UNIVERSITY OF SOUTHAMPTON

CAUSAL RELATIONSHIP BETWEEN FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH: THEORY AND EVIDENCE

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A thesis submitted in accordance with the requirement for the degree of Doctor of Philosophy

Department of Economics

January 2003

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF SOCIAL SCIENCES

ECONOMICS

Doctor of Philosophy

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Recent advances in econometric techniques and data availability have intensified empirical research on the relationship between financial development and economic growth. This thesis, which is made up of three main papers, makes further contributions both theoretically and empirically to the subject matter. The thesis begins with general introductory remarks which make up chapter 1. This is followed by the first of the three papers which is theoretical and makes up chapter 2. It constructs a general equilibrium framework in which bank intermediaries evaluate projects ex-ante and fund only those which signal to be of "good" quality. It is shown that, in the absence of transactions costs, such a strategy is dominant. Conditions are derived under which the same strategy dominates in the presence of transactions costs.

Chapters 3 and 4 are made up of empirical papers. Chapter 3 is time series based and tests for Granger Causality between bank development and economic growth for individual countries. The tests focus on the micro-channels through which finance and growth affect each other as articulated by theory. Macroeconomic stability is controlled for. Most results are found to be tenuous to macroeconomic stability and show reverse causality. Dynamic correlation between stock market development and economic growth is found to be weak.

Chapter 4 performs GMM dynamic estimation on panel data and does group comparison by level of development. The paper rejects pooling data from different levels of development into single regression. Evidence shows differential impacts of financial development on economic growth by level of development.

Chapter 5 summarizes, concludes and suggests further areas for research.

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Acknowledgements

This thesis is made up of three main papers written during my tenure (1999-2002) in the Department of Economics, University of Southampton.

First and foremost, I would like to acknowledge my debt to my supervisor, Akos Valentinyi, for his supervision.

Second, I would like to thank Maurice Kugler, my advisor for his advice. I would also like to thank Sally Srinivasan for her help with the TSP programme.

Last, but not least, I would like to thank the following for their moral support; my brothers Abel Tirivavi and Andrew Tirivavi and, Emmanuel Pamu. I would also like to thank Grazia Rapisarda, my office mate, and the nice people in the department who made the environment conducive.

Chapter 1

Introduction and Summary

One of the challenges facing growth and development economists, alike, is to try to explain why some countries grow faster than others. It is observed that while some countries experience sustained positive growth rates, other countries experience economic stagnation and, especially in developing countries, yet others experience negative growth rates. Since economic growth is one of the measures of wealth of Nations, it is not difficult to appreciate its importance and the interest it generates.

To that effect, there has been extensive research in the area which, instead of producing answers to the question, has produced alternative theories (Pagano 1993, Levine 1997). One of the theories put forward suggests a positive relationship between financial development and economic growth. Development economists have always argued that the evolution of the financial system was an important argument to the development of the real sector. To that effect, some of the theories put forward predict that finance leads growth. The argument is that financial systems perform growth enhancing functions (Levine 1997). This argument seems to be consistent with the "stylised facts": economies with well-developed financial systems tend to grow fast. The corollary being that economies with poorly-developed (or repressed) financial systems are retarded. Other theories predict that finance follows the real sector (Robinson 1952) and yet others belittle the importance of the relationship (Lucas 1988). Some theories predict a changing relationship between the two with finance leading the real sector during early stages of development and growth leading finance as the economy reaches maturity (Patrick 1966).

Recent advances in endogenous growth literature have noted a two way relationship between the two (Greenwood and Jovanovic 1990, among others).

Financial systems promote economic growth by performing growth enhancing functions. While the profession has identified these functions, until recently, there have not been formal models connecting these functions with economic growth. Recently, however, Greenwood and Jovanovic 1990, King and Levine 1993c, among others, have constructed models in which financial intermediaries allow a large fraction of the resources to move to economic activities with the highest (social) return uses. While these models may not have properly addressed the assertions of banking theory, it is with credit to the authors, for putting forward the models, and their insights which have sparked more interest in the subject matter. The question is what is the best way to model the connections between these functions and economic growth in a way that is consistent with the predictions. The predictions are that well-developed financial systems enhance greater economic growth. What is the best way to show that when financial intermediaries perform these functions, growth is greater.

Attempts have also been made to try to put empirical content into the links between financial and economic development. The first attempt was the seminal work of Goldsmith (1969). Goldsmith's study was based on cross-country regression in which data from different countries was averaged and aggregated into one regression. The study established positive correlation between the two. The cross-country correlation tests, however, could not establish the direction of causality between the two; given that correlation between variables does not measure cause and effect. Since Goldsmith's study, there have been many other empirical studies including, recently, King and Levine (1993c) Levine (1997) and Levine and Zervos (1998), among others. All these studies established strong correlation

between financial development and economic growth. Time series attempts by Demetriades and Hussein (1996) show "weak" causality. The question is what is the best way to test the theoretical assertions outlined above, given that different countries have different experiences and that there are more factors accounting for economic growth than just financial development.

This thesis, made up of three main papers, revisits the relationship between financial development and economic growth. Chapter 2, which is the first main paper, is theoretical. In this paper, a general equilibrium framework is constructed in which bank intermediaries and borrowers are asymmetrically informed. In the framework, only bank intermediaries have access to evaluation technology with which they evaluate borrowers and their investment projects ex-ante. They only extend credit to those borrowers whose projects signal to be of "good" quality and returning the highest rate. Relative to the previous papers which have connected information acquisition to economic growth, this paper ascertains whether this strategy enhances greater capital accumulation and economic growth by comparing it with capital accumulation and economic growth when bank intermediaries do not evaluate borrowers and their investment projects ex-ante. (These alternatives include financial autarky and unconditional lending).

The main findings of this paper are that if transactions costs are assumed away, then, by evaluating borrowers and their investment projects ex-ante, bank intermediaries enhance greater capital accumulation and economic growth than the other capital production technologies. However, the introduction of transactions costs means that whether evaluation ex-ante still remains the dominant strategy is no longer clear. Conditions are derived under which it remains the dominant strategy.

Chapters 3 and 4 of the thesis are empirical papers which are meant to evaluate the alternative views outlined above. Chapter 3 is divided into

two parts; (a) bank development; which is time series based and tests for causality between bank development and economic growth for individual countries and (b) stock market development, which performs dynamic correlation tests between stock market development and economic growth. For bank development, the tests will emphasize on providing evidence on the micro-channels through which the two affect each other. The tests involve causality running from bank development to economic growth and conversely. Causality tests are emphasized here for the following reasons (i) Economic policy makers may want to know which variable cause (are caused by) which variables. (ii) Causality is a time series phenomena. (iii) Theory predicts endogeneity between financial development and economic growth. Therefore the tests will be performed in levels VAR, first difference VAR and error-correction models (ECM) partly because they each have shortcomings but, that together, they provide a better picture. Macroeconomic policy form, for each country, particular characteristics of the policy regime under which financial development and economic growth take place and, are therefore, controlled for.

For stock market development, dynamic correlation is performed to test for the presence of Granger causality. These tests involve correlation between current growth rates and lagged indicators of stock market development, after controlling for the lags of growth rates and macroeconomic policy and, conversely.

The main findings of this paper are that; causality between bank development and economic growth is "weak". There are more cases of causality running from economic growth to bank development contradicting the popular view. There are cases of two-way causality supporting endogeneity between the two (Patrick 1966, Greenwood and Jovanovic 1990 among others). Some of the surprising results are the contradictions of "stylised facts" in that; in some countries with high levels of bank

development, there is no evidence of causality while in some countries with low levels of bank development, there is evidence of causality making it difficult to reconcile with theory and the "stylised facts". Most causal relations are tenuous to macroeconomic policy and the results are country specific. These findings contradict cross-country based results. Dynamic correlation between stock market development and economic growth running either or both ways is very "weak" contradicting static correlation based on cross-country regressions (Levine and Zervos 1998).

Chapter 4 is another empirical paper which is based on recent developments in the econometrics of panel data; which includes Panel data, GMM-First Difference and GMM-SYSTEMS estimators. Panel data methodology is preferred because it controls for group heterogeneity, it gives more information and variability, it enables one to study the dynamics of adjustment and, it eliminates aggregation biases. In this paper, data is stratified by level of development; giving three distinct panels. The paper will advocate data stratification because it allows one to study the patterns that emerge as the economy passes through different stages of development, it allows one to distinguish those groups of countries which are credit constained from those which are not and, it allows one to see if pooling and aggregating biases fail the hypothesis being tested.

The paper will then address the following questions: (i) Is it appropriate to pool and aggregate data from different development levels into a single regression to evaluate the different views outlined above? Why does it matter? How are the results based on such data interpreted? (ii) If data from different levels of development cannot be pooled, would single regressions be more informative about the relationship between financial development and economic growth. (iii) Is there causality between financial development and economic growth? (iv) What are the channels of transmission from financial development to economic growth for the different

levels of development? To address these issues, the paper will use recent advances in the econometrics of panel data which includes panel data, GMM-First Differences and GMM-SYSTEMS estimators (Holtz-Eakin, Newey and Rosen 1988, Arellano and Bond 1991, Blundell and Bond 1998).

The main findings are that pooling and aggregating data from different levels of development is rejected in favour of group regressions. Coefficient estimates vary by level of development contradicting results based on aggregate data. Channels of transmission also differ by level of development, again, contradicting results based on restricted models. Causality between bank development and growth is "weak" while that between stock market development and growth is a bit encouraging.

Chapter 5 provides the summary, conclusion and suggestions for further research.

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Chapter 2

Information Acquisition, Efficient Resource Allocation and Economic Growth.

Abstract.

A simple framework in which financial (bank) intermediaries pool resources, evaluate projects ex-ante and channel resources to their highest social return uses is developed. In the framework, rates of return interact with output shares of capital and labour and, the level of technology to describe the evolution of capital accumulation and economic growth. Project evaluation ex-ante, as a technology for producing capital, is compared with financial autarky and unconditional lending as alternative capital production technologies. Assuming away evaluation and verification costs, evaluation ex-ante dominates other technologies in the sense that capital accumulation and economic growth are greater. Conditions are derived under which evaluation ex-ante, in the presence of evaluation and verification costs, remains dominant over other technologies.

2.0 Introduction.

Limited knowledge of borrower characteristics, makes lending a risky business. The result is that either most investment is self-financed or that lenders have to engage in costly information production on potential borrowers. The problem is that borrowers have superior information about the potential productivity of their projects for which they seek funding and that their opportunistic behaviour affects the distribution of the project returns.

Much is said about how financial (especially bank) intermediaries are able to produce information on the quality of borrowers and their

projects (Bernanke and Gertler (1990), Boyd and Prescott (1986), Campbell and Kracaw (1980), Chan (1983) and Leyland and Pyle (1977) among others) allowing resources to move to their highest return uses. Financial intermediaries have a comparative advantage in information gathering and processing leading to intermediated lending in equilibrium. This is so because they gain economies of scope in lending decisions due to their access to privileged information (by holding accounts of future borrowers at the bank) when making a lending decision. Development Literature is replete with examples of the importance of financial intermediaries in choosing those who get to use society's savings.[1]

The purpose of this study is to construct a general equilibrium framework in which both lenders and borrowers are asymmetrically informed and competitive financial intermediaries sell securities to lenders, evaluate borrowers and their projects ex-ante and distribute resources only to those borrowers with projects which signal to be of "good" quality and offering higher returns. It is shown that the rates of return interact with capital accumulation process to generate the path of the economy. The outcome of such a mechanism manifests itself in more resources going to finance higher return projects; enhancing greater capital accumulation and economic growth.

To achieve this, the framework must be such that capital is financed externally through debt and that the level of development of debt itself affects investment behaviour. The framework is then formalized by incorporating the insights of Boyd and Prescott (1986), in which bank intermediaries evaluate projects and fund only those which signal to be of "good" quality, into a two-period-lived overlapping generations model of

[1] Schumpeter (1911), Goldsmith (1969) offer examples.

Diamond (1965) which is then modified to allow for the existence of different technologies for converting current output into future capital. These technologies (to be detailed below), are distinguished by the composition of resources going into producing productive capital and their rates of return. To gauge whether project evaluation ex-ante enhances more capital accumulation and faster economic growth, it is compared with other capital producing technologies. The comparison is carried out without and then with evaluation and verification costs. By explicitly incorporating both evaluation and monitoring costs, conditions necessary for evaluation ex-ante to dominate other capital producing technologies are described.

A number of simplifying assumptions are made and these and other features of the framework will be discussed in section 2.7 of the paper. Also, the framework is kept as simple and illustrative as possible.

The financial structures (capital production technologies) considered in this paper are (i) financial autarky, (ii) financial intermediation with unconditional lending and (iii) financial intermediation with ex-ante evaluation.

In the first, there is no role for intermediation and self-finance is observed. This results in inefficiency since less resources go into productive investment and some resources lie idle as goods in storage, underscoring the importance of resource pooling and intermediation. In the second, there is resource pooling and intermediation so no resources lie idle but some form of inefficiency is observed since some resources go into funding "bad" projects with low returns R_b while some go into funding "good" projects returning R_g. However, this can be completely eliminated by intermediaries who evaluate projects ex-ante and then fund only "good" projects returning R_g – the third market structure. In

equilibrium, all lending is intermediated with ex-ante project evaluation since this strategy returns R_g which maximizes period 2 consumption for young lenders thereby inducing a Pareto-superior state for these lenders.

What connects bank intermediaries with economic growth are growth enhancing functions banks perform. This paper concentrates on ex-ante information acquisition function. Theoretical models connecting information and growth have recently been developed by, among others, Greenwood and Jovanovic (1990), Bencivenga and Smith (1991) and, King and Levine (1993c). In the models by Greenwood and Jovanovic (1990) and Bencivenga and Smith (1991), financial intermediation enhances growth by channeling more resources to activities with highest social returns. In the model by King and Levine (1993c), financial intermediaries enhance growth by evaluating and managing entrepreneurial activities. The fundamental difference between these studies and this paper is that this paper makes a comparison of capital accumulation and growth when the bank intermediaries perform the function; with environments in which they do not. Other differences become clearer as the paper proceeds.

The results obtained in this paper are that first, conditions are described under which the economy will have a unique constant growth rate equilibrium for each of the technologies used to produce capital. Second, rates of return per unit of investment interact with output shares of capital and labour and, the level of technology to generate the path of capital accumulation and economic growth. This path defines a first order difference equation in k_t suggesting a one period gestation for capital. Third, in the absence of transactions costs, ex-ante evaluation dominates unconditional lending and financial autarky (in the sense that for each unit of consumption good invested at time t, time t+1 capital produced

and economic growth are higher) as technologies of producing capital. Fourth, when transactions costs are taken into account, ex-ante evaluation dominates the other capital producing technologies under certain conditions which will be described later. Fifth, in equilibrium, all lending is intermediated.

The remainder of the paper is planned as follows: Section 2.1 describes the environment in the economy. Conditions which allow for the existence of a "steady-state equilibrium" displaying a constant (endogenous) rate of growth are described. Section 2.2 characterizes equilibrium trades in goods and factors. Section 2.3 characterizes trade in finance. Section 2.4 describes equilibrium financial contracts. Section 2.5 establishes the general equilibrium capital formation and economic growth with no information costs. Section 2.6 establishes a general equilibrium capital formation with information costs. Section 2.7 provides discussion of some simplifying assumptions. Section 2.8 summarizes and concludes.

The Model.

The model considered in this paper is meant to show how the functions of bank intermediaries in resource pooling, project evaluation ex-ante and efficient distribution of these resources enhances faster economic growth. This is achieved by using the insights of Boyd and Prescott (1986) formalized in a two-period-lived overlapping generations framework. In order to capture the insights of Boyd and Prescott (1986) that project evaluation ex-ante channels resources to their highest valued use and extend them to growth, the paper allows for the existence of different

technologies for converting current output into future capital, with different compositions of resource distribution and rates of return.

2.1 The Environment.

A discrete time economy in which time is indexed by $t = 1,2.....$is populated by an infinite sequence of two-period-lived overlapping generations, plus an initial old generation endowed with per capita capital stock k_t at time t. (The assumption of discrete time ensures that capital at time t+1 is a result of time t savings). Each generation is made up of a continuum of (measure one) identical agents indexed by $j = 1,2.....$; . At each date t, a new generation appears; and all generations are identical in size and composition (no population growth). (This allows the author to write and analyze equilibrium conditions in per capita/firm terms (Green (1984))).

Each young agent j produces a quantity of intermediate goods, at time t, denoted $q_t(j)$ as a monopolistic competitor. Assume that each young agent producing intermediate goods is endowed with one unit of labour ($L_t(j) = 1$), which is nontraded[2] and that both labour and capital are supplied inelastically. Then, each young agent j produces the intermediate good using his/her own endowment of labour input $L_t(j)$ (=1) (Greenwood and Huffman (1995) Greenwood and Smith (1997)) and rented capital input $k_t(j)$ as primary inputs according to the following technology:

[2] This assumption is meant to avoid problems associated with the allocation of profits from this technology.

$$q_t(j) = A\, k_t(j)\, L_t(j)^{1-\delta,\,3}, \qquad \delta \in (0,1) \quad \ldots\ldots(2.1)$$

There is a single consumption good at each date t which is produced, competitively, by entrepreneurs using intermediate inputs $q_t(j)$ (no profits). Let Y_t be the aggregate production of this consumption good at time t and $y_t = Y_t / M$ be per capita output[4]. Per capita output y_t, in each period t is used either for consumption c_t or for investment i.e. in equilibrium, $c_t + k_{t+1}/R_i = y_t$ where k_{t+1} is the amount of consumption good used for investment at date t which becomes productive capital in period t+1. Assume this good is produced using the following technology:

$$c_t + (k_{t+1}/R_i) = \left[\int_0^1 q_t(j)^{\theta} dj\right]^{1/\theta}; \qquad i \in (\text{good, bad}); \qquad \theta<1 \quad \ldots\ldots(2.2)$$

(adopted from Greenwood and Smith (1997)). In this framework, $c_t = 0$ which means that each unit of consumption good produced at time t, is invested and converts into R_i units of time t+1 capital. The immediate implication of this is that output and capital are the same commodity (Diamond (1965)).

All young agents plan and work in period t and are retired and consume in period t+1. Suppose that each earns w_t which accrues in the form of consumption goods with which they can provide for period t+1. After receiving w_t young agents face a savings/portfolio/career decision. There are two alternative assets in which income can be held; capital or storage technology. Let Φ[5] be an individual specific chara-

[3]The linearity in $k_t(j)$ in the technology allows for the existence of an equilibrium with a constant rate of growth (Bencivenga, Smith and Starr (1996)).

[4] This assumes M agents in the economy.

[5] Φ is intrinsic characteristics which distinguish between those with entrepreneurial skills and those who don't.

cteristic realized before the savings/portfolio /career decision is made. Φ is assumed iid (across agents and space) and has the following probability distribution:

$$\Phi = \begin{cases} 0 & \text{with probability } 1-\pi \\ 1 & \text{with probability } \pi \end{cases}$$

Agents with $\Phi = 1$ become entrepreneurs. These become capital (consumption goods) producers who seek external funding to supplement their own earnings. They supply a mixture of "good" and "bad" investment projects. However, these projects look identical ex-ante, are indivisible and require a fixed operational scale of Q_0. Agents with $\Phi = 0$ lack entrepreneurial skills, become savers who either deposit their incomes in bank intermediaries or put it into storage.[6]

All agents consume in period t+1, savers consume out of either returns from their deposits or from goods in storage while entrepreneurs consume out of rental income. These sequence of events repeat themselves. Figure 2.1 below provides a summary of these sequence of events.

[6] This specification of the population in terms of the probabilities of drawing agents of each type from the population, also allows one to write equilibrium conditions for the economy as a whole in per capita terms (Boyd and Prescott 1986).

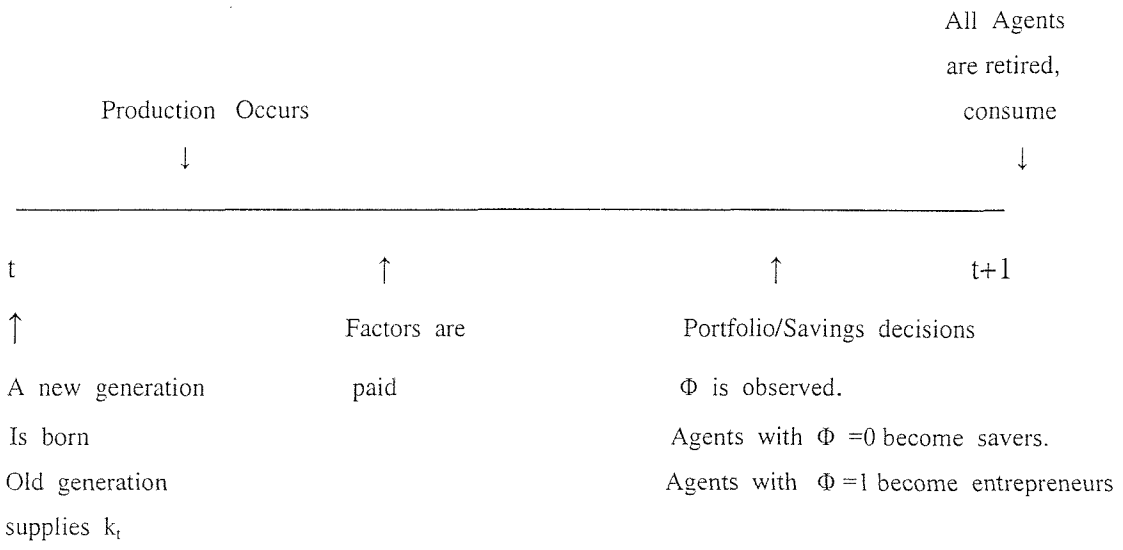

Figure 2.1. Sequence of Events.

The information structure is as follows: The outcome of evaluated projects and returns R_g, consumption c, evaluation signal s(p) ϵ (good, bad), and terms of contracts are publicly observable. But the outcome of "bad" (verified) projects is only observable after incurring verification costs (CSV). Also it cannot be publicly observed whether an individual who claims to have evaluated a project has done so. Assume perfect verification. Ex-ante, project quality (good, bad) is the entrepreneur's private information.

This paper is limited to a closed economy in which there are no equity markets. There is no credit rationing induced by limited resources (the explanation is provided in the discussion section). The next section looks at the trade in goods and factors.

2.2 *Trade in Goods and Factors.*

The paper assumes that there are no frictions in the markets for goods and factors (consistent with the endogenous growth version of Diamond (1965)). As described above, it is only young agent j who can produce intermediate goods $q_t(j)$, $j \in [0,1]$. Let $p_t(j)$ be the price of these intermediate goods (in units of time t consumption). Because producers of intermediate goods $q_t(j)$ are monopolistic competitors, they do not take $p_t(j)$ as given. Assume final goods producers take $p_t(j)$ as given. Then they choose intermediate inputs $q_t(j)$, $j = 1,2.....$ to maximize:

$$y_t - \int_0^1 p_t(j)q_t(j); \qquad \text{by} \quad (2.2)$$

Assuming interior solution, then, the first order conditions give the following inverse demand function for intermediate goods j:

$$p_t(j) = y^{1-\theta}\, q_t(j)^{\theta-1} \quad \forall j \qquad \ldots\ldots(2.3)$$

Young agents, who produce intermediate goods, use their endowment of labour and rented capital k_t, (as described above) held by the initial generation, from competitive rental markets. Let ρ_t be the competitive rental rate for capital at time t. Each young agent j chooses $q_t(j)$ and $k_t(j)$ to:

Max $[p_t(j)q_t(j) - \rho_t k_t(j)]$ (drawn from Greenwood and Smith (1997)) subject to (2.1) and (2.3) and, $L_t(j) = 1$ or by transformation[7], each young agent j chooses $k_t(j)$ to:

$$\text{Max}\{y^{1-\theta}[Ak_t(j)]^{\theta} - \rho_t k_t(j)\} \quad \ldots\ldots(2.4)$$

Assuming interior solution, first order conditions imply:

$$\rho_t = \theta y^{1-\theta} A^{\theta} k_t(j)^{\theta-1} \quad \ldots\ldots(2.5)$$

All agents are symmetric as final goods producers, which means that in equilibrium, $k_t(j) = k_t$; $j \in [0,1]$ where k_t is per capita capital stock at time t and $q_t(j) = q_t$. From equations (2.1) and (2.2), it follows that:

$$y_t = q_t = Ak_t \quad \ldots\ldots(2.6)$$

Substituting equation (2.6) into (2.5) gives the rental cost of capital;

$$\rho_t = \theta A \quad \ldots\ldots(2.7)$$

which is time invariant. Equation (2.7) gives the equilibrium rental cost of capital ρ_t which is determined by the share of output going to capital (θ) and the level of technology (A). Young agent j who supplies labour, earns real income $w_t(j)$ at time t. Substituting (2.5) into (2.4), and

[7] See Greenwood and Smith (1997).

the fact that all young agents are identical in equilibrium, it follows that $w_t(j) = w_t$ and that:

$$w_t(j) = w_t = (1-\theta)\, y^{1-\theta} [Ak_t(j)]^{\theta} \quad \ldots\ldots(2.8)$$

Substituting (2.6) into (2.8) yields

$$w_t = (1-\theta)\, Ak_t \quad \ldots\ldots(2.9)$$

Equation (2.9) shows that the equilibrium wage rate is determined by the share of output going to labour $(1-\theta)$, the level of technology (A) and per capita capital stock k_t at time t. Equation (2.9) implies that the income of young agents grows at the same rate as the per capita capital stock. The next section looks at trade in finance.

2.3 Trade in Finance.

This subsection characterizes trade in finance. Assume no frictions in financial markets. As described above, each young agent supplies labour at time t, earns real income w_t and decides how to save this income. All income is saved in period t. The nature and availability of financial markets determines, in part, how savings are held. The income can either be deposited with a bank intermediary or put into storage. Per capita supply of that income is $w_t \equiv w_t(k_t) = (1-\theta)\, A\, k_t$ by (2.9). By assumption, these agents are risk-neutral and they only care about consumption in period 2, which, in turn, depends on receiving the highest return possible from their savings.

There are two financial structures available to be considered in this paper: (i) financial autarky and (ii) bank intermediaries. The maximum per project demand for the funds is Q_0, which is the maximum operational constraint per project, and is exogenously given, large, and the same for all projects. Q_0, must be large enough to justify costs of evaluation ex-ante or auditing ex-post in the case of failing projects. For simplicity, normalize Q_0 to unity[8]. By imposing maximum operational constraint per project, in effect, bounds the growth of the economy. It is assumed that total supply of funds is no less than total demand for funds which implies that:

$$M(1-\theta) A k_t \geq NQ_o^{9} \quad \forall\ k_t \qquad (2.10)$$

where M is total number of workers, who all supplied funds, and N is the total number of projects funded. The assumption that the demand for funds does not exceed the supply of funds is based on the fact that high returns on investment mean that bank intermediaries are able to elicit more deposits.

This completes the characterization of trade in goods, factors and finance. The next section describes equilibrium financial contracts.

2.4 Optimal Funding Contracts.

This paper is not on financial contracting per se. While it is possible to conjecture different contracts for the different financial structures, this

[8] Unity in this case could be £1million or so.
[9] This may allow banks to hold goods in storage.

paper will only outline the contractual arrangements which capture, in general, the problems of informational asymmetries ex-ante (or adverse selection) and informational asymmetries ex-post (monitoring) with transactions costs. The different contractual arrangements become special cases which become clearer as the paper proceeds. The paper will end up the section with a description of the equilibrium contracting properties associated with CSV.

By assumption, the economy has both "good" and "bad" projects. Also by assumption, "good" projects return a publicly observable outcome R_g, at time $t+1$, for each unit of consumption good invested at time t while "bad" projects return an outcome R_b at time $t+1$, observable only after incurring some verification costs, for each unit of consumption good invested at time t. Obviously $R_g > R_b$. Ultimate savers can either store their savings and receive x units of time $t+1$ consumption goods for each unit of time t consumption good stored; or r units of time $t+1$ consumption goods for each unit deposited. Both x and r are non-contingent. Therefore, the contractual agreements in this case are that for each unit deposited at time t, r units of consumption goods are paid at time $t+1$. Assume $r > x$. The case of observable and non-observable returns on investment is analyzed by Williamson (1986, 1987). Here is the sketch:

The contractual agreements to be signed between borrowers and lenders have to meet the following: First, funding contractual agreements must specify a quantity of resources to be channeled to a particular borrower. Second, the contract must specify a set of repayments that are contingent on firm performance. Third, the contract must specify the states in which auditing will and will not take place and how it will

affect the repayment to the lender. Following Williamson (1986)[10], lenders are assumed risk neutral and have access to funds at an opportunity cost r which each lender takes as parametric. In period 1, lenders (banks on behalf of savers) offer contracts to borrowers who have investment projects which yield a payoff in period 2 of $R^r \in [0,R^*]$. The return R^r is a random variable, drawn from a distribution which is known to both parties. In period 2, after observing R^r, the borrower reports the project outcome to the lender. Suppose that R^s is the reported outcome. $R^s \in [0, R^*]$ does not necessarily imply $R^r = R^s$, since the borrower may have the incentive to underreport if R^s is tied to the project return R^r and requires that monitoring cost be incurred. For simplicity, normalize the project resource requirement to 1 unit. Suppose that monitoring takes place whenever $R^r \in S \subset [0,R^*]$ where S is the audit rule which is identified as a set of reports of the borrower for which the lender can undertake the audit. Let R_b be payment to the lender from the borrower if $R^s \in S$ and verification takes place. By engaging in verification and observing R_b, repayment can be made contingent on R^r. Then, per project return net of verification costs is $R_b - \gamma$ where γ is a fixed per project verification cost.

If the repayment value $R^s \notin S$, then no verification takes place and the borrower pays R_g to the lender, which depends on the signal and not the true outcome of R^r since it cannot be observed by lenders. In this environment, whenever the actual value of $R^s \notin S$, the borrower has the incentive to report the value that results in minimum payment to the lender. Then, if there is no verification, the payment to the lender

[10] Although this framework includes transactions costs, the capital formation section below relegates the costs to the discussion section.

must equal to a constant $K_0=R_g$. The fact that loans are for 1 unit implies that $K_0 - 1$ is the interest rate on the loan if $R^s \notin S$. The intuition in Williams' (1986) model is that if the borrower's reported signal is in S, then verification takes place so that the lender can learn the true value of R^r.

The first constraint that the contracts have to meet to be acceptable to borrowers is that they have to be feasible, in the sense that the borrower's repayment must not exceed the borrower's total available resources (no negative consumption). In the observable return case, the borrower pays R_g and retains $R^s - R_g$ which must guarantee positive consumption for both. In this sense, the feasibility constraint is equivalent to the (limited liability) constraint:

$$\forall R^s \notin S;\ R_g = K_0 \quad \text{.....(2.11)}$$

In the case of unobservable return, incentive compatibility conditions imply that the optimal contract becomes such that an audit takes place only when the cash flows are low enough such that there is default on repayment. Under the circumstances, feasibility then implies:

$$\forall R^s \in S;\ P(R^s) = R_b < K_0 \quad \text{.....(2.12)}$$

The borrower will only report $R^s \in S$ if it is in the interest of the borrower i.e. reporting $R^s \in S$ must be incentive compatible. Therefore, the second constraint the contract must meet to be acceptable to the borrower is that it has to be incentive compatible. Such incentive compatibility mechanism can be implemented using the revelation prin-

ciple by which the contract may be described by a revelation mechanism in which the borrower is asked to report, and in which the rules of the mechanism are designed in such a way that it is always in the interest of the borrower to report truthfully. Then, the efficient incentive compatible debt contracts are obtained by minimizing the probability of an audit for a fixed repayment; or, by maximizing the expected repayment for a fixed probability of an audit, i.e. incentive compatible debt contracts are such that:

(i) $\forall\ R^s \in S,\ P(R^s) = \text{Min}\ \{ R^s, R^r \}$ ..... (2.13)

i.e. the maximum repayment in the audit zone with limited liability and incentive compatibility.

(ii) $S' = \{ R^s,\ R^s < R^r \}$ .....(2.14)

implying that an audit will take place when repayment is not met. If all agents are risk neutral, which they are in this framework, any efficient incentive compatible debt contract is a standard debt contract.[11]

In summary, the properties of equilibrium contracts between borrowers and lenders are such that the investment projects are at their largest possible scale since high returns always make it expensive to leave resources idle. Moreover, in the case of ex-ante project evaluation, the return is no less than the promised payment making it feasible to meet their contractual obligations and avoid auditing. If the return is less than the promised repayment, it is not feasible for the borrowers to meet their contractual obligations prompting verification, learning the va-

lue of R_b, and retaining the entire value of the firm's output. These properties are analogous to findings in CSV frameworks (Diamond (1984), Williamson (1986)) among others. This completes the description of the economic environment.

2.5 General Equilibrium Capital Accumulation: No Transactions Costs.

This section looks at the general equilibrium capital formation for each of the three financial structures (i) financial autarky, (ii) unconditional intermediated lending and (iii) intermediated lending with ex-ante evaluation. (In this section, both evaluation and verification costs are assumed away. They will be reintroduced in the next section). This is then extended by integrating the analysis of entrepreneurs (borrowers) into a neoclassical growth model of Diamond (1965). The assertions of banking theory that bank intermediaries pool resources, efficiently produce information on project quality and distribute these resources in a way which enhances faster economic growth are manifest.

2.5.1 Financial Autarky.

Under a financially autarkic structure, young agents have no opportunity to pool resources. This means that entrepreneurs have to self-finance capital accumulation and put goods in storage. That entrepreneurs self-finance must act as a signal of the quality of their investment projects (Leland and Pyle 1977) which must be "good" quality. They return R_g units of time t+1 consumption goods per unit of time t investment.

[11] See Williamson (1986) for a proof.

Because all young agents save all their time t entire income, they only have to choose how to allocate these savings between capital and storage. All young agents with $\Phi = 0$ have no access to investment projects and consumption at time t+1 is financed only by goods in storage.

Denote by $g^{a,t}$ goods in storage by a financially autarkic young agent at time t and $K^{a,t+1}$ the value, in current consumption, of time t+1 capital accumulation by the same agent. The return on goods in storage is x units of time t+1 consumption goods per unit of time t goods put into storage. Agents who operate firms and produce capital rent it on competitive capital markets for ρ_{t+1} per unit, so that rental income per unit is $\rho_{t+1} = \theta A$ by (2.7). Income w_t earned in period t and the expected return, R_g, at time t+1 enter the expression for and describe the evolution of the capital stock accumulation process in period t+1. The objective of each young agent is to maximize period 2 consumption c_2 subject to the following resource constraints:

$$g^{a,t} + K^{a,t+1} \leq w_t \qquad (2.15)$$

$$C_2 \leq x\, g^{a,t} + R_g\, (\rho_{t+1})\, K^{a,t+1} = x\, g^{a,t} + R_g\, \theta\, A\, K^{a,t+1} \qquad (2.16)$$

In the economy, there are equal numbers of young and old agents, as described above. In equilibrium, under financial autarky, the law of large numbers implies that a fraction $(1-\pi)w_t$ of income from agents with $\Phi = 0$ is put into storage. Therefore, only a fraction πw_t of agents with $\Phi = 1$ translates into t+1 capital stock k_{t+1}. This leads to the following equilibrium law of motion of productive capital:

$k_{t+1} = \pi R_g \rho_{t+1} w_t = \pi R_g (\theta A) w_t$ by (2.7).

$= \pi R_g (\theta A) (1-\theta) A k_t$ by (2.9)

$= \pi R_g \Theta k_t$ .....(2.17)

where $\Theta = (\theta A)(1-\theta)A$.[12] Equation (2.17) is a first order difference equation which explicitly defines k_{t+1} as a function of k_t and it shows that there is a one period gestation for investment. This means that once the economy has a predetermined time 1 capital stock k(1), this sets the economy in motion. From equation (2.17), one can calculate time (2) capital stock which yields the value to calculate time (3) capital stock etc. By repeating this process over and over, equation (2.17) uniquely describes the evolution of future capital stock; $\{ k_t \}_{t\in[0,\infty)}$. Therefore, equation (2.17) and an initial k(1) are enough to describe the entire future path of the economy. Dividing equation (2.17) by k_t yields:

$k_{t+1} / k_t = \pi R_g (\theta A) (1-\theta) A = \pi R_g \Theta \equiv \delta^a$ .....(2.18)

which is a one period growth in capital stock and the rate of output when there is financial autarky. Equation (2.18) shows that under financial autarky, only a fraction of income will be invested in capital production, implying a situation in which there is some inefficiency because some of the resources are idle. Equation (2.18) also suggests that the growth rate of the economy, which is constant, is determined by the interaction of the rate of return (R_g), capital share of output (θ), labour share of output (1-θ)

[12] Hereafter, the paper uses Θ in place of $(\theta A)(1-\theta)A$.

the level of technology (A) and the fraction of resources going into capital production (π).[13] In other words, the rate of return interacts with the capital accumulation process so that the rate of return affects the steady state level of output. It is observed that under financial autarky, the rate of return on investment is R_g. Economic growth is retarded because only a fraction of potential capital is produced.

The finding has been noted in the development literature. Gurley and Shaw (1955) suggest that in poor, primitive environments[14], capital formation is low and economic growth slow because it is accomplished primarily with entrepreneur's savings (self-finance). According to the result in this paper, economic growth is retarded by keeping resources in unproductive goods in storage.

2.5.2 The Functions of Bank Intermediaries.

This section describes the relevant functions performed by the financial (bank) intermediaries upon which this framework is rooted. Financial (bank) intermediaries mobilize savings by accepting deposits from and lending to a large number of agents. They also engage in other income generating and risk sharing activities.[15] They spend resources on, and develop expertise in evaluating borrowers and their projects. In the process, they determine who gets to use society's savings and at what terms (Goldsmith (1969)). They also act as delegated monitors and enfor-

[13] Such findings are consistent with the literature which treats financial autarky as a capital production technology (Greenwood and Smith 1997)
[14] These are the environments in which financial systems are underdeveloped.
[15] E.g off-balance sheet activities, syndicated lending and participating in inter-bank markets.

cers in cases where repayment is defaulted (Diamond (1984)), otherwise they audit and claim everything.

Given non-convexities of some investment projects, bank intermediaries also facilitate the emergency of entrepreneurs by providing necessary funds, on a scale not always feasible for individuals, by engaging in syndicated lending which enables them to finance "immense" works which account for economic development (Bagehot (1873)) and risk sharing. To the extend that ultimate lenders are small, coupled with the fact that "immense" works require a minimum amount beyond many individual's wealth, it may be too costly for would be entrepreneurs to contract with many lenders and emerge. These bank intermediaries are given exogenously and this paper has nothing to say about where they come from.

2.5.3 Intermediated Lending with Ex-Post Information Asymmetry.

Bank intermediaries are now introduced and they intermediate between ultimate lenders and entrepreneurs. These bank intermediaries have access to verification technology for defaulting borrowers. They, and entrepreneurs, are asymmetrically informed, ex-post, with regards to the returns on the entrepreneur's investment projects. For now, assume away verification costs. As pointed out above, entrepreneurs have both "good" and "bad" projects they seek to fund.[16] However, these projects look identical ex-ante.

[16] Under intermediated lending, entrepreneurs do not have to use their own resources. I also assume large, indivisible projects for which individual wealth may not be enough. It is these large projects which offer high rates of return.

As described above, bank intermediaries accept deposits from young savers by promising depositors that for each unit of the consumption good deposited, r units of consumption good will be paid back in period t+1. Bank intermediaries then unconditionally lend to entrepreneurs thereby giving rise to an "adverse selection" problem. Because the projects of different qualities cannot be distinguished, all must be financed at the same price given the pdf and cdf of the returns. This has the effect of attracting a large supply of "bad" projects from entrepreneurs (Chan (1983)). Also, for as long as project outcomes are not publicly observable (which is the case here) and verification is costly, entrepreneurs have the incentive to underreport the outcomes of these projects.

Each entrepreneur can supply either "good" or "bad" investment projects. Therefore, the total return is the sum of returns from "good" and "bad" quality projects. For each unit invested in a "good" project, R_g, which is publicly observable, is returned. Let R_b ($< R_g$) be the return per unit invested in a "bad" project. R_b is not publicly observable and is the claim on everything after auditing. It can only be observed after incurring a fixed verification cost (assumed away for now). This is the case of csv framework of Diamond (1984), Williams (1986) among others. However, the difference between this traditional csv and this paper is that in theirs, there is only a stochastic return whereas in this paper there are both stochastic and deterministic returns.

Depositors can observe the payment they receive from the intermediary, r, but cannot observe the project outcomes, or payment by entrepreneurs to the intermediary. In equilibrium, the bank intermediary is regarded as a cooperative whose objective is to maximize period 2 consumption of a representative depositor, taking the time path of $\{w_t\}$ as given i.e. it

behaves competitively. Since in equilibrium all savings are intermediated, then, because investment in period t depends on labour income in period t and on the return on capital that savers expect in period t+1, it is w_t in period t and R_i[17] in period t+1 which enter the expression that describes the evolution and path of capital stock in period t+1. However, unconditional lending results in the rate of return being both R_g and R_b. Let $\lambda \in (0,1)$ be the fraction of "good" projects and $1-\lambda$ be the fraction of "bad" projects in the economy. Assume that, in equilibrium, all projects are funded. Denote by $g^{bv,t}$ per depositor goods in storage by the bank and $K^{bv,t+1}$ per depositor capital investment by the bank intermediary so that:

$$g^{bv,t} + K^{bv,t+1} \leq w_t \quad \text{.....(2.19)}$$

$$C_2 \leq (\lambda R_g + (1-\lambda)R_b)\, \rho_{t+1} K^{bv,t+1} = (\lambda R_g + (1-\lambda)R_b)\, \theta A K^{bv,t+1} \quad \text{.....(2.20)}$$

Bank intermediaries compete for deposits by choosing $(r, g^{bv,t}, K^{bv,t+1})$ to maximize the expected utility[18] of a representative depositor subject to (2.19) and (2.20). Unconditional lending leads to per capita return on investment being the sum of R_g and R_b which can be converted into period t+1 capital. Therefore, the per firm equilibrium law of motion for the productive capital is:

$$k_{t+1} = (\lambda R_g \rho_{t+1} + (1-\lambda)R_b \rho_{t+1})\, w_t \text{ by (2.7)}$$

$$= [\lambda R_g (\theta A)(1-\theta) A + (1-\lambda) R_b (\theta A)(1-\theta) A]\, k_t \text{ by (2.9)}$$

[17] i here refers to either good or bad.
[18] In this case, expected utility is equivalent to period 2 consumption.

$$=[\lambda R_g \Theta + (1-\lambda) R_b \Theta]k_t \quad \text{.....(2.21)}$$

Equation (2.21) completely describes the evolution of the capital stock and the entire future path of the economy when intermediaries lend unconditionally and produce information on defaulting borrowers ex-post; or that one period growth in the stock of capital, which is equivalent to the growth rate of the economy is:

$$k_{t+1}/ k_t = \lambda R_g \Theta + (1-\lambda) R_b \Theta \equiv \delta^{bv} \quad \text{.....(2.22)}$$

Equation (2.22) highlights a few observations: First, the growth rate of the economy under this technology is the sum of two terms. The first term gives the fraction of growth accounted for by "good" projects while the second term gives the fraction accounted for by "bad" projects. Second, each term is made up of the fraction (or type) of projects funded (λ or $1-\lambda$), the rate of return appropriate for that type (R_g or R_b respectively), the fraction of output that is paid to capital (θ), the fraction of output that is paid to labour ($1-\theta$) and the level of technology (A). The crucial variable in this growth equation is λ. An increase in λ implies that by evaluating firms and their projects ex-ante, λ approaches 1 and R_b is arbitraged away. In the process, this facilitates greater capital accumulation and economic growth. This will become the theme of next section. Meanwhile, when all lending is intermediated and the intermediaries lend unconditionally but produce information ex-post, the following are observed: First, the rates of return between "good" and "bad" projects are observed. Second, capital accumulation and economic

growth are still retarded because some resources are directed to their highest return uses while others are not.

2.5.4 Intermediated Lending with Ex-Ante Information Asymmetry.

Financial intermediaries remain the same as above in that they compete for deposits by choosing (r, $g^{be,t}$, $K^{be,t+1}$) to maximize per depositor consumption c_2. However, they resemble financial coalitions of Boyd and Prescott (1986) in that they evaluate borrowers and their investment projects ex-ante and invest only in those that signal to be of "good" quality.

Entrepreneurs supply projects which look identical ex-ante. Bank intermediaries have access to evaluation technology which they use to evaluate the potential productivity of the projects. Assume perfect signals. For each project evaluated, a signal s(p) $\in$ ("good" , "bad") is observed. A project that is evaluated and signals to be of "good" quality is fully funded, succeeds and returns Rg per unit invested while one that signals to be of "bad" quality fails and returns nothing.[19] To that effect, only projects which are evaluated and signal to be of "good" quality are funded. Therefore, in equilibrium, some borrowers receive funding while others do not. Evaluating projects ex-ante and only funding projects signaling to be of good quality has the effect of forcing entrepreneurs to supply "good" quality projects only. In line with the previous section, $\lambda \rightarrow 1$ and no bad projects are supplied. One can conclude that when banks

[19] In reality, R_b is returned after verification. Once a project signals to be of "bad" quality, no resources are on the project.

operate, and evaluate projects ex-ant, no "bad" investment projects are funded (Boyd and Prescott (1986)).

Because all agents consume in period 2 only, each deposit accepting bank's per capita deposit is $w_t = (1-\theta)Ak_t$. Denote per depositor goods in storage by $g^{be,t}$ and capital investment by $K^{be,t+1}$. Bank intermediaries seek to maximize period 2 consumption of a representative depositor subject to the following resource constraints:

$$x\, g^{be,t} + K^{be,t+1} \leq w_t = (1-\theta)\, A\, k_t \quad \text{.....(2.23)}$$

$$r\, w_t = r\,(1-\theta)\, A\, k_t \leq R_g\, \rho_{t+1}\, K^{be,t+1} = R_g\, (\theta\, A)\, K^{be,t+1} \quad \text{.....(2.24)}$$

In equilibrium, all the savings are intermediated and w_t in period t and R_g in period t+1 enter the expression for the capital stock i.e, $k_{t+1} = R_g w_t$. With ex-ante evaluation returning R_g per unit invested, period 2 consumption of a young agent is maximized. In other words, when bank intermediaries operate, all time t investment returning R_g per unit of investment translates into time t+1 capital. This capital can be rented on competitive capital markets at ρ_{t+1}. Therefore, per firm equilibrium law of motion of productive capital stock is:

$$k_{t+1} = R_g\,(\theta A)\,(1-\theta)\, A\, k_t = R_g\, \Theta\, k_t \equiv \delta^{be} \quad \text{.....(2.25)}$$

Equation (2.25) completely describes the time path or evolution of the capital stock and the entire future path of the economy when there is intermediated lending and when intermediaries evaluate projects ex-ante and fund only those projects which signal to be of "good" quality.

Therefore, one period growth rate of per capita capital stock and output is:

$$k_{t+1}/k_t = R_g\Theta \equiv \delta^{be} \quad \text{.....(2.26).}$$

When there is intermediation with ex-ante evaluation, R_g is the highest possible return. Therefore, all resources are channeled to projects with the highest rates of return which interact with capital accumulation and affects the steady state level of output. In equilibrium, the following are observed: First, all lending is intermediated, since intermediaries choose returns to maximize period 2 consumption of young lenders. Second, all resources are directed to their highest (social) return uses. Third, the rate of return observed is the highest possible rate.

The questions of interest are how δ^{be} is related to δ^{a}, and δ^{bv}. This leads to the following propositions.

Proposition 1. The growth rate of an economy in which lending is intermediated with ex-ante project evaluation exceeds that of a financially autarkic economy. In other words, $\delta^{be} > \delta^{a}$ *or*

$$R_g\Theta > \pi R_g\Theta \quad \text{.....(2.27)}$$

which holds since $1 > \pi$. Equation (2.27) shows that capital accumulation and economic growth are greater in the presence than in the absence of banks who pool resources, evaluate projects ex-ante, and channel resources to their highest return uses. In the absence of intermediation, a fraction $1-\pi$ is lost to unproductive goods in storage. Therefore, the

necessary and sufficient condition for the development of financial intermediation to result in higher equilibrium growth rates for the economy is that, relative to financial autarky, intermediaries eliminate the holding of funds in unproductive goods in storage.[20] This supports the argument, in the development literature, that improvements in the technology for pooling resources enables "immense" works (Bagehot (1873) among others). Another way to explain why growth rates are larger under intermediation, with ex-ante evaluation, than under financial autarky is because "immense" works require large amounts of investment and offer higher rates of return. These amounts may be beyond many individual's wealth. This implies a role for bank intermediaries.

Proposition 2. The growth rate of an economy in which lending is intermediated with ex-ante project evaluation exceeds that of an economy in which lending is unconditionally intermediated with ex-post verification: i.e. $\delta^{be} > \delta^{bv}$ *which is equivalent to:*

$$R_g \Theta > \lambda R_g \Theta + (1-\lambda) R_b \Theta \quad \ldots\ldots(2.28)$$

(2.28) can be rewritten as: $(1-\lambda)R_g > (1-\lambda)R_b$ which holds since $R_g > R_b$. Proposition 2 tests the insights of Boyd and Prescott (1986), in which bank intermediaries engage in information production ex-ante, versus the banking theory of Diamond (1984), Williamson (1986,1987) in which bank intermediaries lend unconditionally and then verify failing projects ex-post. The framework shows that project evaluation ex-ante dominates (in the sense that capital accumulation and economic growth are greater) an

[20] This is so since $r > x$ which increases the opportunity of holding assets in the form of goods in

unconditional lending strategy. This supports the development literature that improvements in the technology of information acquisition will increase both the level and efficiency of financial market activity on the economy (McKinnon (1973) among others.

Proposition 3. The growth rate of an economy in which bank intermediaries lend unconditionally and verify only defaulting projects grows faster than an autarkic economy i.e. $\delta^{bv} > \delta^{a}$ *if* $(\lambda-\pi)R_g + (1-\lambda)R_b > 0$

This follows from equation (2.29)

$$\lambda R_g \Theta + (1-\lambda) R_b \Theta > \pi R_g \Theta \quad \text{.....(2.29)}$$

The condition necessary for the proposition to hold is that λ must be large relative to π.[21] Remembering that λ is the fraction of "good" quality projects supplied under unconditional lending and that π is the number of entrepreneurs producing capital, the condition says that economic growth is greater under unconditional lending than under financial autarky if entrepreneurs do not behave opportunistically by supplying mostly "bad" quality projects given that there is no ex-ante evaluation and the presence of verification costs.

The framework has shown that by evaluating projects ex-ante, bank intermediaries channel resources to their highest return uses and shift the composition of capital production from other technologies to intermediated technology with ex-ante evaluation. Evaluation ex-ante dominates both

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storage.

[21] Given that $R_g > R_b$, this means that if $\lambda < \pi$, then the difference has to be very small so the whole term is positive.

unconditional lending and financial autarky in enhancing economic growth. Unconditional lending dominates financial autarky if and only if entrepreneurs do not behave opportunistically by supplying mostly "bad" quality projects given that there is no ex-ante evaluation and the presence of verification costs.

2.6 General Equilibrium Capital Accumulation With Transactions Costs.

To determine whether project evaluation ex-ante dominates other strategies for capital production as articulated in banking theory, the return due to ex-ante evaluation has to be netted of the costs of evaluation. By the same token, the return due to verification ex-post has to be netted of verification costs. To achieve this, the paper assumes per project fixed costs of evaluation and verification, in current consumption goods, and then convert them into time t+1 capital and subtract them from the capital accumulation processes. Let per project evaluation cost be f and per project verification be γ in time t+1 capital[22]. Assume $f \neq \gamma$. Verification takes place only when the funded borrowers default on their repayments. Assume both evaluation and verification costs to be large to motivate the emergence of bank intermediaries.

2.6.1 Financial Autarky.

As outline above, under financial autarky, only agents with $\Phi = 1$ can produce capital through self-financing. Since entrepreneurs use their own resources only, they must fund only "good" quality projects (Leland and Pyle 1977). Therefore, under financial autarky, there is neither evaluation ex-ante nor verification ex-post. The growth rate of the economy is:

$$k_{t+1}/k_t = \pi R_g \Theta \equiv \delta'^{a} \quad \text{.....(2.30)}$$

2.6.2 Financial Intermediation with Costly Verification.

As above, bank intermediaries unconditionally lend, inadvertently funding both "good" and "bad" projects. Verification costs have to be incurred on the "bad" projects yielding capital accumulation and economic growth net of verification costs of:

$$k_{t+1}/k_t = \lambda R_g \Theta + (1-\lambda)\{R_b \Theta - \gamma\} \equiv \delta'^{bv} \quad \text{.....(2.31)}$$

Equation (2.31) gives one period capital accumulation (economic growth) less verification costs under unconditional lending and verification ex-post. Note that verification costs are subtracted only from the defaulting projects.

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[22] These costs are converted into time t+1 capital by dividing the costs by the operational scale first and then by the rental cost of capital i. e. (F/Q_0 and Γ/Q_0 respectively) or ($F/Q_0\rho_{t+1}$ and $\Gamma/Q_0\rho_{t+1}$ respectively) or (f and γ resp.) where $f \equiv F/\theta A$ and $\gamma \equiv \Gamma/\theta A$ and Q_0 is normalized to 1.

2.6.3 Financial Intermediation with Costly Ex-ante Evaluation.

Bank intermediaries evaluate projects ex-ante as described above. Netting evaluation costs yields the following growth rate of the economy:

$$k_{t+1}/ k_t = R_g \Theta - f \equiv \delta'^{be} \quad \text{.....(2.32)}$$

Equation (2.32) gives one period capital accumulation less evaluation costs when bank intermediaries evaluate projects ex-ante and only fund those that signal to be of "good" quality. The question is what are the relationships among δ'^{a}, δ'^{be} and δ'^{bm}. Unlike the case in which transactions costs are assumed away, whether evaluation ex-ante dominates unconditional lending and verification ex-post and, financial autarky is not clear. This is interesting because banking theory which articulates the link between bank intermediation and economic growth, in most cases, does not give the conditions under which this is true. Conditions will be given under which evaluation still dominates unconditional lending and financial autarky. The following propositions show these relationships.

Proposition 4. The growth rate of an economy in which lending is intermediated with costly ex-ante project evaluation exceeds that of a financially autarkic economy i.e $\delta'^{be} > \delta'^{a}$. or $R_g\Theta - f > \pi R_b\Theta$.

This can be rewritten as:

$$R_g \Theta - \pi R_g \Theta > f. \quad \text{.....(2.33)}$$

Condition (2.33) says that economic growth is greater when lending is intermediated, with ex-ante evaluation, than when there is financial autarky if the net gain in growth as a result of evaluation exceeds the costs of evaluation. In other words, if the costs of evaluation exceeded the gain in growth, there would be no place for wasteful intermediaries. (2,33) can be rewritten as:

$$1-\pi > f / R_g \Theta \quad \text{.....(2.34)}$$

The LHS, $1-\pi$ is the fraction of agents who are ultimate lenders. The RHS is the ratio of fixed per project evaluation costs to the growth rate when evaluation takes place. Therefore, economic growth is greater if and only if evaluation costs relative to the growth rate is smaller than the fraction of ultimate lenders. Another way of interpreting (2.34) is to say that the fixed evaluation costs must be smaller relative to the growth rate as a result of ex-ante evaluation.

Proposition 5. The growth rate of an economy in which lending is intermediated with costly ex-ante evaluation exceeds that of an economy in which lending is unconditional with costly ex-post verification i.e. $\delta^{'be} > \delta^{'bm}$ *or* $R_g\Theta - f > \lambda R_g\Theta + (1-\lambda)\{R_b\Theta - \gamma\}$.

The necessary condition for this to hold is that:

$$R_g\Theta - f/(1-\lambda) > R_b\Theta - \gamma^{23} \quad \text{.....(2.35)}$$

[23] $R_g\Theta - f > \lambda R_b\Theta + (1-\lambda)\{R_b\Theta - \gamma\} \leftrightarrow (1-\lambda)R_g\Theta - f > (1-\lambda)\{R_b\Theta - \gamma\}$ dividing by $(1-\lambda)$ gives (2.35)

The RHS of (2.35) is the growth rate from "bad" projects less verification costs. The first term on the LHS is the growth rate when there is ex-ante evaluation. Realizing that $1-\lambda$ is the number of "bad" projects supplied, and that f is a fixed cost of evaluating a project; (2.35) says that growth is greater when intermediaries evaluate ex-ante then verify defaulting ones ex-post if the growth rate with evaluation less evaluation cost on "bad" projects exceeds growth rate with verification less verification costs. In other words, by not wasting much resources evaluating "bad" projects (which are not fundable), evaluation dominates verification.

Proposition 6. the growth rate of an economy in which bank intermediaries lend unconditionally and then verify only defaulting borrowers grows faster than an autarkic economy i.e. $\delta'^{bm} > \delta'^{a}$ or

$$(\lambda-\pi)R_g\Theta + (1-\lambda)R_b\Theta - \gamma) > 0 \quad \text{.....(2.36)}$$

This follows from:

$$\lambda R_g\Theta + (1-\lambda)\{R_b\Theta - \gamma\} > \pi R_g\Theta$$

The necessary condition for this to hold is that under unconditional lending, a large number of "good" quality projects be supplied. This requires that entrepreneurs not take advantage of their superior information about potential project productivity and the presence of verification costs.

2.7 Discussion.

The discussion will centre on defending and explaining the various assumptions, highlighting a few issues and possible extensions. Specifically, the defense is limited to those assumptions which appear contentious. Although these assumptions are made to simplify the analysis, they need to be defended and explained.

A framework such as the one developed in this paper, in which there is informational asymmetries ex-ante, is normally associated with "adverse selection" and "credit rationing". In this paper, credit rationing based on limited resources is assumed away. The defense for the assumption is that one function of the financial (bank) intermediaries is resource pooling. In particular, by channeling resources to their highest return uses, financial intermediaries can attract more deposits by offering a higher interest rate to depositors. This argument is in line with McKinnon (1973) and others who advocate higher interest rates as a form of financial development which is meant to attract more resources and avoid credit rationing based on limited resources. Therefore, the assumption is consistent with development literature. Also, bank intermediaries take positions in interbank markets. If they experience excess demand, they borrow on the interbank market. If they experience excess supply, they lend on the interbank market. Therefore, the assumption of no credit rationing due to limited resources is consistent with modern banking literature. So the only credit rationing is one by quality type.

Another assumption in this paper which needs to be defended is that of no equity markets as a source of funding investment projects. The problem with this assumption is that it is contrary to the belief

that most financial development takes place outside the banking system i.e. in equity markets. The assumption to exclude equity markets is defended by using empirical evidence on the study of external fund raising by companies in a number of developed countries by Mayer (1990). Using eight developed countries[24], Mayer (1990) finds out that in no country do companies raise a substantial amount of finance from securities markets. He also finds out that banks are the dominant source of external finance in all countries. In developing countries, equity markets are not well developed and banks are also the dominant source of external finance. Therefore, in spite of the popularly held view that most financial development occurs outside the banking system, more investment is still financed by debt and the assumption of no equity markets does not do any harm to the outcome of the paper. It is actually consistent with banking theory which asserts the specialness[25] of bank credit for financing.

Another assumption which needs to be defended is the use of goods in storage to produce capital. In the development literature, it is commonly asserted that inventories of consumption goods are the primary alternative to investments in productive capital (McKinnon (1973)) among others. This follows from the fact that in equilibrium, every unit not invested in the production of capital in the framework results in a unit of the consumption good being held in the form of inventories. In the case of financial autarky, those who cannot operate firms consume out of goods in storage and this is consistent with the literature.

[24] These countries include Canada, Finland, France, Germany, Italy, Japan, UK and USA.
[25] Particularly for small to medium size companies.

Another contentious issue is the use of financial autarky as a capital producing technology in the analysis. In a financial autarkic economy, every unit of wages earned results in an equal amount of consumption good being stored i.e. Q_0 (=1) = w_t in per capita terms. McKinnon (1973) claims that the credit extension for the production of capital, has the effect of reducing inventory investment, again making the use of financial autarky consistent with the development literature.

2.8 Summary and Conclusion.

It is often argued that financial intermediaries channel resources to their highest return uses. Using a simple framework in which goods markets, factor markets and credit markets interact to promote a constant growth rates, it has been shown that bank intermediaries pool resources, efficiently produce information on project types and allocate resources in a way that enhances faster economic growth. This has been achieved by using three capital production technologies; financial autarky, intermediated lending with ex-post information asymmetry and intermediated lending with ex-ante information asymmetry.

If evaluation and verification costs are assumed away, intermediation with ex-ante evaluation dominates financial autarky and financial intermediation with ex-post verification, in the sense that growth is greater. Consistent with the literature, bank intermediaries (i) pool resources and eliminate the need for self-finance, (ii) allocate resources to their highest return uses and (iii) prevent resources from being held in goods in storage.

However, once evaluation and verification costs are introduced, it is no longer clear that evaluation ex-ante remains dominant. Conditions have been developed under which the strategy remains dominant. Measures of these costs are necessary if this hypothesis is to tested empirically.

This distinguishes this paper from the previous literature which has modeled the connections between information gathering by bank intermediaries and growth. The previous literature has shown that bank intermediaries enhance economic growth by mitigating informational asymetries but not that growth is actually faster than when there are no bank intermediaries.

This paper has looked at the role of bank intermediaries in channeling resources to their highest return uses and the consequences for economic growth. The chapter has also considered only the influence of financial intermediation on economic growth. We have not modeled the influence of stock market upon growth, nor either reverse influence, although all four effects will be investigated empirically. Future research should continue to connect the micro-channels, articulated in banking theory, with economic growth. In this frame- work, evaluation and verification costs have been assumed to be fixed. Future research should relax this assumption and allow them to vary. Future research should also allow for different operational scales so that different projects cost different amounts.

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Chapter 3

Causal Relationship Between Financial Development and Economic Growth: Time Series Evidence.

Absract.

Theory predicts that the functions of the financial system in (i) resource pooling, (ii) resource transfer, (iii) liquidity risk amelioration and (iv) transaction cost reduction form channels through which finance causes (is caused by) economic growth. Using time series data on 40 countries spanning high, middle and low-income countries, these predictions are tested using levels VAR, first difference VAR and dynamic error correction for tests on bank development and growth. As a robust check, macroeconomic policy forms the conditioning information set. Evidence shows that in some cases, causality is attenuated and in other cases, enhanced by introducing macroeconomic policy suggesting that the relationship could be driven by macroeconomic. For the few cases where robust causality is detected, there is stronger evidence of reverse causality. Dynamic correlation between stock market development and economic growth is very "weak". There are few cases showing the presence of causality between the two. Overall both causality and dynamic correlation seem to support the traditional view that economic growth leads financial development.

3.0 Introduction.

Theoretical literature linking financial development and economic growth has produced diffuse views on the subject matter. One view, the "new view", suggests that financial development causes economic growth by

performing growth enhancing functions.[1] Adam Smith (1776) Bagehot (1873), Goldsmith (1969), McKinnon (1973), Shaw (1973) and recently in endogenous growth literature, Bencivenga and Smith (1991), Greenwood and Jovanovic (1990) among others, are advocates of this view[2]. The endogenous growth literature has exploited a feature of "non-diminishing marginal productivity" of capital (Romer (1987) and Lucas (1988) to show how the financial system can affect long-run economic growth.

On the contrary there are those who reject this view outright. Joan Robinson (1952), who regards finance as an addendum to the process of growth, represents such a view when she declares (pp86) that "generally it seems to be the case that where enterprise leads, finance follows". Yet other views suggest that the relationship is not all that important; Lucas (1988) pp6 asserts that the relationship is "badly over- stressed." Stern's (1989) review of development economics does not mention finance at all. The view that the relationship between financial development and economic growth tends to run both ways was first advocated by Gurly and Shaw (1955) and Patrick (1966). Patrick (1966), identifies two patterns in the financial and economic development relationships. In one pattern, Patrick (1966) observes the case of economic growth leading financial development and in another pattern, he observes financial development leading economic growth. Patrick (1966) concludes that the direction of causality runs both ways. However, this conclusion left Patrick (1966) asking which of the two was the cause and which was the effect. This possibility was later recognized by Goldsmith (1969) and recently in endogenous growth literature by Gertler and Rose (1991),

[1] These include resource pooling, efficient resource transfer, liquidity risk amelioration, transaction cost reduction, market participation signaling through prices and exerting corporate control.

Boyd and Smith (1996), Berthelemy and Varoudakis (1996), Greenwood and Smith (1997) among others. These different views suggest that, in spite of the many theoretical models and empirical attempts, our understanding of the growth process still remains limited.

Yet there are certain stylized facts casually observable between financial development and economic growth. Counties with well-developed (underdeveloped) financial systems tend to experience sustained growth (retardation).

On the back of this background, the objective of this paper is to evaluate these alternative views, empirically, by testing for Granger causality between the two, for individual countries. The tests emphasize the micro-channels, articulated by theory, through which the two affect each other. While this paper will not discuss policy, it is possible to think of policy implications of establishing causality between financial development and economic growth.

Empirical work that links financial development and economic development goes back to the seminal work by Goldsmith (1969), and then McKinnon (1973), Atje and Jovanovic (1993), DeGregorio and Guidotti (1995), King and Levine (1993b) and Levine and Zervos (1998) among others. These studies are based on cross-section regressions on averaged data over the sample period and they establish strong instantaneous correlation between the two. Specifically, Goldsmith (1969), McKinnon (1973), DeGregorio and Guiddotti (1995) and, King and Levine (1993b) establish correlation between bank development and economic growth. King and Levine (1993b) control for macroeconomic stability and find their results to be robust. DeGregorio and Guidotti (1995) stratify the data by level of

[2] See Pagano (1993) for an overview and Levine (1997) for a survey.

development and find different results[3]. Studies by Atje and Jovanovic (1993) and, Levine and Zervos (1998) investigate and find strong instantaneous correlation between stock market development and economic growth.

Based on cross-section regressions in which data is averaged and aggregated into a single regression, these studies do not allow one to distinguish differential impacts of different levels of financial development experienced across national borders on economic growth. They also make it analytically and statistically difficult to interpret the coefficients[4]. Averaging the variables over the sample period means that unobservable components specific to different countries are captured into the error terms, biasing the coefficient estimates and consequently leading to erroneous conclusions. Averaging also means that country specific and annual data information gets destroyed in the process, again, leading to wrong conclusions. Averaging growth rates from different economies and then using them in a single regression assumes that each economy has a stable growth path (Quah (1993)). There is no evidence that this assumption was tested and found to hold ex-ante. Putting data from different economies into one regression assumes that these economies are homogeneous, by putting equal weight on all the economies large and small, resulting in misleading conclusions. These tests do not resolve the endogeneity problem between financial development and economic growth as predicted by theory and ignore the dynamic relationship between the two. The correlation between financial development and economic growth is consistent with both finance leading and growth leading causing problems with interpretation. Ram (1986) describes the parameter estimates as reflecting

[3] See their paper for details.

inter-country averages which do not apply to any single country. To that effect, caution is called for in interpreting instantaneous correlation tests based on averaged data.

Correlation tests leave the question of which of the two, finance or growth, causes the other still open. Time series based literature on causality is sparse. Time series attempts have been made between certain sectors of the economy and financial development; Gupta (1984), Rajan and Zingales (1998), Neusser and Kugler (1998) among others. These studies, however, do not resolve the issue of causality. Given the forward looking nature of the financial system, which lends to a sector expected to grow, the financial system becomes a leading indicator rather than a cause.

Jung (1986), uses annual data on 56 countries and more standard measures of output and financial development to perform causality tests. He conducts the tests in levels VAR framework. Using both simple and uni-directional concepts of causality and currency ratio and monetization variables as indicators of financial development, Jung (1986) finds that in developed countries, growth leads finance and in developing countries, finance leads growth. He also finds evidence of bi-directional causality. Jung's (1986) tests, however, do not systematically control for other factors accounting for economic growth (Levine and Renelt 1992) leaving his results with the possibility being driven by common omitted variables. Moreover, his tests have methodological and statistical problems[5] and his financial development indicators are limited only to the banking sector

[4] See Levine and Renelt (1992), Levine and Zervos (1998), Ram (1986) and Harmberger (1987) for a critique of cross-country based regressions.
[5] See Demetriades and Hussein (1996) for details.

development and yet part of financial development takes place outside the banking system.

Demetriades and Hussein (1996), use recent developments in time series econometrics and first test for stationarity, cointegration, and then causality. They find "weak" evidence of causality between the two. They could not conclude which was the cause and which was the effect. They also find evidence of bi-directional causality. However, they do not systematically control for other factors associated with economic growth (Levine and Renelt (1992)) leaving the results susceptible to omitted variables bias. The tests are based on only 16 developing countries making it difficult to draw firm conclusions on causality. The tests are performed using only bank development indicators and yet part of financial development takes place outside the banking sector.

This paper differs from the previous literature and makes a contribution in a number of ways. First, this paper has data advantage over the previous studies and uses a sample of 40 countries spanning 17 high-income countries, 12 middle-income countries and 11 low-income countries[6]. These countries show an array of different financial development levels and growth rate experiences, making the data appropriate for addressing causality between financial development and economic growth (see tables 3.1 and 3.2 below) in a way that is consistent with theory. The data includes both bank and stock market development. Except for stock market development, the data has longer series than data used in previous studies making it more appropriate for time series study. Second, this paper focuses attention on the micro-channels through which finance and growth are supposed to affect each other; rather than addressing broad correlations.

By focusing on the micro-channels identified by theory, this paper tests for and documents causality in a way that is consistent with theory. Third, this paper will control for macroeconomic stability. This reduces the omitted variable bias. Fourth, this paper will vigorously pre-test the variables (including control variables) to establish their appropriateness in the study. For bank development, traditional Granger causality tests will be performed and for stock market development, dynamic correlation will be performed to detect the presence of Granger causality. The overall hypothesis is that, other things being equal, countries with well developed financial systems, proxied by the functions grow faster than countries with poorly-developed financial systems.

The first main finding of the paper is that the link (in the causal sense) between the functions (micro-channels) of the financial system and economic growth is not as strong as predicted by theory contradicting cross-country instantaneous correlation based findings. The second main finding is that introducing macroeconomic policy conditioning information set attenuates and overturns the results or enhances causality contrary to instantaneous correlation results based on cross-country regression. The third main finding is that there are few cases where causality is robust to macroeconomic policy and that contrary to the popularly held view and to most theoretical models, "weak" evidence of the link between stock market development and economic growth[7].

The plan of the paper is as follows: Section 3.1 looks at a simple theoretical linkage between financial development and economic growth. Section 3.2 looks at the functions of the financial system which form

[6] The income classifications are from the World Bank 1984.

the micro-channels. Section 3.3 looks at the data. Section 3.4 describes the relevant econometric issues. The methodology is outlined in section 3.5. Empirical results are presented in section 3.6 and section 3.7 concludes.

The paper will not explicitly discuss or include International Banking, Capital Markets or Finance. Therefore by financial development is meant domestic financial development. This makes sense only if International Capital Markets are not perfectly integrated. The exclusion of these markets is based on the assumption that investors tend to deal with familiar lenders with whom they may already have a business relationship as in French and Poterba (1991) who document a strong home bias in portfolio investment, coupled with frictions on International Capital Markets whose evidence is given by cross-country differences in expected returns (Bekaert and Harvey (1995)). The next section links domestic financial development with per capita gross domestic product growth.

[7] This result is similar to the findings by Attanasio et al 2000 on dynamic correlation between savings and investment contrary to instantaneous correlation.

3.1 The Link Between Financial Development and Economic Growth.

In this section, the paper outlines the descriptive linkages between the services performed by the financial systems and, economic growth which motivate the tests. There is vast theoretical literature on these linkages[8]. This paper will be content with the theory appropriate for the tests. Drawing from Pagano (1993), and adding time, economic growth and the services of the financial system are linked through the following equation:

$$g_t = A_{t-1}\theta_{t-1}s_{t-1} \quad \text{.....(3.1)}$$

where g_t is the rate of economic growth at time t, A_{t-1} is the social marginal productivity of capital at time t-1, θ_{t-1} is the fraction of savings at time t-1 which actually go into investment at time t-1. The other $(1-\theta_{t-1})$ fraction is lost because of intermediation costs; and s_{t-1} is the savings rate at time t-1. Equation (3.1) says that economic growth is directly influenced by the social marginal productivity of capital, the savings rate less the cost of market frictions and the savings rate. It is expected that $g_{tAt-1} >0$ (<0),[8] $g_{t\theta t-1}>0$ (<0) and $g_{tst-1}>0$ (<0) implying that financial development (underdevelopment) positively (negatively) affects the social marginal productivity of capital, the fraction of savings which go into investment and the savings rate, enhancing (retarding) economic growth. Bellow, the paper explain how the functions of the financial system positively affect these variables, thereby enhancing economic growth.

[8] g_{tAt-1} is the partial derivative of g_t with respect to A_{t-1}. All the others are read similarly.

3.2 Functions of the financial system:

3.2.1 Savings Mobilization (Resource Pooling).

Transactions costs, coupled with uncertainty, undermine the possibility of lenders and qualified borrowers meeting for business. This is further compounded by the fact that lenders do not want to commit their savings for long, given that uncertainty is not observable and therefore not directly insurable.[9] On the other hand, investment projects may have a long gestation period, which means borrowers may have to borrow long. This creates incompleteness in the financial markets which is further compounded by the absence of well-functioning markets in the primary securities issueable by smaller-to-medium companies and households.[10]

This Market incompleteness results in falling savings ($s_{t-1\downarrow}$) and autarkic economy which, coupled with non-convexity of some investment projects and uncertainty, shrinks the level and efficiency of investment ($A_{t-1\downarrow}$) and, by implication, economic growth. Financial systems, emerge as market makers bringing potential lenders and borrowers together, thereby lowering relevant information costs and inducing more savings ($s_{t-1\uparrow}$). Financial systems attract funds from disparate savers-savings mobilization or resource pooling – raising ($s_{t-1\uparrow}$) which increases financial depth in the financial system. Savings mobilization is a good indicator of the provision of the intermediary services whose importance for economic growth has

[9] See Diamond and Dybvig (1983).
[10] Large companies are not limited by this friction because they can issue securities directly.

long been emphasized in the literature; Bagehot (1873), Schumpeter (1911), King and Levine (1993b) and Greenwood and Smith (1997) among others.

The function of savings mobilization provides households and firms with liquidity, facilitating the purchase of firm ownership thereby diversifying away risk and earning higher returns. This raises ($\theta_{t-1}\uparrow$), and by implication, facilitating economic growth. Resource pooling increases savings ($s_{t-1}\uparrow$) which in turn increases the volume of investment and market expansion and, by implication, economic growth (Bencivenga and Smith (1992), Jappelli and Pagano (1994). In stock markets, stock market capitalization is related with ability to pool and diversify risk. The effect on economic growth is through savings ($s_{t-1}\uparrow$) via investment to economic growth. However, there are studies which cast doubt on whether resource pooling enhances economic growth. Jappelli and Pagano (1994) suggest that, generally, financial deepening on the side of consumer credit is unlikely to increase credit and hence is unlikely to promote economic growth . The null hypothesis motivating the test is that resource pooling function of the financial system does not cause economic growth. To be consistent with theory, the converse is also tested.

3.2.2 Transfer of Economic Resources.

After resource pooling, well-developed financial systems facilitate their movement and deployment to borrowers, by extending credit across time, among households and industries, in such a way that capital moves to its most productive use. This role of financial sector development in resource movement was recognized by Bagehot (1873) and by Gurley and

Shaw (1955) who maintain that "anything the financial sector can do to improve allocation to investment can result in more output." Financial systems achieve this by first engaging in information production on borrowers and then monitoring them, ensuring the efficient allocation, raising ($A_{t-1}\uparrow$) and spurring economic growth. Without the services of the financial systems, high information costs could keep capital from flowing to its highest valued use thereby lowering ($A_{t-1}\downarrow$) and slowing economic growth. The function of credit extension to the private sector by the financial system indicates asset distribution. Better screening ex-ante followed by monitoring investors and then auditing the projects ex-post by bank intermediaries may improve the marginal productivity of capital (Goldsmith (1969), Greenwood and Jovanovic (1990) and DeGregorio and Guidotti (1995)) thereby raising ($A_{t-1}\uparrow$) and economic growth. Financial systems can also design financial contracts to improve corporate control which tend to promote faster capital accumulation and economic growth, by improving the allocation of capital, (Bencivenga and Smith (1991). The null hypothesis and its converse to be tested is that efficient asset distribution function of the financial system does not cause economic growth.

3.2.3 Liquidity Risk Mitigation.

In a world of uncertainty, in which high-return investment projects have a long-gestation period, savers face the risk that, if they put their savings into these high-return long-gestation period projects, they may not be able to convert these assets into a medium of exchange. Literature linking financial systems and the mitigation of liquidity risk abounds. Hicks (1969)

argues that it was capital market improvements- bond markets, equity markets and current account markets- which mitigated liquidity risk and caused industrial revolution in England. Diamond and Dybvig (1983) develop a model in which banks emerge to mitigate liquidity risk. Recently, Levine (1991), Bencivenga, Smith and Starr (1995), among others, have emphasized the role of capital markets in liquidity risk amelioration on economic growth. King and Levine (1993c) maintain that financial systems that ease risk diversification can accelerate technological change and economic growth.

The financial system mitigates risk and accelerates economic growth by providing liquidity and preventing premature liquidation of investment projects and allowing long-term investment ($A_{t-1}\uparrow$) and consequently economic growth. Financial markets, especially liquid capital markets, augment liquidity by providing arenas where it is relatively inexpensive to trade financial instruments, where there is little uncertainty about the timing and settlement of these trades. By facilitating trade, stock markets reduce liquidity risk and transaction costs (raising $\theta_{t-1}\uparrow$) and more investment in the illiquid high-return long-gestation period resulting in more growth. By providing current accounts and choosing an appropriate mixture of liquid and illiquid investments, and through interbank markets, banks provide complete insurance to savers against liquidity risk while simultaneously facilitating long-run investments in long-gestation, high-return projects which are more productive and economic growth enhancing.

However, there are counter-arguments to the effect that liquidity provision by the financial systems may promote economic growth. Greater liquidity availability may have theoretical ambigious effects on saving rates and, by implication, on economic growth. Jappelli and Pagano (1994)

show that, in a model with physical capital externalities, savings rates could fall enough so that growth actually decelerates with greater liquidity. The null hypothesis to be tested is that liquidity provision function of the financial system does not cause economic growth.

3.2.4 Reduction of Transaction Costs.

One of the commonly encountered frictions inhibiting the movement of investment funds, and goods and services, is transactions costs. These are the costs of discovering trading partners, contracting, ascertaining the value of assets and goods and services traded and ex-post auditing of funded projects. All these costs reduce savings which go into investment and reduce ($\theta_{t-1}\downarrow$) and, by implication, economic growth. Gurley and Shaw (1955) recognize the problem of transactions costs and assert "anything the financial system can do to economize on the costs of channeling savings will enhance economic growth." Goldsmith (1969) argues that financial systems promote economic growth by reducing search costs.

Collateral and financial contracts that lower monitoring and enforcement costs reduce impediments to efficient investment (Williamson (1987)). Financial intermediaries can economize on monitoring and enforcement costs by acting as delegated monitors and enforcers, thereby avoiding duplication which minimizes costs and raising ($\theta_{t-1}\uparrow$) and consequently, economic growth. By acting as market makers, financial intermediaries reduce search costs. These measures raise ($\theta_{t-1}\uparrow$) and, by implication, economic growth.

Acquiring information about investment projects and allocating resources involves transactions costs. Financial systems economize on information acquisition. Rajan and Zingales (1998) document this function for companies which are dependent on external finance. The null hypothesis to be tested is that the transaction cost reduction function of the financial system does not cause economic growth.

In summary, theory suggests that the financial system, by pooling resources, transferring these resources, mitigating risk and reducing transactions costs, enhance economic growth. These functions, form the basis of the tests and are, therefore, the hypotheses. Below, the paper discusses the data and the measures of the indicators of all the variables used for testing these hypotheses. Data problems are also raised.

3.3 Data; Financial Development, Economic Growth and Macroeconomic Policy Measures.

3.3.1 Data Sources and Problems.

The data used in this paper is annual time series data. The source of the National Accounts data, Financial data, Government Finance data and International Transactions is the International Monetary Fund's (IMF's) International Financial Statistics Yearbook 1979, 1999 and 2000 issues. The data was validated using the World Bank Tables (various issues). There is some variation which calls for caution in interpreting the results. Data on stock market development comes from Emerging Markets Data Base 1999 Factbook. The sample of countries used is drawn from the International Monetary Fund's 1991-98 World Economic Outlook, May 1999 and the World Bank's World Tables 1984.

One of the problems of doing empirical work is the data problem, particularly data from developing countries. Methods of data collection, accounting and years are different (Ahmad (1994), Heston (1994), Srinivasan (1994)). Because of these problems, all data is measured in domestic currency rather than in a single currency[11] to avoid these problems associated with making comparisons of National Accounts data across different systems. Caution in interpreting the results is called for.

The number of time series observations is roughly 30. For some analysis, for example cointegration, one would be more confident with 80 or more observations.

3.3.2 Measures of Financial Development, Economic Growth and Macroeconomic Policy Indicators.

The measures of financial development, economic growth and macroeconomic policy indicators used in this paper are the same as those used in previous empirical studies.[12] The difference here is the data and methodology. Also, the measures of financial development used in this paper measure the functions of the financial system. This way, it is possible to link theory with empirics and, coupled with the case studies approach, delineate the functions of the financial system appropriate for different countries.

The measures of "the level of financial development" which capture the functions of the financial system, used in this paper include PRIVY, which is given by the ratio of credit to the private sector to GDP. PRIVY is a measure of size and an indicator of asset distribution. The credit extended to the private sector by the financial system involves information production on potential borrowers and therefore reflects the provision of efficient financial services. The assumption underlying this measure is that "financial systems that allocate more credit to the private sector are more interested in researching firms, exerting corporate control, providing risk management services, pooling resources, and facilitating transactions than financial systems that simply channel credit to the government owned enterprises" (Levine (1997) pp705). The definition of PRIVY and the way it has been used in the literature, however, creates a

[11] Usually US dollars.
[12] For financial development and economic growth indicators, see Levine (1997), Levine and Zervos (1998). For macroeconomic policy indicators, see Fischer (1993), Kormendi and Meguire (1985).

problem. Since a significant part of financial development occurs outside the banking system, PRIVY may pose problems as an indicator of financial development because it does not include such developments.

The second measure of financial development indicator is LLY, which is a measure of financial depth and is equal to liquid liabilities of the financial system divided by GDP.[13] The measure assumes that the size of the financial sector is positively associated with the provision of financial services. Liquid liabilities as a measure of financial development raises concerns, however. The presumption of the measure is that the higher the ratio, the more developed the financial system, and vice-versa. Consider a situation in which a nation has monetary overhang, and no alternative assets to hold wealth. This is the case of financial development but with a high ratio. This poses identification problem. Another problem emerges when financial development such as credit or cash cards, result in people holding less money and therefore lower ratios. However, LLY has historical been used as a measure of financial depth and will be included in this study.

The third measure of financial development used in this paper is quasi-liquid liability (QLLY).[14] Quasi-liquid liability is the difference between money M3 and (LL), the sum of currency outside the banking system and current account deposits (M1), divided by GDP. By removing the purely monetary components of the financial size, this measure more accurately captures the size of financial intermediation. QLLY provides long-tern liabilities provide longer-term liabilities appropriate for long-term

[13] Liquid liabilities is the sum of currency, current account deposits, interest-bearing liabilities of banks and non-bank financial intermediaries.

investment.

Because part of financial development occurs outside the banking system, the fourth and fifth indicators of financial development come from stock market development. The fourth measure of financial development is stock market capitalization (MCY) which is the ratio of the value of listed shares to GDP. The assumption is that this ratio is positively associated with the ability to pool and allocate capital and, diversify risk by the stock market. The fifth measure is the Turnover Ratio (TR) which is given by the value of total shares traded divided by market capitalization. The assumption underlying this measure is that higher turnover ratio indicates low transactions costs. This measures liquidity provision by the stock markets.

There are advantages and disadvantages with these measures. They do not cover all aspects of financial development. Financial GDP, as in Neusser and Kugler (1998) would correct this deficiency. However, these measures look at micro-functions of the financial systems which the financial GDP is not able to do. These micro-functions test theoretical predictions spanning various models. Only one measure of economic growth, real per capita GDP, will be used.

Macroeconomic stability is important for economic activity. This paper controls for macroeconomic policies suggested by theory and documented empirically (Fischer (1993), Easterly and Rebelo (1993), Kormendi and Meguire (1985), Grier and Tullock (1989), among others) to affect economic growth. These control variables include monetary policy; producing inflation, fiscal policy; producing budget deficits, and openness to trade.

[14] All the three variables combine stocks and flows. To correct for this arithmetic averages are used. For example, to calculate PRIVY, take the arithmetic average between PRIV at time t and PRIV at time t-1

Inflation (INF) is measured by the rate of change in the GDP deflator,[15] budget deficit (DEF) is given by line 80 of IFS divided by GDP, and openness to trade (OPP) is given by the ratio of the sum of exports (X) and imports (M) to GDP. All variables, with the exception of the rate of change of inflation and the deficit are logged, partly to be consistent with economic theory, and partly for statistical reasons.

In summary, the measures of financial development include PRIVY, LLY, QLLY, MCY and TR while the indicator of economic growth is the growth rate of real per capita GDP. Measures of macroeconomic policy indicators include INF, DEF and OPP.

3.4 Econometric Issues: Unit Roots, Cointegration, Error Correction Models *VAR* and Causality

Recent developments in statistical analysis and applications enable richer and more comprehensive tests for economic relationships. Time series developments appropriate for this research include unit root testing, cointegration testing, error-correction representation, VAR and then causality testing. This subsection gives a brief explanation of these concepts and their appropriateness for this study.

The unit root test, in a time series y_t, is the test of a unit coefficient on a regression of y_t on y_{t-1}. The unit root tests are important because they establish the stationary properties of financial development, economic growth and macroeconomic policy indicators necessary for subsequent cointegration and causality tests. For example, in a bi-variate

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divide by GDP at time t (of course after logging them).

[15] The actual calculation adds one to it and takes the log.

case, if the two processes are I(1) and cointegrated, then there must be Granger causality in at least one direction (Granger (1986)). Unit root tests also enable one to select between I(0) and I(1) series which are useful to know whether innovations to the process have a permanent effect or not. Innovations to I(0) processes have only a temporary while I(1) have a permanent effect. These enable one to know whether innovations to financial development have permanent or temporary effect on economic growth (or vice-versa). Also knowing whether a series is I(0) or I(1) has implications for cointegration and causality tests. If a series $\{y_t\}$ is I(0), then $\{y_t\}$ is a stationary process and conventional causality tests can be performed, validly, in levels VAR framework. If it is I(1), the process is non-stationary and causality can be performed in first difference filter.

Unit root tests will be performed using the Dickey-Fuller (DF, ADF) tests, the Phillips-Perron (PP) test, which is a non-parametric alter- native, and the Weighted Symmetric (WS) test. The reason for performing many test procedures is because there is no uniformly most powerful test for unit roots and partly as a robustness check. The optimal lag lengths of the processes will be chosen by the Akaike Information Croteria (AIC2) described in Pantula et al (1994). One problem with unit root tests is that standard asymptotic distribution theory often does not apply to regressions involving such variables.[16] The DF, ADF and PP, however, pose serious conceptual problems in distinguishing unit root processes from stationary (or near unit root) processes in finite samples. The Weighted Symmetric (WS) provides most powerful tests against the stationary alternative. In the event that the different tests produce conflicting or different conclusions,

more weight will be attached to the Weighted Symmetric (WS) test. With the unit root tests complete, the next step is to perform cointegration tests.

Following Engle and Granger (1987), a m-dimensional purely non-deterministic process $\{y_t\}$ is said to be cointegrated of order one, if each component of $\{y_t\}$ is integrated of order one, and, if there exists r linearly independent m-dimensional vectors β_i $i=1,\ldots\ldots,r\leq m$ such that $\beta_i'X_t$ are stationary. The r is referred to as the dimension of the cointegrating space spanned by $\beta_1,\ldots\ldots\ldots,\beta_r$. Cointegration relationships are tests of no deviation between variables in the long-run. They arise in multivariate macroeconomic models, naturally, with unit root driving processes.[17] To give balance to the cointegration test, two tests will be carried out in this paper and will include the single equation based Engle/Granger (1987) test and the systems based Johansen (1988) test.

The Engle /Granger (1987) test, in a bi-variate system, is a two-step procedure for testing the existence of cointegration and for testing a basis vector. The first step is to choose an arbitrary normalization, by regressing one variable on another. The estimated coefficient vector of this regression then gives the basis of the cointegrating space. In other words, $u_t= y_{1t}-\beta_1^{OLS}-\beta^{OLS}y_{2t}$, with the null hypothesis of no cointegration between $\{y_{1t}\}$ and $\{y_{2t}\}$ being based upon the residuals of this preliminary regression. If they still contain a unit root, then the null hypothesis of no cointegration cannot be rejected. The second stage involves estimating the corresponding error correction model where the estimated residuals

[16] This results in misleading inference to an unwary researcher.
[17] Most macroeconomic variables have unit root driving processes (Campbell and Perron 1991) For the variables in this paper, tests are performed below.

represent the disequilibrium $u_t = \phi u_{t-1} + a_1 \Delta u_{t-1} + .. + a_m \Delta u_{t-m} + \varepsilon_t$. The degree of augmentation was chosen by Akaike Information Criteria (AIC2). The Engle-Granger test has some weaknesses however. It has low power and is not invariant to the choice of the normalized variable and can give conflicting results. It is also a two step procedure allowing errors from the first step to carry over to the second step.

Based on maximum likelihood, and using the theory of canonical correlations, Johansen (1988) and Johansen and Juselius (1990) provide a multivariate alternative approach, which generalizes the Dick-Fuller test and both tests for multiple co-integrating vectors and examine long run causality between variables. Johansen's procedure analyzes the canonical correlation between levels and first differences corrected for lagged differences and deterministic components like a constant term or seasonal dummies. Johansen's procedure circumvents the use of two-step and can estimate and test for the presence of multiple cointegrating vectors. It relies on the relationship between the rank of a matrix and its characteristic roots. The test for the number of characteristic roots that are not significantly different from unity can be obtained from $\lambda_{trace}(r) = -T\sum \ln(1-\lambda_i)$ for testing the null that the number of cointegrating vectors $\leq r$ against a general alternative and $\lambda_{max\,(r,r+1)} = -T \ln(1-\lambda_{r+1})$ for testing the null that the number of cointegrating vectors $= r$ against a specific alternative that it equals r+1; where λ_i are the estimated values of the characteristic roots (eigenvalues) obtained and T is the number of usable observations. Only the trace statistic will be reported.

With the cointegration established, the next step is causality testing. Following Granger (1969), let $\sigma^2(y_{1t}|y_{2t})$ be the variance of $\varepsilon_t(y_{1t}|y_{2t})$ and U_t be all the information in the universe accumulated as of time t and U_t-Y_t denote all this information other than the series $\{y_t\}$, then y_{1t} is said to cause y_{t2}, denoted $y_{1t} \rightarrow y_{2t}$ if $\sigma^2(y_{2t}|\bar{U}) < \sigma^2(y_{2t}|\bar{U}-\tilde{y}_{1t})$; that is if one is better able to predict y_{2t} using all available information[18] than if all information other than y_{1t} had been used. In other words, if the universe consists of only y_{1t} and y_{2t}, then y_{1t} is said to cause y_{2t} if current values of the variable y_{2t} are better predicted by both past values of y_{1t} and y_{2t} than by past values of y_{2t} alone.

The conventional Granger causality tests involve, first, specifying a bi-variate VAR system of order, say, k given by;

$$y_{1t} = \delta_1 + \pi_{11}(L)y_{1t-1} + \pi_{12}(L)y_{2t-1} + \varepsilon_{1t} \quad \text{.....(3.2)}$$

$$y_{2t} = \delta_2 + \pi_{21}(L)y_{1t-1} + \pi_{22}(L)y_{2t-1} + \varepsilon_{2t} \quad \text{.....(3.3)}$$

where δ_1 and δ_2 are drifts and $\pi_{ij}(L)$ are polynomials of order k-1 and L is the lag operator. Under this formulation, the coefficients π_{12} are relevant for testing Granger causality running from y_{2t} to y_{1t} while the coefficients π_{21} are appropriate for Granger causality tests running in the opposite direction. A conventional F-test is used.

If the variables have unit roots, then, reparameterizing the model in error correction (ECM) (Engle and Granger (1987)) is advisable. The representation becomes:

[18] This information is before some point in time.

$$\Delta y_{1t} = \delta_1 + \alpha_{11}(L)\Delta y_{1t-1} + \alpha_{12}(L)\Delta y_{2t-1} + (\pi_{11}(1)-1)y_{1t-1} + \pi_{12}(1)y_{2t-1} + \varepsilon_{1t} \quad \ldots(3.4)$$

$$\Delta y_{2t} = \delta_2 + \alpha_{21}(L)\Delta y_{1t-1} + \alpha_{22}(L)\Delta y_{2t-1} + \pi_{21}(1)y_{1t-1} + (\pi_{22}(1)-1)y_{2t-1} + \varepsilon_{2t} \quad \ldots(3.5)$$

The error correction models (3.4) and (3.5) can be written in compact form as follows:

$$\Delta Y_t = \delta + \Gamma(L)\Delta Y_{t-1} + P_0 Y_{t-1} + \varepsilon_t \quad \ldots(3.6)$$

where $Y_t = (y_{1t}, y_{2t})'$; $\delta = (\delta_1, \delta_2)'$; $\Gamma(L) = \{\alpha_{ij}\}$; $P_0 = (\pi(1) - I_2)$; $\pi(1) = \{\pi_{ij}(1)\}$ and $\varepsilon_t = (\varepsilon_1, \varepsilon_2)'$.

If there are no unit roots, the VAR in (2) and (3) is stable and $\{y_t\}$ is stationary which implies that conventional Granger causality tests are valid in levels VAR framework. If there are unit roots, there is non-stationarity. In this case, causality tests are performed in first differenced VAR framework, if there is no cointegration: otherwise we use ECM. If there is one unit root, then, according to Engle and Granger (1987), this corresponds to cointegration in which y_{1t} and y_{2t} are integrated processes of order 1 where a linear combination $\beta' y_t$ exists and is stationary. In this case, $P_0 = \alpha\beta'$ and the vectors α and β are both different from zero. Equation (6) then can be rewritten as:

$$\Delta Y_t = \delta + \Gamma(L)\Delta Y_{t-1} + \alpha(\beta' Y_{t-1}) + \varepsilon_t \quad \ldots(3.7)$$

If y_{1t} and y_{2t} are I(1) and cointegrated, causality tests can be performed using error correction model (ECM) representation (3.7). If y_{1t} and y_{2t} are cointegrated, error correction modeling allows long-run components of variables to obey equilibrium constraints while short-run components have a flexible dynamic specification.

The idea of error correcting models is that a proportion of the disequilibrium from one period is corrected in the next period. Typical empempirical examples of error correcting behaviour are formulated as the response of one variable, the dependent variable, to shocks of another, the independent variable. Hence the appropriateness of error correction for causality testing. Granger (1988) argues that excluding the error correction term when modeling I(1) processes results in model misspecification and erroneous conclusions. Furthermore, error correction model (ECM) based testing enables researchers to identify the source of causality in the form of short-run dynamics. This is, however, problematic because short-run dynamic based causality could be consistent with business cycles. The econometric techniques discussed above, will be used freely in the remainder of the paper. The next section outlines the methodology.

3.5 Methodology.

The methodology followed in this chapter capitalizes on recent developments in the econometrics of time series. All variables are subjected to appropriate tests before causality tests are performed. First, all variables are tested for unit roots as described above. Once unit root tests are complete, all variables are tested for long-run relationships (co-integration) with each other. This is followed by error correction representation, as outlined above, and then causality tests. Causality tests are performed for

individual countries, emphasizing the micro-channels through which financial development and economic growth affect each other. In other words, the tests focus on providing evidence for micro-channels, articulated by theory, through which finance affects (is affected by) economic growth as opposed to most literature which provides broad correlations.

Causality tests are preferred to correlation tests for the following reasons: (i) The main objective of economic research is to find solutions to guide policies. Causality tests enable policy makers to see which variables cause (are caused by) which variables. (ii) Causality is a time series concept and combined with predictions of endogeneity between financial development and economic growth, allows the tests in VAR framework.

Causality tests on individual countries will be more informative about the relationship because, for each country, the tests are performed under particular characteristics of that country's policy regime under which both financial development and economic growth take place. Other reasons for preferring causality tests on individual countries rather than on aggregated data has to do with the fact that geographical and resource endowments dictate, in part, the nature of companies established and to what extend they depend on external finance. Rajan and Zingales (1998) table 1 pp556, show to what extend different companies rely on external finance. In their conclusion, Rajan and Zingales (1998) state "To the extend that financial development (or the lack thereof) is determined by historical accident or government regulation, the existence of a well-developed market in a certain country represents a source of comparative advantage in industries that are more dependent on external finance."

There are variants regarding causality tests in the literature which raise concerns, however. Sims, Stock and Watson (1990) argue against the idea of differencing I(1) processes before performing Granger causality. On the other hand, Toda and Phillips (1993) cast doubts over the usefulness of causality tests based on levels VAR because of uncertainties over the asymptotics and the potential presence of nuisance parameters in the limit. Because there is no unequivocal agreement on the appropriate causality testing, this chapter will perform the tests in level VARS, first difference VARS and Engle-Granger based dynamic error correction model (ECM) for bank development. For stock market development, dynamic correlation will be used to test for the presence of Granger causality.

For bank development, for which there are enough annual series, for each country the VAR will take the following general form:

$$Gy_t = \delta_1 + \pi_{11}(L)Gy_{t-1} + \pi_{12}(L)FD_{i,t-1} + \pi_{13}(L)CV_{t-1} + \mu_{1t} \quad (3.8)$$

$$FD_{i,t} = \delta_2 + \pi_{21}(L)Gy_{t-1} + \pi_{22}(L)FD_{i,t-1} + \pi_{23}(L)CV_{t-1} + \mu_{2t} \quad (3.9)$$

where Gy is the rate of growth of real per capita DGP, FDi is an indicator of financial development i and CV is a vector of control variables and L is the lag operator. $\pi_{12}(L)$ tests causality running from finanfcial development to economic growth and $\pi_{21}(L)$ reverse causality. As a check for robustness, causality tests are performed with and without controlling for macroeconomic stability and both results are reported[19]. Causality tests will be performed in a general-to-specific approach in that for each test between each financial development and economic growth,

[19] This requires the extension of Granger causality to include more than just two variables.

all control variables will be included but then control variables found to be statistically insignificant are sequentially eliminated to attain parsimony. VAR frameworks as described above will be used.

There is one problem, though, with VAR. The lag length is not known a priori. The lag lengths of all VAR frameworks were chosen by a general-to-specific approach. Starting with a maximum lag length of 4, lags found not to be statistically significant were sequentially eliminated subject to specification testing for autocorrelation in the residuals due to omitted relevant lagged variables. The lag length was, after several experiments, eventually fixed at 2.

There are many factors accounting for economic growth identified in the literature. Macroeconomic policy, spanning monetary policy, fiscal policy and trade policy will be controlled for. Monetary policy produces inflation which has various consequences for economic growth. Inflation (expected) may increase capital accumulation and economic growth (the Mundell-Tobin effect). On the other hand, high and uncertain inflation may both reduce investment and induce capital flight thereby reducing economic growth. Fiscal policy produces budget deficits which crowd out private investment and reduce economic growth. The positive relationship between exports and real GDP implies that countries which are outward oriented tend to grow faster. Tests were performed to establish long-run relationships between macroeconomic policy variables and bank development indicators.[20]

Macroeconomic policy is also controlled for, partly as a robust check and, partly to minimize omitted variable bias and enhance the validity

[20] Most variables were found to show the long-run relationships. Evidence of such tests is available upon request.

of the tests. Levine and Renalt (1992) carried out a sensitivity analysis of previous correlation tests between financial development and economic growth and found that most reported results in the literature became tenuous when macroeconomic policy was taken into account. The role of these policies on economic growth has well been documented.[21] On theoretical grounds, Fry (1989) concludes: "the lessons of experience suggest that theoretical work failed to pinpoint at least two prerequisites for successful financial liberalization; macroeconomic stability and, some aequate prudential supervision of banks."

Part of financial development occurs outside the banking system. To take that into account, stock market development will be included. While including the stock market development does not account for all financial development occurring outside the banking system, it captures part of it. However, data available for stock market development is too short for conventional Granger causality. Instead, causality is tested for by analyzing dynamic correlation. The idea is to use the statistical concept of Granger causality to denote the fact a caused variable is correlated with the lagged values of the driving variable, after controlling for its own past.[22] However, this procedure tests for the presence of Granger causality and should not be interpreted as a causal relationship.

In summary, this paper purports to test the null hypotheses that the functions of the financial system, indicated by financial development measure, do not cause economic growth, against the alternatives that these functions cause economic growth. For stock market development,

[21] See Fischer 1993, Kormendi and Meguire 1985, among others.
[22] This technique for Granger causality tests was used by Carroll and Weil (1994) and, by Attanasio, Picci and Scorcu (2000)

the hypotheses that the lagged values of stock market development do not cause economic growth and their corollaries are tested against the alternatives that they do. The tests are carried out while controlling for macroeconomic policies; which indicate macroeconomic stability. The test procedure, which is time series based on individual countries, involves testing for unit roots first, followed by cointegration, error correction representation and then causality. It follows a general- to-specific approach in which control variables found not to be statistically significant are dropped from the equation.

The next section puts empirical content into theory's predictions outlined in section 3.2.

3.6 Empirical Evidence.

The empirical investigation in this paper addresses two issues: (i) Is there causality between financial development and economic growth. (ii) If so, what is the direction and is it robust to macroeconomic policies? To keep focus, the hypothesis is broken down into hypotheses testing the evidence for micro channels through which theoretical models link finance and the real sector.

Table 3.1 shows non-regression results on the average levels of financial development. The table shows cross-group and cross-country differences for each indicator. For example, for (PRIVY), Switzerland and Japan are the most developed with averages exceeding one, while Burundi, Ghana and Sri Lanka are the least developed with averages less than 0.1. For (LLY), only Switzerland has an average level greater than 1. For (QLLY), there is no country with an average greater than 1. For

stock market development, CMY is greater than 1 in Switzerland, United Kingdom, Malaysia and South Africa. On the other hand, most countries in group C show poorly developed stock markets with Burundi, Ethiopia, Malawi, Tanzania and Zambia showing no stock market development during the sample period.

While there are distinct differences across and within groups, on average, high-income countries lend 65%, as a share of GDP, to the private sector while middle-income countries lend 38% and low-income 14%. For LLY, high-income countries hold 65% in liquidity while middle-income countries hold 46% and low-income countries 28%. For QLLY, on average, high-income countries provide 42% while middle-income countries provide 29% and low-income countries only 11%. For CMY, high-income countries, on average, are 62% capitalized while middle-income countries are 65% capitalized and low-income countries only 18%. For TR, on average, high-income countries trade 52% while middle-income countries 43% and low-income 22%.

These average levels suggest that if financial development causes (is caused by) economic growth, then, other things being equal, group A countries should grow faster than group B countries which, in turn, should grow faster than group C countries.

Table 3.2 shows another non-regression results on average growth rates of real per capita GDP and financial development indicators. Again, there is cross country differences in the growth rates of each indicator. The average growth rates of real per capita GDP is higher in group B (2.6%) than in group A (2.3%) which is, in turn, higher than in group C (1.1%). Overall, faster financial development is experienced more in group B, followed by group A and then group C. The higher growth

rates in stock market than bank development growth indicators are a clear testimonial that financial innovation has been occurring faster outside the banking system.[23] The table shows that the average growth rate in real per capita GDP is higher in group B than it is in group A in spite of the fact that group A has higher average levels of financial development. This could be explained by diminishing returns to financial development. The average slow growth rate in group C can be explained by financial underdevelopment. Another point to note is that the different average levels and growth rates indicators spanning different experiences provide a rich data base for investigating the causal link between financial development and economic growth.

Evidence of unit root tests is available upon request. The tests are applied to both levels and first difference filtered series which include drifts and trend in the Dickey Fuller (DF) test. In most of the cases, the paper fails to reject the null hypothesis of unit roots performed in levels. The paper is, however, able to reject unit roots in first difference tests, suggesting that most of the variables are I(1). A linear trend is also included in the DF tests which elaborates evidence for unit roots. However, there are some variables which show to be already stationary before the difference filter was applied. On the other hand, some variables became stationary only after the second difference filter was applied, suggesting that these variables may be I(2). Otherwise most variables appear to be I(1).

The results that follow may be sensitive to reclassification or omission of some countries (e.g Korea, Malaysia, Thailand). This possibility

[23] Comparison of bank and stock market development growth rates for the same sample period 1989-1999 even shows wider differentials.

has not been investigated. The selection of the countries was influenced by data availability.

Table 3.1 Average Levels of Financial Development.

Group A: High-Income

		Bank			Stock Market	
Countries:		PRIVY	LLY	QLLY	CMY	TR
Australia	1969-98	0.438	0.496	0.351	0.678	0.388
Austria	1969-97	0.756	0.790	0.626	0.133	0.638
Belgium	1969-97	0.370	0.545	0.309	0.465	0.167
Canada	1969-98	0.454	0.477	0.327	0.690	0.455
Denmark	1969-98	0.447	0.521	0.270	0.378	0.445
Finland	1969-98	0.602	0.494	0.347	0.578	0.308
France	1969-97	0.718	0.624	0.355	0.419	0.308
Germany	1969-97	0.867	0.642	0.455	0.314	1.147
Italy	1969-97	0.591	0.760	0.318	0.243	0.453
Japan	1969-98	1.014	0.977	0.651	0.833	0.407
N'lands	1969-97	0.653	0.705	0.473	0.956	0.608
N. Zealand	1969-97	0.376	0.411	0.215	0.453	0.294
Norway	1969-98	0.471	0.564	0.306	0.295	0.561
Spain	1969-97	0.765	0.800	0.506	0.387	0.774
S'tzerland	1969-98	1.360	1.195	0.828	1.273	0.586
U.K	1969-98	0.694	0.614	n/a	1.273	0.387
U.S.A.	1969-98	0.384	0.596	0.428	0.993	0.735

Group B: Middle-Income

Egypt	1969-97	0.228	0.683	0.363	0.154	0.133
Greece	1969-97	0.313	0.558	0.391	0.351	0.372
Honduras	1969-97	0.218	0.269	0.140	n/a	n/a
Indonesia	1969-98	0.271	0.280	0.175	0.209	0.437
Jamaica	1969-97	0.248	0.417	0.269	0.416	0.093
Korea	1969-98	0.476	0.375	0.271	0.417	1.502

Table 3.1 Continued. Average Levels of Financial Development.

		Bank			Stock Market	
Countries		PRIVY	LLY	QLLY	CMY	TR
Malaysia	1969-97	0.510	0.598	0.387	1.954	0.478
Morocco	1969-98	n/a	0.491	0.101	0.185	0.122
Panama	1969-98	0.581	0.416	0.319	n/a	n/a
Philippines	1969-98	0.272	0.308	0.217	0.502	0.281
S. Africa	1969-98	0.562	0.587	0.397	1.797	0.124
Thailand	1969-98	0.488	0.524	0.424	0.532	0.725
		Group C: Low-Income				
Burundi	1969-98	0.080	0.159	0.032	n/a	n/a
Colombia	1969-96	0.173	0.203	0.070	0.148	0.084
Ethiopia	1970-98	0.105	0.306	0.099	n/a	n/a
Ghana	1969-97	0.051	0.188	0.048	0.174	0.023
India	1969-97	0.221	0.385	0.220	0.282	0.408
Kenya	1969-97	0.211	0.340	0.160	0.163	0.029
Malawi	1969-98	0.260	0.419	0.140	n/a	n/a
Pakistan	1969-98	0.146	0.271	0.119	0.161	0.676
Sri Lanka	1969-98	0.065	0.284	0.082	0.155	0.111
Tanzania	1969-97	0.147	0.266	0.121	n/a	n/a
Zambia	1969-97	0.106	0.202	0.092	n/a	n/a

Notes: Data on financial development indicators comes from IMF's yearbooks 1979, 1999 and 2000 issues. The stock market data comes from IFC's Emerging Markets Data Base 1999 and 2000 issues. All the calculations are by the author. PRIVY = credit to the private sector/GDP. LLY=liquid liabilities/GDP. QLLY=(M3 – M1) / GDP CMY=ratio of the value of listed shares (market capitalization) to GDP. TR=value of total shares traded divided by market capitalization. The sample period for stock market data runs from 1989 to 1999. N/A means not available.

Table 3.2 Average Growth Rates.

Group A: High-Income

		Output	Bank			Stock Market	
Countries		RGDP	PRIVY	LLY	QLLY	CMY	TR
Australia	1969-98	2.8	3.5	1.1	0.7	6.8	-2.6
Austria	1969-97	2.6	2.9	1.6	2.3	-1.0	-3.1
Belgium	1969-97	2.4	1.5	1.9	5.7	4.6	11.3
Canada	1969-98	2.0	3.1	1.9	2.4	8.4	3.9
Denmark	1969-98	2.1	-1.3	0.8	0.5	5.2	4.8
Finland	1969-98	3.0	0.7	0.4	-2.9	23.1	2.9
France	1979-97	2.2	3.1	1.5	4.8	9.3	5.7
Germany	1969-97	1.7	1.8	1.4	0.7	5.7	-6.0
Italy	1969-97	2.7	0.1	-1.3	-1.7	11.8	11.7
Japan	1969-98	3.2	1.2	1.6	0.8	-3.6	-4.5
N'lands	1969-97	2.1	4.7	1.9	2.6	9.4	8.7
N. Zealand	1969-97	1.1	6.6	4.8	9.1	4.5	6.4
Norway	1969-98	3.0	2.7	-0.2	-3.1	3.9	5.4
Spain	1969-97	2.5	1.5	-0.2	-0.1	7.7	17.1
S'tzerland	1969-98	1.2	1.5	1.0	3.0	9.7	6.8
U.K.	1969-98	2.1	5.8	3.9	n/a	6.9	1.9
U.S.A	1969-98	2.0	1.5	0.9	2.4	10.2	6.7

Group B: Mddle-Income

Egypt	1969-97	2.1	3.7	2.5	6.6	27.0	16.5
Greece	1969-97	3.2	-1.2	0.0	0.4	29.5	23.7
Honduras	1969-97	1.0	2.8	2.7	4.0	n/a	n/a
Indonesia	1969-98	3.3	8.4	7.5	11.3	28.8	3.1
Jamaica	1969-97	0.1	0.8	1.2	1.5	7.0	-19.1
Korea	1969-98	6.1	3.3	2.8	3.7	1.2	10.6
Malaysia	1969-97	4.3	6.3	3.6	5.3	5.6	6.6
Morocco	1969-98	1.9	n/a	2.2	6.9	27.3	19.4

Table 3.2 Continued. Average Growth Rates.

		RDGP	PRIVY	LLY	QLLY	CMY	TR
Panama	1969-98	1.9	3.6	3.9	5.0	n/a	n/a
Philippines	1969-98	1.1	2.6	3.4	4.9	8.1	6.8
S. Africa	1969-98	-0.1	3.9	1.7	1.7	3.8	21.3
Thailand	1969-98	4.3	7.0	5.0	6.5	0.9	3.1
			Group C: Low-Income				
Burundi	1969-98	0.2	4.9	1.5	7.9	n/a	n/a
Colombia	1969-96	1.5	0.4	0.8	5.7	27.5	-1.3
Ethiopia	1970-98	-2.8	3.9	3.5	5.8	n/a	n/a
Ghana	1969-97	2.8	-0.2	-0.5	0.4	2.8	7.9
India	1969-97	2.7	2.3	2.4	4.9	13.9	0.3
Kenya	1969-97	2.3	1.5	2.2	5.1	7.9	16.1
Malawi	1969-98	-0.6	-0.8	0.4	2.0	n/a	n/a
Pakistan	1969-98	2.9	1.9	1.9	2.5	3.6	36.3
Sri Lanka	1969-98	2.8	2.5	0.8	3.7	3.5	21.1
Tanzania	1969-97	-0.1	-3.5	0.0	3.0	n/a	n/a
Zambia	1969-97	-1.3	-0.3	-0.7	2.1	n/a	n/a

Notes. All variables are as defined above. The sample period for stock market data Is 1989-98 and n/a means not available.

3.6.1 Cointegration.

With the order of integration tests complete, the next tests are cointegration tests which test for the existence of a stable long-run relationship between financial development and economic growth, financial development and macroeconomic policies and, macroeconomic management and economic growth. The null hypothesis is that there is no cointegration among the pairs of variables against the alternative that there is cointegration. Cointegration tests are performed using both single equation (ADF) test for Engle-Granger (1987) test and the multivariate (systems) equations-Johansen (1988) tests. One concern with these tests is the choice of the degree of augumentation. The paper uses the Akaike Information Criteria (AIC2) to choose the optimal lag length. For the Johansen (1988) tests, only the trace statistic, which tests the null hypothesis of zero cointecointegrating vectors i.e. $r=0$ against the alternative that there is at least 1 co-integrating vector i.e. $r\geq 1$ is reported.

Table 3.3 reports the Engle-Granger cointegration tests between real per capita GDP (Gy) and each of the indicators of bank development. The tests were able to detect cointegration relationships between real per capita GDP and at least one indicator of bank development in most countries. For example, countries like Australia, Canada, Germany, Greece, Malaysia, South Africa, Ghana and Tanzania show long-run relationship between Gy and one indicator of bank development. There are two extreme cases in the table. Finland, Italy, Netherlands, Norway, Egypt, Honduras, Indonesia, Korea, Morocco, Philippines, Thailand, Burundi and Ethiopia show no evidence of cointegration at all. Austria, Belgium,

Table 3.3 The Engle-Granger Cointegration Tests.

Variables		Gy, PRIVY		Gy, LLY		Gy, QLLY	
Country.	Group A.	ADF	k	ADF	k	ADF	k
Australia	1969-98	-2.71*	4	-2.14	4	-2.41	4
Austria	1969-97	-2.96**	2	-3.58***	2	-3.74***	2
Belgium	1969-97	-2.51*	2	-2.54*	2	-2.51*	2
Canada	1969-98	-2.66*	3	-2.21	2	-1.94	3
Denmark	1969-98	-3.09**	2	-2.96**	2	-3.49***	2
Finland	1969-98	-1.72	7	-2.12	7	-1.61	7
France	1969-97	-2.77**	2	-3.48***	6	-2.83**	7
Germany	1969-97	-2.04	2	-2.41	3	-2.71*	3
Italy	1969-97	-2.19	3	-1.69	3	-1.79	2
Japan	1969-98	-2.84**	3	-2.01	5	-2.88**	3
Netherlands	1969-97	-2.27	3	-2.41	3	-2.26	3
N. Zealand	1969-97	-2.97**	7	-3.46***	7	-3.49***	7
Norway	1969-98	-1.40	3	-1.87	2	-2.00	3
Switzerland	1969-98	-2.36	3	-2.68	6	-2.58*	6
U. K.	1969-98	-2.47*	7	-3.47***	7	n/a	-
U. S. A.	1969-98	-1.67	2	-3.05**	2	-2.73*	2
	Group B: Middle-Income.						
Egypt	1969-97	-2.06	3	-1.86	3	-1.70	3
Greece	1969-97	-2.49*	3	-2.22	3	-2.14	3
Honduras	1969-97	-2.07	2	-2.04	2	-2.13	2
Indonesia	1969-98	-2.07	3	-2.17	3	-2.05	3
Jamaica	1969-97	-2.48*	7	-2.39	3	-2.60	3
Korea	1969-98	-1.36	2	-1.58	2	-2.12	2
Malaysia	1969-97	-2.62*	3	-2.26	2	-2.27	2
Morocco	1969-98	-1.15	2	-1.65	2	-2.10	7
Panama	1969-98	-2.79**	2	-2.48*	7	-3.37**	7
Philippines	1969-98	-2.08	3	-2.11	3	-2.01	3
S. Africa	1969-98	-2.69*	2	-2.39	2	-2.21	2
Thailand	1969-98	-1.92	3	-2.10	2	-1.66	6

Table 3.3 Continued. The Engle-Granger Cointegration Tests.

Group C: Low-Income.

Variables		Gy,PRIVY		Gy,LLY		Gy,QLLY	
		ADF	k	ADF	k	ADF	k
Burundi	1969-98	-2.16	7	-2.34	2	-1.43	2
Colombia	1969-96	-2.52*	7	-2.41	2	-2.90**	2
Ethiopia	1969-98	-2.17	2	-2.07	2	-2.15	2
Ghana	1969-97	-2.44	6	-2.35	2	-2.69*	2
India	1969-97	-3.56***	5	-3.38**	2	-3.82***	3
Kenya	1969-97	-2.45*	3	-2.38	3	-2.46*	3
Malawi	1969-98	-2.64*	4	-2.92**	2	-2.66*	4
Pakistan	1969-98	-4.70***	2	-5.07***	2	-4.66***	2
Sri Lanka	1969-98	-4.92***	7	-4.86***	7	-1.71	3
Tanzania	1969-97	-2.85**	3	-2.16	4	-2.08	4
Zambia	1969-97	-2.42	4	-2.87**	2	-2.68*	2

Notes: Gy denotes RPGDP. PRIVY, LLY and QLLY are as defined in the text. ADF is the augmented Dickey-Fuller cointegration tests and k is the degree of augmentation. *, ** and *** denote significance at 10%, 5% and 1%.

France, New Zealand, Spain, Panama, India, Malawi and Pakistan show evidence of cointegration between real GDP and all bank development indicators. Overall, more cointegration is detected in high and low-income countries than in middle-income countries. For example, cointegration is detected between Gy and PRIVY in 22 of the 40 countries with 10 countries with 10 countries coming from high-income group, 7 from low-income group and only 5 from middle-income group. There is similar pattern among other pairs of real per capita GDP and other indicators of bank development.

Table 3.4 Johansen Cointegration Test.

Variables		Gy, PRIVY		Gy, LLY		Gy, QLLY	
Country	Group A	λ_{trace}	k	λ_{trace}	k	λ_{trace}	k
Australia	1969-98	20.19**	4	15.59*	0	17.28*	0
Austria	1969-97	15.28	0	20.28*	5	15.43	5
Belgium	1969-97	13.52	0	11.30	0	12.93	0
Canada	1969-98	14.18	0	12.27	5	21.75**	4
Denmark	1969-98	20.73**	5	21.78**	1	23.44***	0
Finland	1969-98	13.43	5	30.59***	4	18.44**	5
France	1969-97	11.64	1	11.29	5	11.78	5
Germany	1969-97	21.30**	1	9.51	3	22.63**	1
Italy	1969-97	27.64***	5	9.60	5	16.24*	4
Japan	1969-98	29.95***	5	10.40	0	17.71*	0
Netherlands	1969-98	18.65**	1	6.70	5	10.17	5
N. Zealand	1969-97	15.92*	0	13.53	0	25.72***	1
Norway	1969-98	23.91***	4	12.69	5	10.28	2
Spain	1969-97	17.55*	5	13.96	5	26.92***	1
Switzerland	1969-98	19.44**	3	23.60***	0	10.09	4
U. K.	1969-98	15.29	5	14.54	1	n/a	-
U. S. A	1969-98	12.74	0	23.25***	1	44.50***	5
		Group B: Middle-Income.					
Egypt	1969-98	19.80**	5	10.57	5	17.25*	4
Greece	1969-98	12.73	5	17.24*	5	21.40**	5
Honduras	1969-97	13.91	5	13.74	0	22.10***	0
Indonesia	1969-98	12.30	3	26.27***	2	15.09	2
Jamaica	1969-97	20.95***	5	25.50***	5	26.27***	5
Korea	1969-98	29.89***	5	19.06**	0	15.95	0
Malaysia	1969-97	14.61	0	15.12	0	11.18	4
Morocco	1969-98	17.97**	3	13.19	1	8.28	1
Panama	1969-98	9.43	5	14.90	5	25.10***	1
Philippines	1969-98	22.46**	5	8.23	5	19.15**	1
S. Africa	1969-98	18.61**	0	17.90**	5	21.62**	0
Thailand	1969-98	9.69	5	19.54**	5	11.43	0

Table 3.4 Continued

Group C: Low-Income.

Country		Gy, PRIVY λ_{trace}	k	Gy, LLY λ_{trace}	k	Gy, QLLY λ_{trace}	k
Burundi	1969-98	19.73**	5	13.20	0	14.38	0
Colombia	1969-96	17.05*	0	27.55***	0	20.97**	0
Ethiopia	1969-98	7.16	4	7.49	0	15.25	0
Ghana	1969-97	21.18**	5	25.93***	4	18.10*	5
India	1969-97	13.82	4	17.79*	2	16.64*	5
Kenya	1969-97	8.66	0	9.09	0	11.57	5
Malawi	1969-98	21.61***	0	18.08**	0	12.99	5
Pakistan	1969-98	53.93***	1	67.49***	1	55.22***	2
Sri Lanka	1969-98	40.57***	0	15.90	5	19.22**	2
Tanzania	1969-98	13.41	2	14.50	5	15.51	0
Zambia	1969-97	17.71*	0	17.58*	0	20.53**	5

Notes. The variable definition is the same as in the text except that Gy = RPGDp. *, ** and *** means significant at 10%, 5% and 1% respectively. The critical values were taken from Johansen and Juselius (1990).

Table 3.4 presents the results of Johansen tests.[24] One problem with the Johansen test is that the leg length is not known a priori. It was chosen by the Akaike Information Criteria (AIC2). According to the Johansen trace test, the null hypothesis of no co-integration between PRIVY and Gy is rejected in 23 of the 40 countries while that between LLY and Gy is rejected in 18 of the 40 countries. The Johansen test does not detect co-integration between at least one indicator of bank development and Gy in the following countries; Belgium, France, United Kingdom, Malaysia, Ethiopia, Kenya and Tanzania.

[24] Although not reported here, the tests also include macroeconomic policy variables.

Overall, only one country shows no evidence of cointegration between the three measures of bank development and Gy-Ethiopia. It is possible that such a relationship exists but that the tests may fail to detect it. It is also possible that the tests may detect a relationship when one does not exist. It is necessary to exercise caution when interpreting these results.

3.6.2 Causality: Bank Development.

The null hypotheses are that the functions of banks in (i) efficient distribution of assets (ii) liquidity provision and (iii) long-term investment provision do not cause economic growth. These hypotheses are tested against the alternatives that they cause economic growth. Reverse causality is also tested.

Table 3.5 presents evidence of the causal relationship between bank development and economic growth in levels VAR. The hypotheses are read as follows; $H_{PRIVY \neq Gy}$ means PRIVY does not cause real per capita GDP (Gy) growth and $H_{Gy \neq PRIVY}$ is its converse. All the remaining hypo- theses are read similarly. Bellow each hypothesis are a set of two numbers. The first set of numbers is the test statistic from the baseline regression and the second set of numbers (in parentheses) is the test statistic of the same hypothesis after controlling for macroeconomic stability. Looking at the baseline statistics for each country for different hypotheses, evidence suggests that the functions of bank intermediaries and Gy are independent in 9 of the 40 countries under study. These include Belgium, Netherlands, New Zealand, United Kingdom, United States of America, Jamaica,

Korea, Philippines and Burundi. The second set of test statistics (which include control variables) for the same 9 countries show no change, in terms of decision criteria, for Belgium and the Philippines. In the other 7 countries, causality is now detected in at least one direction.

For these countries and others such as Finland, Spain, Panama, Ethiopia and Pakistan, evidence suggests that causality is enhanced by macroeconomic policy. The baseline regression test statistic detects causality between PRIVY and Gy in Germany, Italy, Japan, Colombia, Pakistan and Sri Lanka. Of these countries, controlling for macroeconomic stability attenuates causality only in Germany and Colombia while retaining causality in Italy, Japan, Pakistan and Sri Lanka. These findings support Patrick (1966) for Pakistan and Sri Lanka and contradict him for Italy and Japan. For those countries in which causality is retained, evidence lends support for Schumpeter (1911), Goldsmith (1969), Greenwood and Jovanovic (1990), and, Bencivenga and Smith (1991). Controlling for macroeconomic policy enhances causality in Finland, New Zealand, Spain USA, Greece, Korea, Ethiopia and India. For these countries, it seems causality is driven by macroeconomic management. Reverse causality between Gy and PRIVY seems encouraging. The baseline test detects causality in Austria, Canada, France, Germany, Norway, Spain, Switzerland, Malaysia, Morocco, Malawi, Sri Lanka and Zambia. Macroeconomic policy attenuates causality in all but France, Norway, Spain, Switzerland and Morocco while enhancing it in Finland, Italy, Japan, UK, USA, Jamaica, Korea, Panama, Pakistan and Tanzania. For France, Norway, Spain, Switzerland and Morocco, evidence suggests that economic growth leads bank development. This finding seems to be consistent with Patrick (1966).

Table 3.5 Granger Causality: Levels VAR

Country	$H_{PRIVY \neq Gy}$		$H_{LLY \neq Gy}$		$H_{QLLY \neq Gy}$		$H_{Gy \neq PRIVY}$		$H_{Gy \neq LLY}$		$H_{Gy \Rightarrow QLLY}$	
Australia	0.09	(0.99)	0.07	(1.10)	0.09	(0.92)	1.76	(1.57)	2.38	(0.61)	2.79*	(0.85)
Austria	0.60	(1.10)	7.15***	(2.34)	2.01	(1.25)	4.10**	(1.74)	0.40	(1.60)	3.45*	(1.50)
Belgium	1.04	(1.52)	0.79	(1.13)	0.83	(1.31)	0.32	(0.73)	0.84	(1.18)	0.10	(0.62)
Canada	0.29	(2.17)	1.21	(2.40)	1.01	(2.76)*	3.64**	(0.94)	0.95	(1.37)	2.79*	(0.91)
Denmark	0.23	(1.46)	2.53	(1.21)	1.11	(1.02)	1.16	(2.42)	5.34**	(1.58)	2.38	(1.10)
Finland	1.20	(7.25)***	1.00	(6.60)***	0.14	(6.78)***	2.55	(4.41)**	2.66*	(2.00)	0.42	(0.61)
France	2.35	(1.41)	0.05	(0.50)	1.56	(0.94)	3.68**	(10.19)***	1.23	(0.93)	3.70**	(0.98)
Germany	3.43**	(1.67)	5.01**	(1.50)	2.84*	(0.94)	4.24**	(1.84)	1.37	(2.30)	0.53	(3.92)**
Italy	4.86**	(3.00)*	4.01**	(3.32)*	1.79	(2.56)	1.34	(3.00)*	4.11**	(7.22)***	3.60**	(1.49)
Japan	4.55**	(5.24)**	5.75***	(4.77)**	4.49**	(7.43)***	2.42	(4.39)**	7.53***	(3.38)*	2.60*	(3.02)*
Netherlands	0.89	(0.75)	0.74	(0.86)	2.26	(2.26)	1.54	(1.36)	1.52	(1.41)	2.24	(1.08)
N. Zealand	2.14	(2.90)*	0.69	(1.62)	0.38	(1.47)	0.14	(0.48)	0.45	(1.18)	1.88	(2.27)
Norway	0.87	(1.26)	1.92	(1.56)	0.80	(1.26)	4.29**	(5.49)**	1.89	(3.85)**	0.47	(1.89)
Spain	1.70	(3.50)**	1.29	(2.70)*	0.11	(2.93)*	7.37***	(2.84)*	2.06	(0.99)	0.72	(0.55)
Switzerland	1.56	(1.88)	0.99	(1.16)	3.92**	(1.92)	5.77***	(4.78)**	3.81*	(1.58)	4.19**	(3.91)**
U. K.	0.61	(0.74)	0.93	(0.76)	n/a	n/a	1.31	(1.31)	1.01	(2.32)	n/a	n/a
U. S. A.	0.35	(3.18)*	1.63	(7.61)***	2.05	(2.90)*	1.63	(2.94)*	0.42	(1.62)	1.90	(5.64)***
Group B: Middle-Income.												
Egypt	0.37	(1.01)	0.15	(1.47)	0.40	(1.88)	1.89	(1.89)	9.30***	(5.04)**	2.48	(1.01)
Greece	0.63	(3.65)**	4.86**	(4.85)**	4.74**	(4.13)**	0.99	(1.00)	0.07	(0.85)	1.38	(1.34)
Honduras	1.93	(0.86)	2.00	(0.78)	1.13	(0.67)	1.23	(1.58)	2.78*	(1.47)	3.06*	(0.95)
Indonesia	0.24	(1.01)	1.28	(1.10)	1.05	(1.04)	1.86	(0.73)	2.98*	(2.19)	4.37**	(6.82)***
Jamaica	0.16	(0.76)	2.36	(1.03)	0.86	(0.66)	0.90	(3.78)**	0.75	(5.22)**	1.51	(6.82)***
Korea	1.35	(3.66)**	1.97	(3.93)**	0.43	(3.35)*	2.20	(2.59)*	1.24	(1.22)	0.48	(1.59)
Malaysia	0.29	(0.93)	1.14	(1.89)	0.10	(1.23)	2.25	(2.20)	3.37*	(4.15)**	0.87	(1.50)
Morocco	0.91	(1.90)	1.13	(2.42)	0.24	(1.50)	3.85**	(3.44)*	1.43	(1.12)	2.99*	(1.06)
Panama	0.08	(0.90)	3.60**	(1.00)	1.12	(0.77)	0.66	(2.94)*	0.42	(0.75)	0.71	(3.46)**
Philippines	1.13	(1.82)	0.87	(2.27)	2.00	(2.00)	2.48	(1.68)	0.51	(2.18)	2.50	(2.19)
S. Africa	1.47	(0.73)	0.91	(0.57)	0.61	(0.75)	0.51	(1.79)	0.96	(2.04)	5.17**	(1.87)
Thailand	0.78	(1.46)	3.55**	(1.22)	0.40	(2.74)*	1.73	(2.10)	1.19	(0.55)	0.44	(1.63)
Group C : Low-Income.												
Burundi	1.19	(1.55)	0.31	(1.31)	1.19	(1.75)	2.19	(1.10)	2.14	(3.01)*	2.06	(1.27)
Colombia	3.19*	(2.36)	4.58**	(2.00)	0.06	(0.35)	2.29	(1.95)	1.58	(2.28)	1.91	(3.02)*
Ethiopia	1.41	(3.50)**	2.40	(3.99)**	0.28	(2.06)	2.05	(2.11)	6.08***	(2.10)	2.28	(1.15)

Table 3.5continued. Granger Causality: Levels VAR,

Countries	$H_{PRIVY \neq Gy}$		$H_{LLY \neq Gy}$		$H_{QLLY \neq Gy}$		$H_{GY \neq PRIVY}$		$H_{Gy \neq LLY}$		$H_{Gy \neq QLLY}$	
Ghana	1.64	(1.05)	0.19	(1.23)	0.54	(0.90)	0.08	(1.09)	3.41**	(6.56)***	0.76	(1.63)
India	1.76	(6.00)***	3.70**	(5.97)***	0.78	(7.14)***	0.91	(2.42)	1.12	(3.75)**	1.27	(1.10)
Kenya	0.02	(2.03)	1.71	(2.11)	2.18	(2.48)	0.83	(1.78)	0.92	(0.31)	4.83**	(1.92)
Malawi	1.25	(1.39)	0.07	(1.32)	1.49	(0.92)	4.69**	(1.95)	2.04	(1.63)	2.67*	(1.61)
Pakistan	22.10***	(15.45)***	9.64***	(7.06)***	1.38	(4.17)**	0.21	(6.56)***	0.76	(4.15)**	4.47**	(2.15)
Sri Lanka	5.14**	(3.16)*	5.60**	(5.11)**	1.23	(4.36)**	3.10*	(1.59)	2.34	(3.15)*	2.11	(2.41)
Tanzania	0.37	(1.74)	0.14	(1.67)	0.58	(1.77)	0.82	(5.20)*	6.91***	(4.05)**	1.15	(2.47)
Zambia	1.96	(1.54)	1.09	(1.24)	0.54	(0.68)	5.47**	(1.77)	2.14	(0.92)	11.22***	(5.36)**

Notes. The variables PRIVY, LLY, QLLY are as defined in the text. *, **, *** denote significance at 10%, 5% and 1% respectively. The lag length for the VAR is 2. The critical values are based on the F(m, n-2k-2) where m is the lag length, n is the number of observations and k is the number of estimated parameters

Considering LLY, the baseline test detects causality in Germany, Italy, Japan, Greece, Panama, Thailand, Colombia, India, Pakistan and Sri Lanka while macroeconomic policy attenuates it in all except Italy, Japan, Greece, India, Pakistan and Sri Lanka and enhancing it in Finland, Spain, USA, Korea and Ethiopia. For Italy, Japan, Greece, India, Pakistan and Sri Lanka, bank development leads economic growth. The baseline test detects reverse causality in Denmark, Finland, Italy, Japan, Switzerland, Egypt, Honduras, Indonesia, Malaysia, Ethiopia, Ghana and Tanzania. Macroeconomic policy attenuates it in all except in Italy, Japan, Egypt, Malaysia, Ghana and Tanzania. Bi-directional causality is detected in Italy and Japan.

For QLLY, the baseline regression detects causality in Germany, Japan, Switzerland and Greece. Controlling for macroeconomic management retains causality only in Japan and Greece while enhancing it in Canada, Finland,

Netherlands, Spain, USA, Korea, Thailand, India, Pakistan and Sri Lanka. For Japan and Greece evidence lends support for, among others, Sir John Hicks (1969), Levine (1991) Bencivenga, Smith and Starr (1996). Only in Japan is there bi-directional causality.

Overall, for the three functions of bank intermediaries, there is little evidence of causality running either or both ways. In some cases, evidence becomes tenuous and in other cases enhanced once macroeconomic policy is controlled for.

Table 3.6 reports evidence of causality in first difference VAR. For PRIVY, the baseline tests detect causality in Austria, Italy, Japan, Switzerland, South Africa, India, Pakistan and Sri Lanka. After controlling for macroeconomic management, causality is retained only in Italy, Japan, India, Pakistan and Sri Lanka and is enhanced in Finland and USA. The baseline tests detect reverse causality running from economic growth to PRIVY in Austria, Denmark, France, Germany, Japan, New Zealand, Norway, Spain, Egypt, Korea, Malaysia, Philippines, Thailand, Ethiopia, Malawi, Pakistan and Tanzania. After controlling for macroeconomic policy, causality is attenuated in all except France, Japan, Norway, Spain, Thailand, Pakistan and Tanzania and enhanced in Italy and Switzerland. Bi-directional causality is detected in Japan and Pakistan.

Overall, there is little evidence of causality and the results seem to be driven by macroeconomic management. In the few cases where the relationship is robust to macroeconomic policy, there is more evidence in support of reverse causality running from Gy to PRIVY. For LLY, the baseline tests detect causality in Austria, Denmark, Italy, Japan, USA, Egypt, Greece, Malaysia, Panama, Colombia, Ethiopia, India, Pakistan and Sri

Table 3.6: Granger Causality Tests: First Difference VARS.

Country	$H_{PRIVY \not\Rightarrow Gy}$		$H_{LLY \not\Rightarrow Gy}$		$H_{QLLY \not\Rightarrow Gy}$		$H_{Gy \not\Rightarrow PRIVY}$		$H_{Gy \not\Rightarrow LLY}$		$H_{Gy \not\Rightarrow QLLLY}$	
Australia	0.43	(0.80)	0.15	(0.77)	0.15	(0.81)	1.38	(0.32)	0.54	(0.33)	0.74	(0.44)
Austria	2.61*	(1.43)	7.7***	(3.74)**	3.45**	(2.35)	4.23**	(1.81)	3.93**	(1.44)	2.38	(0.97)
Belgium	0.57	(1.08)	0.60	(1.17)	0.60	(1.10)	1.75	(0.81)	0.53	(0.40)	1.62	(0.54)
Canada	1.81	(2.18)	0.23	(1.70)	1.36	(1.58)	2.07	(0.68)	1.48	(1.20)	1.42	(1.38)
Denmark	0.60	(0.49)	3.72**	(0.82)	1.92	(0.74)	3.73**	(1.15)	2.47	(1.97)	1.32	(1.86)
Finland	0.24	(5.64)***	0.22	(4.26)**	0.09	(4.92)**	1.85	(2.16)	0.14	(0.95)	0.06	(0.87)
France	1.08	(1.38)	0.36	(1.15)	0.24	(1.07)	3.08*	(5.73)***	0.75	(2.08)	0.99	(1.84)
Germany	1.80	(0.68)	1.65	(0.61)	0.85	(0.44)	5.39***	(1.23)	6.90***	(2.74)*	9.58***	(3.73)**
Italy	7.78***	(2.86)*	5.81***	(3.26)*	1.12	(2.89)*	1.05	(3.99)**	3.54**	(8.61)***	1.01	(1.35)
Japan	3.25*	(9.29)***	5.56***	(6.02)***	38.57***	(17.75)***	3.59*	(2.83)*	4.52**	(1.51)	6.23***	(8.72)***
Netherlands	0.96	(0.88)	0.07	(1.21)	2.03	(1.51)	0.53	(1.26)	1.09	(0.87)	1.65	(0.95)
N.Zealand	1.30	(1.70)	0.24	(1.27)	0.34	(1.28)	2.82*	(1.33)	0.37	(2.19)	0.08	(1.52)
Norway	0.22	(0.81)	2.25	(1.48)	0.09	(0.81)	2.64*	(3.02)*	1.22	(2.37)	0.08	(2.10)
Spain	0.55	(1.09)	2.30	(1.30)	0.01	(1.31)	10.56***	(3.14)*	0.05	(0.21)	0.68	(1.32)
S'tzerland	2.92*	(1.24)	0.01	(0.66)	1.40	(1.11)	1.19	(5.76)***	0.16	(0.44)	0.03	(5.17)**
U. K.	1.15	(1.99)	1.21	(2.81)*	n/a	n/a	1.52	(1.82)	1.76	(2.27)	n/a	n/a
U. S. A.	0.21	(2.81)*	5.68***	(6.23)***	2.68*	(2.63)*	2.42	(2.16)	1.41	(1.63)	1.54	(4.94)**
Group B: Middle-Income:												
Egypt	2.23	(1.51)	3.46**	(1.40)	4.54**	(1.66)	2.76*	(1.17)	3.20*	(1.63)	4.80**	(1.96)
Greece	0.49	(1.76)	3.45**	(3.25)*	3.60**	(2.51)	0.44	(0.36)	0.00	(0.84)	0.14	(0.74)
Honduras	0.68	(0.49)	0.52	(0.45)	0.78	(0.58)	0.81	(0.35)	1.74	(0.95)	1.76	(0.96)
Indonesia	0.97	(0.42)	1.82	(0.70)	1.24	(0.43)	1.05	(0.76)	3.22*	(1.10)	4.53**	(1.59)
Jamaica	0.48	(1.28)	2.20	(1.35)	0.60	(0.95)	0.07	(0.25)	1.37	(1.18)	1.56	(1.49)
Korea	0.10	(1.83)	1.34	(1.92)	0.07	(1.55)	5.52**	(2.49)	1.06	(1.08)	0.38	(2.55)*
Malaysia	0.92	(1.08)	2.77*	(2.32)	1.80	(1.71)	7.89***	(2.37)	6.06***	(5.16)**	0.20	(0.59)
Morocco	1.39	(1.59)	1.31	(0.98)	0.60	(1.04)	2.43	(2.24)	1.27	(1.36)	1.67	(0.69)
Panama	0.60	(1.97)	4.65**	(1.89)	1.33	(1.84)	2.08	(1.60)	0.02	(1.70)	4.33**	(2.30)
Philippin.	0.92	(0.92)	0.49	(1.03)	0.60	(0.85)	3.10*	(1.27)	0.80	(1.31)	0.27	(1.36)
S. Africa	3.44*	(2.26)	0.02	(1.58)	1.58	(1.39)	0.28	(1.65)	0.72	(0.91)	0.12	(0.13)
Thailand	1.99	(1.53)	1.77	(2.84)*	3.11*	(1.92)	7.82***	(3.55)**	5.92***	(4.85)**	0.54	(1.31)
Group C: Low-Income.												
Burundi	1.01	(1.64)	0.85	(1.24)	0.44	(1.48)	1.67	(0.82)	0.10	(1.25)	2.23	(1.43)
Colombia	1.91	(2.56)	8.00***	(1.98)	0.07	(2.03)	1.15	(0.93)	2.16	(1.37)	1.31	(1.83)
Ethiopia	0.35	(2.48)	3.56**	(3.84)**	1.26	(2.53)	2.62*	(1.37)	0.02	(1.11)	1.23	(0.33)

Table 3.6 continued. Granger Causality: First Difference VARS.

Countries	$H_{PRIVY \neq Gy}$		$H_{LLY \neq Gy}$		$H_{QLLY \neq Gy}$		$H_{Gy \neq PRIVY}$		$H_{Gy \neq LLY}$		$H_{Gy \neq QLLY}$	
Ghana	1.45	(0.88)	0.09	(0.81)	1.48	(0.65)	0.20	(0.64)	8.58***	(3.85)*	0.10	(0.10)
India	7.61***	(6.44)***	6.75***	(10.81)***	0.81	(4.25)**	1.23	(1.54)	2.99*	(1.90)	0.51	(0.91)
Kenya	0.02	(0.21)	0.58	(0.33)	2.68*	(0.83)	0.68	(1.19)	1.45	(0.55)	1.34	(0.39)
Malawi	0.63	(0.42)	0.12	(0.36)	1.09	(0.44)	3.23*	(1.77)	0.07	(4.03)**	0.76	(0.45)
Pakistan	26.05***	(13.28)***	17.74***	(9.74)***	1.31	(4.79)**	7.75***	(3.33)*	11.73***	(3.38)*	0.50	(1.07)
Sri Lanka	6.69***	(4.58)**	8.04***	(4.99)	0.67	(4.87)**	0.83	(0.83)	0.54	(0.76)	1.97	(2.15)
Tanzania	0.51	(0.97)	0.08	(0.94)	0.55	(1.45)	4.15**	(2.79)*	0.93	(0.98)	1.00	(0.82)
Zambia	1.18	(0.63)	0.65	(0.45)	0.73	(0.47)	1.64	(0.56)	0.25	(1.00)	4.90**	(4.22)**

Notes. All variable definitions are as in table5 above. * , ** , *** denote significance at 10%, 5% and 1% respectively.

Lanka. Macroeconomic policy also enhances causality in Finland, UK and Thailand. The baseline regression tests detect causality running from Gy to LLY in Germany, Italy, Japan, Egypt, Indonesia, Malaysia, Thailand, Ghana, India and Pakistan. Of these, only Germany, Italy, Malaysia, Thailand, Ghana and Pakistan are robust to macroeconomic policy. Macroeconomic policy enhances causality in Malawi. Cases of bi-directional causality is detected and is particularly strong in Japan, Italy and Pakistan.

For QLLY, the baseline regression tests detect causality in Austria, Japan, USA, Egypt, Greece, Thailand and Kenya of which Japan and the USA are robust. Causality is enhanced in Finland, Italy, Pakistan and Sri Lanka. Reverse causality is detected in Germany, Japan, Egypt, Indonesia, Panama and Zambia with only Germany, Japan and Zambia remaining robust. Causality is enhanced in Switzerland, USA and Korea. In summary, for QLLY, there is more evidence supporting the argument that economic growth causes financial development.

In first difference filter, evidence shows no form of relationship between financial development and economic growth for the following countries; Australia, Belgium, Canada, Netherlands, Honduras, Jamaica, Morocco and Burundi. For these countries, evidence supports the "traditional" view (Stern (1989)).

As pointed out above, determining the order of integration of the variables guides the subsequent causality testing. If it is established that real per capita GDP (Gy), macroeconomic policy and financial development indicators are I(1) and cointegrated, then, according to Engle and Granger's (1987) Representation Theory, there must exist a dynamic adjustment process representing the short-run relationship between Gy and the indicators of financial development and macroeconomic policy. This dynamic adjustment is the error correction model. Granger (1988) argues that when modeling cointegrated I(1) processes, excluding the error correcting term results in model misspecification. On the other hand, including the error correcting term means there are at least two sources of causation in the process-the lagged dynamic terms and the lagged cointegrating vector (error correcting). The test of causality from these sources can be analyzed individually or jointly. In this paper, only the joint significance will be reported and analyzed. Since unit root tests, because of low power, fail to establish the order of integration unequivocally, ECM tests will be performed on all variables whether they show evidence of I(1) or not and the lag lengths are determined by a general-to-specific approach as outlined above.

Table 3.7 reports the results of the ECM causality tests with the Engle-Granger cointegrating vectors. Variable definitions and hypotheses to be tested are as before. However, there is an additional explanatory

variable in each equation in the form of residual-based error-correcting term. As before, the tests are performed with and without controlling for macroeconomic management. The baseline regression detects causality between PRIVY, Gy in Japan, Norway, Honduras, Jamaica, Korea, Morocco, Panama, South Africa, Thailand, India, Pakistan and Sri Lanka. Controlling for macroeconomic policy attenuates causality and reverses the decision in all but Panama, Thailand, India, Pakistan and Sri Lanka while enhancing it in Finland, Italy, Switzerland and USA. For Panama, Thailand, India, Pakistan and Sri Lanka, evidence lends support for Goldsmith (1969) Greenwood and Jovanovic (1990) among others. The baseline regression for reverse causality detects it in Canada, France, Japan, New Zealand, Norway, Spain, Greece, Indonesia, Korea, Malaysia, Panama, Philippines, Thailand, Kenya, Malawi, Pakistan, Sri Lanka and Tanzania. Controlling for macroeconomic management retains causality in Canada, Spain, Korea, Malaysia, Thailand, Pakistan, Sri Lanka and Tanzania and enhances it in Finland, Italy, UK, USA, Ethiopia and India. For Canada, Spain, Korea Malaysia, Thailand, Pakistan, Sri Lanka and Tanzania, evidence lends support for Robinson (1952). Bi-directional causality is detected in Thailand and Sri Lanka.

Coming to LLY, the baseline regression tests detect causality in in Austria, Italy, Japan, USA, Egypt, Indonesia, Morocco, Thailand, Colombia India and Sri Lanka of which only Italy, USA, Egypt, Morocco, Thailand, India and Sri Lanka are robust to macroeconomic policy. Macroeconomic policy also enhances causality in Finland, New Zealand, Switzerland, UK, Greece and Malawi. For Italy, USA, Egypt, Morocco, Thailand, India and Sri Lanka, LLY causes economic growth lending support for Bancivenga and Smith (1991) and Jappelli and Pagano (1994)

among others. For reverse causality, the baseline regression tests detect causality in Australia, Austria, Canada, France, Germany, Italy, Netherlands, Spain, Egypt, Indonesia, Korea, Malaysia Thailand, Ghana, India, Kenya, Pakistan and Sri Lanka. Controlling for macroeconomic policies attenuates causality in all but Austria, Canada, France, Italy, Egypt, Korea, Malaysia, Thailand, Ghana, Pakistan and Sri Lanka, and, enhances causality in Finland, Switzerland, UK, USA Greece and Malawi. Bi-directional causality between Gy and LLY is detected in Austria, Italy, Thailand and Sri Lanka lending support for endogeneity between the two (Patrick (1966), Greenwood and Jovanovic (1990) among others).

For QLLY, the baseline regression detects causality in Austria, Japan, USA, Egypt, Greece, Honduras, Indonesia, Jamaica, Korea, Morocco, Thailand, India, Kenya, Sri Lanka and Tanzania. However, only Austria, Japan, Egypt, Greece, Morocco, Thailand and Sri Lanka are robust to macroeconomic policy which, in turn, enhances causality in New Zealand, Norway, Switzerland, Ghana and Malawi. For Austria, Japan, Egypt, Greece, Morocco, Thailand and Sri Lanka, evidence supports Sir John Hicks (1969), Levine (1991) and, Bancivenga, Smith and Starr (1996) among others. For reverse causality, the baseline regression detects causality in Australia, Austria, Canada, France, Germany, Japan, Netherlands, Spain, USA, Egypt, Greece, Indonesia, Korea, Malaysia, Thailand, India, Kenya, Pakistan, Sri Lanka and Tanzania. Controlling for macroeconomic policy attenuates causality in all but Austria, France, Japan, Netherlands, Spain, Greece, Korea, Malaysia, Thailand and Pakistan while enhancing it in Switzerland and Malawi. Bi-directional causality between growth and long-term financing is detected in Japan, Greece and Thailand.

Table 3.7 ECM Causality Tests with Engle-Granger Cointegrating Vectors.

Country	$H_{PRIVY \not\Rightarrow Gy}$		$H_{LLY \not\Rightarrow Gy}$		$H_{QLLY \not\Rightarrow Gy}$		$H_{Gy \not\Rightarrow PRIVY}$		$H_{Gy \not\Rightarrow LLY}$		$H_{Gy \not\Rightarrow QLLY}$	
Australia	1.82	(0.69)	0.38	(0.50)	0.32	(0.52)	0.93	(0.50)	2.98*	(1.07)	2.72*	(1.05)
Austria	1.60	(0.81)	5.24**	(2.07)	7.38***	(3.18)*	2.22	(0.95)	14.98***	(4.51)**	9.02***	(3.64)**
Belgium	0.20	(0.48)	0.32	(0.71)	0.32	(0.51)	0.02	(0.44)	0.17	(0.67)	0.02	(0.44)
Canada	0.27	(1.85)	0.33	(1.65)	1.39	(1.35)	5.22**	(3.53)**	5.32**	(3.25)*	5.38**	(2.43)
Denmark	0.57	(0.42)	0.22	(1.37)	0.32	(1.31)	1.89	(0.70)	1.11	(1.64)	0.52	(1.37)
Finland	2.35	(4.91)**	0.38	(6.62)***	1.85	(1.67)	1.22	(4.37)**	0.94	(7.04)***	0.05	(1.16)
France	1.23	(1.29)	0.33	(1.03)	0.06	(0.82)	4.89**	(2.28)	10.37***	(3.73)**	12.21***	(3.92)**
Germany	2.27	(0.55)	0.15	(0.63)	1.53	(2.52)	2.32	(0.56)	2.67*	(1.230	4.24**	(1.67)
Italy	0.05	(2.80)*	5.56**	(4.22)**	2.35	(1.67)	1.65	(3.51)**	8.97***	(5.52)**	1.51	(1.44)
Japan	4.68**	(1.29)	8.07***	(1.73)	18.52***	(8.07)***	8.52***	(2.09)	2.06	(0.56)	43.46***	(16.58)***
Netherlands	1.89	(1.32)	0.02	(1.04)	2.21	(1.50)	0.81	(1.04)	3.18*	(1.94)	8.69***	(3.21)*
N. Zealand	2.49	(1.21)	2.17	(2.91)*	1.35	(3.37)*	2.73*	(1.27)	0.04	(2.24)	0.15	(1.94)
Norway	8.30***	(2.55)	0.89	(1.06)	2.40	(2.66)*	8.68***	(2.64)	1.11	(1.11)	0.19	(1.89)
Spain	0.93	(1.65)	0.72	(0.86)	0.65	(0.67)	15.20***	(6.06)***	3.65**	(1.57)	11.37***	(3.11)*
S'tzerland	2.09	(2.66)*	2.12	(3.84)**	0.39	(4.03)**	1.52	(2.46)	0.71	(3.21)*	0.87	(4.29)**
U.K.	0.73	(2.50)	1.38	(3.31)*	n/a	n/a	1.87	(2.94)*	2.29	(3.71)**	n/a	n/a
U.S.A	0.02	(2.89)*	3.20*	(5.84)***	6.03***	(2.51)	1.68	(3.62)**	1.67	(4.99)**	3.44**	(1.83)
Group B: Middle-Income												
Egypt	1.67	(1.38)	8.83***	(3.48)**	10.44***	(3.56)**	1.71	(1.39)	6.81***	(2.82)*	5.17**	(1.95)
Greece	0.53	(1.77)	1.53	(3.17)*	3.36*	(2.68)*	2.70*	(2.48)	1.83	(3.29)*	4.19**	(2.95)*
Hondurus	3.42**	(0.85)	0.68	(0.67)	3.39*	(1.10)	0.74	(0.32)	1.66	(0.890	2.03	(0.81)
Indonesia	0.88	(0.45)	4.19**	(0.98)	5.47**	(1.46)	6.80***	(1.68)	4.38**	(1.02)	4.46**	(1.25)
Jamaica	4.58**	(1.71)	0.42	(0.88)	3.36*	(2.44)	0.26	(0.41)	1.19	(1.14)	1.54	(1.74)
Korea	4.00**	(1.98)	0.74	(0.34)	5.35**	(1.35)	27.57***	(8.24)***	15.89***	(3.35)*	17.52***	(3.83)*
Malaysia	0.86	(0.840	1.84	(1.13)	2.13	(1.62)	13.81***	(3.95)**	13.19***	(3.88)**	14.01***	(4.91)**
Morocco	3.37*	(1.85)	12.53***	(4.68)**	8.30***	(2.95)*	2.40	(1.59)	1.87	(1.65)	0.06	(0.84)
Panama	6.21***	(3.03)*	1.33	(1.37)	2.56	(2.23)	2.76*	(2.02)	0.02	(1.02)	0.99	(1.74)
Philippines	0.98	(0.39)	0.65	(1.21)	1.85	(1.85)	4.69**	(1.12)	0.70	(1.22)	0.42	(1.42)
S. Africa	2.93*	(1.14)	0.41	(0.70)	0.14	(1.21)	0.82	(0.67)	0.69	(0.77)	0.55	(1.33)
Thailand	7.46***	(2.77)*	12.80***	(3.53)**	16.34***	(3.64)**	12.32***	(4.02)**	16.09***	(4.29)**	13.11***	(2.97)*

Table 3.7 Continued.

Group C: Low-Income.

Countries	$H_{PRIVY \neq Gy}$		$H_{LLY \neq Gy}$		$H_{QLLY \neq Gy}$		$H_{Gy \neq PRIVY}$		$H_{Gy \neq LLY}$		$H_{Gy \neq QLLY}$	
Burundi	1.08	(1.10)	1.80	(2.26)	0.96	(2.01)	1.10	(1.10)	0.22	(0.17)	0.12	(2.05)
Colombia	0.17	(0.67)	2.69*	(0.96)	1.66	(2.07)	1.45	(0.97)	0.50	(0.49)	1.55	(2.03)
Ethiopia	0.42	(2.36)	2.02	(1.84)	0.59	(0.88)	2.43	(3.15)*	0.88	(1.24)	0.06	(0.75)
Ghana	1.31	(1.23)	1.30	(2.34)	1.32	(3.03)*	0.28	(0.96)	5.80***	(3.96)**	0.04	(2.49)
India	4.20**	(4.81)**	4.81**	(3.08)*	6.26***	(1.95)	0.29	(3.00)*	3.15*	(2.54)	6.97***	(2.11)
Kenya	0.35	(0.88)	1.02	(1.05)	2.85*	(1.40)	3.68**	(1.73)	6.63***	(2.48)	6.29***	(2.25)
Malawi	0.21	(1.44)	0.02	(2.62)*	1.16	(3.85)**	3.36*	(2.40)	0.04	(2.63)*	0.04	(3.31)*
Pakistan	3.36*	(3.06)*	0.56	(1.32)	1.44	(1.65)	7.90***	(4.60)*	7.98***	(3.45)**	5.11**	(2.73)*
Sri Lanka	7.02***	(3.13)*	7.52***	(4.87)**	9.68***	(4.58)**	8.22***	(3.47)**	7.90***	(5.01)**	2.79*	(2.38)
Tanzania	0.04	(1.98)	0.85	(1.38)	7.12***	(2.27)	3.95**	(3.40)**	0.93	(1.40)	2.97*	(1.29)
Zambia	0.30	(0.58)	1.47	(1.25)	0.70	(0.70)	1.32	(0.81)	0.28	(0.93)	0.26	(0.60)

Notes. All variable definitions as above. *, ** and *** denote significance at 10%, 5% and 1% respectively. All hypotheses as above.

Overall, the causal relationship between real per capita GDP and long-term financing suggests more reverse causality than theory predicts. The overall error-correcting based causality tests tend to do better because of increased sources of causation. Significantly strong cases of causality are detected in Austria, France, Italy, Japan, Egypt, Korea, Malaysia, Morocco and Pakistan. Of particular interest are Thailand and Sri Lanka where bi-directional causality is exceptionally strong.

Table 3.8 provides summary evidence of causality tests between bank development and economic growth in level VAR (table 3.5), first difference VAR (table3.6) and dynamic error-correction model (table 3.7). The table is read as follows: For each country and below each hypothesis, a "no" means no causal relationship and a "yes" followed by a

number confirms a relationship as indicated in the table number. The following emerge from the summary table: with the exception of the error-correction model which detects more cases of causality, the results tend to be consistent across different test procedures. So the results are robust. The table also provides a clear picture of whether there is strong evidence of causal relationship between bank development and economic growth and whether the relationship is uni-directional or bi-directional. Generally, the table provides little evidence in support of the popularly held view that finance leads economic growth. Instead, there is more evidence in support of reverse causality.

Table 3.8 Summary Table of Causality Tests.

Country		PRIVY causes Gy	LLY causes Gy	QLLY causes Gy	Gy causes PRIVY	Gy causes LLY	Gy causes QLLY
Australia	1969-98	no	no	no	no	no	no
Austria	1969-97	no	yes[6,7]	no	no	yes[7]	yes[7]
Belgium	1969-97	no	no	no	no	no	no
Canada	1969-98	no	no	no	yes[7]	yes[7]	no
Denmark	1969-98	no	no	no	no	no	no
Finland	1969-98	no	no	no	no	no	no
France	1969-97	no	no	no	yes[5,6]	yes[7]	yes[7]
Germany	1969-97	no	no	no	no	yes[6]	yes[6]
Italy	1969-97	yes[5,6]	yes[5,6,7]	no	no	yes[5,6,7]	no
Japan	1969-98	yes[5,6]	yes[5,6]	yes[5,6,7]	yes[6]	yes[5]	yes[5,6,7]
Netherlands	1969-97	no	no	no	no	no	yes[7]
New Zealand	1969-97	no	no	no	no	no	no
Norway	1969-98	no	no	no	yes[5,6,7]	no	no
Spain	1969-97	no	no	no	yes[5,6,7]	no	yes[7]
Switzerland	1969-98	no	no	no	yes[5]	no	yes[5]
U. K.	1969-98	no	no	n/a	no	no	n/a
U. S. A.	1969-98	no	yes[5,7]	yes[6]	no	no	no
			Group B: Middle-Income.				
Egypt	1969-97	no	yes[7]	yes[7]	no	yes[5,7]	no
Greece	1969-97	no	yes[5,6]	yes[5,7]	no	no	yes[7]
Honduras	1969-97	no	no	no	no	no	no
Indonesia	1969-98	no	no	no	no	no	yes[5]
Jamaica	1969-97	no	no	no	no	no	no
Korea	1969-98	no	no	no	yes[7]	yes[7]	yes[7]
Malaysia	1969-97	no	no	no	yes[7]	yes[5,6]	yes[7]
Morocco	1969-98	no	yes[7]	yes[7]	yes[7]	no	no
Panama	1969-98	yes[7]	no	no	no	no	no
Philippines	1969-98	no	no	no	no	no	no

Table 3.8 Continued. Summary table of Causality Tests.

Country		PRIVY causes Gy	LLY causes Gy	QLLY causes Gy	Gy causes PRIVY	Gy causes LLY	Gy causes QLLy
South Africa	1969-98	no	no	no	no	no	no
Thailand	1969-98	yes[7]	yes[7]	yes[7]	yes[6,7]	yes[6,7]	yes[7]
		Group C :Low-Income.					
Burundi	1969-98	no	no	no	no	no	no
Colombia	1969-96	no	no	no	no	no	no
Ethiopia	1970-98	no	yes[6]	no	no	no	no
Ghana	1969-97	no	no	no	no	yes[5,6,7]	no
India	1969-97	yes[6,7]	yes[5,6,7]	no	no	no	no
Kenya	1969-97	no	no	no	no	no	no
Malawi	1969-98	no	no	no	no	no	no
Pakistan	1969-98	yes[5,6,7]	yes[5,6]	no	yes[6,7]	yes[6,7]	yes[7]
Sri Lanka	1969-98	yes[5,6,7]	yes[5,6,7]	yes[7]	yes[7]	yes[7]	no
Tanzania	1969-97	no	no	no	yes[6,7]	yes[5]	no
Zambia	1969-97	no	no	no	no	no	yes[5,6]

Notes. The variables PRIVY, LLY, and QLLY are as defined above. 5, 6 and 7 refer to significance in tables 3.5, 3.6 and 3.7 respectively

The table also shows evidence of contradiction on the relationship between the two; highlighting in part, measurement problems. For example, for PRIVY, the most developed countries are Switzerland and Japan while the least developed are Burundi, Ghana and Sri Lanka. While causality between Gy and PRIVY is detected in Japan, none is detected in Switzerland. On the other hand, while no causality is detected in Burundi, there is strong evidence of it in Sri Lanka. This apparent contradiction is also true among other pairs of indicators. This finding contradicts cross-country regression findings which suggest a strong relation-ship between the two (King and Levine (1993c), Levine

(1997)) among others. The table also shows that the results are country specific, casting further doubts on cross-country based results.

3.6.3 Dynamic Correlation: Stock Market Development.

The stock market data series available is not long enough to conduct traditional Granger causality tests. Instead, dynamic correlation is used to test for the presence of Granger causality. Unlike previous studies which carried out instantaneous correlations on averaged cross- country data, this study performs dynamic correlation tests on annual data. The idea of dynamic correlation is to find correlation between current values of the "caused" variable and the lagged values of the "causing" variable after controlling for its own lags. The approach tests for the presence of Granger causality because if current values of real per capita GDP are correlated with lagged values of stock market development indicators, after controlling for their own lags, coupled with the fact that the future does not cause the past, then, the influence must be running from stock market development indicators to economic growth and conversely.

Table 3.9 gives results of dynamic correlation tests. The null hypotheses are that the lagged values of CMY and TR and current values of Gy are not correlated (or that there is no Granger causality between stock market development and economic growth) and vice versa. The table is read as follows: for a pair of variables (Gy,CMY_{t-1}), the correlation is between the current value of real per capita GDP (Gy) and the lagged values of CMY after controlling for Gy's lags. All other pairs of variables are read similarly.

Table 3.9 Dynamic Correlation between RPGDP and Stock Market Development. Sample period 1989-98

Country	Gy_t, CMY_{t-1}	Gy_t, TR_{t-1}	CMY_t, Gy_{t-1}	TR_t, Gy_{t-1}
Australia	0.118	0.458	0.471	0.525
Austria	-0.110	0.275	0.074	0.544
Belgium	0.577	-0.675	0.088	-0.097
Canada	0.539	0.443	0.304	0.426
Denmark	0.761	-0.146	0.283	0.177
Finland	0.238	0.050	0.678	0.307
France	0.220	-0.153	0.116	-0.060
Germany	0.153	-0.323	0.256	-0.199
Italy	0.272	-0.244	0.305	-0.270
Japan	-0.772	-0.108	0.286	-0.266
Netherlands	0.355	0.175	-0.212	-0.426
New Zealand	-0.728	0.346	-0.154	0.187
Norway	0.375	0.380	0.640	0.639
Spain	0.668	0.704	0.007	0.016
Switzerland	-0.244	-0.023	0.728	0.769
U. K.	0.366	0.283	0.484	-0.029
U. S. A.	0.585	0.474	0.254	0.336
	Group B: Middle-Income.			
Egypt	0.419	0.374	0.343	0.371
Greece	0.450	0.289	0.474	0.175
Indonesia	0.307	0.411	0.115	-0.091
Jamaica	-0.045	0.624	0.489	0.110
Korea	-0.252	-0.134	0.010	0.298
Malaysia	-0.092	0.273	0.255	0.071
Morocco	0.022	0.177	-0.337	-0.234
Philippines	-0.570	-0.067	-0.067	0.247

Table 3.9 Continued. Dynamic Correlation.

Country	Gy_t, CMY_{t-1}	Gy_t, TR_{t-1}	CMY_t, Gy_{t-1}	TR_t, Gy_{t-1}
South Africa	-0.190	0.165	-0.212	0.110
Thailand	-0.156	-0.173	0.206	-0.108
	Group C: Low-Income.			
Colombia	0.426	-0.449	0.787	0.215
Ghana	-0.185	-0.243	0.569	0.931
India	0.520	0.186	0.356	-0.289
Kenya	0.034	-0.519	-0.570	-0.047
Pakistan	-0.148	0.458	0.224	-0.526
Sri Lanka	-0.153	0.327	-0.096	0.165

Notes. The following countries have been dropped from the sample period because the do not show stock development; Honduras, Panama, Burundi, Ethiopia, Malawi, Tanzania and Zambia. Gy is real per capita GDP. CMY is the ratio of market capitalization to GDP. TR is the ratio of the traded value to market capitalization.

The table shows little evidence of the presence of Granger causality between stock market development and real per capita GDP growth in contradiction with the cross-country based static correlation which gives strong correlation between the two (Atje and Jovanovic (1993), Levine and Zervos (1998) among others. The table shows significant dynamic correlation, however, between CMY and Gy in Belgium, Canada, Denmark, Japan, New Zealand, Spain USA, Philippines and India with negative dynamic correlation in Japan, New Zealand and Philippines. For Belgium, Canada, Denmark, Spain, USA and India, there is evidence of causality running from resource pooling and risk diversification function of the stock market to economic growth, a popular view lending support for King and Levine (1993c), among others. Reverse causality running from economic

growth to resource pooling and risk diversification is detected in Finland, Norway, Switzerland, Colombia, Ghana and Kenya with negative dynamic correlation in Kenya.

Dynamic correlation between TR (or liquidity provision function of the stock market) and Gy is detected in Belgium, Spain, Jamaica and Kenya with negative correlation in Belgium and Kenya. For Spain and Jamaica, liquidity provision and transaction cost reduction functions of the financial system Granger cause economic growth while in Belgium and Kenya, the functions are counterproductive (Jappelli and Pagano 1994). Reverse causality running from the turnover ratio to real per capita growth is detected in Australia, Austria, Norway Switzerland, Ghana and Pakistan.

3.7 Summary and Conclusion.

The predictions of theory on the relationship between financial development and economic growth are that (i) savings mobilization or resource pooling (ii) resource transfer (iii) liquidity risk mitigation and (iv) transaction cost reduction form channels through which financial development and economic growth affect each other. Using time series data on 40 countries spanning high-income, middle-income and low-income countries, this paper has tested these predictions in a way that is consistent with theory. The tests were performed using modern time series econometric techniques. This included unit root tests, followed by cointegration and then causality tests. These tests found most variables to be I(1) and to be cointegrated. These were performed using single equation Engle-Granger (1987) tests and multivariate Johansen (1988) tests. This

was followed by causality tests which were performed in levels VAR, first difference VAR and dynamic error-correction based on the Engle-Granger co-integration vectors. As a robust check, macroeconomic management was controlled for. Tests also involve reverse causality.

Table 3.8 summarizes the results. It shows that, for countries such as Australia, Belgium, Denmark, Finland, New Zealand, UK, Hondurus, Jamaica, Philippines, South Africa, Burundi, Colombia, Kenya and Malawi, bank development and economic growth are independent. This result is robust across different test procedures. This result, not detected in cross-country regressions is consistent with the traditional view. On the other hand, countries like Italy, Japan, Egypt, Greece, Thailand, India, Pakistan and Sri Lanka, show evidence of causality running either or both ways. Bi-directional causality is detected in Austria, Italy, Egypt, Morocco, Thailand, Pakistan and Sri Lanka supporting endogeneity between the two. For Stock market development, dynamic correlation detects the presence of causality in few cases (table 3.9) contradicting the findings by Atje and Jovanovic (1993), Levine and Zervos (1998) among others who find strong instantaneous correlation between stock market development and economic growth.

Overall, the findings highlight the following: (i) There is "weak" causal relationship between financial development and economic growth leading to the conclusion that there is no unequivocal acceptance of the causal relationship running either or both ways. This finding contradicts cross-country regression findings which suggest a strong relationship between the two (King and Levine (19993c), Levine (1997)) among others. (ii) For the few cases showing causality between the two, there are more cases of reverse causality running from economic growth to

financial development contradicting the popular view that finance leads growth. Also this finding raises questions on theories put forward by, among others, Patrick (1966) who think that finance leads growth during early stages of development and then growth leads as the economy matures. (iii) The results are country specific reflecting the particular characteristics of the policy regimes under which financial development policies are conducted. This finding is consistent with the findings by Jung (1986), Demetriades and Hussein (1996), Neusser and Kugler (1998). This finding also casts further doubts on cross-country studies and how they should be interpreted. (iv) The findings also raise an interesting observation: From well-developed financial systems, some countries show evidence of causality while others do not. The same observation is also true in poorly-developed financial systems.

Future research on this issue might want to investigate to what extent differences in economic policies affect levels of financial development and their effectiveness in promoting economic growth. Future re-search might want to find out exactly what factors complement finance in the growth process. Better measures of the functions of the financial system are needed if the tests are to guide any policy.

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Chapter 4

Different Levels of Financial Development and Economic Growth: GMM Dynamic Panel Approach.

Abstract.

Using stratified data by level of development and three linear estimators: panel data, GMM-First Difference and GMM-SYSTEMS- this paper investigates group comparison by level of development between financial development and economic growth. First, the paper tests for aggregation and rejects the aggregate model in favour of separate regressions. Second, for the separate regressions, evidence shows wide variation across groups raising questions over inferences based on aggregate data and a specific estimator. Stock market development exerts greater impact on economic growth than bank development. Causality is weak between bank development and economic growth but stronger between stock market development and growth. Channels of transmission vary by level of development as well.

4.0 Introduction.

The policy implications of the causal relationship between financial development and economic growth are enormous. While the relationship itself has been extensively researched, competing theoretical models, coupled with inadequate empirical testing leave the question of which drives the other still begging. Development literature is also replete with suggestions of how the two are related (Bagehot 1873, Schumpeter 1911, Goldsmith 1969) among others. The popular view is that finance drives economic growth.

The theoretical literature motivating this study can be divided into traditional development economics literature and endogenous growth literature.

Development economists such as Gurley and Shaw (1955) note that for developed countries, there is highly organized and broad system of financial intermediation designed to facilitate the flow of loanable funds between ultimate savers and investors. They also note that in the early stages of financial development, commercial banking forms the major form of intermediation. Patrick (1966) notes the changing nature of causality between financial development and economic growth; with financial development leading economic growth during early stages of development and the reverse taking place as the economy matures. Goldsmith (1969), McKinnon (1973), Shaw (1973), among others, all view differences in the quantity and quality of services provided by financial institutions as possible explanations as to why countries grow at different rates.

There are also different opinions as to the channels of transmission between financial development and economic growth. Goldsmith (1969) emphasizes efficiency of investment. McKinnon (1973), Shaw (1973) emphasize levels of investment.

Recent developments in the endogenous growth literature have developed models in which the relationship can go either or both ways (Greenwood and Jovanovic (1990), Boyd and Smith (1996), Greenwood and Smith (1997)) among others. Endogenous growth theory removes the standard assumption of diminishing returns which, in turn, allows for the possibility of persistent differences across countries or group of countries The models underscore the importance of the financial system in savings

mobilization and efficient distribution.[1] Generally, the models suggest that, *ceteris paribus*, countries with superior financial systems will allocate resources more efficiently than countries with inferior financial systems. They also suggest mechanisms by which financial development and eco-economic growth affect each other. Greenwood and Jovanovic (1990) and, Bencivenga and Smith (1991), emphasize efficiency of invest ment. Lucas (1988) stresses general human capital.

Empirical literature on the subject matter has spanned at least three different methodologies with startlingly different results. The traditional methodology going back to the seminal work of Goldsmith (1969) and recently King and Levine (1993c), Atje and Jovanovic (1993), DeGregorio and Guidotti (1995), Levine (1997) and Levine and Zervos (1998), among others, is the cross-country methodology in which data for each country on each variable is averaged into a single data point. These data points are then aggregated into a single regression. These cross-country based studies find strong links between financial development and economic g-rowth. One problem of interpreting such results is that developing count-ries are more credit-constrained than their developed counterparts which aggregate data does not distinguish. How are such results to be interpreted? In addition, by aggregating and averaging all data for countries experien-cing different levels of development and economic growth into a single equation one assumes equal impact of financial development on growth for different levels of development which contradicts theoretical predicti-ons. It is correctly predicted that financial development levels differ across countries. The static correlation relationships they establish, based on averaged data, where over time information is averaged out, ignore

[1] Distribution to the highest return uses.

the dynamic relationships between financial development and economic growth, contradicting theoretical predictions. Correlation relationships are consistent with causality running either or both ways. Another methodology used is time

series. Time series, which addresses the dynamic and persistent country/ group- specific issues and theory establishing causality between financial and economic development, has been carried out by Jung (1986), Demetriades and Hussein (1996). The two studies find "weak" causality running in either or both directions; with more evidence supporting causality running from economic growth to financial development.

While these studies address the issue of causality in individual countries, they do not address the question as to whether differences in growth rates are due to differences in financial development. While cross-country broad correlations suggest broad relationships and time series identifies the nature of the relationship in individual countries, neither is sufficient by itself to test the predictions of theory. Theory predicts that, *ceteris paribus,* economies with well-developed financial systems grow faster than those with poorly-developed financial systems and that the relationship changes as economies develop (Patrick 1966). These predictions require tests which compare countries or groups of countries with different levels of financial development and economic growth over time.

Recently, the use of Dynamic Panel Data Estimation has been introduced in the study of the relationship between financial development and economic growth. Specifically, Beck et al (2000) and Levine et al (2000) use the approach in two different papers to conduct cross-country instrumental variables and GMM dynamic estimation. They find a strong link between the exogenous components of financial development and econo-

mic growth and conclude that the relationship is neither due to omitted variables, simultaneity bias nor to reverse causality. They also find that cross-country differences in legal and accounting systems help account for differences in financial development. For channels to growth, they find a positive financial development impact on total factor productivity growth and an ambiguous long-run link between financial development and both physical capital growth and private savings. They find that these are sensitive to estimation techniques and measures of financial intermediary development.

In their work, however, they pool and aggregate data from developing and developed countries into a single regression constraining them to have the same slope coefficients. The result is biased coefficients which invalidates the tests and fails to evaluate qualitative implications of theoretical models discussed in the introductory remarks. This aggregation bias, among other reasons, motivates the methodology here.

Given this background, the objective of this paper is two-fold. First, this paper will test whether the behavioral relationship predicting the relationship between financial development and economic growth is the same across different levels of development and growth. In other words, that the parameters of the prediction equation do not vary from one group to the other. For the identifiable levels of development for which data is available, the test is based on the following regression:

$$Gy_{it} = X_{it}'\beta + \lambda_t + \eta_i + v_{it} \quad \text{.....(4.1)}$$

$t=1,.....T, \quad n=1,.....N$

where Gy_{it} is the growth rate of real GDP and λ_t and η_i are respectively time and individual (group) specific effects, x_{it} is a vector of explanatory variables which include financial development and control variable indicators. N is the number of cross-section observations which are the number of identifiable groups in this paper. The tests involve testing the stability of β from group to group.[2] Pesaran and Smith (1995) show that in a dynamic panel, if coefficients are different, pooling and aggregating such data results in inconsistent and misleading estimates. The different regressions spanning the different levels of development yield different coefficients. Other reasons for using group regressions are given below.

Second, the paper aims to investigate the patterns that emerge across different stages of development by running the regressions for different subsamples of countries classified according to their levels of income 1984 World Bank Classification. This is achieved by, for part (a), evaluating (i) whether cross-group differences in the quality and quantity of financial development account for cross-group differences in growth rates;[3] (ii) whether there are persistent group heterogeneity which could be driving the relationship:[4] (iii) whether the functions of the financial system identified by theory cause (or are caused by) economic growth. For part (b) whether the channels of transmission are (i) the level of investment (ii) efficiency of investment or (iii) human capital.

To achieve these objectives, the data is stratified into three levels of development (World Bank 1984 classification). Each group will make a

[2] The econometrics of aggregation tests is given in Appendix A
[3] This possibility was first suggested by Goldsmith (1969).
[4] The econometrics of testing for persistent group heterogeneity is given in Appendix B.

panel.[5] The paper will first test for the validity of pooling a wide variety of groups into one single sample. Individual groups and the pooled (restricted model) regression equations are estimated and coefficients compared. Then, for (the restricted model) and each group, the above issues are addressed.

This paper advocates and implements panel data for the following reasons: (i) Controlling for group heterogeneity which time series and cross-section are not able to do. Not accounting for this group heterogeneity causes serious misspecification. (ii) By combining cross-group and over-time dimensions, panel data gives more information, more variability and more efficiency than either time series or cross-section alone. (iii) Panel data enables one to study the dynamics of adjustment. Panel data is well suited to studying the duration of economic states like growth and can shed light on the speed of adjustment to financial development. Panel data, coupled with group data, enables one to relate a group's experience and behaviour at one point in time to other experiences and behaviour at another point in time i.e. the effects of financial development on future rates of economic growth. This is done by comparison of groups experiencing different levels of financial development. (iv) Elimination of aggregation biases resulting from aggregating across groups.

This paper also advocates and implements stratified data, by level of development for the following reasons: (i) Stratifying the data by level of development allows one to investigate the patterns that emerge across different stages of development; by running regressions for the different groups. (ii) Stratifying the data by level of development allows one to test for the relationship between financial development and economic growth

[5] Each group is assumed to have specific effects as though they were individuals.

in a way that is consistent with the requirements of theory. Theory predicts that countries with well developed financial systems are better placed to enhance economic growth than are countries with poorly developed financial systems. (iii) Stratification allows one to distinguish those groups of countries which are credit constrained as a result of poor financial systems. (iv) Econometrically, stratification by levels of development avoids pooling and aggregating data which results in misleading estimates. This results specifically from the work of Pesaran and Smith (1995) who show that in a dynamic panel data, when the coefficient estimates differ across groups, pooling and aggregating give inconsistent and potentially highly misleading estimates of the coefficients.[6] (v) It allows one to address issues such as diminishing returns to financial development, convergence or divergence. (vi) It also shows directly whether pooling and aggregating biases fail the hypotheses being tested.

The use of stratified data in studying the relationship between financial development and economic growth has been used in the literature with startlingly different results. DeGregorio and Guidotti (1995) perform correlation tests using stratified data by level of development (World Bank Classification 1960) and find out that the impact of financial development on growth, though broadly positive, changes according to regions, time periods and levels of income.[7] Specifically, comparing the different groups with the rest of the sample, they find that (i) there is a positive relationship between financial development and economic growth and that the relationship is stronger in middle and lower-income than in high-

[6] See appendix C for details.

[7] Other studies which stratify data and find different results include Grier and Tullock (1989), and Stern (1989). Based on cross-country, these studies highlight the dangers of pooling different experiences into a single one.

income group. (ii) The effect of financial development on growth in high-income countries is relatively small; and they attribute that to the fact that financial innovation occurs more outside the banking system or possible diminishing returns. As for the channels of transmission, De-Gregorio and Guidotti (1995) find that overall, except for high-income countries, the effect of financial development on the volume of investment is relatively small suggesting that most influence comes from increased efficiency; contradicting McKinnon (1973) and Shaw (1973). Efficiency of investment is higher in low and middle-income than in high-income countries. They find that the effect of initial levels of primary and secondary school enrolment ratios differs significantly across groups.

This empirical work will make a contribution to the literature in many ways. First, the study will use a different methodology than the previous papers, which includes pre-aggregation testing to determine if data from different experiences can be validly pooled into a single regression by testing whether the parameters of the prediction equation do not vary from one group to the other.[8] The impacts of financial development on economic growth for the three groups are compared against each other and with the impact of the restricted model. This provides a superior approach which yields sharper results than just using aggregate data which assumes the same impact. In addition, the use of stratified data by the level of development seems to be more appropriate for addressing the issues concerning the relationship between financial developmet and economic growth raised in the introductory remarks. The details are provided in the methodology section. Second, the paper will use different measures of financial development, in a dynamic setting, than

the previous studies. Of the five measures of financial development used in this chapter, only two were used in Levine et al (2000) and are included here for comparison purposes. Third, this study will address different channels of transmission, in a causal sense, from financial development to economic growth and vice-versa. Fourth, this paper will use different data sets which include both bank and stock market development. Fifth, this study will test for causality in a dynamic panel data setting. To narrow the focus, the paper will not discuss International Banking, Capital and Financial Markets.

The main findings of the paper are that; First, aggregation tests reveal that coefficient estimates do not aggregate across groups and therefore reject the aggregate (restricted) models in favour of separate regressions for each group. Coefficients change signs and significance from equation to equation. Second, the impact of financial development on economic growth is equally variable by level of development and estimation procedure. Third, there is evidence of causality running in either or both ways in stock market development. In bank development, causality is weak. Causality also changes by level of development and estimation procedure. Fourth, channels of transmission from financial development to economic growth vary both by level of development and estimation procedure.

The plan of the paper is as follows: Section 4.1 provides the description of the data and the construction of indicators of financial development, growth, control variables and channels of transmission. Section 4.2 describes the methodology used in the paper and its appropriateness. Section 4.3 provides the empirical results and Section 4.4 summarizes and

[8] All econometric issues related to aggregation of data are given in the appendix.

concludes. There is an appendix covering econometric issues and a list of countries used in the study.

4.1 Data; Financial, Growth and Macroeconomic Policy Indicators.

This section provides the description of the data and its sources. The section also provides the construction of all the indicators used in the study; financial development, economic growth, channels of transmission and macroeconomic policy.

4.1.1 Data Sources and Description.

The data on National Income Accounting, government deficits/ surpluses, population, inflation rates and all bank development come from the International Financial Statistics (IFS) 1979 and 2000 yearbook issues. This data includes 60 countries for the period 1971-95 and spans high-income (20) countries, middle-income (20) countries and low- income (20) countries.[9] Stock market data comes from Emerging Stock Market Factbook 2000 issue. The data includes (30) countries for the period 1989-98 and spans high-income (10) countries, middle-income (10) countries and low-income (10) countries. All data is in local currency. Data on human capital, HC, comes from UNESCO Statistical Yearbook (various issues). All data used in this study are logged. Data used to study the relationship between bank development and economic growth and the associated control variables are non-overlapping five year averages and span the period 1971-95; (1971-75, 1976-80, 1981-85, 1986-90 and 1991-95). The 5 year averaging,

partly avoids picking up business-cycle frequency relations between financial development and economic growth and, partly reduces the time series dimension of the sample and hence the number of admissible instruments. They also make the data less likely to be serially correlated than they would be in a yearly data setup. This gives five observations per variable per country. The data used to study the relationship between stock market development and economic growth, together with the control variables are annual. This gives ten observations for each variable per country. The three income classifications of the data and the different experiences they span, in financial development, economic growth, macroeconomic policies and channels to growth, make the data appropriate for evaluating the alternative views articulated by theory.

4.1.2 Financial Development Indicators.

Theory predicts that financial intermediaries emerge to mitigate market frictions which impede the smooth flow of capital from disparate savers to potential borrowers and investors, thereby retarding economic growth. Further, theoretical models articulate that financial (bank) intermediaries lower information and transactions costs because of their access to privileged information[10]. These are the costs of producing information on potential borrowers and investment projects. Financial intermediaries also engage in resource pooling, facilitating exchange, mitigating and managing risk, signaling to lenders, borrowers and traders, providing liquidity and long-term finance and, exerting corporate control. Theory predicts that

[9] World Bank Classification 1984.
[10] This is so because they hold accounts of future borrowers.

by performing these functions, financial intermediaries and institutions enhance long-term economic growth.[11] To test the validity of these theoretical predictions, this subsection will construct three indicators of bank development and two indicators of stock market development which measure these functions. These measures form micro-channels through which finance and growth affect each other. While some of these measures may have been used for different data sets in cross-country studies, they have not been used, as far as I know, in a panel and dynamic panel data group comparison setting. While each indicator has its own strengths and weaknesses, together, they give a clearer picture of the finance-growth relationship and the channels through which the relationship manifests itself.

The first indicator of bank development used in this paper is PRIVATE. PRIVATE equals credit issued to the private sector by deposit money banks and other financial intermediaries (IFS 22d + 42d) divided by GDP. PRIVATE provides a broader measure of financial (bank) development by including other financial institutions than just deposit banks and at the same time excluding central bank credit and inter bank credit. PRIVATE, then, identifies who intermediates and to whom. While it does not accurately measure the above mentioned functions, PRIVATE induces bank intermediaries to engage in identifying profitable investment projects, evaluating borrowers, and, facilitating efficient resource allocation thereby enhancing economic growth (Greenwood and Jovanovic (1990), King and Levine (1993c)) among others. By its own definition, PRIVATE is a ratio of a stock variable and a flow variable. To alleviate the problem, an arithmetic mean of $PRIVATE_t$ and $PRIVATE_{t-1}$ is used as a measure

[11] For an overview, see Pagano 1993 or for a recent survey, see Levine 1997.

of $PRIVATE_t$ divided by GDP_t[12]. This, however, does not completely eliminate the problem.

The second measure of bank development indicator used in this paper is LLY. LLY is liquid liabilities of the financial system, which includes currency plus current and interest-bearing account liabilities of the bank intermediaries and non-bank financial intermediaries, divided by GDP. LLY is a measure of the financial depth. Based on the assumption that the size of the financial intermediary sector is positively correlated with the provision and quality of financial services, this measure is popularly used in the literature (Goldsmith (1969), McKinnon (1973) and recently King and Levine (1993c), DeGregorio and Guidotti (1995)) among others. LLY provides liquidity which contributes to financial efficiency by reducing the risk of saving and of investing thereby lowering the premium on external finance and, by mitigating the need for self-insurance. However, LLY has many shortcomings. Its calculation includes inter-bank deposits. It also poses identification problems in the case where there are no alternatives for holding assets. Under the circumstances, high measures may actually indicate financial underdevelopment. However, it will be used as one measure of bank development indicator.

The third measure of bank development indicator is FME. FME is financial market efficiency measure which is given by the spread between lending and deposit rates. It is used to gauge the efficiency with which the financial system intermediates between savers and investors and signal to potential borrowers. The presumption is that lower spread between loan and deposit rates signifies reduction in the premium of external finance which increases borrowing and investment and, by

[12] All other measures are calculated similarly.

implication, economic growth. This measure, however, has its own problems. It only explains part of the cost of intermediation between savers and borrowers. It excludes all other related costs and charges. It also poses interpretation problems because while low spread leads to more lending, more lending, because of economies of scale, leads to lower spread. So there is the endogeneity problem.

The first measure of stock market development indicator is CMY. It is market capitalization ratio which equals the value of listed shares divided by GDP. This ratio is a measure of stock market size and its significance is that it signals ability to mobilize and allocate capital to investment projects and diversify risk. The second measure of stock market development is TR. TR is turnover ratio which equals the value of total shares traded divided by market capitalization. It is a measure of market liquidity. Higher turnover ratio is often used as an indicator of low transactions costs and therefore more liquidity.

In summary, the indicators of financial development used in this paper include PRIVATE, LLY, FME, CMY and TR. Since each indicator suffers from conceptual, measurement and statistical limitations, together, they provide a clearer picture of the relationship between financial development and economic growth and reflect different functions (channels) of link articulated by theory.

4.1.3 Growth and Channels of Transmission Indicators.

For measures of growth, this paper uses real per capita GDP growth and channels of transmission which include the share of GDP allocated for

investment or, rate of investment, efficiency of investment and human capital accumulation.

Real per capita GDP is per capita GDP in 1995 currencies.[13] The first measure of channels to growth is INV which equals gross national investment divided by gross domestic product. Most of the literature linking finance and growth emphasizes the role of finance in enhancing investment and then, by implication, economic growth. This is the back-bone of the McKinnon (1973), and Shaw's (1973) paradigm for financial liberalization which increase savings and then investment. The second measure of channels to growth is EFF. EFF or "efficiency of investment" is given by the change in per capita output (PGDP) divided by change in domestic capital stock. In other words, EFF = ΔGDP per capita /Δ capital stock. Unfortunately, capital stock data is not available and must be computed. To compute capital stock for each country of the 60 countries over the period 1971-1995, the paper follows King and Levine (1994). The method, *the perpetual inventory method: steady state estimates of initial capital*, which was suggested by Harmberger (1987) starts by deriving the initial estimates of capital stock in 1950. This assumes steady-state for capital-output ratio in 1950.[14] Under the assumption that capital-output ratio is fixed, one gets $\underline{K}_j = \underline{i}_j / [\delta + \gamma_j]$[15] where $\underline{i}$ represents "steady-state" investment rate, γ represents "steady-state" growth rate and δ represents the depreciation rate assumed to be constant across countries and over time. This can be written as:

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[13] Some authors use CPI instead of DGP deflator. I prefer GDP deflators because of the narrowness of CPIs.

[14] The method is sketched without detail.

[15] For the details of this formula and its derivation, please see King and Levine 1993c and Harmberger 1987.

$$K_{initial} = K_j Y_{initial} \quad \text{.....(4.2)}$$

Using this method, the aggregate investment series and a constant depreciation rate of 7%, one can compute the stock of capital K_{it} for country i at time t by using:

$$K_{it} = K_{it-i} + I_{it-i} - \delta K_{it-i} \quad \text{.....(4.3)}$$

Where I_{it} is aggregate investment by country i at time t and δ is the depreciation rate assumed constant across countries and over time.

As pointed out above, in his pioneering empirical work, Goldsmith (1969) emphasizes the efficiency of the investment channel. Also as pointed out above, recent endogenous growth literature emphasizes this channel (Bencivenga and Smith (1991), Greenwood and Jovanovic (1990)) among others. "Efficiency of investment" channel signifies the role played by financial intermediaries in distributing capital to its highest return uses.

The third measure of channels of transmission is human capital (HC). HC is given by the log of one plus the rate of high school enrolment. The attainment of education is considered an act of investment in humans. The presumption is that educated people make good innovators who speed technological diffusion by their ability to receive, decode, and understand information essential for performing many jobs (Nelson and Phelps (1966)). However, human capital (HC) has measurement problems. It does not take into account differences in school quality and does not include on the job training. Some of the HC is accumulated without high school enrolment. This means that the measurement of HC which is

used in the tests is quite different from the operational HC. In summary, growth and channels of transmission indicators include RPGDP, INV, EFF and HC.

4.1.4 Conditioning Information.

There are many variables associated with economic growth. To minimize omitted variables bias and to check the robustness of the results, this paper will control for macroeconomic policies. These include monetary policy, fiscal policy and trade policy. Monetary policy produces inflation (INF) which is measured by the rate of change of the GDP deflator. Fiscal policy (DEF) is given by the deficit/surplus divided by GDP and trade policy (OPP) is given by the ratio of the sum of exports and imports to GDP. In summary, DEF, OPP and INF form the conditioning information set.

To summarize, the financial development indicators used in this paper to test for the relationship between financial development and economic growth include PRIVATE, LLY, FME, CMY and TR. Growth indicators include RPGDP, INV, EFF and HC while DEF, OPP and INF form the conditioning information set.

4.2 Methodology.

The approach followed in this paper is panel and dynamic panel data in which data is stratified by level of development and estimated by the Generalized Method of Moments (GMM) estimators. The first thing is to test whether groups of countries with different experiences of economic

growth and financial development should validly be pooled and restricted to having the same financial development impact on growth. From equation (4.1), the null hypothesis is:

Ho: $\beta_i = \beta$ for all i;[16] .....(4.4)

In other words, cross-group stability of model coefficients. Once evidence rejects the null hypothesis, group estimation will be favoured over the restricted model regression.[17] To determine if this is more informative about the relationship between financial development and economic growth and to keep focus, the analysis will be limited only to the coefficients of financial development on growth.[18] The serious weakness with cross-country approach, is that it is not able to address issues raised by theory because it assumes equal impact of different levels of financial development on economic growth. To concentrate on cross group differences, the paper assumes equal financial development impact on economic growth within groups. This is justifiable because of the presumption that such impact is more pronounced across than within groups and that countries in different groups tend to have the same characteristics.[19] Theoretical predictions are not clear on this.

In addition to the different approach, this paper also tests for causality and reverse causality between financial development and economic growth in a dynamic panel (Holtz-Eakin, Newy and Rosen 1988). The

[16] δ is a subset of β which are the coefficients which measure the impact of financial development on economic growth.
[17] Pooled data regressions will be reported, only, for comparison purposes.
[18] This refers to coefficients of control variables, time dummies, etc will not be reported and are available upon request.
[19] For example, developing countries tend to have common problems such as corruption and political instability whereas developed countries tend to be politically stable with no corruption.

paper also tests for the presence of persistent country and group specific effects which affects statistical inference (Runkle 1991). This determines whether it is necessary to control for other factors that might be driving the results and the appropriateness of the instruments. Most studies assume the presence of such persistent country/group effects. The results are subjected to a battery of diagnostic tests. These measures ensure a relationship which is consistent with theoretical predictions and robust. Estimation procedures include Panel data, GMM-First Differences and GMM- SYSTEMS dynamic panel data estimators.

Consider the following panel regression which predicts real per capita GDP as explained by financial development and control variable indicators:[20]

$$Gy_{it} = \eta_i + \beta_1 FD_{jit} + \beta'_2 CV_{it} + \nu_{it} \quad \text{.....(4.5)}$$

where Gy_{it} is growth in real per capita GDP of group i at time t, FD_{jit} is financial development indicator j of group i at time t, CV_{it} is a vector of control variables of group i at time t, ν_{it} is the error term of group i at time t and η_i is the group i's specific effects (assumed to be constant over time). Using equation (4.3) and the three classifications of the levels of development, the paper tests for persistent group specific effects. This involves regressing growth rates on their own lags and financial development indicators.[21] The presence of such persistent group heterogeneity manifests itself in significant coefficients of lagged growth rates[22]. If

[20] Although not explicitly included, all regressions are estimated with time dummies.
[21] The details of persistent group heterogeneity econometrics is given in Appendix B.
[22] The lags start at 2.

persistent group specific effects are detected, then panel data approach becomes appropriate since it removes these persistent specific effects. As predicted by theory, the growth rates in a group of countries with poorly developed financial systems should be lower than the growth rates of their well-developed financial systems counterparts. The presumption behind the use of group comparisons is that, although there are cross country differences in financial development and economic growth, such differences are more pronounced across than within groups.

Now consider the dynamic panel. This paper will exploit recent developments in GMM dynamic panel estimators to address various issues between financial development and economic growth; including causality issues. The Dynamic panel approach has many advantages. In addition to addressing the issue of causality, GMM dynamic panel estimator also addresses the problem of endogeneity of explanatory variables in lagged dependent variable models which is appropriate for studying economic growth. In addition, GMM dynamic panel estimation allows for across group heterogeneity in the dynamic effects which links financial development, economic growth and the vector of control variables. In case of omitted variables and inconsistency due to simultaneity biases, GMM dynamic panel estimators remove any omitted variable bias due to unobservable group specific effects by differencing the regression (Arellano and Bond (1991), Holtz-Eakin et al (1988)). Inconsistency due to simultaneity bias is eliminated by instrumenting the right-hand-side with the differenced values of the original regressors (Arellano and Bover (1995), Blundell and Bond (1998)).

The methodology is grounded on the GMM dynamic panel estimators developed by Holtz-Eakin et al (1988), Arellano and Bond (1991), Arellano

and Bover (1995), Blundell and Bond (1998) and Alonso-Borrego and Arellano (1999). Consider the following general regression for each group:

$$y_{it} = \sum_{k=1}^{p} \alpha_k y_{i,t-k} + \beta'(L) X_{it} + \lambda_t + \eta_i + v_{it} \quad \begin{matrix} t = q+1,.....T \\ i = 1,.....N \end{matrix} \qquad (4.6)$$

where η_i and λ_t are, respectively, individual and time specific effects. X_{it} is a vector of explanatory variables. B (L) is a vector of associated polynomials in the lag operator and q is a maximum lag length in the model. Of interest is where the levels of X_{it} are correlated with η_i but ΔX_{it} (and possibly Δy_{it}) are not correlated with η_i. This allows one to use ΔX_{it} and possibly $\Delta y_{it's}$ as instruments for equations in levels.

Now consider the following regression equation of financial development on economic growth and control variables:

$$Gy_{it} = \alpha Gy_{it-1} + \beta_1 FD_{jit} + \beta_2' CV_{it} + \eta_i + v_{it} \qquad (4.7)$$

where Gy_{it} is real per capita GDP for group i at time t, FD_{jit} is financial development indicator j for group i at time t, CV_{it} is a vector of control variables for group i at time t, η_i is group i specific effects (assumed constant over-time) and v_{it} is the error term for group i at time t. By taking first differences of equation (4.7) for each group, one eliminates group specific effects:

$$Gy_{it} - Gy_{it-1} = \alpha(Gy_{it-1} - Gy_{it-2}) + \beta_1(FD_{jit} - FD_{jit-1}) + \beta_2'(CV_{it} - CV_{it-1}) + (v_{it} - v_{it-1}) \qquad (4.8)$$

This however, results in a first order moving average MA(1) $v_{it} - v_{it-1}$, with unit root, which is correlated with the lagged dependent variable ($Gy_{it-1} - Gy_{it-2}$). The solution would be to instrument those lagged dependent variables. This would also be appropriate for addressing endogeneity of the explanatory variables under the assumption that these independent variables, i.e. financial development and control indicators are weakly exogenous variables and that the error term v_{it} is serially uncorrelated. The GMM dynamic panel estimator uses the following orthogonality restrictions which ensure consistent estimates (Blundell and Bond (1998)).

$$E[Gy_{i,t-s}(\Delta v_{it})] = 0 \quad \text{for } t = 3,\ldots\ldots T;\ s \geq 2 \ldots\ldots\ldots\ldots\ldots\ldots (4.9)$$

$$E[FDj_{i,t-s}(\Delta v_{it})] = 0 \quad \text{for } t = 3\ldots\ldots\ldots T;\ s \geq 2 \ldots\ldots\ldots\ldots\ldots\ldots (4.10)$$

$$E[CV_{i,t-s}(\Delta v_{it})] = 0 \quad \text{for } t = 3\ldots\ldots\ldots T;\ s \geq 2 \ldots\ldots\ldots\ldots\ldots\ldots (4.11)$$

These conditions result in consistent estimates from differenced GMM dynamic estimators. There is however a problem with the difference estimator in that it eliminates cross-group differences thereby eliminating crucial information. This will limit the effectiveness of the estimator to address questions related to differences in growth rates, financial development and macroeconomic policies. In addition, Alonso-Borrego and Arellano (1999); Blundell and Bond (1998) show that when the independent variables are persistent over time, lagged levels of the very same variables

make weak instruments for the regression in differences leading to biased coefficient estimates and wrong conclusions.[23]

As a solution, Arellano and Bover (1995); Blundell and Bond (1998) suggest a systems approach which combines the instruments, as above in levels, which are lagged differences of the corresponding variables. These instruments are valid if there is no correlation between the differences of these variables and the group specific effects. However, this is true if the variables are strictly exogenous as suggested by Breusch, Mizon and Schmidt (1989). This follows from the following stationarity property in which these variables have constant correlation with individual effects.

$$E[G_{i,t+m}\eta_i] = E[G_{i,t+n}\eta_i] \qquad \forall \text{ m and n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.12)$$

$$E[FDj_{i,t+m}\eta_i] = E[FD_{i,t+n}\eta_i] \qquad \forall \text{ m and n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.13)$$

$$E[CV_{i,t+m}\eta_i] = E[CV_{i,t+n}\eta i] \qquad \forall \text{ m and n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.14)$$

However, since theory predicts the existence of endogeneity between financial development and economic growth; economic growth and macroeconomic policy, instruments constructed from these variables would not meet the above stationarity properties.[24] Instead, the paper focuses on the following additional conditions appropriate for regression in levels (Blundell and Bond (1998)).

$$E[\Delta G_{i,t-s}(\eta_i + \nu_{it})] = 0 \qquad \text{for } s = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.15)$$

$$E[\Delta FDj_{i,t-s}(\eta_i + \nu_{it})] = 0 \qquad \text{for } s = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.16)$$

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[23] Evidence suggests they are.

[24] Empirical evidence supporting endogeneity between financial development and economic growth is given in Jung 1986, Demetriades and Hussein 1996.

$$E[\Delta CV_{i,t-s}(\eta_i + v_{it})] = 0 \qquad \text{for } s = 1 \ldots\ldots (4.17)$$

These moments in addition to moments for Differenced GMM dynamic panel estimators are appropriate for Systems GMM dynamic panel estimation. Once these conditions are met, the estimator results in more efficiency and precision (Blundell and Bond 1998)

The preceding has put down moment restrictions on which estimation of Differenced and Systems GMM dynamic panel is based. Once the assumptions of no second order serial correlation in the error terms and the validity of the instruments are met, these GMM dynamic panel estimators will be consistent. The first task is to ensure that the assumptions are met. One test, the Sargan test of over-identifying restrictions, has been suggested by Arellano and Bond (1991), Arellano and Bover (1995) and, Blundell and Bond (1998). This is a test of the validity of the instruments and it analyzes the sample analog of the moment conditions used in the estimations. It has a $\chi^2_{(m)}$ distribution where m is the number of degrees of freedom given by the difference between the number of instruments and regressors. PcGive reports the Sargan test. The other test is a test of serial correlation in the error term. The differenced equation (4.8) already shows first order serial correlation. Therefore, the test for serial correlation will be the test for second-order serial correlation. Under the null hypothesis of no second-order serial correlation, the test statistic has a standard normal distribution. If the instruments are valid and there is no second order serial correlation, then the hypotheses could not be rejected, supporting the estimation procedures.

In addition, this paper will address the issue of causality. Following Holtz-Eakin, Newey, and Rosen (1988) and Arellano and Bond (1991) a general representation of a dynamic model linking two panels x and y is:

$$y_{i,t} = \beta_{11}(L)\, y_{i,t-1} + \beta_{12}(L)\, x_{i,t-1} + \eta_i + \mu_{i,t} \quad \text{.....(4.18)}$$

$$x_{i,t} = \beta_{21}(L)\, y_{i,t-1} + \beta_{22}(L)\, x_{i,t-1} + \lambda_i + \nu_{i,t} \quad \text{.....(4.19)}$$

where η_i and μ_i are individual effects. From these equations, β_{12} are relevant for testing for the presence of Granger causality running from x to y while β_{21} are relevant for the presence of Granger causality tests running in the opposite direction.

In summary, the methodology used in this paper is relevant given recent developments in the econometrics and estimation of panel and dynamic panel data and data availability which are appropriate for the study of the relationship between financial development and economic growth. Tests for the validity of aggregation and persistence of group specific effects are performed. Data is then stratified into three levels of development and the relevant coefficient estimates compared. Three estimation procedures are used to rigorously investigate this relationship. These include panel data estimators, Differenced GMM dynamic panel estimators and Systems GMM dynamic panel estimators . Using the three estimation procedures services two purposes; addressing different issues and as a robust check. The three procedures have to pass a battery of tests to ensure their validity and the robustness of the results. The next section looks at the empirical evidence.

4.3 Empirical Evidence.

Table 4.1: Average Levels of Financial Development.

Indicator	High-Income	Middle-Income	Low-Income.
PRIVATE	0.603	0.300	0.144
LLY	0.626	0.462	0.290
QLLY	0.403	0.279	0.145
FME	0.069*	0.049	0.056
CMY	0.550	0.662	0.166
TR	0.522	0.412	0.150

Notes. The figures are average levels over the sample period, except FME which is an average rate. The sample period for PRIVATE, LLY, QLLY and FME is 1971-95 and for CMY and TR is 1989-98. The FME for higher income is higher because of very high rates for Israel. The variable definitions are as in the body of the paper.

Table 4.1 gives non-regression summary figures. They are average levels of financial development indicators by income categories. Although there are cross-country differences within each group, on average, high-income countries have 60 percent of their loans (PRIVATE) going to private borrowers, whereas middle-income countries have only 30 percent and low-income 14 percent. That in faster growing economies, a higher percentage of credit goes to the private sector rather than public sector is well in line with expectations. These loans are a measure of efficient asset distribution by the banks. The table also shows that for LLY, liquidity liabilities, high-income countries hold 63 percent of GDP, on average, in liquid assets

while middle-income countries hold 46 percent and low-income only 29 percent. These are all consistent with expectations. The interesting indicator is provided by FME- the financial market efficiency. Theory predicts that well-developed financial systems are more efficient, which means that they have lower costs of intermediating between savers and borrowers. However, evidence shows otherwise. This may be because the rates are nominal and countries with high inflation rates[25] may be responsible for the apparent contradiction. According to the table, for each pound intermediated, on average, about 7 percent go into cost of intermediation in high-income countries while the cost in middle-income countries is 5 percent and 6 percent in low-income countries.[26] In the case of stock market development, 55 percent of market capitalization as a share of GDP goes to risk diversification in high-income countries while it is 66 percent in middle-income countries and only 17 percent for low-income countries[27]. In terms of liquidity provision by the stock market, on average, high-income countries hold 52 percent of stock market liquidity while middle-income countries hold 41 percent and low-income only 15 percent. Overall, the table shows that high-income countries have more developed financial systems, followed by middle-income countries and then low-income countries.

If the predictions of theory are valid, other things being equal, high-income countries should grow fastest, followed by middle-income countries and then low-income countries. During the sample period, 1971 -95 for which the relationship between bank development and economic growth is

[25] For example, Israel had high inflation rates.
[26] Of course the actual cost is higher than this. This measure is only for interest rates and yet there are more charges for an application than just interest rates. This is one problem of this measure.

being investigated, on average, high-income countries grew at 2.2 percent; middle-income countries at 4.4 percent and low-income countries at 1.1 percent. During the sample period 1989-98 for which the relationship betwe en stock market development and economic growth is being investigated, high-income countries grew at 1.4 percent; middle-income countries at 3.1 percent and low-income countries at 1.9 percent.[28]

To summarize the observations so far, high-income countries have higher levels of financial development, followed by middle income countries and then low-income countries. Yet middle-income countries grew faster, on average, during the sample period than both high-income and low-income countries. If the predictions of theory are valid, the observations so far have to suggest diminishing returns to financial development as deduced between high-income and middle-income groups. However, theoretical predictions between either of these two and low-income, seen valid.

To keep focus, only coefficient estimates of financial development and growth indicators and appropriate statistics will be reported from the regression based results. The first thing is to test the validity of pooling data from different experiences in financial development and economic growth into a single regression. Table 2 below shows the results of the tests. The econometrics of the tests are given in the appendix.

[27] Stock markets seem to be developing faster in middle than in high or low-income groups.
[28] These are all the author's calculations.

Table 4.2: Aggregation Tests.

Indicator:	PRIVATE	LLY	FME	CMY	TR
(F-statistics) :	12.75	7.58	7.63	4.17	13.99

Notes. All these statistics are significant at 0.10 level. All indicator variables are as defined above.

The results provide evidence that when the three data sets are pooled into one regression and constrained to have the same coefficient estimates, the F-statistics testing that validity are all significant at 0.10 and reject pooling in favour of group regressions.

Table 4.3 below gives evidence of the impact of PRIVATE, the efficient distribution of resources, on economic growth from the three linear estimators: panel data, GMM-First Difference and GMM-SYSTEMS.

First, the F-tests for model specification are all statistically significant, except in panel restricted model. Significant Sargan tests of over-identifying restrictions suggest poor instruments. The tests for second order serial correlation could not be rejected in GMM-First Differenced middle and low-income groups and, GMM-SYS- TEMS low-income group.

Second, evidence suggests both cross-group and estimator differences in coefficient estimates, signs and statistical significance. For example, take the restricted model (T), the coefficient estimate from panel data is -0.01 and not statistically significant. The same data yields coefficient estimates of 5.59 and -1.70 from GMM-First Difference and GMM-SYSTEMS estimators. Neither is statistically significant. Compared to these coefficient estimates, the estimates for high-income groups are 12.02, -1.05 and 2.16 for panel data, GMM-First Difference and GMM-SYSTEMS estimators respectively.

All are statistically significant. The coefficient estimates for middle-income group are 13.77, 1.85 and 3.73 for, respectively, panel data, GMM-First Difference and GMM-SYSTEMS estimators. All of them are positive and statistically significant. The coefficient estimates for low-income group are 2.88, -0.13 and -1.03 for, respectively, panel data, GMM-First Difference and

Table 4.3: Efficient Resource Distribution (PRIVATE) **and Growth.**

	PANEL DATA				GMM-FIRST DIFF				GMM-SYSTEMS			
Coefficient	T	H	M	L	T	H	M	L	T	H	M	L
$PRIVATE_{i,t}$	-0.01	12.02	13.77	2.88	5.59	-1.05	1.85	-0.13	-1.70	2.16	3.73	-1.03
	(0.43)	(4.34)	(4.23)	(1.43)	(0.50)	(2.91)	(1.60)	(0.41)	(1.31)	(2.30)	(1.77)	(1.48)
F(p-values)	[0.670]	[0.000]	[0.000]	[0.163]	[0.000]	[0.000]	[0.000]	[0.000]	[0.036]	[0.000]	[0.000]	[0.000]
Sargan					339.9	34.94	26.27	37.98	39.91	35.79	45.52	48.91
(df)[a]					(6)	(6)	(6)	(6)	(45)	(45)	(45)	(45)
AR(2)					[0.617]	[0.618]	[0.168]	[0.498]	[0.506]	[0.930]	[0.646]	[0.446]

Notes. All variables are as defined above. Figures in parentheses are t-ratios and those in brackets are p-values. The regressions were run with both control variables and time dummies. T stands for aggregate sample, H for high-income, M for middle-income and l for low-income groups. AR (2) is a test for second order serial correlation in the first differenced residuals, and is distributed asymptotically as N(0,1) under the null hypotheses of no second order serial correlation. The Sargan tests the over-identifying restrictions and is distributed asymptotically as a χ^2 under the null hypot hesis of the validity of instruments. The instruments used are:

GMM-First Difference: $Gy_{i,t-2}$, $Gy_{i,t-3}$.....$Gy_{i,1}$; $PRIVATE_{i,t-2}$, $PRIVATE_{i,t-3}$.....$PRIVATE_{i,1}$; $DEF_{i,t-2}$, $DEF_{i,t-3}$.$DEF_{i,1}$; $OPP_{i,t-1}$, $OPP_{i,t-3}$....$OPP_{i,1}$; $INF_{i,t-2}$, $INF_{i,t-3}$.....$INF_{i,1}$.

GMM-SYSTEMS: Difference Equations as in GMM-First Difference.

Levels: $\Delta Gy_{i,t-1}$, $\Delta PRIVATE_{i,t-1}$, $\Delta DEF_{i,t-1}$, $\Delta OPP_{i,t-1}$, $\Delta INF_{1,T-1}$.

[a] The degrees of freedom are given by the difference between the instruments used and the parameters estimated.

GMM-SYSTEMS estimators. Only panel data and GMM-SYSTEMS coefficient estimates are significant.

In terms of consistent impact of PRIVATE on growth across groups and estimators, high and middle-income groups show strong impact on growth under panel data estimation. Under GMM-First Difference, both high and middle-income groups are still statistically significant, though for high-income group, with a negative sign. Under GMM-SYSTEMS, both high and middle-income groups yield positive and statistically significant impacts on growth. The impact in low-income group, in addition to changing signs, is weak.

In summary, although the impact of PRIVATE on growth varies widely across groups and estimators, it turns to be stronger in high and middle-income groups than it is in restricted model and low-income group. These findings are consistent with expectations because in high and middle-income groups, unlike the low-income group where credit is mostly directed, banks engage in evaluating borrowers and channeling funds to their highest return uses. On the other hand, the findings are counterintuitive because the impact of PRIVATE should be weaker in high-income group where financial innovation outside the banking systems was the largest. To that effect, allowing for different sample periods and estimators used, the findings here somehow contradict the findings by GreGorio and Guidotti (1995).

Table 4.4: **Liquidity Provision (LLY) and Growth.**

	Panel Data				GMM-FIRST DIFF.				GMM-SYSTEMS			
Coefficient	T	H	M	L	T	H	M	L	T	H	M	L
LLY_{iT}	7.55	9.75	10.29	3.78	2.29	-0.46	-2.73	-0.43	-3.56	2.65	2.42	-1.02
	(3.74)	(3.65)	(1.87)	(1.00)	(0.50)	(0.54)	(1.16)	(0.25)	(0.92)	(1.74)	(0.23)	(0.24)
F(p-values)	[0.000]	[0.000]	[0.072]	[0.321]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan					340.76	35.18	16.96	30.58	28.43	22.81	47.57	45.34
(df)					(6)	(6)	(6)	(6)	(45)	(45)	(45)	(45)
AR(2)					[0.627]	[0.711]	[0.383]	[0.549]	[0.498]	[0.881]	[0.623]	[0.674]

Notes. All variables are as defined above. Figures in parentheses are t-ratios and those in brackets are p-values. All equations included both control variables and time dummies. AR(2) is a test for second order serial correlation in the first differenced residuals, and is distributed asymptotically as N(0,1) under the null hypotheses of no second order serial correlation. The Sargan tests the over-identifying restrictions and is distributed asymptotically as a χ^2 under the null hypothesis of the validity of instruments. The instruments used in the equations are:

GMM-First Diff.- $Gy_{i,t-2}$, $Gy_{i,t-3}$,....$Gy_{i,1}$; $LLY_{i,t-2}$, $LLY_{i,t-3}$,....$LLY_{i,1}$; $DEF_{i,t-2}$...$DEF_{i,1}$; $OPP_{i,t-2}$...$OPP_{i,1}$; $INF_{i,t-2}$...$INF_{i,1}$.

GMM-SYSTEMS: Difference Equations as in GMM-First Difference

Levels: $\Delta Gy_{i,t-1}$, $\Delta LLY_{i,t-1}$, $\Delta DEF_{i,t-1}$, $\Delta OPP_{i,t-1}$, $INF_{i,t-1}$.

Table 4.4 gives evidence of the impact of liquidity provision (LLY) on economic growth from the three linear estimators; panel data, GMM-First Differences and GMM-SYSTEMS.

First, the diagnostic statistics; the F-tests for the models specifications are all statistically significant, implying that all the models are well-specified. The tests for over-identifying restrictions show that that most inst-

ruments used are poor. Also tests for second order serial correlation show that it is not possible to reject all.[29]

Second, evidence shows both cross group and cross estimator differences in coefficient estimates, signs and statistical significance. The impact of aggregate data on growth changes from 7.55 in panel data estimation to 2.29 in GMM-First Difference to -3.56 in GMM-SYSTEMS estimation. Of these, only the panel data coefficient estimate is statistically significant. For high-income group, the coefficient estimates change from 9.75 in panel data to -0.46 in GMM-First Differences to 2.65 in GMM-SYSTEMS estimation. Such differences in magnitudes, signs and statistical significance across estimation are observed in all income groups.

As to how the impact of the restricted model compares with group data, take for example, the impact of LLY on growth in panel data. The coefficient estimate is 7.55 which is positive and statistically very significant. Compared to it, the impacts of group data are 9.75, 10.29 and 3.78 for, respectively, high, middle and low-income groups. All, but the low-income group,[30] are statistically significant. All those which are statistically significant support the view that liquidity provision is important for economic growth and are consistent with previous studies. For the GMM-First Difference estimator, the coefficient estimate for the restricted model is 2.29 which is positive but not statistically significant. The coefficient estimates of group data are -0.46, -2.73 and -0.43 for, respectively, high, middle and low-income groups. None is statistically significant. One interesting finding is that while aggregate data exerts positive impact on growth all group data exert negative impacts on growth and support the

[29] The ones in question are [0.383] and [0.498]
[30] Liquidity Provision, on average, for this group is very low. The result is consistent.

theory that liquidity provision is counterproductive.[31] For GMM-SYSTEMS, the coefficient estimate for the restricted model is -3.56 which is not statistically significant. Compared to it, the coefficient estimates for high, middle and low-income groups are 2.65, 2.42 and -1.02 respectively. Only high-income group co- efficient is statistically significant.

In terms of the relationship between liquidity provision and growth, in static form, there seems to be strong and statistically significant relationship. However, the dynamic relationship is positive and statistically significant only in high-income group and under GMM-SYSTEMS estimation. Otherwise most of the dynamic relationships are negative and statistically insignificant.

Table 4.5 below gives evidence of the impact of Financial Market Efficiency (FME) on economic growth from the three linear estimators; panel data, GMM-First Differences and GMM-SYSTEMS.

First, the F-tests for models specifications show that most of the model equations are well specified.[32] All tests of second order serial correlation, but one, reject second order serial correlation. However, not all tests of over-identifying restrictions suggest good instruments.

Second, evidence shows varied and weak impact of financial market efficiency (FME) on economic growth. The coefficient estimates change from 0.04 for panel data to -8.71 for GMM-First Difference to -2.44 for GMM-SYSTEMS. However, none of these is statistically significant. Compared to these, the coefficient estimates for disaggregated data are 0.13, -0.02 and 0.04 for, respectively, high, middle and low-income groups from panel data estimation.

[31] Jappelli and Pagano (1994)
[32] Only in panel data for middle-income group is the model not well specified.

Table 4.5: Financial Market Efficiency (FME) and Growth.

	PANEL DATA				GMM-FIRST DIFF.				GMM-SYSTEMS.			
	T	H	M	L	T	H	M	L	T	H	M	L
$FME_{i,t}$	0.04	0.13	-0.02	0.04	-8.71	0.002	-0.02	-0.01	-2.44	0.01	-0.01	-0.02
	(1.09)	(2.07)	(0.29)	(0.90)	(1.30)	(0.52)	(1.71)	(3.59)	(0.88)	(2.02)	(0.73)	(1.34)
F(p-v)	[0.283]	[0.042]	[0.771]	[0.368]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan					296.6	24.19	36.54	54.23	32.87	27.51	64.82	31.9
(df)					(6)	(6)	(6)	(6)	(45)	(45)	(45)	(45)
AR(2)					[0.512]	[0.542]	[0.325]	[0.523]	[0.714]	[0.879]	[0.893]	[0.856]

Notes. All variables are as defined above. Figures in parentheses are t-ratios and those in brackets are p-values All regression equations included both control variables and time dummies. AR(2) is a test for second order serial correlation in the first differenced residuals, and is distributed asymptotically as N(0,1) under the null hypotheses of no second serial correlation. The Sargan tests the over-identifying restrictions and is distributed asymptotically as a χ^2 under the null hypotheses of the validity of instruments. The instruments used in the equations are:

GMM-First Diff.-$Gy_{i,t-2}$,.....$Gy_{i,1}$; $FME_{i,t-2}$.....$FME_{i,1}$; $DEF_{i,t-2}$.....$DEF_{i,1}$; $OPP_{i,t-2}$.....$OPP_{i,1}$; $INF_{i,t-2}$,.....$INF_{i,1}$.

GMM-SYSTEMS: Difference Equation as in GMM-First Diff.

Levels: $\Delta Gy_{i,t-1}$, $\Delta FME_{i,t-1}$, $\Delta DEF_{i,t-1}$, $\Delta OPP_{i,t-1}$, $\Delta INF_{i,t-1}$.

Of these, only high-income group coefficient estimate is statistically significant. For GMM-First Difference estimation, the coefficient estimates become 0.002, -0.02 and -0.01 for, respectively, high, middle and low-income groups. Of these, only middle and low-income groups are statistically significant but are both negative. For GMM-SYSTEMS, the coefficient estimates are 0.01, -0.01 and -0.02 for, respectively, high, middle and low-income groups. Only high-income group is positive and statistically

significant: suggesting the importance of bank intermediaries in minimizing the costs of external finance and enhancing economic growth.

Otherwise evidence shows very weak relationship between financial market efficiency and growth. Only high-income group shows consistent positive impact of FME on growth. Again, this finding is consistent with expectations because high-income group bank intermediaries are more efficient and, in general, exhibit the lowest spread between lending and borrowing rates.

Table 4.6 gives evidence of the impact of stock market capitalization (CMY) on economic growth from the three linear estimators: panel data, GMM-First Difference and GMM-SYSTEMS.

Diagnostic statistics show that the model equations are well specified. Except for three cases,[33] tests reject the presence of second order serial correlation. Tests for over-identifying restrictions suggest that the instruments used are appropriate.

Given these tests, the impact of stock market capitalization on economic growth changes by level of development and by estimation techniques both of which suggest that any relationship between the two is not robust. From panel data estimation, the coefficient estimates of stock market capitalization (CMY) from aggregate data is 2.29 and is statistically significant. Compared to it, the coefficients of individual group data estimates are -15.16, 3.67 and 1.26 for, respectively, high, middle and low-income groups. Except for the middle-income group, they are all statistically significant. Note the huge negative and statistically significant impact

Table 4.6: Stock Market Capitalization (CMY) and Growth.

	PANEL DATA				GMM-FIRST DIFF.				GMM-SYSTEMS.			
	T	H	M	L	T	H	M	L	T	H	M	L
$CMY_{i,T}$	2.29	-15.16	3.67	1.26	-0.08	-0.05	0.39	-0.05	-0.002	-0.37	0.23	0.07
	(3.43)	(5.70)	(1.06)	(1.97)	(2.31)	(0.28)	(1.55)	(1.28)	(0.06)	(2.48)	(2.03)	(11.4)
F(p-v)	[0.000]	[0.000]	[0.286]	[0.048]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan					106.0	55.90	51.54	39.02	370.8	125.70	180.7	200.0
(df)					(45)	(45)	(45)	(45)	(270)	(270)	(270)	(270)
AR(2)					[0.743]	[0.312]	[0.788]	[0.839]	[0.868]	[0.165]	[0.204]	[0.769]

Notes. All variables are as defined above. Figures in parentheses are t-ratios and those in brackets are p-values. All regression equations included both control variables and time dummies. AR(2) is a test for second order serial correlation in the differenced residuals, and is distributed asymptotically as N(0,1) under the null hypotheses of no second order serial correlation. The Sargan tests the over-identifying restrictions and is distributed asymptotically as a χ^2 under the null hypotheses of the validity of instruments. The instruments used in the equations are:

GMM-First Difference: $Gy_{i,t-2}$,.....$Gy_{i,1}$; $CMY_{i,t-2}$,...$CMY_{i,1}$; $DEF_{i,t-2}$;...$DEF_{i,t-2}$,...$DEF_{i,1}$;.....$INF_{i,t-2}$,...$INF_{i,1}$.

GMM-SYSTEMS: First Difference as in GMM-First Difference

Levels: $\Delta Gy_{i,t-1}$, $\Delta CMY_{i,t-1}$, $\Delta DEF_{i,t-1}$, $\Delta OPP_{i,t-1}$, $\Delta INF_{i,t-1}$.

Note the huge negative and statistically significant impact in high-income group. Since high-income group countries are well risk diversified, this finding could be supporting the theory that high risk diversification can be counterproductive (Obstfeld 1994). From GMM-First Difference estimation, the coefficient estimate for aggregate data is -0.08, negative and statistically significant. The corresponding coefficient estimates for high, middle and low-income groups are, respectively -0.05, 0.39 and -0.05 and only the middle-income group coefficient estimate is positive and statistically

[33] These include [0.312] [0.165] [0.204]

significant. For GMM-SYSTEMS estimation, the coefficient estimate for aggregate data is -0.002 negative and statistically significant. The corresponding coefficient estimates for group data are -0.37, 0.23 and 0.07 for, respectively, high, middle and low-income groups. All of them are statistically significant.

For the restricted model, the coefficient estimates change from 2.29 and statistically significant to -0.08, negative, and statistically significant to -0.002 negative and statistically significant, as estimation changes from panel data to GMM-First Difference to GMM-SYSTEMS. Therefore, for the restricted model, the relationship between CMY and growth changes in magnitudes, signs and statistical significance and is not robust. For high-income group, the coefficient estimates change from -15.16 to -0.05 to -0.37. The sign is consistently negative, though not significant for GMM-First Difference estimate. Otherwise the impact seems to be robust to estimation technique as far as the sign is concerned. For middle-income group, the coefficient estimate changes from 3.67 to 0.39 to 0.23. All are positive and, except for panel data estimate, are statistically significant. For middle-income group, the impact of CMY on growth is robust to estimation technique as far as the sign is concerned. For low-income group, the coefficient estimates change from 1.26 to -0.05 to 0.07. Both panel data and GMM-SYSTEMS estimates are positive and statistically significant.

In summary, evidence shows that coefficient estimates vary widely; by level of development and estimation technique. Otherwise the interesting findings are that high-income group coefficient estimates are all negative across the three linear estimators and are, therefore, robust with regard to the sign. For middle-income group, the coefficient estimates are all positive

Table 4.7: Turnover Ratio (TR) and Growth.

	PANL DATA				GMM-FIRST DIFF.				GMM-SYSTEMS.			
	T	H	M	L	T	H	M	L	T	H	M	L
$TR_{i,t}$	0.71	-14.27	14.65	2.20	-0.001	0.12	-0.29	0.004	0.0004	-0.06	0.09	0.06
	(3.14)	(6.60)	(5.88)	(4.59)	(0.46)	(2.26)	(1.74)	(0.32)	(0.10)	(0.44)	(11.5)	(6.44)
F(p-v)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[.0.000]	[0.000]	[0.000]
Sargan					104.8	51.07	57.20	42.57	300.60	118.40	175.20	192.40
(df)					(45)	(45)	(45)	(45)	(270)	(270)	(270)	(270)
AR(2)					[0.543]	[0.312]	[0.698]	[0.739]	[0.923]	[0.227]	[0.680]	[0.905]

Notes. All variables are as defined above. Figures in parentheses are t-ratios and those in brackets are p-values. All regression equations included both control variables and time dummies. AR(2) is a test for second order serial correlation in the first differenced residuals and is distributed asymptotically as N(0,1) under the null hypotheses of no second order serial correlation. The Sargan tests the over-identifying restrictions and is distributed asymptotically as a χ^2 under the null hypotheses of the validity of instruments. The instruments used are:

GMM-First Difference: $Gy_{i,t-2}$,....$Gy_{i,1}$; $TR_{i,t-2}$,.....$TR_{i,1}$; $DEF_{i,t-2}$,.....$DEF_{i,1}$; $OPP_{i,t-2}$,....$OPP_{i,1}$; $INF_{i,t-2}$,..$INF_{i,1}$.

GMM-SYSTEMS: Differences Equations as in GMM-First Difference.

Levels: $\Delta Gy_{i,t-1}$; $\Delta TR_{i,t-1}$; $\Delta DEF_{i,t-1}$; $\Delta OPP_{i,t-1}$; $\Delta INF_{i,t-1}$.

and robust with respect to estimation procedure. Otherwise the impact of CMY on growth, though relatively strong, is not robust.

Table 4.7 gives evidence of the impact of turnover ratio (TR) on economic growth from the three linear estimators: panel data, GMM-First Difference and GMM-SYSTEMS.

The F-tests for models specifications show that the regression models are well specified. Tests for second order serial correlation reject the presence of such correlation in all, but two cases.[34] Tests for over-ide-

[34] These include [0.312], [0.227].

ntifying restrictions show that most instruments used in these equations are not appropriate.

The impact of turnover ratio (TR) on economic growth changes from group to group and estimator to estimator. For example, the coefficient estimates for aggregate data change from 0.71, from panel data estimation to -0.001, from GMM-First Difference estimation, to 0.0004, from GMM-SYSTEMS estimation. Only the panel data coefficient estimate is statistically significant. The corresponding high-income group estimates are -14.27, 0.12 and -0.06. Only the GMM-First Difference coefficient estimate is positive. Both the panel data and GMM-First Difference coefficient estimates are statistically significant. The negative impact of turnover ratio on growth supports the theory that liquidity provision may be counterproductive.[35] The coefficient estimates for middle-income group change from 14.65 to -0.29 to 0.09 from panel data to GMM-First Difference to GMM-SYSTEMS respectively. Although they change in sign, they are all statistically significant. For low-income group, the coefficient estimates change from 2.20 to 0.004 to 0.06. First, the coefficient estimates, though different in magnitudes, are consistently positive. Also, except for GMM-First Difference coefficient estimate, they are statistically significant.

As for the comparison between groups and aggregate data, take panel data estimator; the coefficient estimate for aggregate data is 0.71. Compared to it, the group coefficient estimates are -14.27, 14.65 and 2.20 for high, middle and low-income groups respectively. All are statistically significant. The interesting finding is the huge negative impact of turnover ratio in high income countries. A similar pattern of such differences is

[35] Japelli and Pagano 1994.

observed in the other estimators: GMM-First Differences and GMM-SYSTEMS.

In summary, only in low-income group is there a consistently positive impact of turnover ratio on growth across different estimators. Otherwise the coefficient estimates change in magnitudes, signs and statistical significance from estimator to estimator and from one level of development to the other. Evidence also shows that data from different experiences cannot be confirmed by a pooled data regression.

4.3.1 Causality.

Table 4.8 below provides evidence of the presence of causality between financial development and economic growth. The table is in two parts. The first part tests for the presence of causality running from financial development to economic growth. For PRIVATE, the null hypotheses are that PRIVATE does not cause economic growth.[36] All the other hypotheses in this part and for different levels of development are formulated similarly.

Evidence suggests that for PRIVATE, statistically significant causality is detected only in the low-income group. This can be explained by the sample period used in the study which runs from 1971 to 1995. The 70's and 80's saw very active financial innovation occurring outside the banking system. Such innovation was not taking place in low-income countries. Hence while high and middle-income countries did not have to rely on debt finance, low-income countries still had to.

[36] This refers to PRIVATE for all levels of development.

Table 4.8: Financial Development and Growth: Causality.

(i) Causality Running from Financial Development to Growth:

(a) Bank Development.

	PRIVATE				LLY				FME			
	T	H	M	L	T	H	M	L	T	H	M	L
Coef.	-0.27	-0.61	1.35	0.77	-1.52	-2.15	3.17	1.66	-2.84	-0.002	0.02	0.02
t-ratios	(1.04)	(0.86)	(0.51)	(2.01)	(1.00)	(1.82)	(0.30)	(0.72)	(0.95)	(0.89)	(0.56)	(0.76)

(b) Stock Market Development.

	CMY				TR			
	T	H	M	L	T	H	M	L
Coefficient	-0.01	0.38	0.26	0.08	-0.004	0.12	0.02	0.07
t-ratios	(0.28)	(3.16)	(2.05)	(9.28)	(3.72)	(1.73)	(2.95)	(8.16)

(ii) Causality Running from Growth to Financial Development:

(a) Bank Development.

	PRIVATE				LLY				FME			
	T	H	M	L	T	H	M	L	T	H	M	L
Coef.	-0.01	0.004	-0.02	0.05	-0.06	-0.07	0.004	0.01	0.001	-9.96	4.64	3.85
t-ratios	(5.68)	(0.07)	(1.16)	(1.13)	(1.44)	(1.95)	(0.44)	(0.61)	(3.86)	(2.11)	(0.99)	(0.86)

(b) Stock Market Development.

	CMY				TR			
	T	H	M	L	T	H	M	L
Coefficient	0.01	0.04	0.08	0.03	0.17	0.04	0.03	0.01
t-ratios	(0.14)	(50.4)	(1.67)	(2.74)	(0.09)	(31.7)	(9.80)	(0.15)

Notes. All variables are as defined above. Figures in parentheses are t-ratios of lagged independent variables. The null hypotheses running from financial development to economic growth are that: financial development does not cause economic growth. For reverse causality: economic growth does not cause financial development.

For liquidity pro-vision (LLY) high-income group shows evidence of negative causality running from the provision of liquidity to economic growth. The negative causality supports the theory that liquidity provision may be counterproductive (Jappelli and Pagano (1994)) or diminishing returns to financial development. Evidence show no causality between growth and financial market efficiency (FME).

For stock market development, causality is detected in all but the restricted model or CMY. Also, note that coefficient estimates for the restricted models are negative for both CMY and TR. This might be due to aggregation biases. All other groups for both indicators show strong presence of causality. This fits well with theoretical predictions since the sample period covers 1989-98 when stock markets were booming even in the low-income group.

The second part of the table shows evidence of reverse causality running from economic growth to financial development. The hypothesis for each test is that economic growth does not cause the financial development indicator in question. For bank development, for PRIVATE, only the restricted model shows negative and statistically significant causality. Again, this could be due to aggregation bias. For LLY, economic growth seems to cause it when data are pooled and in high-income group. Note also that both coefficient estimates are negative. For FME, economic growth seems to have causal effect in pooled data and negative causal effect in high-income group. The other two groups show no evidence of causality. For stock market development, economic growth does not cause CMY when data is pooled. Economic growth does not cause TR in pooled data and the low-income group. All other groups show the presence of cau-

sality, particularly strong in high-income group. For pooled data, the problem could be aggregation bias.

Overall, for causality, there is very weak causality running from bank development to economic growth. Reverse causality is a bit encouraging but still weak. This finding of reverse causality contradicts Levine et al (2000) whose results they say are not due to reverse causality. There is strong causality running either or both ways between stock market development and economic growth. The sampling periods might have a lot to do with these observations.

4.3.2 Channels of Transmission.

Table 4.9 below provides evidence for tests of the channels to growth. These tests are performed on growth indicators and test the presence of Granger causality.

The results show wide coefficient estimates variation and different channels to growth by levels of development. For example, PRIVATE exerts no causal link to growth through the efficiency of investment (EFF) contradicting DeGregorio and Guidotti (1995). The coefficient estimates of PRIVATE on the efficiency of investment are -0.08, 1.64, 6.26 and 13.96 for, respectively, restricted model, high, middle and low-income groups. None of them is statistically significant. The coefficient estimates for liquid liabilities provision on the efficiency of investment (EFF) are 3.68, -7.72, 9.38 and 28.74 for, respectively, restricted model, high, middle and low-income groups. Of these, only high and middle-income groups are not statistically significant.

Table 4.9: Finance and Growth: Channels of Transmission.

(a) Bank Development.

	PRIVATE				LLY				FME			
	T	H	M	L	T	H	M	L	T	H	M	L
EFF												
Coef.	-0.08	1.64	6.26	13.96	3.68	-7.72	9.38	28.74	0.01	0.02	0.09	0.29
t-ratios	(1.08)	(0.04)	(0.36)	(0.61)	(3.03)	(1.29)	(0.24)	(1.50)	(0.57)	(0.27)	(1.36)	(1.61)
F(p-va)	[0.420]	[0.947]	[0.003]	[0.001]	[0.116]	[0.051]	[0.000]	[0.000]	[0.547]	[0.098]	[0.000]	[0.000]
Sargan	43.76	5.83	45.02	18.16	36.45	34.95	67.46	23.71	32.38	33.92	39.74	27.13
(df)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)
AR(2)	[0.584]	[0.377]	[0.201]	[0.753]	[0.752]	[0.610]	[0.140]	[0.610]	[0.572]	[0.397]	[0.234]	[0.560]
INV												
Coef.	-0.02	-0.70	1.12	-1.31	-0.59	3.33	-4.14	-3.12	0.01	0.02	0.008	0.05
t-ratios	(1.88)	(0.34)	(1.26)	(1.79)	(1.86)	(1.43)	(3.31)	(2.00)	(1.31)	(2.90)	(0.52)	(1.75)
F(p-v)	[0.000]	[0.000]	[0.005]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan	59.36	59.25	71.22	73.42	39.85	34.77	53.71	46.07	66.24	9.19	54.71	74.54
(df)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)
AR(2)	[0.728]	[0.912]	[0.967]	[0.072]	[0.633]	[0.959]	[0.680]	[0.182]	[0.650]	[0.750]	[0.957]	[0.017]
HC												
Coef.	0.09	-0.05	1.69	1.21	-0.10	-1.09	-4.26	-1.52	0.004	-0.01	0.03	0.02
t-ratios	(8.55)	(0.03)	(0.96)	(0.46)	(1.07)	(0.29)	(2.87)	(0.49)	(0.49)	(1.30)	(2.19)	(0.61)
F	[[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan	36.70	7.78	29.80	27.45	38.25	66.16	29.95	25.62	37.60	31.57	40.45	28.32
(df)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)
AR(2)	[0.861]	[0.438]	[0.236]	[0.262]	[0.875]	[0.522]	[0.135]	[0.042]	[0.647]	[0.788]	[0.073]	[0.724]

(b) Stock Market Development.

	C MY				*TR*			
	T	H	M	L	T	H	M	L
INV								
Coef.	0.21	0.23	0.19	0.01	0.04	0.20	0.18	0.22
t-ratios	(0.38)	(12.0)	(11.7)	(0.11)	(0.76)	(42.4)	(38.0)	(1.84)
F(p-values)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan	267.4	182.1	172.7	204.4	271.2	179.3	211.0	203.8
(df)	(270)	(270)	(270)	(270)	(270)	(270)	(270)	(270)
AR(2)	[0.953]	[0.032]	[0.522]	[0.658]	[0.829]	[0.519]	[0.642]	[0.613]

Table 4.9 Continued. Channels of Transmission.

(b) Stock Market Development.

	CMY				TR			
	T	H	M	L	T	H	M	L
EFF								
Coef.	6.74	-1.06	0.08	1.11	0.49	-0.69	0.54	0.38
t-ratios	(0.99)	(1.21)	(0.16)	(1.49)	(1.54)	(1.06)	(2.20)	(0.73)
F(p-val)	[0.000]	[0.008]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan	232.5	179.5	209.7	168.0	203.9	167.4	147.4	150.3
(df)	(270)	(270)	(270)	(270)	(270)	(270)	(270)	(270)
AR(2)	[0.418]	[0.913]	[0.592]	[0.740]	[0.378]	[0.561]	[0.612]	[0.695]

Notes. All variables are as defined above. Figure in parentheses are t-ratios. Figures in brackets are p-values. Although not reported, all regressions include time dummies and control variables. The t statistics test the presence of Granger causality, given that the coefficients are on lagged respective indicators if financial development after controlling for the lags of each indicator of the channels of transmission and control variables. The null hypotheses of the Sargan tests are that the instruments used are not correlated with the residuals. The null hypotheses of AR(2) are that the errors in the first differenced regressions show no second order serial correlation.

While the restricted model shows a very significant causal effect of liquidity provision (LLY) on the efficiency of investment (EFF), the effect in the low-income group is huge but marginally significant. Financial market efficiency (FME) exerts a statistically significant causal link on EFF for the low-income group only. LLY and FME cause EFF and are consistent with the theory which underscores efficiency of investment as the channel of transmission. All others, though positive, are not statistically significant.

In summary, EFF exerts different causal links on PRIVATE, LLY and FME for different levels of development with low-income group causing EFF for LLY and FME. This finding could be explained by the fact that during the sample period, most of financial innovation was taking place outside the banking system. Such innovation was associated with high and middle-income groups.

For the level of investment INV, the coefficient estimates for PRIVATE are, respectively, -0.02, -0.07, 1.12 and -1.31 for the restricted model, high, middle and low-income groups. Pooled data and low-income group are statistically significant, suggesting that PRIVATE exerts a negative causal link on growth through the level of investment in low-income countries, and on pooled data. For LLY, the causal link through INV is negative and statistically significant for the restricted model, middle and low-income groups. For high-income group, the link is positive and significant at 10% level. For the financial market efficiency (EFF), the coefficient estimates are 0.01, 0.02, 0.008 and 0.05 for, respectively, pooled data, high, middle and low-income groups. Only high and low-income groups are statistically significant, implying that the financial market efficiency exerts a causal link to economic growth through the levels of investment for these groups.

For human capital (HC), the coefficient estimates for PRIVATE are 0.09, -0.05, 1.69 and 1.21 for, respectively, pooled data, high, middle and low-income groups. Only the restricted model shows a statistically significant coefficient estimate. For these different groups, PRIVATE exerts no significant causal link through the accumulation of human capital (HC). This could be explained by the fact that education is mostly publicly provided and the evaluation of borrowers is of no consequences. The coefficient estimates for LLY on HC are 1.07, -0.26, -4.26 and -1.52 for,

respectively, restricted model, high, middle and low-income groups. All are negative and only middle-income group is statistically significant. The negative coefficient estimates suggest that liquidity provision discourages the accumulation of human capital. The negative effect and its statistical siginificance on human capital has been observed in the literature. The problem has to do with the measurement of human capital itself. There is a discrepancy between the theoretical HC in production functions and the actual variable used in regressions. Also school enrolments are only a partial measure of human capital. Some of it comes from on the job training.

Concentrating on different groups, PRIVATE exerts a statistically significant but negative causal impact on growth via the level of investment for low-income groups. All other effects are not statistically significant. LLY exerts statistically significant causal links through EFF for low-income groups, through INV for high-income group and negative causal effects for middle-income and low-income groups. Through (HC), LLY exerts a negative and significant causal effect for middle-income group. FME exerts a causal link to growth through EFF for low-income countries only, while through INV, it exerts for high and low-income groups. Through HC, the statistically significant link is for middle-income group.

Turning to stock market development, for CMY, the coefficient estimates are 0.21, 0.23, 0.19 and 0.01 for, respectively, the restricted model, high, middle and low-income groups. High and middle-income groups show strong statistical significance. For high and middle-income groups, CMY exerts a causal link to growth via the level of investment (INV). For TR, the coefficient estimates are 0.04, 0.20, 0.18 and 0.22 for, respectively, the restricted model, high, middle and low-income groups. Only the coefficient

estimate of the restricted model is not statistically significant. Therefore, TR exerts a causal link to growth through investment levels for all income groups but not for the restricted model.

For EFF, the coefficient estimates for CMY are 6.74, -1.06, 0.08 and 1.11 for pooled data, high, middle and low-income groups respectively. Only the low-income group is statistically significant. For TR, the coefficient estimates are 0.49, -0.69, 0.54 and 0.38. Only restricted model and middle-income group are statistically significant.

In summary, for stock market development, CMY exerts a statistically significant causal link through EFF only for low-income group. TR exerts a statistically significant causal link through EFF only for the restricted regression model and middle-income group.

4.4 Summary and Conclusion,

Using stratified data by level of development and three linear estimators; panel data, GMM-First Difference and GMM-SYSTEMS, the paper has tested a number of issues related to the relationship between financial development and economic growth.

First, the paper tested for and found persistent group heterogeneous effects. The paper also tested for the poolability of different experiences of financial development, economic growth and macroeconomic stability into a single regression. Tests reject such poolability in favour of group regressions. The first lesson from these findings is how to interpret evidence based on restricted models.

Second, evidence on the relationship between financial development and economic growth shows wide variation in signs, magnitudes and statistical significance by level of development and estimation procedure. For the estimation method, panel data shows strong relationship between growth and liquidity provision. Dynamic panel estimation attenuates the relationships and most of them reverse the signs. This variation is observed across other financial development indicators. Such findings raise the concerns of drawing conclusions based on one estimator. The profession needs to check robustness of estimates by subjecting them to different estimation procedures before concluding.

Evidence also brings to light the problem of restricting different experiences into one. The coefficient estimates differ from group to group by level of development and the estimation procedure. Previous work based on aggregate data resulted in specific conclusions being drawn but, once the data is disaggregated by level of development, such conclusions change.

Causality tests show that, for PRIVATE, causality is detected only in the low-income group only. For LLY, negative causality is detected only in the high-income group only. No causality is detected between PRIVATE and growth across all groups of incomes. For stock market development, both MCY and TR show causality in all groups. Reverse causality also varies and is stronger in stock market development. The findings raise serious questions on the true nature of the relationship between financial development and economic growth. If the relationship was causal, then it would be expected to hold in all data and at all times. In other words, robust.

For channels of transmission, only FME exerts a causal link through EFF for low-income group. Through INV, LLY exerts a positive causal

link for high-income group. FME exerts a causal link for high and low-income groups. Through INV, CMY exerts a causal link in high and middle -income groups. TR exerts for all groups. These variations would make it difficult for policy makers.

The evidence has shown wide variation in signs, magnitudes and statistical significance by level of development and estimation procedures. The profession may need to test for robustness with respect to these issues before a conclusion is reached. The relationship between financial development and economic growth is still a long way from being resolved. Better empirical testing techniques which are consistent with theory are required.

Appendix A. Tests for Poolability (Baltagi 1995)

The test statistic for pooling data from different groups is given by:

$$F_{obs} = \frac{SSE(g^{*}_{GLS}) - SSE(\beta^{*}_{GLS})}{(N-1)K'} \text{ divided by } \frac{SSE(\beta^{*}_{GLS})}{N(T-K')}$$

where $SSE(g^{*}_{GLS})$ is the error sum of squares in the generalized least squares regression restricted by Ho, and $SSE(\beta^{*}_{GLS})$ is the error sum of squares in the unrestricted GLS regression. In the tests performed in this paper, $SSE(\beta^{*}_{GLS})$ is a sum of error of squares in the unrestricted GLS regressions. Under the null hypo-thesis, this has an F((N-1)K', N(T-K'))

(For the Details of derivations, see Baltagi 1995 pp

B Persistent Group Specific Effects (Runkle 1992)

The presence of group persistent effects affects the tests for the relationship between financial development and economic growth because they violate the following assuptions (2) below.

Consider,

$$\Delta y_{i,t} = \alpha_{0,i} + \alpha_1 x_{i,t} + v_{i,t+1}; \quad E(v_{i,t+1} \mid I_{i,t}) = 0 \quad \text{.....(1)}$$

$$E(v_{i,t}, v_{j,s}) = \delta^2_v \quad i=j \text{ and } t=s \quad \text{.....(2)}$$
$$= 0 \text{ otherwise..}$$

Group-specific heterogeneity arises if each group has its own characteristics which are constant within the group and across time. This means that $\alpha_{0,i}$ differs among groups. By falsely assuming $\alpha_{0,i}$ to be the same for each group, the difference between $\alpha_{0,i}$ and α_0 become group-specific η_i. This implies that from (1)

$$V_{i,t+1} = \eta_i + \varepsilon_{i,t+1}, \quad E(\varepsilon_{i,t+1} \mid I_{i,t}) = 0 \text{ where } \eta_i = \alpha_{i,0} - \alpha_0..$$

To test whether group-specific effects occur, include past values of $y_{i,t}$ as independent variables or instruments in (1). Significant lags imply the presence of persistent group-specific effects.

C. Pooled Estimators (Pesaran and Smith 1995).

Consider the following:

$y_{i,t} = \lambda_i y_{i,t-1} + \beta_i' x_{i,t} + \varepsilon_{i,t}$ i=1,.....N;

t=1.....T.....(1)

with λ_i and β_i varying across groups according to:

Ho: $\lambda_i = \lambda + \eta_{1,i}$ $\beta_i = \beta + \eta_{2,i}$ .....(2)

with $\eta_{1,i}$ and $\eta_{2,i}$ having zero means and constant variances..

Assumptions.

(1) $x_{i,t}$ and $\varepsilon_{i,s}$ are ID for all t and s and both sets of variables are ID of $\eta_{1,i}$ and $\eta_{2,i}$ under Ho. The disturbances $\varepsilon_{i,t}$ have zero means and variances δ^2_i, that are constant over time.

(2) $x_{i,t}$'s are covariance stationary and mean square ergodic processes with means μ_i.

(3) The support of the random coefficients λ_i lie in the stable range (-1,1).

Further, all the cross-moments of λ_i and β_i exist and are finite.

Suppose the relations are specified as in (1) with random parameters as in (2). The pooled regression is given by:

$y_{i,t} = \alpha_i + \lambda y_{i,t-1} + \beta' x_{i,t} + v_{i,t}$, i=1,..N; t=1,....T. .....(3)

$v_{i,t} = \varepsilon_{i,t} + \eta_{1,i} y_{i,t-1} + \eta_{2,i} x_{i,t}$ .....(4)

Different group-specific fixed effects or random effects can be included in the restricted regression through the intercept term α_i. It follows that under assumptions (1)-(3), $y_{i,t-1}$ and $x_{i,,t}$ are correlated with $v_{i,t}$ giving inconsistent estimators.
(See Pesaran and Smith 1995 for details).

D: List of Countries used for Bank Development and Growth.

High-Income	Middle-Income	Low-Income
Australia	Barbados	Burkino Faso
Austria	Chile	Burundi
Belgium	Costa Rica	Cameroon
Canada	Dominican Republic	Colombia
Denmark	Egypt	Ethiopia
Finland	Greece	Ghana
France	Guatemala	Guyana
Germany	Hondurus	Haiti
Iceland	Indonesia	India
Ireland	Jamaica	Kenya
Israel	Korea	Malawi
Italy	Malaysia	Mauritius
Japan	Malta	Nepal
Netherlands	Mexico	Nigeria
New Zealand	Morocco	Pakistan
Norway	Panama	Sierra Leone
Spain	Philippines	Sri Lanka
Switzerland	South Africa	Swaziland
United Kingdom	Thailand	Tanzania
United States of America	Venezuela	Zambia

Notes: There are no interest rates in Pakistan so it was left out for FME.

E Countries Used in Stock Market Development and Growth.

High-Income	Middle-Income	Low-Income
Australia	Chile	Colombia
Austria	Egypt	Ghana
Belgium	Greece	India
Canada	Indonesia	Kenya
Denmark	Korea	Mauritius
France	Malaysia	Nepal
Germany	Morocco	Nigeria
Japan	Philippines	Pakistan
United Kingdom	South Africa	Sri Lanka
United States	Thailand	Swaziland

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Chapter 5.

Summary and Conclusions

The relationship between financial development and economic growth has generated intense research interest. The result is that many alternative theories linking the two have been put forward. One strand of research has produced theories in which financial development leads economic growth (Bagehot 1873, Goldsmith 1969, King and Levine 1993c among others). This popularly held view (new view) has identified several functions (micro-channels) of the financial system through which financial development promotes economic growth (Levine 1997). Another strand of research rejects this view and regards financial development to be an addendum to the development of the real sector (Robinson 1952). In between these views, lie those who believe that the relationship is badly "overstressed" (Lucas 1988) or those who do not associate the two at all (Stern 1989).

While the functions of the financial systems have long been identified, there have not been formal models connecting these functions to economic growth. Recently, however, Greenwood and Jovanovic (1990), King and Levine (1993c), among others, have modeled the connections of the function of the financial systems, in channeling more resources to their highest return uses, with economic growth. These models show that when financial systems engage in the efficient distribution of resources, then more resources are channeled to activities, in the economy, where returns are the highest and the impact on economic growth positive. Since the

seminal work of Goldsmith (1969), most of the research has been more lively primarily in empirical work (McKinnon 1973, Atje and Jovanovic 1993, Levine 1997, among others). Based on cross-country regressions, these empirical studies have established positive and significant static correlation between financial development and economic growth.

This thesis has revisited the relationship between financial development and economic growth by using different methodologies and making further contribution to both theoretical and growing empirical literature on the subject matter. In chapter 2, which is a theoretical paper, a general equilibrium framework was constructed in which bank intermediaries evaluate borrowers and their investment projects ex-ante and then fund only those projects which signal to be of "good" quality, under perfect signals. These "good" quality projects returned the highest (social) return. Because the assertions of theory are that financial systems mitigate informational asymmetries and allow capital to move to its highest return uses, greater capital accumulation and economic growth; in order to gauge the assertion, the paper has compared capital accumulation and economic growth when the financial systems perform the function and when they do not. The comparison is made with and without transactions costs.

The main findings in this paper are that; when transactions costs are assumed away, evaluating projects ex-ante is a dominant strategy (in the sense that capital accumulation and economic growth are greater) unequivocally. This result extends previous work which did not gauge the effect of the functions of the financial systems by comparing with alternative situations. Once transactions costs are introduced, and evaluation costs are different from verification costs, then it is no longer clear that evaluation ex-ante still dominates other strategies. Conditions

were derived under which it can still dominate. As in previous studies, the channels through which economic growth is enhanced are (i) savings mobilization, (ii) avoiding self-finance and (iii) preventing resources from lying idle in the form of goods in storage. There are possible extensions of the framework. In the framework, operational scales of all projects were assumed to be the same, evaluation costs were assumed to be the same and verification costs were assumed to be the same. One could relax these simplifying assumptions and see how the results change. Another possible extension is to allow for the existence of equity markets and see the mix of debt-equity finance that emerges because of transactions costs in debt markets.

Chapter 3 is one of the two empirical papers. Empirical literature on the subject matter has been based primarily on correlation tests based on cross-country regressions. In this paper, for bank development, the methodology followed is time series in which causality is tested for. The time series methodology was preferred to the traditional cross-country regressions for the following reasons (a) One objective of economic research is to find out which variables cause (or are caused by) which variables. This is achieved by causality tests. (b) Causality is a time series phenomena. (c) Theoretical predictions of endogeneity can be tested for by using VAR which is a time series concept. The causality tests focused on testing for micro-channels through which financial development and economic growth affect each other. Macroeconomic policies were controlled for, partly as a robust check, and partly because they form particular characteristics of the policy regime under which both financial development and economic growth take place. Because there is no consensus on the exact way to test for causality, the tests were performed in levels

VAR, first difference VAR and the dynamic error correction model (ECM) VAR. Reverse causality was also performed. For stock market development, dynamic correlation was preferred to static correlation because dynamic correlation can test for the presence of Granger causality. The idea is to find the correlation between current values of real GDP and past levels of stock market development indicators after controlling for the lags of real GDP growth rates and macroeconomic policy variables.

The main findings were that contrary to correlation evidence, for bank development, causality between bank development and economic growth is "weak". Evidence shows that causality is not consistent across countries to constitute "stylized facts" in the sense that in developed countries, some countries with high levels of financial development may show evidedence of causality while others do not. The same observation is noted in developing countries with low levels of financial development. The results have been found to be country specific; casting further doubts on the meaning of the results based on aggregate data. Causality, in most countries is tenuous to macroeconomic policies. For stock market development, dynamic correlation show "weak" presence of Granger causality running either or both ways. This is in contradiction with static correlation tests based on aggregate data, which run the risk of being confounded by all the differences between countries.

Chapter 4 is the other empirical paper. The paper is based on recent developments in the econometrics of panel data which includes the following three linear estimators: panel data, GMM-First Difference and GMM-SYSTEMS estimators. The three estimators were used, partly, as a robust check. The data itself was classified into groups by level of development The use of panel data was preferred to the traditional cross-country reg-

ressions for the following reasons: (i) It controls for group heterogeneity which the cross-country methodology is not able to do. (ii) The panel data approach combines cross-group and over-time dimensions which ensure more information, more variability and more efficiency than the cross-country methodology. (iii) Panel data enables one to study the duration of economic states like economic growth and can give an idea of the speed of adjustment to financial development. (iv) Panel data methodology eliminates aggregation biases resulting from aggregating across groups. The paper also advocated data stratification by development level for the following reasons: (i) It allows one to investigate the patterns that emerge from different stages of development which aggregate data does not allow. (ii) It allows one to distinguish those groups of countries which are credit constrained which aggregate data does not. (iii) It allows one to address several issues raised by theory which aggregate data is not able to do. (iv) It also shows directly whether pooling and aggregation biases fail the hypothesis under test.

The objective of the paper is two-fold. First, the paper tested whether the behavioral relationship predicting the relationship between financial development and economic growth is the same across different levels of development and growth. Second, the paper investigated the patterns that emerge across different stages of development by running regressions of different levels of development. Specifically, the questions addressed are (i) Whether the functions of the financial systems cause (or are caused by) economic growth. (ii) Whether there are persistent group specific effects which could be driving the relationship. (iii) For the different levels development, what are the channels of transmission. All these tests are

performed while controlling for macroeconomic policies spanning fiscal policy, monetary policy and trade policy.

The main findings of the paper were that pooling and aggregating data from different experiences of financial development, economic growth and macroeconomic policies are rejected in favour of group regressions. Evidence on the relationship between financial development and economic growth shows wide variation in signs, magnitudes and statistical significance by level of development and estimation method. Causality tests and tests for channels of transmission are equally variable, making it difficult to reconcile evidence with "stylized facts".

Overall, while theoretical models have identified the functions of the financial systems, empirical testing has not produced conclusive evidence on the nature of the relationship between financial development and economic growth. This could be due to fact that empirical testing is not being conducted according to the requirements of theory and therefore is inadequately done. For example, if theoretical predictions are that finance leads growth in the development process and then correlation tests are conducted, the results will not confirm theoretical predictions. Such has been the tradition in macroeconomics where, instead, the tests should be those of cause and effect. Another explanation could be the data problem most of which is not reliable. Having said that, however, the comprehensive causality tests performed in chapter 3 have not produced any clear pattern of the relationship between the two that could constitute "stylized facts". There are apparent contradictions in that in some countries with well-developed financial systems, there is evidence of some causality running either or both directions and none in others. In some countries with poorly developed financial systems, there is evidence of causality running

either or both ways and none in others. This finding, combined with the finding that evidence tends to be country specific makes it difficult to reconcile theory with such findings. My own view is that empirical tests should be more consistent with theory and that data collection should be harmonized. Another issue raised by such findings is whether evidence based on aggregate data is not misleading. Such evidence has prompted conclusions which emphasize strong links (static correlation) between the functions of the financial systems and economic growth.

Another interesting finding is that macroeconomic policies attenuate causality between financial development and economic growth in some countries, leave it unchanged in others and, enhance it in yet others. It is appropriate to incorporate macroeconomic policies in theoretical models linking financial development with economic growth.

In chapter 4, data was stratified by level of development with the objective of capturing the patterns that emerge during development stages as articulated by theory. What emerged from the tests were differences in impacts of financial development on growth and channels of transmission. However, there is no clear pattern from the evidence that is consistent with theoretical predictions. To constitute "stylized facts", it is important that there be an empirical relationship which remains roughly constant over time. This is not borne out by the data. Contrary to the conclusions based on cross-country regressions, the fundamental question about the relationship between financial development and economic growth remains open to dispute.

Overall, evidence has shown the divergence between theory and empirics, reminding the profession that it does not understand the relationship between financial development and economic growth as well as it

should like. It is hoped that although the studies find "weak" evidence of causality, they should not dampen the debate over causality between the two. To the contrary, new theories are needed and better data and measures of the functions of the financial systems are needed and more research is encouraged.

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