ESSAYS ON INSTITUTIONS, FINANCIAL DEVELOPMENT, AND ECONOMIC GROWTH

by

Nabanita Sukumar Nandi

B.A., University of Pune, 1996

M.A., University of Pune, 1998

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This dissertation was presented

by

Nabanita Sukumar Nandi

It was defended on
July 3, 2008
and approved by
Steven Husted, PhD, Professor, Economics
Alexis Leon, PhD, Assistant Professor, Economics
Salvatore Babones, PhD, Associate Professor, Sociology
Dissertation Co-Advisor: David N. DeJong, PhD, Professor, Economics
Dissertation Co-Advisor: Marla P. Ripoll, PhD, Associate Professor, Economics

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A number of recent papers using a linear specification have indicated that private property institutions are a fundamental determinant of growth. In my first paper, I use a semi-nonparametric partially linear model to provide evidence against a linear specification and to support nonlinearities in the relationship. The findings indicate that the exogenous component of private property institutions contributes positively to economic growth for countries in the lower and middle stages of private property institutions and have a negative relationship with economic growth of countries having the highest level of private property institutions. These results are confirmed when using an appropriate parametric specification and estimation by GMM. When using different measures of private property institutions as the 'rule of law' and 'political freedom', the results are consistent.

The second paper documents a nonlinear relationship between financial development and income inequality across developing and developed countries, and uncovers the empirical root of this phenomenon. The source is in two parts: there is a close relationship between the level of economic development and the level of financial development across countries; and the impact of financial development on income inequality is contingent on the level of economic development.

The 1990s saw considerable economic turbulence due to varying degrees of financial crisis in many countries in Asia and Latin America. In the third paper, I document that a combination of external shocks, weak institutional background and excessive bank lending contributed to the differential responses by countries to financial crisis. Using a version of the models of Bernanke and Gertler (1990) and Jensen and Meckling (1976), the paper builds a theoretical model to show that institutional problems, coupled with external shocks, can affect the capital structure of firms and lead to a choice of projects having low net present value, which carries implications for aggregate investment and growth.. In the empirical counterpart, the study shows that proxies for weak institutions of corporate finance, excessive bank lending and terms of trade shocks played a central role in determining the magnitude of growth and investment collapse as observed in these regions.

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PREFACE

I would like to thank my advisors, David DeJong, Marla Ripoll, Steven Husted, Alexis Leon and Salvatore Babones for their invaluable comments. I am particularly indebted to David DeJong and Marla Ripoll for their advice and support throughout my doctoral studies.

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1.0 INTRODUCTION

My dissertation focuses on recent issues in the economic growth and development literature. The questions addressed identify potential growth determinants by exploring heterogeneity in growth, and by examining the relative success of alternate factors in explaining cross-country growth experiences. In recent years, there has been a breakthrough in econometric estimation techniques and availability of new datasets, enabling enhanced searches for answers to fundamental questions in this area of research. For example, well-known concerns expressed by pioneer economists Harberger (1987) and Solow (1994) and many others regarding the assumption of a common linear model for a set of widely different countries can now be addressed by more general models that allow for heterogeneity. In the first two chapters, I use parametric and recently advanced semi-parametric estimators to uncover potential nonlinearities so that the marginal effect of a particular variable can differ across countries and over time. In the third chapter, with the help of recently available data on institutional and financial infrastructure across countries, I examine a specific episode, the financial crises witnessed in the 1990s decade, to investigate why certain countries have the ability to recuperate from external shocks relatively quickly, while others are overwhelmed. The following paragraphs give a description of my dissertation.

The first chapter explores the relationship between institutions and growth. A number of papers (Hall and Jones, 1999, Acemoglu et al. 2002, Rodrik et al. 2004) use linear growth models to document that institutions are a fundamental determinant of economic growth. Motivated by Douglass North (1990), I explore whether private property institutions have a differential relationship with economic growth when countries are in different thresholds of their level of institutions. The investigation uses a combination of parametric and semi-nonparametric methods that allow for more flexible model specifications. The nonlinear parametric specification is estimated using a combination of instrumental variable

and generalized method of moments methods. The semi-nonparametric model is estimated using the sieve minimum distance estimator. Results obtained using both methodologies indicate a nonlinear relationship in which the development of property rights institutions is associated with enhanced growth at low and intermediate levels of institutions but with depressed growth when economies have attained a high level of institutional development. Using the index 'constraint on executive' as a proxy for private property institutions, the results indicate that institutions have a positive relationship with growth only when its level is below 6. After this level, the relationship is found to be negative. The results are confirmed using different measures of institutions such as 'rule of law' and 'democracy'.

In the second chapter, I explore the relationship between financial development and income inequality. A wide literature (King and Levine, 1993, Levine and Zervos, 1998) documents that financial intermediary development is beneficial for economic growth. However, its relationship with income distribution is not widely established. Evidence from theoretical studies suggests alternative predictions, and due to unavailability of reliable data on these variables until recently, empirical evidence has been lacking. This paper is an attempt to shed light on this empirical relationship. I address this question using two methodologies; GMM estimation of a parametric specification and sieve minimum distance estimation of a semi-nonparametric specification. The benchmark model is a nonlinear specification that includes control variables common to the cross-country literature on growth and financial intermediation. The GMM panel estimator and the semi-nonparametric estimator produce consistent findings. The results indicate that income inequality tends to decrease as countries initially develop their financial infrastructure; beyond a certain threshold, the relationship is non-negative. When using the indicator 'private credit', I find that the inflexion point is approximately at the level of 55 percent of GDP. The finding is in accordance with the theoretical predictions by Galor and Maov (2000). The results are robust to modification in the conditioning information set, alternations in the sample in accordance with levels of per capita income and using alternate measures of financial development.

In the third chapter, I explore potential growth determinants by examining whether varying institutions of corporate governance and excessive bank lending contributed to the differential response of countries to financial crisis witnessed in 1997. To investigate these

factors, I build a simple model to show that the quantity of investment spending is sensitive to the share of borrowers' net worth in the project, the quality of institutions protecting investors, and the possibility of a negative shock. Based on comparative statics exercises, I find that large external shocks, coupled with relatively low levels of corporate governance, have detrimental effects on aggregate output and investment. Moreover, rapid increases in external lending in prior years induce greater risk of output/ investment collapse. In the empirical analysis, I find that for a set of countries including and excluding crisis countries, these three factors were important in explaining the growth and investment collapse during five years immediately after the crisis in 1997. The results are robust when controlling for simultaneity and for additional determinants as advanced in literature.

The results have some policy implications. From the first paper, the analysis reveals that for countries enjoying low and intermediate level of institutions, growth is enhanced when accountability groups have more power to regulate the state machinery from expropriation. However, for economies having the highest level of institutions, increasing the level of "checks and balances" in the decision making process can stifle the growth process by introducing more regulation within the existing system of institutions. From the second paper, the analysis reveals that financial development for developing economies corresponds with reduced income disparity and poverty among various sections of the society. This is also witnessed from the success enjoyed by micro-credit institutions across the world in improving living standards of the poorest sectors of the economy. For more developed economies, the findings indicate that financial development is not an important factor when designing policies aimed at decreasing income inequality. From the third paper, the findings indicate that with greater integration of global financial markets, strong corporate governance, vigilant supervision, and heightened screening of potential investment projects by banks and other financial intermediaries during economic boom periods are important components to stabilize emerging economies who are recipients of large investments.

The chapters are organized as follows. Chapter 2 documents the relationship between private property institutions and economic growth. Chapter 3 examines the relationship between income inequality and financial development and documents a

nonlinear relationship. Chapter 4 examines the Asian financial crisis and documents the effect of weak corporate governance institutions, financial fragility, and external terms of trade shocks on growth and investment declines witnessed during this episode.

2.0 PRIVATE PROPERTY INSTITUTIONS AND ECONOMIC GROWTH: AN EMPIRICAL EXPLORATION OF NONLINEARITIES

2.1 INTRODUCTION

In the recent cross-country growth literature, the role of institutions is widely recognized as having a positive relationship with economic growth. A number of papers have shown that private property institutions are an important determinant of economic growth, trumping other variables measuring macroeconomic policies (Hall and Jones, 1999; Acemoglu et al., 2003; Rodrik et al., 2004). This study attempts to contribute to this area by investigating the relationship between private property institutions and economic growth of countries at different thresholds of their level of institutions. While most recent papers have assumed a linear relationship between institutional development and growth, the study shows that the relationship is more complex and nonlinear. The findings indicate that the development of property rights institutions is positively associated with growth at low and intermediate levels of property right development, but negatively associated when a high level of development has been attained. Also, the positive relationship is relatively weak for countries having the lowest level of institutions, but is more pronounced as countries develop their institutions over time.

The role of institutions in enhancing the growth and development of economies was explored by Douglass North (1990), drawing from writings by Coase (1937) and Williamson (1985). North delineated the role of formal and informal institutions in shaping incentives of economic agents and in creating opportunities for production and enterprise. His theory extended the role of institutions to the development of laws protecting private property, their enforcement, and regulation. In particular, the theory linked the transformation of resources to productive units, the costs of transactions in exchange of goods, and the costs of

enforcement, to the quality of institutions existing in a society. Recent literature (Acemoglu 2005), drawing from North's theory, define private property institutions as rules and regulations protecting the citizens against the power of government and elites. In this sense the concept of private property institutions is closely linked to the distribution of political power in the society and in regulating the relationship between ordinary citizens, politicians, and elites who have access to political power. In accordance, measures of private property institutions depict the extent of checks and balances between various parts of the decision-making process of the economies.

The beneficial impact of having good private property institutions is widely suggested in various studies in growth. For countries having moderate levels of institutional development, growth is enhanced when accountability groups have more power to regulate the state machinery from expropriation by the ruling executive. As a result, transaction costs and other rent-seeking costs in production are reduced. Hence investors feel more secure and the market mechanism works efficiently, resulting in growth. In an environment wherein the enforcement of property rights is reliable, firms tend to increase investment in fixed capital, use capital intensive technology, and have long-term horizons.

The differential impact of institutions on growth can be discerned when examining conflict-ridden countries having no real institutions that protect private property. In countries having the lowest level of institutions as measured by independent research organizations, political "accountability groups" such as legislatures or councils of nobles have no control over the actions of the ruling regime or chief executive. Many of these countries (for example, Ghana, Burkina Faso, Nigeria, Sudan, Uganda and Zaire in the sample of countries considered in this paper) have the lowest value in the index of private property institution, "constraint on executive"[1]. These economies also have some of the lowest per capita incomes in the world. The political scenario in these countries can be collectively described by examining the case of Ghana. In Ghana, the Convention People's Party (CPP) ruled over the nation since its independence in 1957 under the leader Kwame Nkrumah. By 1960, the leader took many actions to suppress the opposition and alter the Constitution to strengthen

[1] This index is popularly used in empirical literature as a measure of the extent of institutions supporting private property. The index is described in detail in section 3.

his political power. The bad economic policies adopted under this regime were analyzed by Bates (1981) and discussed in Acemoglu et al (2003). Bates showed that the government used the state Cocoa marketing board and exchange rate policy to systematically expropriate the cocoa farmers who dominated the economy and exports. In later years the distortionary policies continued as these economies could not develop a system of checks and balances. The political scenarios in Nigeria, Sudan, Uganda and Zaire were similar to Ghana, with totalitarian leaders using the state machinery to expropriate resources over this period.

When totalitarian regimes improve their system of checks and balances, the process is usually conflict ridden, and improvements can have a turbulent impact on the real economy. In the sample of countries under our study, Algeria, Ethiopia, Togo, and Morocco have seen the value of private property institutions in the index of 'constraint of executive' rise from 1 to 2 over the period 1970 to 1990. An implication of the move from 1 to 2 for this index is that from a state of complete control over its actions, the executive faces some real but limited constraints in the exercise of its power. The transition is usually not smooth. For example, in Algeria, the main political transition which laid more power in the hands of "accountability groups" occurred following the political uprising in 1989. Elections were held in 1992, but political instability over the period 1986-1991 lead to economic instability, with economic growth falling to an annual average of 0.4 percent in 1990s from 3.09 percent in the 1970s. In Togo, President Eyadema ruled the nation from 1969 onwards after ousting President Grunitzky in a bloodless military coup. Since then till the mid 1980s, political parties were banned and all constitutional processes suspended. The president ran uncontested elections in 1979 and 1986. However, in 1989-90 there was some movement toward developing a real opposition party. Thus the political transition happened in late 1980s till a new Constitution was adapted in 1992 which gave some authority to the Opposition party. The change in political structure resulted in an increase in level of institutions from 1 in 1970 and 1980 to 2 in 1990. During this period, the annual average growth rate dropped from 0.16 percent in 1970s to -0.51 percent in 1990s.

Similarly, Morocco moved from a level of 1 in the index of 'constraint on executive' to 2 over 1970 to 1990. Its growth rate averaged at 2.7 percent over the decade of 1970s, 1.6 percent in 1980s and 0.4 percent in the decade of 1990s. From these examples, I infer that

while countries are under a totalitarian system in which there is no system of checks and balances in the powers of the decision making body, resources are expropriated and rents transferred to agents supporting the ruling body. But when the political system changes to bring some accountability, the resulting power struggle has an adverse impact on the real economy. As a result, economic growth declines during this period. The decline may be caused by even worse expropriation and redistribution or it may be a result of the unstable political scenario affecting the investment climate with investors having a bleak view of the safety of their assets. The above situation is summarized in North (1990) as follows:

> The costs of transacting depend on the cost of measurement and the costs of enforcement. Enforcement is the critical obstacle to increasing specialization and division of labor. Enforcement poses no problem when it is in the interests of the other party to live up to agreements. But without institutional constraints, self interested behavior will foreclose complex exchange, because of the uncertainty that the other party will find it in his or her interest to live up to the agreement. The transaction cost will reflect the uncertainty by including a risk premium, the magnitude of which will turn on the deflection by the other party and consequent cost to the first party. Throughout history the size of this premium has largely foreclosed complex exchange and therefore limited the possibilities of economic growth. [p. 32]

The paper also explores the possibility that for countries having the highest level of private property institutions, a further extension in private property institutions may have an adverse impact on economic growth. In the case of these economies, increasing the existing level of institutions implies increasing the level of "checks and balances" in the decision making process, sometimes in terms of more regulation within existing system of institutions. An example is the chronic 'cabinet instability' that is witnessed in multiparty democracies as in India, Pakistan, South Africa as in the sample of countries considered. These countries have the highest value in the index of 'constraint on executive' in 1990. The implication is that the accountability groups for these countries have more power than the ruling executive, and in many instances important legislation are stalled as a result of multi party politics which ultimately effects growth adversely.

Another instance wherein higher levels of regulation may have an adverse impact on growth by increasing transaction, transformation, and enforcement costs can be seen in cases of corporate reform laws like the Sarbanes –Oxley Act. This law was passed by the US Congress in the year 2002 after accounting scandals hit multinational companies as Enron, WorldCom, and others. The act mandated rigorous accounting standards and inspection by a specialized team of independent experts of the company accounts. Fallout of the reform act is that it has severely affected the overall costs of big businesses as the new compliance regulations involve huge costs in auditing and insurance. A survey by Korn/Ferry International found that the law cost Fortune 1000 companies an average of $5.1 million in compliance expenses in 2004. This has resulted in many cases of small U.S. and big foreign firms deregistering from the U.S. stock exchanges. The incidence has been a blow to the US capital markets and to the smaller companies that depend on these capital markets for financing. There is a widespread belief that the Act will make capital more expensive and lower the rate of growth in the US. The Sarbanes-Oxley Act is an example of how "accountability groups" can impose regulations on existing practices of business and legislation which in the end affect economic growth negatively.

North (1990) asserts:

> Even with the relatively secure property rights that exist in high income countries, it is possible and indeed frequently the case that a technical combination that involves costly monitoring may be less efficient than a technique that has a lower physical output but less variance in the product or lower costs of monitoring workers.[p. 110]

Thus in countries with relatively high per capita incomes, transactions costs such as legal fees, title insurance, credit rating searches – and also costs in terms of time that must be devoted to gathering all the information – results in the consumption of resources that could have been allocated to more productive means.

In this paper, I explore potential nonlinearities in the relationship between private property institutions and economic growth, based on an otherwise standard reduced-form model used in cross-country growth studies. In the 1990s, the growth literature focused on the effectiveness of macroeconomic policies in promoting cross-country growth. But since the late 1990s, studies have conclusively shown the supremacy of institutions over

macroeconomic policies (Rodrik, Subramanian and Trebbi, 2002; Hall and Jones, 1999; Parente and Prescott, 1999). More recently, Acemoglu, Johnson, Robinson and Thaicharoen (2003) used a linear framework to investigate causal relationships between institutions and macroeconomic policies on economic growth, crises, and volatility, and provided evidence that countries that inherited 'weak' institutions from their colonial past were more likely to experience high volatility and economic crises. In this study, apart from assuming a nonlinear specification for the variable measuring institutions, I use the same framework as in the above quoted paper. Thus in the empirical exercise, the benchmark model is a linear specification having the same variables as in Acemoglu et al. (2003). The nonlinear specification is estimated separately using parametric and semiparametric techniques. The semiparametric estimation method allows for the derivation of consistent estimates without any assumption regarding the functional form for the nonlinear component. The semiparametric model is a partially linear model that allows the nonlinear components to enter additively. The approach focuses on estimating and then graphically presenting evidence on the nature of these nonlinearities. The graphical representation, as also seen in recent studies of the non-linear components (Banerjee and Duflo 2003; Liu and Stengos, 1999, Kalaitzidakis et al, 2001) provides direct evidence of the presence of nonlinearities in the relationship between property rights institutions and economic growth. As a further check for the robustness of these results, I estimate separate regressions using a parametric square and cubic specification of the measure of private property institutions and arrive at similar results showing evidence of nonlinearities in the relationship.

The remainder of the paper is organized as follows. Section 2 discusses the literature investigating the effect of institutions on growth. Section 3 provides the details on the data used, the empirical strategy, the benchmark linear and semiparametric estimation results, and the evidence of nonlinearities in the relationship between private property institutions and growth. Section 4 provides robustness checks by testing the data for outliers, observations with large influence, and gives the results from these tests. Next, the section gives a glimpse of contingencies in the relationship between initial income and the measure of private property institutions by splitting the entire sample according to poor, middle and rich economies under income standards of classification as defined by the World Bank. Also the section offers further evidence using other measures of private property institutions as the

'rule of law' (Kauffman, 2002) and 'political rights' (Freedom House, 1997). Section 5 concludes.

2.2 EMPIRICAL EVIDENCE OF THE RELATIONSHIP BETWEEN INSTITUTIONS AND GROWTH: A SURVEY OF RELATED LITERATURE

Over the past decade there has been resurgence in studies investigating the relationship between growth and institutions. The upshot of this strand of literature is that political and economic institutions are viewed as a major determinant of economic outcomes. The pioneering papers by Jones (1981), North and Thomas (1981), North (1981) and Olson (1981) inspired a generation of economists to look for alternative explanations of the broad and persistent differences observed in economic performance among nations. In early work examining the influence of institutions on growth, Kormendi and Meguire (1985) and Scully (1988) used cross-sectional growth regressions and Gastil's indexes of civil and political rights. These papers suffered from endogeneity problems because the indexes of civil and political rights are measured contemporaneously with growth and their results were inconclusive. Mauro (1995) found that efficient bureaucracy indexes are a significant determinant of investment. Knack and Keefer (1995) used two institutional indexes in growth regressions capturing the security of contract and property rights, the ICRG index and BERI index. They reported that institutional indexes were significant in the investment regression, confirming indirect effect on growth through factor accumulation. Barro (1996), in a panel study over the sample period 1960-90, used ICRG and BERI indexes of property rights to measure their impact on growth. The 'rule of law' index was found to have a positive and significant impact on growth, but the BERI index was only marginally significant, which was attributed to the reduced sample size due to unavailability of data. Hall and Jones (1999), following Knack and Keefer (1995), used a weighted average measure of institutions from the ICRG indexes, and showed that differences in social infrastructure across countries caused large differences in capital accumulation, educational attainment, and productivity, and hence accounted for cross-country income differences. Rodrik et al. (2002), using the index of 'rule of law' as proxy for institutions by Kaufman et al (2002), estimated the contributions of institutions, geography, and trade in determining

income levels of countries, and found significant evidence that the measure of institutions had strong effects, and that the other variables had insignificant effects once the measure of institutions is controlled for.

The study by Acemoglu et al. (2006) is the nearest to the concept and measure of institutions followed in this paper. They proxied for private property institutions with the index 'constraint on executive' by Polity IV, and showed that private property institutions were a major influence on long-run growth, investment and financial development, while contracting institutions measured with legal formalism by Djankov et al. (2002) had weak effects on growth and investment. The next section gives the empirical methodology and linear estimation results.

2.3 THE ESTIMATION METHOD: DATA, PARAMETRIC AND SEMI-PARAMETRIC ESTIMATION

2.3.1 Data details

The empirical analysis is based on data for 58 countries[2]. The estimation procedure is based on pooled cross-country data averaged over the 1970s, 1980s, and 1990s, so that there are three observations per country (1970-80, 1980-90, 1990-2000). The dependent variable is the growth rate of per capita gross domestic product (GDP). The variables used as regressors can be classified as stock and flow variables[3]. The stock variables are measured at the beginning of the decade, and consists of initial income, which is logged per capita real (chain weighted) GDP measured in 1970, 1980 and 1990[4]; secondary school enrolment rates, defined as gross enrolment ratio for secondary school education from the Barro and Lee data set for the year 1970, 1980, 1990; and also the preferred measure of private

[2] The list of countries are given in the Appendix A1. The countries are chosen as per the sample of countries used by authors Acemoglu et al (2002). Though the Acemoglu et al (2003) database includes 64 countries, the restrictions on availability of data for controls limit the sample to 58 countries.
[3] Appendix A3 gives a summary statistics of the data used.
[4] Source is Penn world tables 6.1.

property institutions, 'constraint on executive' for the year 1970, 1980, 1990 from the Polity IV dataset. The flow variables are a set of macroeconomic policies measured as averages over the decades following Acemoglu et al (2003). They are: average government consumption as a percent of GDP, defined as average of real government consumption to real GDP (Source: Barro and Lee dataset); the log of average inflation as a percent of GDP for each decade, defined as log of annual inflation in the consumer price index (Source: World Development Indicators 2005); and the log of an average measure of overvaluation of exchange rates for each decade, defined as an index of real overvaluation of the official exchange rate (Source: Easterly and Levine, 2002). The other controls are time dummies for decades 1980 and 1990.

The benchmark OLS estimation model specification is:

$$Y_{it} = Q_{it}^{'} \cdot \alpha + \beta \cdot I_{it} + Z_{it}^{'} \cdot \gamma + \theta \cdot \ln y_{it-1} + \varepsilon_{it} \quad , \qquad (2.1)$$

where Y_{it} is the average growth rate of the decades 1970, 1980, 1990; Q_{it} is the vector of macroeconomic policies; I_{it} is the measure of institutions, Z_{it} is the vector of controls, $ln\ y_{it}$ is the log of initial GDP per capita income and ε_{it} is the random error term.

Since the property rights institutions are the focus of the study, the preferred measure 'constraint on executive' is briefly described in this paragraph. The index is from the Polity IV database based on the work of Robert Gurr. The measure corresponds to procedural rules constraining state action, and highlights the close relationship between private property institutions and political institutions. It measures the extent of constitutional limits on the exercise of arbitrary power by the executive. Theoretically, a society wherein elites and politicians are effectively constrained is expected to experience less infighting between various groups to take control of the state, and to pursue more sustainable policies. The polity dataset reports a qualitative score between 1 and 7 for every independent country. This measure is used extensively in the recent empirical literature on institutions and growth; for example Acemoglu et al. (2003, 2006) showed that this measure is correlated with other measures of institutional quality and economic development. Another important consideration is that this is the only measure of institutions available from 1950 onwards for most countries, including the sample of countries chosen. The next paragraph discusses the implications of having a qualitative score of 1 to 7 so as to better understand the implications of nonlinearities of this variable in economic growth.

This paragraph aims to provide an interpretation of situations that prompt movements from a particular level to another level in this index. The index refers to the extent of institutionalized constraints on the decision making powers of the chief executive, whether they are individuals or collectives[5]. The 'constraints' are usually imposed by accountability groups such as legislatures in democracies, to the ruling party in a one-party state, or councils of nobles in a monarchy. When a country has a score of 1 in the index, it implies that there is no regular limitation (apart from removal of executive through assassinations or coups) on the power of the executive. Examples of this situation are when Constitutions are frequently revised or suspended at the executive's initiative; when Constitutional restrictions are ignored; when the executive appoints the members of accountability groups and removes them at will; when rules by decree are repeatedly used; when the legislature cannot initiate legislation, or veto or suspend actions of the executive. The score of 2 is an intermediate category. The score of 3 implies that there is some real but limited constraints on the actions of the executive. An examples is when there is evidence that the legislature initiates some categories of legislation; when the legislature blocks implementation of executives acts and decrees; when ruling parties take legislative actions independently of the executive; when there is an independent judiciary; when the legislature approves of some appointments made by executive; when attempts by executive to change some constitutional restrictions are not adopted and finally when there is a civilian executive but policy decisions reflect military demands. The score of 4 is an intermediate category. The score of 5 indicates that the executive has more authority than any accountability group but is subject to substantial constraints by them. An examples is when there is evidence of the legislature often modifying executive proposals for legislation; when the legislature refuse funds to the executive; when the legislature make important appointment in administrative posts; when the legislature refuse the executive permission to leave the country. The score of 6 is an intermediate category. The score of 7 is when accountability groups have power equal to or greater than the executive in most areas of activity. For example, when there is evidence that a legislature initiates most of legislation; when the executive is chosen by the accountability group and is dependent on their support for

[5] The source of information in this paragraph from the Polity IV Project: Dataset User's Manual, pp 23-24.

remaining in office; and when there is chronic 'cabinet instability' in multi-party democracies. The next paragraph gives a description of the method to tackle endogeneity issues in the estimation process.

OLS estimates are inconsistent due to endogeneity and measurement error problems. This is because both institutions and macroeconomic policy variables are endogenous, so estimation by OLS may be capturing reverse causality, or the effect of some omitted characteristics (geography) on both policy (or institutions) and the economic outcome. Also, the variables may be measured with error, so OLS estimates can have a downward attenuation bias. To address these problems, the two-stage least squares estimation procedure is employed using the variable *settler mortality* as a distinct instrument for institutions. Acemoglu et al. (2001) developed this instrument based on studies by Curtin (1989, 1998) and Gutierrez (1986), and showed that differences in mortality rates serve as an exogenous source of variation in the historical development of institutions among former colonies, and hence satisfy the exclusion criteria that the instrument should be correlated with the endogenous regressor and should be orthogonal to any omitted characteristics and other regressors. The interpretation given is as follows: in the colonial era of 17^{th} and 18^{th} century, European settlements developed in areas when disease environments were favorable to health. In these locations, Europeans migrated in large numbers and developed political and economic institutions similar to, or even better than, contemporary institutions in Europe. In such settler colonies as the United States, Canada, Australia, and New Zealand, colonialists rapidly developed and maintained good institutions, with tight constraints on politicians and elites, and secure property rights. In contrast, in places in which the Europeans did not settle, because they faced high mortality rates (for example in sub-Saharan Africa, South Asia, and Central America), relatively extractive institutions is established, with power concentrated in the hands of small elite. These countries typically ended up with weaker institutions at the beginning of the postwar era.

The identification strategy for the 2SLS estimation is to use the settler mortality measure as an instrument for institutions. In all regressions I instrument for institutions using log settler mortality. The first-stage regression specification is as follows:

$$I_{it} = \lambda + \phi \cdot sm_i + \varphi \cdot X_i + u_i \quad , \tag{2.2}$$

where sm_i refers to log settler mortality, X_i are the control variables and u_i is the random error term. The exclusion restriction is that in the population Cov(ε_i, sm_i) = 0, that is, settler mortality is not correlated with any unobserved determinant of growth (after controlling for covariates). Panel B in Table 2.1 gives first-stage estimates for settler mortality. The estimates are negative (-0.74, s.e 0.21) and significant at the 1 percent level, and similar to the estimates reported in Acemoglu et al. (2003). They report a value of -0.91 (with t-statistics of 5.68) using original ex-colonies sample of 64 countries from AJR (2001) for the period 1970-97.

To explore for nonlinearities parametrically, I estimate the above specification with the index of 'constraint on executive' entering at first as a quadratic and then as a cubic form. These estimations are undertaken using GMM estimation techniques using square and cubic terms of settler mortality as instruments for the variable for private property institutions when they are entered as a quadratic or as a cubic form. The population moment condition is as follows:

$E\left(Z_i' \left(Y_i - X_i' \beta \right) \right) = 0$ where $Z = \left(Z_1', Z_2' \right)'$ and Z_1 indicates the matrix of instruments for institutions and Z_2 is the matrix of instruments for other variables.

To test the validity of the moment conditions, I use the test of over-identifying restrictions developed by Hansen (1982) and Newey and West (1987). The null hypothesis of Hansen's test is that the over-identifying restrictions are valid, that is the instrumental variables are not correlated with the error term. The test statistic is simply the sample size times the value attained by the objective function at the GMM estimate (the J-statistic). Hansen's test is distributed as χ^2 with degrees of freedom equal to the number of moment conditions minus the number of parameters to be estimated. These statistics are reported in the tables.

2.3.2 Parametric Estimation Results

Panel A in Table 2.1 gives the OLS, 2SLS and GMM coefficient estimates from the linear model. The first and third columns have all explanatory variables in the linear

specification of equation (2.1). The first column reports the OLS coefficient estimates of the baseline model, while the third reports the 2SLS estimates after controlling for endogeneity. The second and fourth columns report the estimates of a quadratic specification of constraint on executive in the attempt to capture the potential nonlinearities in the relationship between private property institutions and growth. The fifth column reports estimates obtained when constraint on executive enters as a cubic function in the regression specification.

Table 2.1. Private Property Institutions, Macroeconomic Policies and Growth

Explanatory variable	OLS (I)	OLS(II)	2SLS (III)	GMM (IV)	GMM (V)
Panel A: Dependent variable is Growth rate of GDP per capita					
Initial Constraint on executive	0.002	0.75	0.82	6.69	1.54
	(0.106)	(0.41)*	(0.26)***	(3.43)*	(2.75)
Initial Constraint on executive index square		-0.096		-0.76	1.44
		(0.051)*		(0.41)*	(0.81)*
Initial Constraint on executive index cubed					-0.22
					(0.07)***
Government consumption	-0.06	-0.056	-0.07	-0.09	-0.071
	(0.04)	(0.033)*	(0.03)**	(0.05)*	(0.068)
Log(average inflation)	-0.59	-0.59	-0.56	-0.64	-0.84
	(0.16)***	(0.14)***	(0.16)***	(0.21)***	(0.28)***
Log (exchange rate overvaluation)	-0.46	-0.62	-0.064	-1.10	-1.40
	(0.49)	(0.52)	(0.49)	(0.94)	(1.33)
Log(Initial income)	-0.56	-0.37	-0.88	-0.20	0.08
	(0.40)	(0.33)	(0.44)**	(0.55)	(0.70)
Secondary school Enrolment	3.68	3.57	2.57	1.95	1.62
	(1.28)***	(1.35)***	(1.09)**	(4.44)	(0.58)***
Dummy 80	-1.69	-1.46	-1.61	-1.53	-1.51
	(0.44)***	(0.51)***	(0.43)***	(0.77)**	(0.92)*
Dummy 90	-1.53	-1.23	-2.02	-2.55	-3.12
	(0.49)***	(0.56)**	(0.48)***	(0.94)***	(0.98)***
Constant	10.32	8.07	8.6	1.2	2.88
	(3.39)***	(3.05)***	(3.28)***	(6.9)	(7.2)
R^2	0.24	0.248			
Hansen's J				[0.92]	[0.93]
Panel B. First Stage estimates for measure of Private property institutions					
Log settler mortality			-0.74		
			(0.21)***		
R^2			0.177		

Notes: The figures in parentheses are the standard errors. The figures in brackets are p-values. Panel A is a pooled cross section regression with 3 observations per country. In all there are 58 countries based on the sample of 64 countries by Acemoglu (2002). In Panel A the dependent variable is the growth rate over the decades 1970-80, 1980-90 and 1990-00. Details of sources of data are given in Appendix A. ***, **, * indicates significance levels at 1%, 5% and 10% levels respectively.

In column 1, I present the OLS estimates of the baseline specification. The coefficient estimate of 'constraint on executive' is found to be positive (0.002, s.e. 0.10) but

insignificant at conventional levels. In column 2, the coefficient estimate of the linear term of 'constraint on executive' is positive (0.75. s.e. 0.41) and quadratic term is negative (0.096, s.e. of 0.51), both significant at the 10 percent level.

The relationship between private property institutions and growth when controlling for endogeneity (2SLS and GMM estimates) are given in columns 3, 4 and 5. In these estimates, the institutions variable is instrumented using settler mortality. From the 2SLS estimates in column 3, I find the historically determined component of private property institutions to be a good predictor of growth rates, being positive (0.82, s.e 0.26) and significant at the 1 percent level. The estimates of the controls are as follows. The coefficient on log GDP per capita is negative (-0.88, s.e 0.44) and significant at the 5 percent level and confirm the conditional convergence that has been reported in various studies. The value of annualized rates of conditional convergence or divergence if negative, λ implied by the coefficient estimates associated with initial income value θ solves

$$\theta = \exp(-\lambda \cdot t) \ , \tag{2.3}$$

where t is the time distance between current and lagged income. The 2SLS estimate of initial income of -0.88 implies a convergence estimate of 0.426%. To compare with other studies, Barro and Salai-Martin (2004, Table 12.3, p.522), using cross-sectional OLS, obtain a convergence estimate of 2.48% using a broader set of explanatory variables than I consider, and with a sample of 86 countries. The estimated coefficient on secondary schooling enrolment is positive (2.57, s.e. 1.09) as confirmed by numerous studies and significant at the 5 percent level. The estimate implies that a one-standard-deviation increase in enrolment (0.26 in the decade of 90s) is associated with an increase in growth rate by 0.67. Among the policy variables, the estimated coefficient of government consumption ratio is negative (-0.07, s.e. 0.03) and significant at the 5 percent level. The coefficient value compares with that found by Barro and Salai-Martin (2004 table 12.3 p522) at 0.062 (s.e. 0.023). This estimate implies that reduction in the ratio by 0.25 (which is the standard deviation in the 1990s) is associated with an increase in growth by 0.0175. The coefficient estimate of inflation is positive (0.56, s.e 0.16) and significant at the 5 percent level. The estimate for average value of exchange rate overvaluation is positive (0.064, s.e. 0.48) and not significant. From these estimates, I conclude that inflation is an important variable among the policy variables as a factor influencing growth rate for this sample. However, when

compared to the estimate of constraint on executive, this factor has a smaller influence. In some ways the results confirm those in studies by Acemoglu et al. (2003) and Rodrik et al. (2002).

The regressions include an overall constant term and separate time dummies for the two decade periods, 1980-90 and 1990-2000. These two time dummies are negative (-1.61, s.e. 0.43) and (-2.02, s.e. 0.48) respectively and significant at the 1 percent level. This compares with the negative estimates found by Barro and Salai-Martin (2004, table 12.3 p522). The interpretation is that the sample's rate of economic growth seems to have declined from 1970 to 2000.

In the fourth column, I add a square of the private property institutions variable 'constraint on executive' to allow for a nonlinear effect on economic growth. This system is now estimated using the generalized method of moments. The instrument list includes settler mortality and its square. The results indicate that the linear and the squared term in the variable are each statistically significant with coefficient estimates at 6.69 (s.e. 3.43) and -0.76 (s.e. 0.41) respectively. These estimates imply that starting from a system with no rights on private property, increases in 'constraint on executive' tend to stimulate growth. However, the positive influence attenuates as the indicator takes on a midrange value of 6, and further increases tend to retard growth. Therefore, increases in institutions promoting property rights tend to enhance growth for countries that have low and moderate levels, but to retard growth for countries that have the highest levels as measured in the index. These results are confirmed in the sample which has been treated of outliers and observations of undue influence, these estimates are presented in Table A4 in the Appendix A.

In the fifth column, I add a cubic term in the specification of 'constraint on executive' to explore further evidence on the existence of nonlinearities in the relationship between income and the measure of private property institutions. The GMM results indicate that private property institutions have nonlinear effects on growth: the linear term with a positive coefficient of 1.54 (s.e. 2.75), and the squared and cubic term in constraint on executive is 1.44 (s.e. 0.82) and -0.22 (s.e. 0.07), respectively. The estimates imply that starting from a system in which there are no constraints in the power of the executive,

increases in constraints in power tend to have at first weak positive relationship with growth. Therefore installing more checks and balances on the power of the executive seems to have a weak impact on growth when countries are at a low level in their index of 'constraint on executive'. A possible reason can be that for countries having the weakest level of institutions, the macroeconomic outlook is also bleak. Thus the marginal impact on increasing the level of institutions is not as significant as improving the economic infrastructure. Further increases in the level of constraint in powers of the executive are associated with significant beneficial effects on growth. The results also indicate that after a certain level in the index (at the value of 6); growth is negatively associated with an increase in the level of private property institutions. This nonlinear result is shown by Figure 1c and 1d. Figure 1c represents the full sample, whereas in Figure 1d estimation is done after outliers are removed from the sample[6]. The solid lines indicate fitted values implied by the linear, square and cubic terms in 'constraint on executive'. The findings imply that growth would likely be increased by further checks and balances in the political system in countries such as Tunisia and Malaysia, which exhibit intermediate levels of private property institutions. Moreover future growth may be retarded by an increase in checks and balances in the existing political system in countries as India, USA, and Chile, which have the highest levels of institutions protecting property. For countries with the lowest level of institutions (e.g. Sudan, Zambia), unless the reforms to improve the level of institutions are done rapidly, the impact on growth maybe positive but negligible.

Next, I investigate whether the impact of the variable 'constraint on executive' on growth differs among the different categories of the variable. The method used is to do so is by dividing the index in its components parts and analyzing the impact of its component parts on growth. This method is helpful in measuring the marginal impact of different levels of the variable on growth. Column 1 in Table 2.2 shows the result when the private property institutions index is replaced by two dummy variables. The first dummy equals 1 if the index is 1 and 2, and equals zero otherwise. The second dummy equals 1 if the index is 3, 4, and 5 and equals zero otherwise. If the index exceeds 5 (has values 6 and 7), then both dummies are equal to zero.

[6] The details of the test for the presence of outliers and influence observations are in section 4. The results of the 2SLS and nonlinear GMM estimates are given in Table 5 in Appendix A4.

Table 2.2. Impact of Private property institutions on Growth: by Category

Explanatory variable	Coefficient (I)	Coefficient (II)
Dummy 12	0.93	0.87
	(0.46)**	(0.51)*
Dummy 345	0.99	
	(0.45)**	
Dummy 34		0.78
		(0.53)
Dummy 56		0.88
		(0.55)*
Government consumption	-0.08	-0.08
	(0.03)**	(0.03)**
Log(average inflation)	-0.44	-0.49
	(0.13)***	(0.13)***
Log (exchange rate overvaluation)	-1.06	-0.99
	(0.46)**	(0.46)***
Log(Initial income)	-0.43	-0.46
	(0.31)	(0.31)
Secondary school Enrolment	4.40	4.30
	(1.18)***	(1.24)***
Dummy 80	-1.89	-1.87
	(0.39)***	(0.39)***
Dummy 90	-1.70	-1.69
	(0.41)***	(0.42)***
R^2	0.34	0.33
F	8.66 [0.00]	7.5 [0.00]

Notes: The figures in parenthesis are standard errors and in brackets are p values. The sample size is 164; the sample is with no outliers or observations of undue influence. ***, **, * indicates significance levels at 1%, 5% and 10% levels respectively.

The estimated coefficients with their standard errors are positive (0.92, s.e. 0.46) for the first dummy and positive (0.98, s.e. 0.45) for the second dummy; both estimates are significant at the 5 percent level. These results indicate that the hypothesis of linearity, requiring the coefficient of the first dummy to be roughly double that of the second, is strongly rejected. Also, the middle level of 'constraint on executive' is most favorable to growth, the lowest level comes second, and the highest level comes third. In column 2, I undertake a similar exercise. Here, the first dummy equals 1 if the index is 1 and 2, and equals zero otherwise; the second dummy equals 1 if the index is 3 and 4, and equals zero otherwise. The third dummy equals 1 if the index is 5 and 6, and zero otherwise. If the index is 7, then all dummies equal zero. The estimated coefficients are 0.87 (s.e. 0.51) for the first dummy, 0.78 (s.e. 0.53) for the second dummy and 0.88 (s.e. 0.55) for the third dummy. The results are similar to that estimated in the first column.

In Table 2.3, column 1, I have a dummy variable for six of the seven values in the index of 'constraint on executive'. The value of 7 in the index serves as the benchmark category. The estimated coefficients indicate a positive impact of the institutions variable on growth for countries having lower and middle levels of institutions. The impact on growth falls for countries having the highest level of institutions. The results confirm this in Table 2.3. For countries that have a low level of institutions, the relation is positive 0.88 (s.e. 0.55) and significant at the 10 percent level for Dummy 1; the estimate is slightly bigger at 0.94 (s.e.0.64) and significant at the 14 percent level for Dummy 2. The countries in the middle range have a positive association with growth, for example, the estimates of Dummy 3 is 0.89 (s.e. 0.54) and significant at the 10 percent level. The estimate on Dummy 4 is negative (- 0.16, s.e. 1.24); its insignificance is possibly due to the extremely small number of observations (a total of 4) in that category. The coefficient estimate for Dummy 5 is bigger at 1.34 (s.e. 0.63) and significant at the 5 percent level. Lastly, for countries having a high level of institutions (the value of 6 and above) the correlation with growth is marginal. The coefficient estimate for the Dummy 6 is positive and marginal at 0.075 (0.75). In the second column, these conclusions are further reiterated when only including the dummy for category 7, the best level of the measure. The estimate is negative (-0.85, s.e.0.4) and significant at the 5 percent level. The estimate implies that compared to the baseline levels of institutions (categories 1 to 6 in case of estimation in column 2), growth for countries having the highest level is relatively low.

From the 2SLS estimation results, for given values of per capita GDP and human capital, growth depends positively and significantly on private property institutions rather than policy variables. The 2SLS estimates provide the benchmark linear framework. From the GMM estimates and the analysis using dummy variables, I find evidence of nonlinearities in the effect of the index of private property institutions on growth. Figure 2.1c and 2.1d shows the nature of the nonlinearities. An inverse u- shape can be discerned. The next section provides the semi-parametric estimates and further evidence of the effect of private property institutions on economic growth.

Table 2.3 The Relationship between Private Property Institutions and Growth : By Category

Variable	Estimate (1)	Estimate (2)
Dummy 1	0.88	
	(0.55)*	
Dummy 2	0.94	
	(0.64)	
Dummy 3	0.89	
	(0.54)*	
Dummy 4	-0.16	
	(1.24)	
Dummy 5	1.34	
	(0.63)**	
Dummy 6	0.075	
	(0.75)	
Dummy 7		-0.85
		(0.40)**
Government consumption	-0.08	-0.08
	(0.03)**	(0.03)**
Log(average inflation)	-0.45	-0.48
	(0.13)***	(0.12)***
Log (exchange rate overvaluation)	-1.08	-0.99
	(0.47)**	(0.42)**
Log(Initial income)	-0.35	-0.46
	(0.32)	(0.32)
Secondary school Enrolment	4.05	4.33
	(1.26)***	(1.10)***
Dummy 80	-1.93	-1.86
	(0.39)***	(0.40)***
Dummy 90	-1.76	-1.68
	(0.42)***	(0.39)***
Constant	10.45	12.03
	(3.07)***	(2.96)***
R^2	0.34	0.33
F	6.02	9.38
	[0.00]	[0.00]

Notes: The dependent variable is the growth rate over the decades 1970-80, 1980-90 and 1990-00. The figures in parenthesis are standard errors and in brackets are p values. The sample size is 164; the sample is with no outliers or observations of undue influence. ***, **, * indicates significance levels at 1%, 5% and 10% levels respectively.

2.4 SEMI-PARAMETRIC PARTIALLY ADDITIVE MODEL ESTIMATION: METHODOLOGY AND ESTIMATES

A semi-parametric framework is one in which part of the regression specification assumes a functional form and part of it is estimated without any assumptions about the specific functional form beyond some degree of smoothness. Many different estimators have been used to evaluate the pertinent growth equations, and there are certain rules associated with the choice of each estimator. I will briefly discuss these estimators in order to motivate the approach of estimation that I adopt. Next, I will give a brief description of the methodology I use to explore for potential nonlinearities in the relationship between private property institutions and growth.

The semi-parametric partially linear specification (PLR) of the model can be written as:

$$Y_i = X_i^T \beta + h(Z_i) + u_i \tag{2.4}$$

where X_i is a variable of dimension q, β is a $q \times 1$ vector of unknown parameters, Z_i is a continuous variable of dimension p, $h(.)$ is an unknown function and $E(u_i \mid X_i, Z_i) = 0$. In the semi-parametric literature, Robinson (1988) provided a method of obtaining a $n^{1/2}$ consistent estimator of the parameter vector β by concentrating out the influence of nonlinear variables, the Zs. This is accomplished by conditioning on them through kernel methods and estimating the conditional expectations $E(Y_i \mid Z_i)$ and $E(X_i \mid Z_i)$. In the second stage of the two-step estimation procedure, the kernel estimates of $E(Y_i \mid Z_i)$ and $E(X_i \mid Z_i)$ are used to estimate β. The estimate of β is given by:

$$\hat{\beta} = \left[\sum (x - \hat{m}_{xx})(x - \hat{m}_{xx})' \right]^{-1} \left[\sum (x - \hat{m}_{xx})(y - \hat{m}_{yx}) \right] \tag{2.5}$$

Where $\hat{m}_{xx} = E(X \mid Z)$ and $\hat{m}_{yx} = E(Y \mid Z)$ are kernel based estimators. Once $\hat{\beta}$ is found, $h(Z_i)$ can be estimated from (2.4) as $\hat{h}(Z_i) = \hat{m}_{yxi} - \hat{m}_{xxi}' \hat{\beta}$. This estimator has been used in growth studies to find evidence of nonlinearities in income and human capital and economic growth (Liu and Stengos, 1999, Mamuneas et al. 2004).

When the nonparametric part is endogenous, the above estimator cannot be used to estimate the unknown nonlinear function as the resulting estimator is inconsistent. In recent semi-parametric literature, a number of papers have tried to resolve this by using the sieve minimum distance (SMD) estimator (Ai and Chen 2003, Newey and Powell, 2003). Both papers provide a method for obtaining $n^{1/2}$ consistent estimator of β_0 and $h(.)$ using the SMD estimator. I closely follow Ai and Chen (2003) and give a description of this estimator. In a general formulation, equation (2.4) can be can be written in terms of the conditional moment restriction,

$$E\left[\rho\left(V_i, \theta_0, h_0\right) | X\right] = 0 \tag{2.6}$$

where $V' = \left(Y', X_z^{'}\right)$, X_z is a subset of X, $\rho(.)$ is a vector of known (residual) functions, and $E\left[\rho\left(V_i, \theta_0, h_0\right) | X\right]$ is the conditional expectation of $\rho\left(V_i, \theta_0, h_0\right)$ given X. The parameters of interest $\alpha_0 = (\theta_0, h_0)$ contain a vector of finite dimensional unknown parameters of interest θ_0 and a infinite dimensional unknown functions $h_0(.) = (h_{01}(.), \ldots., h_{0q}(.))$. The model is semi-parametric in the sense it contains unknown functions h_0.

The partially linear regression model studied by Robinson (1988) as specified in equation (2.4) have the conditional moment restriction as follows:

$$\rho\left(V_i, \alpha_0\right) = Y_{1i} - X_{1i}'\theta_0 - h_0\left(Z_i\right) \ , \tag{2.7}$$

with $E\left[\rho\left(V_i, \alpha_0\right) | X_{1i}, X_{2i}\right] = 0$, where $\alpha_0 = (\theta_0, h_0)$, $V = (Y, X'_1)'$, $X = \left(X_1', X_2'\right)'$, and $Y = \left(Y_1', Z'\right)'$. Under the assumption that the above model is identified, Ai and Chen (2003) provide a method for obtaining $n^{1/2}$ consistent estimator of α_0 when the nonparametric part appears endogenously in the model using a sieve minimum distance estimator (SMD) $\hat{\alpha}_n = \left(\hat{\theta}_n, \hat{h}_n\right)$. The SMD estimator is analogous to the GMM or a two- stage nonlinear least squares (2SNLS). The authors have shown that under a set of sufficient conditions, $\hat{\alpha}_n$ converging to α_0 and θ_0 is both $n^{1/2}$ consistent and asymptotically normally distributed. The following paragraph outlines the method of SMD estimator[7].

[7] The next paragraph is heavily derived from Ai and Chen (2003). Please refer to this paper for more details on the efficiency and consistency of estimator and derivation of variance-covariance matrix.

Suppose that the observations *{(Y, X) : i = 1, 2, ...n}* are drawn independently from the distribution of *(Y, X)* with support $\mathrm{Y} \times \aleph$ where Y is a subset of $\Re^{dy}$ and $\aleph$ is a compact subset of $\Re^{dx}$. Suppose that the unknown distribution of *(Y, X)* satisfies the conditional moment restriction given by (2.7), where $\rho : \Omega \times \mathrm{A} \to \Re^{d\rho}$ is a known mapping, up to an unknown vector of parameters, $\alpha_0 \equiv (\theta_0, h_0) \in \mathrm{A} \equiv \Theta \times \mathrm{H}$. I assume that $\Theta \subseteq \Re^{d\theta}$ is compact with nonempty interior and that $\mathrm{H} \equiv \mathrm{H}^1 \times ..... \times \mathrm{H}^q$ is a space of continuous functions. I further assume that $V \equiv (Y', X_z')' \in \Omega \equiv \mathrm{Y} \times \aleph_z$ and $\aleph_z \subseteq \aleph$.

Let $F_{Y|X}$ be the functional form of the conditional distribution of *Y* given *X*. If $F_{Y|X}$ were known, then the functional form of the conditional mean function $m(x, \alpha) = \int \rho(y, x_z, \theta, h(.)) dF_{Y|X=x}(y)$ would be known. The minimum distance estimator of α_0 would then minimize:

$$\inf_{\alpha=(\theta,h)\in\Theta\times\mathrm{H}} E\left[m(X,\alpha)' [\Sigma(X)]^{-1} m(X,\alpha) \right], \tag{2.8}$$

where $\Sigma(X)$ is a positive definite matrix for any given X. The true value of α_0 could then be estimated by minimizing the sample analog of (2.8). Following the sieve literature, Ai and Chen (2003), replace the H with the sieve space $\mathrm{H}_n \equiv \mathrm{H}_n^1 \times ..... \times \mathrm{H}_n^q$, which is computable and often finite-dimensional compact parameter space that becomes dense in H as *n* increases. The SMD estimator of α_0 minimizes the sample analog of a nonparametric version of (2.7) with h restricted to the sieve space H_n:

$$\hat{\alpha}_n = (\hat{\theta}_n, \hat{h}_n): \min_{\alpha=(\theta,h)\in\Theta\times\mathrm{H}} \frac{1}{n} \sum_{i=1}^{n} \hat{m}(X_i, \alpha)' \left[\hat{\Sigma}(X)\right]^{-1} \hat{m}(X_i, \alpha),$$

where $\hat{\Sigma}(X)$ is a consistent estimator of $\Sigma(X)$. To compute the consistent estimator of *m(X, α)* the linear sieve estimator is used. Let $\{p_{0j}(X), j = 1,2,.....\}$ denote a sequence of known basis functions (as in splines, Fourier series, power series etc.), the linear sieve estimator is given by

$$\hat{m}_l(X, \alpha) = \sum_{j=1}^{n} \rho_l(Z_j, \alpha) p^{kn}(X_j)' (P'P)^{-1} p^{kn}(X) \quad (l = 1, \ldots\ldots d_\rho), \tag{2.9}$$

where $P = \left(p^{kn}(X_1),....., p^{kn}(X_n)\right)'$.

The integer k_n is the smoothing parameter which is required to grow with n so that the approximation error decreases to zero. The above sieve estimator can be interpreted as GMM. With $\hat{\Sigma}(X)$ = I, the SMD estimator $\hat{\alpha}_n$ is the solution to

$$\min_{\alpha=(\theta,h)\in\Theta\times H}\left(\sum_{j=1}^{n}\rho_l(Z_j,\alpha)\otimes p^{kn}(X_j)\right)'(I\otimes P'P)^{-1}\left(\sum_{j=1}^{n}\rho_l(Z_j,\alpha)\otimes p^{kn}(X_j)\right), \qquad (2.10)$$

where $\otimes$ denotes the Kronekar product and I the $d_\rho \times d_\rho$ identity matrix.

Following Ai and Chen (2003), I assume that the nonparametric part of the estimating equation assumes a Fourier series form with, $h_{0j} \in H^j = \Lambda_{c_1}^{\gamma_1}[-1,1], \gamma_1 > 1/2,$ for $j = 1....q$. For identification I assume that Z contains a constant with *dim (Z) > 1*, and $h_{oj}(0) = 0$ for $j = 1, ..., q$. I consider the Fourier series sieves for $j = 1, ..., q$:

$$H_n^j = \left\{ \begin{array}{l} h_1(X_j) = a_0 + \sum_{l=1}^{Jn}\left[a_{1l}\cos(\pi l X_j) + a_{2l}\sin(\pi l X_j)\right], \\ h_j(0) = 0, a_0 + \sum_{l=1}^{Jn} l^{2p}\left(a_{1l}^2 + a_{2l}^2\right) \le c_1^2 \end{array} \right\},$$

where $p \in (1/2, \gamma_1)$ is a constant arbitrary close to γ_1. I apply the SMD procedure described above with $H_n \equiv H_n^1 \times ..... \times H_n^q$, H_n^j given in (2.6) and $k_{ln} = q(2J_n + 1)$. The SMD procedure with the identity weighing is a 2SLS estimation applied to

$Y_{1i} = X_{1i}^{'} + h(Z_i)\beta + u_{i1}$, with $p^{kn}(X_i)$ as instruments.

For the nonlinear component, to determine the individual impact of private property institutions, I model the unknown function $h(Z_i)$ as a function of the measure of private property institutions. The results of the estimates are presented in Table 2.4. The first column reports the results from estimation of the full sample. The second column gives the results of estimates when outliers and other observations of undue influence are removed. The semiparametric coefficient estimates of the control variables and nonparametric $h(Z_i)$ are presented in the table.

Table 2.4. Institutions, Macroeconomic policies and Growth: Semiparametric estimates

Explanatory variable	Coefficient Estimates I (Full sample)	Coefficient Estimates II (sample without Outliers)
A_0	13.2	14.2
	(6.4)**	(7.6)*
A_1	5.77	4.83
	(3.20)*	(2.66)*
A_2	4.31	4.29
	(2.19)*	(2.23)*
Government consumption	-0.08	-0.075
	(0.07)	(0.055)
Log(inflation)	-0.75	-0.79
	(0.28)**	(0.29)**
Log (exchange rate overvaluation)	-1.58	-2.15
	(1.07)	(1.05)**
Log(Initial income)	0.09	0.35
	(0.13)	(0.50)
Enrolment	3.21	1.48
	(2.14)	(0.55)**
Dummy 80	-1.56	-1.62
	(0.94)*	(0.87)**
Dummy 90	-3.06	-3.24
	(0.99)***	(0.93)***
N	174	164

Notes: The figures in parenthesis are the standard errors. The dependent variable is growth rate of GDP per capita averaged over the decades 1970s, 1980s and 1990s. There are three observations per country.

In column I, the semiparametric estimate of the policy variables average of log of inflation is significant with estimate of -0.75 (s.e. 0.28), average of government consumption and exchange rate overvaluation are negative and insignificant at conventional levels. These results are somewhat similar to the 2SLS results. The estimated results for human capital and initial per capita income also are slightly different. The estimates for human capital increase to 3.21 (s.e. 2.14) while initial income is 0.094 (s.e. 0.13). A possible explanation for the insignificant estimates of initial income can be that the historically determined component of institutions is a good predictor for initial income, making our institutions variable and initial income collinear. Also, the estimate of initial per capita income implies a rate of divergence of 7.8%. The estimates of the nonparametric function $h(Z_i)$ are positive and significant. The fitted values of the coefficients a_0 , a_1, *and* a_2 are represented in Figures 2.1a for the full sample. The estimates show that function is highly nonlinear and similar to the fitted values of GMM estimates represented in the previous section. In column II, the estimates of the policy variables are similar; the only difference is the estimates of human capital become smaller (1.48, s.e. 0.55) and significant at the 5 percent level. The estimate of initial income

increases to 0.35 (s.e. 0.5), remains insignificant and implies a divergence rate of 3.5 %. The coefficients of the nonparametric h(Zi) are positive and significant.

The estimates of the nonlinear components for private property institutions are presented graphically in Figure 2.1 alongside 95 percent confidence intervals. In the figure, 'institutions' is the only variable which enters as a non-linear determinant of economic growth; this is done to examine the relationship between private property institutions and growth without considering the possible non-linear effects of other variables. The Figure 2.1 has four parts. Figures 2.1a and 2.1b denote the semi-parametric estimates of the measure 'constraint on executive' using the full sample and the sample without the presence of outliers and observations having a large influence . The horizontal axis shows the exogenous component of constraint on executive while the vertical axis shows the value of $h(Z_i)$ in the standardized form. The Figures 2.1c and 2.1d show the parametric estimations from the fitted value implied by the linear, squared, and cubic terms in 'constraint on executive' from the estimates presented in column 4 in Table 2.1. The parametric estimates are included to show similar effects of the measure when estimating parametrically instead of semi-parametrically. To highlight the difference between the nonlinear GMM and linear estimates, I have plotted the linear benchmark. In situations in which the benchmark lies outside the confidence bounds, there is evidence of a nonlinear structure not captured by the simple linear model.

In Figures 2.1a and 2.1b, two different regions can be discerned based on the level of institutions. The diagrammatic effect is similar when examining the fitted values of linear, square, and cubic terms of the exogenous component of parametric estimates of 'constraint on executive'. (The linear benchmark lies inside the confidence bands of the semi-parametric fit for the sample without outliers only in the ranges 1.3 to 6 on the measure 'constraint on executive' and lies outside the band for the other levels of the measure). The figure suggests that the beneficial effects of this measure of private property institutions are limited to countries enjoying low to middle levels of private property institutions, while for high-private-property-institutions countries the relationship is negative. Moreover, this result is repeated with fitted parametric estimates as seen in Figure 2.1d, indicating there is some

adverse impact of private property institutions on growth for countries enjoying higher levels of constraint on executive.

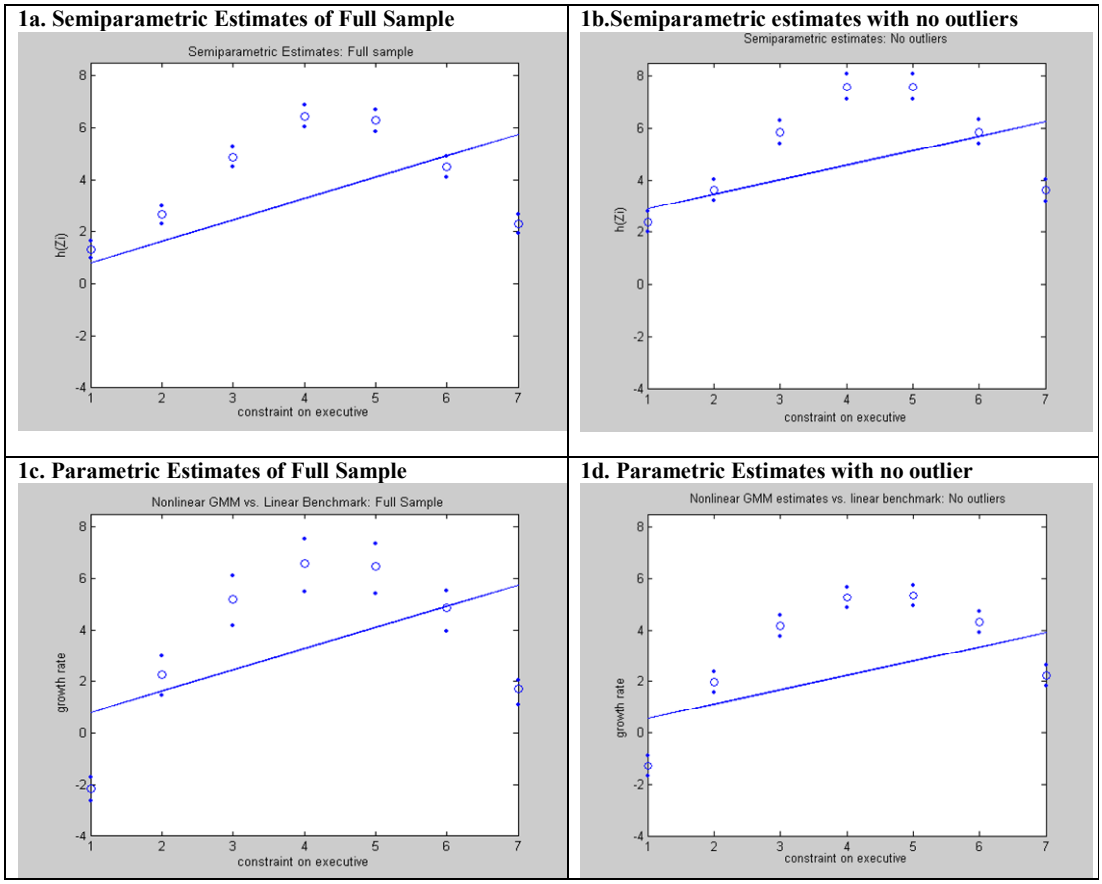

Figure 2.1. Private property institutions and Economic Growth: Parametric and Semiparametric estimations

Notes: In figures a, b, the circled points gives the non-parametric estimate of $h(Z_i)$, the dotted lines are confidence intervals at the 95% level. In figures c and d, the circled line gives the fitted value implied by the linear, square and cubic terms of constraint on executive from the 2SLS estimates; the solid line gives the linear benchmark

The implication is that at low and middle ranges of private property institutions (below 6), growth is increasing with increases in the measure of institutions. Also as seen in the figures, the impact is more pronounced for estimates in the middle ranges, rather than in the lower ranges of the index. In the context of the sample of countries in the study, Sudan, for example, has a value of 1 in the index of private property institutions, and its growth would rise by 0.043 percent on average per year if this country moved to 2 (the value

Algeria and Gambia in the sample) in the index over a decade . The result reflects the marginal beneficial impact of improving property rights by creating economic opportunities that have growth enhancing incentives. A possible explanation is that economies with weak institutions have lower constraints in the expropriatory power of the ruling executive. As a result, when these economies experience some political change which results in increasing constraints in powers of the executive to some extent (or developing institutions which makes executive more accountable), they may witness a marginal positive impact on growth because the investment environment become less fragile and the efficiency of investment is enhanced as the enforcement of property rights is more reliable even in times of uncertainties in the power struggle.

At the middle levels of institutions, for example, Tunisia has a value of 3 in the property rights index and, its growth would rise on average by 0.063 percent per year if its index rises to 4 (as enjoyed by Malaysia in the sample) over the decade. Thus the relationship is stronger after a certain threshold, as institutions in these levels have more power to check the predatory actions of executive. This results in higher growth by increasing the volume of investment, by for example, eliminating red tape and rent seeking costs. Higher growth can also result from the increase in the efficiency of investment, and by enforcing well-defined property rights.

At higher levels of institutions (above 5.5 as measured by the constraint on executive), the relationship between private property institutions with growth becomes negative. This could be because in economies enjoying a high level of private property institutions, there is already an effective system of checks and balances in the power of the executive. Any reform to increase the existing level of regulation on powers of the executive corresponds with higher transaction and transformation costs as more rules and regulations are involved in the measurement of tangible and intangible assets. Again, costs of enforcement can be increasing in terms of, for example, legal fees, credit rating searches, realtor fees etc. In terms of the coefficient estimate, for example, Brazil and Indonesia having a index value of 6 would be predicted to incur a fall in the average growth rate of 0.07 percent per year if either increased its current level of institutions to a value of 7 (as enjoyed by United States and Canada in the sample) over a decade. Thus the findings

indicate that the measure of private property institutions has nonlinear relationship with economic growth. In the next section, I provide robustness checks.

2.5 ROBUSTNESS CHECKS

2.5.1 Impact of Outliers, and influence statistics

Table A4 in the Appendix A reports parametric estimates obtained given the elimination of potential outlier observations. The results provide evidence of whether the results reported above are driven by certain influential observations. In the full sample, seven observations (Congo in decade 1970s, Congo, Uruguay, Zaire in the decade 1980s, and Honduras, Haiti, and Zaire in the decade 1990s) were singled out using a combination of two test statistics to flag observations which act as outliers. The first test statistics is advocated by Belsley, Kuh and Welch (1980) which involves use of DFITS statistic to flag observations associated with high combination of residual and leverage statistics . The second test statistic, the Cook's D statistic, is used as a measure of the aggregate impact of each observation on a group of regression coefficients and their covariances. Usually values larger than 4/n are considered to be highly influential. I also use a test for checking observations that have a large influence and as a result I drop three observations: Australia, New Zealand in the 1990s and Nigeria in the 1980s. The leverage values measure how far an observation is far from the others in terms of the levels of the independent variables (not the dependent variable). Observations with values larger than 2(k +1)/n are considered to be highly influential, where k is the number of predictors and n is the sample size.

From the results in Table A4, the 2SLS estimate (column 2) of private property institution is positive (0.56, s.e. 0.22) and significant at the 5 percent level. Estimates of coefficient for enrolment is higher, positive (2.86, s.e. 1.11) and significant at the 5 percent level. The estimates of inflation and government consumption are similar to estimates presented for full sample; however the estimate for exchange rate overvaluation is higher, negative (-0.56, s.e.0.45), though still insignificant at conventional levels. The estimate for

initial income is negative (-0.75, s.e. 0.31) and significant at the 5 percent level. In column 3, I report GMM estimates with the linear and quadratic terms of the measure 'constraint on executive'. The coefficient estimate on the linear term is positive (4.9, s.e. 2.9) and significant at the 10 percent level, whereas that on the squared term is negative (-0.53, 0.35) and significant at the 12 percent level. The coefficient estimate on government consumption is negative (-0.093, s.e. 0.04) and significant at the 5 percent level whereas, the coefficient estimate on exchange rate overvaluation is negative (-1.35, s.e. 0.85) and significant at the 10 percent level. The real differences are in the estimates of initial income and enrolment; the former becomes insignificant at conventional levels, while for the latter, the estimate is smaller, positive (0.97, se 1.8) and no longer significant. Thus the results from the estimations of sample without outliers underscore the relationship between institutions on growth, as well as some macroeconomic policy variables on growth.

2.5.2 Income – Private property institutions contingencies

In this section, I examine the relationship between initial income and measure of private property institutions. Using the preferred measure 'constraint on executive', I find the correlation coefficient between the two variables for the whole sample is 0.59. Contrary to the general belief that countries with good private property institutions usually belong to the income category representing high levels of per capita income, I find that many countries (such as India, Jamaica, Chile, Trinidad and Tobago in our sample of countries) with lower levels of per capita income tend to enjoy higher values in the measures of private property institutions in 1990. Again, this reaffirms that these measures represent the availability of checks and balances in the powers of the executive, and apparently this criteria does notguarantee high levels of per capita income.

To examine income – private property institutions contingencies I split the sample of countries to sub-samples, including lower-income, middle-income, and rich countries, and estimate separate linear specifications for each. The criteria for the three income levels are as follows: the sample of poor countries includes those with per capita incomes less than $2,650, the middle-income sample includes countries with incomes between $2,650 and $5499; and the upper-income sample includes countries with incomes above $5499. These

thresholds are as defined in the World Bank's income measures corresponding to measures from the Penn World Tables. Usually rich income levels are those with per capita incomes higher than $11,500, but due to data constraints, I club the richer countries with the sample of upper-middle-income countries when examining the income-institutions contingencies in the linear specification. Table A5 in Appendix A reports estimates of the impact of institutions on growth in a linear specification for these split samples.

For the poor-income sample, the impact of private property institutions on growth is positive (0.70, s.e. 0.37) and significant at the 10 percent level. When estimating without the presence of outliers, the estimate is smaller, positive (0.51, s.e. 0.29) and significant at the 8 percent level. For the middle-income sample, the coefficient is larger, positive (2.21, s.e. 0.81) and significant at the 1 percent level. This corresponds to the documented evidence of large impact of private property institutions on economic growth. For the richer income group, however the coefficient estimate becomes smaller (0.48, s.e. 0.35) and statistically insignificant. When estimated without the presence of outliers, the estimate is larger, positive (0.86, s.e. 0.72) but still insignificant. These results reinforce the evidence that for countries with higher income levels, the relationship between private property institutions and economic growth is marginal.

I will briefly discuss the coefficient estimates obtained for the additional explanatory variables. The ratio of government consumption to GDP is consistently negative for all income samples, but factors more for middle-income countries (-0.12, s.e. 0.06) and is significant at the 5%. For richer and lower-income countries, the estimates are smaller and insignificant. Estimated coefficients for secondary school enrolment are positive and significant for all three income levels, but factor more importantly for the middle-income countries (5.75, s.e. 2.33). From the estimated coefficient of initial income, I find that similar to results by DeJong and Ripoll (2006), 'club convergence' is more rapid for richer income countries than middle-income countries. From the estimates of initial income for rich economies, convergence is at the rate of 3.10 percent per annum. For middle-income economies the rate is 2.29 percent. The estimates of initial income for the poor countries sample indicate divergence at the rate of 7.9 percent per year. Finally, inflation is an important variable that has a strong, negative correlation with growth for middle-income (0.87, s.e. 0.14) and high-income economies (0.53, s.e. 0.22); but its estimate is negative (0.12, s.e. 0.26) and insignificant for poor countries. In contrast, exchange rate overvaluation

is negatively correlated with growth for lower-income economies (1.53, s.e. 0.59) and is statistically significant. However, the correlation with growth is positive for richer (1.39, s.e. 1.36), and middle-income countries (0.91, s.e. 0.81) but insignificant at conventional levels.

2.5.3 Other Measures of Private Property Institutions

In this section I provide additional evidence of the nonlinear relation of private property institutions with economic growth using other measures widely used in literature: the 'rule of law' and 'political rights'. The 'rule of law' measure is obtained from Kaufman et al (2002) and is for the year 1997-98 and has been used in studies by Rodrik et al. (2002). This is a composite indicator of a number of elements that capture the protection afforded to property rights as well as the strength of the rule of law. This is a standardized measure that varies between – 2.5 (weakest institution) and 2.5 (strongest institution). Figure 2.2 gives results obtained using a fitted value implied by the linear, square and cubic terms of rule of law. The estimations are obtained after testing the data for outliers and observations having undue large influence. Semi-parametric estimates could not be obtained due to small sample size of the data. The figure reiterates the evidence in Figure 2.1 that private property institutions relate positively with growth for countries having low and middle levels of the measure.

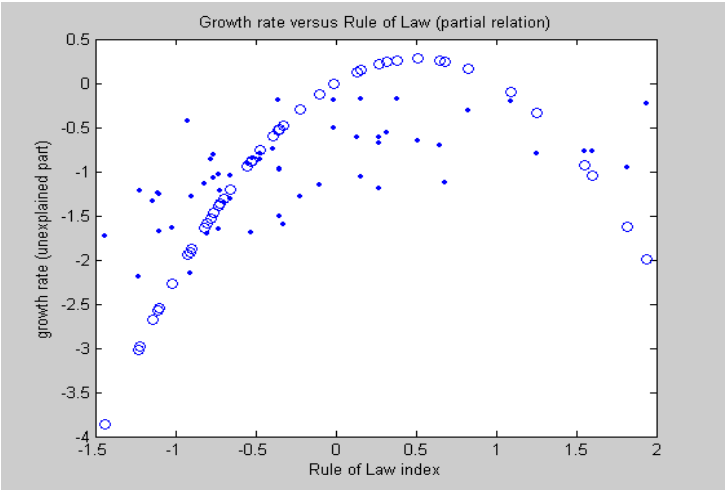

Figure 2.2. Rule of Law and Economic Growth

Moreover there is some evidence of an adverse effect on economic growth for countries enjoying the best level of private property institutions as per this measure. The estimates of the 2SLS and GMM regression are given in the Appendix A, Table A6. The 2SLS estimates show a strong, significant, and positive relationship (3.63, s.e.1.48) between the measure of private property institutions 'rule of law' and economic growth. The coefficient estimates of initial income show the presence of economic convergence, at the rate of 3.5 percent per year. As seen in Figure 2.2, for levels of index below 0.5, increasing the levels of institutions protecting private property is beneficial. For levels of index in the range above 0.5, the impact on growth is marginal, and at higher levels there is a suggestion of a negative impact on economic growth.

Next, I use Gastil's measures of political freedom and civil liberties which have been used in a number of studies examining the effect of variables describing qualitative political and civil liberties on cross country growth and investment (Kormendi and Mequire, 1985; Scully, 1988; Sachs and Warner, 1997; and Barro, 1996). This measure is a seven point index, with higher values of this variable indicating fewer freedoms or greater political violence and thus bad conditions for investment. The logic of using this index is that leaders whose tenures are insecure are more likely to expropriate because they expect to bear fewer of future costs of their current expropriatory actions (Knack and Keefer, 1995). Also in periods of political instability triggered by unconstitutional events, mechanisms for protecting property and contractual rights become fragile. The result is that investors reduce and/or reallocates their investments to avoid risk. However, this measure has several drawbacks in capturing the effects of property rights. The most common reason cited (Knack and Keefer, 1995) is that countries may exhibit a stable political environment and still may have insecure property rights. For instance, dictators who are more effective in the repression of dissent may be most successful in avoiding coups, revolutions and assassinations, but offer the worst political rights. Figure 2.3 demonstrates non-linearities between the measure of democracy and economic growth.

As the measure is increasing in insecure political freedom, Figure 2.3 can be interpreted as follows. At low levels of democracy (from the range 7 to 5.5) increasing levels of democracy is beneficial to growth. At middle levels of democracy (the turning point is 5.5 and the upper limit is 3), increasing political freedom has a marginal correspondance with

growth. At higher levels of democracy (range 3 and below), increasing political freedom still further corresponds with deteriorations in rate of growth. These are similar to those found by Barro (1996). The intuition is that where a moderate amount of political rights already has been extended, a further increase could diminish growth, perhaps due to pressures for income redistribution. Table A7 in Appendix A reports 2SLS and the GMM estimates. In accordance with previous 2SLS results, democracy has a negative (-0.59, s.e. 0.22) and significant impact on growth.

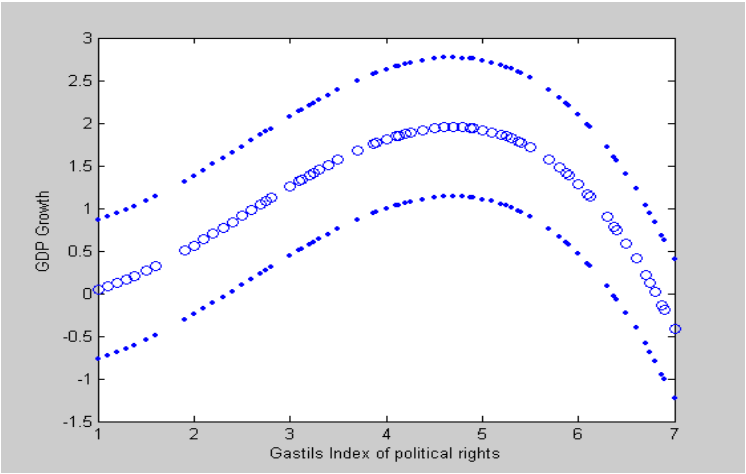

Figure 2.3. Democracy and Economic Growth

Notes: The above diagram plots the fitted values of the linear and quadratic terms the of GMM estimation. The solid line gives the fitted estimates, the dotted lines gives the 95 % confidence intervals.

The results from the two alternate measures of private property institutions reiterate the findings of the previous section. The GMM estimates show the presence of nonlinearities. When comparing these variables in terms of their economic impact, I find 'rule of law' has a greater explanatory power than 'political rights' variable.

2.5.4 Private Property Institutions and Malaria Index

Settler mortality rates, which measure mortality of early colonial settlers in the 16th century, may become a weak instrument in specifications that introduce a variable denoting disease environment such as the Malaria Index. In order to examine the strength of the results, in this section I introduce the Malaria Index in the regression equation and use an

additional instrument for institutions. Table 2.5 presents the results when using the Malaria Index. The Malaria Index measures the proportion of each country's population that lives with the risk of malaria transmission and is derived from Gallup and Sachs (1998). It is defined as the product of fraction of population living in areas of high malaria risk times that fraction of malaria cases in 1990 that are due to *P. falciparnum*. The additional instrument is is the 'fraction of population speaking English'. This variable has been previously used as an instrument for institutions by Hall and Jones (1999). The instrument is meant to capture the exogenous variation in Western European influence around the world which contributed to the existence of differing institutions. Intuitively, Western Europe discovered the ideas of Adam Smith, the importance of property rights, and the system of checks and balances in government. The countries that were strongly influenced by Western Europe were likely to adopt favorable infrastructure and institutions. The extent of Western European influence is proxied by the extent to which the languages of Western Europe are spoken as a mother tongue. The instrument is positively correlated with the measure of institutions and is presented in Table 2.5.

Column 1 and 2 report the OLS estimates of the linear and quadratic specification of institutions and includes Malaria Index in the regression equation. The coefficient estimates of 'constraint on executive' are similar to that reported in the baseline estimates presented in Table 2.1. The coefficient estimate of the Malaria index is negative (-1.47, s.e. of 0.60) and significant at the 5 percent level. The coefficient estimate implies that a one-standard-deviation increase in the index (0.45 in the 1990s) is associated with a growth decline of 0.66. Column 3 reports the instrumental variable estimates using 'log settler mortality' and 'fraction of population speaking English' as instruments. In column 3, the coefficient estimate for 'constraint on executive' is positive (0.68, s.e. of 0.38) and significant at the 10 percent level. The estimate for malaria index is negative (-1.65, s.e. 0.69) and significant at the 5 percent level. The first-stage estimate for 'fraction of population speaking English' is positive (2.94, s.e. 0.56) and significant at the 1 percent level. The first-stage estimate for 'log settler mortality' is positive (0.31, s.e. 0.15) and significant at the 5 percent level.

Column 4 reports the GMM estimates of the quadratic specification of institutions. The coefficient estimates of linear and quadratic terms of 'constraint on executive' indicate the presence of nonlinearities. The linear term is positive (5.04, s.e. 2.86) and significant at

the 10 percent level and the quadratic term is negative (-0.57, s.e. 0.28) and significant at the 5 percent level.

Table 2.5. Institutions, Growth and Malaria Index

N = 174	OLS (I)	OLS (II)	IV (III)	GMM (IV)
Panel A. Dependent variable is Growth rate of GDP per capita				
Constraint on executive	0.007	0.69	0.68	5.04
	(0.09)	(0.40)*	(0.38)*	(2.86)*
Constraint on executive square		-0.09		-0.57
		(0.05)*		(0.28)**
Malaria index	-1.47	-1.42	-1.65	-0.99
	(0.60)**	(0.59)**	(0.69)**	(0.87)
Enrolment	2.45	2.82	5.79	1.79
	(1.36)*	(1.37)**	(2.75)**	(2.87)
Exchange rate overvaluation	-0.46	-0.56	-0.70	-0.89
	(0.51)	(0.51)	(0.60)	(0.66)
Inflation	-0.58	-0.59	-0.61	-0.62
	(0.13)***	(0.13)***	(0.15)***	(0.13)***
Government consumption	-0.04	-0.04	-0.03	-0.07
	(0.03)	(0.03)	(0.04)	(0.05)
Initial Income	-0.71	-0.67	-0.74	-0.43
	(0.35)**	(0.35)*	(0.40)*	(0.47)
Dummy 80	-1.09 (0.51)**	-1.14	-1.35	-1.19
		(0.51)**	(0.61)**	(0.76)
Dummy 90	-0.58 (0.58)	-0.73	-0.44	-1.65
		(0.59)	(0.67)	(0.86)*
R-square	0.2597	0.2737		
Hansen's J				[0.89]
Panel B. First Stage Estimates				
Fraction of population speaking English			2.94	
			(0.56)***	
Log Settler mortality			-0.31	
			(0.16)*	
R-square			0.299	

Notes: The figures in parenthesis are the standard errors. The figure in brackets are p-values.

The results indicate that the presence of a variable controlling for the disease environment somewhat weakens the main results. The level of significance of the result fall from 5 percent level to 10 percent level. The results indicate a nonlinear relationship between the index of private property institutions and growth when controlling for disease environment with a lower significance level[8].

[8] Table A8 in the Appendix A reports estimates from IV and GMM using an alternate set of instruments. The instruments are absolute value of latitude, the Frankel and Romer (1996) instrument

2.6 CONCLUSION

This paper examined the relationship between private property institutions and economic growth and found some support for the presence of nonlinearities in the relationship. First, using parametric estimation, I found that there is evidence of nonlinearities in the relationship. The results are reinforced using various measures of private property institutions. Second, in order to establish the shape of the nonlinear relationship, I resort to semi-parametric estimation which allows for consistent estimation of the variable of interest without assuming a functional form. The graphical representation of the result indicates a nonlinear relationship in the shape of an inverted-U. For lower levels of institutions (below 2), increases in the level of private property institutions corresponds positively with growth. The quantitative implication of the estimate is that, for example for Zaire (with a level of private property institutions of 1 as per Polity IV index), would incur a rise in its average growth rate of 0.04 percent per year would be predicted given an increase in its level of private property institutions to that enjoyed by Algeria (the value of 2 in the index) over a decade. For countries having level of institutions between 2 and 5.5, the relationship is positive as broadly documented. For example, for Tunisia (having a value of 3 in the index), growth would be predicted to rise on average by 0.06 percent per year if its index rises to 4 (as enjoyed by Malaysia in the sample) over the decade. For levels of institutions above 5.5, the relationship is negative. A possible channel could be that the cost of enforcement increases as the level of sophistication and specialization increase at high income levels. In terms of the results, for example Brazil (having an index value of 6) would be predicted to incur a fall in the growth rate of 0.07 percent per year if it increased its current level of institutions to a value of 7 (as enjoyed by United States and Canada in the sample) over a decade. Using other measures of private property institutions shows that the results are broadly replicated.

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based on a gravity model of international trade that only uses a country's population and geographical features and log settler mortality. The first two instruments have been used by Hall and Jones (1999). The results indicate that the presence of Malaria Index does not change the baseline results and the estimated relationship between private property institutions and growth is nonlinear.

3.0 AN INVESTIGATION OF THE CONTINGENT RELATIONSHIP BETWEEN FINANCIAL DEVELOPMENT AND INCOME INEQUALITY

3.1 INTRODUCTION

A wide body of evidence indicates that financial development can help spur economic growth (King and Levine, 1993 and Levine and Zervos, 1998). During the 1990s, a number of theoretical studies explored the relationship between financial development and income inequality and suggested a wide range of possibilities for why this might be so. However to date, the empirical evidence of this relationship is scant. This paper attempts to shed light on this empirical relationship. The goal is to evaluate the empirical relevance of alternate theoretical predictions, while simultaneously suggesting appropriate policies to address issues associated with observed patterns of income inequality.

Among the theoretical studies, Greenwood and Jovanovic (1990) suggest that the relationship between financial development and income inequality should be a nonlinear inverted-U, and related to the level of economic development. In initial stages of development, as financial development occurs endogenously with economic development, only the rich can afford to access and profit from financial markets so that financial development intensifies income inequality. At higher levels of economic development, financial development helps an increasing proportion of the society, aggregate savings and income increase, and the distribution of income becomes more equal. Alternatively, Galor and Zeira (1993), Banerjee and Newman (1993) Aghion and Bolton (1997) argue that credit-market imperfections, coupled with indivisible human capital investment, imply that initial distributions of wealth should determine long-term levels of aggregate output and investment. The implication is a negative relationship between financial development and income inequality, as financial sector development can reduce credit- market imperfections,

enable agents to enjoy the benefits of higher returns to education, and thereby lead to a more equitable income distribution. In contrast, Galor and Maov (2000) suggest that the relationship between financial development and income inequality is U-shaped and cyclical at mature stages of development. In their model, in initial stages of development, financial development enables agents to acquire skills and earn higher returns to education, which reduces income inequality between skilled and unskilled sectors. However, with further financial development, technological progress raises the demand for high-skill labor and returns to ability, creating wage dispersion between and within skilled and unskilled sectors. The predictions of this model can also be combined with insights of Kuznets (1955, 1965) to suggest potential links between the sectoral structure of the economy, economic and financial development, and income inequality. The main Kuznets hypothesis focused on the transition of an economy from being agriculturally based to becoming mature and industrialized, and conjectured an inverted-U relationship between income inequality and economic development. However, during the process of transition and industrialization, he suggested that income inequality may increase with the development of economic infrastructure. The implication is that sectoral structure has an impact on the relationship between economic and financial development and income inequality. Thus theoretically, there are alternative predictions of the relationship between income inequality and financial development.

The first part of the paper revisits the relationship between financial development and income inequality. I document this relationship using parametric and non-parametric techniques. The empirical results indicate that income inequality tends to decrease as countries initially develop their financial infrastructure; however, beyond a certain threshold (corresponding to 55% of GDP when the measure private credit to GDP is used as proxy for financial development), further financial development has a nonnegative relationship with income inequality. The results are consistent with the predictions by Galor and Maov (2000) and runs directly counter to the theoretical predictions of an inverted-U relation as suggested by Greenwood and Jovanovic (1990). It is also inconsistent with the linear negative relationship predicted by Galor and Zeira (1993) and others.

In accordance with the insights of Kuznets (1955) and Galor and Maov (2000), financial development not only has a nonlinear relationship with income inequality, but it also seems to depend on the level of development. Guided by theory, the second part of the paper explores these mechanisms. To test the suggestion by Kuznets (1955) that income inequality increase with sectoral development, I add as an explanatory variable an interaction term between the ratio of the industrial and service sectors to GDP and financial development. This specification reveals a significant interaction effect under which the marginal impact of financial development on income inequality is increasing with industrial and service sector development. To test the suggestion by Galor and Maov (2000) that income inequality increases with the rise in demand for skilled workers at higher levels of financial development, I add an interaction term between employment in the service sector as a percentage of total employment and financial development. This specification also indicates a significant interaction effect under which the marginal impact of financial development on inequality is increasing with higher employment in service sectors.

As noted, the empirical literature on the relationship between income equality and financial development is scant. Evidence that does exist stems primarily from a paper by Clarke, Xu, and Zou (2003), who study this relationship using GMM estimation techniques and find evidence of a negative linear relationship. A major motivation to reexamine this finding is the availability of a more extensive dataset on income distribution than was previously available and used by Clarke et al (2003); and also an interest in examining sensitivity to the use of semiparametric estimation techniques. In the late 1990s and early 2000, empirical studies of income inequality received a substantial boost from the important work of Deininger and Squire (1996), Lynn and Squire (2000) and Dollar and Kraay (2002), who constructed a large comprehensive cross-country dataset on inequality that was previously unavailable. In the arena of studies in banking and financial infrastructure development, Beck, Demirguc-Kunt and Levine (2000, 2004) compiled a comprehensive cross-country dataset of various indices of financial infrastructure spanning a period of over forty years. These datasets have a panel structure, and thus jointly enable an analysis of the evolution of the relationship between financial development and income inequality over the course of the development process. Thus this study uses the newer and more extensive dataset on income distribution (the Dollar and Kraay, 2002 dataset), which incorporates a

larger number of countries and a longer time frame relative to the Lynn and Squire (2000) dataset used by Clarke, Xu and Zou (2003). Also, this study takes advantage of the larger number of observations to employ nonparametric and parametric estimation techniques. The results indicate that nonlinearities become apparent only when using the expanded set of countries included in the Dollar-Kraay dataset.

Methodologically, the paper uses two econometric techniques: (i) generalized method of moments (GMM) estimation of a parametric specification; and (ii) sieve minimum distance (SMD) estimation of a semi-nonparametric specification. The benchmark model is a nonlinear specification that includes control variables common to the cross-country literature on growth and financial development (for example as pioneered by King and Levine, 1993). The semi-nonparametric model is a partially linear model that allows the nonlinear components to enter additively. It has an advantage over the more widely used semiparametric partially linear model (PLR, Robinson, 1988) in that it allows for explicit estimation of the marginal effects of the nonlinear components on the dependent variable, whereas the PLR formulation treats the variables that enter the non-linear part of the model as nuisance variables. The SMD estimator (developed by Newey and Powell 2003, Ai and Chen 2003) provides consistent estimates of the endogenous nonlinear variables of interest. The approach focuses on estimating and then graphically presenting evidence on the nature of these nonlinearities. The graphical representation, as also seen in recent studies of the nonlinearities in growth, initial output and schooling (Liu and Stengos, 1999, Kalaitzidakis et al, 2001), provides direct evidence of the presence of nonlinearities in the relationship between financial intermediation and income inequality. As a robustness check, I estimate a parametric quadratic specification of the model first and obtain results indicating evidence of nonlinearities in the relationship. The regression results are robust to a number of diagnostic tests for the presence of outliers, specification tests supporting the appropriateness of instruments used in GMM estimation, as well as alterations in sample in accordance with levels of per capita income and alternations in control variables and instruments.

The relationship between financial development and income inequality is important in its policy implications. The results indicate that making financial markets universally accessible will not only have a beneficial effect on growth at initial stages of development,

(as has been proposed by a wide empirical literature cited at the introduction) but will also reduce income disparity and poverty among various sections of the society. In fact, the success of micro-credit institutions across the world shows how effective increased access to credit can be in improving living standards of the poorest sectors of the economy. For more developed economies, the findings indicate that there are limits to how much financial development can decrease income inequality. Further efforts can be directed to the design of welfare schemes and scholarship programs that target unskilled workers to facilitate their transition to the skilled sector where they can enjoy the benefits of higher income.

The remainder of the paper is organized as follows. Section 2 gives a survey of the literature on financial development, growth and inequality. In section 3, I give details on the data used, and the parametric and semi-nonparametric estimation strategies. In section 4, I report the parametric and semi- nonparametric estimates. I also isolate why my results differ from those of Clarke et al. (2003). In section 5, I check whether the relationship between Gini coefficients and financial development depends on the sectoral structure of the economy, and on employment in skill-oriented sectors. In section 6, using other measures of financial development, alternative measure of income inequality, and other controls, I provide robustness checks of the results. There, I also provide evidence of contingencies between inequality and financial intermediation in countries stratified by per capita income. Section 7 concludes.

3.2 LITERATURE REVIEW: THEORETICAL EVIDENCE ON FINANCIAL DEVELOPMENT AND INEQUALITY

In the early literature on growth and development, the leading view regarding the relationship between income distribution and economic development was dominated by writings by Kuznets (1955, 1965). The Kuznets hypothesis is the proposition that during the course of an economy's lifetime, income inequality rises during the transition from a more egalitarian agricultural sector to a less egalitarian industrial sector. However, as the agricultural sector shrinks, and agricultural wages increase, this trend reverses and income

inequality decreases, resulting in an inverted U-shaped trajectory over the course of economic development.

Over the past decade a number of studies have theorized on the expected relationship between income inequality and financial intermediation. Greenwood and Jovanovic (1990) formulated a model in which financial intermediaries arise endogenously during the process of economic development. In their model, financial trading organizations serve as intermediaries and allow investors who join them to earn a higher return on capital investment on risky projects, which in turn feeds back on economic growth and income levels. At lower levels of development income inequality widens between agents who join these coalitions after paying a fixed entry cost and those who remain outside. However, since the entry fee is fixed, eventually low-income people can save enough to join these intermediaries, resulting in reversal in the upward trend, with income distribution stabilizing to a higher growth level. In the final stages of development, the distribution of income across agents stabilizes, the saving rate falls, and the economy's growth rate converges to a higher level than that prevailing during its infancy. The distributional effect of financial deepening is thus adverse for the poor at early stages, but positive for the poor after a turning point, indicating a nonlinear inverted-U relationship.

A number of other theoretical studies gave contrary views of the relationship. For example, Galor and Zeira (1993) suggested that in the presence of credit-market imperfections and indivisibilities in investment in human capital, the initial distribution of wealth has persistent effects on aggregate income and investment. They presented a two-sector model with bequests between generations, where agents who make an indivisible investment in human capital can work in the skill-intensive sector. However with the assumption of capital-market imperfections, only individuals with bequests larger than the investment amount or who can borrow were able to make this investment. In the model, this results in income inequality that is perpetuated through bequests to the next generation. An implication of their model is that strengthening credit markets can ameliorate credit constraints and allow agents to invest in costly human capital, thereby allowing them to enjoy the benefits of higher returns in skill-intensive jobs. It is through this mechanism that

the model predicts a negative relationship between financial development and income inequality.

In a similar spirit, Banerjee and Newman (1993) showed that the presence of credit-market constraints can affect the pattern of occupational choice, process of development and distribution of income. They constructed a three-sector model in which two of the technologies require indivisible investment. Due to capital-market imperfections, only rich agents can borrow enough to run these indivisible, higher-return technologies. As a result, occupations that require a high level of investment are beyond the reach of poor people who instead chose wage contracts serving as employees under wealthier agents. Thus the pattern of occupational development is determined by the initial distribution of wealth. The ultimate distribution of wealth depends on the initial distribution, and this result is compounded as access to financial markets is constrained. Relatedly, Aghion and Bolton (1997) showed that informational asymmetries produce credit constraints that are particularly binding on the poor because the poor do not have the resources to fund their own projects, nor the collateral to access bank credit. These credit constraints thus restrict the poor from exploiting investment opportunities. Holding all else equal these models suggested that countries with larger capital-market imperfections (that is, higher hurdles to borrow funds to finance indivisible investment) should have higher income inequality.

In a third alternative prediction, Galor and Maov (2000) predicted a U-shaped relationship that becomes cyclical at higher levels of development. In their model, at initial stages of development, a reduction in credit-market imperfections leads to increasing investment in human capital. As a result, the supply of skilled workers increases and this reduces the returns to ability and hence wage inequality within the skilled workers. Also among the unskilled workers inequality falls as the average ability declines due to the outflow of the upper tail of the ability distribution. With further reduction in credit-market imperfections and larger availability of a pool of skilled labor, there is rapid technological progress. The increase in the rate of technological progress induces a higher demand for skilled workers and simultaneously increases returns to ability. The heterogeneity of ability between skilled and unskilled workers results in a rise in wage dispersion, and thus higher inequality.

Only recently has any empirical work been undertaken to study this relationship, primarily due to difficulties in assembling credible data across countries on income distributions and also measurement of financial development. The first empirical work on the topic is by Clarke, Xu and Zou (2003). Using a cross country framework and sample of 44 countries they showed that financial development has a strong negative linear impact on income inequality, and thus that the inverted-U proposition fails to hold. Beck et al. (2004) examined the relationship between financial development and the growth of income inequality and poverty using a cross section sample of 55 countries, and reiterated the findings of Clarke, Xu and Zou (2003). They showed that financial development has a strong negative impact on income inequality, that is, improving the financial infrastructure leads to a lessening of inequality. However this analysis was based on a cross country sample averaged over 30 years for 55 countries.

3.3 METHODOLOGY AND DATA

This section provides a description of the different techniques used to examine the data for uncovering the relationship between financial intermediation and income inequality. First, I provide a description of the data proxing income inequality and financial intermediary development as well as other controls used in the estimation process. Second, I present a description of the parametric estimation process. Third, I outline the strategy to deal with endogeneity and simultaneity problems in the estimation process. Lastly, I present the nonparametric estimation technique and outline why I use this technique instead of available alternatives.

3.3.1 The Data Details

The study uses a sample of 60 countries over the period 1961 to 2000. The sample period is divided in eight non-overlapping 5-year periods[9]. Data averages are used in

[9] Section B1 in the Appendix lists the countries in the sample.

measuring stock variables and beginning-of-period values are used in measuring flows. The primary measure of income inequality is the Gini coefficient. The Gini coefficient is derived from the Lorenz curve, which plots the cumulative percentage of the population on the horizontal axis and the cumulative percentage of income on the vertical axis for each country. A 45-degree line diagonal line depicts a situation in which there is a perfectly even income distribution. To measure income inequality, the Gini coefficient equals the ratio of the area between the Lorenz curve and the 45-degree line. Since the Lorenz curve equals the 45-degree line when there is perfect income equality, the Gini coefficient equals zero when perfect income equality holds. The data are from the Dollar and Kraay (2002) dataset, which is cited to be drawn from four different sources: the UN-WIDER World Inequality Database, which is a substantial extension of Deininger and Square (1996); the Deininger and Square (1996) measure for data not included in UN-WIDER; Chen and Ravillion (2000) who construct measures of income distribution and poverty from 265 household surveys in 83 countries; and the Lundberg and Squire (2000) database. Dollar and Kraay have restricted their sample to income distribution measures based on nationally representative surveys. Also since all surveys reported whether the measure is income or consumption, and whether they are gross or net of taxes, their data is adjusted for taxes and transfers.

The primary measure of financial intermediary development is '*Private credit*' which is defined as the value of credit by financial intermediaries to the private sector divided by GDP. This measure has been used in a number of recent papers (e.g., Levine et al. 2000; Beck et al., 1999). The advantage of this measure is that it excludes credit issued by the central bank and development banks. Furthermore, it excludes credit to the public sector, credit to state owned enterprises, and cross claims of one group of intermediaries on another. Private credit is a comprehensive measure capturing the amount of credit channeled from savers through financial intermediaries to private firms. To assess the robustness of the results I use two additional measures of financial development. The first measure, '*liquid liabilities*' is traditionally used and equals the liquid liabilities of the financial system (currency plus demand and interest-bearing liabilities of financial intermediaries and nonblank financial intermediaries) divided by GDP. A second measure is '*bank assets*' which are claims on the non-financial domestic sector by the deposit money banks divided by GDP. This measure has been used by Clarke et al (2003) as a secondary measure of financial intermediation. All measures of financial intermediation are from the World Bank

Financial Infrastructure database (Beck et al., World Bank 2004). Details of these measures are given in Appendix B2.

Since the main focus of the paper is on potentially nonlinear relationships between financial development and income inequality, I use the usual controls used in the literature on finance and growth and inequality. King and Levine (1993) and Levine et al. (2000) include trade openness, inflation, government spending as a share of GDP, and education as plausible channels through which financial intermediary development could affect growth. Trade openness is the sum of exports and imports as a share of GDP and its relationship with income inequality has not been clearly established in empirical literature. Average inflation rates is assumed to have a positive relationship with income inequality, higher levels of inflation tend to increase inequality in an economy. Government consumption can have a negative relationship with income inequality if there are explicit policies to redistribute income through taxes and transfers. Education is assumed to have a negative relationship with income inequality. With higher education, income levels increase and this reduces income inequality within a society. Detailed definitions and sources for the variables used and data procured are given in Table B2 in Appendix B. Table B3 in Appendix B provide summary statistics for the variables in the analysis. The statistics are reported for the sample cleaned of outliers[10].

3.3.2 Linear Estimation Techniques

The basic parametric specification of the relationship is as follows:

$$Y_{it} = \alpha + f(X_{it}) + Z'_{it}\gamma + \varphi \cdot T_t + \varepsilon_{it} \tag{3.1}$$

where Y_{it} is the measure of income inequality of country *i* in period *t*, X_{it} is the measure of financial development, Z_{it} is the vector of other controls, T_t is the time dummies, $f(X_{it})$ is assumed to be a linear or quadratic functional form, γ is a vector capturing effects of

[10] Following the method of Belch, Kelsey and Huh (1980), I use DFITS and Influence statistics to select data points that may have undue influence on point estimates. Details are provided in section 3.6.

control variables in Z_{it} and φ are parameters capturing the effect of time dummies. To proxy for measures of financial development I use three measures. The baseline measure is private credit. I also use 'liquid liabilities' and 'bank assets' as other measures for robustness checks. The subscripts *i* and *t* represents the country and time period respectively.

The simplest strategy is to estimate the model in equation (3.1) using OLS regression. There are two distinct problems with this strategy. First, financial development is endogenous, so this may capture reverse causality and simultaneity or the effect of some omitted characteristics (like geography, institutions, culture or other variables). Second, the variable may be measured with error, so there may be a downward attenuation bias. These concerns imply that OLS regressions will generate results that do not correspond to the causal effect of financial development on income distribution. To avoid these concerns, the strategy is to estimate the linear equation (3.1) using two stage least squares (2SLS) using distinct and plausible instruments for measures of financial development. Ideal instruments are correlated with the endogenous regressor but orthogonal to any other omitted characteristics (i.e., uncorrelated with the outcome of interest through any channels other than their effect via the endogenous regressor). A successful IV strategy corrects not only for differential measurement error in the endogenous variable but also for endogeneity bias, and the parameters can be estimated consistently. I lean on literature on financial development and growth to identify legal origin of countries (La Porta et al 1998) as a valid instrument. A description of the instrument is given in the next section 3.3. The first stage for the IV strategy is given by equations (3.2) and (3.3) below. In (3.2), the instrument is the legal origin of countries (that is, whether countries have English Common law, Napoleonic Civil law, German or Scandinavian law); and in (3.3) I add latitude to the instrument list following empirical literature in finance and growth:

$$X_{it} = \delta \cdot E_i + \phi \cdot F_i + \mu \cdot G_i + \psi \cdot Z_{it} + \tau \cdot T_t + u_{it} \quad (3.2)$$

$$X_{it} = \delta \cdot E_i + \phi \cdot F_i + \mu \cdot G_i + \lambda \cdot L_i + \psi \cdot Z_{it} + \tau \cdot T_t + u_{it}, \quad (3.3)$$

where X_{it} is the measure of financial development, E_i is a dummy for English legal origin, F_i is a dummy for French legal origin, G_i is a dummy for German legal origin and L_{it} is the

latitude of a country, Z_{it} is the vector of other controls and T_t is the time dummies. The exclusion restriction is that in the population ,

$$Cov(\varepsilon_{it}, E_i) = Cov(\varepsilon_{it}, F_i) = Cov(\varepsilon_{it}, G_i) = Cov(\varepsilon_{it}, L_i) = 0\,, \tag{3.4}$$

where ε_{it} is the error term in the second stage (3.1).

To estimate the parameters of the nonlinear version of (3.1), the generalized method of moments (GMM) estimation methodology is used. The 2SLS estimation technique is ruled out for the nonlinear version to avoid the trap of the forbidden regression. The forbidden regression describes the replacement of a nonlinear function of an endogenous regressor with the same nonlinear function of fitted values from the first-stage estimation (for details see Wooldridge, 2002, pp 236). The implication is that if the forbidden regression is run, the resulting estimates are inconsistent. The GMM estimation technique is used to overcome this concern and consistently estimate the parameters of interest. The GMM estimator uses the following moment condition: $E[V_{it} \cdot \varepsilon_{it}] = 0$ where V_i is the matrix of instruments and ε_{it} is error term in equation (3.1). The standard errors reported are clustered by country to avoid serial correlation within observations of the same country.

To test the validity of the moment conditions, I use the test of over identifying restrictions by Hansen (1982) and Newey and West (1987). The null hypothesis of Hansen's test is that the over-identifying restrictions are valid, and thus, the instrumental variables are not correlated with the error term. The test statistic is the sample size times the value attained by the objective function at the GMM estimate (the J-statistic). Hansen's test is distributed as χ^2 with degrees of freedom equal to the number of moment conditions minus the number of parameters to be estimated. These statistics are reported in the tables.

3.3.3 Endogeneity and instrument selection

In this section I provide a description of the instruments legal origin and latitude, and the results of the first stage estimation. La Porta, Lopez, Sheifer and Vishy (1998) show that the legal systems with European origins can be classified into four major legal families (Reynolds and Flores, 1996): the English Common law, and the French, German, and Scandinavian Civil law countries. LLSV (1998) identified that the legal origin of countries influenced the legal treatment of shareholders, the laws governing creditor rights, the

efficiency of contract enforcement and accounting standards. The logic is that since financial systems are based on legal contracts which protect investors and creditors, legal origins play a role in the financial development of a country. Legal origin is usually considered as an exogenous endowment as the English, German, French, Scandinavian legal systems were spread through occupation and colonialism. Hence legal origin can serve as an instrument as it is exogenous with respect to income distribution, and correlated with indicators of financial development. Originally LLSV (1998) had a 44 country data set. This was extended by Levine et al (2000) to a total of 71 countries using Reynolds and Flores (1996). The second instrument, latitude, is the absolute value of the *latitude* of the capital city, normalized between zero and one. In recent literature, a number of papers show that natural resource endowments as proxied by latitude account for development of national institutions (Acemoglu et al. 2001; Engerman and Sokolof, 1997; and Easterly and Levine 2003). In accordance, I have used this variable to account for differences in financial development in some regressions.

Table 3.1 presents regressions of the financial intermediary indicators on the control variables, including dummy variables for English, French, and German legal origin relative to Scandinavian origin (which is captured in the constant). The table also presents regressions that include latitude as an instrumental variable along with other controls.

Table 3.1. Legal Origin and Financial Intermediary Development

	Private Credit		Liquid liabilities		Bank Assets	
ENGLISH	0.15	0.28	0.35	0.42	0.16	0.31
	(0.1)	(0.11)***	(0.07)***	(0.08)***	(0.097)*	(0.1)***
FRENCH	0.082	0.24	0.08	0.15	0.09	0.26
	(0.11)	(0.12)**	(0.077)	(0.08)*	(0.10)	(0.11)**
GERMAN	1.09	1.15	0.81	0.84	1.00	1.07
	(0.15)***	(0.15)***	(0.11)***	(0.11)***	(0.14)***	(0.14)***
LATITUDE		0.72		0.35		0.8
		(0.26)***		(0.18)**		(0.24)***
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-square	0.575	0.59	0.625	0.632	0.591	0.61
Prob(F-test)	19.81	17.27	26.31	20.98	18.95	17.77
	0.000	0.000	0.000	0.000	0.000	0.000
N	225	225	225	225	225	225

Notes: Figures in parenthesis are robust standard errors. ENGLISH = English legal origin. FRENCH = Napoleonic legal origin. GERMAN = German legal origin. Scandinavian legal origin is the omitted category. The F-test is for the particular significance of the legal origin and latitude variables and is not the overall F test for regression. The standard errors reported are clustered by country.

The results show that the countries with German legal origin have better-developed financial intermediary systems in comparison to countries having the Common Law or French legal systems. This result holds for the range of specifications that I estimate as a part of robustness checks and is in accordance with studies by Levine et al (2000). When latitude is added to the regression specification, it has a large positive impact, implying countries at higher latitudes have deeper levels of financial development. The F-test reported in the table provides a diagnostic statistic for the presence of weak instruments. The results indicate that there is little evidence that the legal origin and latitude variables are weak instruments; rather, they explain a significant portion of cross-country differences in financial intermediary development.

3.3.4 Semi nonparametric estimation techniques

With the availability of large datasets, semi-nonparametric estimation is increasingly used in the growth literature to investigate nonlinearities in the relationships studied[11]. In this framework a part of the regression specification assumes a functional form and part of it is estimated without any assumptions beyond some degree of smoothness. The semi-nonparametric partially linear specification of the model specified can be written as

$$Y_{it} = X_{it}^{'}\beta + h(Z_{it}) + u_{i}, \tag{3.5}$$

where X_{it} is a matrix of control variables of dimension q, β is a $q \times 1$ vector of unknown parameters, Z_{it} is a continuous variable of dimension p, $h(.)$ is an unknown function and $E(u_{it} \mid X_{it}, Z_{it}) = 0$.

Equation (3.5) can be written in terms of the conditional moment restriction

$$E[\rho(V_i, \theta_0, h_0) \mid X] = 0, \tag{3.6}$$

where $V' = (Y', X_z')$, X_z is a subset of X, $\rho(.)$ is a vector of known (residual) functions, and $E[\rho(V_i, \theta_0, h_0) \mid X]$ is the conditional expectation of $\rho(V_i, \theta_0, h_0)$ given X. The parameters of interest $\alpha_0 = (\theta_0, h_0)$ contain a vector of finite-dimensional unknown parameters of interest θ_0 and a infinite-dimensional unknown functions

[11] A model is called semi-nonparametric if it contains both finite-dimensional and infinite-dimensional unknown parameters of interest.

$h_0(.) = (h_{01}(.),.....h_{0q}(.))$. The model is semiparametric in the sense it contains unknown functions h_0.

When the nonparametric regression component is endogenous, Ai and Chen (2003) provided a method for obtaining a $n^{1/2}$ consistent estimator of β_0 and *h(.) using the sieve minimum distance estimator*. The method of sieves has certain advantages over other nonparametric methods. Semi-nonparametric models usually involve unknown parameters that lie in infinite-dimensional parameter spaces; hence their estimation is problematic given finite samples. The method of sieves overcomes this problem by optimizing a criterion function over a sequence of less complex and finite-dimensional parameter spaces. The sieves or approximating spaces are usually constructed using linear spans of power series, Fourier series, splines or other basis functions. Since these approximating spaces can be characterized by a finite number of parameters, a nonparametric estimation technique is often reduced to a parametric one when the method of sieves is used (more details are provided in Chen 2005). The consistency of the method is ensured as the method requires that the complexity of sieves increases with sample size so that in the limit the sieves are dense in the original parameter space. Ai and Chen (2003) and Newey and Powell (2003) have shown that under a set of sufficient conditions, $\hat{\alpha}_n = (\hat{\theta}_n, \hat{h}_n)$ converges to α_0 and h_0 is both $n^{1/2}$ consistent and asymptotically normally distributed. Table B14 provides a description of the sieve minimum distance estimator.

3.4 ESTIMATION RESULTS

In this section, first I present the OLS, Instrumental Variable and GMM estimates and provide evidence of the presence of nonlinearities in the relationship. Next, I provide the corresponding semi-nonparametric estimates and examine whether they corroborate the findings of the parametric section. Lastly, I conduct a series of estimations to isolate the difference in results obtained in this study relative to those obtained by Clarke et al. (2003).

3.4.1 Parametric estimates

In Table 3.2, the parametric coefficient estimates of equation (1) are presented using simple OLS estimations as well as instrumental and GMM estimation to explore for nonlinearities when using private credit. The Table reports estimates obtained after the elimination of potential outliers and other observations having high values of residual and leverage statistics. The details are in section 3.6.1. In Column 1 and 2, I first report OLS estimates of (3.1). In column (1) private credit enters linearly in the regression, and the OLS results indicate a strong negative relationship between financial development and income inequality. The coefficient estimate is -0.067 with a standard error of 0.029. The negative relationship between financial development and income inequality is presented in Figure B1 in Appendix B. Figure B1 reports a partial regression plot showing the estimated effect of private credit on income inequality when all other explanatory variables are held constant[12]. The graph suggests that the estimated relationship is not driven by outlier observations and has a strong negative relationship with income inequality.

In terms of the control variables, the OLS regression shows that higher levels of income inequality is associated with lower government consumption, higher international integration with trade, lower levels of schooling and higher inflation rates. The *government consumption* ratio is the average of real government consumption to real GDP. The estimated coefficient is negative - 0.007 (0.006) and insignificant. The estimate implies that a one-standard-deviation increase in the ratio (5.8 in the 1990s) would reduce inequality by 0.041. The estimated coefficient on trade openness is positive but not statistically significant, 0.05 (0.06). Hence there is only weak statistical evidence that greater international openness increases inequality from the OLS estimates. The point estimate implies that a one-standard-deviation increase in openness ratio (0.415 in the 1990s) would raise the inequality on impact by 0.021. The estimated coefficient for *secondary schooling* is negative -0.65 (0.16) and significant at the 1 percent level; the point estimate implies that a one-standard-deviation increase in schooling (0.154 in the 1990s) in the sample period would reduce income

[12] In partial regression plots, I regress inequality against the full conditioning information set and collect the inequality residuals. Then, I regress financial development measures against the full conditioning set and collect these residuals. Figure 1 plots the inequality residuals against the private credit residuals along with the regression line.

inequality by 0.102. The *inflation variable* is the average rate of retail price inflation over each of the five year periods. The estimated coefficient, 0.028 (0.021) is positive and insignificant. This coefficient implies that a one-standard-deviation increase in inflation rate (0.11 in the 1990s) increases the inequality on impact by 0.003. Also to account for the Kuznets' inverted-U hypothesis on income inequality and initial income level, I add a squared *log GDP* term in all our specifications. The estimate for the linear term from the OLS in column 2 is positive and highly significant, 1.38 (0.44) while for the squared term is negative, -0.079 (0.028) and also significant. The regressions include an overall constant term and separate time dummies for the later periods. The coefficient estimate of the *time period dummies* are negative in value till the early 1980s and then become positive in the mid 1980s and 1990s. Hence the sample's level of inequality seems to have declined from 1960 to early 1980s but there is some marginal evidence that inequality increased from mid-1980s onwards (estimates are positive though not significant).

To control for the possibility that this negative impact of private credit on income inequality is due to simultaneity bias, I conduct 2SLS estimation and report the results in column three and four. In column 3, legal origin is used as the instrument, and in column 4 both legal origin and latitude are used as instruments. The results in column 3 indicate that the exogenous component of financial development has a significant negative impact on income inequality, -0.09 (0.04). The estimated coefficient on private credit implies that a 1 percent increase in private credit results approximately in about 0.09 percent decrease in income inequality (since both variables are in logs). The coefficient on private credit in the IV estimation is larger than the corresponding OLS estimation (0.09 versus 0.06), suggesting that the attenuation bias from measurement error in the instrumental variables swamps the reverse causality bias that would tend to make the OLS estimates greater than IV estimate. The IV results indicate that if Brazil (with an average private credit value of 28.8% of GDP over 1995-2000) had the same level of financial intermediary development as Australia (average value of 74% of GDP over 1995-2000), their level of inequality would have been lower by 0.85 percent over this period[13].

[13] To see this, recall the regressors are in logs and note that ln(74) – ln(28.8) = 0.94. The estimated parameter on private credit equals -0.09, thus -0.09(0.94) = - 0.0846.

Table 3.2. The Parametric Estimates : Financial Development and Income Inequality

Variable	OLS 1	OLS 2	*2SLS*	*2SLS*	*GMM*	*GMM*
Private credit	*-0.067*	*-0.20*	*-0.094*	-0.19	*-1.84*	-3.05
(in natural logs)	*(0.029)***	*(0.12)**	*(0.047)***	(0.05)***	*(1.18)**	(1.25)**
Private credit		*0.021*			*0.24*	0.41
square		*(0.018)*			*(0.15)**	(0.17)**
Government	-0.007	-.006	-0.007	-0.006	0.006	0.015
consumption	(0.006)	(0.006)	(0.006)	(0.006)	(0 .009)	(0 .007)**
Trade openness	0.051	0.049	0.053	0.057	0.028	0.026
	(0.069)	(0.067)	(0.067)	(0.075)	(0.04)	(0.076)
Inflation (rate)	0.028	0.027	0.021	-0.005	-0.031	-0.074
	(0.021)	(0.02)	(0.023)	(0.018)	(0.053)	(0.072)
Schooling rate	-0.65	-0.66	-0.66	-0.67	-0.75	-0.91
	(0.16)***	(0.17)***	(0.16)***	(0.18)***	(0.25)***	(0.31)***
GDP per capita	1.38	1.47	1.40	1.49	2.63	3.68
(logs)	(0.44)***	(0.46)***	(0.44)***	(0.44)***	(1.10)**	(1.18)***
GDP per capita	-0.079	-0.084	-0.08	-0.08	-0.15	-0.21
square	(0.028)***	(0.029)***	(.027)***	(.027)***	(0.06)**	(0.06)***
Dummy 65	-0.056	-0.06	-0.058	-0.065	-0.101	-0.09
	(0.042)	(0.04)	(0.047)	(0.042)	(0.076)	(0.11)
Dummy 70	-0.076	-0.075	-0.075	-0.073	-0.059	-0.06
	(0.037)**	(0.038)*	(0.037)**	(0.041)	(0.051)	(0.07)
Dummy 75	-0.033	-0.031	-0.033	-0.033	-0.014	-0.014
	(0.029)	(0.029)	(.028)	(0.030)	(0.04)	(0.057)
Dummy 80	-0.040	-0.041	-0.036	-0.022	-0.024	-0.023
	(0.038)	(0.038)	(0.039)	(0.043)	(0.06)	(0.082)
Dummy 85	0.034	0.033	0.04	0.063	0.06	0.062
	(0.037)	(0.038)	(.04)	(0.044)	(0.07)	(0.09)
Dummy 90	0.060	0.058	0.067	0.092	0.086	0.08
	(0.049)	(0.049)	(0.051)	(0.058)	(0.073)	(0.09)
Dummy 95	0.090	0.092	0.099	0.13	0.17	0.21
	(0.047)*	(0.048)*	(.051)**	(0.057)**	(0.08)**	(0.11)*
Constant	-1.87	-2.06	-1.93	-2.18	-4.55	-7.14
	(1.83)	(1.85)	(1.78)	(1.80)	(3.23)	(4.20)*
Instruments Used			*Legal O*	Legal O & latitude	*Legal O*	Legal O & latitude
R-Squared	0.56	0.57				
Hansen's J					[0.55]	[0.569]
N	225	225	225	225	225	225

Notes: The dependent variable is log of Gini coefficient. The figures in parenthesis are standard errors. ***, **, * indicates significance levels at 1%, 5% and 10% levels respectively. The F-test for the significance level of both set of instruments is presented in Table 1. The standard errors reported are clustered by country.

To test the presence of nonlinearities, I add a squared term for the measure of financial sector development and estimate the model using GMM methodology. The results are presented in column 5 when using only legal origin as an instrument, and column 6 when using both legal origin and latitude as instruments. The results in column 5 indicate that the linear and squared terms in private credit are each statistically significant at the 10 percent

level: - 1.84 (1.18) and 0.24 (0.15), respectively. The results in column 6 indicate that the linear and squared terms are -3.05 (1.25) and 0.41 (0.17) respectively, and statistically significant at the 5 percent level. The results indicate a nonlinear relationship in which inequality falls initially as economies develop their financial infrastructure; beyond a threshold the relationship becomes nonnegative. This result is consistent with theoretical predictions by Galor and Maov (2000). Thus in accordance, at initial stages of development, reductions in credit-market imperfections tend to reduce income inequality. However the negative influence attenuates as private credit rises and reaches zero when the indicator takes on the midrange value of 4 (i.e. when private credit takes a value of 55 percent of GDP), beyond which there is a reversal in the trend. For countries having higher levels of financial development there is no evidence of the negative relationship and some indication that income inequality rises with further financial development. Therefore, increases in financial development appear to coincide with reduced inequality for countries that have less-mature financial systems but tend to have a marginally positive relationship with inequality for countries that have achieved financial depth. This nonlinear relationship is shown in Figure 3.1: the solid line indicates the fitted values implied by linear and squared terms for private credit; the dotted lines are 95 percent point-wise confidence intervals. The figure serves to provide a comparison to the graphical presentation of the semi nonparametric estimates.

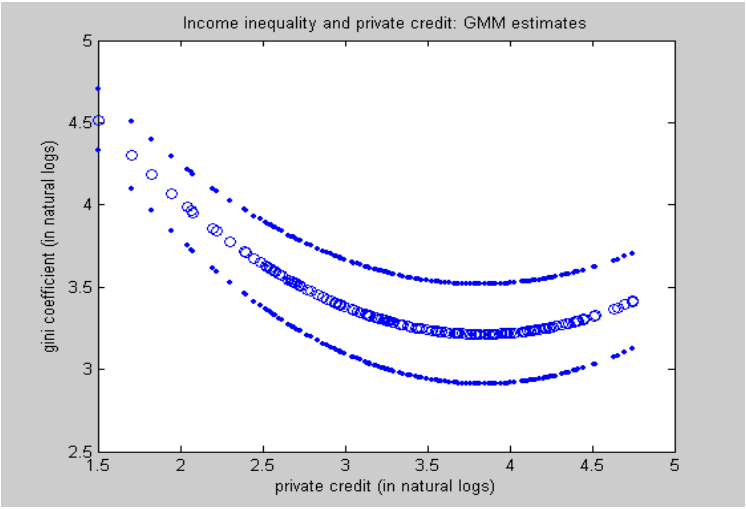


Figure 3.1. Income inequality and financial intermediation

Notes: The above figures are from the GMM estimation presented in column 5. The solid line shows fitted values of linear and square values of private credit, the dotted values are 95 percent confidence intervals.

Regarding the observations in the figure, I find that economies having low levels of private credit and levels of development are at the extreme left tail of the figure; these observations are for example, Ghana (1991-95), Nepal (1976-80), and Bolivia (1965-70) among others. Again at the extreme right tail of the figure, I find observations are of economies having high levels of financial and economic development, for example, Japan (1991-95), Germany (1991-95), and the Netherlands (1991-95) among others.

For robustness checks, two other measures of financial development are used separately in a similar parametric framework. Table 3.3 presents the results of estimating (1) using these measures; bank assets is presented in panel A and liquid liabilities in panel B. Bank assets measures claims on the non-financial domestic sector by deposit money banks divided by GDP. In comparison to private credit, this measure excludes credit issued by non-bank financial intermediaries and includes credit issued to government and state-owned enterprises. In panel A, the OLS results show that higher income inequalities are associated with lower levels of bank credit, government consumption, secondary schooling, and are positively correlated with the level of international integration and inflation, consistent with results using private credit. The benchmark OLS estimate of bank asset is negative -0.09 (0.02) and significant at the 1 percent level. Figure B3 in Appendix B reports the partial relationship between bank assets and income inequality. The figure shows that when controlling for other covariates, the relationship is negative and highly significant and not driven by outliers.

In column 3, the instrumental variable estimates obtained using legal origin as the lone instrument show that the exogenous component of the measure bank asset has a negative and significant relationship with income inequality -0.11 (0.054). The remaining explanatory variables enter the regressions as expected. Initial income enters the regression with a significantly positive coefficient and its square is negative and significant, as in the previous table. Secondary school enrollment has a strong negative correlation with income inequality, while trade openness enters positively. Government consumption enters the regression with a negative coefficient, and is statistically insignificant. Also, the inflation

coefficient is positive and insignificant. The 2SLS estimates are similar when using legal origin and latitude in the instrument list as reported in column 4.

Table 3.3**.** The Parametric Estimates: Bank assets and Income Inequality

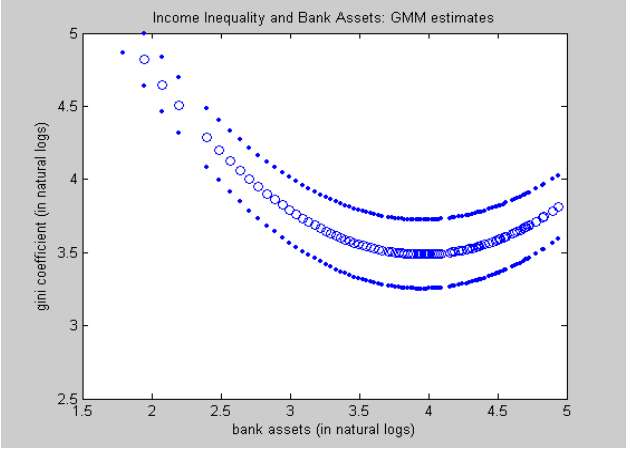
Variable (N = 225)	**OLS 1**	**OLS 2**	***2SLS***	***2SLS***	***GMM***	***GMM***
		A. Using Bank Assets				
Bank Assets	-0.091	-0.22	-0.11	-0.22	-1.39	-2.62
(in natural logs)	(0.033) ***	(0.19)*	(0.054)**	(0.063)***	(0.85)*	(0.93)***
Bank Assets Square		.018			0.17	0.33
(in natural logs)		(0.02)			(0.11)*	(0.12)***
Government	-0.006	-0.006	-0.006	-0.004	.001	0.008
consumption (rate)	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)
Trade openness	0.063	0.062	0.07	0.085	0.069	0.09
	(0.065)	(0.064)	(0.06)	(0.068)	(0.067)	(0.08)
Inflation (rate)	0.03	0.029	0.026	-0.005	.005	-0.024
	(0.018)	(0.018)*	(0.021)	(0.02)	(0.03)	(0.052)
Schooling rate	-0.67	-0.67	-0.67	-0.69	-0.7	-0.78
	(0.16)***	(0.16)***	(0.16)***	(0.18)***	(0.18)***	(0.22)***
GDP per capita(in	1.33	1.41	1.34	1.36	2.00	2.61
logs)	(0.42)***	(0.44)***	(0.41)***	(0.39)***	(0.64)***	(0.77)***
GDP per capita(in	-0.076	-0.08	-0.076	-0.074	-0.11	-0.15
logs) square	(0.027)***	(0.028)***	(0.025)***	(0.024)***	(0.03)***	(0.04)***
Instruments Used			*Legal O*	Legal O & latitude	*Legal O*	Legal O & latitude
R-Squared	0.575	0.577				
Hansen's J					[0.67]	[0.19]
		B. Using liquid liabilities				
Liquid liabilities	-0.098	-0.63	-0.17	-0.25	-1.15	-2.72
(in logs)	(0.036)***	(0.27)**	(0.069)***	(0.085)***	(0.71)*	(1.11)**
Liquid liabilities		0.071			0.12	0.32
square (in logs)		(0.037)*			(0.073)*	(0.14)**
Government	-0.008	-0.006	-0.008	-0.009	-0.005	0.006
consumption	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
trade openness	0.073	0.075	0.09	0.11	0.11	0.15
	(.069)	(0.067)	(0.069)**	(0.07)	(0.07)	(0.07)*
Inflation rate	0.022	0.014	0.09	-0.015	-0.02	-0.06
	(0.023)	(0.023)	(0.026)	(0.024)	(0.04)	(0.035)*
Schooling rate	-0.67	-0.65	-0.68	-0.69	-0.67	-0.72
	(0.16)***	(0.16)***	(0.16)***	(0.16)***	(0.14)***	(0.15)***
GDP per capita	1.19	1.30	1.10	0.99	1.24	1.65
(logs)	(0.46)***	(0.47)***	(0.46)**	(0.47)**	(0.45)***	(0.48)***
GDP per capita	-0.068	-0.074	-0.061	-0.053	-0.07	-0.093
square	(0.029)**	(0.029)***	(0.029)**	(0.031)*	(.028)**	(.031)***
Instruments Used			*Legal O*	Legal O & latitude	*Legal O*	Legal O & latitude
R-squared	0.56	0.57				
Hansen's J statistic					[0.72]	[0.023]

Notes: The dependent variable is the natural log of Gini coefficient. The figures in parenthesis are robust standard errors. ***, **, * indicates significance levels at 1%, 5% and 10% levels respectively. The standard errors reported are clustered by country.

In column 5, I add a linear and square term for bank assets and estimate this specification via GMM, using legal origin as the lone instrument. The results indicate the presence of nonlinearity: the estimates for the linear and quadratic terms are -1.39 (0.85) and 0.17 (0.11) respectively; both estimates are significant at the 10 percent level. Again when using latitude and legal origin as instruments, the results are stronger. The estimates for the linear and quadratic terms are -2.62 (0.93) and 0.33(0.12) respectively; both estimates are significant at the 1 percent level. Thus the pattern follows the results derived using private credit, and clearly indicates the presence of a nonlinear relationship.

Figure 3.2a shows the nature of nonlinearities by plotting the fitted relationship between inequality and bank assets implied by the GMM estimates of bank assets. As seen in the figure, improvements in the level of financial intermediary correspond with reductions in income inequality over the lower ranges of financial development. When the index reaches a mid-range value of 60.34 percent of GDP, the impact on inequality attenuates and becomes nonnegative. Hansen J results show that the null hypothesis is not rejected, implying the instruments are appropriate.

3.2a. Bank assets and Income inequality



3.2b. Liquid liability and Income inequality

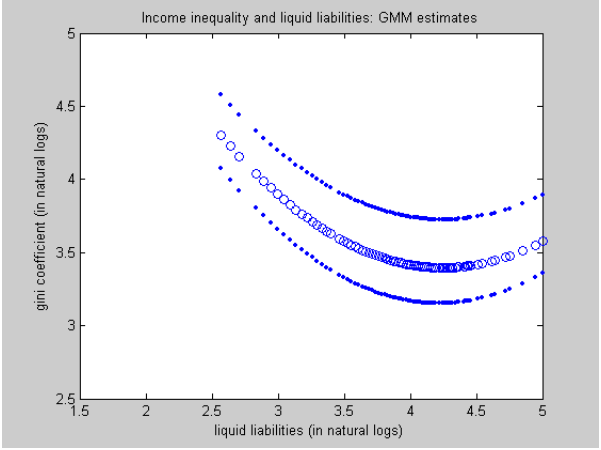


Figure 3.2. Bank Assets, Liquid Liabilities And Income Inequality: Evidence From GMM

In panel B, Table 3.3, the parametric estimates obtained using 'liquid liabilities' are presented. This measure equals the ratio of currency, demand and interest bearing liabilities

of banks and non-bank financial intermediaries to GDP. This is a typical measure of 'financial depth' and of the overall size of the financial intermediary sector and has been used in studies by Goldsmith (1969), McKinnon (1973), King and Levine (1993), Levine et al. (2000), Beck et al. (1999). The measure is useful if one makes the assumption that the size of the financial intermediary sector is positively correlated with the provision and quality of services. However the measure has some shortcomings, as reported in Levine et al (2000). In particular, it may not accurately gauge the effectiveness of the financial sector in ameliorating informational asymmetries and easing transaction costs. Also, the measure includes deposits by one financial intermediary in another, which may involve 'double counting'.

In panel B, the OLS results indicate a strong negative relationship between financial development and income inequality. The estimate for liquid liability is negative and significant, -0.098 (0.036). Figure B2 in Appendix B provides a graphical description of the partial relation between the log Gini coefficient and liquid liability. The graph suggests that the estimated relationship is not driven by outlier observations and has a strong negative relationship with income inequality. The benchmark OLS estimates of control variables yields results similar to those obtained using private credit and bank assets. In column 3, IV results indicate that the exogenous component of financial development has a significant negative relationship with income inequality, -0.17 (0.06). The estimated coefficient implies that a 1 percent increase in liquid liabilities results in an approximate 0.17 percent decrease in income inequality. In column 5, I add a squared term of the measure and estimate the system using GMM. The results indicate that the linear and squared term in liquid liability are each statistically significant at the 10 percent level: -1.15 (0.71) and 0.12 (0.07), respectively. When using legal origin and latitude in the instrument list, the estimates are stronger and significant at the 5 percent level. These estimates have implications similar to those obtained using private credit, and again provide evidence of the presence of nonlinearities. The fitted relationship is shown in Figure 3.2b. The figure indicates that in comparison to private credit, the negative effect of higher financial depth on income inequality attenuates and reaches zero when the indicator takes a midrange value of 74% of GDP. From this range further increases in financial intermediary seem to have a nonnegative

impact on income inequality. In the next section, the estimates from the semi-nonparametric method are presented.

3.4.2 Semi-nonparametric estimates

Here, the measures of financial intermediation form the nonparametric component of the model specification, while the controls enter the model linearly. Table B5 in the Appendix B gives the results of the semi-nonparametric estimation. The first column gives results using obtained using private credit as a measure of financial intermediation, the second and third column give results obtained using bank assets and liquid liabilities, respectively. The coefficients a_0, a_1 and a_2 provide estimates of the nonlinear $h(Z_i)$ component of equation (3.4). Figure 3.3 illustrates a representative semiparametric fit for the $h(Z_i)$ component in equation (3.4) along with 95 percent confidence intervals. The horizontal axis depicts logarithms of private credit while the vertical axis depicts estimates of the nonlinear component $h(Z_i)$. The figure shows that the function is nonlinear and similar to the fitted values of GMM presented in the previous section. The results suggest that the linear hypothesis is true only for countries having low and middle levels of financial infrastructure. For countries having private credit above 44 percent of GDP, there is no indication of a negative relationship.

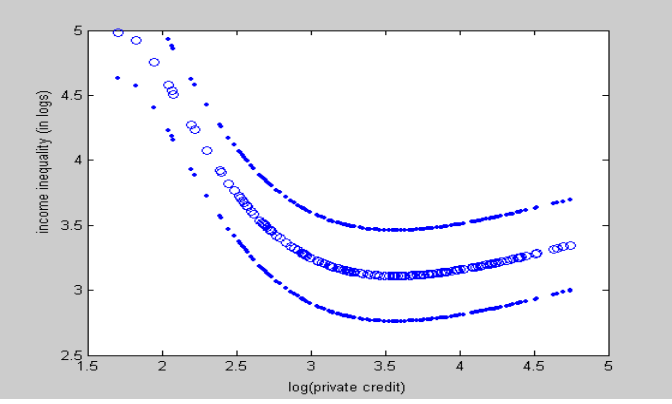


Figure 3.3. Private Credit And Income Inequality: Semiparametric Estimates

Notes: The figure in circles are fitted values of linear and quadratic terms of private credit, the figures in dots are 95 percent confidence levels of the fitted values.

This result is reinforced when using the alternate measures of financial intermediary development. Figures 3.4a and 3.4b illustrate estimates obtained using 'bank assets' and 'liquid liability' respectively. Figure 3.4a indicates that increases in the level of bank assets correspond with reductions in income inequality; however after the mean value of 55 percent, the relationship becomes nonnegative. In case of Figure 3.4b, the turning point is at the level of 66.7 percent in liquid liability.

Figure 3.4a: Bank Assets and Income Inequality: Semiparametric Estimates

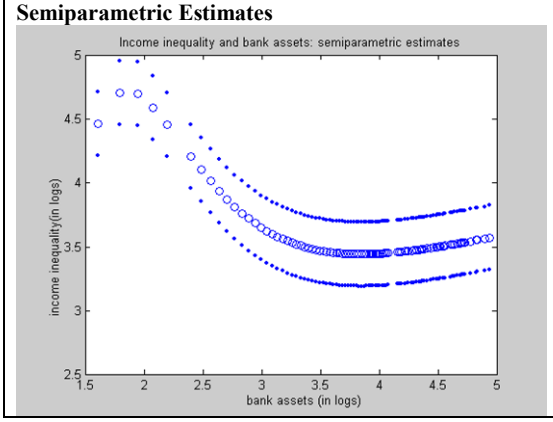


Figure 3.4b: Liquid Liabilities and Income Inequality: Semiparametric Estimates

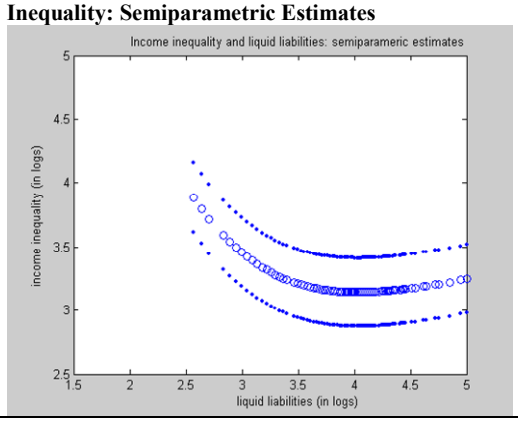


Figure 3.4. Bank Assets and Liquid Liability: Semiparametric Estimates

Notes: The figure in circles are fitted values of nonlinear terms of bank and liquid liabilities, the figures in dots are 95 percent confidence levels of the fitted values.

The semi-nonparametric estimates of the control variables are similar to those obtained using GMM estimation. For example, in column 2 the estimate for secondary schooling rate is negative – 0.71 (0.16) and significant at the 1 percent level. The coefficient estimate for inflation is negative -0.095 (0.18) and insignificant, whereas that for trade openness is positive 0.067 (0.05) and insignificant. The estimated impact of government consumption is negative -0.086 (0.11) but insignificant. The coefficient estimates obtained using the other measures are similar, and to conserve space not discussed. In sum, the graphical analysis constructed using parametric and nonparametric methods provide evidence of a nonlinear relationship between financial intermediary development and income inequality.

3.4.3 Comparison with Clarke et al. (2003)

Here I investigate why my results differ with those obtained by Clarke et al. (2003). Towards this aim, I report a series of estimates. First I replicate the sample, time period and models used by Clarke et al. and compare these results with the original sample of 60 countries used in this study for the same time period. Next using the same sample of 44 countries in Clarke et al., I extend the period to 2000 with the additional data that I have access to and compare these results with the original sample of 60 countries for the period extended to 2000. The analysis is carried out using the measure 'private credit' as used by Clarke et al.

Clarke et al. used the same estimation strategy as followed in this paper; however they used a slightly different set of control variables. Specifically, they used the linear and squared terms of the log of real per capita GDP, inflation rate, government consumption as used in this study, but they differed in their inclusion of the variable ethno-linguistic fractionalization and a measure of protection of property rights. They also excluded the measure of human capital and trade openness which are incorporated in the baseline model used in this paper. In the exercise in this section, I use the same control and source of data as in their paper to isolate the difference in estimation results. In Table B13 in the Appendix B, I report results obtained using the smaller sample of 44 countries for the period 1960-1995 in panel A; and the original sample (as in this study) restricted to the time period 1960-1995 in panel B using the measure of private credit. In panels C and D, I report results obtained by extending the sample period to 2000 for both sets of samples. For all variables except per capita income, the same source was used [14]. For the latter variable, Clarke et al. used an unconventional source which could not be found. In panel A, the replication result for the OLS estimate of private credit is 0.044 (0.029); in comparison, the original estimate in the previous paper is 0.05 (0.027)[15]. The GMM estimate of the linear specification for the replication set is -0.22 (0.072); in comparison, the previous paper reported -0.23 (0.074). I

[14] The following countries are included in addition to that in the sample of countries of Clarke et al. (2003): Bangladesh, Bolivia, Switzerland, Costa Rica, Dominican Republic, Fiji, Guatemala, Guyana, Honduras, Israel, Jamaica, Mauritius, Niger, Nepal, Panama, Paraguay, Senegal, Sierra Leone, El Salvador, Trinidad and Tobago and Uruguay.

[15] A possible reason why there is a slight difference here is that the number of observations was slightly bigger at 178 from 170 as reported in the previous paper. But since the sample is an unbalanced panel, this problem couldn't be avoided.

was not able to replicate the GMM quadratic specification results. The coefficients of the other regressors are similar. In panel D, the GMM estimate of the linear term is -2.19 (1.31); and of the squared term is 0.28 (0.16), the estimates are significant at the 10 percent level. The results indicate that ignoring the effects of using an unconventional source for per capita income, the addition of new observations brings about a significant nonlinear relationship between income inequality and financial development.

As a further robustness check, I explore whether the experience of financial crisis in late 1990s of some economies had any impact on the relationship. To investigate this I excluded observations of economies facing the financial crisis. However the exclusion of these observations did not change the main results, the nonlinearities in relationship was evident[16].

3.5 UNDERSTANDING THESE RESULTS

In this section, guided by theoretical suggestions by Kuznets (1955, 1965) and Galor and Maov (2000) I report a series of estimates in order to explain the result of the nonnegative relationship at higher levels of financial development derived previously. To test whether income inequality is higher in economies having a higher level of industrial and service sector, I introduce a variable, termed as 'modern sector' which measure the share of economy accounted by industrial and service sector as a percentage of GDP. Also, to test whether financial sector development may have a positive relationship with income inequality in countries with larger modern sectors, I include an interaction term between the value added in industrial and service sector as a percentage of GDP and the measure of financial sector development. This channel of causation of higher inequality has been explored by Clarke et al. where it is termed as the *augmented Kuznets hypothesis*. The results are presented in Table B6 in the Appendix B for two measures of financial intermediary development, private credit and bank assets. The results obtained using liquid liabilities are similar and are not reported to conserve space. In the first column, the OLS estimates show

[16] The GMM estimate of the linear term is -1.61 (0.09) and the squared term is 0.21 (0.12), the estimates are significant at 10 percent level. This table is not presented but is available on request.

that after controlling for other factors that may affect income inequality including per capita income and other controls, the share of economy accounted for by service and industrial sector as a percentage of GDP is positive 0.004 (0.002) and significant at the 10 percent level. The results are similar when using bank assets and is reported in column 5. The result on the interaction term is presented in column 4 for private credit and column 8 for bank assets. The coefficient estimate on the interaction term is positive at 0.023 (0.014) and significant at the 10 percent level for private credit. When using bank assets the estimate of the interaction term is similarly positive and significant. These results indicate that financial sector development reduces inequality in countries having smaller service and industrial sectors, while increases in the size of these sectors are associated with higher inequality in countries having a mature financial infrastructure.

Next, I explore whether the rise in income inequality is a result of higher demand for skilled labor in response to higher returns to ability and report a series of estimates. Specifically, I explore whether inequality is increasing with financial sector development because of increasing employment in the service sector (which serves to proxy high skill labor). Table B7 in the Appendix B shows the result when I add a variable denoting the percent of employment in service sector to total employment. The data is derived from the World Development Indicators (2007). The OLS estimates show that income inequality is positively correlated with the percent of employment in service sector; the coefficient estimate is 0.004 (0.001) and significant at the 1 percent level. The GMM estimate of the interaction term in column 4 is positive 0.98 (0.72) and insignificant. These results indicate that financial sector development tend to increase inequality in countries having higher employment in skill oriented sectors.

Again, in order to proxy for high-skill content production, I use available cross country data on high technology exports as a percentage of the manufacturing sector (Source: WDI, 2007). The goal here is to explore whether income inequality is higher in countries having a high level of high technology exports, which serves to indicate a high-skill biased manufacturing sector. In Table B8 in the Appendix B, I use private credit and bank assets to proxy financial development. The controls apart from the usual include the share of industrial and service sector to GDP and high technology exports as a percentage of the manufacturing sector. The OLS results show that having a high technology export sector

tend to increase the level of income inequality in the economy. For example, in column 1 and 2, the coefficient estimate for high technology exports is positive and range between 0.27 (0.16) and 0.25 (0.15); in both cases it is significant at the 10 percent level. Using bank assets, the coefficient estimates are similar and range between 0.29 (0.17) and 0.24 (0.15), and both are significant at the 10 percent level. These results confirm that inequality is positively correlated with high-skill oriented sectors. The coefficient estimate on modern sector is positive and significant at the 1 percent level for this sample and it ranges between 0.011 (0.004) to 0.013 (0.004). Since data was available for most countries in the sample only from the mid 1980s, the sample size is significantly smaller.

Thus in sum, the findings indicate that in countries having a large industrial and service sector, income inequality is greater than in agrarian economies. Further, the findings indicate that inequality is higher in economies having more people employed in the service sector, where the average skill content of work is generally higher, and it increases with further financial development. Again the results indicate that when economies have a large high technology sector, income inequality is seen to be higher. Together, these results aim to explain why inequality is seen to have a nonnegative relationship with financial development at higher levels of financial development.

3.6 ROBUSTNESS CHECKS

In this section I provide a wide array of sensitivity analyses to gauge the robustness of these findings. In the first section, I provide details of tests conducted to clean data of the potential influence of outliers. Secondly, I split the data according to income levels as specified by the World Bank and explore the relationship between financial infrastructure and income distribution of samples stratified by income. Next, I use the ratio of 90 to 10 income percentile as an alternate measure of income inequality and explore whether the results withstand the test of an alternate measure. Lastly, I change control variables to test whether the results withstand this robustness check.

3.6.1 Tests for Outliers, Influence Statistics and Leverage

As a first robustness check, I explore for the potential influence of outliers. A total of 11 observations were singled out using a combination of two test statistics to flag observations which act as outliers. The first test statistics is advocated by Belsley, Kuh and Welch (1980) which use the DFITS statistic to flag observations associated with a high combination of residual and leverage statistics[17]. The second test statistic, the Cook's D statistic, is used as a measure of the aggregate impact of each observation on a group of regression coefficients and their covariance. As a standard rule, values larger than $4/n$ are considered highly influential. I also use the leverage test for checking observations which have a large influence. The leverage values measure how far an observation is from others in terms of the levels of the independent variable. Observations with values larger than $2(k+1)/n$ are considered to be highly influential, where *k* is the number of predictors and *n* is the sample size. The results in all tables represent samples without outliers and other observations having high leverage and influence[18].

3.6.2 Income – Financial Development Contingencies

To examine the income financial development contingencies, I split the sample of countries to sub-samples, including low income, lower middle income countries, upper-middle income countries and high income countries, and estimate separate linear specifications for each. The criteria for the four income levels are as follows; sample of poor countries are those with per capita income less than $2,650, middle income countries with income between $2,650 and $5,499, upper-middle countries are those with incomes between $5,500 and $11,499 and high income are those with incomes above $11,500. These thresholds are as defined in the World Bank's income measures and correspond to measures

[17] Following Belsley, Kuh and Welch (1988), I identified as potential outliers countries with associated DFITS statistics greater than 2(k/n)^0.5 where k is the number of explanatory variables and n is the number of countries in the sample.

[18] The presence of outliers in the gini (Y), the measure of financial development (X) or controls (Z) are not affecting the main results in the sample. The magnitude of the GMM estimates varies depending on whether X or Y/Z is included, the magnitude is smaller when X is included and is larger when Y/Z is included. These results are presented in Table B12 in the Appendix using private credit.

from the Penn World Tables. Table B9 in the Appendix B provides the estimates of the relationship between financial development and income inequality in a linear specification for these income split samples using private credit and liquid liability.

For the poor-income sample, the relationship between financial development and inequality is large and negative -0.36 (0.08) and significant at the 1 percent level. The estimates progressively decrease in their magnitude in any sample having higher income. For example, the estimates are negative -0.17 (0.10) and significant at the 5 percent level for the lower middle group, but for the upper middle group the estimates are negative -0.08 (0.07) and significant at the 5 percent level. For the richer income level, estimates indicate a positive relationship 0.036 (0.05) though insignificant. Regarding the quantitative significance, the impact on income inequality of a 10 percent point increase in financial development is estimated as -0.72 percent for low income economies, -0.34 percent for lower-middle economies, -0.16 percent for upper middle economies and 0.07 percent increase in income inequality for rich economies[19]. The results from using liquid liabilities and bank assets are reported in panel B and C respectively in Table B9 (Appendix B). In sum, these results show that increasing the level of financial infrastructure has a large negative relationship with income inequality for poor economies, but its relationship is positive and small in richer economies.

I will briefly discuss the coefficient estimates obtained for the additional explanatory variables when using private credit. The ratio of government consumption to GDP is negative and insignificant for rich-income samples, but positive and insignificant for low and upper-middle income countries. A possible reason for the former could be that more spending in social welfare programs in these societies on non-aged population may be beneficial for an equal income distribution. Estimated coefficients for secondary school enrollment is negative and significant, but have larger impact on lower income societies at -2.72 (0.46) and then lower-middle, -0.91 (0.40) and upper-middle income, -0.63 (0.18) in that order respectively. For rich-income countries, the estimates are small -0.06 (0.20) and insignificant. The estimates for trade openness are positive for low, lower-middle and

[19] These measures are obtained by multiplying the coefficient estimate by the percentage point change of 10, and dividing by the time span between inequality observations (5 years).

upper-middle economies implying increasing openness and international trade leads to higher inequalities, an issue which is sometimes attributed to skill-biased technological change (Acemoglu, 2002 etc.). The coefficient estimate is positive 0.42 (0.10) and significant at the 1 percent level for low income countries, but negative -0.09 (0.04) and significant at the 5 percent level for high income countries. The estimates for initial income for all samples indicate higher levels of initial income leads to higher inequality, a finding which has been also reported by Edwards (1997). Finally, inflation has a negative relationship with inequality for low income and lower-middle income countries and a positive relationship for the high income countries.

3.6.3 Using 90th to 10th percentile as a measure of inequality

In Table B10 in the Appendix B4, I report results using 90^{th} to 10^{th} percentile as an alternative measure of income inequality. The objective of using this measure is to capture the ratio of the extreme tails of the distribution of income inequality in the particular time period for each country. The correlation between this measure and the adjusted Gini is 0.71. In panel A, I report the estimates of OLS, IV and GMM regression using the measure private credit, while in panel B, I report the same using bank assets as a measure of financial intermediation. In column 1, the OLS estimates of private credit is negative -0.26 (0.10) and significant at the 1 percent level. When controlling for endogeneity, the estimate of private credit increases to -0.54 (0.22) and is significant at the 5 percent level. The results obtained when adding a quadratic term and estimation by GMM are reported in column 4. The results indicate that the linear term is negative -12.07 (6.8), and significant at the 10 percent level, while the quadratic term is positive 1.57 (0.95) and significant at the 10 percent level. The results imply a nonlinear relationship between private credit and ratio of 90^{th} percentile to 10^{th} percentile and confirm previous results obtained using the gini coefficient. From the p-value of the Hansen's J test, I find that the over-identifying restrictions are valid and the instruments are uncorrelated with the error term.

In panel B, I report the estimates obtained using bank credit. As above, the OLS estimate obtained when bank credit enters the estimating equation linearly is negative -0.33 (0.11) and significant at the 1 percent level. With a quadratic specification, the estimates

indicate a nonlinear relationship. The linear term negative and significant at the 5 percent level, and the squared term positive and significant at the 10 percent level. The alternative measure of income inequality reinforces the previous results.

3.6.4 Income Inequality, Current Account and other Controls

In Table B11 in the Appendix B4, I present results obtained using the current account as an additional control variable which may have an impact on the degree of income inequality in the economy. The current account typically reveals the net capital inflows in a society and hence can be an indirect measure of external capital inflows in a country. Table B11, columns 1 and 2 present OLS and GMM estimates obtained when using private credit. In columns 3 and 4, I present estimates obtained using bank assets as a measure of financial intermediation. All columns include the current account along with the usual control variables. However for the sample of countries in this paper, I find that the current account does not have a significant relationship with income inequality. The results in all four columns show that the estimate is negative, small and insignificant.

Incorporating this variable, however, does not change the basic results of the relationship between domestic financial intermediation indices and income inequality. In column 1, the instrumental variable estimate of private credit is negative, -0.21 (0.07) and significant at the 1 percent level. In column 2, the coefficient estimates of private credit from the GMM estimation show evidence of a nonlinear relationship; the linear term is negative -3.20 (1.55) and significant at the 5 percent level and the squared term is positive 0.41 (0.19) and significant at the 1 percent level. In columns 3 and 4, estimation results obtained when using bank assets as a measure of financial depth are similar. Also in Table B13 (panel D), the controls include a variable proxying property institutions and ethnological background of the population. Here the estimates of the linear and squared terms of private credit indicate that the nonlinear relationship survives changes in control variables. One implication of this analysis is that the basic nonlinear relationship withstands alternations in control variables, and this serves as a further robustness check of the results derived.

3.7 CONCLUSION

This paper studies the empirical relationship between various measures of financial intermediary development and income inequality. Using a linear specification and controlling for endogeneity, I find that higher levels of financial intermediary development lead to a reduction in income inequality. When a suitable model specification is made that allows for nonlinearities in the model specification, I find evidence of a nonlinear relationship in accordance with the theoretical predictions by Galor and Maov (2000). The results indicate a possible U-shaped relationship in which at lower levels of economic development income inequality falls with financial development. At higher levels of development, the relationship is nonnegative with further financial intermediary development. This result is confirmed when using different indicators of financial development. When using the indicator 'private credit', I find that the inflexion point is approximately at the level of 55 percent of GDP. In the second part of the paper, I find that the empirical root of the results lies in the close relationship between the level of economic development and the level of financial development. When introducing a variable measuring the depth of the industrial and service sector in the economy, I find that the marginal impact of financial development on inequality is increasing with the development of industrial and service sectors. When the sample is altered based on the income specification as defined by the World Bank, I find that income inequality is significantly reduced when low income economies improve their level of financial infrastructure; however the same result cannot be extended for richer economies. For these countries, the estimates are small and insignificant, implying that the impact of this variable is marginal. Overall, using alternate measures of financial development, I find support for the theoretical predictions by Galor and Maov (2000) and no indication of an inverted-U relationship as suggested by Greenwood and Jovanovic (1990), or a negative relationship as suggested by Banerjee and Newman (1993) and Galor and Zeira (1993).

4.0 EXTERNAL SHOCKS, DEPTH OF FINANCIAL INSTITUTIONS AND ECONOMIC GROWTH: ACCOUNTING FOR WHAT DETERMINES VARYING RESPONSES TO MAJOR FINANCIAL SHOCKS

4.1 INTRODUCTION

The Asian financial crisis in 1997 had a significant negative impact on the real economy of most countries in East Asia and Latin America. In this paper, I explore why some emerging markets were hit particularly hard by the financial crises during 1997, while others were not. To this end, I present a simple model that highlights three factors that influence the vulnerability of countries to financial crisis: external terms of trade shocks, fragile financial infrastructures, and weaknesses in institutions that provide protection to investors. I find that for the sample of emerging and developed economies, significant differences in these factors help account for the output and investment collapse witnessed in the Asian crisis in 1997.

The literature focuses on the importance of certain factors in determining the financial crises, such as, changes in current accounts, foreign exchange reserves, short-term debt, capital inflows, and the appreciation of the real exchange rates prior to a crisis. In this paper, I find that after controlling for external terms of trade shocks, fragile financial infrastructures, and weak investor protection, many alternative hypotheses that have been used previously to explain financial crises have low marginal explanatory power in my sample. Hence in comparison to prior studies, this paper attempts to extend the literature by showing a robust and strong relationship between these three factors and growth and investment declines for the period of the Asian financial crisis.

The importance of external shocks in determining the low persistence observed for growth rates has been explored previously in empirical growth literature. For example,

Easterly, Kremer, Pritchett and Summers (1993) explored this factor when addressing the puzzle that whereas economic growth varies considerably decade by decade, country characteristics such as educational levels, political stability, and policy configurations carry persistent implications for growth. They tested the extent to which the variation in growth rates between countries can be explained in terms of differences in policies, and the extent due to differences in shock variables such as terms of trade, external transfers, changes in war-related casualties per capita, and the realization of a debt crisis. Their results showed that much of the variance in growth rates observed for the decades of 1960s, 1970s, and 1980s can be directly attributed to shocks to terms of trade. In a related paper, Rodrik (1999) gave evidence that external shocks, in combination with domestic institutions of conflict management (such as rule of law and democratic rights) are important in determining the low persistence of growth rates. Rodrik's paper focused on the growth collapse of Latin America and Middle East countries in the second half of 1970s, particularly when they had satisfactory growth rates in 1960s and 1970s.

In East Asia, negative shocks manifested in many forms and are briefly described as follows. For example, the Asian economies of Korea, Thailand, Malaysia, Indonesia, Singapore, and Hong Kong experienced a collapse of export growth in 1996 after many years of growth in excess of 20 percent. A plausible reason could be that after 1994, the US dollar experienced a period of sharp real appreciation relative to the European currencies and the Japanese yen. This had an adverse affect on export competitiveness in the Asian region, as most currencies were pegged to the US dollar. Moreover, the period prior to the crisis experienced a global glut of labor-intensive manufactured exports. This resulted in declining terms of trade for these products and a fall in export earnings, as they constituted an important share of exports in most East Asian economies. Sector-specific shocks such as the fall in the demand for semi-conductors in 1996 added to the declining exports in the region. Also the concurrent rising economic growth in China may have shifted export-oriented production away from East Asia, particularly after the official devaluation of the Chinese Yuan in 1994.

A second key factor for triggering the crisis advanced in this paper is that the economies most affected suffered from excessive bank lending and financial fragility. The

concept of ‘financial fragility’ or instability is borrowed from Bernanke and Gertler (1990). The concept is as follows. When borrowers (entrepreneurs or managers with access to productive investment projects) have lower contributions to the total investment of a project, their interests are likely to diverge from those of the lenders. Since borrowers have the ability to take unobserved actions that affect the distribution of project returns, a greater incompatibility of interests can increase agency costs associated with the investment process. A financially fragile situation is one in which potential borrowers have low wealth relative to the size of their projects. Using a two-period general equilibrium model, Bernanke and Gertler showed that financial fragility is more acute when potential borrowers have low wealth relative to the size of the project. In extreme cases this can lead to a decrease in investment.

A third key factor for triggering the crisis and the subsequent negative impact on the real economy as advanced in this study was the poor level of regulatory institutions that governed the corporate sector. A number of studies point to weak levels of corporate governance as a major reason for the loss of confidence of foreign and domestic investors in these economies. For example, Fisher (1999) mentions ‘lax prudential rules and financial oversight’ as a factor that can lead to a deterioration in the quality of banks’ loan portfolios. In particular for the most affected economies, Thailand, Indonesia and Korea, he writes that, “weak financial systems, excessive unhedged foreign borrowing by the domestic private sector, and a lack of transparency about the ties between government, business and banks have both contributed to the crisis and complicated efforts to defuse it.” In a similar vein Temple (2000), in describing Indonesia’s spectacular fall in growth rates after averaging over 8 percent growth rate per annum prior to the onset of the crisis, attributes as a major cause “unusually pervasive corruption, associated with state involvement in the economy and the centralization of political power.” La Porta et al. (1998) suggest that relatively weak accounting standards in East Asian countries may have allowed firms in crisis-affected countries to shelter their actual financial positions and continue in business even after they were no longer financially viable.

To this end I present a simple model to determine how these factors may have had an impact on aggregate output and investment. The model is a version of models presented

by Bernanke and Gertler (1990) and Jensen and Meckling (1976) in which I incorporate external shocks and weak institutions as additional factors determining outcome variables. In the model, individual entrepreneurs perform costly evaluations of potential investment projects and then undertake those projects that seem sufficiently worthwhile. The evaluation process gives entrepreneurs better information about the quality of the project than is available to potential lenders. This information asymmetry creates an agency problem between lenders and borrowers. The model shows that the quantity of investment spending is sensitive to the share of borrowers' net worth in the project, the quality of institutions protecting investors, and the probability of a negative shock. Based on comparative statics exercises, I find that large external shocks, coupled with relatively low levels of corporate governance, have detrimental effects on aggregate output and investment. Moreover, rapid increases in external lending in prior years increases the risk of an output/ investment collapse.

The empirical analysis focuses on differences in rates of economic growth and investment observed between five years before and after the occurrence of the Asian financial crisis in 1997. In the empirical part, I test the importance of financial fragility, weak institutions of corporate governance and negative external shocks in influencing growth and investment collapses in East Asia. I find that for a set of countries including and excluding crisis countries, these three factors were important in explaining the growth and investment collapse during five years immediately after the crisis in 1997. I then test the leading contenders using additional control variables and in multiple regressions.

The paper is organized as follows. The section 2 gives a review of literature in this area. Section 3 sketches a simple two period model to derive testable implications in terms of our main hypothesis. The section 4 gives details on the data used, results from OLS estimation and results on instrumental variable estimation. The section 5 reports the results of robustness tests where the main factors are tested against the leading contenders of the crisis from literature. The section 6 concludes.

4.2 LITERATURE REVIEW

The literature on the East Asian crisis in 1997 has focused mainly on macroeconomic and banking issues. A number of authors, such as Corsetti et al. (1998) and Greenspan (1998), observed that many Asian countries had inappropriate macroeconomic policies during the 1990s, and the crisis in a way reflected the structural and policy distortions in the countries most affected. In their view, the root of the Asian crisis was the existence of close links between governments and private institutions that created a moral hazard problem. Specifically, due to these facts, markets operated under the impression that investment returns were 'insured' against adverse shocks. Hence even when facing negative returns, risky investments were undertaken with the anticipation of future bailouts from the government. Such beliefs resulted in a sustained process of capital accumulation, resulting in persistent and sizeable current account deficits, increases in foreign indebtedness, and short-term inflows. In their view these factors were an important indication of the vulnerability of these economies in face of a sudden crisis.

In contrast, others such as Radelet et al. (1998) argued that the Asian crisis displayed elements of a self-fulfilling crisis, in which capital withdrawals by creditors cascaded into a financial panic and resulted in unnecessarily deep contractions. In their view, the countries most affected had relatively strong fundamentals, but due to a series of international financial market shocks, individual investors panicked, which led to collective herd behavior. Thus the crisis was triggered by dramatic swings in creditors' expectations, thereby creating self-fulfilling financial panic. In the process, domestic financial institutions that borrowed heavily defaulted on their loans. Hence even though these economies were essentially solvent, strong real economies, the temporary illiquidity problem resulted in large capital outflows and subsequent exchange rate and growth collapses. The rapid increase in short-term external debt prior to the crisis was in their view a key signal of the vulnerability of the economies to international financial market instability. It signaled to foreign creditors that there was insufficient foreign exchange to pay off all creditors in the case of a panic.

Further still, a number of authors have argued that the crisis resulted primarily from the existence of weak regulatory institutions. Johnson, Boone, Breach and Friedman (2000)

explored this issue when examining the collapse of stock markets and nominal exchange rates of the East Asian economies. They showed that weak legal institutions (that is, legal institutions that do not effectively support the claims of outside investors), help account for cross-country differences in stock market declines and exchange rate depreciations during the Asian crisis. The importance of legal protection afforded to creditors and minority shareholders as a determinant of corporate valuation was also examined by La Porta et al. (1997, 2002). They provided evidence from a sample of 49 countries that weak shareholder rights and poor enforcement lead to underdeveloped stock markets. They showed that the extent to which creditors and minority shareholders are protected explains a great deal of the variation in how firms are funded and owned across countries. In a similar vein, Caballero and Krishnamurthy (1998) emphasized the underinvestment in appropriate collateral that occurred due to incentive problems. Rajan and Zingales (1998) explained problems that can occur when a relationship-based financial system is opened to capital inflows.

Some of the literature in this area has emphasized the role of appreciating real exchange rates in triggering financial crises. Sachs, Tornell and Velasco (1996) explored this issue while studying determinants of the growth collapse in the aftermath of the Mexican peso crisis in 1994-95. These authors argued that the peso crisis resulted primarily from a large appreciation of the real exchange rate, compounded by excessive bank lending and low levels of foreign reserves. In their view, financial investors tried to avoid short-term capital losses by fleeing from countries in which there was an expectation of impending large nominal exchange rate depreciation. Nominal currency depreciation was the most common policy undertaken by economies to counter the possibility of defaulting on external loans, and the extent of depreciation was usually larger in economies that experienced a large appreciation of real exchange rate during a period of rapid capital inflows relative to past average values. They found that for a sample of twenty emerging market economies, differences in these factors were able to better explain the eventuality of the occurrence of a crisis relative to other factors, such as increasing current account deficits and high foreign capital inflows. However, their paper related to the experience of the Peso crisis in 1994, and hence the strength of these factors was not evaluated for the Asian crisis economies.

Most of the empirical literature in this area seeks to identify a set of determinants that can account for the *occurrence* of a crisis. However, there is a void in identifying factors important for accounting for declines in growth and investment that occurred *after* the crisis in 1997. This paper attempts to establish factors associated with differential growth declines across countries. The focus is on rapid increases in domestic lending, rather than international lending, in economies with weak regulatory institutions and experiencing negative external shocks. The next section illustrates a simple model designed to explain how these factors can influence a growth collapse.

4.3 THE MODEL

The following two-period model is based on models developed by Bernanke and Gertler (1990) and Jensen and Meckling (1976). These papers depict a conflict of interest between managers and outside financiers (banks, equity holders); in addition, I have incorporated institutional strength and the possible realization of external shocks as factors that can determine output, in order to evaluate their empirical implications. In the model, investment is a lengthy (more than one-stage) process. The success of investment projects depends on actions taken along the way by the firm's "insiders" (entrepreneurs, managers, and directors). The actions cannot be perfectly observed by people outside the firm. In addition, as the process evolves, insiders obtain superior information about the quality of the investment. To the extent that external finance is required for the project, informational asymmetries introduce an agency problem: insiders have the incentive to invest the funds of the outside lenders in negative-present-value projects. The specific assumptions of the model are as follows.

There is a countable infinity of people. An individual drawn at random is an entrepreneur with probability μ and is a non-entrepreneur with probability $(1 - \mu)$. At the beginning of the first period, an endowment of a non-consumable input good is distributed continuously over the population; each individual i receives the quantity w_i. During this period, the endowment may be either stored or invested. The output of either storage or

investment is a consumption good, available in the second period. The gross rate of return on any amount stored is ***r*** units of output per unit of input.

All projects are identical ex-ante. There are two stages in the investment process, which takes place in the first period. In the first stage the project is "evaluated" which costs the entrepreneur ***e*** units of effort and yields a probability $\hat{p}$ that the project if undertaken will succeed. Only entrepreneurs can evaluate projects. Undertaking the project requires *one unit of endowment.* The entrepreneur must obtain external finance if his endowment is less than unity.

The investment technology is indivisible, involves informational asymmetries, and yields a random payoff. If the project succeeds it pays a gross rate of return $\boldsymbol{R > r}$ units of consumption. R is a random variable having a value $\boldsymbol{r_0}$ when the economy experiences a negative shock with probability ***q*** and $\boldsymbol{r_1}$ when the economy experiences a positive shock with probability $\boldsymbol{(1-q)}$. If the entrepreneur decides not to proceed, he may simply store his endowment or lend it to others; however, the effort expended in the evaluation stage is sunk and cannot be recouped if the project is abandoned. A non-entrepreneur could undertake a project, but since non-entrepreneurs cannot evaluate, the project would fail with certainty.

All individuals are risk neutral. Entrepreneurs maximize expected second period consumption less any effort expended on project evaluation. Non-entrepreneurs maximize expected second-period consumption; their only decision is whether to store or lend their endowment. Let $\overline{w}$ be per capita endowment, let ***m*** be the fraction of individuals who evaluate projects. Formally, with no external financing by entrepreneurs, the output is given by the following equation.

$$Q = r\left[\overline{w} - m\hat{p}\right] + m\left[\hat{p}\alpha\left(r_0 q + r_1(1-q)\right) - e\right] \qquad (4.1)$$

In equation 4.1, the first term is the expected per capita return from storage and the second is the per capita return (net of evaluation costs) from investment.

Now suppose that for most of the individuals i, $w_i < 1$ so that individual endowments are less than the unit required to operate the project. Then entrepreneurs who

decide to proceed with their projects must borrow endowments from lenders like financial intermediaries (i.e. non- entrepreneurs and entrepreneurs who do not proceed with investment). The entrepreneur owns share α $(\alpha = f(w))$ of the firm and the lenders/ intermediaries own share *(1 – α)*. The intermediaries lend the entrepreneurs the amount *(1 – w)* of the input good and suppose in return the entrepreneur is to pay the intermediary an amount of consumption good, Z_s.

When $w_i < 1$, an agency problem emerges as has been suggested by Jensen (1988). Because the financial intermediary cannot directly verify project quality, there maybe cases in which entrepreneurs channels the borrowed funds in negative present value projects, or simply expropriate the funds. Suppose that some entrepreneurs steal $S \geq 0$ of the borrowed capital and obtains a utility *S* from them. Stealing is equivalent to all forms of expropriation. Stealing is costly, and the entrepreneur expects to lose $C(S) = (S^2/2k)$ when he steals, for example because there is some punishment associated if caught. The parameter ***k*** denotes a weak legal system or weaker levels of corporate governance. If ***k*** is high, it is less costly to steal. Thus, the value of stealing, ***S – C(S)***, is concave in ***S***. The marginal value of stealing falls as the amount stolen increases because it becomes harder to steal as the absolute amount of theft increases; the stealing becomes more obvious and easier for the court to stop[20]. With borrowing capital and expropriation, output is given by:

$$Q = \max_{\hat{p},m} r[\overline{w} + S - m\hat{p}] + m[\hat{p}\alpha(r_0 q + r_1(1-q))(1-S) - S^2/2k - \hat{p}(1-\alpha)Z_s - e], \quad (4.2)$$

The first term in (4.2) is the expected per capita return from storage which includes per capita endowment net of that invested in project plus the amount expropriated by managers; and the second is the expected per capita return (net of costs of expropriation, payments to investors and evaluation costs) from investment.

To examine the impact of negative shocks, costs of expropriation in terms of institutions protecting investors, and share of net worth of entrepreneurs on output and investment, I undertake the following comparative statics exercise. Differentiating equation (4.2) with respect to ***k*** gives:

[20] The variables *S, C(S) = S^2/2k, q, α, r_o, and r_1* are added in this paper in comparison to the model depicted in Bernanke and Gertler (1990).

$$\frac{dQ}{dk} = -\frac{mS^2}{2k^2} < 0; \qquad (4.3)$$

This implies that weaker level of corporate governance (high ***k***) leads to a fall in investment and output. As ***k*** rises, the amount of expropriation in equilibrium rises and this results in siphoning funds from productive investment which ultimately leads to a fall in output and investment.

Differentiating equation (4.2) with respect to ***α*** gives:

$$\frac{dQ}{d\alpha} = m\left[\hat{p}R(1-S) + \hat{p}Z_s\right] > 0 \qquad (4.4)$$

This implies that having greater share in ownership by the entrepreneurs leads to a rise in output and investment. Because the manager owns share **α** of the firm, he has an incentive to invest at least some of the firm's cash rather than to steal it all. The net result is increase in output and investment.

Differentiating equation (4.2) with respect to ***q*** gives :

$$\frac{dQ}{dq} = m\hat{p}\alpha(r_0 - r_1)(1-S) < 0 \text{ since } r_1 > r_0 > 0, S < 1; \qquad (4.5)$$

This implies that a higher incidence of negative shocks leads to a fall in output and investment.

Next, I examine the implications of the model in terms of aggregate output. Let w_l be the threshold level of personal endowment required by any entrepreneur to evaluate his project. If $w < w_l$, it is not profitable for the entrepreneur to evaluate his project. Let *F(w)* and *f(w)* be the cdf and pdf of initial endowments for the entrepreneurs. Let $\overline{w}$ be per capita mean endowment. Then total output is given by

$$Q = r(\overline{w} + S) + m\int_{w_l}^{1} \left(\alpha\hat{p}R(1-S) - S^2/2k - \hat{p}(1-\alpha)Z_s - r - e\right)f(w)dw$$
$$+ m(1-F(1))(\hat{p}R - r - e)$$

(4.6)

In equation (4.6), the first term is the per capita return from storage; the second term is the per capita surplus from projects owned by "middle class" entrepreneurs (those with endowments between w_l and unity); the third term is the per capita surplus from "rich" entrepreneurs (those with endowments exceeding unity).

As shown by Bernanke and Gertler (1990), a situation in which many entrepreneurs have low wealth (between w_l and unity) is financially fragile. In this situation, many potential borrowers need funds but are not "credit worthy": that is, agency costs of lending to them are too high. In such situations, even though the fundamentals of investment may be good, the average realized return of investments undertaken may be low. In this situation there is a possibility of investment and output collapse if entrepreneurs have low endowments; this is compounded if the probability of a negative shock is high and if institutions protecting investors are weak. In the next section, we test these implications for the output and investment collapse witnessed in East Asia after 1997.

4.4 DATA DETAILS AND RESULTS

4.4.1 Data Details

The sample includes 48 countries: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Denmark, Ecuador, Egypt , Finland, France, Germany, Greece, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Japan, Jordon, Kenya, Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Nigeria, Pakistan, Peru, Philippines, Portugal, Singapore, Spain, Sweden, Switzerland, Sri Lanka, Thailand, Turkey, South Africa, USA, UK, Uruguay, Venezuela and Zimbabwe. The list includes 19 emerging economies, – the rest are OECD and other developing economies. This sample of countries is chosen in accordance to the availability of data for indices of corporate governance[21]. The key dependent variable is the change in the per capita growth rate (chain weighted) from 1997 to 2001. The year 1997 is taken as the breakpoint as the crisis erupted in the summer of 1997 with the initial devaluation of Thailand's baht. The second dependent variable is the change in investment levels from 1997 to 2001. The data for growth and investment are from the Penn World Tables 6.2 (Heston, Summers, Allen 2006). Table A in the appendix provides

[21] The sample size is restricted to countries in which there were at least five domestic non-financial publicly traded firms since an important focus is on protecting investor rights (see La Porta et al. (1998) for details).

summary statistics of the key variables. All the regressions contain the following independent variables (in addition to variables representing external shocks, indicators of corporate governance, and indicators of financial fragility): regional dummies for East Asia, Latin America and sub-Saharan Africa, and log per capita GDP in 1993. Per capita GDP and regional dummies are included to control for structural characteristics that are correlated with income levels and geographical location.

The measure of external shocks is calculated by multiplying the standard deviation of the first log-differences of the terms of trade with the average share of total trade in GDP during 1993-1997. It is meant to capture the unexpected component of the volatility of the streams of income associated with foreign trade. Assuming that the terms of trade follow a random walk (possibly with a drift), this is the theoretically appropriate indicator of external volatility (Rodrik, 1998b). The data are derived from the World Development Indicators (World Bank, 2006).

The measure of financial fragility is proxied by two variables. The first is the ratio of the increase in 'Private Credit' to the increase in the aggregate capital stock over the same period 1993 to 1996. The measure intends to capture whether increases in external borrowing by the private sector is matched by increases in the capital stock, and serves as a rough proxy of the concept of financial fragility portrayed by Bernanke and Gertler (1990)[22]. 'Private Credit' is defined as the value of credit by banking and other financial intermediaries to the private sector divided by GDP. The second proxy is the increase in 'Private Credit' over the period 1993 to 1997. The presumption is that when bank lending increases sharply during a short period of time, banks' ability to screen marginal projects declines; thus they are more likely to end up with a large share of weak borrowers in their portfolios. The measure 'Private Credit' is popular, as witnessed in a number of recent papers (e.g., Levine et al. 2000, Beck et al (1999)). The measure isolates credit issued to the private sector as opposed to credit issued to governments and public enterprises. It also

[22] The measures of capital stock are constructed using the Perpetual Inventory Method (see Barro and Salai-Martin, 2004 for details). The data for investment are derived from the Penn World Tables 6.2 (Summer and Heston, 2006). The initial capital is proxied by using twice the real per capita income in 1960.This is under the assumption that per capita income follows a Cobb-Douglas production function and the share of capital is ½. A constant value of depreciation of capital stock at 10 percent is used for all countries.

excludes credit issued by the central bank and development banks. It captures the amount of credit channeled from savers, through financial intermediaries, to private firms. The data are from the World Bank Financial Infrastructure Database (Beck et al. , World Bank 2004).

As a proxy for measuring the quality of corporate governance, I use the 'Investor Protection' index (World Bank, Doing Business 2006) and also the index of 'Average Protection against Expropriation Risk' (International Country Rating) as measures of overall quality of governance institutions. The indices are described as follows. The Investor Protection index measures the strength of minority shareholder protections against directors' misuse of corporate assets for personal gain. The indicator is a composite of three indicators which distinguish alternate dimensions of investor protection: transparency of related-party transactions (extent of disclosure index), liability for self-dealing (extent of director liability index) and shareholders' ability to sue officers and directors for misconduct (ease of shareholder suits index). The data come from a survey of corporate lawyers and are based on securities regulations, company laws and court rules of evidence. The index ranges from 0 to 10, with higher values indicating more investor protection. The second institutional measure is the Average Protection against Expropriation Risk 1985-95, from Political Risk Services. The index measures the risk of outright confiscation by governments or forced nationalization. It scales from 0 to 10, where a higher score means less risk. For ease of interpretation, both the indices are adjusted so higher levels indicate weaker level of institutions.

4.4.2 Results from OLS Estimation

Table C.1 in the Appendix C provides summary statistics for the key variables in the analysis. There is considerable variation across countries in changes in growth rates and investment shares during the period 1997 to 2001. For example, emerging market economies like Malaysia, Hong Kong and Brazil suffered growth-rate declines of -4.9 percent, -3.65 percent, and -2.32 percent from its 1997 value. In contrast, the sample mean is -0.73 percent (s.d of 2.18 percent). In terms of investment share differentials, whereas Sweden and Italy experienced increases of 1.04 and 1.25 percent, Thailand, Singapore and Malaysia

experienced declines of -14.02, -12.01, and -15.56 percent. The sample mean is -2.22 percent (s.d. of 4.16). Further, there is considerable variation in the extent of increases in private credit prior to the crisis. For example, allocations increased by 56.4 percent, 42.1 percent, and 25 percent in Thailand, Malaysia and Hong Kong from 1993 to 1997; in comparison, Canada, Austria and Germany experienced modest increases of 6 percent, 5.3 percent, and 14.5 percent over the period. The sample mean is 21 percent (s.d. of 43 percent). Again in terms of variation in investor protection, OECD members Canada and USA scored a high level of 9.3 and 8.3 in the index whereas Philippines, Indonesia and Mexico scored lower values of 3.3, 5.3 and 4.

Table 4.1 display OLS estimates of the relationship between growth rate differentials between 1997 and 2001 and external shocks, weak institutions, and measures of financial fragility, excess bank lending and controls. Table 4.2 display OLS estimates of the relationship between the level of investment differentials between 1997 and 2001 and the variables listed above. The sample is restricted to countries for which data for corporate governance indicators are available. Also, each leading variable of interest (external shocks, the proxies for financial fragility, and the proxies for weak institution) are added separately in column 1 to 3 to assess their individual explanatory power. In column 4, both external shocks and proxies for financial fragility are included. Finally in column 5, all variables are included in the regression specification.

Column 1 (Table 4.1) reports results obtained by regressing growth rate differentials between 1997 and 2001 on external shocks and the additional control variables. The estimated coefficients on the regional dummies indicate that East Asia and Latin America suffered a growth decline during this period: the coefficients on both dummies are large, negative and significant at the 1 percent level. The estimated coefficient for initial per capita GDP in 1993 is positive but insignificant. Finally, I estimate a statistically significant relationship between the external shock and the growth differential, indicating greater exposure to external turbulence during this period is associated with larger reductions in growth. The estimated coefficient on the external shock is negative (-0.13, s.e. 0.06) and significant at the 5 percent level. This coefficient estimate implies that a country like Thailand (with an external shock value of 13.88) is predicted to have a growth rate decline of

1.8 percent per annum over this period. This estimate is similar to that found by Rodrik (1999) (-0.17, s.e. 0.06) in his analysis of the impact of shocks on growth differentials between the period 1960-75 and 1975-89.

Table 4.1. Impact of External Shocks, Financial Fragility and Weak Institutions on Growth: OLS Estimates

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Per capita growth rate between 2001 minus per capita growth rate in 1997					
External shocks	-0.13			-0.12	-0.10
	(0.06)**			(0.05)**	(0.04)**
Increase in ratio of private credit to capital stock		-0.024		-0.022	-0.015
		(0.009)***		(0.006)***	(0.007)**
Increase in Private Credit		-1.62		-1.64	-1.26
		(0.57)***		(0.49)***	(0.48)**
Investor Protection Index			-0.50		-0.32
			(0.14)***		(0.12)**
Risk of Expropriation			-0.66		-0.44
			(0.33)**		(0.28)
East Asia	-2.36	-3.39	-2.72	-2.33	-2.04
	(0.81)***	(0.63)***	(0.65)***	(0.69)***	(0.65)***
SSA	0.34	-0.31	0.21	-0.20	-0.11
	(1.04)	(1.04)	(1.00)	(0.91)	(0.84)
Latin America	-1.54	-1.54	-1.56	-1.23	-1.16
	(0.65)***	(0.64)***	(0.71)**	(0.56)**	(0.61)**
Initial GDP (in logs) 1993	0.25	0.10	-0.38	-0.12	-0.47
	(0.33)	(0.34)	(0.57)	(1.10)	(0.47)
R^2	0.4822	0.5748	0.5850	0.6251	0.6797
N	46	46	46	46	46

Notes: The figures in brackets are standard errors. Levels of significance are indicated by asterisks: *** 99 percent, **95 percent , * 90 percent

Column 2 reports results obtained by regressing growth rate differentials on proxies for financial fragility and excessive bank lending and the additional control variables. The estimated coefficient of the ratio of increase in private credit to capital stock is negative (-0.024, s.e. 0.009) and significant at the 1 percent level. The estimate implies that large lending which is not followed by increases in the capital stock is associated with a fall in output. The coefficient implies that a one-standard-deviation increase in the variable private credit to capital stock (26.3 during the period 1993-97) is associated with a growth rate decline of 0.63. Again, the estimate of increase in private credit to GDP is negative (-1.64, s.e. 0.57) and significant at the 1 percent level. The coefficient implies that a one-standard-deviation increase in the private credit (0.43 during the period 1993-97) is associated with a

growth rate decline of 0.71. The results are in accordance with the implications of the model presented: when bank lending expands very sharply over a short period of time, banks' ability to screen marginal projects declines, so that they are more likely to end up with a larger share of weak borrowers in their portfolios.

Column 3 reports results obtained by regressing growth differentials on the proxies for weak institutions and the additional control variables. The indicator 'Investor Protection Index' proxies weakness in institutions protecting minority shareholders from expropriation by management and serves as an indicator for strength of corporate governance. The proxy 'Risk of Expropriaton' captures expropriation by government officials and serves as an indicator for the overall quality of institutions in these economies. Improvement in law and order as gauged by this subjective index implies enhanced property rights. The results indicate a statistically significant relationship; the estimate for 'investor protection' is negative (-0.50, s.e. 0.14) and significant at the 1 percent level. The coefficient implies that a one-standard-deviation reduction in the index (1.74 during the period 1993-97) is associated with a growth rate decline of 0.87. Hence when institutions do not adequately safeguard the interests of investors, higher expropriation and investment in negative net present projects result ultimately in having an adverse impact on the real economy. The estimate for the indicator 'Risk of Expropriation' is negative (-0.66, s.e. 0.33) and significant at the 5 percent level, indicating that weak institutions are associated with the growth collapse witnessed in this region. The coefficient implies that a one-standard-deviation fall in the index (1.59 during the period 1993-97) is associated with a growth rate decline of 1.05.

Column 4 reports results obtained by regressing growth rate differentials on external shocks, financial variables and the additional controls. The results indicate a statistically significant relationship indicating that both external shocks and financial fragility is associated with the growth decline. The estimate for external shock is negative (-0.12, s.e 0.05) and is significant at the 5 percent level. The estimate for increase in ratio of private credit to capital stock is negative (-0.022, s.e. 0.006) and is significant at the 1 percent level. The estimate for increase in private credit is negative (-1.64, s.e. 0.49) and is significant at the 1 percent level.

In column 5, all variables are added to the regression specification. The results indicate that external shocks, financial variables and weak investor protection have a negative and significant relationship with growth differential over the period. However, the estimate of the variable, 'average risk of expropriation' is -0.44 (s.e. 0.28) and is not significant at conventional levels. To conclude, the OLS estimates from Table 4.1 indicate that East Asia and Latin America suffered a growth decline during the period 1997 to 2001. The decline is strongly correlated to external shocks in terms of trade, proxies of financial fragility, and weak investor protection.

Table 4.2 reports results of the relationship of external shocks, weak institutions and excessive lending on the levels of investment differentials between 1997 and 2001. Column 1 reports results obtained by regressing investment differentials between 1997 and 2001 on external shocks and the additional control variables. The coefficient on regional dummies implies East Asia suffered a large decline in investment. The coefficient estimate is negative and statistically significant (-5.29, s.e. 1.26). The coefficient on Latin America is negative but insignificant (-0.8, s.e. 1.02). The coefficient on the external shock is negative (-0.33, s.e. 0.09) and significant at the 1 percent level. The estimate implies greater exposure to external turbulence during the 1990s is associated with larger reduction in investment after 1997. The point estimate implies that a one-standard-deviation increase in external shocks (5.17 during the period 1993-97) is associated with an investment decline of 1.71.

In column 2, the proxies for excessive bank lending and financial fragility are added. The estimated coefficient of the ratio of increase in private credit to capital stock is negative (-0.04, s.e. 0.02) and significant at the 5 percent level. Thus paralleling its impact on growth collapse, financial fragility did have some contribution in the investment collapse during this period. The coefficient implies that a one-standard-deviation increase in the private credit to capital stock (26.3 during the period 1993-97) is associated with an investment decline of 1.05. Finally, the coefficient on increase in bank lending to private sector is negative (-1.26, s.e. 1.04) but insignificant, indicating excessive bank lending and the resulting high probability of bad loans was not a significant factor in the investment decline during this period.

Table 4.2. Impact of External Shocks, Financial fragility and Weak institutions on Investment: OLS Estimates

	(1)	(2)	(3)	(4)	(5)
Dependent variable: investment between 2001 Minus investment rate in 1997					
External shocks	-0.33			-0.32	-0.29
	(0.09)***			(0.09)***	(0.09)***
Increase in ratio of private credit to capital stock		-0.04		-0.03	-0.024
		(0.02)**		(0.01)**	(0.014)*
Increase in private credit		-1.26		-1.33	-0.92
		(1.04)		(0.92)	(0.96)
Investor Protection Index			-0.73		-0.48
			(0.25)***		(0.25)*
Risk of Expropriation			-0.56		-0.40
			(0.60)		(0.56)
East Asia	-5.29	-8.19	-7.22	-5.43	-5.12
	(1.26)***	(1.15)***	(1.16)***	(1.28)***	(1.28)***
SSA	0.55	-0.12	0.13	0.16	0.21
	(1.61)	(1.89)	(1.80)	(1.66)	(1.65)
Latin America	-0.80	-1.12	-1.61	-0.34	-0.46
	(1.02)	(1.16)	(1.26)	(1.05)	(1.20)
Initial GDP (in logs) 1993	0.47	0.64	0.27	0.30	-0.02
	(0.51)	(0.62)	(1.03)	(0.56)	(0.92)
R^2	0.6563	0.6161	0.6375	0.7098	0.7327
Adjusted R^2	0.6133	0.5570	0.5818	0.656	0.6659
N	46	46	46	46	46

Notes: The figures in brackets are standard errors. Levels of significance are indicated by asterisks: *** 99 percent, **95 percent , * 90 percent.

Column 3 reports results obtained by regressing investment differentials between 1997 and 2001 on proxies for weak institutions and additional control variables. The coefficient estimate on investor protection is negative (-0.73, s.e. 0.25) and significant at the 1 percent level. Hence weak corporate governance is associated with slowing investment in this period. The estimate implies a one-standard-deviation increase in the index (1.74 during the period 1993-97) is associated with an investment rate decline of 1.27. The estimate for risk of expropriation is negative (-0.56, s.e. 0.6) but insignificant, indicating existence of weak private property institutions was not a significant factor for the investment decline. The coefficient implies that a one-standard-deviation increase in the index risk of expropriation (1.59 during the period 1993-97) is associated with an investment decline of 1.03.

Column 4 reports results obtained by regressing investment differentials between 1997 and 2001 on external shocks, proxies for excessive bank lending and financial fragility,

and the additional controls. The results indicate that external shocks remain negative (-0.32, s.e. 0.09) and significant at the 1 percent level. The estimate for the increase in ratio of private credit to capital stock is negative and remains statistically significant at the 5 percent level. In column 5, all variables are added. These results are similar to their contribution in the growth decline. The estimates of external shocks, ratio of increase in credit to capital stock and investor protection are significant, indicating a first-order effect of these variables on growth and investment decline. To conclude, the OLS results indicate that external shocks witnessed in this region is strongly correlated with the decline in investment together with poor investor protection and evidence of financial fragility when bank lending out-surpassed increase in capital stock. In the next section, these results are examined when controlling for potential endogeneity of some of the variables of interest.

4.5 ON ENDOGENEITY AND INSTRUMENTS

One problem in the inference associated with the OLS is the likely endogeneity of the regressors. To counter this issue, I report two-stage least squares estimates after identifying suitable instruments for institutions and banking variables. The instruments are chosen such that they are correlated with the endogenous regressors but remain orthogonal to any omitted characteristics and are not correlated with the outcome variables through any other channel other than their effect via endogenous variables. For the institutional variables measured at a particular point in time, the instruments are identified from literature. La Porta et al. (1998, 2002) showed that differences in legal origin and rules of investors help explain how firms are financed and owned differently in various countries. Legal scholars place countries into four major legal families: English, French, German and Scandinavian systems. Company and bankruptcy/ reorganization laws pertaining to investor protection are part of the commercial codes in Civil law countries and exist as separate laws mainly in the form of Acts, in Common law countries. La Porta et al. (1998) identified that Common law countries have the strongest investor protection and in accordance *English legal origin* is identified to be a good instrument for the investor protection. In this section, I use English legal origin as instruments for the Investor Protection. Again, several authors as Hall and Jones (1999), and Rodrik, Subramanium and Trebbi (2002) identified *latitude* to be a good instrument for

institutions. They showed that countries having higher latitude tend to be highly correlated with those with good institutions. Accordingly Latitude and German legal origin is used as an instrument for the measure Average Risk of Expropriation. The endogeneity problems in the banking variable may be marginal as they are measured as changes from 1993 to 1997 and hence are before the period of growth and investment collapse after 1997. However to counter the possibility that anticipation of a growth decline resulted in excessive bank lending and financial fragility, I take into account possible endogeneity before drawing empirical conclusions of the theoretical model. For the banking variables, the likely endogeneity of the explanatory variable is taken into account by using lagged values as instruments. Thus the strategy aims to isolate the effect of excessive bank lending on growth rather than the opposite by using lagged instruments. The variable external shock is exogenous by definition.

Tables 4.3 and 4.4 report results obtained when controlling for endogeneity for the institutions of corporate governance and banking variables. First-stage estimates are reported in Tables C2, C3, and C4 in the Appendix C corresponding to the three instrumental variable regressions reported in Tables 4.3 and 4.4. The results indicate that when regressing investor protection on English legal origin and other controls, the former have a strong negative relationship with weak investor protection in all cases: the coefficient estimate of English legal origin as reported in column 3, Table C4 is negative (-2.84, s.e. 0.44) and is significant at the 1 percent level. In column 4, Table C3, latitude has a negative and statistically significant relationship with the index of risk of expropriation: the coefficient estimate is -6.03 (s.e. 1.45), indicating that bad institutions are associated with economies nearer to the equator in accordance to the empirical literature. Also when regressing changes in private credit on lagged values and other controls, the estimate of lagged private credit is positive and significant (0.88, s.e. 0.04). Similarly, when regressing changes in the ratio of private credit to capital stock on lagged values and other controls, the coefficient estimate of the lagged value is positive and significant (4.04, s.e. 0.98) as reported in column 2, Table C3.

In column 1, Table 4.3, the estimating equation includes all variables: the dummies for geographical location, initial income, external shocks, the measures of excessive bank lending and financial fragility, and two measures of weak institutions. The IV estimates

obtained when including all variables indicates that external shocks and increases in the credit /capital stock ratio are associated with the observed growth collapse. However, both the institutions variables are found to have insignificant though negative correlation with growth. A potential problem with applying instrumental variable estimation is that the IV standard errors have a tendency to be large in comparison to the OLS estimates, particularly because of the quality of the endogenous and exogenous instruments. Hence, the associated control variables add to the noise. In order to reduce the noise in the standard error of the variables of interest, the next strategy is to drop any variables that are not of any consequence for the inference of the model. Towards this aim, I drop two variables, the dummy for sub-Saharan Africa and initial per capita income and report the subsequent IV estimates in column 2[23]. The coefficient estimate on external shocks is negative (-0.12, s.e. 0.06) and significant at the 5 percent level. Again the estimate on increase in credit /capital stock ratio is negative (-0.016, s.e. 0.009) and significant at the 10 percent level. The results indicate that increases in bank lending have a large negative relationship (-1.79, s.e. 0.64) and is significant at the 5 percent level. Also, the estimate on weak investor protection is negative (-0.25, s.e. 0.14) and significant at the 10 percent level. The estimate on risk of expropriation is large, negative (-0.34, s.e. 0.32) but insignificant.

As a further check, I drop the measure 'risk of expropriation' to assess the impact of the main variables of interest; the results are reported in column 3. The estimates indicate that after controlling for endogeneity, external shocks, excessive banking lending and weak level of institutions of corporate governance have a significant negative relationship with growth, and are associated with the growth collapse in accordance to the model presented. The corresponding first stage results are presented in Table C4 in the Appendix C.

[23] The OLS estimates corresponding to this table are reported in Table C5 in the Appendix C.

Table 4.3. Impact of External Shocks, Financial Fragility and Weak Institutions on Growth: IV Estimates

	(1)	(2)	(3)
Panel A. Dependent variable Growth rate 2001 Minus Growth rate 1997			
External shocks	-0.11	-0.12	-0.12
	(0.06)*	(0.06)**	(0.05)**
Increase in ratio of private credit to capital stock	-0.02	-0.016	-0.017
	(0.01)*	(0.009)*	(0.009)*
Increase in private credit	-0.93	-1.79	-1.58
	(1.03)	(0.64)**	(0.48)**
Investor Protection Index	-0.14	-0.25	-0.26
	(0.22)	(0.14)*	(0.145)*
Risk of Expropriation	-1.48	-0.32	
	(1.77)	(0.34)	
East Asia	-1.79	-2.06	-2.13
	(1.02)*	(0.75)**	(0.71)***
SSA	0.3		
	(1.28)		
Latin America	0.16	-1.64	-1.46
	(2.05)	(0.7)**	(0.60)**
Initial GDP (in logs) 1993	-1.96		
	(2.43)		
N	46	46	46

Notes: The variable increase in private credit between 1993 to 1997 is instrumented using lagged value of increase in private credit. The variable increase in ratio of private credit to capital stock is instrumented using lagged values. The variable investor protection is instrumented using English legal origin.. The variable Average Risk of Expropriation is instrumented using latitude and German legal origin.

Table 4.4 reports instrumental variable estimates of external shocks, excessive bank lending and weak institutions on investment differentials[24]. In the first column, the estimates when taking into account the likely endogeneity of the institutions and banking variables indicate that external shocks are negatively correlated with the investment collapse during this period. The point estimate is negative (-0.34, s.e. 0.1) and is significant at the 1 percent level. The estimate for financial fragility and increase in bank lending are negative but insignificant: the estimate for increase in ratio of private credit to capital stock is negative (-0.03, s.e. 0.02), the estimate for increase in private credit is negative (-0.57, s.e.1.52), both estimates being statistically insignificant. Also the estimates of the variables indicating weak institutions are negative but again insignificant.

[24] The OLS estimates corresponding to this table are reported in Table C6 in the Appendix C.

In column 2, after dropping the variables initial income and dummy for sub-Saharan Africa, the coefficient estimates indicate that external shocks are negatively correlated with investment during this period: the estimate is negative (-0.34, s.e. 0.10) and is significant at the 1 percent level. The estimate for increases in credit /capital stock ratio remain negative (-0.022, s.e. 0.016) and insignificant; similarly the estimate for increase in private credit to GDP is negative (-1.62, s.e. 1.1) and insignificant. The estimate for the investor protection index is negative (-0.41, s.e. 0.24) and significant at the 10 percent level. Similar to the OLS results, the estimate for risk of expropriation is negative (-0.21, s.e. 0.47) and insignificant.

Table 4.4. External Shocks, Financial fragility and Weak institutions on Investment: IV Estimates

	(1)	(2)	(3)
Panel A. Dependent variable is investment rate between 2001 Minus 1997			
External shocks	-0.34	-0.34	-0.32
	(0.10)***	(0.10)***	(0.09)***
Increase in ratio of private credit	-0.03	-0.022	-0.028
to capital stock	(0.02)	(0.016)	(0.014)*
Increase in private credit	-0.57	-1.62	-1.37
	(1.52)	(1.10)	(0.85)*
Investor Protection Index	-0.35	-0.41	-0.43
	(0.34)	(0.24)*	(0.24)*
Risk of Expropriation	-1.11	-0.21	
	(2.69)	(0.47)	
East Asia	-4.93	-4.88	-5.01
	(1.55)***	(1.29)***	(1.23)***
SSA	-1.24		
	(1.20)		
Latin America	0.39	-1.24	-0.94
	(3.13)	(1.20)	(1.07)
Initial income 1993	-1.0		
(in logs)	(3.7)		
N	46	46	46

Notes: The Investor protection index is instrumented by English legal origin, expropriation risk is instrumented by German legal origin and latitude of countries. The increase in private credit and private credit to capital stock are instrumented by their lagged values.

In column 3, the IV estimates indicate that the variables external shocks, increase in credit /capital stock ratio and investor protection are negative and become statistically significant. The estimate for increase in private credit to GDP is negative (-1.37, s.e. 0.85) and is statistically significant at the 10 percent level. These results are similar to the OLS results presented in the previous section: external shocks, investor protection and excess

banking are associated with the investment collapse, and the results survive after controlling for endogeneity bias. In conclusion, when taking into consideration the potential endogeneity of the variables of interest, the resulting estimates indicate that external shocks, weak institutions of corporate governance and excessive bank lending are associated with the growth and investment collapse realized in East Asia during this period.

4.6 ROBUSTNESS CHECKS

The debate on the Asian crisis has focused on the relative importance of some macroeconomic variables such as large current account deficits, large foreign investment inflows, sudden changes in foreign exchange reserves, appreciation of the real exchange rate prior to the crisis, and increases in short-term debt to total debt. In this section, some of these factors are considered and their explanatory power is evaluated. Using instrumental variable regression, I check whether any of them help to explain the growth and investment collapse, after controlling for external shocks, financial fragility and weak institutions. In Table 4.5, I report a series of estimates to explore for factors determining the growth collapse. Similarly, in Table 4.6, I report the results for determining investment collapse. Tables C7 and C8 in Appendix C gives the corresponding OLS estimates. The estimating equation includes the dummies for East Asia and Latin America, external shocks, proxies for financial fragility and investor protection index. In addition, each leading contender is added separately to test their explanatory power. The variable risk of expropriation is not included in these regressions as its explanatory power was found to be statistically insignificant.

Economists including Corsetti et al. (1998) and Greenspan (1998) attributed the emergence of the crisis to large current account deficits prior to the crisis. In their view, a high current account deficit can lead to two sets of problems. Firstly, large deficits lead to high external debt until the country either becomes insolvent (the present value of conceivable trade balance surpluses does not suffice to cover external obligations) or they face a borrowing constraint (lenders understand that the country will have no incentive to repay any additional debt). In either case, if lending ceases, the country can be facing a crisis. In the second case, large external deficits expose a country to the instabilities of

international capital markets. Column 1 reports results obtained by regressing growth differentials on the current account balance to GDP ratio from 1993 to 1996, the main variables and the additional control variables, dummies for East Asia and Latin America. The data are from the World Development Indicators (World Bank 2007)[25]. I control for endogeneity using lagged values as an instrument for current account balance to GDP. The results indicate the coefficient estimate for change in the current account balance to GDP ratio is negative (-0.15, s.e. 0.33) but insignificant. The point estimate implies that a one-standard-deviation increase in the current account balance to GDP (4.18 during 1993-97) is associated with a growth rate decline of 0.63. Table C4 in the Appendix C gives the results of the OLS estimation. The coefficient estimate on current account is negative, and statistically insignificant (-0.08, s.e. 0.07). The coefficient estimates of external shocks, increases in private credit and increase in private credit to capital stock remain significant and are similar to the baseline in Table 4.3. The estimates of weak investor protection is negative (-0.10, s.e. 0.24) but insignificant in the IV estimation. The corresponding OLS value is negative (-0.30, s.e. 0.14) and significant at the 5 percent. The evidence suggests that the growth decline was not associated with trade and current account deficits since most of these economies were strong growing economies.

A number of papers, including Corsetti et al. (1998) and Radelet et al. (1998), indicated that rapid increase in foreign capital inflows played an important role in the exchange rate and subsequent growth collapse in Asia. Foreign capital inflows are prone to become rapid outflows in the face of investor panic, as was witnessed in Mexico in 1994. I test the explanatory power of the change in foreign direct investment as a percent of GDP from 1993 to 1996. The data is from the World Development Indicators (World Bank). The results as reported in column 2, Table 4.5 indicate that this variable has little effect on the main results: the estimate for change in FDI is positive (0.18, s.e. 0.61) and insignificant. The implication is an increase in foreign direct investment inflows is weakly correlated with higher growth in the subsequent period. The OLS estimates are reported in Table C7 in the Appendix C. The coefficient estimate for change in FDI is positive (0.027, s.e. 0.11) and insignificant. A plausible reason could be that foreign direct investments are considered as

[25] The current account data was not available for the following countries, Belgium, Hong Kong and Zimbabwe. The sample size is reduced to 43.

longer-term inflows and lead to increases in the productive capacity of economies. These results are similar to those found by Sachs, Tornell and Velasco (1996) when examining the explanatory power of this variable in the Mexican Peso crisis. The coefficient estimates of the main variables remain negative and significant.

Table 4.5. Financial Crisis, Economic Growth Collapse and its Causes: IV Estimates

	(1)	(2)	(3)	(4)	(5)
Panel A. Dependent variable is change in growth rate between 2001 Minus 1997					
External shocks	-0.10	-0.11	-0.11	-0.06	-0.11
	(0.058)*	(0.05)*	(0.05)**	(0.11)	(0.05)**
Private credit to	-0.022	-0.02	-.017	-0.034	-0.019
capital stock	(0.012)*	(0.01)*	(0.009)*	(0.038)	(0.013)
Increase in private	-1.54	-1.42	-1.36	-3.61	-1.60
credit	(0.61)**	(0.72)*	(0.52)**	(1.50)**	(0.52)***
Investor Protection	-0.10	-0.24	-0.30	0.04	-0.24
Index	(0.24)	(0.13)*	(0.19)	(0.51)	(0.14)*
Change in current account balance 1993-96	-0.15 (0.33)				
Change in Foreign Direct Investment 1993-96		0.18 (0.61)			
Change in Real Exchange Rate 1993-96			-3.84 (2.88)		
Change in short term debt 1993-96				-0.11 (0.07)	
Changes in total reserves 1993-96					0.06 (1.80)
East Asia	-2.69 (1.34)**	-2.23	-2.22	-3.38	-2.24
		(0.78)***	(0.76)*	(1.61)**	(0.79)***
Latin America	-1.38	-1.67	-1.47	-1.52	-1.48
	(0.72)*	(0.87)*	(0.63)**	(0.80)*	(0.65)**
N	42	45	44	21	42

Notes: This table leaves out the variables sub-Saharan Africa, initial GDP and Average risk of Expropriation. The figures in brackets are standard errors. Levels of significance are indicated by asterisks: *** 99 percent, **95 percent , * 90 percent.

In column 3, I check the robustness of the results by adding the change in real exchange rate between 1993 and 1996. Sachs, Tornell and Velasco (1996) attributed the emerging market crisis in 1994 to real exchange rate appreciation in the period prior to the crisis. The data are from the World Development Indicators (WDI, 2007). The results indicate the real exchange rate appreciation prior to the period had a large negative effect on the growth collapse, but the estimates are insignificant (-3.84, s.e. 2.88). The coefficient

estimate implies that a one-standard-deviation increase in real exchange rate (0.11 during 1993-97) is associated with a growth rate decline by 0.42. The corresponding OLS estimate also indicates weak correlation, -2. 62 (s.e. 1.86) and is reported in column 3 in Table C7. Moreover when including this variable, external shocks and financial variables or weak investor protection do not lose their explanatory power and remain negative and significant. A possible explanation could be that the real appreciation in East Asia during the 1990s was relatively modest compared with those seen in Latin American countries as for example Brazil and Argentina. In these countries, the real exchange rate appreciated more than 40 percent since 1990. Real exchange rate appreciated by 8 percent in Korea and Indonesia and 14 percent, 35 percent and 12 percent in Malaysia, the Philippines, and Thailand from 1990-96.

Radelet et al. (1998) attributed the crisis to the sharp increase in short-term debt, which can contribute to financial market instability in face of panic by creditors. A high ratio of short-term debt to total debt make economies vulnerable in the face of a crisis, as this signals foreign creditors that there may not be enough foreign exchange to payoff all creditors in the case of a sudden exodus of capital. The variable used is short-term debt as a percent of total external debt, the source is the World Development Indicators (WDI, 2007)[26]. Column 4 reports results obtained by regressing growth differentials on the main variables, the change in short term debt to total external debt 1993-96 and the additional controls. The coefficient estimate from the instrumental regression indicates that when controlling for the main variables of interest, this variable is negative but statistically insignificant (-0.11, s.e. 0.07). The evidence suggests that solvency was not an important issue for the growth decline.

Lastly, I also examine whether low foreign exchange reserves were a potential reason for the growth collapse after the 1997 crisis. The level of reserves is an important determinant of whether a country is able to meet its external obligations in face of a self-fulfilling panic without nominal depreciation of the currency or other structural adjustments. The variable added is the change in total reserves in months of imports from 1993 to 1996.

[26] The sample size is reduced to 22 countries. The following countries did not have short-term debt: Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Portugal, Singapore, Spain, Sri Lanka, Sweden, Turkey, USA,

The data is from the World Development Indicators (2007)[27]. I use lagged values of the variable as an instrument to control for endogeneity. The results indicate that when controlling for the main factors, the estimate for the change in total reserves is positive (0.06, s.e. 1.8) and insignificant. An implication is that the reduction in total reserves is weakly correlated with growth reversals. The OLS results as presented in Table C7 in the Appendix C indicate that the coefficient estimate is negative (-0.21, s.e. 0.66) and insignificant. The other main factors remain negative and significant.

Next, these factors are also examined for their impact on the investment collapse during 1997 to 2001. The instrumental variable estimation results are reported in Table 4.6 and the corresponding OLS estimates are reported in Table C8 in the Appendix C. In column 1, the instrumental estimate for change in current account during 1993 to 1996 is positive, of small magnitude (0.04, s.e. 0.52) and insignificant. In comparison, the estimates for external shock and weak institutions are negative and significant. The corresponding OLS estimates are presented in Table C5 in the Appendix. The coefficient estimate for change in current account is negative (-0.14, s.e. 0.12) and insignificant. In the OLS estimates, the main variables have negative value and are statistically significant indicating the importance of these variables in accounting for the investment collapse in comparison.

In column 2, the instrumental variable estimate for change in foreign direct investment between 1993 and 1996 is positive (0.06, s.e. 1.04), but insignificant. The corresponding OLS estimate is negative (-0.19, s.e. 0.18). Foreign capital inflows do not appear to be related to growth rate changes, while the coefficient on external shocks and weak institutions are negative and remain statistically significant as in the baseline Table 4.4. The proxies for excessive bank lending and financial fragility though negative in value, lose their significance level in comparison to the corresponding OLS estimates.

Column 3 reports results obtained by instrumental regression of investment differentials on the changes in real exchange rate between 1993 and 1996, the main variables and the additional controls. The estimate on change in real exchange rate is negative (-0.31, s.e. 5.09) and insignificant. The corresponding OLS estimates are reported in Table C8 in the Appendix C, the estimate is negative (-0.44, s.e. 3.28). The instrumental variable

[27] The following countries were excluded due to lack of data: Belgium, Hong Kong and Zimbabwe.

estimates for external shocks and investor protection remain negative and statistically significant. Hence sudden appreciation of the real exchange rate is not significantly contributing to the investment collapse when including factors as external shocks and weak investor protection.

Table 4.6. Financial Crisis, Investment Collapse and its Causes: IV Estimates

	(1)	(2)	(3)	(4)	(5)
Panel A. Dependent variable is change in investment between 2001 Minus 1997					
External shocks	-0.29	-0.30	-0.30	-0.13	-0.29
	(0.10)***	(0.10)***	(0.09)***	(0.12)	(0.09)***
Private credit to capital stock	-0.023	-0.02	0.020	-0.01	-0.034
	(0.019)	(0.017)	(0.016)	(0.07)	(0.022)
Increase in private credit	-1.38	-1.23	-1.27	-2.40	-1.40
	(0.96)	(1.23)	(0.93)	(1.65)	(0.91)
Investor Protection Index	-0.48	-0.54	-0.56	-0.72	-0.36
	(0.24)*	(0.28)*	(0.34)*	(0.55)	(0.16)*
Change in current account balance 1993-96	0.04				
	(0.52)				
Change in Foreign Direct Investment 1993-96		0.06			
		(1.04)			
Change in Real Exchange Rate 1993-96			-0.31		
			(5.09)		
Change in short term debt 1993-96				-0.14	
				(0.08)	
Changes in total reserves 1993-96					2.31
					(3.28)
East Asia	-5.49	-5.37	-5.38	-8.75	-5.84
	(2.10)**	(1.33)***	(1.35)***	(1.76)***	(1.42)**
Latin America	-1.18	-0.46	-1.19	-1.07	-1.03
	(1.13)	(4.48)	(1.10)*	(0.87)	(1.14)
N	42	45	44	21	43

Notes: This table leaves out the variables sub-Saharan Africa, initial GDP, and Average risk of expropriation. The figures in brackets are standard errors. Levels of significance are indicated by asterisks: ***99 percent, **95 percent, *90 percent.

Column 4 adds changes in ratio of short term debt to total external debt. The instrumental variable estimate is negative (-0.14, s.e. 0.08) and marginally significant at the 11 percent level. The corresponding OLS estimate is -0.15 (s.e. 0.07) and significant at the 5 percent level. Thus there is some support that changes in short-term external financing had some impact on the investment decline in the region. In comparison, the instrumental variable estimates of the main variables are negative in value, and are statistically insignificant.

Lastly, column 5 reports results obtained by instrumental variable regression of investment differentials on changes in total reserves from 1993 to 1996, main variables and the additional controls. The estimate on changes in total reserves is positive (2.31, s.e. 3.28) and insignificant. Thus there is a weak correlation between larger reductions in reserves and greater investment declines. The corresponding OLS estimate as reported in Table C8 is positive (0.53, s.e. 1.12). The OLS estimates of the main variables are negative and statistically significant.

The results of these robustness exercises indicate that after controlling for endogeneity, the data suggest a significant relationship between external shocks, excessive bank lending and weak investor protection and growth decline from 1997 to 2001. In comparison, the other factors as discussed in literature have a marginal contribution on the growth collapse as witnessed during this period. When examining the impact of the variables on investment collapse, apart from increase in short-term debt, the other factors had marginal contribution when incorporating the main variables of interest.

4.7 CONCLUSION

The Asian financial crisis raised some questions on the growth strategies employed by some of the fastest growing economies of the world. The magnitude and severity of the crisis in some of the most affected economies suggested important gaps in the growth strategy adapted by these economies. In this paper, I present a simple model to illustrate why poor corporate governance institutions and excessive bank lending can lead to a fall in aggregate output and investment when economies experience negative terms of trade shocks. When tested empirically, the results indicate that these factors mattered significantly in the growth and investment declines witnessed during this period. The results are robust to controlling for endogeneity bias. The paper also finds that some common explanations for the occurrence of the crisis are not supported by the data from the sample. Changes in the current account, capital inflows, short term debt, reserves, and also real exchange rate appreciation prior to the crisis during the period 1993 to 1996, do not explain why some

countries experienced greater financial crises rather than others after 1997, conditional on the additional explanatory variables I employ.

The results indicate that strong corporate governance and investor protection are important components of any strategy to enhance resilience to volatility in the external environment. With greater integration of global financial markets, these elements are increasingly important to stabilize emerging economies who are recipients of large investments. Further, the results suggest that banks and financial intermediaries should follow capital adequacy rules in lending and investments so that there are lower non-performing loans to account for. The reform of institutions governing corporate sector, vigilant supervision, and greater degree of screening before the financing of investment projects by banks and other financial intermediaries during economic boom periods are some policy conclusions that can be made from the results derived from this paper.

APPENDIX A:

PRIVATE PROPERTY INSTITUTIONS AND ECONOMIC GROWTH: CHAP 2

Table A1. List of Countries and theirs level of Constraint on executive in 1970-90

No.	Country	1970	1990	No.	Country	1970	1990
1	Algeria	1	3	30	Jamaica	7	7
2	Angola	3	3	31	Kenya	3	3
3	Argentina	1	5	32	Madagascar	3	3
4	Australia	7	7	33	Malaysia	3	5
1	Bolivia	1	7	34	Mali	1	1
6	Brazil	1	6	35	Mexico	3	4
7	Burkina	2	2	36	Morocco	1	2
8	Cameroon	3	2	37	New Zealand	7	7
9	Canada	7	7	38	Nicaragua	1	5
10	Chile	5	7	39	Niger	3	3
11	Colombia	6	6	40	Nigeria	1	1
12	Congo(Brazzaville)	3	2	41	Pakistan	3*	7
13	Costa Rica	7	7	42	Panama	1	6
14	Cote I'voire	1	2	43	Paraguay	1	3
15	Dominican Republic	3	5	44	Peru	1	7
16	Ecuador	1	7	45	Senegal	3	3
17	Egypt	3	3	46	Sierra Leone	4	3
18	El Salvador	4	5	47	Singapore	3	3
19	Ethiopia	1	2	48	South Africa	7	7
20	Gabon	1	2#	49	Sri Lanka	7	7
21	Gambia	1	2	50	Tanzania	3	3
22	Ghana	5	1	51	Togo	1	1
23	Guatemala	3	3	52	Trinidad &Tobago	7	7
24	Guinea	1	1	53	Tunisia	2	3
25	Guyana	6	1	54	Uganda	3	1
26	Haiti	1	6	55	Uruguay	5	7
27	Honduras	3	5	56	USA	7	7
28	India	7	7	57	Venezuela	6	6
29	Indonesia	2	2	58	Zaire	1	1

Source: Polity IV dataset. #Value for 1991, 1990 data not available. *Value for 1968, 1970 data not available.

Table A2. Variable Definitions and Sources

Variable	Description	Source
Growth rate of GDP per capita 1970-80, 1980-90, 1990-2000	Average of annual GDP growth rate	Penn World Table 6.1
Government consumption	average of the ratio of real government 'consumption' expenditure to real GDP from 1970-80, 1980-90 and 1990-2000	Barro and Lee data set
Log average inflation	Log of the average annual inflation in the Consumer Price Index from the period 1970-80, 1980-90, 1990-2000.	World Bank, World Development Indicators, CD-Rom, 1999
real exchange rate overvaluation	An index of real overvaluation of the official exchange rate during 1970-80, 1980-90 and 1990-2000.	Easterly and Levine(2002) using the methodology of Dollar (1992)
Constraint on the Executive in 1970, 1980 and 1990	A seven category scale, from 1 to 7, with a higher score indicating more constraints. Score of 1 indicates unlimited authority; score of 3 indicates moderate limitations; score of 5 indicates substantial limitations, score of 7 indicates executive parity or subordination.	Polity IV data set, downloaded from the Inter-University Consortium for Political and Social Research.
Log settler mortality	Log of estimated mortality for European settlers during the early period of European colonization (before 1850). Settler mortality is calculated from the mortality rates of European-born soldiers and bishops when stationed in colonies.	Acemoglu, Johnson and Robinson (2001).
Log GDP per capita	Logarithm of real GDP per capita (1980 international prices)	Penn World Table 6.1
Secondary school enrolment rate	Total gross enrollment ratio for secondary education	Barro and Lee dataset
Average Protection Against Expropriation Risk, 1985-95	Risk of expropriation of private foreign investment by government, from 0 to 10, where a higher score means less risk. Acemoglu, Johnson and Robinson (2001) report an average value for all years from 1985-95.	As used in Acemoglu, Johnson and Robinson (2001)
Economic Freedom	A five category scale, from 1 to 10 with a higher score indicating higher economic freedom.	Gwartney et al. (1997)
Democracy	This measure is a seven point index, with higher values of this variable indicating feIr freedoms or greater political violence and thus bad conditions for investment.	Gastil, Freedom house
Rule of law	Indicator of a number of elements that capture the protection afforded to property rights as Ill as the strength of the rule of law. Is a standardized measure that varies between –2.5 (Iakest institution) and 2.5 (strongest institution).	Kaufmann (2002)

Table A3. Summary Of Data Statistics

Variable	Mean	Std. Dev	Min	Max
Growth rate	1.07	2.33	-4.61	8.34
Secondary school Enrolment	.32	0.23	.01	1
Log(average inflation)	2.69	1.22	-.22	7.23
Log (exchange rate overvaluation)	4.68	.38	3.46	5.47
Government consumption	16.68	6.38	7.1	35.2
Log(Initial income)	7.96	.89	6.2	10.18
Initial Constraint on executive	3.65	2.24	1	7
Rule of Law	-0.206	0.82	- 1.44	1.94
Political Rights	4.17	1.85	1	7
Log settler mortality	4.73	1.24	2.15	7.99

Notes: these data represent the sample with observations which fall under outliers, violate influence statistics, the number of observations is 164.

Table A4. Private property institutions, macroeconomic policies and Growth: Parametric and Semiparametric Estimates with no outliers

Explanatory variable	OLS (I)	2SLS (II)	GMM (III)	GMM (IV)
The dependent variable is the growth rate over the decades 1970-80, 1980-90 and 1990-00				
Constant	12.26	6.8	3.94	7.28
	(3.05)***	(3.2)**	(6.34)	(8.66)
Dummy 80	-1.85	-1.72	-1.58	-1.63
	(0.39)***	(0.47)***	(0.66)**	(0.83)**
Dummy 90	-1.60	-1.90	-2.44	-3.73
	(0.41)***	(0.41)***	(0.82)***	(0.95)***
Government consumption	-0.084	-0.091	-0.094	-0.044
	(0.03)	(0.02)	(0.046)	(0.032)
Log(average inflation)	-0.44	- 0.41	-0.58	-1.10
	(0.12)***	(0.12)***	(0.20)**	(0.36)***
Log (exchange rate overvaluation)	-0.94	- 0.56	-1.35	-2.34
	(0.46)**	(0.45)	(0.85)	(1.27)*
Log(Initial income)	-0.50	-0.75	-0.05	0.63
	(0.31)	(0.31)**	(0.52)	(0.74)
Secondary school Enrolment	4.27	2.86	0.97	0.47
	(1.22)***	(1.11)**	(1.8)	(0.14)**
Initial Constraint on executive	-0.12	0.56	4.9	-3.78
	(0.08)	(0.22)**	(2.9)*	(1.81)**
Initial Constraint on executive index square			-0.53	3.27
			(0.35)	(2.25)
Initial Constraint on executive index cubed				-0.38
				(0.18)**
R^2	0.32	0.335		
Hansen's J			[0.91]	[0.88]
N	164	164	164	164
First Stage estimates for measure of Private property institutions				
Log settler mortality			-0.70	
			(0.13)***	
R^2			0.15	

Notes: The figures in parentheses are standard errors. Those in brackets are p-values. These figures are produced given the exclusion of outlier observations, Congo in the decade 1970s, Nigeria, Congo, Uruguay and Zaire in the decade of 1980s and Australia, New Zealand, and Zaire in the decade 1990s. The identification of these countries as outliers was made on the basis of a combination of high associated residual and leverage statistics.

Table A5. Linear Specification, Income Sample Splits

Table A5.1. Poor Income Sample

Regressor	Coefficient	Robust S.E.	T-ratio	Pvalue
Constraint on executive	**0.51**	**0.29**	**1.73**	**0.09**
Government consumption	-0.06	0.04	-1.39	0.17
Log(inflation)	-0.12	0.26	-0.44	0.66
Log (exchange rate overvaluation)	-1.52	0.59	-2.59	0.01
Log(Initial income)	-0.09	0.71	-0.13	0.90
Enrolment	4.50	2.26	1.99	0.05
D80	-1.33	0.60	-2.20	0.03
D90	-2.66	.598	-4.45	0.00
Constant	9.09	4.87	1.87	0.07
N		80		
R^2		0.37		

Table A5.2. Middle Income Sample

Regressor	Coefficient	Robust S.E.	T-ratio	Pvalue
Constraint on executive	**2.21**	**.813**	**2.72**	**0.010**
Government consumption	-0.12	0.06	-1.99	0.054
Log(inflation)	-0.87	0.14	-6.21	0.000
Log (exchange rate overvaluation)	0.91	.81	1.12	0.269
Log(Initial income)	-1.99	1.60	-1.25	0.22
Enrolment	5.75	2.34	2.46	0.018
D80	-2.57	.675	-3.80	0.000
D90	-3.68	1.07	-3.44	0.001
Constant	9.28	14.71	0.63	0.532
N		48		
R^2		0.6		

Table A5.3. Rich Income Sample

Regressor	Coefficient	Robust S.E.	T-ratio	Pvalue
Constraint on executive	**0.86**	**0.72**	**1.2**	**0.24**
Government consumption	-0.13	0.14	-0.94	0.36
Log(inflation)	-0.53	0.22	-2.34	0.03
Log (exchange rate overvaluation)	1.39	1.36	1.02	0.31
Log(Initial income)	-2.54	1.3	-1.96	0.06
Enrolment	3.32	2.12	1.56	0.13
Constant	16.51	9.26	1.78	0.09
N		36		
R^2		0.36		

Notes: The above estimates are of a sample without the presence of outliers. Lower income economies are countries with per capita GDP less than $2650. Middle income economies are countries with per capita GDP between $2650 and $5499. Rich income economies are countries with per capita GDP greater than $5499. The dependent variable is the growth rate over the decades 1970-80, 1980-90 and 1990-00

Table A6. Rule of Law, Macroeconomic Policies and Growth: Parametric and Semiparametric Estimates with no Outliers

Explanatory variable	**2SLS Estimates**	**GMM Coefficient Estimates**
The dependent variable is the growth rate over the decades 1970-80, 1980-90 and 1990-00		
Government consumption	-0.105 (-2.47)	-0.0646 (0.46)
Log(inflation)	-0.305 (-2.10)	-0.3926 (0.13)
Log (exchange rate overvaluation)	-1.05 (-1.97)	-1.1528 (1.53)
Log(Initial income)	-0.826 (-1.73)	-0.346 (1.32)
Enrolment	1.27 (2.1)	2.95 (4.73)
Rule of Law	3.63 (2.45)	13.74 (5.88)
Rule of law index squared		4.2178 (1.14)
Rule of law index cubed		-7.348 (3.01)
R^2	0.48	
N	55	55
Panel B: First stage estimation for Rule of Law		
Log Settler mortality	-0.3983 (.071)	
R^2	0.3273	

Notes: The figures in parentheses are t – ratios and that in brackets is p-value. The sample excludes three observations which were singled out for violating the tests for outlier and influence statistics. Detailed sources and definitions of data are in Appendix A2. The dependent variable in Panel A is the average growth rate for GDP per capita over the period 1990-2000. In panel A, the measure of Rule of Law is instrumented by log settler mortality. Source of Rule of Law is Kaufman et al. (2002)

Table A7. Political Rights, Macroeconomic Policies and GDP growth

Explanatory variable	2SLS (Coefficient)	GMM estimates
Constant	11.33	7.75
	(2.90)	(5.03)
D80	-1.38	-2.11
	(0.44)	(0.52)
D90	-0.74	-2.27
	(0.51)	(0.56)
Govt consumption	-0.059	0.028
	(0.032)	(0.043)
Log(inflation)	-0.54	-0.58
	(0.13)	(0.17)
Log (exchange rate overvaluation)	-0.062	-0.08
	(0.52)	(0.62)
Log(Initial income)	-0.71	-0.287
	(0.33)	(0.42)
Enrolment	2.38	0.80
	(1.26)	(1.68)
Political rights index (PR)	-0.59	0.98
	(0.22)	(2.00)
Political rights index squared		-0.13
		(0.54)
Political rights index cubed		-0.02
		(0.04)
R^2	0.266	
N	174	164
Panel B: First stage estimates		
Log Settler mortality	0.83	
	(0.095)	
R^2	0.28	

Note: The figures in brackets are standard errors. Detailed sources and definitions of data are in Appendix A2. The dependent variable in Panel A is the average growth rate for GDP per ca112pita over the period 1970-80, 1980-90 and 1990-2000. In panel A, the measure of Political rights is instrumented by log settler mortality. The data for Political rights is taken from Gastil Freedom House.

Table A8. Private Property Institutions, Macroeconomic Policies and Growth: Using Alternate Instruments

Explanatory variable	IV (I)	IV (II)	GMM (III)	GMM (IV)
Initial Constraint on executive	0.68 (0.27)***	0.49 (0.29)*	2.98 (1.34)**	2.95 (1.74)*
Initial Constraint on executive index square			-0.33 (0.16)**	-0.33 (0.20)*
Government consumption	-0.055 (0.032)*	0.04 (0.03)	-0.06 (0.04)	-0.06 (0.04)
Log(average inflation)	-0.55 (0.13)***	-0.56 (0.13)***	-0.60 (0.13)***	-0.60 (0.15)***
Log (exchange rate overvaluation)	-0.21 (0.52)	-0.26 (0.52)	-0.79 (0.59)	-0.63 (0.64)
Log(Initial income)	-0.64 (0.34)*	-0.78 (0.35)**	-0.22 (0.35)	-0.44 (0.40)
Secondary school Enrolment	2.11 (1.30)*	1.87 (1.31)	2.23 (2.01)	2.02 (2.93)
Dummy 80	-1.09 (0.51)**	-0.96 (0.52)*	-1.53 (0.59)***	-1.23 (0.60)**
Dummy 90	-0.55 (0.58)	-0.35 (0.60)	-1.77 (0.62)***	-1.32 (0.79)*
Malaria Index		-1.01 (0.65)		-0.90 (0.81)
Constant	6.59 (3.09)	8.93 (3.43)**	4.57 (3.76)	5.91 (4.44)
Hansen's J			0.55	0.58
		First Stage Estimates		
	Without Malaria Index		With Malaria Index	
Log Settler mortality	-0.68 (0.18)***		0.66 (0.2)***	
Latitude	1.17 (0.58)**		1.14 (0.69)*	
Log Frankel-Romer Instrument	0.05 (0.025)**		0.05 (0.03)*	
R^2	0.3318		0.35	

Notes: (1) The following instruments are used for the IV and GMM estimation: Latitude, log settler mortality and log of Frankel and Romer instrument. Latitude is the absolute distance from the equator scaled to 0 to 1. The Frankel and Romer instrument is a variable constructed by Frankel and Romer (1996). It is defined as the (log) predicted trade share of an economy, based on a gravity model of international trade that only uses a country's population and geographical features. Both latitude and Frankel and Romer instrument has been used by Hall and Jones (1996).

(2) Columns 2, and 4 include Malaria Index in the regression equation. The malaria Index is derived from Gallup and Sachs (1998) is the proportion of each country's population that live with risk of malaria transmission.

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APPENDIX B

APPENDIX TO INCOME INEQUALITY AND FINANCIAL INTERMEDIATION: CHAP. 3

Table B1. Countries in the sample

Australia	Malaysia
Austria	Mauritius
Bangladesh	Mexico
Belgium	Nepal
Brazil	Netherlands
Canada	New Zealand
Chile	Niger
Colombia	Norway
Costa Rica	Pakistan
Denmark	Panama
Dominican Republic	Papua New Guinea
Ecuador	Paraguay
Fiji	Peru
Finland	Philippines
France	Portugal
Germany	Salvatore, El
Ghana	Senegal
Greece	Sierra Leone
Guatamala	South Africa
Guyana	Spain
Honduras	Sri Lanka
India	Sweden
Indonesia	Switzerland
Ireland	Thailand
Israel	Trinidad &Tobago
Italy	USA
Jamaica	UK
Japan	Uruguay
Kenya	Venezuala
Korea, South	Zimbabwe

Table B2: Variable Description and Sources

Variable	Definition	Source
Gini Coefficient	The Gini Coefficient is the ratio of the area between the Lorenz curve, which plots share of population against the income share received, to the area below the diagonal. It lies between 0 and 1, where 0 is perfect equality and 1 is perfect inequality.	Dollar and Kraay, 2002
Private Credit	$[(0.5)*\{F(t)/P_e(t)+F(t-1)/P_e(t-1)\}] / [GDP(t)/P_a(t)]$, where F is credit by deposit money banks and other financial institutions to the private sector(lines 22d+42d), GDP is the line99b, Pe is the end of period CPI and Pa is the average CPI for the year.	Levine et al (2006) , original source is IFS
Liquid liabilities	$[(0.5)*\{F(t)/P_e(t)+F(t-1)/P_e(t-1)\}] / [GDP(t)/P_a(t)]$, where F is liquid liabilities (line 55I), GDP is the line99b, Pe is the end of period CPI and Pa is the average CPI for the year.	Levine et al (2006) , original source is IFS
Bank Asset	$[(0.5)*\{F(t)/P_e(t)+F(t-1)/P_e(t-1)\}] / [GDP(t)/P_a(t)]$, where F is deposit assets of deposit money banks (lines 22d), GDP is the line 99b, Pe is the end of period CPI (line 64) and Pa is the average CPI for the year.	Levine et al (2006) , original source is IFS
Schooling	Average years of secondary schooling in the population over 25	Barro and Lee (1996)
Government consumption	Government Expenditure as a share of GDP.	World Development Indicators
Openness to trade	Sum of real exports and imports as a share of real GDP	World Development Indicators
Inflation rate	Log difference of Consumer Price Index	International Financial Statistics
Log GDP per capita	Log of real per capital GDP (chain weighted series).	Penn World tables.
Legal Origin	Dummy variable for British, French, German and Scandinavian legal origin	LLSV (1998), Levine et al (2000) using Reynolds and Flores (1996)
Latitude	The distance of the country from the equator scaled between 0 and 1.	LLSV (1996) using CIA Factbook
Modern sector	The modern sector is the value added of service and industrial sectors as share of GDP.	World Development Indicators
Ethno-linguistic fractionalization	Average value of five indices of ethno-linguistic fractionalization, with values ranging from 0 to 1, with higher values indicating greater fractionalization.	Levine, Loayza and Beck (2000)
Employment in Modern Sector	Employment in industrial and service sector industries as percent of total employment.	World Development Indicators, 2007
High technology exports	High technology exports as a share of real GDP	World Development Indicators, 2007

Table B3. Summary Of Data

Summary of Data for Main Results			Poor	Lower-Middle	Upper-Middle	Rich
Variable	**Mean**	**Std. Dev**	**Mean (stdev)**	**Mean (stdev)**	**Mean (stdev)**	**Mean (stdev)**
Gini Coefficient	38.56	9.086	40.4 (9.78)	45.36 (7.0)	39.8 (8.15)	31 (3.6)
GDP per capita (in natural logs)	9.05	8.75	7.37 (6.35)	8.28 (6.7)	9.02 (7.46)	9.72 (8.12)
Government consumption	14.99	5.19	10.9 (3.1)	12.27 (3.63)	14.5 (3.9)	19.91 (4.14)
Private credit	44.24	28.15	15.9 (7.2)	24.07 (14.5)	39.1 (21.9)	51.2 (24.8)
Liquid liabilities	47.52	26.43	28.19 (9.4)	35.26 (17.48)	51.4 (22.5)	66.6 (28.6)
Bank assets	44.24	28.15	21.78 (9.6)	30.76 (17.14)	47.24 (21.9)	67 (29.9)
Trade openness	0.56	0.32	0.44 (0.24)	0.62 (0.35)	0.61 (0.37)	0.53 (0.26)
Inflation	0.14	0.37	0.13 (0.14)	0.15 (0.14)	0.25 (0.7)	0.06 (0.04)
Schooling rate	0.247	0.157	0.12 (0.085)	0.156 (0.08)	0.24 (0.13)	0.4 (0.11)
N	225	225	42	63	50	70

Notes: This table reports the mean and standard deviation for the main variables for the full sample of observations (N = 225) and also that when the sample is stratified in accordance to income levels as analyzed in section 6.2. The data is cleaned of outliers using the methods outlined in section 6.1.

Table B4. Correlation Statistics

	GINI	GDP	GOVT.	PRIV	LIAB	BANK	TRADE	INF	SCHOL
GINI	1.00								
GDP	-0.446	1.00							
GOVT	-0.494	0.66	1.00						
PRIVATE PROPERTY INSTITUTIONS	-0.364	0.587	0.37	1.00					
LIAB	-0.38	0.566	0.37	0.824	1.00				
BANK	-0.414	0.616	0.443	0.938	0.833	1.00			
TRADE	0.083	0.0724	0.169	0.12	0.118	0.145	1.00		
INF	0.22	-0.062	-0.137	-0.151	-0.182	-0.144	-0.112	1.00	
SCHOL	-0.59	0.7274	0.618	0.474	0.4335	0.494	0.098	-0.163	1.00

PARTIAL REGRESSION PLOTS FOR OLS

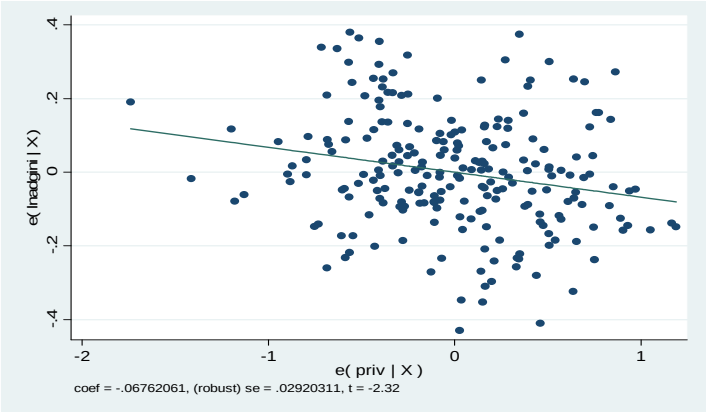

Figure B1. Private Credit and Log Gini Interaction

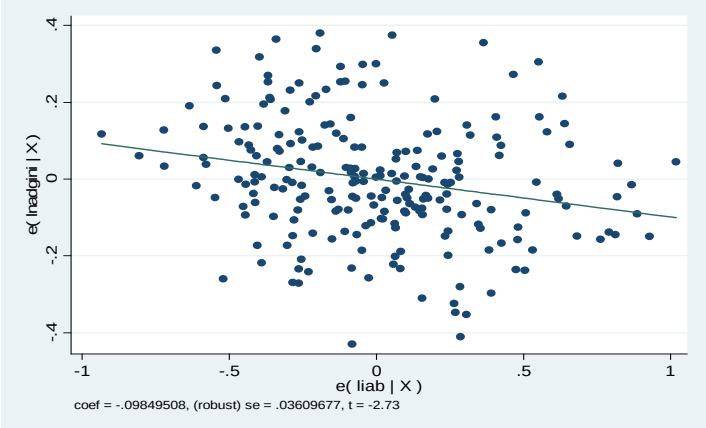

Figure B2. Liquid Liability and Log Gini Interaction

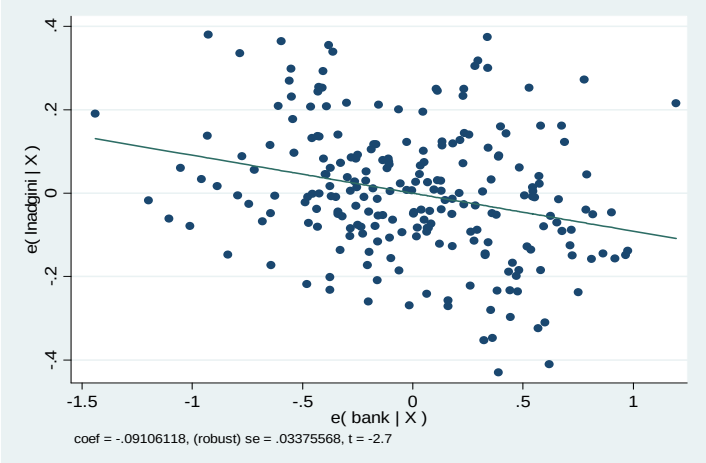

Figure B3. Bank Assets and Log Gini Interaction

Table B5. Financial Intermediation and Income Inequality: Semiparametric estimates

Variable	Private credit	Bank assets	liquid liabilities
Ao	*-11.33*	*-6.87*	*-1.62*
	*(7.5)**	*(3.7)**	*(1.1)**
A1	*0.91*	*-0.62*	*-0.21*
	*(0.57**	*(0.40)**	*(0.14)**
A2	*-0.21*	*-0.13*	*-0.20*
	*(0.13)**	*(0.07)**	*(0.08)***
GDP per capita (in	3.6	2.51	1.29
natural logs)	(1.81)**	(0.88)**	(0.31)***
GDP per capita square	-0.21	-0.143	-0.0733
(in natural logs)	(0.1)**	(0.05)**	(0.019)***
Schooling rate	-0.69	- 0.71	- 0.66
	(0.204)***	(0.16)***	(0.11)***
Inflation (rate)	-0.44	- 0.095	- 0.001
	(0.43)	(0.18)	(0.11)
Trade openness	-0.02	0.067	0.092
	(0.09)	(0.05)	(0.04)**
Government	0.013	-0.086	- 0.055
consumption (rate)	(0.015)	(0.11)	(0.06)
Dummy 65	-0.028	-0.04	-0.095
	(0.096)	(0.07)	(0.06)
Dummy 70	0.022	-0.021	-0.081
	(0.11)	(0.07)	(0.05)
Dummy 75	0.098	-0.04	-0.05
	(0.12)	(0.07)	(0.04)
Dummy 80	0.081	-0.081	-0.042
	(0.12)	(0.09)	(0.05)
Dummy 85	0.233	-0.092	0.01
	(0.16)	(0.07)	(0.04)
Dummy 90	0.22	-0.0977	0.04
	(0.14)	(0.07)	(0.05)
Dummy 95	0.29	0.19	0.072
	(0.18)	(0.11)*	(0.05)
N	225	225	225

Notes: The dependent variable is log Gini coefficient. The figures in parenthesis are standard errors. The financial development measures has been instrumented using dummy variables for English, German and French legal origin.

Table B6. Income Inequality, Financial Intermediation and Modern sector

	Private Credit				Bank Assets			
Variable	**OLS**	**OLS**	**IV**	**GMM**	**OLS**	**OLS**	**IV**	**GMM**
Private credit (in natural logs)	***-0.068 (0.029)******	***-0.25 (0 .14)****	***-0.094 (0.048)****	***-2.18 (1.33)****				
Modern Sector* private credit (interaction term)		***.002 (.002)***		***0.023 (0.014)****				
Bank assets (in natural logs)					***-0.092 (0.032)******	***-0.18 (0.15)***	***-0.10 (0.05)****	***-2.10 (1.3)****
Modern Sector* bank assets (interaction term)						***0.001 (0.002)***		***0.022 (0.014)****
Government consumption (rate)	-0.13 (0.07)*	-0.084 (0.05)*	-0.094 (0.06)	0.02 (0.08)	-0.12 (0.07)*	-0.08 (0.06)	-0.05 (0.06)	0.019 (0.11)
Trade openness	0.05 (0.06)	0.051 (0.06)	0.055 (0.065)	0.04 (0.06)	0.06 (0.05)	0.06 (0.05)	0.05 (0.04)	0.09 (0.08)
Inflation (rate)	0.18 (0.11)*	0.11 (0.09)	0.1 (0.11)	-0.12 (0.18)	0.17 (0.12)	0.10 (0.07)	0.07 (0.06)	-0.083 (0.20)
Schooling rate	-0.66 (0.16)***	-.66 (.16)***	-0.65 (.15)***	-0.89 (0.33)***	-0.67 (0.16)***	0.68 (0.16)***	-0.67 (0.15)***	-0.84 (0.30)***
GDP per capita (in logs)	1.36 (0.41)***	1.53 (0.47)***	1.33 (.39)***	3.16 (1.54)**	1.48 (0.45)***	1.38 (0.47)***	1.27 (0.38)***	2.88 (1.57)*
GDP per capita square (in logs)	-0.078 (0.025)***	-0.089 (.029)***	-0.07 (.02)***	-0.18 (0.08)**	-0.12 (0.04)***	-0.08 (0.03)***	-0.07 (0.02)***	-0.16 (0.08)**
Modern sector	0.004 (0.0025)*	-0.005 (.005)	0.003 .002	-0.058 (0.041)	0.0042 (0.002)**	-0.003 (0.007)	0.001 (0.002)	-0.064 (0.062)
Constant	-1.81 (1.65)	-2.02 (1.74)	-1.69 (1.43)	-3.99 (2.89)	-1.68 (1.54)	-1.58 (1.68)	-1.39 (1.56)	-2.21 (3.14)
R-Squared	0.52	0.5688			0.538	0.5769		
Hansen's J				[0.38]				[0.8448]
N	225	225	225	225	225		225	225
F-test for first stage legal origin variables [prob.]		18.93 [0.00]				17.55 [0.00]		

Notes: The dependent variable is the natural log of Gini coefficient. The figures in brackets are robust standard errors. The modern sector is the value added of service and industrial sectors as share of GDP. The instruments for GMM specification are dummies indicating legal origin. The null hypothesis of the Hansen test is that instruments are not correlated with error terms. The ***, **, * indicate 1%, 5% and 10% levels of significance. The F-test is for the particular significance of the legal variables and is not the overall F test for regression. The standard errors reported are clustered by country.

Table B7. Income inequality and employment in service sector

	OLS	**OLS**	**IV**	**GMM**
Private credit	***-0.016***	***0.42***	***-0.25***	***-4.6***
(in natural logs)	***(0.03)***	***(0.37)***	***(0.073)******	***(2.9)***
Private credit*Employment in nonagricultural sectors (in natural logs)		***-0.104***		***0.98***
		(0.08)		***(0.66)***
Government consumption (rate)	-0.09	-0.085	-0.094	- 0.17
	(0.07)	(0.057)	(0.09)	(0.11)
Trade openness	0.053	0.053	0.077	0.042
	(0.05)	(0.046)	(0.08)	(0.09)
Inflation (rate)	0.199	0.22	-0.24	-0.85
	(0.12)	(0.15)	(0.22)	(0.38)**
Schooling rate	-0.46	-0.43	-0.57	-0.76
	(0.16)***	(0.14)***	(0.19)***	(0.28)***
GDP per capita (in logs)	1.33	1.13	1.64	4.53
	(0.57)**	(0.48)**	(0.74)***	(1.5)***
GDP per capita (in logs) square	-0.079	-0.068	-0.09	-0.25
	(0.033)**	(0.028)**	(0.04)**	(0.083)***
Employment in nonagricultural	0.087	0.42	0.04	-3.09
sectors	(0.07)	(0.28)	(0.09)	(2.15)***
Constant	-1.97	-2.57	-2.73	-1.22
	(2.36)	(1.94)	(3.0)	(6.5)
R-Squared	0.55	0.56		
Hansen's J				[0.10]
N	135	135	135	135
F-test for first stage legal origin variables [prob]			8.94 [0.00]	

Notes: The dependent variable is log gini coefficient. The figures in parenthesis are standard errors. The financial development measures have been instrumented using dummy variables for English, German and French legal origin and latitude. The estimates of controls and dummy variables controlling for time are not reported for brevity. The sample size is reduced due to unavailability of data for employment in service sector for the period of 1960s and 1970s. The standard errors reported are clustered by country.

Table B8. High technology exports, Financial intermediation and Income inequality

	Private Credit		**Bank Assets**	
Dependent variable is natural log of Gini coefficient				
Variable	**OLS**	**GMM**	**OLS**	**GMM**
Private credit	**-0.125**	**-0.116**		
(in natural logs)	**(0.054)****	**(0.106)**		
Bank assets			**-0.15**	**-0.10**
(in natural logs)			**(0.06)*****	**(0.09)**
High technology sector	**0.27**	**0.25**	**0.29**	**0.24**
	(0.16)*	**(0.15)***	**(0.17)***	**(0.15)***
Government consumption	0.12	0. 136	0.13	0.14
(rate)	(0.071)*	(0.064)**	(0.07)*	(0.064)**
Trade openness	0.034	0.037	0.025	0.033
	(0.073)	(0.064)	(0.067)	(0.058)
Inflation (rate)	-0.04	0.018	-0.12	0.058
	(0.34)	(0.45)	(0.36)	(0.43)
Schooling rate	-0.53	-0.51	-0.58	-0.53
	(0.20)***	(0.17)***	(0.19)***	(0.18)***
GDP per capita (in logs)	1.46	1.53	1.52	1.58
	(0.75)**	(0.67)***	(0.73)**	(0.66)**
GDP per capita square	-0.092	-0.097	-0.095	-0.096
	(0.043)**	(0.039)***	(0.042)**	(0.038)***
Modern sector	0.013	0.013	0.013	0.011
	(0.004)***	(0.004)***	(0.004)***	(0.004)**
Dummy 90	0.065	0.065	0.065	0.065
	(0.026)**	(0.023)**	(0.026)**	(0.022)**
Dummy 95	0.052	0.062	0.062	0.07
	(0.041)	(0.043)	(0.043)	(0.04)*
Constant	-3.0	-3.32	-3.1	-3.47
	(3.1)	(2.82)	(3.05)	(2.75)
R-Squared	0.637		0.642	
Hansen's J [sig. level]		[0.494]		[0.492]
N	78	78	78	78

Notes: The dependent variable is log gini coefficient. The figures in parenthesis are standard errors. The financial development measures have been instrumented using dummy variables for English, German and French legal origin. The standard errors reported are clustered by country.

Table B9. Results from Income splits: IV Results

Variable	**Low income**	Lower middle	Upper middle	High Income
Panel A. Estimates using Private Credit				
Private credit	**-0.36**	**-0.17**	**-0.08**	**0.036**
(in natural logs)	**(0.08)*****	**(0.10)***	**(0.07)**	**(0.055)**
Government	0.003	-0.003	-0.003	0.002
consumption (rate)	(0.02)	(0.009)	(0.014)	(0.003)
Trade openness	0.42	-0.05	0.065	-0.089
	(0.10)**	(0.07)	(0.093)	(0.049)**
Inflation (rate)	-0.12	-0.19	0.017	1.37
	(0.21)	(031)	(0.016)	(0.48)***
Schooling rate	-2.72	-0.91	-0.63	-0.065
	(0.46)***	(0.40)**	(0.18)***	(0.20)
GDP per capita	3.24	-3.96	-1.15	-10.20
(in natural logs)	(3.51)	(8.57)	(8.11)	(7.87)
GDP per capita	-0.19	0.25	0.05	0.54
square	(0.23)	(0.52)	(0.45)	(0.40)
R-Squared	0.47	0.3494	0.5478	0.371
Panel B. Estimates using Liquid Liabilities				
Liquid liabilities	**-0.34**	**-0.12**	**-0.16**	-.036
(in natural logs)	**(0.16)****	**(0.08)**	**(0.09)***	(.065)
Government	-0.003	0.001	-0.001	-0.001
consumption (rate)	(0.01)	(0.008)	(0.01)	(0.004)
Trade openness	0.44	0.062	0.10	-0.10
	(0.08)***	(0.09)	(0.08)	(0.055)*
Inflation (rate)	0.23	0.13	-0.006	0.93
	(0.17)	(0.12)	(0.02)	(0.51)*
Schooling rate	-1.97	-1.14	-0.68	-0.11
	(0.32)***	(0.28)***	(0.16)***	(0.20)
GDP per capita	2.99	-13.32	1.56	-9.57
(in natural logs)	(2.43)	(8.82)	(8.94)	(7.32)
GDP per capita	-0.19	0.81	-.095	0.50
square	(0.16)	(0. .53)	(0.49)	(0.37)
R-Squared	0.658	0.4057	0.5398	0.3575
Panel C. Estimates using Bank Assets				
Bank Assets	-0.41	-0.18	-0.05	0.034
(in natural logs)	(0.16)**	(0.12)	(0.09)	(0.056)
Government	0.012	0.003	0.002	0.001
consumption (rate)	(0.014)	(0.008)	(0.013)	(0.003)
Trade openness	0.402	0.056	-0.052	-0.10
	(0.11)***	(0.091)	(0.097)	(0.046)**
Inflation (rate)	-0.25	-0.002	0.021	1.34
	(0.36)	(0.20)	(0.018)	(0.48)***
Schooling rate	-2.40	-1.02	-0.66	-0.074
	(0.45)***	(0.33)***	(0.18)***	(0.19)
GDP per capita	0.76	-9.44	0.17	-10.38
(in natural logs)	(3.34)	(8.13)	(7.76)	(8.02)
GDP per capita	-0.02	0.58	-0.023	0.54
square	(0.22)	(0.49)	(0.43)	(0.41)*
R-Squared	0.43	0.3252	0.52	0.3707
N	42	63	50	70

Notes: The country classifications are as defined by World Bank's income measures; high-income countries are those with real per capita GDP above $11,500; upper- middle income countries those between $5,500 and $11,499; lower - middle income countries are between $2,650 and $5,499; and low income countries those with less than $2,650. The standard errors reported are clustered by country. Legal origin is used as an instrument.

Table B10. Using ratio of 90th percentile to 10th percentile of Gini as dependent variable

N = 205	**OLS Coefficient**	**OLS 2**	**IV**	**GMM**
		Using Private credit		
Private credit	**-0.26**	**-0.72**	**-0.54**	**-12.07**
(in natural logs)	**(0.10)*****	**(0.53)****	**(0.22)****	**(6.8)***
Private credit		**0.068**		**1.57**
Square		**(0.06)**		**(0.95)***
Government	-0.14	-0.11	-0.018	0.86
consumption (rate)	(0.29)	(0.29)	(0.014)	(0.80)
Inflation (rate)	0.66	0.59	-0.38	-3.92
	(0.46)	(0.47)	(0.45)	(2.45)
Real GDP	4.52	4.86	4.96	14.65
(in natural logs)	(1.28)***	(1.38)***	(1.35)***	(7.54)**
Real GDP square	-0.27	-0.29	-0.29	-0.83
(in natural logs)	(0.08) ***	(0.08)***	(0.08)***	(0.41)**
Schooling rate	-1.19	-1.21	-1.16	-1.59
	(0.53)**	(0.53)**	(0.55)**	(1.08)
Trade openness	0.026	0.023	0.014	-0.05
	(0.22)	(0.22)	(0.23)	(0.32)
Constant	-14.93	-15.68	-16.15	-38.34
	(5.42)***	(5.65)***	(5.58)**	(22.83)*
R-Squared	0.5738	0.576	0.5436	
Hansen's J				[0.98]
F-test for first stage legal origin variables [prob]			26.83 [0.0]	
		Using Bank Assets		
Bank Assets	**-0.33**	**-0.53**	**-0.53**	**-14.56**
(in natural logs)	**(0.11)*****	**(0.48)**	**(0.26)****	**(6.95)****
Bank assets square		**0.03**		**1.69**
		(0.07)		**(0.91)***
Government	-0.09	-0.08	-0.02	1.05
consumption (rate)	(0.27)	(0.27)	(0.29)	(0.84)
Inflation (rate)	0.54	0.51	0.15	-2.97
	(0.43)	(0.42)	(0.45)	(2.51)**
Real GDP	4.41	4.54	4.59	13.87
(in natural logs)	(1.17)***	(1.28)***	(1.14)***	(7.57)*
Real GDP square	-0.26	-0.27	-0.27	-0.79
(in natural logs)	(0.07)***	(0.08)***	(0.07)***	(0.42)*
Schooling rate	-1.21	-1.21	-1.21	-1.27
	(0.53)***	(0.53)***	(0.54)***	(1.03)
Trade openness	.05	0.05	0.06	-0.07
	(0.21)	(0.21)	(0.19)	(0.28)
Constant	-13.76	-14.07	-14.56	-29.22
	(3.18)***	(5.16)***	(4.82)	(20.22)
R-Squared	0.583	0.583	0.57	
Hansen's J				[0.28]
F-test for first stage legal origin variables [prob]			24.82 [0.0]	

Notes: The dependent variable is the natural log of ratio of 90th percentile to 10th percentile of gini. The data is drawn from the World Income Inequality database, version 2a. The estimates for the time dummies are not presented for want of space but can be available on request. The sample size is slightly reduced due to unavailability of data on percentiles for the whole period 1960-2000 for many of the countries in the sample. The standard errors reported are clustered by country.

Table B11. Adding current account as a percent of GDP in the control list

	2SLS	GMM	2SLS	GMM
	Using Private Credit		**Using Bank assets**	
Private credit	-0.21	-3.20		
(in natural logs)	(0.07)***	(1.55)**		
Private credit		0.41		
Square		(0.19)***		
Bank Assets			-0.22	-2.73
			(0.07)***	(1.49)*
Bank assets square				0.33
				(0.18)*
Current account	0.001	-0.003	0.003	-0.004
	(0.004)	(0.009)	(0.004)	(0.008)
Government	-0.004	0.016	-0.002	0.01
consumption (rate)	(0.006)	(0.015)	(0.005)	(0.01)
Inflation (rate)	-0.06	-0.91	-0.051	-0.58
	(0.09)	(0.58)	(0.08)	(0.35)*
Real GDP	1.53	5.28	1.42	3.90
(in natural logs)	(0.64)**	(2.23)**	(0.56)**	(1.43)**
Real GDP square	-0.084	-0.29	-0.078	-0.22
(in natural logs)	(0.04)**	(0.12)**	(0.034)**	(0.08)**
Schooling rate	-0.66	-0.74	-0.67	-0.69
	(0.19)***	(0.33)**	(0.18)***	(0.24)**
Trade openness	0.024	-0.11	0.041	-0.02
	(0.09)	(0.12)	(0.07)	(0.08)
Constant	-2.57	-12.96	-1.98	-7.58
	(2.61)	(6.79)	(2.30)	(4.23)*
R-Squared	0.44		0.54	
Hansen's J		[0.4632]		[0.6186]
N	185	185	185	185
F-test for first stage legal origin variables [prob]	11.17 [0.00]		17.68 [0.00]	

Note: Dependent variable is log of Gini. The data for current account is from the International Financial Statistics. The figures in brackets are robust standard errors. The ***, **, * indicate 1%, 5% and 10% levels of significance. The F-test is for the particular significance of the legal origin and latitude variables and is not the overall F test for regression. The estimates for the time dummies are not presented for want of space but can be available on request. The standard errors reported are clustered by country.

Table B12. Income Inequality and Private Credit: Estimates when Including Outliers

	OLS	OLS	IV	IV	GMM	GMM
Panel A (N = 227) **Outliers in Y included**						
Private credit	-0.065 (0.02)***	-0.19 (0.10)*	-0.094 (0.035)***	-0.19 (0.038)***	-2.12 (1.23)*	-3.59 (0.88)***
Private credit square		0.02 (0.016)			0.28 (0.17)*	0.48 (0.12)***
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Instruments used			Legal origin	Legal origin and latitude	Legal origin	Legal origin and latitude
					0.54	
Panel B (N = 231) **Outliers in Z included**						
Private credit	-0.069 (0.02)***	-0.185 (0.10)*	-0.089 (0.034)	-0.187 (0.04)***	-1.98 (1.16)*	-3.55 (0.85)***
Private credit square		0.018 (0.016)			0.27 (0.16)*	0.48 (0.12)***
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Instruments used			Legal origin	Legal origin and latitude	Legal origin	Legal origin and latitude
Hansen's J					0.59	0.544
Panel C (N = 228) **Outliers in X included**						
Private credit	-0.07 (0.02)***	-0.196 (0.09)**	-0.098 (0.033)***	-0.18 (0.04)***	-1.28 (0.63)**	-2.81 (0.62)***
Private credit square		0.02 (0.014)			0.17 (0.089)*	0.38 (0.09)***
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Instruments used			Legal origin	Legal origin and latitude	Legal origin	Legal origin and latitude
Hansen's J						
Panel D (N = 236) **All Outliers (Y, X, Z) included**						
Private credit	-0.07 (0.019)***	-0.18 (0.09)**	-0.092 (0.092)	-0.183 (0.041)***	-1.33 (0.64)**	-2.91 (0.67)***
Private credit square		0.017 (0.014)			0.18 (0.09)**	0.39 (0.09)***
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Instruments used			Legal origin	Legal origin and latitude	Legal origin	Legal origin and latitude
Hansen's J					0.49	0.0.08

Notes: These estimates show the relationship between income inequality and financial development in the sample of countries when the observations identified as outliers are included. The outliers are identified as that in Y (the adjusted Gini) variable and those in X (private credit) and Z (the controls). The following observations are identified as outliers in the sample: the outliers for Yare South Africa (1991-1995), Spain (1996-2000); the outliers for X are Chile (1971-75), Niger (1996-2000), Peru (1986-1990); the outliers for Z are Brazil (1991-95, 1986-1990), India (1961-65), Pakistan (1961-65), Spain (1966-1970), Greece (1971-75). In panel A, I only included the outliers in Y to gauge the impact of these outliers on the results. Similarly, I included the outliers in Z and X separately in panel B and C respectively. In panel D, I included all the outliers.

Table B13. Comparison with previous literature

	Replication results (N = 178)				**All sample till 1995 (N = 209)**			
	OLS	OLS	GMM	GMM	OLS	OLS	GMM	GMM
Private	.044	-0.17	-0.22	-1.46	0.037	-0.16	-0.21	-2.35
Credit	(0.029)	(0.14)	(0.072)	(1.15)	(0.026)	(0.12)	(0.08)**	(1.28)*
Sq. Private		0.015		0.21		.029		0.31
Credit		(0.02)		.14)		(0.016)*		(0.16)*
Initial GDP	1.19	1.29	1.33	0.59	1.17	1.38	1.38	1.24
per capita	(0.3)***	(0.34)	(0.36)	(0.94)	(0.31)***	(0.32)***	(0.36)***	(1.37)
GDP capita	-0.069	-0.074	-0.076	-0.03	-0.069	-0.082	-0.081	-.076
squared	(0.02)***	(0.02)	(0.02)	0.054	(0.018)***	(0.02)***	(0.02)**	(0.08)
Risk of	-0.081	-0.08	-0.021	-0.07	-0.077	-0.078	-0.034	-.097
Expropriation	(0.013)**	(0.01)	(0.02)	.042)	(0.012)***	(0.011)***	(0.019)*	(.036)***
Ethno-	0.069	0.073	0.082	0.02	.036	0.033	.035	0.145
linguistic frac	(0.074)	0.074	(0.08)	(0.1)	(0.064)	(0.06)	(0.08)	(0.14)
Government	-0.10	-0.09	-0.16	-0.21	-0.058	-0.04	-0.066	-0.23
Consumption	(0.039)	(0.04)	(0.05)	(0.06)	(0.046)	(0.045)	(0.055)	(0.13)
Inflation	0.42	0.41	-0.09	0.32	0.36	0.32	-0.18	1.24
	(0.13)	(0.13)	(0.19)	(0.33)	(0.14)***	(0.11)***	(0.23)	(0.66)*
Modern	.002 .002	0.002	0.005	0.006	0.003	.003	.0055	-0.007
Sector		(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(.002)**	(0.006)*
Constant	-0.87	-1.06	-1.22	1.52	-0.66	-1.25	-1.48	6.3
	(1.32)	(1.34)	(1.46)	(2.24)	(1.34)	(1.3)	(1.55)	(4.46)
R2	0.5705	0.5718			0.599	0.6079		
Hansen J-test			0.35	0.42			0.56	0.87
	Clarke sample till 2000 (N = 190)				**All sample till 2000 (N = 225)**			
Private	0.034	-0.15	-0.25	-1.86	0.024	-0.18	-0.15	-2.19
Credit	(0.025)	(0.09)	(0.07)**	(1.33)	(0.023)	(0.12)	(0.07)**	(1.31)*
Sq. Private		.02		0.26		.03		0.28
Credit		(0.013)*		(0.16)		(0.016)		(0.16)*
Initial GDP	1.31	1.33	1.51	-0.21	1.49	1.69	1.57	0.65
per capita	(0.31)***	(0.32)***	(0.37)***	(1.11)	(0.28)***	(0.29)***	(0.29)***	(1.32)
GDP square	-0.077	-0.078	-0.086	.014	-0.09	-0.10	-0.09	-0.04
	(0.02)***	(0.018)***	(0.021)**	(0.065)	(0.017)***	(0.017)***	(0.02)***	(0.07)
Risk of	-0.067	-0.067	-0.022	-0.06	-0.065	-.067	-0.042	-0.072
Expropriation	(0.013)***	(0.013)***	(0.018)***	(.035)**	(0.01)***	(0.01)***	(0.013)***	(0.03)**
Ethno-	.014	0.014	0.062	-0.012	0.02	0.014	-0.004	0.173
linguistic frac	(0.07)	(0.07)	(0.08)	(0.10)	(0.06)	(0.06)	(0.07)	(0.17)
Government	-0.088	-0.087	-0.15	-0.22	-0.02	-0.03	-0.036	-0.17
Consumption	(0.04)**	(0.042)**	(0.053)**	(0.07)	(0.04)	(0.04)	(0.045)	(0.12)
Inflation	0.39	0.39	-0.22	0.66	0.35	0.31	-.007	1.38
	(0.13)***	(0.12)***	(0.22)	(0.58)	(0.13)***	(0.11)***	(0.21)	(0.87)***
Modern	0.002	0.002	0.007	0.001	-0.002	-0.001	.003	-0.01
Sector	(0.002)	(0.002)	(0.003)**	(0.007)	(0.001)**	(0.001)	(0.002)	(0.008)
Constant	-1.41	-1.44	-2.07	2.37	-2.11	-2.64	-2.31	3.89
	(1.29)	(1.29)	(1.52)	(3.08)	(1.23)	(1.2)	(1.25)	(3.99)
R2	0.56	0.56			0.59	0.587		
Hansen J-test			0.29	0.23			0.35	0.46

Notes: Dependent variable is log of Gini. The figures in brackets are robust standard errors. The ***, **, * indicate 1%, 5% and 10% levels of significance. The financial development measures are instrumented using legal origin.

Table B14. The Mechanism of the SMD Estimator (Ai and Chen, 2003)

The semiparametric model applicable to our problem is the partially linear regression model studied by Robinson (1988) having the conditional moment restriction is as follows: $\rho(V_i, \alpha_0) = Y_{1i} - X'_{1i}\theta_0 - h_0(Z_i)$ (7)

With $E[\rho(V_i, \alpha_0) \mid X_{1i}, X_{2i}] = 0$, where $\alpha_0 = (\theta_0, h_0)$, $V = (Y, X'_1)'$, $X = (X'_1, X'_2)$, and $Y = (Y'_1, Z')'$. The following paragraph describes the SMD estimator[28].

Suppose that the observations *{(Y, X) : i = 1, 2, ...n}* are drawn independently from the distribution of *(Y, X)* with support $\mathrm{Y} \times \aleph$ where Y is a subset of $\Re^{dy}$ and $\aleph$ is a compact subset of $\Re^{dx}$. Suppose that the unknown distribution of *(Y, X)* satisfies the conditional moment restriction given by (7), where $\rho : \Omega \times \mathrm{A} \to \Re^{d\rho}$ is a known mapping, up to an unknown vector of parameters $\alpha_0 \equiv (\theta_0, h_0) \in \mathrm{A} \equiv \Theta \times \mathrm{H}$. We assume that $\Theta \subseteq \Re^{d\theta}$ is compact with nonempty interior and that $\mathrm{H} \equiv \mathrm{H}^1 \times ..... \times \mathrm{H}^q$ is a space of continuous functions. We further assume that $V \equiv (Y', X'_z)' \in \Omega \equiv \mathrm{Y} \times \aleph_z$ and $\aleph_z \subseteq \aleph$. If $\mathrm{F_{Y|X}}$ (functional form of the conditional distribution of Y given X) were known, then the functional form of the conditional mean function $m(x, \alpha) = \int \rho(y, x_z, \theta, h(.)) dF_{Y|X=x}(y)$ would be known. The minimum distance estimator of α_o would then minimize:

$$\inf_{\alpha=(\theta,h)\in\Theta\times H} E\left[m(X,\alpha)' \left[\sum(X)\right]^{-1} m(X,\alpha) \right] \qquad (8)$$

where $\sum(X)$ is a positive definite matrix for any given *X*. The true value of α_0 could then be estimated by minimizing the sample analog of (7). Following the sieve literature, Ai and Chen replace the H with the sieve space $\mathrm{H}_n \equiv \mathrm{H}_n^1 \times ..... \times \mathrm{H}_n^q$ which is computable and often finite-dimensional compact parameter space that becomes dense in H as *n* increases. Then the SMD estimator of α_0 minimizes the sample analog of a nonparametric version of (9) with h restricted to the sieve space H_n:

$$\hat{\alpha}_n = (\hat{\theta}_n, \hat{h}_n): \min_{\alpha=(\theta,h)\in\Theta\times H} E\left[\hat{m}(X_i,\alpha)' \left[\hat{\Sigma}(X)\right]^{-1} \hat{m}(X_i,\alpha) \right] \qquad (9)$$

To compute the consistent estimator of *m(X)*, the linear sieve estimator is used. Let *{p_{0j}(X). j = 1,2, ...}* denote a sequence of known basis functions (as in splines, Fourier series, power series etc.), the linear sieve estimator is given by :

[28] This portion is heavily derived from Ai and Chen (2003). More details on the derivation of the variance covariance is available in this paper.

$$\hat{m}_l(X,\alpha) = \left(\sum_{j=1}^{n} \rho_l(Z_i,\alpha) \otimes p^{kn}(X_j) \right)' (P'P)^{-1} p^{kn}(X), l = 1,.....d_\rho$$

where P = $\left(p^{kn}(X_1),....., p^{kn}(X_n)\right)'$.

The integer k_n is the smoothing parameter which is required to grow with n so that the approximation error decreases to zero. The above sieve estimator can be interpreted as GMM. With $\hat{\Sigma}(X)$ = I, the SMD estimator is the solution to

$$\min_{\alpha=(\theta,h)\in\Theta\times H} \left(\sum_{j=1}^{n} \rho(Z_i,\alpha) \otimes p^{kn}(X_j) \right)' (I \otimes P'P)^{-1} \left(\sum_{j=1}^{n} \rho(Z_i,\alpha) \otimes p^{kn}(X_j) \right) \qquad (10)$$

where $\otimes$ denotes the Kronekar product and I the $d_\rho \times d_\rho$ identity matrix.

Following the procedure as specified in Ai and Chen (2003), we assume that the nonparametric part of the estimating equation , $h_{0j} \in H^j = \Lambda_{c_1}^{\gamma_1}[1,-1], \gamma_1 > 1/2$ for $j = 1, ...q$. For identification we assume that Z contains a constant with $dim(Z) > 1$, and $h_{oj}(0) = 0$ for $j = 1, ..., q$. We consider the Fourier series sieves for $j = 1, ..., q$:

$$H_n^j = \left\{ \begin{array}{l} h_1(X_j) = a_0 + \sum_{l=1}^{Jn} \left[a_{1l} \cos(\pi l X_j) + a_{2l} \sin(\pi l X_j) \right] \\ h_j(0) = 0, a_0 = \sum_{l=1}^{Jn} l^{2p} \left({a_{1l}}^2 + {a_{2l}}^2 \right) \le c_1^2 \end{array} \right\} \qquad (11)$$

here $p \in (1/2, \gamma_1)$ is a constant arbitrary close to γ_1. We apply the SMD procedure described above with $H_n \equiv H_n^1 \times ..... \times H_n^q$, H_n^j given in (7) and $k_{1n} = q(2J_n + 1)$. The SMD procedure with identity weighing is just a 2SLS estimation applied to $Y_{1i} = X_{1i}'\theta_0 + h_0(Z_i) + u_{1i}$, with $p^{kn}(X_i)$ as instruments.

APPENDIX C

APPENDIX ON EXTERNAL SHOCKS, INSTITUTIONS : CHAP 4

Table C1. Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Change in growth	46	-0.73	2.18	-5.77	2.524
Change in investment	46	-2.22	4.16	-15.56	3.9
EEA	46	0.17	0.38	0	1
SSA	46	0.09	0.28	0	1
Latin	46	0.19	0.40	0	1
External Shock	46	5.00	5.17	0.72	28.56
Per capita GDP 1993 (in logs)	46	9.12	0.89	6.98	10.23
Change in private credit to GDP	46	0.21	0.43	-0.50	2.12
Change in ratio of private credit to capital stock	46	-1.46	26.34	-95.34	122.11
Investor Protection Index	46	5.77	1.74	2.7	9.7
Average Risk of Expropriation	46	7.94	1.59	5.22	9.98
Latitude	46	0.34	0.20	0.011	0.711
Change in current account	43	-1.08	4.18	-19.35	3.58
Change in FDI	45	0.96	2.03	-1.37	12.16
Change in REER	45	0.135	0.34	-0.26	2.25
Change in Short term debt	21	0.027	6.02	-13.86	11.53
Change in total reserves	43	-0.044	0.27	-0.49	0.72

Table C2. First stage for growth and investment collapse: Including all variables

	(1)	(2)	(3)	(4)
	For private credit	*For credit to capital stock*	*Investor protection*	*Risk of Expropriation*
East Asia	0.041	-7.95	-1.51	0.55
	(0.056)	(13.81)	(0.64)**	(0.43)
SSA	0.03	4.76	0.27	0.51
	(0.06)	(16.39)	(0.76)	(0.50)
Latin America	-0.10	12.78	-0.45	1.08
	(0.05)*	(13.68)	(0.65)	(0.43)**
Initial income 1993	-0.001	2.92	-0.59	-1.37
(in logs)	(0.026)	(6.55)	(0.30)*	(0.20)***
External shocks	0.003	0.29	0.006	0.01
	(0.004)	(1.05)	(0.049)	(0.03)
Private credit to capital stock lagged	0.004	4.10	-0.11	-0.036
	(0.004)	(1.01)***	(0.05)	(0.031)
Increase in private credit lagged	0.88	-7.02	-0.38	0.45
	(0.03)***	(8.32)	(0.39)	(0.26)*
English	0.022	-0.98	-2.51	-0.06
	(0.038)	(9.58)	(0.44)***	(0.29)
Latitude	-0.03	-5.29	-1.82	0.73
	(0.16)	(40.54)	(1.88)	(1.25)
German	-0.016	14.17	1.06	-0.45
	(0.05)	(13.22)	(0.60)*	(0.39)
R-square	0.967	0.4444	0.7013	0.8423
N	46	46	46	46

Notes: This table serves as first stage estimates for column 1 in Table 3 and 4. The variable investor protection is instructed using English legal origin. The variable Average Risk of Expropriation is instrumented using latitude and German legal origin.

Table C3. First stage for growth and investment collapse : Excluding SSA and GDP

	(1)	(2)	(3)	(4)
	For private credit	*For credit to capital stock*	*Investor protection*	*Risk of Expropriation*
East Asia	0.02	-7.42	-1.99	-0.55
	(0.05)	(12.41)	(0.62)***	(0.64)
Latin America	-0.11	13.33	-.97	-0.07
	(0.05)*	(12.07)	(0.61)	(0.63)
External shocks	0.003	0.35	-0.019	-0.05
	(0.004)	(1.00)	(0.05)	(0.05)
Private credit to capital stock lagged	0.004	4.04	-0.10	-0.018
	(0.004)	(0.98)***	(0.05)	(0.05)
Increase in private credit lagged	0.87	-7.69	-0.44	0.35
	(0.03)***	(9.77)	(0.39)	(0.40)
English	0.021	-0.17	-2.69	-0.46
	(0.03)	(9.16)	(0.45)***	(0.46)
Latitude	-0.07	2.57	-4.82	-6.03
	(0.11)	(28.33)	(1.41)***	(1.45)***
German	-0.01	15.12	0.87	-0.88
	(0.05)	(12.74)	(0.61)	(0.63)
R-square	0.96	0.4321	0.6558	0.5654
N	46	46	46	46

Notes: This table serves as first stage estimates for column 2 in Table 3 and 4.

Table C4. First stage for growth and investment collapse: Excluding variables SSA, Log GDP and Average Risk of Expropriation

	(1) *For private credit*	(2) *For credit to capital stock*	(3) *Investor protection*
East Asia	0.024	-2.89	-1.73
	(0.047)	(11.88)	(0.59)**
Latin America	-0.11	12.75	-1.06
	(0.05)**	(12.13)	(0.61)
External shocks	0.003	0.18	-1.05
	(0.004)	(0.99)	(0.61)
Private credit to capital stock	0.0042	3.72	-0.11
	(0.0039)	(0.94)***	(0.05)
Increase in private credit	0.87	-8.08	-0.45
	(0.031)***	(7.80)	(0.39)
English	0.024	-1.96	-2.84
	(0.035)	(9.08)	(0.44)***
Latitude	-0.075	6.99	-4.63
	(0.11)	(28.24)	(1.42)***
R-square	0.96	0.357	0.63
N	46	46	46

Notes: This table serves as first stage estimates for column 3 in Table 3 and 4.

Table C5. Impact on Growth: OLS estimates corresponding to the IV estimates in Table 3

	(1)	(2)	(3)
Panel A. Dependent variable Growth rate 2001 Minus Growth rate 1997			
External shocks	-0.10	-0.10	-0.11
	(0.04)**	(0.05)*	(0.05)**
Increase in ratio of private	-0.015	-0.015	-0.015
credit to capital stock	(0.007)**	(0.008)*	(0.008)*
Increase in private credit	-1.26	-1.28	-1.57
	(0.48)**	(0.52)**	(0.48)**
Investor Protection Index	-0.32	-0.32	-0.27
	(0.12)**	(0.14)**	(0.13)**
Risk of Expropriation	-0.44	-0.21	
	(0.28)	(0.16)	
East Asia	-2.04	-2.15	-2.09
	(0.65)***	(0.69)***	(0.70)***
SSA	-0.11		
	(0.84)		
Latin America	-1.16	-1.35	-1.53
	(0.61)**	(0.59)**	(0.58)**
Initial GDP (in logs) 1993	-0.47		
	(0.47)		
R-square	0.6797	0.672	0.6585
N	46	46	46

Notes: The figures in brackets are standard errors. Levels of significance are indicated by asterisks: *** 99 percent, **95 percent , * 90 percent.

Table C6. Impact on Investment: OLS corresponding to the IV estimates in Table 3

	(1)	(2)	(3)
Panel A. Dependent variable is investment rate between 2001 Minus 1997			
External shocks	-0.29	-0.29	-0.32
	(0.09)***	(0.09)***	(0.09)***
Increase in ratio of private	-0.024	-0.025	-0.025
credit to capital stock	(0.014)*	(0.014)*	(0.015)*
Increase in private credit	-0.92	-0.95	-1.45
	(0.96)	(0.91)	(0.83)*
Investor Protection Index	-0.48	-0.43	-0.32
	(0.25)*	(0.24)*	(0.19)*
Risk of Expropriation	-0.40	-0.36	
	(0.56)	(0.28)	
East Asia	-5.12	-5.16	-5.05
	(1.28)***	(1.20)***	(1.21)***
SSA	0.21		
	(1.65)		
Latin America	-0.46	-0.53	-0.84
	(1.20)	(1.02)	(1.00)
Initial GDP (in logs) 1993	-0.02		
	(0.92)		
R-square	0.7341	0.7326	0.7211
N	46	46	46

Notes: The figures in brackets are standard errors. Levels of significance are indicated by asterisks: *** 99 percent, **95 percent , * 90 percent.

Table C7. Financial Crisis, Growth Collapse and its Causes: OLS Estimates

	(1)	(2)	(3)	(4)	(5)
Panel A. Dependent variable is change in growth rate between 2001 Minus 1997					
External shocks	-0.11	-0.11	-0.11	-0.05	-0.11
	(0.05)*	(0.05)**	(0.05)**	(0.10)	(0.05)**
Private credit to capital	-0.015	-0.016	-0.017	-0.032	-0.015
stock	(0.009)*	(0.008)*	(0.008)*	(0.036)	(0.009)*
Increase in private credit	-1.53	-1.54	-1.42	-3.35	-1.54
	(0.50)***	(0.49)***	(0.49)**	(1.38)**	(0.51)***
Investor Protection	-0.30	-0.27	-0.27	-0.15	-0.29
Index	(0.14)**	(0.14)*	(0.13)**	(0.27)	(0.14)**
Change in current	-0.08				
account balance 1993-97	(0.07)				
Change in Foreign		0.03			
Direct Investment 1993-96		(0.11)			
Change in Real			-2.62		
Exchange Rate 1993-96			(1.86)		
Change in short term				-0.10	
debt 1993-96				(0.07)	
Total reserves 1996					-0.21
					(0 .66)
East Asia	-1.91	-2.21	-2.21	-3.17	-2.21
	(0.85)**	(0.76)***	(0.75)***	(1.47)	(0.79)**
Latin America	-1.59	-1.59	-1.47	-1.61	-1.59
	(0.61)**	(0.604)***	(0.59)**	(0.76)	(0.62)***
R-square	0.6569	0.6548	0.6721	0.6698	0.6518
N	42	45	44	22	43

Notes: The figures in brackets are standard errors. Levels of significance are indicated by asterisks: *** 99 percent, **95 percent , * 90 percent.

Table C8. Financial Crisis, Investment Collapse and its Causes: OLS Estimates

	(1)	(2)	(3)	(4)	(5)
Panel A. Dependent variable is change in investment between 2001 Minus 1997					
External shocks	-0.29	-0.31	-0.30	-0.13	-0.297
	(0.09)***	(0.09)***	(0.09)***	(0.12)	(0.09)***
Private credit to	-0.027	-0.026	-0.025	-0.003	-0.028
capital stock	(0.015)*	(0.015)*	(0.015)	(0.04)	(0.016)*
Increase in private	-1.33	-1.57	-1.41	-2.28	-1.42
credit	(0.85)	(0.84)*	(0.87)	(1.50)	(0.85)*
Investor Protection	-0.39	-0.38	-0.36	-0.48	-0.38
Index	(0.23)*	(0.23)*	(0.24)	(0.27)*	(0.24)
Change in current	-0.14				
account balance	(0.12)				
1993-96					
Change in Foreign		-0.19			
Direct Investment		(0.18)			
1993-96					
Change in Real			-0.44		
Exchange Rate 1993-			(3.28)		
96					
Change in short term				-0.15	
debt 1993-96				(0.07)**	
Changes in total					0.53
reserves 1993-96					(1.12)
East Asia	-5.61	-5.42	-5.44	-9.14	-5.67
	(1.44)***	(1.29)*	(1.33)***	(1.16)***	(1.33)***
Latin America	-1.09	-0.75	-0.92	-0.96	-1.05
	(1.04)	(1.02)	(1.04)	(0.82)	(1.04)
R-square	0.7363	0.7285	0.7205	0.9091	0.7292
N	43	45	44	22	43

Notes: The figures in brackets are standard errors. Levels of significance are indicated by asterisks: *** 99 percent, **95 percent , * 90 percent.

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