real GDP per capita. The results indicate that larger firm size and higher foreign ownership share lead firms to export more (as a fraction of their revenues) as predicted. While higher firm age improves the probability of being an exporter as shown in Tables 4.1 and 4.2, the results show, perhaps surprisingly, that older firms generate a lower fraction of their sales from

exports than younger firms. More importantly for this study, the results show that higher dependence on external finance decreases the share of revenue from exports. However, having a higher level of financial development allays the constraints placed by dependence on external finance, and allows firms to export higher fraction of their revenues. Column (2) of Table 4.3 includes real GDP per capita in the regression equation. The main results remain qualitatively similar to the ones in column (1), although the coefficient estimate on real GDP per capita is negative.

To be specific, for a firm in the metals and machinery industry (the industry with the median level of external dependence), the results indicate that an improvement in private credit from the 25^{th} percentile (value of .18) to the 50^{th} percentile level (value of .32) improves the volume of exports by as much as 10.3%, ceteris paribus. The intensive margin further improves by 19.1% as private credit increases to the 75^{th} percentile (value of .58). These results hence show that an advancement in financial development promotes the intensive margin of trade given the financial constraints faced by firms.

In order to examine if financial development affects the volume of exports differently for firms with different levels of external dependence, I consider firms in industries with the 25^{th} percentile and the 75^{th} percentile levels of external dependence. The food industry has the 25^{th} percentile level of external dependence with the value of .14 and the electronics and other manufacturing industry has the 75^{th} percentile level of external dependence with the value of .74. The results show that, for the food industry, an improvement in private credit from the 25^{th} percentile level to the 50^{th} percentile level yields in increase in a firm's volume of exports by 6.3%. For the same level of change in private credit, a firm in the electronics and other manufacturing industry sees an improvement in the volume of exports by 12%. The results, hence, indicate that financial development disproportionately helps

firms with a higher level of external dependence than the ones with a lower level. These results are comparable to the general findings of the intensive margin of trade.

I continue by analyzing firms' classifications as young and mature firms and use the age-based external dependence (RZAGE) accordingly. Table 4.4 presents these results. First, in column (1), I use the age-based measure of external dependence (RZAGE), and the interaction of financial development and RZAGE (FD × RZAGE). The results here indicate that young firms and mature firms are affected differently as they have different external dependence measures. For instance, for firms with a median level of external dependence (the metals and machinery industry), the results indicate that an increase in private credit from the 25^{th} percentile to the 50^{th} percentile leads young firms to improve their volume of exports by 14.8%. For the same amount of change in private credit, mature firms, on the other hand, only improve their volume of exports by 9.8%. The results indicate that given the measure of external dependence, financial development affects young firms more than their mature counterparts.

Upon further investigation, however, the results indicate that the effect of financial development on the volume of export is not significantly different for young and mature firms. In the second column (2), I divide the effect of RZAGE and FD × RZAGE into the the effect on young and mature firms (RZAGE_*young* and RZAGE_*mature*, and FD×RZAGE_*young* and FD × RZAGE_*mature*). Conducting several tests on the coefficients, the results indicate that the coefficients estimates on RZAGE_*young* and RZAGE_*mature*, and FD×RZAGE_*young* and FD×RZAGE_*mature* are individually and jointly significant.[1] However, the results show that the coefficients on RZAGE_*young* and RZAGE_*mature* are not statistically different from one another, and neither are the coefficients on FD×RZAGE_*young* and FD×RZAGE_*mature*.[2]

[1] χ^2 statistics of 49.51 and 37.5 respectively for the joint significance test.
[2] χ^2 statistics of .87 and 1.1 respectively for the test of equality of coefficients

Table 4.4: Financial development and Intensive margin of trade of Mature and Young firms

VARIABLES	(1)	(2)
RZAGE	-38.028***	
	(6.546)	
FD	47.224**	29.746
	(18.448)	(33.695)
FD × RZAGE	72.417***	
	(14.308)	
RZAGE_*young*		-61.334**
		(30.812)
RZAGE_*mature*		-29.392***
		(6.042)
FD × RZAGE_*young*		131.222*
		(72.238)
FD × RZAGE_*mature*		45.356***
		(13.844)
Medium size	1.078*	1.243*
	(0.634)	(0.719)
Large size	3.681***	3.853***
	(0.460)	(0.552)
OWNERSHIP	0.124***	0.132***
	(0.010)	(0.015)
FIRMAGE	-0.396***	-0.390***
	(0.023)	(0.028)
Real. GDP/capita	-2.443***	-2.087**
	(0.580)	(0.871)
Constant	65.136***	68.137***
	(3.455)	(5.671)
Observations	10,120	10,120
F-stat	94.69	79.78
rk LM stat	47.92	4.776
rk F stat	26.05	1.542
excluded Instruments	2	3

Dependent variables: Volume of exports if the firms export. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Instruments for column (1): PRI & PRI×FD. Instruments for column (2): PRI, PRI×RZAGE_young & PRI×RZAGE_mature. Firm size omitted category: small sized firms. Real GDP per capita measured in thousands of dollars.

These results indicate a lack of asymmetry on the effect of external dependence and financial development on the intensive margin of trade based on the age of firms.

The results for the intensive margin of trade suggest that while the dependence on external finance negatively affects the volume of exports, the negative effect is reversed with a country's financial development which mitigates some of the constraints of exporting. Evaluated at the median level of external dependence, I find that a higher level of a country's financial development is associated with higher volume of exports. As with the extensive margin of trade, I find that a country's financial development disproportionately benefits firms with higher level of external dependence. Unlike the results for the extensive margin of trade, I find that a country's financial development does not affect young and mature firms differently on their volume of exports.

4.6 Conclusion

Firms face fixed sunk-costs and variable trade costs in their exporting activities. These costs can be a binding constraint which may affect a firm's decision to export (the extensive margin of trade) and how much a firm exports (the intensive margin of trade). The finance-trade literature emphasizes the role of financial constraints faced by firms in hindering the export behaviors (Melitz, 2003; Chaney, 2005, among others). Given the financial constraints, a country's financial development is shown to positively influence exports (Beck, 2002; Berman and Héricourt, 2010, among others).

This paper empirically investigates the effect of financial development on the probability of being an exporter (the extensive margin of trade) and the volume of exports (the intensive margin of trade) given the industry-level dependence on external finance of firms. Moreover, it builds on the existing literature in several ways. First, I investigate whether financial development affects young and mature firms differently as they differ on their dependence on external finance as pointed out by (Rajan and Zingales, 1998a). Second, to account for endogeneity in exports regressions, I use the instrumental variable approach in the

estimation of role of financial development in influencing exports. This estimation approach has not been emphasized in the empirical firm-level financial development-trade literature.

Using firm-level data of approximately 43,500 firms from 80 countries for the 2002-2009 time period, I find that dependence on external finance of firms negatively affects both the export market participation and the volume of exports. The results also show that a country's financial development negatively affects the extensive margin of trade and positively affects the intensive margin of trade evaluated at the median level of external dependence. Furthermore, this study finds that financial development disproportionately affects firms with higher level of external dependence. For both margins of trade, I find that financial development facilitates firms with higher levels of external dependence more that the ones with lower levels. Finally, I find that young and mature firms are affected differently by financial development on their export participations. However, the results do not support such asymmetry for the extensive margin of trade. These findings hence contend that examining the effect of financial development using the overall industry-level measure of external dependence may mask an important asymmetric effect of financial development on young and mature firms.

.1 Appendix C

.1.1 Description and Sources

Firm level:

Exports value	Exports as a fraction of total sales. Source: World Bank Enterprise Surveys (WBES)
Exporter dummy	Dummy variable that takes a value of unity if firm exports. Source: WBES
SIZE	SIZE=1 (small) if the number of full time workers (FTWKR) is less than 20. SIZE=2 (medium) if FTWKR is between 20 and 100. SIZE=3 (large) if FTWKR are greater than 100. Source: WBES
FIRMAGE	Age of a firm. Source: WBES
OWNERSHIP	The percentage of shares of domestic firms held by foreign owners. Source: WBES

Industry level:

RZ	External dependence of all firms in an industry. Source: Rajan and Zingales (1998a)
RZAGE	External dependence of firms depending on whether they are mature or young firms. Young firms have age of less than 10 years. Source: Rajan and Zingales (1998a)

Country level:

FD	Private credit by domestic money banks Source: Beck, Demirguc-Kunt, and Levine (2009)
PRI	Property rights index (on a scale from 1 to 5). Measures the degree to which the government protects and enforces laws that protect private property. Source: LaPorta et al. (1999)
INCOME	Real GDP per capita (measured in thousands of US $'s). Source: Heston et al. (2011)

.1.2 Country level data

Table 5: Country level

Country	PRI	FD	Income	Obs.
Albania	3	0.164	5.151	308
Algeria	3	0.119	6.063	424
Angola	2	0.055	3.673	283
Argentina	4	0.109	10.655	767
Armenia	3	0.110	4.618	429
Bangladesh	2	0.344	1.290	1340
Benin	3	0.191	1.116	55
Bolivia	3	0.341	3.535	453
Botswana	4	0.193	9.660	174
Brazil	3	0.412	8.502	2984
Bulgaria	3	0.481	9.805	1597
Burkina Faso	3	0.155	0.902	189
Burundi	2	0.195	0.374	151
Cambodia	2	0.140	1.801	220
Cameroon	2	0.088	1.810	246
Cape Verde	4	0.475	3.536	125
Chad	2	0.027	1.276	63
Chile	5	0.619	11.645	724
Colombia	3	0.309	7.068	728
Congo, Dem. Rep.	2	0.022	0.220	201
Costa Rica	3	0.315	9.949	338
Croatia	2	0.637	14.958	574
Czech Republic	4	0.421	20.898	285
Cte d'Ivoire	2	0.170	1.343	208
Egypt, Arab Rep.	3	0.423	4.758	2186
El Salvador	3	0.413	6.239	499
Estonia	4	0.874	15.454	227
Ethiopia	2	0.181	0.551	365
Fiji	3	0.565	4.284	42
Gabon	3	0.258	10.280	37
Gambia, The	4	0.135	1.163	79
Georgia	2	0.238	4.615	273
Germany	5	1.109	31.611	468
Greece	4	0.715	25.724	164
Guatemala	3	0.290	5.809	372
Honduras	3	0.395	3.444	312
Hungary	4	0.512	16.326	539
Indonesia	3	0.230	4.075	1156
Ireland	5	1.421	37.032	222
Jordan	4	0.835	4.378	387
Kenya	3	0.224	1.234	449
Korea, Rep.	5	0.894	22.808	287
Lao PDR	1	0.063	2.633	156
Latvia	4	0.828	12.135	188
Lesotho	3	0.112	1.311	94
Lithuania	3	0.390	12.628	444
Madagascar	3	0.099	0.753	229
Malawi	3	0.089	0.653	80

Continued on next page

Table 5 – *Continued from previous page*

Country	**PRI**	**FD**	**Income**	**Obs.**
Malaysia	4	1.007	11.643	1075
Mali	3	0.160	0.937	301
Mexico	3	0.148	12.418	1117
Moldova	3	0.273	2.214	488
Mongolia	3	0.592	3.167	184
Morocco	4	0.609	3.328	146
Mozambique	2	0.128	0.716	346
Nepal	3	0.686	1.211	128
Niger	3	0.087	0.535	93
Nigeria	3	0.173	1.940	1133
Pakistan	4	0.271	2.292	772
Panama	3	0.767	8.357	422
Paraguay	3	0.160	3.620	466
Peru	3	0.172	6.231	380
Philippines	4	0.209	2.839	971
Poland	4	0.321	13.737	853
Portugal	4	1.403	20.097	191
Romania	2	0.277	8.618	676
Russian Federation	3	0.380	13.505	1111
Senegal	4	0.208	1.495	262
Sierra Leone	2	0.055	0.873	78
Slovak	3	0.418	18.073	193
Slovenia	3	0.700	23.352	275
South	3	0.754	7.673	694
Spain	4	1.301	27.984	238
Swaziland	4	0.205	3.380	135
Tanzania	3	0.096	0.984	298
Turkey	4	0.222	9.836	2533
Uganda	4	0.059	1.028	355
Uruguay	4	0.225	9.278	435
Vietnam	1	1.097	2.872	829
Zambia	3	0.101	1.794	308
Mean	**3.15**	**0.383**	**7.447**	
St. dev.	**0.858**	**0.331**	**7.890**	
Count				**39607**

.1.3 Descriptive Statistics

Table 6: All Firms

Variable	Obs	Mean	Std. Dev.	Min	Max
Full-time workers	39022	110.773	275.303	0	7000
OWNERSHIP	39606	11.859	32.331	0	100
FIRMAGE	39606	18.398	15.806	1	172
Export value	39606	12.275	27.592	0	100

Table 7: Exporters

Variable	Obs	Mean	Std. Dev.	Min	Max
Full-time workers	10528	244.289	424.267	1	7000
OWNERSHIP	10824	24.704	43.131	0	100
FIRMAGE	10824	21.919	18.566	1	172
Export value	10824	44.914	36.329	0.25	100

Table 8: Non-exporters

Variable	Obs	Mean	Std. Dev.	Min	Max
Full-time workers	28494	61.442	168.145	0	5359
OWNERSHIP	28782	7.0287	25.563	0	100
FIRMAGE	28782	17.074	14.413	1	151

.1.4 Industry Dependence

Table 9: RZ numbers

Industry	RZ dependence	
Chemicals and Pharmaceuticals	All	1.49
	Young	2.06
	Mature	0.03
Non-metalic and plastic	All	1.14
	Young	1.14
	Mature	..
Other manufacturing+classified +electronics	All	0.47
	Young	0.8
	Mature	-0.05
Metals and Machinery	All	0.345
	Young	0.81
	Mature	0.31
Textiles	RZ all	0.40
	Young	0.66
	Mature	0.14
Auto and auto components	All	0.39
	Young	0.76
	Mature	0.11
Wood and furniture	All	0.24
	Young	0.68
	Mature	0.33
Food	All	0.14
	Young	0.66
	Mature	-0.05
Garments	All	0.03
	Young	0.27
	Mature	-0.02
Leather	All	-0.14
	Young	-1.53
	Mature	-1.33

Young: less than 10 years

.1.5 Pairwise correlation

Table 10: Pairwise Correlation with Property Rights Index

	PRI	COMMON	EXPDUM	EXPVALUE
COMMON	0.019	1		
Exporter dummy	0.094	-0.037	1	
Export value	0.018	0.014	0.073	1
FD	0.174	0.056	0.105	0.091

COMMON: dummy variable that takes the value of 1 if common law as legal origin. EXPDUM: dummy variable that takes the value of 1 of if the firm exported. EXPVALUE: Total exports as a share to total sales.

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