Essays on Financial Development and Economic Growth

by

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"Find rest, O my soul, in God alone;
my hope comes from him.
He alone is my rock and my salvation;
he is my fortress, I will not be shaken."

Psalm 62 v5,6

Declaration

I declare that this thesis submitted to Trinity College, Dublin for the degree of Doctor of Philosophy (Ph.D.) has not been submitted as an exercise for a degree at any other university. All research contained herein is entirely my own. I authorise the Library of Trinity College, Dublin to lend or copy this thesis upon request.

Date: 11 March 2003

Signature: Fraser Hosford

Summary

This thesis is a collection of essays on the relationship between financial development and economic growth. The thesis is introduced in Chapter One, which talks about the motivation for the thesis and outlines the structure of the remaining chapters.

Chapter Two provides a selective review of the literature on finance and growth. This literature suggests that the financial structure of an country affects its overall economic performance. First, we review specific transmission mechanisms whereby finance influences growth. Then we survey some existing empirical evidence for these channels and for an overall link between finance and growth.

Our first empirical paper is presented in Chapter Three. This paper extends a prominent paper, Levine, Loayza and Beck (2000), to include an examination of finance and growth in Ireland. In a cross-country setting we examine how Ireland performs, relative to the model, by analysing the Irish residuals and an Irish dummy variable. We find that initial finance is an important determinant of Ireland's economic growth performance. Its relative importance, however, decreases for the *Celtic Tiger* time period.

Chapter Four uses a time series approach to answer the same question: has finance aided economic growth in Ireland? This paper conducts cointegration analysis and then tests for causality, between financial development and real GDP in Ireland. A range of proxies are used for financial development, including the innovative use of proxies for the role played by foreign financial systems. We find that finance, including foreign finance, is related to growth. Furthermore, it is evident that growth is the causal factor in this relationship.

Chapter Five returns to a cross-country setting and examines the role foreign finance may play in economic growth. We find mixed evidence for the use of foreign finance in our non-OECD subsample. First, foreign liabilities of financial institutions have a positive effect on growth. Second, foreign credit to the domestic non-bank sector has a negative influence on economic growth, possibly reflecting exposure to extreme currency movements. We interpret these results to mean that foreign finance is more likely to have a positive effect when it is intermediated through domestic institutions. We also present evidence for the fragility of one of the key results in the finance and growth literature: the relationship between private credit and economic growth.

Our last empirical paper is Chapter Six. Most of the existing finance-growth literature looks at finance's effect on the overall economy. This paper adds to the literature by using a sectoral approach. We examine the behaviour of labour productivity in finance and its effect on other

sectors. Specifically, we test whether it is the cause of cost disease and / or positive spillovers in other industries. We find evidence that productivity growth in finance does cause positive spillovers and that finance is not the cause of cost disease. We also find different results, in part, for countries which may be regarded as financial centres.

Chapter Seven concludes.

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Chapter 1

Introduction

1.1 A Foreword

This thesis consists of a collection of essays on financial development and economic growth. The relation between finance and growth is now an established research field in contemporary macroeconomics. In fact, it has become a burgeoning area of economic research in recent years.

A large body of theoretical literature exists which promotes finance as a factor in determining economic growth. Furthermore, empirical macroeconomics has provided evidence for this general relation. If a country's financial system is more developed, its rate of economic growth is likely to be higher.

1.2 Motivation and Structure

The first essay of this thesis is a selective review of some of this literature.[1] This essay sets the context for the four empirical essays which constitute the main part of the thesis.

The first two empirical essays apply the finance and growth literature to Ireland. These essays emerge from the original motivation for the thesis. This motivation is based on the phenomenon that was the *Celtic Tiger*. The last decade saw unprecedented economic growth in Ireland: Irish GDP expanded by almost one hundred and ninety per cent in the ten years from 1992. During the same time period the US expanded by only sixty per cent and the UK by sixty two per cent.[2]

De la Fuente and Vives (1997), in their study of this Irish growth performance, examine the importance of standard factors such as convergence, labour market performance, factor accumulation and government size. They conclude "that factors not considered by (their) model have played an important role and point (them) towards specifically Irish characteristics."[3] Thus, a complete explanation of Ireland's growth remains elusive. Therefore, further studies of Irish growth, incorporating new potential determinants of growth, seem worthwhile.

In 1987, the International Financial Services Center (IFSC) in Dublin was launched. It has now exceeded its goal of directly employing seven thousand, five hundred people. Moreover, the presence of many blue-chip financial institutions from North America, Japan and Europe lends it a high profile. Its success is, at least partially, due to the high priority it was afforded and the "wholly exceptional" united approach of the public and private sectors.[4] Thus, Ireland's economic improvement coincided with the growth in importance of the financial sector. This

[1] Existing surveys of this literature include Gertler (1988), Pagano (1993), Galetovic (1996) and Levine (1997).

[2] These figures are taken from line 99B of the International Monetary Fund's (IMF) International Financial Statistics (IFS). The exact figure for Ireland is 188 per cent growth, from 1992 to 2001.

[3] De la Fuente and Vives (1997, p125).

[4] A nice inside account of the development of the IFSC is provided in MacSharry and White (2000).

suggests a possible relation between the two.

This anecdotal evidence for Ireland combines well with the aforementioned growing literature on the finance-growth nexus. This literature shows that in other countries the financial system is a causal influence on economic growth. Therefore, it makes sense to extend this literature to Ireland. Thus, this thesis commences with the aim of establishing whether this international evidence is true for the case of Ireland. This research has important policy implications. If a link exists between the financial sector and growth in Ireland, economic policy should then aim to improve the working of the financial sector in order to improve overall economic performance. Thus, we begin with the following question: has the financial system aided economic growth in Ireland?

Our first empirical paper, Chapter Three, addresses this question using a cross-country approach.[5] Using the dataset compiled by Levine, Loayza and Beck (2000), we extend their paper to include an analysis of Ireland in particular. Two techniques are employed to do this. First, we examine the Irish residuals and see how they change when finance is included in the regression. Second, we use a dummy variable for Ireland. Both of these techniques measure Ireland's performance relative to the model. We find that the addition of initial finance aids the explanation of Ireland's growth performance. This result also holds for the sub-period associated with the *Celtic Tiger*, but it is of a smaller magnitude.

A time series analysis of the same question constitutes our second empirical paper.[6] This helps us to more adeptly address the issue of causality: does finance cause growth or does finance merely follow growth? A range of financial variables are used including proxies for the role of foreign financial institutions. Stationarity tests are conducted on these variables. We then test whether finance and growth move together and we try to measure this potential relation. Cointegration testing and estimation techniques are used in this regard and we find that finance and growth are cointegrated. Causality is then addressed using error correction models and vector autoregressions in levels. It is found that growth is the causal variable in this relationship.

The focus of the thesis then switches away from Ireland and back to the international literature on finance and growth. The two remaining empirical papers, Chapters Five and Six, attempt to address imbalances in the literature.

Chapter Five examines the role of foreign finance in determining economic growth. The

[5] A preliminary paper on this topic was presented at the Irish Economic Association Annual Conference in April 2000.

[6] Previous versions of this paper have been presented at the 33rd Annual Conference of the Money Macro Finance Research Group, September 2001, and at the Irish Economic Association Annual Conference, April 2002.

literature so far has concentrated on how domestic economic growth is influenced by institutions resident in the country. It has largely omitted the role of foreign institutions. Foreign finance, however, could aid growth through the same theoretical channels as domestic finance. Conversely, it could have a negative impact through exposure to extreme currency movements. We test these theories using the same cross-country specification as in Chapter Three. We use a range of foreign finance proxies and different time periods in our analysis.

In this paper we find that foreign finance has a positive influence on economic growth. This result emerges for non-OECD countries. It seems that they use foreign liabilities to compensate for underdeveloped domestic financial systems. We also find evidence of a negative effect of foreign finance on growth. We interpret this to reflect the dangers of exposure to exchange rate risk.

Most of the existing empirical research has just focused on finance's effect on overall economic growth. Chapter Six adds to the literature by using a sectoral approach. We employ data from the OECD's Intersectoral Database (ISDB) for finance and a range of other sectors. First, we look at the cross-country evolution of productivity in finance by examining convergence. Then we look at linkages between finance and the other sectors. We draw on the literature related to Baumol's cost disease and also test for positive spillovers. We find a number of results here. First, labour productivity in the financial sector leads to labour productivity in other industries. Second, cost disease does exist in this dataset but finance is not the causal industry. Third, financial labour productivity does not converge across countries. Finally, this paper highlights the role of financial centres.

Chapter Seven summarises the main results of the thesis.

Chapter 2

Literature Review

2.1 Introduction

"Does finance make a difference?" Raymond W. Goldsmith (1969)[1]

A large body of literature exists on the role of the financial system in aiding overall economic performance. Since Walter Bagehot in the nineteenth century and Joseph Schumpeter at the start of the twentieth century, economists have considered this issue. There also exists a strong diversity of opinion among economists on the issue. Joan Robinson and Robert Lucas would hold the opinion that finance is of little importance to growth, in contrast to the literature that has emerged in the last two decades supporting the finance-growth link.

This chapter begins by reviewing the existing literature on the finance-growth nexus, focusing mainly on the more recent contributions. Attention is then paid to the related question of what influences financial development. Section 2.4 concludes.

2.2 Financial Development and Economic Growth

In this section we shall first examine the theoretical arguments concerning how the financial system can influence economic growth. The empirical work to date examining this hypothesis is then reviewed.

2.2.1 Theoretical Review

We proceed by first examining a situation where finance has no influence on overall economic performance. Then, by relaxing assumptions made to establish that situation, we can identify specific channels where finance influences growth. These channels shall be examined in turn.

Benchmark The benchmark result in financial theory is the Modigliani Miller (1958) theorem. This states that for an individual firm the choice of financial arrangement is irrelevant for the determination of real factors. In the context of this study, the Modigliani Miller result implies that a country's financial structure has no influence on its real rate of economic growth.

In such a world there is no need for financial intermediaries. Due to the assumption of symmetric information and the absence of transactions costs, efficient resource allocation is reached in direct and impersonal markets.[2] In the real world, however, financial intermediaries play a large role in the economy. Thus, in the real world frictions must exist. Financial markets develop to overcome these frictions and thus increase the efficiency of resource allocation. Levine (1997) has identified five separate functions of financial intermediaries:

[1] p408.

[2] Galetovic (1996, p60).

1. Facilitating risk amelioration
2. Information costs
3. Monitoring managers
4. Technological frictions
5. Specialisation and technology

We now investigate these specific functions.

Facilitating risk amelioration One function of financial markets is to ease the trading, hedging and pooling of risk. The main example of this is the role intermediaries play in overcoming the problem of liquidity risk. Investors are loathe to invest their savings in a project for a long time. This is because in the face of a shock they might use their savings for consumption purposes, or switch them to more profitable investment opportunities which have arisen.[3] Some high return projects are long-term and thus will suffer from a lack of investment, damaging economic growth. Both the stock market and financial intermediaries can decrease liquidity risk. The stock market enables investors to sell their investment to another investor, for liquidity purposes, while the company retains the original capital invested. Intermediaries such as banks can offer liquid deposits to customers while investing some of the capital in high return illiquid projects. Bencivenga and Smith (1991) develop a general equilibrium model which illustrates this result. The return on investment, and economic growth, is increased as less of an economy's savings are held in unproductive liquid assets. This is a relative phenomenon. As stock markets and intermediaries become more efficient at these functions, risk decreases more and economic growth increases.

There are also possible disadvantages to liquidity. Shareholders have less incentive to monitor managers if it is easier to sell their shares. Large institutional shareholders, however, may continue to monitor and this should suffice. There is also a possibility that liquidity might decrease savings. Jappelli and Pagano (1994) present cross-country evidence for this effect. Liquidity constraints on households result in increased savings, as they cannot borrow all the capital they desire. The relevant financial constraint for households, however, is the loan to value ratio for mortgages which Jappelli and Pagano use as their proxy for financial constraints. It is doubtful whether more liquid stock markets will decrease the liquidity constraints that households face. Levine and Zervos (1998) do not find any significant statistical relationship

[3] Information costs in verifying whether an individual has received a shock prohibit the use of state-contingent contracts.

between stock market liquidity and private savings.[4] Bonser-Neal and Dewenter (1996) find similar results.

The hedging of risk is known as diversification. Financial markets, with professional expertise and experience, can diversify investments so as to decrease nonsystematic risk.[5] This will lead to increased investment in more risky (now diversified risk) and thus productive assets, which will boost the growth rate of the economy. Furthermore, diversification leads to more stable growth which decreases the permanent damage that crises can cause (Acemoglu and Zilibotti, 1997a).

Information Costs Asymmetric information about the potential / likely profitability of projects results in capital not being directed to its most efficient use. The costs of acquiring the necessary relevant information are likely to be prohibitive for individual investors. Thus, financial intermediaries emerge and perform the functions of information gathering and evaluation. As intermediaries improve in this function and information costs decrease, the cost of finance will decrease and more information will be used. Therefore, the efficiency and quantity of investment will increase. Greenwood and Jovanovic (1990) develop a model which shows that as intermediaries collect and analyse information, funds flow to their most profitable use.[6] King and Levine (1993b) extend this theory by developing a model that includes entrepreneurship.[7] Thus, resource allocation is improved by identifying both the best existing production technologies and the best entrepreneurial opportunities. This boosts overall economic growth.

The importance of information concerning specific projects and firms is highlighted in Stiglitz and Weiss's (1981) paper on credit rationing. They show that, due to an adverse selection problem, the market interest rate may fail to achieve an efficient equilibrium position. The imperfection in the market is that different borrowers have different probabilities of repayment, which are only known to themselves. The interest rate fails as a screening device because it affects the riskiness of the pool of loans. Assuming the borrower defaults when the project fails (and thus pays no interest), only the higher return and higher risk projects remain feasible investments (for borrowers) when the interest rate is increased. Thus, for the lender, the expected return from the loan decreases when the interest rate is increased, as the loan is now less likely to be repaid. The result is that some form of credit rationing will prevail in the market

[4] Levine and Zervos (1998, p546).

[5] Nonsystematic risk is risk that is unique to an asset and thus can be diversified away by the judicious choice of other assets in the portfolio. Systematic risk, on the other hand, cannot be eliminated by diversification.

[6] Goldsmith (1969) is his seminal study argued that finance accelerated economic growth "to the extent that it facilitates the migration of funds to the best user" (p400).

[7] They also argue that good financial systems aid innovation by accurately revealing the benefits of using new technology.

place, where information on specific borrowers will be used to determine lending. Consequently, firms with bad repayment records or entrepreneurs (possibly with no repayment records) may have worthwhile investment projects which are not undertaken due to a lack of funding. Thus, we can see that if more information is used in the decision making process, resource allocation will be more efficient.

Levine reviews the empirical evidence on asymmetric information and finds that for different ways of analysing the problem the results are similar: firms with bigger asymmetric information problems find it relatively more difficult to raise funds and thus rely more on internal sources of finance. Furthermore, firms with close relationships to financial intermediaries are less constrained in their investment decisions. Also evidence from stock price movements, when banks sign a new loan agreement with a firm for example, show that financial intermediaries have valuable extra information about firms.[8]

Stock markets play an ambiguous role with respect to this channel between finance and growth. It is possible that larger and more liquid stock markets stimulate the acquisition of information, because in such markets it is easier to disguise private information.[9] Conversely, stock markets disseminate information through share prices. This may decrease the incentive for investors to spend resources acquiring information.

Monitoring Managers The above channel refers to the costs of acquiring information before any actual investment is undertaken, due to an adverse selection problem. The third channel refers to the costs of acquiring information after the investment has been undertaken. This is because a moral hazard problem exists. The borrower may have an incentive to misreport the results of the project in order to decrease his / her repayment costs. Thus, the lender has to verify the result of the project, incurring costs.

It has been shown by Townsend (1979) that the optimal contract under this situation is the standard debt contract. This is where the borrower makes a fixed repayment or defaults. If the borrower defaults all the return from the project goes to the lender. Consequently, monitoring costs are minimized as the lender only has to verify when the borrower defaults and the borrower has an incentive to avoid default.

The main point of this analysis is that the overall cost of external finance will be higher due to this moral hazard problem.[10] Thus, the quantity of external investment will be smaller and

[8] Levine (1997, p715).

[9] Levine (1997, p695). Intuitively, in larger markets individual agents are more anonymous.

[10] While this exposition relates to debt instruments this point also holds for equity markets. Managers faced with poor investment opportunities may prefer to invest in these projects rather than return the firm's cash flow to shareholders (Stulz, 2001). The shareholders do not have full access to the information about the project.

firms will use retained earnings as a source of finance.[11] Furthermore, firms that use more of their own internal resources in financing a project are more likely to receive external finance (or receive it at a lower interest rate) because they are less likely to default. Thus, the quality of investment is decreased, as finance is not being directed to the project with the highest potential return. Therefore, if financial intermediaries reduce monitoring costs, they increase the efficiency and quantity of investment.

Acemoglu and Zilibotti (1997b) argue that economies of scale exist in monitoring through *relative performance evaluation.* Banks have many clients and the many economic conditions that affect firm performance, and thus need to be monitored, will be common to these clients. Thus, banks reduce cost per unit by spreading out these monitoring costs over their client base. Furthermore, as banks keep private much detailed information of projects the public good nature of this information is overcome.[12] Levine notes evidence that stronger relationships with a bank results in lower interest rates for the firm and a decrease in the likelihood of the firm having to pledge collateral.[13] This evidence supports the existence of this channel as a mechanism where financial structure can influence economic growth.

Technological Frictions The fourth channel Levine suggests is that financial intermediaries overcome technological frictions that are a barrier to the mobilization of savings. In the economy there are individuals who want to save (or invest) their money and there are firms who want capital. Therefore, economic growth will be boosted if these coincidental wants can be matched. This can be done by direct finance where firms issue very small securities to millions of consumers.[14] This is practically impossible at times, however, because securities issued by individual firms are not perfectly divisible. In addition, this can be inefficient, as economies of scale in transactions costs will be available. Thus, satisfaction of these wants is best achieved by the emergence of financial intermediaries. They can combine the savings of small investors and overcome the previous two technological frictions (problems caused by the nature of the security-issuing technology). In consequence, the existence of intermediaries increases economic growth.

Galetovic argues that once intermediaries exist technological frictions, under weak assump-

Thus, if it fails they may attribute its failure to bad luck.

[11] Mayer's (1990) study of eight major industrial countries confirms the importance of retained earnings as a source of funds.

[12] Acemoglu and Zilibotti (1997b) argue that this helps to explain why stock markets emerge later in the process of financial development as then "more information becomes naturally available."

[13] Petersen & Rajan (1994) and Berger & Udell (1995).

[14] Hellwig (1991, p42). There has to be a large number of consumers as they will be anxious to avoid firm-specific risk.

tions, do not change the Walrasian benchmark results. If scale economies are "large enough to justify intermediation, but small enough to permit competition, intermediaries allocate funds and risks efficiently, and financial arrangements do not affect real allocations."[15]

Specialisation and Technology This channel was identified by Adam Smith in the Wealth of Nations. He argued that specialisation, division of labour, was the key to increasing productivity. Lower transactions costs in the financial system will increase specialisation, as specialisation requires more transactions. It is probable that more technologically advanced production processes use input goods which are more specialised.[16] Thus, "lower transactions costs will increase the range of *on the shelf* production processes that are economically attractive."[17] This may result in more efficient production processes being used, boosting economic growth. Furthermore, new production processes may be invented.

Open Economy Trade in Financial Services The consequences of international trade in financial services are profound for this study. The analysis so far has implicitly assumed a closed economy in financial services. This means that economic growth in a country is dependent solely on the domestic financial system and is not influenced by the international financial system. This is not a valid assumption, however, and needs to be modified. Thus, Rajan and Zingales (1998) assume that world capital markets are not perfectly integrated. This is an implicit assumption for all work in this area, as it is only then that the domestic financial system and its shortcomings are relevant for domestic economic performance. This is a valid assumption and this section shall provide evidence which suggests that capital can be immobile.

Gordon and Bovenberg (1996) examine various theories why capital is immobile internationally. First, they present the following evidence for capital immobility:

- Additional savings in a particular country lead to a near equal increase in investment in that country. This conjecture is supported by the following papers: Feldstein and Horioka (1980), Penati and Dooley (1984), Dooley et al. (1987), Bayoumi (1990).
- Real interest rate differentials may exist across countries (Mishkin, 1984; Cumby and Obstfeld, 1984; Cumby and Mishkin, 1986).
- A strong domestic bias exists in individual portfolios (Adler and Dumas, 1983; French and Poterba, 1991; Tesar and Werner, 1994).

[15] Galetovic (1996, p61). Levine omits this point.

[16] This is a key assumption in the model Greenwood and Smith (1997) use to show how specialisation affects growth.

[17] Levine (1997, p701).

They then proceed by outlining all the possible explanations that have been advanced in the literature. Shocks to a country that affect both savings and investment might explain the observed correlation between the two variables, but they do not account for the other two pieces of evidence presented above. Accounting for capital controls, transaction costs and exchange-rate risk does not empirically explain the phenomenon. Therefore, the authors explore the possibility that asymmetric information is the problem. Asymmetric information exists between foreign and domestic investors about specific firms, potential government policy changes and the domestic economy in general. This may lead to overpayment when foreigners acquire shares in a firm or, having acquired a firm, when they purchase inputs or services. Furthermore, this lack of information on the part of foreigners may lead to poor management decisions and resultant inefficiencies, due to an inability to predict market demand for example.

The model Gordon and Bovenberg (1996) develop, based on this asymmetric information problem, accounts for the three empirical regularities noted above. They also note some empirical evidence for their case. According to Grubert et al. (1993) foreign subsidiaries in the United States receive rates of return much lower than domestic US firms. Harris and Ravenscraft (1991) show that foreign investors pay a higher premium than domestic investors when acquiring a publicly traded firm. During the Mexican devaluation of 1994, domestic investors moved their funds before the devaluation while foreign investors waited.

In a development to the above study, Razin et al. (1998) assume that foreign direct investment (FDI) overcomes the asymmetric information problem. The actual exercise of control and management gives foreign investors the same level of information that domestic investors have. Portfolio investment, debt and equity, still suffers from asymmetric information. This explains the fact that over 50% of private capital flows are in the form of FDI.[18] This is pertinent to the Irish case where FDI flows are quite large and a definite factor in the economic boom. It allows for both international capital flows (in the form of FDI) and the domestic financial system (as capital markets can be assumed to be not perfectly integrated) to be contributors to Irish economic growth.

Theoretically these imperfections means that our previous domestic channels are still relevant and that another channel exists whereby finance affects growth. Improvements in the international mobility of capital will increase the trade in financial services and thus increase the quality and quantity of investment, boosting growth.

[18] Razin et al. (1998, p47). Figures from the World Bank.

2.2.2 Empirical Review

We now review some of the empirical work in this area. First, we look at the literature that forms the historical background to the recent upsurge of empirical work in this area. Then we examine the more recent work in subsections defined by the econometric nature of the studies.[19]

Historical Background The breakthrough empirical work in this area is Goldsmith's (1969) work on national balance sheets. Goldsmith defines financial development as change in financial structure. The main variable he uses to measure financial structure is the financial interrelations ratio. This ratio is the total value of all financial assets divided by the total value of national wealth. Much of the recent empirical literature follows this approach: the size of the financial system measures the extent of the financial system and is used as a proxy for the efficiency of the financial system. Khan defines the extent of the financial system as "the proportion of firms and households able to easily access the services provided by financial markets and intermediaries."[20]

Goldsmith finds a positive correlation between his financial interrelations ratio and GNP.[21] On the key question of interest he notes "there is no possibility, however, of establishing with confidence the direction of the causal mechanism", and he describes virtually all attempts to do so as "impressionistic".[22] Overall his work suggests that "external finance was an integral part of the process of industrialization, and that modern financial systems developed during the early stages of industrialization and sustained economic growth, not after."[23]

McKinnon (1973) and Shaw (1973) extend Goldsmith's work by looking at how public policy shapes finance and its effect on growth.[24] In particular, they focus on financial repression caused by policies such as interest rate ceilings, foreign exchange controls and other forms of interference in the financial system. These policies breakdown the natural functioning of the financial system whereby capital flows to its most productive use. In some cases this happens directly, as governments direct capital to favoured industries. In other cases banks have to allocate credit according to transaction costs and perceived risks of default, as use of the interest rate as a price mechanism is effectively prohibited. Thus, the quality of investment decreases.

[19] A select survey of some time series literature is reserved for our time series analysis in Chapter Four. This literature broadly supports the contention that finance *causes* growth, although this is not true in all of the studies examined. Indeed some studies emphasize how this link differs across countries.

[20] Khan (2000, p4).

[21] He finds, however, that this relationship is less striking when growth rates for both variables are employed.

[22] Goldsmith (1969, p48 and p403).

[23] Galetovic (1996, p63).

[24] Earlier work by Shaw includes Gurley and Shaw (1955) which is a seminal article in linking finance and development. It is, however, more of a theoretical paper in content.

They also argue that these policies lead to lower and even negative real interest rates, which depress savings and thus decrease the quantity of investment. Their empirical evidence is largely based on case studies and descriptive statistics.

Cross-Sectional Studies Of the more recent work, one of the key references is King and Levine (1993a). Their study examines eighty countries for the time period 1960 to 1989. They attempt to overcome the problem of measuring financial structure by using four different measures. The first proxy follows Goldsmith, as it is a measure of financial depth, *depth*: the ratio of liquid liabilities of the financial system to GDP.[25] Further measures are also used, as the second and third channels, identified in the theoretical section, relate more to the assets of financial intermediaries, than their liabilities. Furthermore, banks are more likely to provide information gathering and monitoring services. Thus, the second measure used is *bank*: the ratio of bank credit to bank credit plus central bank domestic assets.[26] The allocation of credit is also important, as lending to the government may mean the financial functions being examined are less likely to be fulfilled. This is accounted for in the next two measures. *Private* is credit allocated to private enterprises, scaled by total domestic credit. *Privy* is credit allocated to private enterprises, scaled by GDP. The literature that follows, which this paper largely spawned, generally uses finance proxies of a similar ilk.[27]

A further improvement on Goldsmith's study is that four growth indicators are used.[28] Moreover, other variables affecting long run growth are accounted for in the econometric study. The regressions are in the style of Barro (1991), where each country has one observation: an average over the time period. The results show positive and significant coefficients for all four of the financial development proxies. Furthermore, the size of the coefficients imply an economically important relationship. All these results are robust to sensitivity checks such as altering the control variables, using subsamples of countries and time periods, omitting outliers and Levine and Renelt's (1992) extreme bounds analysis.

In an effort to overcome the causality problem the analysis was repeated using initial levels of

[25] M3 is the measure used for liquid liabilities.

[26] The authors note that further financial intermediaries are excluded, but the breakdown they use is all that is permitted by the data.

[27] The shortcomings of these proxies have been well documented. Wachtel (2001a), for example, notes that at times they give measurements which are hard to understand. Perhaps they pick up a country's greater reliance on bank-based finance, rather than greater overall financial sector development. Furthermore, high ratios of credit to GDP can signal overlending and declining loan quality, and subsequent crises (Kaminsky and Reinhart, 1999; Gourinchas et al., 2001).

[28] These are *gyp*: real per capita GDP growth; *gk*: the rate of physical capital accumulation; *inv*: the ratio of gross national investment to GDP; and *eff*: total productivity growth measured by a Solow residual.

financial development. The results support the finance-growth nexus and suggest that it is more that just a contemporaneous association. Overall King and Levine conclude that there results are "consistent with the view that financial services stimulate economic growth by increasing the rate of capital accumulation and by improving the efficiency with which economies use their capital."

In Galetovic (1996)'s review of the literature he notes the following limitation of the above King and Levine study. When a subsample of OECD countries minus Japan is used there is no statistically significant relationship between the financial indicators and growth (Fernandez and Galetovic, 1994). Furthermore, the same pattern emerged in De Gregorio and Guidotti's (1995) study, where the relationship is smaller (though still significant) for richer countries.[29] Galetovic, however, notes that a sample of just OECD countries may not have enough variation to capture a positive effect of finance on growth. Furthermore, King and Levine found their results robust to use of an OECD subsample; what drives the results of Fernandez and Galetovic is the exclusion of Turkey, Greece and Portugal, in addition to Japan. The idea that OECD countries had mature financial systems, and thus exhausted their impact on growth, by the beginning of the twentieth century doesn't seem to fit the evidence. The standard indicators of financial development decrease after the Great Depression and the Second World War, and don't reach 1913 levels till the 1980s (Rajan and Zingales, 2001).

Levine and Zervos (1998a) extend the King and Levine (1993a) analysis by including measures of the functioning of stock markets, as proxies for financial development.[30] Stock market liquidity is the most important measure of stock market development used. They find the other three indicators to be insignificant: stock market size, volatility and international integration. Two measures of liquidity are used. *Turnover* is the value of the trades of domestic shares on domestic exchanges, divided by the value of listed domestic shares. *Value traded* is the value of the trades of domestic shares on domestic exchanges, divided by GDP.[31] The main proxy for financial development is *bank credit*: the value of loans made by deposit-taking banks to the private sector, divided by GDP. This is similar to the *privy* measured used by King and Levine (1993a).

[29] The authors themselves note that this maybe due to the fact that their finance measure focuses on the banking sector, while many developed countries are financially developed outside the banking sector.

[30] Previously, Atje and Jovanovic (1993) had found a positive effect of stock markets on development in a cross-sectional setting.

[31] Value traded is subject to the pitfall of the price effect, where the value of transactions rise because of a price increase due to bullish expectations. Thus, it appears that liquidity has increased even though there is no change in the number of transactions or in transactions costs. Turnover, however, overcomes this pitfall as stock prices enter both the numerator and the denominator.

The regression results show that the initial levels of both stock market liquidity and banking development have statistically significant relationships with output growth, capital stock growth and productivity growth. Initial levels are again used in the regression showing the statistical relationship does not merely reflect contemporaneous shocks to both variables and that stock market and banking development do not simply follow economic development.[32] These results are robust to changes in the data and are controlled for other factors which may contribute to long run economic growth. Furthermore, the relationships analysed are economically significant. The estimated coefficients imply "that if a country had increased both stock market and banking development in 1976 by one standard deviation, then by 1994 real per capita GDP would have been 31 percent larger, the capital stock per person would have been 29 percent higher, and productivity would have been 24 percent greater."[33] Also the results show that financial development affects growth mainly through productivity growth rather than capital stock growth. This paper also suggests that banks and stock markets provide different financial services to each other, as both have significant relationships with economic performance.

Levine et al. (2000) is one of Levine's most recent contributions. The paper has two related aims. The first is to further examine the standard finance-growth nexus. The second is to evaluate whether cross-country differences in financial development are attributable to differences in legal and accounting system characteristics. We are interested in the first aim here, the relation between law and finance is discussed in Section 2.3.1. This question of the finance-growth link is analysed using two different techniques. The first econometric method is a cross-sectional study of seventy one countries for the period 1960 - 1995, again using Barro style regressions but this time with GMM estimation. In an attempt to overcome causality problems they use legal origin as an instrumental variable for finance. The second econometric technique uses panel data and is discussed below. Both techniques produce the same result, "financial intermediary development exerts a statistically significant and economically large impact on economic growth."[34]

In a companion paper using identical econometric techniques, Beck et al. (2000), the authors investigate the channel through which finance affects growth. They find a robust, economically large and statistically significant relation between their standard finance measures and total factor productivity. In contrast, the results for private savings and physical capital accumulation are ambiguous: a significant relation only exists in certain specifications. Thus, they conclude that financial development primarily affects the quality of investment, not the quantity.

[32] Levine & Zervos (1998, p544).
[33] Levine & Zervos (1998, p547).
[34] Levine, Loayza, and Beck (2000, p31).

Wurgler (2000) uses the efficiency of capital allocation as his dependent variable. He measures this by first regressing the growth in industry gross fixed capital formation on the growth in industry value added. The slope estimate of this regression then measures the extent to which a country's investment is moving to growing industries from declining industries.[35] The key result is that financial development, measured by credit claims and stock market capitalization, is a statistically significant independent variable explaining the efficiency of capital allocation. Developed financial markets are associated with a better allocation of capital.

Panel Studies One of the first studies to incorporate panel techniques was Neusser and Kugler (1998) who examine the finance-growth hypothesis for thirteen OECD countries. The distinctiveness of their research is the data they use. They measure financial development by the GDP of the financial sector, including a wide range of institutions such as insurance companies. Manufacturing GDP is used as a growth measure reflecting their belief in the primacy of technical progress in stimulating economic growth. They also use manufacturing Total Factor Productivity (TFP), as a direct measure of technical progress. They use a range of bivariate cointegration techniques and a panel cointegration test in the fashion of Pedroni (1997). They find that financial sector GDP is related to manufacturing GDP and also to manufacturing TFP, for most of the countries they study.

Levine et al. (2000) extends Levine's previous empirical work on finance and growth by using GMM dynamic panel estimators. These help to solve the problems caused by unobserved country-specific effects and joint endogeneity of the explanatory variables. They use two different estimators. The first is a difference estimator developed by Arellano and Bond (1991) and Holtz-Eakin et al. (1990). As the cross-country relationship is eliminated here, they also use a systems estimator developed by Arellano and Bover (1995). This combines the regression in differences with the regression in levels. They use three different measures of financial development: liquid liabilities, commercial-central bank and Levine's preferred measure private credit. All three are significant at the five per cent significance level in nearly all of the specifications. The shortcoming of this technique is the five-year periods used: these result in the study not being free from business cycle effects.

Benhabib and Spiegel (2000) use two separate base regressions in their analysis, a neoclassical model based on Mankiw, Romer and Weil (1992) and an endogenous model similar to Benhabib and Spiegel (1994). These two equations are estimated using panel GMM methods in the

[35] Theory dictates that an economy allocates capital efficiently when capital is invested in the best investment opportunities. The premise that value added growth reflects investment opportunities is evidenced by the high correlation it has with sales growth and the price earnings ratio, in the USA.

fashion of Arellano and Bond (1991). The indicators of financial development employed are taken from King and Levine (1993a). The results show that finance still affects growth after accounting for differences in factor accumulation, suggesting finance affects TFP. The strongest results, however, are found for finance affecting growth through physical capital accumulation. Interestingly, the significance of financial development for growth is not robust to the introduction of country fixed effects, which suggests that the financial variables may be acting as a proxy for a number of other factors that are correlated with financial development.

Spiegel (2001) repeats the empirical analysis of Benhabib and Spiegel (2000) with a special focus on APEC countries.[36] He finds that APEC countries are significantly more dependent on financial development that the rest of the sample.

Khan and Senhadji (2000) use pooled cross-section with five year averages. They do not include country fixed effects as first, they believe they dominate other variables and second, initial income is included in the growth regression. Only two of the four financial variables they use are statistically significant, compared with all four in a straight cross country OLS.

The relation between stock markets and growth is examined by Rousseau and Wachtel (2000), using adapted Arellano and Bond (1991) GMM estimators in a panel VAR approach. They find a joint role for liquidity and size in economic growth that is more than twice as large as that attributable to market capitalization alone. This is a causal result with no feedback from growth to finance.

Beck and Levine (2001) extend Levine et al. (2000) to include stock markets as well as banks. They claim to improve on the work of Rousseau and Wachtel by virtue of using systems estimators such as Arellano and Bover (1995). They find that stock market development and bank development jointly enter all their growth regressions significantly. The results are slightly less convincing when they analyse the independent impact of these financial variables.

Graff and Karmann (2001), and Graff (2001), use a completely different panel technique, a 2-wave path (LISREL) model. They use the following raw variables: share of the financial sector in GDP, share of the labour force employed in the financial sector and the number of banks and branches per worker. They consider these real variables to be more exogenous than the monetary variables used elsewhere. They believe, however, that these raw data are unreliable, so they use principal component analysis to identify the common variance of these three variables. The individual scores for the first component are then used as the finance proxy. They find that from 1970 to 1990 finance *caused* growth, although they can't rule out mutual causation. Also the results are not as strong for the developing countries subgroup and for the second half of the 1970s they find that finance is detrimental to growth possibly due to the oil shock. Graff also

[36] APEC is an acronym for Asia-Pacific Economic Cooperation.

performs a standard cross-country analysis, Graff (1999), with two interesting results. First, he finds that an interaction term for financial development and output is significant, implying that developing countries gain more from financial development. Second, an interaction term for literacy and finance is also significant. This variable seems is used to ensure that the finance proxy is measuring the quality of financial services.

The link between inflation, financial development and growth is examined by Rousseau and Wachtel (2001). They find a robust relationship between finance and growth. If the inflation rate is held constant the relationship remains. It is only in high inflation scenarios, inflation greater than forty per cent, that the relationship weakens. These results are based on a simple panel of five-year averages from 1960 to 1995. Haslag and Koo (1999) do some related work where they use inflation, as well as the reserve ratio, as a proxy for financial repression. They employ panel data, using decade long averages, as well as Barro style cross-county regressions. They reach a conclusion that financial repression is empirically linked to financial development, which in turn is linked to growth according to King and Levine (1993a).

Li et al. (1998) extend the literature by testing for a relation between finance and inequality. They postulate that credit constraints, due to asymmetric information, prevent the poor from making productive investments. Furthermore, their present poverty implies a lack of collateral, exacerbating the situation. Thus, a poor financial system can perpetuate poverty and inequality. Using instrumental variables, on a panel of five-year period averages, they find a robust relation between finance and inequality. In addition, they find that this finance argument is more important than a political economy argument which they also test.

Microeconometric Studies Jayaratne and Strahan (1996) use a completely different method in examining the finance-growth link. They examine the natural experiment that has taken place as states in the USA have deregulated their banking systems. Since the 1970s most states in the US have liberalised their banking laws in two main ways. First, they have allowed holding companies to convert subsidiary banks into branches. Second, they have allowed de novo branching, which is where banks can open new branches within the state.[37]

The regression results show that bank deregulation has a statistically significant relationship to economic growth. They also show an economically significant relationship, the increase in annual growth rates is between 0.51 to 1.19 percentage points. Individually all but six of the states that deregulated after 1972 performed better than their respective control groups, showing

[37] There were also reforms in interstate banking but previous research suggests that the above intrastate reforms are more important, thus Jayaratne and Strahan concentrate on those intrastate reforms.

that the results are not driven by a handful of states.[38]

These results are also robust to changes in the methodology, the inclusion of fiscal policy and tax receipts as other regressors, and to controlling for local business cycles. Furthermore, with regards to the causality issue, no evidence was found to suggest that liberalisation was implemented in anticipation of good future growth prospects.

The data suggests that the quality of investment, not the quantity, is the main channel through which the banking reforms affected growth. The amount of loan growth did not change after the reforms and the relationship between liberalisation and growth is consistent when loan growth is controlled for. Furthermore, three indicators of loan quality improved dramatically following liberalisation. First, the number of non-performing loans decreased. Second, the fraction of loans written off during the year decreased. Finally, the number of insider loans to executive officers and principal shareholders decreased. This shows that the banks improved in the financial functions related to the second and third channels identified in the theoretical section. The authors propose three possible reasons why the reforms increased the performance of the banks. First, they propose a selection mechanism where the weaker banks failed, or were taken over, in the face of increased competition. This means only the better performing banks were left in the state. Second, perhaps the increased threat of takeover disciplined the management into action. Finally, maybe the increase in the size of the banking companies led to scale economies in monitoring and information costs.

Rajan and Zingales (1998) attempt to highlight a specific mechanism by which finance affects growth. They examine whether financial development reduces the cost of external finance to firms. Specifically, they test to see if industries that are more dependent on external finance grow relatively faster in countries with more developed financial systems. This is in effect a test of the third channel, monitoring managers, identified in the theoretical section. The cost of external finance is higher than the cost of internal finance as the lender incurs monitoring costs due to the moral hazard problem.

This study assumes that industries depend on external finance for a technological reason and that this reason persists across countries. Thus, the demand for external finance can be calculated from one country's actual experience, in this paper USA is the benchmark country. Growth in value added is used to measure the economic success of the industry. Two measures of financial development are used. The first is the ratio of domestic credit plus stock market capitalisation to GDP, the capitalisation ratio.[39] The second measure is the accounting standards

[38] Fifty states were included in the overall study, of which 35 deregulated after 1972.

[39] This again assumes that the quality of financial structure can be proxied by the size of the financial system. As stock market capitalization is not a measure of the actual amount of funding received, the regressions are

in a country. It is easier for firms to raise funds from a broader pool of investors in a country with higher accounting standards. In relation to the theoretical section, the higher accounting standards are then the more information there is, and thus information costs are decreased and monitoring managers is probably easier. Therefore, accounting standards aid growth through the second and third channels.

The regression results affirm the hypothesis tested and the economic magnitudes are significant. Two thirds of the increase in growth is due to an increase in the size of existing establishments, with the remaining one third due to an increase in the number of establishments. This is significant as the creation of new firms is more likely to require external funds. The results are also robust to changes in some of the proxies. Thus, it seems that Rajan and Zingales have pushed "the causality debate one step further by finding evidence for a channel through which finance theoretically influences growth."[40]

A similar study is that of Demirguc-Kunt and Maksimovic (1998). First, they estimate the rate at which a firm could grow if it only availed of retained earnings and short term credit. They then compare this with the realized growth rates. Then they find that the proportion of firms in a country that grow faster than the predicted rate is dependent on the country's legal and financial system.[41]

2.3 The Evolution of Financial Development

Thus far, we have examined how finance affects growth. We have seen that the literature attempts to address the causality issue, to show that finance does not merely follow growth. If that is true then what does affect finance: why do some countries have highly developed financial systems while others do not?

2.3.1 Law and Finance

La Porta, Lopez-de-Silanes, Shleifer and Vishny's (1998) breakthrough paper (henceforth LLSV) attempts to answer this question by highlighting the legal underpinnings of corporate finance. They analyse finance by defining securities by the rights they bring to owners rather than their cash flows. In particular, they focus on the rights of shareholders and of creditors. Their

repeated, omitting stock market capitalisation from the capitalisation ratio, to check for robustness. Stock market capitalisation, however, should be useful as a measure of the stock market's role in providing liquidity and information.

[40] Rajan & Zingales (1998, p584).

[41] The role of the legal system is dicussed in more detail in Section 2.1 The law and order variable used here is taken from the International Country Risk Guide, the same variable used by Knack and Keefer (1995). The financial proxies used are standard bank credit and stock market capitalisation variables.

argument is that the breadth and effective power of these rights are determined by the relevant laws and their enforcement. As the supply of finance is a function of these rights we have a channel whereby law affects finance.

These rights measure the ease with which investors can exercise their powers against management. For shareholders some of the rules they examine cover voting powers, ease of participation in corporate voting and legal protections against expropriation by management. For creditors they look at the respect for the security of the loan, the ability to grab assets in case of a loan default and the inability of management to seek protection from creditors unilaterally.

They find a big difference in rights across countries. They explain these differences by focusing on legal origin: common-law versus civil-law. Common-law is modelled on English law and is formed by judicial decisions on specific disputes. Civil-law is older and more widely distributed. It originates in Roman law and is based on legal scholars' interpretations of a multitude of statutes and codes. As most countries adopted their legal systems involuntarily, through conquest or colonization, it can be treated as an exogeneous variable.

The key result is that countries whose legal rules originate in the common-law tradition tend to protect investors more than those from a civil-law tradition. This is particularly true of countries from a French-civil-law tradition which offers the least protection.[42]

They also look at legal enforcement which may work as a substitute for good legal rules. This includes analysing accounting standards which are needed to measure a firm's income and assets. Again legal tradition influences the quality of law enforcement, even when per capita income is controlled for (richer countries have a higher quality of law enforcement). Common-law-countries are eclipsed here as German and Scandinavian-civil-law countries have the best law enforcement. French-civil-law countries, however, still come last.

Finally, the authors examine ownership. A lot of capital may be necessary to exercise control rights. French-civil-law countries have unusually high ownership concentration suggesting that it becomes a substitute for legal protection.

Levine (1998) extends LLSV (1998) by showing that these cross-country differences in the legal rights of creditors, and the efficiency of contract enforcement, explain over half of the cross-country variation in the level of banking development.[43] Countries with a German legal system

[42] French-civil-law focuses more on the rights of the state than the individual because Napoleon developed it to prevail over judges and thus solidify state power. German and Scandinavian-civil-law countries have stronger financial development than French-civil-law countries because they were not birthed in the same anti-judiciary political atmosphere (Beck, Demirguc and Levine, 2002). In contrast, British-common-law evolved to protect private property owners against the Crown.

[43] Levine provides further evidence of this ilk in Levine et al. (2000).

tend to have better developed banks, even after controlling for the level of GDP.[44] Thus, we have an intuitive result: countries with legal systems that give a higher priority to banks have better developed banks.

They then use this result to add to the standard finance-growth literature by using law as an instrumental variable for finance, thus addressing the causality issue. They find that this exogenous part of banking development has a statistically significant and economically large relationship with long-run economic growth. This is after controlling for a wide array of other factors.[45]

Djankov et al. (2002) further research in this area by directly examining courts. For one hundred and nine countries they construct a measure of *procedural formalism*: the extent of regulation of dispute resolution. They do this by measuring the exact procedures used by litigants and courts in two specific disputes. These are evicting a tenant for non-payment of rent and collecting a bounced check. They are typical examples of defaulting on an everyday contract which are comparable across countries.

They find two key results. First, legal origins alone explain approximately forty per cent of the variation in procedural formalism. Formalism is greater in civil-law countries, especially French-civil-law countries, than in common-law countries. Second, formalism is nearly universally associated with a higher duration of dispute resolution and lower survey measures of the quality of the legal system.[46] Legal origin, as noted above, is largely seen as exogenous in this literature. This means we have a causal chain whereby legal origin determines formalism which determines judicial quality.

2.3.2 Politics and Colonisation

Rajan and Zingales (2001) criticise these "structural" theories of financial development which focus on legal origin. They do not believe that these theories alone can explain the relevant empirics, such as why it took financial development until the late 1980s to reach its 1913 levels. Surely the Great Depression and the Second World War are insufficient to explain such a delay.

They propose an insider / outsider model which involves incumbents in industry as well as the financial sector. They are hostile to *arm's length* financial markets because they do not respect the value of incumbency and thus they breed competition.[47] Better financial systems facilitate entry to the market place which results in lower profits for incumbents. Thus, incumbents

[44] The *bank* measure of Levine and Zervos (1998) is used here.

[45] These GMM results are robust to using origin of the legal system as the instrumental variable.

[46] These survey measures include judicial efficiency, access to justice, honesty, consistency, impartiality, fairness and even human rights.

[47] As the phrase *arm's length* suggests, they focus on stock market measures of financial development.

choose a policy of financial repression It is more attractive than direct entry restrictions, which is a more public process. Consequently, for financial development to take place it requires a change in the incentives of incumbents.

The combination of trade openness and capital flows can change these incentives. Trade openness decreases the profits of industrial incumbents through increased competition. This makes them more dependent on external finance. Concurrently, they may need to invest more to match foreign technologies and enter foreign markets. Open capital markets mean that these incumbents can look abroad for this investment. Thus, their need to control the domestic financial sector decreases. Furthermore, with the threat of foreign competition, the emergence of new domestic competition becomes less threatening. This further decreases their incentive to oppose domestic financial liberalisation. With these developments domestic financial institutions will want to seek new clients, domestic and foreign, which means they too have an incentive to support liberalization.

In cross-section regressions they find that financial development is positively correlated with trade openness. This is true when capital flows are high, but holds to a lesser extent, or not at all, when capital flows are low. They believe this explains the history of financial development in the twentieth century, in particular why it took financial markets so long to recover after the Second World War. The Bretton Woods agreement implicitly endorsed the restriction on free capital movements so the incentives of incumbents were not in place till the 1980s.

The authors note, however, that this theory does not exclude the role of legal origin. Incumbents are more likely to capture the governance system when it is centralized, i.e. a civil-law country. In a common-law country the judiciary can defy the political will of the center. Therefore, in this model legal structure filters the impact of interest groups.

A different angle comes from Acemoglu, Johnson and Robinson (2001). They explain the nature of present day institutions by referring to the colonial past of the respective countries, a return to structuralism. Their theory is based on the following three premises. First, Europeans undertook different strategies of colonisation which created different sets of institutions. In "settler" states *good* institutions were set up by and for the settling Europeans (e.g. USA and New Zealand). In "extractive" states *bad* institutions were set up to support the extraction of resources back to Europe. The second premise is that these colonisation strategies were, at least partly, determined by the feasibility of settlements, in particular the prevalence of disease. Third, these colonial institutions persist to the present.

Strong empirical evidence is then presented to support this theory. Various regressions find evidence of high correlations between mortality rates and European settlements; between these settlements and early institutions; and between early and current institutions. In a direct regression settler mortality rates, more than one hundred years ago, explain over a quarter of the variation in current institutions.

This theory can be easily applied to the financial sector. One of the institutions that an extracted colony will miss out on is a good financial system. To summarise, Acemoglu et al. focus on the conditions in the colonies, in contrast to LLSV where the identity of the coloniser is paramount.

Berkowitz, Pistor and Richard (2002) amend this approach by arguing the way the law was initially transplanted and received is the key. They build on the idea that the law is primarily a cognitive institution. Legality, the effectiveness of legal institutions and enforcement, depends on the knowledge and understanding of the law by social actors. Thus, when a whole legal system is transplanted into a foreign culture problems can arise. Receptivity, a country's ability to give meaning to the new law, is crucial. If adaptions are made, or the receiving country is already familiar with parts of the system, receptivity and thus legality should increase. The author's econometric results show that "the transplant effect is a more important predictor of legality than the supply of a particular legal family."[48] Furthermore, it has a large negative impact on economic development through its impact on legality. Interestingly, this is directly linked to the thesis of the Acemoglu et al. paper. Familiarity can be increased through migration, so settler states have higher receptivity to imported legal systems.

Beck, Demirguc and Levine (2002) consider simultaneously the legal and endowment views of financial development. Endowment refers to the above theory of Acemoglu et al. which focuses on disease / geographical endowments.

They find that both theories have empirical power. Initial endowments help explain cross-country variation in financial development when controlling for legal origin and vice versa. Furthermore, they find that both are still significant even when controlling for political structure. Conversely, their political competitiveness and openness measures are not significant after controlling for endowments and legal tradition, contrary to the findings of Rajan and Zingales.

2.4 Conclusion

The literature seems to suggest that the financial structure of an economy does affect its overall economic performance. In the theoretical section, specific transmission mechanisms have been identified where finance influences growth. The empirical section has given some evidence for these channels and for an overall link. Furthermore, this growing acceptance of finance as a causal influence on growth has led to the emergence of a new research field: what causes financial

[48] Legality is measured using LLSV's dataset.

development? Indeed a recent World Bank publication, which is the culmination of a research project in this field, concludes that "the widespread desire to see an effectively functioning financial system is warranted by its clear causal link to growth, macroeconomic stability, and poverty reduction."[49]

[49] Caprio and Honohan (2001, p32).

Chapter 3

Does Finance Explain Ireland's Puzzling Growth?

3.1 Introduction

A large body of theoretical literature exists which promotes finance as a factor in determining economic growth. If a country's financial system is more developed, its rate of economic growth is likely to be higher. Furthermore, empirical evidence exists which supports this hypothesis. The aim of this paper is to extend the previous work in this area to include an analysis of Ireland in particular. Our study shall focus on Ireland and its performance relative to the other countries in the dataset. We investigate whether finance is a factor which helps explain Ireland's puzzling growth performance. A standard cross-country approach is used, employing data from Levine, Loayza and Beck (2000).

We introduce the Levine, Loayza and Beck (2000) paper in Section 3.2. Some institutional background specific to Ireland is introduced in Section3.3 and we then review some literature on Irish economic growth in Section 3.4. Sections 3.5 and 3.6 look at financial indicators and descriptive statistics respectively. Our main regressions are presented in Section 3.7. We then repeat these regressions for a shorter time period and in a fixed effects setting. Section 3.10 employs a counterfactual analysis and Section 3.11 concludes.

3.2 Levine, Loayza and Beck

The study by Levine, Loayza and Beck (2000) follows on, in particular, from recent work by Levine in this area.[1] The first aim of this paper is to evaluate whether the level of financial intermediary development exerts a causal influence on economic growth. They also examine whether these cross-country differences in financial development are attributable to differences in legal and accounting system characteristics. We are interested in their first goal. This question of the finance-growth link is analysed using two different techniques. The first econometric method is a cross-sectional study of 71 countries, with one observation (an average for the period 1960 - 1995) used for each country. This method is the basis of our analysis in Section 3.7.[2] The second econometric technique uses panel data, the data being assembled into seven five-year periods. Two Generalized Method of Moments (GMM) dynamic panel estimators are then used:

[1] Two earlier papers are Levine and Zervos (1998) and King and Levine (1993a).

[2] We do not follow Levine et al. in the use of instrumental variables for financial sector development, as it is hard to find convincing instruments. Levine, Loayza and Beck (2000) use law as their main instrument. The main result in the literature with regard to law and finance concerns the importance of legal origin (La Porta et al., 1998). The main types of legal origin are English common law, French civil law, German civil law and Scandinavian civil law. Dummies for the four main legal origins, however, will not explain time series variation in finance, or cross section variation within a particular legal origin. Rajan and Zingales (2001) note that legal theories of financial development cannot explain why it took financial development until the late 1980s to reach its 1913 levels.

a difference estimator and a system estimator. This second technique is not used in our present study, as one consequence of the five-year time periods is the study is not free from business cycle effects. Both techniques produce the same result: "financial intermediary development exerts a statistically significant and economically large impact on economic growth."[3] Our study, as stated above, aims to extend this work to include a particular focus on Ireland using the cross-sectional approach.

3.3 Irish Institutional Background

As we turn to the case of Ireland we first briefly introduce some relevant background details. The country's first comprehensive national plan, *Economic Development*, was published in 1958 and heralded a key change in national economic policy. Previously, from the 1930s on, Ireland practised a policy of protectionism which ran into obvious difficulties by the 1950s. The new economic strategy was outward-looking, focusing on policies of free trade and the attraction of foreign direct investment (FDI). Trade liberalisation began in the 1960s and in 1966 the Anglo-Irish Free Trade Agreement was signed. This was followed by membership of what become the European Union in 1973. The existing Industrial Development Authority (IDA) was given new impetus in its search for inward investment, offering capital grants and a zero corporate profits tax rate on maunfactured exports. This tax policy was later replaced in 1981 by a flat ten per cent tax rate on all manufacturing. In 1973 the IDA launched a Service Industry Programme and FDI in the services sector grew in importance.

It was not until the 1990s that the real benefit of these policies was seen. The percentage of FDI flowing into the OECD countries that went to Ireland increased from an average of 0.06 per cent for 1986 - 1990 to a comparable figure of 0.66 per cent for 1991 - 1997.[4] The timing of this increase has been attributed to various factors such as the increase in investment in third level education in the 1980s and 1990s and the new macroeconomic stability of the country.

Ireland's industrial development policy extended to the financial sector in 1987 with the launch of the International Financial Services Center (IFSC). This center benefits from the ten per cent tax rate as well. Its success has also been attributed to the high priority it was afforded and the "wholly exceptional" united approach of the public and private sectors.[5] A example of the government's commitment to the IFSC is the Government Representative Group that was set up to market the project at the highest levels. This group consisted of an ex-Governor of the Central Bank, Tomás Ó Cofaigh, a former Chairman of the Revenue Commissioners, Séamus

[3] Levine, Loayza, and Beck (2000, p31).
[4] O'Sullivan (2000, p263).
[5] MacSharry and White (2000).

Páircéir, and a former Second Secretary in the Department of Finance, Maurice Horgan. Ó Cofaigh's contacts alone led to personal introductions with the leading banks in Holland and Germany from the respective Presidents of their Central Banks. By 2001 eleven thousand people were employed at the IFSC, equalling a quarter of total financial sector employment in Ireland.[6]

3.4 Literature on Irish Growth

We now examine, in turn, two recent empirical studies of Irish economic growth: Ó Gráda and O'Rourke (1996) and de la Fuente and Vives (1997).

3.4.1 Ó Gráda and O'Rourke

Ó Gráda and O'Rourke (1996) examine Ireland's growth performance in a cross-section study of eighteen countries. Their approach focuses on the empirical observation that, in terms of economic convergence, Irish growth from 1950 to 1988 was very poor. Convergence is an empirical phenomenon where poorer countries grow faster than richer countries. There are many possible reasons why economies converge to similar income levels. It can be due to poorer economies not having reached their steady state growth path yet. Also poorer economies have less capital per worker, and thus a higher rate of return on capital. Another possible reason is lack of technological diffusion, where poorer countries fail to receive knowledge about production methods and other technologies.[7] In the dataset Ó Gráda and O'Rourke examine, a clear negative link exists between initial income and growth. Ireland is a clear outlier with respect to this relationship. In 1950, Irish GDP per capita was 48 per cent lower than GDP per capita in the UK and 15 per cent lower than GDP per capita in Western Europe. As convergence is a feature of OECD economies, Ireland should have grown more quickly than Western Europe as a whole, but it did not.[8] Ó Gráda and O'Rourke conclude that "Ireland was a clear underachiever throughout the post-1950 period."[9]

The authors then proceed to examine possible reasons for this poor performance. They regress growth, measured by GDP per capita, on initial GDP and a dummy variable for Ireland. The dummy variable measures how Ireland's performance differs from that of the other countries. Specifically, the dummy variable measures the difference between the recorded Irish growth rate and its predicted growth rate. This is because the residuals, ϵ_i, are zero when Ireland is the cross section unit, i, due to the dummy variable. This can be seen by rearranging the regression

[6] Honohan and Walsh (2002, p31).

[7] Romer (1996, p27).

[8] Ó Gráda and O'Rourke (1996, p392).

[9] Ó Gráda and O'Rourke (1996, p395).

equation below,

$$Growth_i = c + \beta_1(initialGDP_i) + \beta_{irl}(IRL) + \epsilon_i \tag{3.1}$$

$$\therefore \beta_{irl}(IRL) = Growth_i - [c + \beta_1(initialGDP_i)] - \epsilon_i \tag{3.2}$$

$$\therefore \beta_{irl}(IRL) = Growth_{irl} - [c + \beta_1(initialGDP_{irl})] \tag{3.3}$$

The predicted growth rate, $[c + \beta_1(initialGDP_{irl})]$, is determined by Ireland's initial level of GDP and its parameter value, which are derived in the model with the Irish data excluded due to the dummy variable.[10]

The equation is estimated for several different time periods with the result that β_{irl} is 2 per cent in 1950 - 1960, but decreases to the region of 1.2 per cent for the later periods. This reflects the poor growth performance during the 1950s, which economic historians call the lost decade, due largely to protectionist policies. More regressors are then added into the equation to see what effect the inclusion of these variables has on the size of β_{irl}, the coefficient of the dummy variable. The effect of the extra regressors is most clearly evident when the data are pooled. When the contribution of agriculture to GDP is included as an independent variable, β_{irl} is reduced by roughly one third. The inclusion of secondary school enrolment rates also reduces β_{irl}, but only by a further three per cent. A dummy variable for corporatism reduces β_{irl} by twelve to thirteen per cent, but the authors are dubious about the accuracy of the variable as a proxy for industrial relations. Thus, the importance of the size of the agricultural sector in explaining poor Irish growth during the period 1950 to 1988 is a key econometric finding of this paper.

3.4.2 De la Fuente and Vives

A second recent econometric study of the sources of Irish growth is that of de la Fuente and Vives (1997). They examine nineteen countries for the period 1970 - 1995. They undertake a growth regression to see how much of Ireland's growth performance is explicable using standard factors. The Irish residual is then interpreted to show the extent to which "special explanations based on particular Irish features" are needed to explain Ireland's growth performance.[11] They find that, for the overall period, conventional variables such as the convergence effect, labour market performance, factor accumulation and government size, explain Ireland's economic growth very well. When the sample is split up into sub-periods, however, problems emerge. For the sub-period 1970 - 1985, Ireland underperforms by 0.54 percentage points per annum and for the sub-period 1985 - 1995 there is a large unexplained positive element in Ireland's growth

[10] Kennedy (1998, p226).

[11] De la Fuente and Vives (1997, p112).

rate. In this period Ireland grew by 0.61 percentage points more per annum than is predicted by the model incorporating just the conventional variables listed above. Thus, the model has switched from overestimating to underestimating Ireland's growth. This means that the model grossly underestimates the change in Ireland's growth performance, by 1.14 percentage points per annum. It is possible that the contributions of the conventional variables, that are overestimated in the 1970 - 1985 period, are overestimated in the 1985 - 1995 period. Thus, 'special explanations' may account for more than the 0.61 percentage points difference between Ireland's actual growth rate and the one predicted by the model, in the 1985 - 1995 period.

Of the conventional variables included in the model, government size in particular played a prominent role in Ireland's turn around.[12] This is in marked contrast to Ireland's erstwhile neighbours in the OECD income distribution for whom government size is still a negative factor.[13] This accords with the popular theory that Ireland's fiscal rectitude in 1987, and since, has been crucial. Also the convergence effect predicted by the model has decreased hugely in the second period. Considering the sheer size of the change, it is possible this effect has been underestimated in the 1985 - 1995 period. The other statistic of note is the change in the labour market performance over the two periods, compared with the equivalent change in Spain and Portugal. This variable, however, while an influence on income per capita in an accounting sense, is itself largely influenced by overall economic performance.

Overall their results suggest "that factors not considered by (their) model have played an important role and points (them) towards specifically Irish characteristics."[14]

Both Ó Gráda and O'Rourke (1996) and de la Fuente and Vives (1997) omit the role of the financial system in their studies of Irish economic growth.

3.5 Financial Indicators

One of the main problems encountered in examining the effect the of financial system on economic growth is measuring the quality of the financial system. In the literature we can see the channels through which finance affects growth. Ideally we would like to directly measure the efficiency and quality with which each country's financial sector operates in these channels. We want to measure how the respective financial systems reduce liquidity risk, information costs, monitoring

[12] Government size is measured by the share of total expenditures in GDP. De la Fuente and Vives control for factor accumulation and employment, thus the goverment size measure will not pick up effects on investment and labour supply. Therefore, government size measures the efficiency of resource allocation and the possible expansionary fiscal contraction.

[13] De la Fuente and Vives use a unweighted average of Spain and Portugal with which to compare Ireland's performance.

[14] De la Fuente and Vives (1997, p125).

costs and transaction costs. The quality and efficiency of these financial services, however, cannot be directly measured and thus the issue of proxies is crucial. The main proxies used in the literature are all related and have been developed by Levine during his continued work in this area.

The first proxy, 'Liquid Liabilities' is the traditional measure of financial depth. It equals currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries, divided by GDP. It effectively measures the size of the financial intermediary sector. The quality of financial services, however, is likely to depend on who allocates the savings of society: the central bank or commercial banks. The activities of the financial sector that stimulate economic growth, monitoring and information gathering etc., are more likely to be performed by private commercial banks than by central banks. Thus, the second proxy 'Commercial-CB' is used. This equals the ratio of commercial bank assets divided by commercial bank plus central bank assets.

'Private Credit', the third proxy, is Levine's preferred measure and is standard in the literature. It is the measure used in this paper. It equals the total value of credits issued by financial intermediaries to the private sector divided by GDP.[15] Thus, as well as excluding credit issued by the central bank, it excludes credit issued to the public sector. The intuition is similar to before, the quality of financial services is likely to vary with who it is allocated to, as well as who allocates it. It is measured by line 22d and line 42d of the IMF's International Financial Statistics (IFS). As these are stock variables and GDP, the scaling variable, is a flow variable we use Levine et al.'s deflating procedure.[16]

3.6 Descriptive Statistics

Descriptive statistics for the key variables are presented in Tables 3.1 and 3.2. At first glance the evidence is mixed. Ireland has a higher economic growth rate than the average for the study and records a higher value for private credit. This seems to support our thesis. When compared

[15] De Gregorio and Guidotti note that the use of GDP as a scaling variable helps to overcome possible endogeneity problems (1995, p441).

[16] The end of year financial variable is deflated by end of year CPI and GDP is deflated by annual CPI. The value of the financial variable for the year t is equal to the simple average of the end of year values for the years t and $t-1$. The formula is as follows:

$$\frac{0.5 * \left[\frac{(22d_t + 42d_t)}{CPI_{e,t}} + \frac{(22d_{t-1} + 42d_{t-1})}{CPI_{e,t-1}}\right]}{\frac{GDP_t}{CPI_{a,t}}} \quad (3.4)$$

where e indicates end of period, and a average for the period.

CPI and GDP are measured by line 64 and line 99b of the IFS respectively.

Table 3.1: Summary Statistics for 1960 - 95

Variable	Ireland	EU Average	OECD Average	Full Study Average
GDP Growth	3.25	2.65	2.50	1.94
GDP p.c. in 1960	3,259	5,240	5,935	3,269
Private Credit	53.6	58.7	66.9	42.2
Private Credit in 1960	46.2	36.6	42.4	25.6

Note: These figures are based on the 48 countries used for initial finance in Sections 3.8 and 3.9.

Table 3.2: Summary Statistics for 1986 - 95

Variable	Ireland	EU Average	OECD Average	Full Study Average
GDP Growth	5.00	1.93	1.64	1.58
GDP p.c. in 1986	7,083	11,436	12,281	6,406
Private Credit	64.0	76.0	88.1	55.4
Private Credit in 1986	59.5	74.8	77.8	51.3

Note: These figures are based on the 48 countries used for initial finance in Sections 3.8 and 3.9.

to the EU and the OECD, however, Ireland has a higher GDP growth rate but its private credit is lower. This holds for both the complete time period, 1960 - 1995, and the shorter sample during which Ireland experienced its higher growth rates, 1986 - 1995. Interestingly, Ireland's private credit in 1960 is higher than both the EU and the OECD average.

Of course finance is only one factor of many that may have an influence on economic growth and thus Ireland's higher growth rate could be due to other factors. The regression analysis to follow accounts for other variables.

3.7 1960 - 1995 Regression

The data used in these cross-country regressions are averages of the respective variables, for the period 1960 - 1995. By taking average figures for such a lengthy time period business cycle effects are removed from the data. The ordinary least squares regression technique is employed. The dependent variable is economic growth, measured by the average annual growth rate of real GDP per capita. The independent variables used are the same as Levine et al. and are standard in growth econometrics. First, we include the initial level of real per capita GDP in 1960 and the average years of schooling in the total population in 1960. These are used to capture the convergence effect and the effect of human capital on growth respectively. Levine et al. call this the *simple* conditioning set.

The main regressions also use the policy set of control variables: inflation, fiscal policy, black market premium, and trade.[17] Inflation has been shown to have a negative relationship with economic growth, by reducing both capital accumulation and productivity growth. Inflation also serves as a proxy for the wider stability of the macroeconomic system.[18] Fiscal policy is measured by the share of government expenditure in GDP and is used to capture the distortionary effects of certain government activities. Fischer (1993) has shown that the budget surplus has a positive correlation with growth, the effect mainly coming through the productivity channel. Thus, we expect government share to have a negative correlation with growth. The black market exchange rate premium is a good indicator of a distorted or controlled market for foreign exchange. Again we expect a negative relationship here. Finally, an economy's openness to international trade is measured by the sum of exports plus imports as a share of GDP. It is expected that trade will have a positive correlation with growth. As average rates of these variables over long time periods are being used, they are more likely to be determined by structural factors than by short term shocks.[19]

Each regression is performed twice, with finance (private credit) included as an independent variable in the second regression. This reveals whether finance is a significant explanatory variable for the overall model and gives estimates of its quantitative impact. The results (see Table 3.3) show that finance is statistically significant, judging both by its t-statistic and the increase in the reported R^2. It is also economically important: for example if Brazil's figure for private credit increased by 20%, it would have an extra 0.26 percentage points added to its average annual growth rate.

The Irish residuals in the general model are then examined. The Irish residuals show how much higher Irish economic growth is over the period, compared to the model's prediction. This can be seen from the following simple equation,

$$Y_{irl} = c + \beta X_{irl} + \varepsilon_{irl} \tag{3.5}$$

$$\therefore \varepsilon_{irl} = Y_{irl} - (c + \beta X_{irl}) \tag{3.6}$$

where Y_{irl} = Irish growth performance and $(c+\beta X_{irl})$ = Irish growth performance as predicted by the general model.

We can see that these residuals are positive in the case of Ireland, showing that it experienced some economic growth that is not explained by the general model. Maybe the influence of some of the independent variables are higher for Ireland than the parameters of the general model

[17] All the independent variables are expressed in natural logarithms. Further details are presented in Appendix 3.A.

[18] See Fischer (1993).

[19] Fischer (1993, p489).

Table 3.3: Regressions and Irish Residuals for 1960 - 1995

Variable	general	finance	general	finance
GDP 1960	-1.01*** *-3.29*	-1.29*** *-4.31*	-0.95*** *-3.00*	-1.35*** *-4.94*
School	2.23*** *2.99*	1.71*** *2.89*	2.67*** *4.25*	2.08*** *3.93*
Government	0.77 *1.20*	0.51 *0.69*		
Trade	0.18 *0.46*	0.39 *1.12*		
Black market premium	-2.17** *-2.43*	-1.35 *-1.15*		
Inflation	-0.77 *-0.48*	1.77 *1.28*		
Private Credit		1.41** *2.43*		1.56*** *4.36*
R^2	0.38	0.47	0.26	0.43
Adjusted R^2	0.32	0.40	0.23	0.40
Irish Residuals	0.32	0.25	0.66	0.47
Cumulative Effect	11.83	9.13	25.89	17.83
- smaller for finance?	-2.70		-8.06	
Sample Size	63	63	63	63

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

suggest, or some important factor has been left out of the model. Our question is whether finance is one of these missing factors. Thus, we now examine the Irish residuals when private credit is included in the general model. Its inclusion as an explanatory variable in the model decreases the Irish residual. This means that more of Ireland's economic growth is now explained by the model. In the regressions recorded in Table 3.3, with a sample size of sixty three, the original model explains Ireland's performance quite well. Ireland's actual performance was 0.32 percentage points greater than that predicted by the model. When finance is added, however, Ireland's growth overshoots that of the model by only 0.25 percentage points. For the whole thirty five years these figures mean that the economy grew by 11.83 per cent more (general), and 9.13 per cent more (with finance), than was predicted by the model. Therefore, these results seem to suggest that Ireland's growth performance is less unusual when finance is included as a regressor: the addition of finance helps to solve the Irish growth puzzle.

The regressions are repeated using initial finance, measured by private credit in 1960, as a regressor. The sample size is reduced to fifty three for this set of regressions due to data limitations. The results, presented in Table 3.4, show that initial finance is also a significant factor in explaining growth in the overall model. Moreover, here we find a very interesting

Table 3.4: Regressions and Irish Residuals with Initial Finance for 1960 - 1995

Variable	**general**	**finance**	**initial**	**general**	**finance**	**initial**
GDP 1960	-0.57**	-0.91***	-0.88***	-0.95***	-1.37***	-0.87**
	-2.20	*-3.01*	*-2.91*	*-3.00*	*-4.94*	*-2.66*
School	0.87	0.68	0.97	2.67***	2.08***	1.98***
	1.29	*1.27*	*1.54*	*4.25*	*3.93*	*3.07*
Government	0.99*	0.52	0.97*			
	1.84	*0.91*	*1.70*			
Trade	0.28	0.44	0.43			
	0.70	*1.29*	*1.09*			
Black market premium	-2.89***	-2.02**	-2.83***			
	-3.64	*-2.26*	*-3.44*			
Inflation	-0.24	1.82	0.52			
	-0.16	*1.46*	*0.35*			
Private Credit		1.32***			1.56***	
		3.17			*4.36*	
Private Credit in 1960			0.56**			0.69**
			2.00			*2.41*
R^2	0.46	0.56	0.50	0.26	0.43	0.27
Adjusted R^2	0.38	0.49	0.42	0.23	0.40	0.22
Irish Residuals	0.44	0.33	0.04	0.84	0.58	0.38
Cumulative Effect	16.61	12.22	1.41	34.01	22.44	14.20
- smaller for finance?		-4.39			-11.57	
- smaller for initial finance?		-15.20			-19.81	
Sample Size	53	53	53	53	53	53

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

result for the Irish residuals. At 0.04 percentage points, they are significantly smaller than the residuals with no finance, 0.44, or with contemporaneous finance, 0.33. Thus, it seems that finance does help to explain Ireland's puzzling growth and it is initial finance that is most important. This fits in with the descriptive statistics in Table 3.1. Ireland had a high level of finance in 1960: nearly twice the average in the study and four percentage points larger than the OECD average. Irish finance, however, did not grow significantly over the period and was outstripped by the EU and OECD average, judging by the average value for the period 1960 - 1995. This explains why using average private credit gives notably different results.

The second method of examining the effect of finance in Ireland involves the use of a dummy variable for Ireland, see Tables 3.5 and 3.6. This follows the Ó Gráda and O'Rourke study noted above. As we saw in Equation 3.3, the dummy variable measures the difference between the recorded and predicted Irish growth rates. The predicted growth rate is derived in the model, with the Irish data excluded due to the dummy variable. The more significant the dummy variable, economically and statistically, then the more Ireland's growth performance, in relation to the model, differs from that of the other countries. It uses a similar logic to our above residual analysis and as such it provides us with a similar set of results. They are simply presented in a different manner. Whenever private credit is added to the regression the coefficient for the Irish dummy variable decreases. Moreover, a larger decrease again emerges when initial finance is used. This is highlighted when just initial GDP and human capital, Levine et al.'s simple conditioning set, is used. The dummy variable for Ireland is significant at the 1% level with no finance, or contemporaneous finance, but when initial finance is added to the regression it loses its significance. Therefore, before initial finance is considered, Ireland has an economically and statistically different growth performance, in relation to the model. This is no longer true when initial finance is added to the model as another possible explanatory factor.

3.7.1 Robustness Analysis

We test the robustness of these results by looking for leverage points in the regressions. Leverage points are observations which are influential in determining the statistical significance of key results. We determine the leverage points of the regression by using observation-specific dummy variables. This is where a dummy variable is used for country i, effectively excluding its data from the dataset for that regression.[20] This is then repeated for each country in turn. In our context, these regressions tell us how the result for private credit changes when each country's data are in turn excluded from the regression.

[20] Kennedy (1998, p226).

Table 3.5: Regressions with Dummy Variable for 1960 - 1995

Variable	general	finance	general	finance
GDP 1960	-1.01*** *-3.27*	-1.29*** *-4.28*	-0.95*** *-2.97*	-1.37*** *-4.88*
School	2.22*** *2.95*	1.71*** *2.85*	2.65*** *4.15*	2.06*** *3.84*
Government	0.78 *1.20*	0.51 *0.69*		
Trade	0.17 *0.42*	0.38 *1.06*		
Black market premium	-2.16** *-2.38*	-1.34 *-1.13*		
Inflation	-0.78 *-0.48*	1.76 *1.27*		
Ireland	0.34 *1.04*	0.27 *0.81*	0.68*** *2.75*	0.49** *2.19*
Private Credit		1.40** *2.41*		1.55*** *4.30*
R^2	0.38	0.47	0.26	0.43
Adjusted R^2	0.31	0.39	0.22	0.39
Sample Size	63	63	63	63

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

In the policy regression presented in Table 3.3, private credit remains significant when the biggest leverage point is removed. It is also robust to using just the simple control set. Our main interest, however, is the effect of finance in Ireland which leads us to examine the robustness of the Irish residuals. The residuals decrease when finance is added to the regression and this holds when the simple conditioning set is used. This result, however, is not robust to the exclusion of Belgium from the sample. When Belgium is excluded, the Irish residuals change to 0.32 (no finance) and 0.34 (finance). Thus, in this adjusted sample, the Irish growth performance becomes more unusual when finance is added to the equation. These results are presented in Appendix 3.B.

The key result of this section is the effect of initial finance on Ireland's growth performance. In the policy regression in Table 3.4 the Irish residuals experience a notable decrease when finance is included in the regression. This key result is robust to the exclusion of any one country from the dataset.[21] Furthermore, it is robust to the exclusion of the two, and also the four, biggest leverage points.[22] Our result on the insignificance of the Irish dummy variable using the simple

[21] It should be noted that the significance of initial finance itself, in the policy regression in Table 3.4, is not robust to the removal of Bolivia from the dataset.

[22] The two biggest leverage points in terms of the Irish residuals are Bolivia and Haiti. When they are both excluded the Irish residuals have the following values: 0.42 (no finance), 0.32 (finance), 0.27 (initial finance). The

Table 3.6: Regressions with Dummy Variable and Initial Finance for 1960 - 1995

Variable	general	finance	initial	general	finance	initial
GDP 1960	-0.57**	-0.91***	-0.88***	-0.43	-0.99***	-0.86**
	-2.16	*-2.96*	*-2.80*	*-1.31*	*-3.21*	*-2.55*
School	0.86	0.68	0.97	1.76**	1.28**	1.96***
	1.26	*1.23*	*1.51*	*2.37*	*2.19*	*2.96*
Government	0.99*	0.52	0.97*			
	1.83	*0.91*	*1.69*			
Trade	0.27	0.42	0.43			
	0.63	*1.20*	*1.04*			
Black market premium	-2.87***	-2.00**	-2.83***			
	-3.55	*-2.22*	*-3.37*			
Inflation	-0.25	1.80	0.52			
	-0.16	*1.43*	*0.35*			
Ireland	0.46	0.35	0.04	0.87***	0.60***	0.40
	1.39	1.04	0.10	3.45	2.58	1.31
Private Credit		1.32***			1.60***	
		3.10			*5.50*	
Private Credit in 1960			0.55*			0.68**
			1.89			*2.27*
R^2	0.46	0.56	0.50	0.20	0.48	0.27
Adjusted R^2	0.37	0.48	0.41	0.15	0.43	0.21
Sample Size	53	53	53	53	53	53

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

control set, however, is not robust. In Table 3.6 the Irish dummy variable, using the simple control set, is significant with no finance variable and with the contemporaneous finance variable. When the initial finance variable is used the Irish dummy is no longer significant. This result does not hold when Malta is excluded from the dataset. The Irish dummy variable is now significant when initial finance is a regressor. This new result is itself robust to the exclusion of any one country from the dataset.

A caveat on the interpretation of these results is the quality of the Irish datum for initial finance. The Irish data, for the variable private credit, are taken from the IMF's IFS 2001 Yearbook, due to an error on the IFS CD-Rom.[23] The problem is these data only go back to 1971. Thus, for 1960 - 1971 the IFS CD-Rom data have to be used. We correct these by multiplying them by the average ratio of the two series during their overlap period. This procedure can be viewed with confidence as this average figure of 1.46 varies within a small range of 1.42 to 1.53, during the period 1971 - 1981.

We re-run our analysis for initial finance using the uncorrected data from the IFS CD-Rom, as a further robustness check on our results.[24] We know that these data are inaccurate and underestimate the true value of private credit. As such they give a minimum value for Irish private credit in 1960. This new value is equal to 31.76.

Our general results on the significance of finance do not change, as only one observation out of fifty three has changed. We pay particular attention to our analysis of the Irish residuals and the Irish dummy variable, as the changed datum is of direct relevance to these results. For the Irish residuals we find that our key result still holds, just at a lower magnitude: the residuals decrease when initial finance is included. Their new value is 0.24 which compares favourably with our previous results for no finance (0.44) and average finance (0.33). Again this result is robust to the removal of any one country from the sample, see Appendix 3.B, and also to the exclusion of the two and four biggest leverage points.[25] Nevertheless, the size of the decrease is smaller as previously the residuals decreased to 0.04.[26]

When we look at the dummy variable for Ireland we notice a change: when we use the

four biggest leverage points in this regard are Bolivia, Haiti, Japan and Malta. When these countries are all omitted from the sample the Irish residuals are 0.69 (no finance), 0.624 (finance), 0.617 (initial finance).

[23] This error affects the Levine et al. (2000) dataset which we are using.

[24] Our average finance results are less affected by this data problem, as only twelve of the thirty six years in our average finance figure have to be constructed in this manner.

[25] The two biggest leverage points in terms of the Irish residuals are again Bolivia and Haiti. When they are both excluded the Irish residuals have the following values: 0.42 (no finance), 0.32 (finance), 0.35 (initial finance). The four biggest leverage points in this regard are Bolivia, Haiti, Japan and Belgium. When these countries are all omitted from the sample the Irish residuals are 0.42 (no finance), 0.39 (finance), 0.39 (initial finance).

[26] For the simple set the new residuals have a value of 0.63, still smaller than the residuals without finance.

uncorrected datum the dummy variable is now significant in the initial finance regression, with the simple set. Nonetheless, the coefficient on the dummy variable still decreases when initial finance is included. These new results follow much the same pattern as the new results for the Irish residuals. For the full policy set regression the coefficient on the Ireland dummy is 0.25, which is still a decrease from the 0.46 (no finance) and 0.35 (average finance) recorded previously.

To summarise, the key result that finance, and initial finance in particular, helps to explain Ireland's growth performance seems robust. Unfortunately, the size of this effect cannot be precisely calculated due to the aforementioned data problem. We believe the truth is closer to the original results presented in Tables 3.4 and 3.6 with the corrected data, than to the uncorrected data results just described. This is on account of the steady relationship between the IFS 2001 Yearbook data and the IFS CD-Rom data, illustrated by the narrow range of their ratio.

3.8 1986 - 1995 Regression

In this section the regression analysis in Section 3.7 is repeated for the smaller time period, 1986 - 1995, during which Ireland's growth performance improved.[27]

The results in Tables 3.7 and 3.8 show that private credit is statistically significant only for the smaller sample size. Both this result and the insignificant result for the larger sample are not robust to the removal of leverage points from their respective samples. Indeed no robust result for private credit emerges in either regression: private credit switches between significance and insignificance as each leverage point is omitted in turn. In both cases, however, the insignificant results for private credit are more robust than the significant results.[28] Thus, we do not have a consistent relation where finance affects growth in this time period. A different picture emerges when we look at initial finance. It is strongly significant and this is robust to the exclusion of any one country from the dataset.[29]

The results for Ireland echo those for the longer time period in Section 3.7. It should be noted, however, that the concern that business cycle effects are present in this data, due to

[27] The sample for initial finance decreases to forty eight in this section, and the next, due to data contraints. Brazil, Guyana, Spain, Sudan and Zimbabwe are the countries no longer in the sample.

[28] The significant result for private credit with the smaller sample size, regression (4) in Table 3.7, has sixteen leverage points. Thus, the exclusion of any one of these sixteen countries, out of the forty eight in the sample, will result in a regression where private credit is insignificant. Malaysia is the biggest of these leverage points. When it is excluded from the sample private credit is insignificant. This subsequent regression has only one leverage point: Kenya. When the full sample is used, regression (2) in Table 3.7, we get an insignificant result for private credit. Botswana is the only leverage point for this regression. When it is omitted from the sample private credit becomes significant. This subsequent regression has two leverage points: Thailand and Korea.

[29] These general effects of finance are also robust to use of the simple set of control variables.

Table 3.7: Regressions and Irish Residuals for 1986 - 1995

Variable	general	finance	general	finance	initial
GDP 1960	-0.60 *-1.48*	-0.83* *-1.68*	-0.40 *-1.05*	-0.67* *-1.69*	-0.73* *-1.80*
School	2.50** *2.09*	2.08* *1.93*	0.54 *0.48*	0.25 *0.24*	0.79 *0.72*
Government	-0.02 *-0.02*	-0.15 *-0.13*	-0.02 *-0.02*	-0.09 *-0.08*	-0.25 *-0.23*
Trade	0.84 *1.38*	0.92 *1.55*	0.84 *1.59*	0.95** *2.02*	0.98** *2.13*
Black market premium	-0.77 *-0.56*	-0.46 *-0.33*	-6.93** *-2.12*	-6.49** *-2.03*	-7.41** *-2.41*
Inflation	0.53 *0.36*	1.73 *1.11*	2.91 *1.21*	4.72* *1.84*	4.37* *1.95*
Private Credit		0.90 *1.26*		0.90* *1.73*	
Private Credit in 1986					0.65*** *3.10*
R^2	0.17	0.20	0.27	0.32	0.38
Adjusted R^2	0.08	0.10	0.17	0.20	0.27
Irish Residuals	2.43	2.49	2.46	2.51	2.31
Cumulative Effect	27.14	27.88	27.51	28.13	25.66
- smaller for finance?	0.74			0.62	
- smaller for initial finance?				-1.85	
Sample Size	63	63	48	48	48

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

the shorter time period, is especially pertinent for Ireland given this time period coincides with Ireland's economic improvement. This time the Irish residuals increase when finance is added as a regressor. Nevertheless, when initial finance is added to the regression we again find a decrease in the Irish residuals. Therefore, again it is initial finance that is important. In this shorter, and later, time period the effect is not as big.

The results for the second technique are similar. The dummy variable is slightly larger when finance is added to the regression, and slightly smaller when initial finance is added. It is interesting to note the strong statistical and economic significance of the dummy variable for Ireland in these results This highlights that the Celtic Tiger emerged at a time when other economies were struggling.

Table 3.8: Regressions with Dummy Variable for 1986 - 1995

Variable	**general**	**finance**	**general**	**finance**	**initial**
GDP 1960	-0.63 -1.58	-0.87* -1.76	-0.39 -1.06	-0.67* -1.69	-0.72* -1.80
School	2.51** 2.09	2.09* 1.93	0.41 0.37	0.12 0.11	0.66 0.61
Government	0.09 0.08	-0.04 -0.03	0.18 0.16	0.12 0.11	-0.05 -0.05
Trade	0.72 1.18	0.80 1.35	0.67 1.25	0.78 1.66	0.82* 1.75
Black market premium	-0.77 -0.57	-0.45 -0.33	-6.67** -2.01	-6.21* 1.93	-7.15** -2.29
Inflation	0.53 0.36	1.76 1.12	2.89 1.19	4.74* 1.80	4.31* 1.88
Ireland	2.58*** 4.37	2.65*** 4.90	2.68*** 5.26	2.74*** 5.97	2.52*** 5.21
Private Credit		0.91 *1.25*		0.92* *1.72*	
Private Credit in 1986					0.63*** *2.93*
R^2	0.19	0.22	0.32	0.37	0.42
Adjusted R^2	0.08	0.10	0.21	0.24	0.31
Sample Size	63	63	48	48	48

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

3.9 Fixed Effect Regression

The next analysis is a fixed effects regression. Here we examine the finance-growth relationship by looking at the changes in variables, rather than the levels of these variables. This uses the same OLS framework as above, with the same variables, but the data used is the difference between the average level for 1986 - 1995 and the average level for 1976 - 1985. We can see, by looking at a panel dataset with two time periods, t = 1 (1976 - 1985), 2 (1986 - 1995), that this is the same as a fixed effects regression,

$$y_t = \alpha_t + \beta x_t + \epsilon_t \quad (3.7)$$

$$y_1 = \alpha_1 + \beta x_1 + \epsilon_1 \quad (3.8)$$

$$y_2 = \alpha_2 + \beta x_2 + \epsilon_2 \quad (3.9)$$

$$\therefore y_2 - y_1 = (\alpha_2 - \alpha_1) + \beta(x_2 - x_1) + (\epsilon_2 - \epsilon_1) \quad (3.10)$$

This regression is also repeated including a dummy variable for Ireland. The results are reported in Tables 3.9 and 3.10. We find a similar pattern of results to Section 3.8: average finance is not significant but initial finance is significant. Both results are robust to the exclusion of any one country from the dataset and to the use of the simple conditioning set. Therefore, differences in finance within countries (fixed effects regression) are important in addition to differences in finance across countries (Section 3.7 and 3.8).

When we turn to our analysis of Ireland, we find that the above result holds: initial finance, not average finance, is important. There is a substantial decrease in both the residuals and the dummy variable for Ireland when initial finance is added to the regression.

3.10 Counterfactual

The results so far suggest that the Irish growth puzzle is partially explained by the finance effect. Specifically, when initial finance is added to the standard model we employ, the model gives a better explanation of Ireland's growth performance. This section gives growth predictions for Ireland with different values for private credit, the finance proxy.

The results, see Table 3.11, illustrate that if Ireland's value for private credit in 1960 was equal to the full sample average, Ireland's average annual economic growth rate would be thirty six percentage points lower. A better comparison may be with an EU or an OECD average. In addition, a value for Spain and Portugal may be useful, as they had reasonably similar income levels to Ireland at the start of the period.[30] With all of these values the model underestimates

[30] The figure used here is an unweighted average of the Spanish and Portugese levels of private credit, following de la Fuentes and Vives (1997).

Table 3.9: Regressions and Irish Residual for Fixed Effect

Variable	general	finance	general	finance	initial
GDP 1960	-5.58***	-5.94***	-7.45***	-7.07***	-7.84***
	-3.47	*-3.38*	*-4.71*	*-4.08*	*-5.97*
School	-4.85	-4.48	-6.36	-6.46	-5.70
	-1.49	*-1.36*	*-1.63*	*-1.63*	*-1.58*
Government	-2.10	-1.74	0.56	0.45	0.13
	-0.91	*-0.79*	*0.25*	*0.20*	*0.06*
Trade	-0.23	-0.27	-0.91	-0.97	-0.82
	-0.18	*-0.20*	*-0.61*	*-0.64*	*-0.51*
Black market premium	-0.52	-0.37	-0.33	-0.42	-0.93
	-0.73	*-0.52*	*-0.54*	*-0.69*	*-1.18*
Inflation	0.30	0.73	-0.18	-0.60	0.90
	0.20	*0.41*	*-0.12*	*-0.40*	*0.49*
Private Credit		0.78		-0.50	
		0.86		*-0.73*	
Initial Private Credit					1.29**
					2.32
R^2	0.31	0.32	0.50	0.50	0.57
Adjusted R^2	0.24	0.23	0.43	0.42	0.50
Irish Residuals	2.44	2.62	3.34	3.25	2.81
Cumulative Effect	27.26	29.52	38.89	37.69	31.93
- smaller for finance?		2.26		-1.20	
- smaller for initial finance?				-6.96	
Sample Size	63	63	48	48	48

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

Table 3.10: Regressions with Dummy Variable for Fixed Effect

Variable	general	finance	general	finance	initial
GDP 1960	-5.63*** *-3.46*	-6.05*** *-3.42*	-7.69*** *-4.77*	-7.44*** *-4.46*	-8.00*** *-5.94*
School	-4.71 *-1.46*	-4.27 *-1.31*	-6.58* *-1.74*	-6.64** *-1.72*	-5.97* *-1.68*
Government	-1.66 *-0.70*	-1.20 *-0.54*	1.69 *0.74*	1.60 *0.69*	1.15 *0.53*
Trade	-0.35 *-0.27*	-0.40 *-0.31*	-1.28 *-0.89*	-1.32 *-0.89*	-1.16 *-0.74*
Black market premium	-0.50 *-0.72*	-0.33 *-0.48*	-0.14 *-0.22*	-0.20 *-0.34*	-0.69 *-0.85*
Inflation	0.28 *0.18*	0.78 *0.43*	-0.36 *-0.25*	-0.62 *-0.41*	0.62 *0.34*
Ireland	2.63*** *3.86*	2.84*** *4.41*	3.76*** *4.62*	3.69*** *4.58*	3.23*** *3.72*
Private Credit		0.90 *0.99*		-0.32 *-0.49*	
Initial Private Credit					1.13* *1.87*
R^2	0.33	0.34	0.56	0.57	0.62
Adjusted R^2	0.24	0.24	0.49	0.48	0.54
Sample Size	63	63	48	48	48

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, *10%, **5%, ***1%.

Table 3.11: Regression Results for 1960 - 1995 using different values for Private Credit

Model	Private Credit	Growth Rate	Residual
Recorded Irish Growth	-	3.25	-
Ireland Finance 1960	46.2	3.22	0.04
Sample Average Finance 1960	25.0	2.89	0.36
EU Finance 1960	36.9	3.10	0.16
OECD Finance 1960	42.3	3.17	0.09
Spain / Portugal Finance 1960	42.8	3.18	0.08
USA Finance 1960	77.7	3.46	-0.21
Ireland Finance 1986	59.5	3.34	-0.08
Sample Average Finance 1986	51.3	3.27	-0.01

Note: The growth rate and residual are for Ireland using the different values for private credit, in the standard model.

Ireland's growth rate. The lowest residual is eight percentage points for Spain and Portugal.

This suggests that it is not just the magnitude of Ireland's private credit in 1960 that is important. The Irish residuals would decrease considerably when private credit is included, even if Ireland's value for private credit in 1960 was equal to the OECD average. Thus, it is the inclusion of initial private credit in the regression that seems to be crucial.

3.11 Conclusion

This paper follows Levine et al. (2000) in showing, in a cross-country analysis, that finance is a significant determinant of economic growth. This fact is then used to try to explain Ireland's puzzling growth performance. The inclusion of initial finance as a regressor in our model decreases the size of the Irish residuals and the size of the Irish dummy variable. Thus, the addition of initial finance aids the explanation of Ireland's growth performance. The exact size of this effect, however, cannot be determined due to a data problem. This result seems to hold best for our longer time period: 1960 - 1995. When Ireland's growth rate increases, during the period 1986 - 1995, the result still holds but it is of a smaller magnitude. Thus, the financial sector has played a role in the *Celtic Tiger*. This is confirmed by a fixed effects regression. Improvements in Ireland's financial system help to explain improvements in Ireland's growth rate.

The cross-section method, however, imposes common coefficients across countries. To reach more definite conclusions the next chapter will use a time series analysis. This will also address the causality issue: does finance cause growth or merely follow growth? Presently we are left with the tentative conclusion that when the finance effect is accounted for, which it should be, the Irish growth puzzle is partially explained.

3.A Data Appendix

The data employed in this paper are taken from the dataset of Levine, Loayza and Beck (2000), which we thank them for sharing. The original sources of their data are as follows:

- Growth in GDP and initial GDP are based on GDP per capita from the World Bank's World Development Indicators 2001 (WDI).
- Human capital is the variable "Average years of schooling in the total population over age 25" from Barro and Lee (1993).
- Trade is expressed as a percentage of GDP and is from the WDI.
- Government Size is also expressed as a percentage of GDP and taken from the WDI.
- Inflation is based on the consumer prices and is the log difference of line 64 from the IFS.
- Black market premium is the ratio of the black market exchange rate and the official exchange rate minus one. Its original sources are Pick's Currency Yearbook and the World Currency Yearbook.

As stated previously the Irish data for the variable private credit are actually taken from the IFS 2001 Yearbook, due to an error on the IFS CD-Rom which affects Levine et al.'s dataset. These IFS CD-Rom data only go back to 1971. Thus, for 1960-1971 the IFS CD-Rom data are used and are corrected by multiplying them by the average ratio of the two series during their overlap period.[1]

3.B Robustness Appendix

The Tables presented here relate to the robustness analysis of Section 3.7.1.

[1]This average figure is 1.46 and varies within a small range of 1.42 to 1.53 during the period 1971-1981.

Table 3.B.1: Robustness of Irish Residuals

Country omitted from the sample	Value of Irish Residuals				
	general	finance	general	corrected initial finance	uncorrected initial finance
Argentina	0.32	0.25	0.44	0.04	0.24
Australia	0.30	0.25	0.43	0.04	0.24
Austria	0.36	0.29	0.46	0.06	0.26
Belgium	0.32	0.34	0.44	0.04	0.27
Bolivia	0.28	0.22	0.39	0.09	0.25
Botswana	0.43	0.37			
Brazil	0.28	0.23	0.41	0.01	0.20
Cameroon	0.32	0.25			
Canada	0.32	0.26	0.44	0.04	0.24
Chile	0.31	0.23	0.44	0.03	0.23
Colombia	0.32	0.25	0.44	0.04	0.24
Costa Rica	0.31	0.25	0.44	0.02	0.22
Denmark	0.28	0.25	0.41	0.01	0.20
Dominican Republic	0.33	0.27	0.46	0.05	0.25
Ecuador	0.32	0.26	0.45	0.04	0.23
El Salvador	0.32	0.25	0.44	-0.01	0.21
Finland	0.33	0.27	0.45	0.05	0.25
France	0.34	0.26	0.44	0.04	0.24
Germany	0.30	0.22	0.43	0.01	0.21
Ghana	0.26	0.18	0.36	-0.08	0.13
Greece	0.34	0.27	0.46	0.06	0.25
Guatemala	0.32	0.26	0.44	0.04	0.24
Guyana	0.29	0.19	0.43	0.01	0.21
Haiti	0.35	0.26	0.47	0.19	0.33
Honduras	0.31	0.25	0.42	0.04	0.23
India	0.32	0.25	0.42	0.02	0.21
Israel	0.32	0.25	0.44	0.04	0.24
Italy	0.34	0.27	0.45	0.06	0.25
Jamaica	0.29	0.22	0.40	-0.01	0.19
Japan	0.32	0.26	0.43	0.09	0.26
Kenya	0.32	0.24	0.42	-0.04	0.18
Korea	0.36	0.30			

Table 3.B.1 continued

Country omitted from the sample	Value of Irish residuals				
	general	finance	general	corrected initial finance	uncorrected initial finance
Lesotho	0.26	0.21			
Malaysia	0.39	0.30	0.51	0.07	0.30
Malta	0.52	0.44	0.74	0.35	0.54
Mexico	0.34	0.28	0.45	0.05	0.25
Netherlands	0.34	0.24	0.44	0.04	0.24
New Zealand	0.25	0.22	0.38	0.01	0.20
Niger	0.37	0.30			
Norway	0.38	0.30	0.48	0.08	0.27
Pakistan	0.29	0.23	0.42	0.03	0.22
Panama	0.27	0.21	0.38	0.01	0.19
Papua New Guinea	0.32	0.25			
Paraguay	0.33	0.27	0.46	0.05	0.25
Peru	0.32	0.25	0.43	0.01	0.22
Philippines	0.28	0.21	0.40	-0.05	0.16
Portugal	0.38	0.29	0.49	0.14	0.31
Senegal	0.29	0.22			
South Africa	0.26	0.14			
Spain	0.33	0.26	0.45	0.06	0.25
Sri Lanka	0.32	0.25	0.46	0.06	0.25
Sudan	0.25	0.14	0.44	-0.01	0.20
Sweden	0.30	0.22	0.41	-0.01	0.20
Switzerland	0.32	0.19	0.43	-0.03	0.18
Thailand	0.35	0.27			
Togo	0.33	0.26			
Trinidad and Tobago	0.31	0.25	0.43	0.03	0.23
United Kingdom	0.30	0.25	0.42	0.04	0.23
United States	0.32	0.25	0.44	0.04	0.24
Uruguay	0.30	0.23	0.42	-0.01	0.20
Venezuela	0.31	0.24	0.43	0.07	0.25
Zimbabwe	0.32	0.26	0.44	-0.02	0.21

Chapter 4

A Time Series Analysis of Finance and Growth in Ireland

4.1 Introduction

It is now widely accepted in macroeconomics that finance is a factor in determining economic growth. A large body of theoretical literature suggests this and, moreover, there is empirical evidence to support this hypothesis. Levine (1993, 1998, 2000), in particular, has produced a number of papers which have found evidence that a better financial system results in higher economic growth. This topic is of particular interest to Ireland given the high profile role of the financial sector in the country's recent economic success.

The aim of this paper is to address this question using a time series approach. We find that finance and growth move together in Ireland over time and that finance seems to follow growth. The rest of the paper proceeds as follows. Some theoretical issues are examined in the next section. Section 4.3 reviews previous time series analyses of finance and growth, and our empirical strategy employed is outlined in Section 4.4. The dataset which is constructed for Ireland is presented in Section 4.5 and Section 4.6 examines the issue of stationarity. Standard cointegration testing and estimation techniques are then employed in Sections 4.7 and 4.8, respectively. Section 4.9 investigates the issue of causality and Section 4.10 looks at robustness. Finally, Section 4.11 concludes.

4.2 Theoretical Background

As stated previously, a large body of theoretical and empirical literature exists on this topic. The existing theory says that the financial sector affects economic growth by overcoming market frictions and thus increasing the efficiency of resource allocation. Financial intermediaries decrease liquidity risk for individual investors while channeling funds to profitable investment opportunities, regardless of their liquidity. Furthermore, financial intermediaries avail of economies of scale to reduce information costs, transactions costs and monitoring costs. The net result of these effects is an increase in the efficiency and the quantity of investment.

Empirically there are major issues with trying to test and measure this theory. First, one cannot directly measure the success of financial institutions at these functions. Consequently, proxies have to be employed. Second, theory also supports the idea of growth causing finance. Joan Robinson has said that "where enterprise leads finance follows."[1] The idea here is that as an economy grows so does the demand for financial services. As existing companies grow, and new companies emerge, there will be an increase in investment which has to be financed. Therefore, the financial sector will grow in an effort to keep up with overall economic performance. This competing theory means that empirical work has to deal with the thorny issue of causality.

[1] Quoted in Levine (1997, p688).

To address the first issue this paper employs both new and old proxies for the efficiency of the financial sector. With regard to the second issue, the time series approach is more adept at handling causality issues. This paper departs theoretically from the existing literature by examining the effect foreign financial systems may have on domestic economic performance. This is particularly relevant for Ireland as a small open economy.

There are a number of channels through which Ireland might increasingly benefit from foreign financial systems. First, improvements in foreign financial systems themselves. Second, when Irish firms increase their importation of foreign financial services, for instance by raising overseas loans. Third, when Irish financial institutions lend more abroad. The domestic economy will benefit through the last channel as financial institutions acquire knowledge, improving the efficiency of their resource allocation. Also diversification of their portfolios enables them to lend more domestically. Theoretically, all these channels could affect the quality and quantity of domestic investment and thus affect economic growth.

This approach is different from that of De Gregorio (1998), who includes financial integration in a Levine-type cross country format. De Gregorio was mainly looking for the effect of portfolio diversification. He finds that financial integration has no direct impact on economic growth, once financial depth is held fixed. He finds, however, that financial integration has a positive relationship with financial depth.

4.3 Previous Literature

This section reviews some recent literature, see Table 4.1, which uses the time series approach to analyse the finance-growth link. Demetriades and Hussein (1996) examine the finance-growth relationship within sixteen developing countries.[2] The first financial proxy they use is the ratio of bank deposit liabilities to GDP. The second is the ratio of bank claims on the private sector (loans) to nominal GDP, which is close to Levine's private credit measure. They focus their analysis on the issue of causality. To do this they first test for cointegration utilising both the Engle and Granger (1987) and Johansen (1988) procedures. They then test for causality using both error correction models (ECMs) and Granger tests on vector autoregressions (VARs) in levels.

Their results suggest that there is, in general, a relationship between finance and growth, but that it varies across countries. The Johansen technique finds cointegration for thirteen of the sixteen countries, for at least one of the finance indicators. The Engle-Granger method

[2] The exact criterion is that the country must not be highly developed in 1960, according to the World Bank definition.

only finds cointegration in five countries. As regards causality, the results are again mixed. The main result is that seven of the sixteen countries have a bi-directional relationship. In six countries it is found that finance follows growth and in only three countries does finance seem to cause growth.

Hansson and Jonung (1997) study the link between finance and growth in Sweden from 1834 - 1991. Levine's private credit measure is again used to proxy finance. They also employ Johansen (1988) cointegration analysis. In their initial model, which includes only GDP and finance, a unique cointegrating relationship is identified. It seems that this relationship is not stable, as the coefficients for finance are significantly different for different sub-periods. They also test for multivariate cointegration using a range of other variables, including investment, human capital and technological progress.

Arestis and Demetriades (1997) test the finance-growth relationship using the Johansen cointegration analysis for Germany and the US. Four variables are used: a growth variable, stock market capitalisation, stock market volatility and a Levine-type finance variable (M2 as a ratio of GDP for Germany and bank credit as a ratio of GDP for the US). The results highlight that the finance-growth relationship need not be similar across countries. For Germany it appears that there is uni-directional causality from financial development to GDP, but the reverse seems to be true for the United States. They also examine the effects of financial repression in South Korea using a weighted index of five banking sector controls. This variable has a positive effect on financial development, which the authors find consistent with a monopoly banking model.

The finance-growth nexus in Taiwan between 1960 and 1995 is examined by Ford (1997). He uses standard proxies for the development of the financial system. He also constructs some new indices which measure the development of the banking sector, using principal components analysis aided by information from principal factor analysis. He uses Johansen cointegration analysis, Engle-Granger ECM modelling and Granger causality tests on VARs. It is found that finance causes growth. Ford and Agung (1999), use similar techniques to examine the case of Japan. For the sub-period 1984 Q3 to 1995 Q2, finance is found to Granger cause growth. In general, however, the causality results vary according to the type of causality test.

Neusser and Kugler (1998) examine the finance-growth hypothesis for thirteen OECD countries. The distinctiveness of their research is the data they use. They measure financial development by the GDP of the financial sector, including a wide range of institutions such as insurance companies. Manufacturing GDP is used as a growth measure, reflecting their belief in the primacy of technical progress in stimulating economic growth. They also use manufacturing Total Factor Productivity (TFP), a direct measure of technical progress. They use a range of cointegration techniques including a panel cointegration test in the fashion of Pedroni (1997).

They find that financial sector GDP is positively related to manufacturing GDP, and also to manufacturing TFP, for most of the countries they study.

Rousseau and Wachtel (1998) undertake a time series analysis of the finance-growth relationship for five countries: the United States, the United Kingdom, Canada, Norway, and Sweden. They believe disappointing results from existing time series studies are due to the recent time periods studied, when countries were already quite sophisticated financially. Therefore, they examine the period 1870 - 1929 which was a time of rapid industrialization for all the countries in the study, reflected in the declining share of the agricultural sector. Standard proxies are used for finance in the regression analysis. One innovation is that the monetary base is included as a benchmark so that movements in money are excluded from the measured finance-growth relationship. The causality issue is addressed using a VECM and VARs in levels. The results for the United States and the United Kingdom are in favour of finance causing growth.

Much of the above literature is criticised by Luintel and Khan (1999) for its bivariate nature. They believe that a time series study in this field which omits the real interest rate and the capital stock is mis-specified. They *correct* for this by using a multivariate VAR analysis. They find cointegration according to the Johansen technique. In the ten countries analysed, the authors find bi-directional causality. We do not employ a multivariate approach in our study due to our small sample size. Furthermore, a bivariate approach places our analysis within the existing literature.

The rest of the above literature seems to support the contention that finance *causes* growth, although this is not true in all of the studies examined. Some studies emphasize how this link differs across countries. Thus, a study particular to Ireland is definitely worthwhile. A range of econometric techniques have been employed in the previous literature, most of which we will use in this paper. These include unit root tests, Engle-Granger and Johansen cointegration techniques, ECMs, VECMs, and Granger causality tests. The literature also highlights the importance of the proxies used to measure the quality of the financial system. Nonetheless, none of these studies include proxies for the role of foreign financial systems. Such proxies are developed in this study and are presented in Section 4.5 below.

4.4 Empirical Strategy

The paper proceeds by first describing the data that is used as we apply the issue of finance and growth to Ireland. We then ask the following questions:

1. Is there a relation between finance and growth?

2. If there is a relation, which variable is the causal factor?

Table 4.1: Previous Literature Summary Table

Author(s)	Method	Finance Measure
Demetriades and Hussein (1996)	Johansen + EG Cointegration ECM, VAR Granger causality	bank deposits / GDP private credit / GDP
Hansson and Jonung (1997)	Johansen	private credit, per capita
Arestis and Demetriades (1997)	Johansen	stock market capitalisation stock market volatility private credit / GDP bank deposits / GDP ex-ante real deposit interest rate financial repression index
Ford (1997)	Johansen ECM VAR Granger causality	currency to M2 total financial assets to GNP index based on number of bank branches index based on PCA and PFA
Agung and Ford (1998)	Johansen ECM	liquid liabilities / GDP Private Credit / GDP % of total credit allocated by comm. banks currency to M2
Neusser and Kugler (1998)	Johansen + EG Cointegration Granger Lin / Granger causality	GDP of the financial sector
Rousseau and Wachtel (1998)	Johansen VECM, VAR Granger causality	private credit, per capita Monetary stock-monetary base, per capita
Agung and Ford (1999)	Johansen ECM Granger causality	M2 / GDP Private Credit / GDP % of total credit allocated by comm. banks currency to M2
Luintel and Khan (1999)	multivariate VAR	bank deposits / GDP

Before we can do this, we first examine the statistical properties of the data in terms of stationarity. Then we answer the above questions by looking at the two key issues of cointegration and causality.

4.5 Data

4.5.1 Economic Growth

The consensus from the existing literature is to use real GDP as the indicator of economic development.[3] Real GDP is employed here also as this seems a judicious measure.

4.5.2 Financial Development

The main finance measures used in the literature are Levine-type proxies. Levine's preferred measure is private credit and an amended version is used in this study. It is defined as

- "DC" = Domestic credit = The total value of credits issued by resident financial intermediaries to the government and the private sector.[4]

In effect it measures the activity of the banking sector. The data are taken from the IMF's International Financial Statistics (IFS) Yearbook 2001.

The limitation of this measure is that, effectively, it measures the size of the financial sector. Thus, our analysis relies on the assumption that bigger financial sectors provide more efficient financial services. This assumption is unavoidable, seems to be reasonable and is standard in the literature. It makes sense that domestic credit will increase as the quality of financial services improves.

We repeat our econometric analysis using other measures of domestic finance in Appendix 4.B, as a robustness check on our results.

[3] The difference, in the case of Ireland, is that sizeable net factor income has resulted in a gap between GDP and GNP. GDP is still chosen as, theoretically, finance should influence domestic economic activity.

[4] This measure is equal to "line 22A + line 22D + line 42A.K + line 42D.K" in International Financial Statistics. Whereas Levine et al.'s (2000) private credit just uses "line 22D + line 42D", omitting credit to the government. We use domestic credit as it is more consistent with some of our foreign financial variables which also include credit to the government. In the robustness section, we repeat the empirical analysis using private credit.

The amalgamation of lines 22A + 22D with lines 42A.K + 42D. means that both bank and non-bank financial intermediaries are included. This is particularly important in the case of Ireland as in 1995 building societies, state sponsored financial institutions, and trustees savings banks where reclassified as banking institutions, having previously been classified as nonbank financial institutions.

4.5.3 Financial Integration

In view of the fact that Ireland is a small open economy, it is likely that foreign financial systems affect domestic economic growth as discussed in Section 4.2. Hence, suitable proxies are needed to account for this.

The first measure is taken from Table 6B of The Quarterly Review of the Bank of International Settlements (BIS):

- "FC" = Foreign credit = The external positions of reporting banks with the Irish non-bank sector.

It measures foreign lending that comes to Ireland and thus serves as a proxy for the second channel identified in Section 4.2.

This foreign credit measure can be combined with domestic credit to give an overall figure for the volume of credit reaching the Irish private and governmental sectors:

- "TC" = Total credit = "DC + FC" = Domestic credit + foreign credit.

The next measure is also taken from The Quarterly Review of the BIS (Table 2B):

- "ILA" = Irish lending abroad = The external assets of Irish banks vis a vis the non-bank sector in all currencies.

It measures the lending of Irish banks abroad and is therefore a proxy for the third channel. The fourth measure is similar but also includes lending to foreign financial institutions, whereas ILA deals solely with the non-bank sector.

- "FA" = Foreign Assets = Total foreign assets of deposit money banks and non-bank financial institutions

It is the sum of line 21 and line 41 from the IMF's International Financial Statistics.

The remaining measure is also taken from the IFS:

- "FL" = Foreign Liabilities = Total foreign liabilities of deposit money banks and non-bank financial institutions.

It is the sum of line 26c and line 46c. This proxy measures the foreign lending to, and foreign deposits with, Irish financial institutions. Both FA and FL experience a decrease in 1982 due to a definitional change.[5]

The econometric analysis is conducted on the natural logarithms of the variables in volume terms. This has no effect on the results, as the correlation rates between volume and per capita are over 0.99 for all the variables. All the variables used are of annual frequency and are transformed into 1995 Irish pounds; they are deflated by the GDP deflator.[6] The respective time periods of the variables are noted in Table 4.2.

4.6 Stationarity

The first step in the statistical analysis is to examine the stationarity of all the data series. Stationary variables fluctuate around their mean with a finite variance. A series is weakly stationary if its mean, variance, and autocovariance are time invariant.[7] We examine stationarity by testing for unit roots. The presence of a unit root means that the series is non-stationary. The standard test that is employed here, the augmented Dickey-Fuller (ADF) test, uses a null hypothesis that the series contains a unit root.[8] The ADF test, Table 4.2, finds that all the variables employed here are non-stationary.[9]

[5] From 1982, data is recorded on a residency-of-customer basis. According to the IFS Yearbook 2001 (p1093), "the activities of nonresident offices are, therefore, excluded from the data, and accounts of nonresidents at resident offices are classified under FA and FL." In private correspondence, the IMF confirmed that the first consequence of this change, the exclusion of the activities of nonresident offices, causes a drop in FA and FL. The Zivot-Andrews test performed in Appendix 4.A, however, does not find that 1982 constitutes a statistically significant structural break for these series. Nevertheless, to check our results, we still correct for this in the econometric analysis. We do this by including a dummy variable for 1982.

The second noted consequence of this change is a shift in the classification of the accounts of nonresidents at resident offices from DC to FA and FL. The Central Bank of Ireland Annual Report 1983 (p59) notes that "the exclusion of lending to nonresident private sector entities by resident offices of Associated Banks from the definition of private sector credit has little impact on the series." Thus, this second consequence of the definitional change is not significant empirically. Therefore, the variable DC can be used with confidence.

[6] All the financial variables are stock variables and thus are measured at the end of a period. In consequence, we use simple averages of two years of data, which are in effect the value at the start of the period and the value at the end of the period, to ensure the variables are measured *over* the period. This is in line with Levine et al's construction of private credit.

[7] Gujarati (1995, p713).

[8] We also perform the Zivot-Andrews test which allows for the presence of a structural break in the data. The results of this test are presented in Appendix 4.A.

[9] John Cochrane has noted that there is a major problem with such tests for stationarity, "in finite samples, unit roots and stationary processes cannot be distinguished"(Cochrane, 1991, p202). We should not place confidence in unit root tests due to the impossibility of properly handling deterministic trends. Furthermore, Cochrane notes that for most series we already know if a variable is stationary or not: variables in volume terms are non-stationary and variables expressed in ratio terms are stationary. As all the variables used in this paper are in volume terms, they are deemed non-stationary by Cochrane's approach which is in accord with the above results from standard ADF tests.

Table 4.2: Unit Root Tests

Series	Time Span	ADF test	
		k = 1	**k = 3**
GDP	1972 - 2001	2.26	1.74
DC	1972 - 1998	1.43	1.44
FC	1983 - 2001	0.26	1.09
TC	1983 - 1998	2.48	1.78
ILA	1983 - 2001	-0.65	-1.26
FA	1972 - 1998	0.13	-0.15
FL	1972 - 1998	1.19	1.01

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 2.5% level, **** 1% level

4.7 Cointegration

We are now in a position to ask the first key question: are finance and economic development related?[10] To do this we test for cointegration, which is a long-run equilibrium relationship between two or more variables. Although two variables themselves may be non-stationary, they may move closely together over time and a linear combination of the variables may be stationary. We use two different cointegration techniques here: the Engle-Granger and Johansen tests.

4.7.1 Engle-Granger

We test for cointegration in this section using the standard augmented Engle-Granger (1987) method. This involves a standard OLS regression of the two variables concerned,

$$y_t = \beta_0 + \beta_1 x_t + e_t \tag{4.1}$$

and then an ADF test of the residuals, e_t. The lag length of the ADF test is determined using the general to specific methodology employed by Ben-David and Papell (1995), starting at a lag length of 3. If the residuals are stationary, I(0), given that the variables are non-stationary, I(1), we say that the two variables are cointegrated. The tests are repeated with the lag length set at zero and at one, for comparison purposes. Since the residuals are estimates of the disturbance term, the asymptotic distribution of the test statistic differs from the distribution used for ordinary series. Thus, the normal critical values are not appropriate. The correct critical values are provided by Davidson and MacKinnon (1993, Table 20.2).

[10] To be precise, we are asking is the level of finance related to the level of income, GDP. Some endogenous growth models suggest that the level of finance affects the growth rate of output. We do not test for this latter relation.

Table 4.3: Engle-Granger Cointegration Results

Cointegrating Regression	**ADF Statistic**			
	G to S	**k**	**k = 0**	**k = 1**
GDP = *f* (DC)	-2.32	1	-1.73	-2.32
GDP = *f* (TC)	-1.94	0	-1.94	-2.11
GDP = *f* (DC, FC)	-1.81	0	-1.81	-2.18
GDP = *f* (DC, ILA)	-1.74	1	-0.88	-1.74
GDP = *f* (DC, FA)	-2.27	1	-1.58	-2.27
GDP = *f* (DC, FA, 1982)	-1.74	0	-1.74	-2.01
GDP = *f* (DC, FL)	-2.20	1	-1.53	-2.20
GDP = *f* (DC, FL, 1982)	-2.27	1	-1.58	-2.27

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

This method is also performed on multivariate regressions using our different proxies for foreign finance. The results are recorded in Table 4.3.[11,12] Estimation of the cointegrating relationships will take place in Section 4.8.

4.7.2 Johansen

The other main test for cointegration is the Johansen procedure. It is effectively a multivariate generalization of the Dickey-Fuller test.

Following Enders (1995) consider a VAR of order 1:

$$x_t = A_1 x_{t-1} + \epsilon_t \tag{4.2}$$

so that

$$\triangle x_t = A_1 x_{t-1} - x_{t-1} + \epsilon_t \tag{4.3}$$

$$\triangle x_t = (A_1 - I) x_{t-1} + \epsilon_t \tag{4.4}$$

$$\triangle x_t = \pi x_{t-1} + \epsilon_t \tag{4.5}$$

where x_t and ϵ_t are (n x 1) vectors of non-stationary I(1) variables, A_1 is an (n x n) matrix of parameters, I is an (n x n) identity matrix and π is defined to be $(A_1 - I)$. The rank of π

[11] Only one of these regressions, [GDP, FINGDP, FL, 1982 dummy], is deemed to have nonnormal errors by the Jarque-Bera test.

[12] The results are robust to reversing the order of the underlying cointegrating regression (reverse normalisation). These results are recorded in Appendix 4.B.

Table 4.4: Johansen Cointegration Results

Variables				Trace	Max
GDP	DC			17.48	14.12
GDP	TC			17.19	12.12
GDP	TC	(2 lags)		44.75***	40.21***
GDP	DC	FC		48.77***	25.87**
GDP	DC	ILA		34.96**	23.13**
GDP	DC	FA		39.14**	18.89
GDP	DC	FA	1982	65.97***	31.20**
GDP	DC	FL		35.84**	17.09
GDP	DC	FL	1982	59.54**	29.70**

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the bivariate regressions' trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67. For the multivariate regressions' trace statistic the 1% value is 41.07 and the 5% value is 34.91. For the max statistic the 1% value is 26.81 and the 5% value is 22.00.

equals the number of cointegrating vectors. The rank of a matrix is equal to the number of its characteristic roots (eigenvalues) that differ from zero. We use the two standard test statistics based on the eigenvalues, λ_{trace} and λ_{max}, to test for the number of cointegrating vectors. The λ_{trace} statistic tests the null of no cointegration against a general alternative of cointegration. The λ_{max} statistic uses a specific alternative of a set number of cointegrating relationships. This procedure can be extended to include further lags.

The Johansen technique is performed on the same sets of variables as for the Engle-Granger technique. Our main concern is whether there is cointegration present. As such, we report the test statistics for when the null hypothesis is that of no cointegrating equations. This is rejected if the test statistics are bigger than the critical values, indicating that cointegration exists. For the bivariate regressions the same lag lengths are used as in the Engle-Granger analysis. In the multivariate regressions, the results reported are for a lag length of one, as the Johansen procedure requires at least one lag.[13] The results are reported in Table 4.4.

[13] For the third and fifth multivariate equations, [GDP; DC; FA] and [GDP; DC; FL], extra data permit us to extend the lag length to four. The results reported for both equations are for a lag length of 1 where the test statistic is significant at 5%. Cointegration is found at the 1% level when the lag length is set at two, three or four for both equations.

Table 4.5: Summary of Cointegration Results

Variables			Engle-Granger	Johansen
GDP	DC		x	x
GDP	TC		x	✓
GDP	DC	FC	x	✓
GDP	DC	ILA	x	✓
GDP	DC	FA	x	✓
GDP	DC	FL	x	✓

4.7.3 Results

The results of the two tests are collated in Table 4.5. According to the Engle-Granger methodology, there is no cointegration. The results from the Johansen analysis, however, strongly imply that cointegration is present between finance and growth. We resolve this conflict by following recent research which favours the use of Johansen tests in small samples, due to the low power of the Engle-Granger methodology (Haug, 1996). Focusing on Johansen, we see that the bivariate analysis of domestic credit and GDP is deemed not cointegrated.[14] In the multivariate regressions, however, when the foreign financial variable is included, cointegration exists. An explanation for this could be that in bivariate analysis the equation is misspecified and the omitted variable, foreign finance, is included in the residual term. This omitted variable is non-stationary, and thus so are the residuals, deeming the variables unrelated. When the variable is included, the equation is correctly specified and considered cointegrated. In all four regressions of [GDP, domestic finance, foreign finance] cointegration is present. Furthermore, cointegration is also present in a bivariate relation when we use total credit, the sum of domestic credit and foreign credit.

4.8 Estimation and Economic Significance

In the previous section we have found that finance and growth are related, according to Johansen. In this section, we estimate this cointegrating relationship to see its economic significance. Standard OLS coefficient estimates are consistent in regressions with I(1) variables. In finite samples, however, they can have quite a large bias and the asymptotic distribution of their t-statistics depends on nuisance parameters.[15] This is due to the endogeneity of the regressors and residual autocorrelation. Thus, the use of standard OLS is inappropriate in our study.

[14] [GDP, DC] is cointegrated at a lag length greater than four. In the robustness section we find that the equation [GDP, PC] is also cointegrated at a lag length greater than four.

[15] Hayashi (2000, p651).

We correct for this problem by employing Dynamic OLS (DOLS).[16] This method adds past, current and future changes of the regressor to the regression.[17] These results are presented in Table 4.6. They are in close agreement with the results from both Phillips-Hansen Fully Modified OLS (FMOLS) and simple OLS.[18]

We perform these regressions on equations where both foreign and domestic finance are included. The first equation is a bivariate regression of GDP on TC. Here we see that the total amount of credit and GDP have a sensitive relationship: the coefficient has a value of 0.78. In the next regressions we include our individual foreign finance proxies with DC, to estimate how this impact is split between domestic and foreign finance.

In the six multivariate equations, the domestic finance proxy is nearly always significant with the coefficient ranging between 0.69 and 1.10.[19] This shows that the relationship is economically large, as well as statistically significant. Foreign finance is significant in only one of the equations, with an economically smaller impact. The respective coefficients of this equation are 0.80 and 0.04, suggesting that domestic and foreign finance are not perfect substitutes in the development process.[20]

We examine this vector, [GDP; DC; FA], in more detail, as it also has a relatively large sample size. Domestic credit has a coefficient of 0.80. This means that if domestic credit was ten per cent higher in 1998, GDP would have been £4.2 billion, or 7.9 per cent, larger. The level of Irish lending abroad (FA) has a coefficient of 0.04, so in 1998 GDP would have been £180 million (0.3 per cent) larger if FA were ten per cent higher.

[16] This approach is used in preference to the Johansen procedure which has limited efficiency in small samples. Furthermore, systems estimators are prone to specification bias.

[17] Hayashi (2000, p655).

[18] FMOLS applies nonparametric corrections to the OLS estimator. There are eight equations where the DOLS results are different from the FMOLS results. All of these occur when the two regressors are themselves cointegrated (see Appendix 4.B) which violates an assumption of both the models. There seems to be no econometric research, at present, into the relative robustness of these two techniques to the violation of this assumption. Dr. Jonathan H. Wright, Board of Governors of the Federal Reserve System, confirmed this in private correspondance. In general, however, the simulation evidence favours DOLS (Maddala and Kim, 1998, p184).

There is only one DOLS regression, [GDP, DC, FA, 1982], which has nonnormal errors, according to Jarque-Bera. Three FMOLS and one SOLS regressions have nonnormal errors and again all of these are when a dummy variable is included.

[19] The exception is when FC is included with DC. Further results in the next section suggest this regression may be untrustworthy.

[20] A Wald test of the equality of these two coefficients is rejected at a 1% significance level.

Table 4.6: Dynamic OLS

Domestic Finance	Coefficient	Foreign Finance	Coefficient	Sample Size
TC	0.78*** *10.84*			13
DC	-0.31 *-1.36*	FC	0.59*** *5.62*	13
DC	0.78*** *5.47*	ILA	-0.01 *-0.82*	13
DC	0.80*** *33.87*	FA	0.04* *1.87*	24
DC	0.69*** *5.02*	FA^{1982}	0.06 *1.61*	24
DC	0.83*** *17.01*	FL	-0.01 *-0.17*	24
DC	1.10*** *5.13*	FL^{1982}	-0.08 *-0.78*	24

Note: There is one lag in these equations. The time period is 1983-1998 for the first three equations and 1972-1998 for the last four equations; all the data are annual. The t-statistics are in italics, * 10% level, ** 5% level, *** 1% level. Equations with 1982 beside the foreign finance variable name include a dummy variable for 1982.

4.9 Causality

After discovering that economically important long-run relationships do exist among the variables, the next issue we want to examine is causality. Is finance causing growth or is it simply following growth?

4.9.1 Error-Correction Models

We first test for causality using error-correction models (ECMs).[21] The Granger Representation theorem states that if a set of variables are cointegrated of order one, then there exists a valid error-correction representation of the data (Engle and Granger, 1987). We can use the residual from the cointegrating regression as an instrument for the error-correction term so the ECMs take the following form:

$$\triangle y_t = \alpha_1 + \alpha_y e_{t-1} + \sum_{i=1}^{n} \alpha_{11t-i} \triangle x_{t-i} + \sum_{i=1}^{n} \alpha_{12t-i} \triangle y_{t-i} + \sum_{i=1}^{n} \alpha_{13t-i} \triangle z_{t-i} + \epsilon_{1t} \quad (4.6)$$

$$\triangle x_t = \alpha_2 + \alpha_x e_{t-1} + \sum_{i=1}^{n} \alpha_{21t-i} \triangle x_{t-i} + \sum_{i=1}^{n} \alpha_{22t-i} \triangle y_{t-i} + \sum_{i=1}^{n} \alpha_{23t-i} \triangle z_{t-i} + \epsilon_{2t} \quad (4.7)$$

[21] We use ECMs in our trivariate cointegrating equations instead of vector error-correction models (VECMs) due to our small sample size and the data-intensive nature of VECMs. The two techniques are based on the same equation but the VECMs are estimated jointly. The results from some trial VECMs were counter-intuitive.

$$\triangle z_t = \alpha_3 + \alpha_z e_{t-1} + \sum_{i=1}^{n} \alpha_{31t-i} \triangle x_{t-i} + \sum_{i=1}^{n} \alpha_{32t-i} \triangle y_{t-i} + \sum_{i=1}^{n} \alpha_{33t-i} \triangle z_{t-i} + \epsilon_{3t} \quad (4.8)$$

It is evident that these equations are Granger causality equations which include an error-correction term. As such we can test for Granger causality on these relationships. If the error-correction term is significant then a causal relationship exists: the dependent variable is being driven by the deviation from the long-run cointegrating relationship.[22] The Hendry general-to-specific methodology is again employed to decipher the appropriate lag length for the lagged variables in the error-correction models.[23] We start with a lag length of one for each variable due to the sample size.

In order to check the robustness of these standard ECMs, we run a different specification where the residual is replaced by the difference of the variables, i.e. GDP minus the financial variables. Lags of the independent variables are also added to the equation so we can indirectly estimate the beta coefficient of the cointegrating equation.[24] This is illustrated by first examining a basic error-correction model which includes the error-correction term, $y_{t-i} - \beta_1 x_{t-i}$,

$$\triangle y_t = \alpha_1 + \alpha_{11}[y_{t-i} - \beta_1 x_{t-i}] + \epsilon_t \quad (4.9)$$

We can see that this includes the coefficient on x_{t-i}, β_1. The standard Engle-Granger method, however, employs the residuals from the cointegrating equation as the error-correction term, e.g. equation 4.6. Thus, a value for β_1 cannot be determined. This new specification solves this problem by rearranging equation 4.9 to give

$$\triangle y_t = \alpha_1 + \alpha_{11}[y_{t-i} - x_{t-i}] + (1 - \beta_1)\alpha_{11} x_{t-i} + \epsilon_t \quad (4.10)$$

Thus, it provides an estimate of β_1. This specification for the trivariate case is as follows:

$$\triangle y_t = \alpha_1 + \alpha_{11}[y_{t-i} - x_{t-i} - z_{t-i}] + \alpha_{12} x_{t-i} + \alpha_{13} z_{t-i} + \epsilon_{1t} \quad (4.11)$$

$$\triangle x_t = \alpha_2 + \alpha_{21}[y_{t-i} - x_{t-i} - z_{t-i}] + \alpha_{22} x_{t-i} + \alpha_{23} z_{t-i} + \epsilon_{2t} \quad (4.12)$$

$$\triangle z_t = \alpha_3 + \alpha_{31}[y_{t-i} - x_{t-i} - z_{t-i}] + \alpha_{32} x_{t-i} + \alpha_{33} z_{t-i} + \epsilon_{3t} \quad (4.13)$$

[22] In checking for the significance of the error-correction term, we use the student's t distribution and account for the small and varying sample size.

[23] Due to the small sample size, we impose a sign restriction on the lagged variables: we do not include lags which imply a negative relationship between finance and growth. This is counter-intuitive and is interpreted to signify an overspecified model.

We also use the general to specific methodology to decide whether to include the contemporareous changes in the independent variables.

[24] This specification is run without lagged first differences of the other variables due to its degrees of freedom, as it includes two extra regressors.

Table 4.7: Error-Correction Models

Y	X	EC term	R^2	DW	X,X,Y lags	$D(X_1)$, $D(X_2)$
GDP	TC	0.01 *0.02*	0.18	1.92**	-	Yes
		-0.25 *-0.97*	0.22	2.34**	0,1	No
TC	GDP	0.88*** *3.70*	0.38	0.67	0,0	No
GDP	DC, FC	0.01 *0.03*	0.47	1.72**	-	Yes, No
		0.07 *0.25*	0.22	1.96**	1,0,0	No, No
DC	GDP, FC	0.39** *2.55*	0.55	0.76	-	Yes, No
		0.13 *0.99*	0.84	2.13***	0,0,1	Yes, No
FC	GDP, DC	0.67 *0.76*	0.07	1.19*	-	No, No
		-0.17 *-0.39*	0.47	2.01**	1,0,1	No, No
GDP	DC, ILA	0.06 *0.35*	0.47	2.23**	-	Yes, No
		0.09 *0.49*	0.23	2.01**	0,1,0	No, No
DC	GDP, ILA	0.20 *0.92*	0.50	0.94	-	Yes, No
		0.54*** *3.62*	0.90	2.13**	0,0,1	Yes, Yes
ILA	GDP, DC	3.80*** *3.98*	0.58	1.69**	-	Yes, No
		4.41*** *8.84*	0.75	1.87**	0,1,0	No, No

Note: White heteroskedasticity-consistent standard errors. EC term: t-statistics in italics, critical values from the student's t-distribution, the coefficient needs to be negative when Y = GDP and positive when Y = a financial variable to restore equilbrium, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), * means dl<d<du (inconclusive). The time period is 1983-1998 and the data are annual. Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 4.7 continued

Y	**X**	**EC term**	R^2	**DW**	**X,X,Y lags**	**D(X_1), D(X_2)**
GDP	DC, FA	0.01 *0.01*	0.52	1.89**	-	Yes, Yes
		0.01 *0.03*	0.22	2.01**	0,0,1	No, No
DC	GDP, FA	0.22 *1.33*	0.42	0.90	-	Yes, No
		0.30** *2.30*	0.75	1.99**	0,0,1	Yes, Yes
FA	GDP, DC	2.58*** *2.75*	0.48	1.50*	-	Yes, No
		2.48** *2.53*	0.53	1.53*	0,1,0	Yes, No
GDP	DC, FL	0.01 *0.06*	0.52	1.82	-	Yes, Yes
		0.06 *0.42*	0.24	1.53*	0,1,0	No, No
DC	GDP, FL	0.25* *1.79*	0.44	0.90	-	Yes, No
		0.16 *1.57*	0.71	1.69**	0,0,1	Yes, No
FL	GDP, DC	1.25** *2.67*	0.54	1.29*	-	Yes, No
		1.03** *2.16*	0.62	1.49*	0,1,0	Yes, No

Note: White heteroskedasticity-consistent standard errors. EC term: t-statistics in italics, critical values from the student's t-distribution, the coefficient needs to be negative when Y = GDP and positive when Y = a financial variable to restore equilbrium, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), * means dl<d<du (inconclusive). The time period is 1972-1998 and the data are annual. Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

The coefficient α_{j2} contains an estimate for β_1 that is retrieved using the formula

$$\beta_1 = 1 - \frac{\alpha_{j2}}{\alpha_{j1}} \tag{4.14}$$

We also estimate β_2 using

$$\beta_2 = 1 - \frac{\alpha_{j3}}{\alpha_{j1}} \tag{4.15}$$

These estimates serve as a robustness check on the regression results of the previous section. The results are similar to those in Section 4.8, again some of the results involving foreign credit appear to be counter-intuitive.

The main part of this section is the results of the ECMs themselves, which are shown in Tables 4.7 and 4.8.[25,26] The results are very similar for the different regressions. The financial variables always act to bring the relationship back to equilibrium: when one of them is the dependent variable, the error-correction term is significant with the correct positive sign. Our second ECM specification, which is used to check robustness, finds the error-correction term to be significant less often but again a financial variable is always the equilibrating factor. Therefore, it seems that GDP *causes* finance.

4.9.2 Vector Autoregressive Models

This result is checked by conducting Granger causality tests on Vector Autoregressive models (VARs) in levels. Usually non-stationary variables have to be differenced in order to conduct such tests. Sims, Stock and Watson (1990), however, have shown that this is unnecessary in trivariate VARs where cointegration is present.[27] We set the lag length equal to one for the VARs as it is at that lag length that the equations are cointegrated under the Johansen technique.

The results are recorded in Table 4.9.[28] They suggest that growth Granger causes finance,

[25] Of the results in Table 4.7, the regression [GDP, TC] has nonnormal errors, according to the Jarque-Bera test, when TC is the dependent variable. [GDP, DC, FA] also has nonnormal errors, when FA is the dependent variable. The errors are normal, however, when DC is the dependent variable. In the ECMs in the robustness section there are two further regressions where nonnormal errors occur when a financial variable is the dependent variable: [GDP, FINGDP, FC] and [GDP, PC, FA]. Again, however, we get normal errors, and a statistically significant error-correction term, when the other financial variable is the dependent variable. Thus, we can still conclude that growth causes finance.

[26] All but three of the regressions for the robust ECM specification (Tables 4.8 and 4.B.10) have normally distributed errors: [GDP, DC, FA], [GDP, DC, FL] and [GDP, PC, FA].

[27] We follow Rousseau and Wachtel (1998) in employing this approach. It should be noted that Toda and Phillips (1993) argue that this approach is only valid if there is *sufficient* cointegration.

[28] The only cases of Jarque-Bera nonnormal errors in the VAR analysis, at a lag length of one, occur for the regressions [GDP, DC, FA] and [GDP, DC, FL] when foreign finance is the dependent variable. When domestic

Table 4.8: Error-Correction Models - Robustness

Y	X	EC term	β_1	β_2	R^2	DW	D(X₁), D(X₂)
GDP	TC	0.01 *0.03*			0.38	1.96**	No
TC	GDP	-0.53** *-2.52*			0.67	1.34*	No
GDP	DC, FC	0.21 *1.05*			0.56	2.56**	No, Yes
DC	GDP, FC	0.43** *2.21*	-0.27	0.58	0.80	1.84*	No, Yes
FC	GDP, DC	0.78** *2.13*	-0.49	0.78	0.69	1.97**	Yes, No
GDP	DC, ILA	0.03 *0.21*			0.38	1.99**	No, No
DC	GDP, ILA	0.04 *0.18*			0.75	1.20*	Yes, No
ILA	GDP, DC	3.87*** *8.25*	0.70	0.03	0.81	2.18**	No, No
GDP	DC, FA	0.01 *0.06*			0.54	2.00**	Yes, Yes
DC	GDP, ILA	0.17 *1.14*			0.61	1.25*	Yes, No
FA	GDP, DC	2.58** *2.47*	0.74	0.05	0.51	1.50*	Yes, No
GDP	DC, FL	0.01 *0.03*			0.56	1.96**	Yes, Yes
DC	GDP, FL	0.19 *1.51*			0.66	1.35*	Yes, No
FL	GDP, DC	1.33* *1.93*	0.70	0.05	0.52	1.34*	No, Yes

Note: White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), * means dl<d<du (inconclusive). The ECM equations include a constant and are estimated by ordinary least squares.

or, as is customary, finance follows growth. GDP Granger causes both domestic and foreign finance and there is no case where finance Granger causes growth.[29]

Interestingly, it was also found that foreign and domestic finance are in competition. A rise in domestic finance causes a decline in Irish lending abroad, i.e. when more credit is lent at home less is lent abroad. This is confirmed by a similar result for foreign credit. The results for foreign assets and foreign liabilities, however, do present some evidence to the contrary.[30]

The possibility of a change in causation over the period, or even a change in the long-run relationship, cannot be adequately tested here due to the size of the data set.

4.10 Robustness

All of the econometric analysis (stationarity, cointegration and causality) is repeated for different proxies of domestic finance as a robustness check. The other variables are private credit, value added of the financial sector and employment in the financial sector. These results largely confirm our existing findings.[31] The only differences are that one case of bi-directional causality emerges in the ECM analysis and four cases of bi-directional causality emerge in the VAR analysis.[32]

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finance is the dependent variable, the errors are normally distributed. Therefore, we can still conclude with confidence that growth Granger causes finance. The same diagnostic result occurs in the robustness section for [GDP, PC, FA] and [GDP, FINGDP, FA]. The other diagnostic result in the robustness section is when FINGDP is the domestic finance variable. When it is used in conjuction with FA or FL we cannot conclude that finance does not Granger cause growth, as those regressions have nonnormal errors.

[29] The exceptions to this are when a dummy variable for 1982 is included in the regressions for FA and FL. The results in Table 4.9 show that birectional causality exists in these cases. We discount these results, however, as they have a counter-intuitive negative coefficient. The negative coefficient implies that private credit may be acting as a proxy for overlending (Gourinchas et al., 2001; Kaminsky and Reinhart, 1999). This seems plausible as the inclusion of the dummy variables means that we are, in effect, only examining the finance-growth link before 1982 and after 1982, and private credit is more likely to proxy for overlending in a shorter time period.

For the multivariate equation [GDP; DC; FA] the following causal relationships hold at other lag lengths: GDP $\rightarrow\rightarrow$ DC (2,3 lags), GDP $\rightarrow\rightarrow$ FA (2 lags), FA $\rightarrow\rightarrow$ DC (2,3 lags). For the equation [GDP; DC; FL] some of the causal relationships also hold at other lag lengths: GDP $\rightarrow\rightarrow$ DC (2,3 lags), FL $\rightarrow\rightarrow$ DC (2,3 lags).

[30] It should be noted that some of these directional results are not robust to the use of different proxies for domestic finance (see Appendix 4.B).

[31] They are presented in full in Appendix 4.B.

[32] The bidirectional causality in the ECM analysis is for the equation [GDP, FINEMP, ILA]. It is bidirectional for the robust ECM specification but in the standard specification finance causes GDP.

Table 4.9: Vector Autoregressive Models

Cointegrating Equation				Causal Relationships	p value	Sign
GDP	DC	FC		FC →→ DC	0.04	−
GDP	DC	ILA		GDP →→ ILA	0.01	+
				DC →→ ILA	0.01	−
GDP	DC	FA		GDP →→ DC	0.05	+
				GDP →→ FA	0.02	+
				DC →→ FA	0.03	−
GDP	DC	FA	1982	GDP →→ DC	0.10	+
				GDP →→ FA	0.02	+
				DC →→ FA	0.05	−
				FA →→ DC	0.08	+
GDP	DC	FL		GDP →→ DC	0.03	+
				GDP →→ FL	0.02	+
				FL →→ DC	0.03	+
				DC →→ FL	0.02	−
GDP	DC	FL	1982	GDP →→ DC	0.01	+
				DC →→ GDP	0.05	−
				GDP →→ FL	0.03	+
				FL →→ DC	0.01	−

Note: The symbols '+' and '-' in the sign column signify positive and negative coefficients respectively.

White heteroskedasticity-consistent standard errors.

4.11 Conclusion

This paper provides strong evidence that finance and growth move together in Ireland. It is found that growth and finance have a long-run equilibrium relationship: they are cointegrated. Furthermore, foreign financial systems play an important role in the process.

It is also found that growth is the causal variable in this relationship. Finance does not Granger cause growth in Ireland: finance follows growth. While the financial sector is important in itself as part of the economy in Ireland, it does not seem to be a major spur to overall economic growth. Nevertheless, we can say that finance does not hinder growth in Ireland. Instead finance plays a supportive role. This includes foreign financial systems so the second theoretical channel seems to be important. Likewise the third channel is significant but again with causality reversed: as output increases surplus savings are invested abroad by Irish institutions.

This causality result echoes Demetriades and Hussein (1996), who find that growth is the causal factor more often than finance. It is possible, however, that at an earlier period in Irish history the causation is reversed and that finance caused growth during that phase.

Future research in this area could increase the range of financial proxies. Stock market measures such as stock market capitalisation, liquidity and volatility could be used.

4.A Zivot-Andrews Appendix

In a seminal paper, Nelson and Plosser (1982) are unable to reject the null of a unit root for most of the long-term macroeconomic series in the US. Perron (1989), however, was able to reject the null for most of those series by allowing for a one-time exogenous change in either the intercept or the slope of the trend function. Thus, there is now a consensus in the literature that the standard unit root tests find it hard to discriminate between unit roots and structural breaks. In our analysis we follow Ben-David and Papell (1995) in using the sequential Dickey Fuller test approach of Zivot and Andrews (1992). This approach endogenizes the breakpoint selection. Perron, in contrast, picked what he deemed the obvious trend breaks of the Great Crash, 1929, and the oil price shock, 1973. Ben-David, Lumsdaine and Papell (1999) extend the work of Ben-David and Papell by using unit root tests that allow for two shifts in the deterministic trend: these techniques were developed by Lumsdaine and Papell (1997). Papell et al. (1999), however, do not use these techniques in another study as "the short time span of the data makes application of these methods problematic."[33] For similar considerations, the use of such tests is prohibited here.

Following Ben-David and Papell, we employ Model C from Zivot and Andrews (1992). This allows a break in both the intercept and the slope of the trend function and takes the form:

$$\triangle y_t = \mu + \theta DU_t + \beta.t + \gamma DT_t + \alpha y_{t-1} + \sum c_j \triangle y_{t-j} + \varepsilon_t. \quad (4.A.1)$$

The period at which the change in the parameters of the trend function occurs will be referred to as the time of break, or T_B. The break dummy variables have the following values: $\mathrm{DU}_t = 1$ if $t > T_B, 0$ otherwise, and $\mathrm{DT}_t = t - T_B$ if $t > T_B, 0$ otherwise. This equation is estimated sequentially for $T_B = 2, ..., T-1$, where T is the number of observations after adjusting for those lost by using a lag length k and first-differencing.

The time of break for each series is selected by choosing the value of T_B for which the Dickey-Fuller t-statistic (the absolute value of the t-statistic for α) is maximized. The null hypothesis, that the series $\{y_t\}$ is an integrated process without an exogenous structural break, is tested against the alternative hypothesis that $\{y_t\}$ is trend stationary with a one-time break in the trend function which occurs at an unknown time.[34]

Ben-David and Papell select the lag length by using a general-to-specific methodology utililised by Campbell and Perron (1991). As our data covers a much shorter time period, we have performed our unit root tests for a lag length of one and also for a lag length of three. These were

[33] Papell et al. (1999, p11).

[34] Ben-David and Papell (1995, p457).

Table 4.A.1: Zivot-Andrews Unit Root Tests

Series	Time Span	Break Year		ZA t-stat	
		k = 1	k = 3	k = 1	k = 3
GDP	1972 - 2001	1993	1994	-2.55	-2.02
DC	1972 - 1998	1994	1993	-3.02	1.59
FC	1983 - 2001	1989	1989	-3.16	-3.96
TC	1983 - 1998	1992	1995	2.01	-2.01
ILA	1983 - 2001	1987	1994	-3.65	-3.25
FA	1972 - 1998	1982	1983	-4.52	-4.35
FL	1972 - 1998	1992	1992	-3.07	-2.65
PC	1972 - 1998	1994	1991	-3.79	-2.28
FINGDP	1980 - 2000	1990	1990	-5.01*	-3.86
FINEMP	1985 - 2000	1997	1996	-5.37***	-3.97

Note: * 10% level, ** 5% level, *** 2.5% level, **** 1% level

chosen a priori.[35] The results are shown in Table 9.

FINGDP and FINEMP are the only variables that are found to be stationary (trend stationary with a structural break) by reference to the Zivot-Andrews test. FINGDP's break occurs in 1990, the data at which a definitional change occurs in the data and two series are spliced together. The rest of the variables are all non-stationary even allowing for a structural break.

[35] This follows the work of Katarina Juselius who, in her working paper "Models and Relations in Economics and Econometrics" (April 1999), *assumes* the lag length.

4.B Robustness Appendix

This appendix includes econometric results that are supplementary to those already presented. The results are for regressions with the same specification as those presented before using a different proxy for domestic finance. The following proxies are used:

- "PC" = Private credit = The total value of credits issued by domestic financial intermediaries to the private sector.[36]

This is similar to DC except it excludes credit to the government.

- "FINGDP" = Financial GDP = GDP of credit and insurance institutions.

This directly measures the size of the financial sector in terms of value added and national income. This measure was used as an indicator of financial development in Neusser and Kugler (1998). It is available from 1980 to 2000 from Ireland's Central Statistics Office (CSO). A new definition was used for financial sector value added in 1990. We extend this backwards by multiplying the old figures by the ratio of the new and old definitions.[37]

- "FINEMP" = Financial employment = The total persons engaged in banking, insurance, and building societies.

This proxy is available from 1985 to 2001, again from Ireland's CSO. This exact series actually only starts in 1988, so we extend the series backwards for the first three years using a broader industry variable: insurance, finance and business services.[38]

The following tables are presented in the same fashion, and following the same order, as those in the main body of the paper.

[36] The private credit measure used here for Ireland is equal to "line 22D + line 42D.K" in International Financial Statistics whereas Levine et al. (2000) use "line 22D + line 42D". Line 42D = claims on rest of domestic economy, and line 42D.K = claims on private sector. Line 42D is unavailable for Ireland for the time period required and, furthermore, it seems probable that Levine et al. do not use line 42D.K due to data constraints, as their paper refers to credit to the private sector.

[37] This ratio was derived from the most recent five years of overlap between the two definitions; a simple average of this ratio was used.

[38] Again we use a simple average of the two series to form a ratio. In the four year overlap period used the ratio is 1.63 and moves within a small range of 1.56 to 1.68.

Table 4.B.1: Unit Root Tests

Series	**Time Span**	**ADF test**	
		k = 1	**k = 3**
PC	1972 - 1998	1.37	1.05
FINGDP	1980 - 2000	0.98	1.54
FINEMP	1985 - 2000	-1.05	1.18

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 2.5% level, **** 1% level

Table 4.B.2: Engle-Granger Cointegration Results

Cointegrating Regression	**ADF Statistic**			
	G to S	**k**	**k = 0**	**k = 1**
GDP = f (PC)	-2.11	1	-1.53	-2.11
GDP = f (FINGDP)	-3.04*	0	-3.04*	-2.83
GDP = f (FINEMP)	-3.01	1	-2.15	-3.01
GDP = f (PC, FC)	-2.10	0	-2.10	-1.94
GDP = f (PC, ILA)	-1.59	2	-1.09	-1.33
GDP = f (PC, FA)	-2.26	1	-1.44	-2.26
GDP = f (PC, FA, 1982)	-2.24	1	-1.46	-2.24
GDP = f (PC, FL)	-2.13	1	-1.35	-2.13
GDP = f (PC, FL, 1982)	-2.14	1	-1.64	-2.14
GDP = f (FINGDP, FC)	-2.75	0	-2.75	-2.57
GDP = f (FINGDP, ILA)	-2.01	0	-2.01	-2.05
GDP = f (FINGDP, FA)	-3.24	0	-3.24	-2.93
GDP = f (FINGDP, FA, 1982)	-2.96	0	-2.96	-2.01
GDP = f (FINGDP, FL)	-3.16	0	-3.16	-2.81
GDP = f (FINGDP, FL, 1982)	-2.59	0	-2.59	-1.98
GDP = f (FINEMP, FC)	-2.46	0	-2.46	-2.93
GDP = f (FINEMP, ILA)	-2.04	0	-2.04	-2.12

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 4.B.2 continued

Cointegrating Regression	ADF Statistic			
	G to S	**k**	**k = 0**	**k = 1**
GDP = *f* (FC)	-3.51**	2	-2.37	-3.13*
GDP = *f* (ILA)	-3.27*	3	-1.92	-1.79
GDP = *f* (FA)	-1.65	1	-1.34	-1.65
GDP = *f* (FA, 1982)	-3.33	0	-3.33	-2.61
GDP = *f* (FL)	-1.64	1	-0.86	-1.64
GDP = *f* (FL, 1982)	-2.54	2	-2.08	-1.82
DC = *f* (FC)	-2.72	1	-1.18	-2.72
DC = *f* (ILA)	-1.67	1	-2.06	-1.67
DC = *f* (FA)	-1.75	1	-1.51	-1.75
DC = *f* (FA, 1982)	-3.46*	0	-3.46*	-3.07
DC = *f* (FL)	-1.89	1	-1.19	-1.89
DC = *f* (FL, 1982)	-3.04	0	-3.04	-2.81
PC = *f* (FC)	-3.01	1	-1.33	-3.01
PC = *f* (ILA)	-2.00	1	-1.57	-2.00
PC = *f* (FA)	-1.60	1	-1.39	-1.60
PC = *f* (FA, 1982)	-3.76**	0	-3.76**	-2.93
PC = *f* (FL)	-1.95	3	-1.09	-1.67
PC = *f* (FL, 1982)	-3.22	0	-3.22	-2.52
FINGDP = *f* (FC)	-3.23*	1	-2.39	-3.23*
FINGDP = *f* (ILA)	-3.96***	0	-3.96***	-3.26
FINGDP = *f* (FA)	-2.37	0	-2.37	-3.22*
FINGDP = *f* (FL)	-1.94	0	-1.94	-2.59
FINEMP = *f* (FC)	-4.82***	2	-2.24	-4.80***
FINEMP = *f* (ILA)	-3.95***	1	-2.18	-3.95***
FA = *f* (FL)	-2.41	3	-1.38	-1.92

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 4.B.3: Engle-Granger Cointegration Results (reverse normalisation)

Cointegrating Regression	**ADF Statistic**			
	G to S	**k**	**k = 0**	**k = 1**
GDP = f (DC)	-2.37	1	-1.78	-2.37
GDP = f (TC)	-1.79	0	-1.79	-1.94
GDP = f (DC, FC)	-1.50	1	-0.58	-1.50
GDP = f (DC, ILA)	-1.98	1	-0.96	-1.98
GDP = f (DC, FA)	-2.35	1	-1.65	-2.35
GDP = f (DC, FA, 1982)	-2.56	1	-1.86	-2.56
GDP = f (DC, FL)	-2.23	1	-1.70	-2.23
GDP = f (DC, FL, 1982)	-2.67	0	-2.67	-3.09
GDP = f (PC)	-2.13	1	-1.57	-2.13
GDP = f (FINGDP)	-3.09*	0	-3.09*	-2.84
GDP = f (FINEMP)	-3.81**	1	-2.63	-3.81**
GDP = f (PC, FC)	-1.15	2	-1.04	-1.05
GDP = f (PC, ILA)	-2.95	2	-0.63	-1.93
GDP = f (PC, FA)	-2.27	1	-1.47	-2.27
GDP = f (PC, FA, 1982)	-1.98	0	-1.98	-2.17
GDP = f (PC, FL)	-2.16	1	-1.47	-2.16
GDP = f (PC, FL, 1982)	-2.87	0	-2.87	-2.58
GDP = f (FINGDP, FC)	-2.78	0	-2.78	-2.59
GDP = f (FINGDP, ILA)	-3.92**	0	-3.92**	-3.32
GDP = f (FINGDP, FA)	-3.25	0	-3.25	-3.00
GDP = f (FINGDP, FA, 1982)	-3.22	0	-3.22	-2.91
GDP = f (FINGDP, FL)	-3.27	0	-3.27	-3.08
GDP = f (FINGDP, FL, 1982)	-3.27	0	-3.27	-3.08
GDP = f (FINEMP, FC)	-3.98**	1	-2.60	-3.98**
GDP = f (FINEMP, ILA)	-2.66	0	-2.66	-3.31

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 4.B.3 continued

Cointegrating Regression	ADF Statistic			
	G to S	k	k = 0	k = 1
GDP = f (FC)	-3.73**	2	-2.36	-3.24*
GDP = f (ILA)	-3.89**	3	-1.84	-1.84
GDP = f (FA)	-1.46	1	-0.38	-1.46
GDP = f (FA, 1982)	-2.94	0	-2.94	-2.20
GDP = f (FL)	-1.35	1	-0.09	-1.35
GDP = f (FL, 1982)	-2.23	2	-1.51	-1.39
DC = f (FC)	-2.65	1	-1.47	-2.65
DC = f (ILA)	-1.82	1	-2.02	-1.82
DC = f (FA)	-1.56	1	-0.41	-1.56
DC = f (FA, 1982)	-2.97	0	-2.97	-2.45
DC = f (FL)	-1.63	3	-0.06	-1.49
DC = f (FL, 1982)	-2.53	0	-2.53	-2.28
PC = f (FC)	-2.84	1	-1.65	-2.84
PC = f (ILA)	-3.03	2	-1.60	-2.12
PC = f (FA)	-1.71	3	-0.37	-1.43
PC = f (FA, 1982)	-3.29	0	-3.29	-2.39
PC = f (FL)	-1.68	3	-0.03	-1.31
PC = f (FL, 1982)	-2.75	0	-2.75	-2.05
FINGDP = f (FC)	-3.43	1	-2.19	-3.43**
FINGDP = f (ILA)	-3.53**	0	-3.53**	-2.66
FINGDP = f (FA)	-1.84	0	-1.84	-2.64
FINGDP = f (FL)	-1.20	0	-1.20	-1.94
FINEMP = f (FC)	-3.77**	1	-1.86	-3.77**
FINEMP = f (ILA)	-3.07*	1	-1.71	-3.07
FA = f (FL)	-1.60	1	-1.17	-1.60

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 4.B.4: Johansen Cointegration Results

Variables				Trace	Max	k
GDP	PC			17.66	13.45	1
GDP	FINGDP			21.67**	15.50	1
GDP	FINEMP			32.54***	25.28***	1
GDP	PC	FC		75.12***	42.28***	1
GDP	PC	ILA		45.01***	26.32**	1
GDP	PC	FA		35.50**	18.25	1
GDP	PC	FA	1982	68.09***	34.21***	1
GDP	PC	FL		36.26**	18.58	1
GDP	PC	FL	1982	60.17***	27.11	1
GDP	FINGDP	FC		42.47***	23.06**	1
GDP	FINGDP	ILA		31.02	16.51	1
GDP	FINGDP	FA		45.81***	24.90**	1
GDP	FINGDP	FL		46.62***	25.39**	1
GDP	FINEMP	FC		54.09***	32.30***	1
GDP	FINEMP	ILA		48.65***	28.51***	1

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the bivariate regressions' trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67. For the multivariate regressions' trace statistic the 1% value is 41.07 and the 5% value is 34.91. For the max statistic the 1% value is 26.81 and the 5% value is 22.00.

Table 4.B.4 continued

Variables			Trace	Max	k
GDP	FC		25.77***	17.44**	1
GDP	ILA		11.95	8.48	1
GDP	ILA		23.02**	16.98**	2
GDP	FA		16.19	12.38	1
GDP	FA	1982	32.61	21.43	1
GDP	FL		16.21	12.27	1
GDP	FL	1982	26.45	15.06	1
GDP	FL	1982	59.92***	32.64**	2
DC	FC		20.69**	13.04**	1
DC	ILA		7.19	4.13	1
DC	FA		14.50	11.00	1
DC	FA	1982	36.83**	20.56	1
DC	FL		14.56	10.67	1
DC	FL	1982	33.97	21.30	1
PC	FC		27.44***	19.72**	1
PC	ILA		7.93	5.41	1
PC	FA		11.22	7.71	1
PC	FA	1982	32.78	17.26	1
PC	FL		12.40	8.78	1
PC	FL		24.33**	19.99**	3
PC	FL	1982	26.45	15.06	1
FINGDP	FC		24.52**	13.02	1
FINGDP	ILA		18.40	12.81	1
FINGDP	FA		29.01***	22.08**	1
FINGDP	FL		26.50***	20.83***	1
FINEMP	FC		27.56***	22.79***	1
FINEMP	ILA		26.08***	19.20**	1
FA	FL		18.83	16.85**	1

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the bivariate regressions' trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67. For the multivariate regressions' trace statistic the 1% value is 41.07 and the 5% value is 34.91. For the max statistic the 1% value is 26.81 and the 5% value is 22.00.

Table 4.B.5: Summary of Cointegration Results

Variables			Engle-Granger	Johansen
GDP	PC		x	x
GDP	FINGDP		✓	✓
GDP	FINEMP		✓	✓
GDP	PC	FC	x	✓
GDP	PC	ILA	x	✓
GDP	PC	FA	x	✓
GDP	PC	FL	x	✓
GDP	FINGDP	FC	x	✓
GDP	FINGDP	ILA	x	x
GDP	FINGDP	FA	x	✓
GDP	FINGDP	FL	x	✓
GDP	FINEMP	FC	✓	✓
GDP	FINEMP	ILA	x	✓

Table 4.B.5 continued

Variables			Engle-Granger	Johansen
GDP	FC		✓	✓
GDP	ILA		✓	✓
GDP	FA		x	x
GDP	FA	1982	x	x
GDP	FL		x	x
GDP	FL	1982	x	✓
DC	FC		x	✓
DC	ILA		x	x
DC	FA		x	x
DC	FA	1982	✓	✓
DC	FL		x	x
DC	FL	1982	x	x
PC	FC		x	✓
PC	ILA		x	x
PC	FA		x	x
PC	FA	1982	✓	x
PC	FL		x	✓
PC	FL	1982	x	x
FINGDP	FC		✓	✓
FINGDP	ILA		✓	x
FINGDP	FA		x	✓
FINGDP	FL		x	✓
FINEMP	FC		✓	✓
FINEMP	ILA		✓	✓
FA	FL		x	✓

Table 4.B.6: Dynamic OLS

Domestic Finance	Coefficient	Foreign Finance	Coefficient	Sample Size
PC	0.02 *0.20*	FC	0.46*** *5.94*	13
PC	0.65** *2.91*	ILA	-0.01 *-0.35*	13
PC	0.60*** *36.15*	FA	0.05** *2.88*	24
PC	0.59*** *4.68*	FA^{1982}	0.07 *1.74*	24
PC	0.61*** *18.03*	FL	0.02 *0.31*	24
PC	0.86*** *5.37*	FL^{1982}	-0.04 *-0.42*	24
FINGDP	0.40*** *2.14*	FC	0.20** *0.91*	15
FINGDP	0.64 *1.86*	ILA	-0.02 *-0.19*	15
FINGDP	-0.11 *-0.61*	FA	0.24** *3.58*	16
FINGDP	0.72*** *3.00*	FL	-0.05 *-0.48*	16
FINEMP	1.63 *1.75*	FC	0.13 *0.39*	14
FINEMP	1.38*** *5.90*	ILA	0.05* *2.13*	14

Note: There is one lag in these equations. The t-statistics are in italics, * 10% level, ** 5% level, *** 1% level.

Equations with 1982 beside the foreign finance variable name include a dummy variable for 1982.

Table 4.B.7: Phillips-Hansen Fully Modified OLS

Domestic Finance	Coefficient	Foreign Finance	Coefficient	Sample Size
TC	0.84*** *20.32*			15
DC	0.61*** *4.32*	FC	0.26** *2.66*	15
DC	1.07*** *6.42*	ILA	-0.02 *-0.71*	15
DC	0.80*** *26.33*	FA	0.04** *2.72*	26
DC	0.49*** *5.57*	FA^{1982}	0.12*** *4.76*	26
DC	0.80*** *15.80*	FL	0.04 *1.22*	26
DC	0.69*** *4.82*	FL^{1982}	0.08 *1.38*	26
PC	0.52*** *6.14*	FC	0.22** *2.90*	15
PC	0.84*** *7.56*	ILA	-0.02 *-0.79*	15
PC	0.61*** *26.30*	FA	0.05*** *3.38*	26
PC	0.42*** *5.49*	FA^{1982}	0.11*** *3.99*	26
PC	0.61*** *15.54*	FL	0.06* *1.79*	26
PC	0.60*** *5.36*	FL^{1982}	0.07 *1.11*	26
FINGDP	0.32*** *3.08*	FC	0.31** *2.78*	17
FINGDP	0.50** *2.66*	ILA	0.03 *0.60*	17
FINGDP	0.49*** *7.67*	FA	0.03 *1.02*	18
FINGDP	0.25*** *3.93*	FA^{1982}	0.14*** *3.40*	18
FINGDP	0.54*** *6.97*	FL	0.02 *0.38*	18
FINGDP	0.42*** *4.38*	FL^{1982}	0.10 *1.46*	18
FINEMP	0.82*** *3.02*	FC	0.37*** *3.68*	16
FINEMP	0.94*** *10.28*	ILA	0.09*** *9.64*	16

Note: Bartlett Weights, 2 lags, no trend. The t-statistics are in italics, * 10% level, ** 5% level, *** 1% level.

Equations with 1982 beside the foreign finance variable name include a dummy variable for 1982.

Table 4.B.8: Simple OLS

Domestic Finance	Coefficient	Foreign Finance	Coefficient	Sample Size
TC	0.85*** *23.91*			16
DC	0.69*** *5.43*	FC	0.20** *2.28*	16
DC	0.98*** *5.05*	ILA	-0.01 *-0.05*	16
DC	0.80*** *27.19*	FA	0.05*** *3.33*	27
DC	0.68*** *7.67*	FA^{1982}	0.08*** *2.92*	27
DC	0.79*** *18.35*	FL	0.06* *2.11*	27
DC	0.82*** *6.42*	FL^{1982}	0.05 *0.87*	27
PC	0.58*** *6.54*	FC	0.18** *2.36*	16
PC	0.86*** *6.16*	ILA	-0.02 *-0.60*	16
PC	0.61*** *29.05*	FA	0.06*** *4.22*	27
PC	0.59*** *7.96*	FA^{1982}	0.06** *2.28*	27
PC	0.60*** *19.22*	FL	0.07*** *2.93*	27
PC	0.71*** *7.14*	FL^{1982}	0.02 *0.42*	27
FINGDP	0.31*** *2.92*	FC	0.33** *2.87*	18
FINGDP	0.42*** *3.39*	ILA	0.06 *1.46*	18
FINGDP	0.51*** *8.59*	FA	0.03 *1.06*	19
FINGDP	0.34*** *4.52*	FA^{1982}	0.11*** *3.05*	19
FINGDP	0.51*** *7.81*	FL	0.04 *0.91*	19
FINGDP	0.39*** *4.82*	FL^{1982}	0.12* *2.10*	19
FINEMP	0.71*** *2.97*	FC	0.38*** *3.99*	17
FINEMP	0.81*** *7.60*	ILA	0.10*** *8.31*	17

Note: The t-statistics are in italics, * 10% level, ** 5% level, *** 1% level. Equations with 1982 beside the foreign finance variable name include a dummy variable for 1982.

Table 4.B.9: Error-Correction Models

Y	X	EC term	R^2	DW	X,X,Y lags	$D(X_1)$, $D(X_2)$
GDP	PC, FC	-0.11 *-0.46*	0.64	2.55**	-	Yes, No
		0.03 *0.09*	0.35	2.07**	1,0,0	No, No
PC	GDP, FC	0.51*** *4.22*	0.70	1.15*	-	Yes, No
		-0.14 *-0.42*	0.90	1.65*	1,0,1	Yes, No
FC	GDP, PC	0.63 *0.62*	0.04	1.20*	-	No, No
		0.16 *0.14*	0.46	1.76**	1,0,0	No, Yes
GDP	PC, ILA	-0.04 *-0.25*	0.64	2.67**	-	Yes, No
		0.10 *0.57*	0.37	2.20**	0,1,0	No, No
PC	GDP, ILA	0.34 *1.34*	0.67	1.36*	-	Yes, No
		0.62*** *3.48*	0.91	1.82*	0,0,1	Yes, Yes
ILA	GDP, PC	4.73*** *3.89*	0.64	1.65**	-	No, Yes
		4.78*** *6.63*	0.73	1.73**	0,1,0	No, No
GDP	PC, FA	-0.01 *-0.04*	0.59	1.95**	-	Yes, Yes
		0.07 *0.37*	0.19	1.42*	0,1,0	No, No
PC	GDP, FA	0.19 *0.75*	0.41	0.98	-	Yes, No
		0.48** *2.71*	0.80	1.63*	0,0,1	Yes, Yes
FA	GDP, PC	2.51* *1.88*	0.46	1.48*	0,0,0	Yes, No
GDP	PC, FL	0.02 *0.22*	0.58	1.88**	-	Yes, Yes
		0.09 *0.58*	0.24	1.55**	0,1,0	No, No
PC	GDP, FL	0.24 *1.19*	0.43	0.95	-	Yes, No
		0.32** *2.15*	0.75	1.52*	0,0,1	Yes, Yes
FL	GDP, PC	1.04* *1.73*	0.51	1.29*	-	Yes, No
		0.45 *0.83*	0.63	1.88*	0,0,1	Yes, No

Note: White heteroskedasticity-consistent standard errors. EC term: t-statistics in italics, critical values from the student's t-distribution, the coefficient needs to be negative when Y = GDP and positive when Y = a financial variable to restore equilbrium, * 10% level, ** 5% level, *** 1% level. DW statistic: ** d>du (no autocorrelation), * dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by OLS.

Table 4.B.9 continued

Y	X	EC term	R^2	DW	X,X,Y lags	$D(X_1)$, $D(X_2)$
GDP	FINGDP	-0.13 *-0.90*	0.37	2.49**	0,1	No
FINGDP	GDP	1.06** *2.57*	0.31	1.68**	0,0	No
GDP	FINGDP, FC	0.05 *0.24*	0.01	1.09	-	No, No
		-0.16 *-0.68*	0.28	2.52**	0,0,1	No, No
FINGDP	GDP, FC	0.86* *1.97*	0.15	2.16**	0,0,0	No, No
FC	GDP, FINGDP	1.33*** *7.02*	0.53	1.08	-	No, No
		1.03*** *4.05*	0.59	1.32*	1,0,0	No, No
GDP	FINGDP, FA	-0.03 *-0.26*	0.47	1.92**	-	No, Yes
		-0.03 *-0.20*	0.48	1.96**	0,1,0	No, Yes
FINGDP	GDP, FA	1.34*** *2.90*	0.41	1.83**	0,0,0	No, No
FA	GDP, FINGDP	0.15 *0.21*	0.01	0.81	-	No, No
		1.49** *2.72*	0.66	2.02**	0,1,0	Yes, No
GDP	FINGDP, FL	-0.01 *-0.13*	0.58	2.16**	-	No, Yes
		0.04 *0.27*	0.38	2.07**	0,1,0	No, No
FINGDP	GDP, FL	1.33** *3.09*	0.49	1.99**	0,0,0	No, Yes
FL	GDP, FINGDP	0.04 *0.08*	0.58	1.67**	-	Yes, No
		0.68 *1.49*	0.70	1.99**	0,1,0	Yes, No

Note: White heteroskedasticity-consistent standard errors. EC term: t-statistics in italics, critical values from the student's t-distribution, the coefficient needs to be negative when Y = GDP and positive when Y = a financial variable to restore equilibrium, * 10% level, ** 5% level, *** 1% level. DW statistic: ** d>du (no autocorrelation), * dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by OLS.

Table 4.B.9 continued

Y	X	EC term	R^2	DW	X,X,Y lags	$D(X_1)$, $D(X_2)$
GDP	FINEMP, FC	0.08 *0.65*	0.02	1.53*	0,0,0	No, No
FINEMP	GDP, FC	0.29** *3.18*	0.26	1.28*	-	No, No
		0.31** *2.76*	0.49	1.21*	0,0,1	No, No
FC	GDP, FINEMP	1.06*** *2.97*	0.34	1.20*	-	No, No
		1.21*** *3.52*	0.48	1.86**	0,0,1	No, No
GDP	FINEMP, ILA	-0.51*** *-3.38*	0.22	1.22*	-	No, No
		-0.80*** -5.54	0.59	2.36**	0,0,1	Yes, No
FINEMP	GDP, ILA	0.34 *1.36*	0.52	1.64*	0,0,0	Yes, Yes
ILA	GDP, FINEMP	-2.07 *-0.88*	0.43	1.73**	-	No, Yes
		-1.99 *-1.13*	0.69	2.39**	1,1,0	No, Yes
GDP	FC	0.12 *0.91*	0.07	1.26*	-	No, No
		-0.05 *-0.29*	0.23	2.35**	0,1	No, No
FC	GDP	0.97*** *4.63*	0.45	1.23*	-	No, No
		1.08*** *5.53*	0.62	2.33**	0,1	No, No
GDP	ILA	0.01 *0.11*	0.01	1.07	-	No, No
		-0.06 *-0.50*	0.25	2.31**	0,1	No, No
ILA	GDP	1.48*** *2.80*	0.23	0.50	-	No, No
		1.03* *2.07*	0.63	2.42**	0,1	No, No

Note: White heteroskedasticity-consistent standard errors. EC term: t-statistics in italics, critical values from the student's t-distribution, the coefficient needs to be negative when Y = GDP and positive when Y = a financial variable to restore equilibrium, * 10% level, ** 5% level, *** 1% level. DW statistic: ** d>du (no autocorrelation), * dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by OLS.

Table 4.B.10: Error-Correction Models - Robustness

Y	X	EC term	β_1	β_2	R^2	DW	$D(X_1)$, $D(X_2)$
GDP	PC, FC	-0.12 *-0.73*			0.74	2.94**	Yes, No
PC	GDP, FC	0.47*** *3.11*	-0.06	0.49	0.94	2.41**	Yes, Yes
FC	GDP, PC	1.66*** *5.72*	-0.01	0.49	0.81	2.84**	No, Yes
GDP	PC, ILA	0.05 *0.39*			0.71	3.09**	Yes, No
PC	GDP, ILA	-0.03 *-0.19*			0.87	1.96**	Yes, No
ILA	GDP, PC	4.04*** *6.20*	0.57	0.02	0.78	1.82**	No, No
GDP	PC, FA	-0.01 *-0.05*			0.61	2.04**	Yes, Yes
PC	GDP, FA	0.32 *1.65*			0.64	1.09*	Yes, Yes
FA	GDP, PC	2.55* *1.91*	0.57	0.06	0.49	1.49*	Yes, No
GDP	PC, FL	0.01 *0.08*			0.62	2.01**	Yes, Yes
PC	GDP, FL	0.18 *1.16*			0.62	1.20*	Yes, No
FL	GDP, PC	1.01* *1.71*	0.57	0.01	0.56	1.39*	Yes, No

Note: White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), * means dl<d<du (inconclusive). The ECM equations include a constant and are estimated by ordinary least squares.

Table 4.B.10 continued

Y	X	EC term	β_1	β_2	R^2	DW	D(X_1), D(X_2)
GDP	FINGDP	0.02 *0.23*			0.56	2.01**	No
FINGDP	GDP	1.14*** *2.85*	0.54		0.38	1.92**	No
GDP	FINGDP, FC	0.36 *1.50*			0.60	2.61**	No, Yes
FINGDP	GDP, FC	0.94* *1.73*	0.74	-0.20	0.40	2.08**	No, No
FC	GDP, FINGDP	1.47*** *6.94*	0.20	0.65	0.76	2.00**	Yes, No
GDP	FINGDP, FA	0.03 *0.22*			0.51	2.04**	No, No
FINGDP	GDP, FA	1.34*** *2.87*	0.48	0.04	0.44	1.99**	No, No
FA	GDP, FINGDP	0.29 *0.41*			0.71	1.89**	Yes, No
GDP	FINGDP, FL	-0.01 *-0.10*			0.58	2.15**	No, Yes
FINGDP	GDP, FL	1.33*** *2.82*	0.47	0.05	0.43	2.03**	No, No
FL	GDP, FINGDP	-0.47 *-0.93*			0.83	2.26**	Yes, Yes

Note: White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), * means dl<d<du (inconclusive). The ECM equations include a constant and are estimated by ordinary least squares.

Table 4.B.10 continued

Y	X	EC term	β_1	β_2	DW	R^2	$D(X_1)$, $D(X_2)$
GDP	FINEMP, FC	0.09 *0.83*			0.23	2.00**	No, No
FINEMP	GDP, FC	0.27** *2.66*	1.41	0.19	0.43	1.33*	Yes, No
FC	GDP, FINEMP	1.07*** *3.17*	0.21	0.53	0.48	1.42*	No, No
GDP	FINEMP, ILA	-0.59*** *-4.69*	0.92	0.10	0.56	1.81*	Yes, No
FINEMP	GDP, ILA	0.55*** *3.38*	1.11	0.07	0.50	1.45*	Yes, No
ILA	GDP, FINEMP	-1.80 *-0.74*			0.48	1.78*	No, Yes
GDP	FC	0.31** *2.28*			0.59	2.59**	Yes
FC	GDP	1.15*** *8.97*	0.53		0.67	2.02**	Yes
GDP	ILA	0.06 *0.59*			0.45	1.99**	No
ILA	GDP	1.72*** *3.88*	0.14		0.47	0.76	No

Note: White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), * means dl<d<du (inconclusive). The ECM equations include a constant and are estimated by ordinary least squares.

Table 4.B.11: Vector Autoregressive Models

Cointegrating Equation				Causal Relationships	p value	k	sign
GDP	PC	FC		FC →→ PC	0.03	1	+
GDP	PC	ILA		GDP →→ ILA	0.01	1	+
				PC →→ ILA	0.01	1	−
GDP	PC	FA		GDP →→ FA	0.05	1	+
				GDP →→ FA	0.06	2	+
				PC →→ FA	0.07	1	−
				PC →→ FA	0.08	2	−
				FA →→ PC	0.02	3	+
GDP	PC	FA	1982	GDP →→ FA	0.03	1	+
				GDP →→ FA	0.07	2	+
				GDP →→ FA	0.08	3	+
				PC →→ GDP	0.08	1	−
				PC →→ FA	0.06	2	−
GDP	PC	FL		GDP →→ PC	0.06	1	+
				PC →→ GDP	0.08	1	−
				PC →→ GDP	0.10	3	+
				GDP →→ FL	0.05	1	+
				FL →→ PC	0.06	1	+
				FL →→ PC	0.06	2	+
				FL →→ PC	0.02	3	+
				PC →→ FL	0.06	1	−
GDP	PC	FL	1982	GDP →→ PC	0.02	1	+
				PC →→ GDP	0.01	1	−
				PC →→ GDP	0.02	2	−
				PC →→ GDP	0.03	3	−
				GDP →→ FL	0.06	1	+
				GDP →→ FL	0.09	2	+
				FL →→ GDP	0.05	3	+
				FL →→ PC	0.04	1	+
				FL →→ PC	0.07	3	+

Note: The symbols '+' and '-' in the sign column signify positive and negative coefficients respectively.

White heteroskedasticity-consistent standard errors.

Table 4.B.11 continued

Cointegrating Equation			Causal Relationships	p value	k	sign
GDP	FINGDP	FC	GDP →→ FINGDP	0.10	1	+
			GDP →→ FC	0.01	1	+
			GDP →→ FC	0.01	2	+
			GDP →→ FC	0.01	3	+
			FINGDP →→ FC	0.01	1	−
			FINGDP →→ FC	0.01	2	−
GDP	FINGDP	FA	GDP →→ FINGDP	0.01	1	+
			GDP →→ FINGDP	0.01	2	+
			FINGDP →→ GDP	0.07	2	+
			GDP →→ FA	0.01	3	+
			FINGDP →→ FA	0.07	1	+
			FINGDP →→ FA	0.02	2	+
			FA →→ FINGDP	0.01	2	−
GDP	FINGDP	FL	GDP →→ FINGDP	0.01	1	+
			GDP →→ FINGDP	0.03	2	+
			FINGDP →→ GDP	0.07	2	+
			FINGDP →→ FL	0.07	1	+
			FINGDP →→ FL	0.01	2	+
GDP	FINEMP	FC	GDP →→ FINEMP	0.02	1	+
			GDP →→ FINEMP	0.01	2	+
			GDP →→ FC	0.01	1	+
			GDP →→ FC	0.01	2	+
GDP	FINEMP	ILA	GDP →→ FINEMP	0.06	2	+
			FINEMP →→ GDP	0.06	1	+
			GDP →→ ILA	0.03	2	−
			ILA →→ GDP	0.01	1	+
			ILA →→ GDP	0.02	2	+
			FINEMP →→ ILA	0.02	1	+

Note: The symbols '+' and '-' in the sign column signify positive and negative coefficients respectively.

White heteroskedasticity-consistent standard errors.

Chapter 5

The Role of Foreign Finance in Growth

5.1 Introduction

The relationship between financial development and economic growth is now an established research field in contemporary macroeconomics. The existing literature shows theoretically how finance may affect growth and empirically provides evidence that it does so. The literature so far, however, has largely omitted the role of foreign institutions in this process. It has concentrated on how growth is influenced by institutions resident in the same country. This paper aims to fill this gap by examining the role of foreign financial institutions in development.

This paper shall first review some of the literature that has already looked at foreign finance. Section 5.3 provides some theoretical background, and the empirical strategy of the paper is then outlined in Section 5.4. Section 5.5 introduces the variables used to proxy for the role of foreign institutions and Sections 5.6, 5.7 and 5.8 form the empirical study for different time periods. Section 5.9 concludes.

5.2 Literature Review

Some aspects of the role of foreign finance have already been examined. Levine and Zervos (1998b) show that the liberalisation of restrictions on capital and dividend flows increases the liquidity, size, international integration and volatility of stock markets. This is one way foreign finance can affect growth, since in another study (Levine and Zervos, 1998a) they have shown that the level of stock market development influences economic growth. In a more recent paper, Levine (2000) pools together some existing theory and evidence on finance and growth. He reemphasizes his above argument and then adds a second: greater foreign bank presence increases domestic bank efficiency. This is of importance, he argues, because the existing evidence points to the domestic banking system influencing growth through total factor productivity (TFP) growth. Furthermore, recent studies (Klenow and Rodriguez, 1997; Easterly and Levine, 2001) propose that TFP growth accounts for about ninety per cent of cross-country growth differences.

A recent paper by Claessens, Demirguc-Kunt and Huizinga (2001) highlights this banking channel. They provide evidence that a higher level of foreign ownership of banks is linked to decreased margins and profits of domestic banks. This suggests that foreign entry increases the efficiency of the domestic banking sector, which may then increase economic growth. De Gregorio (1998) includes financial integration in a Levine-type cross-country format and finds that financial integration has a positive relationship with financial depth. He also examines whether foreign finance affects growth through the portfolio diversification channel. On this issue, however, he finds that financial integration has no direct impact on economic growth once financial depth is held fixed. This again highlights the role foreign finance has in improving domestic finance.

5.3 Theoretical Background

Theoretically foreign finance can influence domestic economic growth in more ways than the narrow channels examined so far in the literature. Indeed the existing theoretical literature points to a number of channels where finance affects growth by overcoming market frictions. Financial intermediaries decrease liquidity risk and avail of economies of scale to reduce information costs, transactions costs and monitoring costs. There is no inherent reason why these channels are restricted to the actions of domestic financial institutions. What matters for domestic economic growth is the frequency of and quality with which these functions are performed. Thus, capital is allocated to a more productive use and the level of investment may also increase. Therefore, where foreign institutions are prominent they may increase economic growth directly by performing these functions, as well as indirectly by increasing the quality and efficiency with which domestic institutions perform.

Globalisation of financial services also has its problems. A recent World Bank Report (2001) argues that the most acute problem is the "risk of extreme currency movements resulting in losses to insufficiently hedged intermediaries and businesses."[1] When businesses borrow from foreign financial institutions this may be in a foreign currency. If the domestic country then experiences an exchange rate devaluation, these liabilities increase in monetary value. Thus, the use of foreign finance can at times place financial burdens on domestic companies and institutions and consequently have a negative influence on economic growth. As foreign finance theoretically has both costs and benefits, empirical analysis needs to be undertaken to estimate the trade off.

5.4 Empirical Strategy

The econometric analysis employed is similar to the cross-section technique used by Levine et al. (2000). This places our analysis in line with the existing literature on finance and growth. One observation is used for each country in the dataset: this is an average figure for the time period studied. Growth in real per capita Gross Domestic Product (GDP) is used as the dependent variable. We use the same independent variables as Levine.[2] These are initial GDP, initial human capital, trade, government size, inflation, black market premium and private credit, which is Levine's preferred finance measure. The one change is that a foreign finance variable is added, to see how foreign finance affects economic growth. The next section introduces the proxies that

[1] Caprio et al. (2001, p187).

[2] All independent variables are expressed in natural logarithms. Further details are presented in Appendix 5.A.

we employ for foreign finance. For each regression we show the results when foreign finance is included and when it is excluded. This is to observe how the coefficient for private credit changes when foreign finance is included. Both finance variables [private credit and our foreign measures] are measured using their initial value in order to address the issue of causality. Estimation is by Ordinary Least Squares (OLS). The sample used is different from Levine et al. due to data limitations for the foreign variables. The countries included are listed in Appendix 5.B.[3]

5.5 Financial Indicators

We employ proxies for both domestic and foreign finance in our regressions. Our main domestic measure is

- "PC" = Private credit = The total value of credits issued by resident financial intermediaries to the private sector, divided by GDP.

It is Levine et al.'s preferred measure of financial depth. It is equal to line 22D + line 42D in the IMF's International Financial Statistics (IFS). It measures the existing stock of credit owed to resident institutions.

As one of our foreign financial variables below includes credit to the public sector, we shall amend this private credit variable to also include credit to the public sector for reasons of consistency. Thus, we have the following variable

- "DC" = Domestic credit = The total value of credits issued by resident financial intermediaries to the government and the private sector, divided by GDP.

It is equal to line 22A + line 22D + line 42A + line 42D in IFS.

We then employ four different variables to measure the role of foreign institutions. Together they offer comprehensive coverage of any possible role of foreign financial systems. They are as follows:

- "FL" = Foreign liabilities = Foreign liabilities of bank and non-bank financial institutions, divided by GDP.

[3]Panama is excluded from the dataset due to its role as a financial center. This is highlighted by extreme values for some of the variables introduced in Section 5.5 indicating that, in the case of Panama, these variables are not good proxies for what we are trying to measure (Section 5.3). In the time period 1980 to 1998, for example, Panama has a value of 2.84 for foreign liabilities and the next highest is Singapore with 0.60. For foreign credit, in the same time period, Panama has a value of 2.10 and the next highest value is under 0.40.

These data are taken from line 26C, line 46C and line 99B of IMF's International Financial Statistics. Foreign liabilities is a proxy for the money resident financial institutions borrow from abroad, money which at least partially serves the domestic market.

- "FC" = Foreign credit = The external positions of reporting banks with the domestic non-bank sector, divided by GDP.

This is taken from Table 6B of The Quarterly Review of the Bank of International Settlements (BIS). Foreign credit proxies the credit lent directly from foreign institutions to the domestic non-bank sector. It is a foreign equivalent to the above DC measure. This measure is available from 1983 to 1998.[4]

- "TC" = Total credit = Domestic Credit + foreign credit

This amalgamation serves as a proxy for the total credit that reaches the domestic non-bank sector.

- "FBA" = Foreign Bank Assets = Foreign bank assets divided by total bank assets.

A foreign bank is defined to have at least 50 percent foreign ownership. These data, taken from Claeesens et al. (2001), are one observation per country: an average for the 1988 - 1995 period. This variable measures the impact foreign institutions may have by actually setting up, or taking over, operations based in the domestic market.

The paper proceeds by examining each of these foreign variables over a selection of suitable and available time periods. We examine different time periods because the extent of foreign finance has increased due to the increasing globalisation of the world economy, see Table 5.1.[5]

5.6 1960 - 1995 Regressions

The first time period where we investigate this issue is 1960 - 1995. We follow Levine et al. in the choice of this time period. If there is a paucity of data for finance between the years 1960 and 1965 the country is still included in the dataset, in order to increase the sample size. Thus, the initial value for foreign finance is 1960 or the earliest year available up to 1965. Of the foreign finance proxies only foreign liabilities is available for this time period and it is examined below.

[4] Another possible BIS variable is domestic lending abroad. It is equal to the external assets of domestic banks vis a vis the non-bank sector in all currencies and is taken from Table 2B of The Quarterly Review. Unfortunately this variable is only available for a limited amount of countries. When it is incorporated into the framework of our cross-section study we have only sixteen observations. Therefore, the analysis of this variable is not presented here.

[5] An interesting exception to this is that foreign credit is lower in the 1990s than in the 1980s.

Table 5.1: Arithmetic Means of Financial Variables

Variable	Mean		
	1960 - 1995	1980 - 1998	1990 - 1998
FL	2.44	12.67	18.11
FC	-	13.27	6.83
FBA	-	-	16.18
PC	25.62	48.52	63.72
DC	-	59.37	76.33

Note: All values are for the twenty eight countries common to all time periods.

5.6.1 Foreign Liabilities

In regression (1), of Table 5.2, we find that private credit has a statistically significant positive effect on economic growth, this is in accordance with the existing literature. The variable foreign liabilities, however, is not significant at the standard ten per cent level: the variable has a p-value of 0.17. We then test the robustness of this result.

First, we look for the leverage points in the regression. Leverage points are influential observations, in our study they are countries which are influential in determining the statistical significance of foreign finance. We determine the leverage points of the regression by using observation-specific dummy variables. This is where a dummy variable is used for country i, effectively excluding its data from the dataset for that regression.[6] This is then repeated for each country in turn. Thus, these regressions show us how the statistical significance of foreign liabilities changes when each country's data are in turn excluded from the regression. Therefore, we can see which countries are influential in determining the statistical significance of foreign finance.[7]

In regression (1) we find that Kenya is a leverage point. When it is dropped from the sample foreign liabilities becomes significant. This regression, when Kenya is omitted from the sample, is recorded as regression (2). When Haiti is excluded from this regression, however, we find that foreign liabilities becomes insignificant again. This pattern continues: as the biggest leverage point is dropped from each sequential regression the significance, or otherwise, of foreign liabilities changes.

For our next robustness check we just use initial income and human capital as control vari-

[6] Kennedy (1998, p226).

[7] Another method of identifying influential observations is the jacknife procedure. It also creates repeated samples from the original sample by omitting one observation at a time. The difference is that a final parameter estimate is calculated as the average parameter of these samples. We do not use this method here as it does not work well in small samples (Hair et al., 1998, p607).

ables, what Levine et al. call the simple conditioning set. We find that the same pattern emerges here: the result of the significance of foreign liabilities changes when each leverage point is excluded in turn. Furthermore, this pattern continues when we just include non-OECD countries in the sample, regression (3).

The consistency of this pattern suggests that there is a relationship between foreign liabilities and growth. The sensitivity of this relationship to leverage points suggests that it is not consistent across countries. It should be noted that more leverage points exist for a statistically significant relationship than for an insignificant relationship. This suggests that the regressions where the variable foreign liabilities is insignificant are more robust than the regressions where foreign liabilities is significant. This is illustrated in regression (1) which has two leverage points (Kenya and Portugal) out of forty five countries, and where foreign liabilities is insignificant. By dropping any one country from this sample, forty five new samples can be created. In only two of these will foreign liabilities be significant. Regression (2), however, where foreign liabilities is significant, has seven leverage points. Thus, out of forty four new samples, created by dropping one country from regression (2), seven will have an insignificant result for foreign liabilities.

Interestingly in regression (3) we also see that private credit is no longer significant.[8] Thus, the standard result for private credit in the literature seems to be fragile. This result is itself robust to the removal of the biggest leverage point and to use of the simple set.

A further test for robustness is to express foreign liabilities as a percentage of private credit. Here we find that foreign finance is not significant. This result holds when the biggest leverage point is excluded and when the simple conditioning set is used. Interestingly, foreign liabilities is significant when we use the non-OECD subset, regression (4).[9] This result is robust to using just the simple set of control variables and to dropping the biggest leverage point. A partial scatter plot of growth and foreign liabilities in this regression is shown in Figure 5.1.

The interpretation of this result hinges on two points: the use of private credit as the scaling variable and the non-OECD subset. As private credit itself is already included in the regression its direct effect on growth is controlled for. Thus, we are just measuring an indirect effect: foreign liabilities are significant when scaled by private credit not GDP.[10] Therefore, foreign liabilities' relation to private credit is important. Theoretically, there seems to be two ways this could work. A good domestic financial system could work in tandem with foreign credit and use local knowledge to distribute the credit effectively. Or foreign credit could compensate for an underdeveloped domestic financial system. For a given level of foreign liabilities in volume

[8] In the previous regressions private credit behaves in a similar fashion to foreign liabilities.

[9] Only one column is shown for this regression in Table 5.2 as the regression when foreign finance is excluded is the same as for regression (3).

[10] When foreign liabilities are scaled by GDP we have the first result of an inconsistent relation across countries.

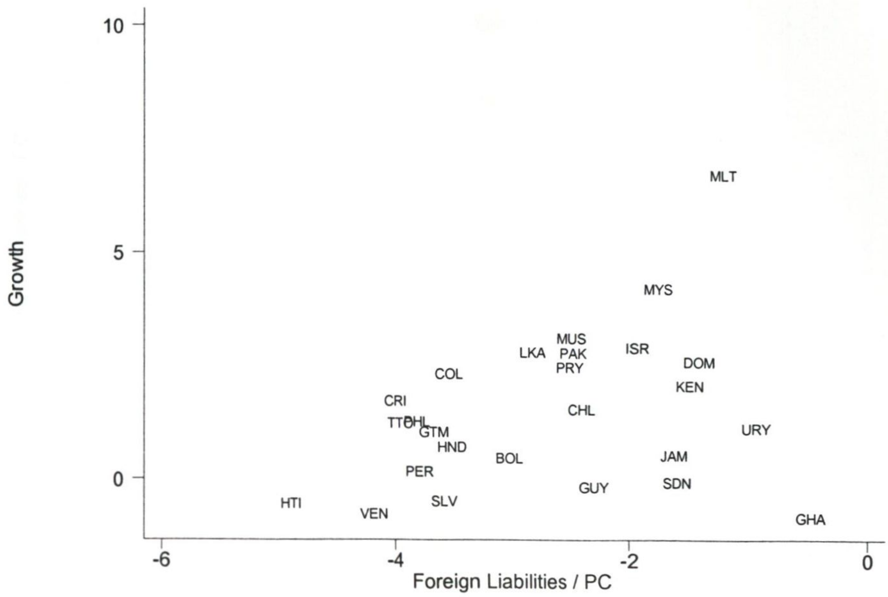

Figure 5.1: Growth and Foreign Liabilities / Private Credit, 1960 - 1995: Regression (4)

Table 5.2: Foreign Liabilities 1960 - 1995

Variable	**(1)**		**(2)**		**(3)**		**(4)**
GDP	-0.96*** *-2.77*	-0.98*** *-2.94*	-1.12*** *-3.20*	-1.17*** *-3.68*	-0.81** *-2.16*	-0.72** *-2.08*	-0.71** *-2.15*
School	1.02 *1.45*	1.03 *1.54*	0.84 *1.17*	0.82 *1.23*	0.75 *0.92*	1.43* *1.93*	1.60** *2.10*
Government	1.08 *1.60*	0.95 *1.38*	1.48** *2.11*	1.39** *2.06*	1.38* *1.81*	0.81 *1.11*	0.82 *1.18*
Trade	0.63 *1.41*	0.47 *1.03*	0.70 *1.55*	0.51 *1.12*	1.17* *1.74*	0.43 *0.75*	0.29 *0.50*
BMP	-2.72*** *-2.90*	-2.80*** *-3.35*	-3.01*** *-2.91*	-3.17*** *-3.55*	-2.86** *-2.53*	-2.65*** *-3.00*	-2.65*** *-3.32*
Inflation	-1.31 *-0.89*	-1.79 *-1.13*	-0.94 *-0.62*	-1.46 *-0.91*	0.06 *0.03*	-3.30 *-1.28*	-3.72 *-1.36*
PC	0.60** *2.15*	0.40 *1.28*	0.72*** *2.68*	0.49* *1.66*	0.20 *0.46*	-0.50 *-1.03*	0.04 *0.11*
FL		0.22 *1.41*		0.27* *1.81*		0.55** *2.67*	0.63** *2.60*
Sample Size	45	45	44	44	26	26	26
R^2	0.57	0.59	0.60	0.64	0.66	0.75	0.77
Adjusted R^2	0.49	0.50	0.52	0.55	0.53	0.63	0.66

Note: White heteroskedasticity-consistent standard errors. t-Statistics in italics. * 10%, ** 5%, *** 1%.

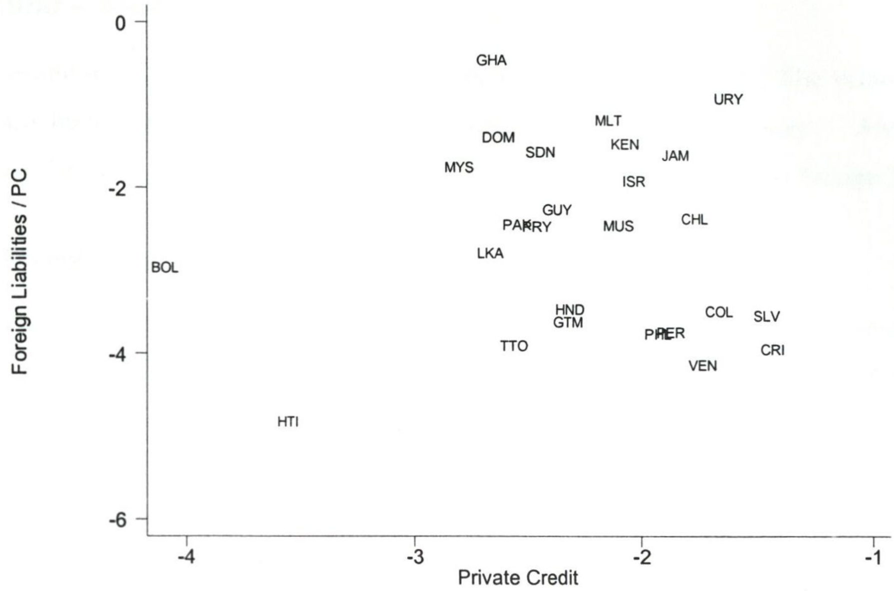

Figure 5.2: Private Credit and Foreign Liabilities / Private Credit, 1960 - 1995, non-OECD sample.

terms, the former implies a negative coefficient and the latter a positive coefficient. As the coefficient is positive we take the latter interpretation. This holds for the non-OECD subset where the private credit figures are smaller, indicating a poor financial system and hence a need for compensating provision.[11]

Therefore, this result implies that developing countries use foreign liabilities to compensate for their shallow domestic financial systems and the variation of this compensation helps to explain variation in their growth performance. This result doesn't hold for the full sample as it includes more developed financial systems and thus the variable doesn't proxy credit compensation for those countries.

Interestingly, there is no relation between private credit and foreign liabilities over private credit: they have a correlation coefficient of 0.01 and their bivariate regression line is practically horizontal (see Figure 5.2). Consequently, the amount of compensation is not related to the present state of the domestic financial system.

[11]Private credit ranges from 1% to 25% of GDP in this non-OECD subsample.

5.7 1980 - 1998 Regressions

We now examine this subject for a more recent time period: 1980 - 1998. The values of foreign finance are higher in this period (Table 5.1) reflecting its increasing usage. Also the data availability for this period allows us to examine foreign credit in addition to foreign liabilities.

5.7.1 Foreign Liabilities

In this period, we find that the variable foreign liabilities is not significant as a determinant of economic growth in the standard Levine et al. regression. This is recorded as regression (1) in Table 5.3. This result is robust to the exclusion of the biggest leverage point in the regression. In regression (2) we test for robustness to a change in the control variables using the simple set. Foreign liabilities is again insignificant and this result is also robust to the exclusion of any one country. Next we check the subset of non-OECD countries and again foreign liabilities is insignificant.[12] This is recorded as regression (3) and holds when the simple control set is used. Finally, all these regressions are repeated with foreign liabilities expressed as a percentage of private credit and all the key results stay the same.

On that account, foreign liabilities is not significantly related to growth in this time period. Interestingly, neither is private credit, our domestic finance measure. This result is also robust to all the above checks.

5.7.2 Foreign Credit

Now we turn to foreign credit, data for which is only available for a shorter time period, 1983 to 1998. Thus, the foreign credit figures employed in these regressions are for 1983. We use these to proxy for the value of foreign credit at the start of the time period.

In our standard regression, regression (1) in Table 5.4, the variable foreign credit is not significant as a determinant of economic growth. The robustness of this result is then tested. First, we determine the leverage points of this regression and it is found that this result changes when Chile is excluded. We then re-run the regression with Chile dropped from the sample. This subsequent regression is not robust either and no obvious robust result emerges. We continue this pattern of forming new regressions by omitting the biggest leverage point in turn and find that foreign credit switches between significance and insignificance in these regressions. Furthermore, these regressions have a similar number of leverage points, suggesting that the significant and insignificant results for foreign credit are robust to a similar degree.[13]

[12] This result is itself robust to the exclusion of any one country.

[13] In regression (1), in Table 5.4, foreign liabilities is insignificant. This regression has two leverage points: Chile and Portugal. The regression is re-run with Chile omitted from the sample. Foreign liabilities is significant

Table 5.3: Foreign Liabilities 1980 - 1998

Variable	(1)		(2)		(3)	
GDP 1980	-0.23 *-0.69*	-0.22 *-0.67*	-0.11 *-0.34*	-0.11 *-0.32*	-0.21 *-0.53*	-0.28 *-0.74*
School	1.05 *1.25*	1.08 *1.35*	0.95 *1.19*	0.96 *1.21*	1.43 *1.39*	1.58 *1.60*
Government	-0.28 *-0.40*	-0.29 *-0.21*			-0.02 *-0.02*	0.12 *0.13*
Trade	1.01** *2.23*	1.05** *2.32*			0.77 *0.97*	0.80 *0.95*
BMP	-0.28 *-1.20*	-0.30 *-1.21*			-0.34 *-1.08*	-0.37 *-1.05*
Inflation	-2.16* *-1.84*	-1.99 *-1.53*			-2.90* *-1.77*	-2.51 *-1.43*
PC	-0.20 *-0.52*	-0.09 *-0.24*	0.26 *0.78*	0.28 *0.77*	-0.41 *-0.69*	-0.21 *-0.36*
FL		-0.14 *-0.72*		-0.02 *-0.08*		-0.23 *-0.79*
Sample Size	55	55	55	55	39	39
R^2	0.31	0.32	0.10	0.10	0.32	0.33
Adjusted R^2	0.21	0.20	0.05	0.03	0.16	0.15

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, * 10%, ** 5%, *** 1%.

In regression (2) we turn to the simple set of control variables: initial income and human capital. Here we find that foreign credit is insignificant and this result is robust to the exclusion of any one country. This exact pattern of results, for the policy set and the simple set, is repeated when foreign credit is expressed as a ratio to domestic credit. This overall pattern suggests that there may be a relationship between foreign credit and growth but that it seems to be quite a particular relationship: particular to the countries in the sample and the control variables used.

Examination of the of the non-OECD sample of countries may shed some light on this potential relationship. In regression (3), see Figure 5.3 also, we find that foreign credit is significant at the 2% level. This result is robust to the exclusion of any one country and the coefficient is negative. This result holds for the simple conditioning set too, regression (4).[14] Furthermore,

in this regression which also has two leverage points: Botswana and Nepal. We drop Nepal from the sample and find foreign liabilities to be insignificant in the subsequent regression. There are four leverage points (Cyprus, Ireland, Netherlands and Portugal) in this regression. When Portugal is then dropped from this new sample, foreign liabilities is significant and this regression also has two leverage points: Botswana and Iran.

[14] It is noteworthy that domestic credit becomes significant when foreign credit enters this equation, this also holds in regression (2). This is due to a high correlation coefficient between the two variables (0.62). The domestic credit result however, unlike the foreign credit result, does not hold when the full policy control set is used.

Table 5.4: Foreign Credit 1980 - 1998

Variable	(1)		(2)		(3)		(4)	
GDP 1980	-0.27	-0.31	-0.17	-0.25	-0.26	-0.36	-0.22	-0.31
	-0.79	*-0.94*	*-0.49*	*-0.74*	*-0.62*	*-0.97*	*-0.45*	*-0.69*
School	1.03	1.22	0.92	1.22	1.35	1.83*	1.08	1.96*
	1.23	*1.44*	*1.15*	*1.47*	*1.29*	*1.94*	*1.13*	*1.77*
Government	-0.28	-0.36			-0.05	-0.14		
	-0.39	*-0.55*			*-0.05*	*-0.17*		
Trade	1.00**	1.29***			0.82	1.17		
	2.20	*2.69*			*1.04*	*1.47*		
BMP	-0.26	-0.30			-0.30	-0.39*		
	-1.18	*-1.53*			*-1.05*	*-1.79*		
Inflation	-2.13*	-0.31			-2.76	0.47		
	-1.84	*0.20*			*-1.66*	*0.20*		
DC	-0.04	0.19	0.43	0.59*	-0.21	0.44	0.44	0.98**
	-0.09	*0.53*	*1.12*	*1.67*	*-0.35*	*0.87*	*0.90*	*2.08*
FC		-0.32		-0.24		-0.68**		-0.63**
		-1.48		*-1.36*		*-2.57*		*-2.55*
Sample Size	55	55	55	55	39	39	39	39
R^2	0.31	0.34	0.12	0.14	0.31	0.42	0.09	0.21
Adjusted R^2	0.20	0.22	0.06	0.07	0.15	0.26	0.01	0.12

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, * 10%, ** 5%, *** 1%.

it holds when foreign credit is expressed as a ratio to domestic credit. Thus, we find that foreign credit has a negative effect on growth for the non-OECD countries.

This provides evidence for the exposure to currency movements theory presented in Section 5.3. Firms in non-OECD countries are less likely to have the ability to hedge their exposure and thus are more vulnerable to currency movements.

We also examined total credit and found it to be insignificant in all the specifications.

5.8 1990 - 1998 Regressions

The last time period we examine is 1990 - 1998. This allows us to examine the variable foreign bank assets. It also informs us whether any of the relationships change over time.

5.8.1 Foreign Liabilities

For this shorter time period, again using the standard Levine et al. specification, the variable foreign liabilities is only just insignificant: it has a p-value of 0.11. This is recorded in Table 5.6 as regression (1). When the USA, the biggest leverage point, is omitted from the sample foreign liabilities becomes significant. This result, however, is not robust and we again have a situation where we cannot find a result that is robust to this leverage point analysis. When each

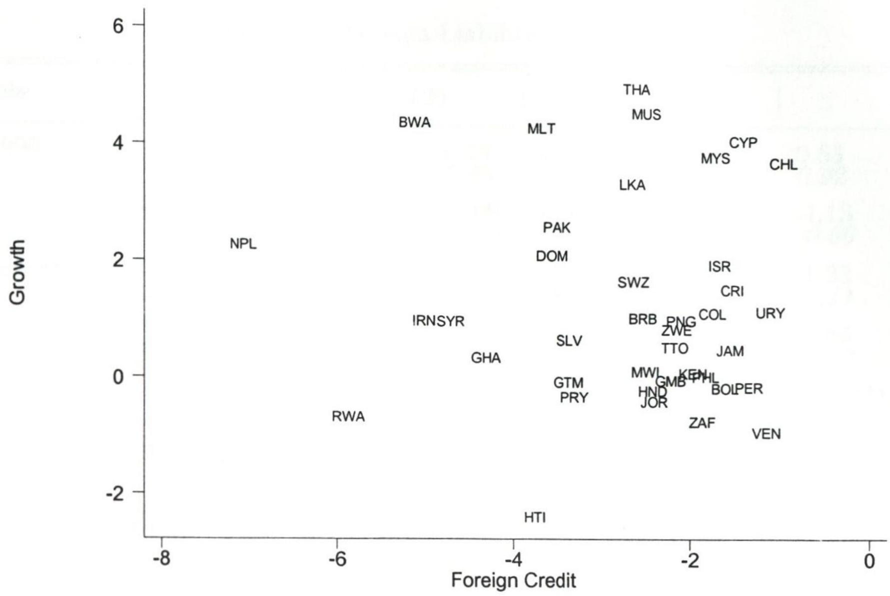

Figure 5.3: Growth and Foreign Credit, 1980 - 1998: Regression (3)

of the six biggest leverage points are removed from the regression, one at a time, the result of the significance of foreign liabilities reverses. In regression (2) we use the simple set of control variables and here we find a robust result: foreign liabilities is insignificant.

When we turn to non-OECD countries, regression (3), we find a statistically significant role for foreign liabilities. When South Africa is removed from this regression, however, significance is lost. This subsequent regression, regression (4), is robust to the removal of any one country. This result is also robust to use of the simple conditioning set.

The remaining robustness check is to express foreign liabilities as a percentage of private credit. Here we find a very similar pattern of results. The only difference occurs when we use the non-OECD sample with the policy variables: here we do not find a robust result. Thus, in three specifications (full sample, full sample with private credit as the scaling variable and non-OECD sample with private credit as the scaling variable) there is no obvious robust result. In all three of these cases, however, we find that the regressions where foreign liabilities is significant are more robust, as they have less leverage points.[15]

[15] In the full sample, when foreign finance is insignificant, 9 of the 43 countries act as leverage points. In contrast, only 2 of the 42 countries are leverage points when foreign finance is significant. When private credit is used as the scaling variable for foreign liabilities we have a similar result. The corresponding figures are 4 out of 43 when finance is significant, and 6 out of 42 when insignificant. The non-OECD sample figures are 2 out of 25 when finance is significant, and 3 out of 24 when insignificant.

Table 5.5: Foreign Liabilities 1990 - 1998

Variable	(1)		(2)		(3)		(4)	
GDP 1990	0.47	0.44	0.21	0.19	0.48	0.69	0.53	0.65
	1.30	*1.25*	*0.65*	*0.60*	*0.89*	*1.38*	*0.92*	*1.26*
School	-0.61	-0.76	-0.03	-0.09	-0.88	-1.56	-1.13	-1.48
	-0.57	*-0.70*	*-0.03*	*-0.09*	*-0.46*	*-0.82*	*-0.60*	*-0.81*
Government	-1.87**	-2.08***			-1.79*	-2.18**	-1.33	-1.71*
	-2.49	*-2.82*			*-1.91*	*-2.73*	*-1.41*	*-1.88*
Trade	1.13*	1.03*			0.61	0.63	-0.06	0.15
	1.86	*1.80*			*0.61*	*0.75*	*-0.07*	*0.17*
BMP	-7.64***	-8.03***			-8.36***	-8.59***	-8.24***	-8.42***
	-5.14	*-6.07*			*-4.71*	*-5.21*	*-4.18*	*-4.49*
Inflation	-0.25	-0.61			0.01	-0.78	-0.24	-0.67
	-0.11	*-0.29*			*0.01*	*-0.26*	*-0.09*	*-0.22*
PC	-0.30	-0.70	0.09	-0.04	-0.25	-1.02	0.14	-0.46
	-0.79	*-1.42*	*0.23*	*-0.08*	*-0.38*	*-1.26*	*0.21*	*-0.47*
FL		0.33		0.12		0.61*		0.38
		1.64		*0.57*		*1.82*		*1.05*
Sample Size	43	43	43	43	25	25	24	24
R^2	0.47	0.50	0.05	0.06	0.53	0.59	0.57	0.59
Adjusted R^2	0.36	0.39	-0.02	-0.04	0.33	0.39	0.39	0.38

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, * 10%, ** 5%, *** 1%.

To summarise these results it seems that, for this time period, in general the variable foreign liabilities does not affect growth. Previously we found there was such a relationship for the period 1960 - 1995, when private credit was the scaling variable for the non-OECD sample. This result is present to a weak degree in this time period. It holds for certain subsamples of the non-OECD countries when the policy variables are included. Therefore, the later, and shorter, time period dilutes the key finding of Section 5.6.1.

5.8.2 Foreign Credit

We find no evidence for our foreign credit variable being a statistically significant determinant of growth in this time period. In the standard regression, regression (1) in Table 5.6, foreign credit is insignificant. Using the simple control variables, regression (2), it is again insignificant. Restricting the sample to just the non-OECD countries, regression (3), does not change this result either.[16] All these results are robust to the exclusion of any one country and to the use of private credit as a scaling variable. We also examine total credit, see regression (1), and find it to be insignificant, a result robust to all the above checks.

This result is of course contrary to what we find for the 1980 - 1998 period. This is possibly

[16]This is true for the simple set or the full policy set of control variables.

Table 5.6: Foreign Credit 1990 - 1998

Variable	(1)			(2)		(3)	
GDP 1990	0.45 *1.24*	0.47 *1.19*	0.44 *1.26*	0.20 *0.62*	0.27 *0.81*	0.46 *0.83*	0.46 *0.77*
School	-0.63 *-0.60*	-0.74 *-0.63*	-0.62 *-0.57*	-0.05 *-0.05*	-0.34 *-0.33*	-1.00 *-0.52*	-0.99 *-0.49*
Government	-1.85** *-2.49*	-1.87** *-2.39*	-1.85** *-2.50*			-1.78* *-1.96*	-1.77* *-1.79*
Trade	1.12* *1.84*	1.03 *1.62*	1.13* *1.83*			0.60 *0.59*	0.60 *0.56*
BMP	-7.70*** *-5.17*	-7.60*** *-4.96*	-7.72*** *-5.19*			-8.31*** *-4.68*	-8.31*** *-4.55*
Inflation	0.06 *0.03*	0.13 *0.06*	0.08 *0.04*			0.42 *0.16*	0.41 *0.15*
DC	-0.23 *-0.63*	-0.27 *-0.71*		0.12 *0.30*	-0.06 *-0.16*	-0.08 *-0.13*	-0.07 *-0.09*
FC		0.12 *0.39*			0.35 *1.13*		-0.02 *-0.04*
TC			-0.23 *-0.61*				
Sample Size	43	43	43	43	43	25	25
R^2	0.47	0.47	0.47	0.05	0.09	0.52	0.52
Adjusted R^2	0.36	0.34	0.36	-0.02	-0.01	0.33	0.29

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, * 10%, ** 5%, *** 1%.

due to the lower absolute value for foreign credit in this time period (see Table 5.1).

5.8.3 Foreign Bank Assets

In our standard regression the variable foreign bank assets is insignificant at the ten per cent level. It becomes significant, however, when Nepal is dropped from the sample, this regression is recorded as number (1) in Table 5.8 and is illustrated in Figure 5.4. Nepal is both the biggest leverage point and is an outlier due to a value of 100 for foreign bank assets. This result is robust to changes in the sample size according to the leverage point method. A similar result occurs when the simple set of control variables is used. Foreign bank assets is insignificant initially, but it becomes significant after Haiti is omitted from the sample, regression (2).[17] Again this subsequent result is robust to the exclusion of any one further country.

When the non-OECD subset is used we get a different result. In the initial regression the variable foreign bank assets is insignificant. Again this result changes when Nepal is excluded. The subsequent regression, however, is not robust either and it is not until Papua New Guinea, Honduras and the Philippines have been omitted in turn that we get a robust result. This is

[17] Haiti has a value of zero for foreign bank assets, as well as being the biggest leverage point in this specification.

Table 5.7: Foreign Bank Assets 1990 - 1998

Variable	(1)		(2)		(3)		(4)		
GDP 1990	0.50	0.40	0.23	0.22	0.03	-0.02	0.44	0.36	0.74
	1.39	*1.20*	*0.75*	*0.79*	*0.07*	*-0.05*	*0.83*	*0.70*	*1.06*
School	-0.34	-0.43	-0.41	-0.75	3.65**	3.04	-0.75	-1.14	-1.26
	-0.29	*-0.41*	*-0.46*	*-0.86*	*2.27*	*1.49*	*-0.50*	*-0.79*	*-0.79*
Government	-1.91**	-1.44*			-2.50***	-2.11*			-1.45
	-2.54	*-1.83*			*-3.04*	*-2.09*			*-1.32*
Trade	1.23**	1.34**			0.39	0.73			
	2.06	*2.48*			*0.48*	*0.82*			
BMP	-7.64***	-8.14***			-8.15***	-8.61***			
	-6.27	*-5.71*			*-5.68*	*-5.30*			
Inflation	0.20	0.72			-3.72*	-2.50			
	0.10	*0.37*			*-1.93*	*-0.84*			
PC	-0.31	-0.42	-0.01	-0.12	-1.15**	-1.15*	0.21	-0.04	0.13
	-0.84	*-1.12*	*-0.01*	*-0.34*	*-2.24*	*-2.05*	*0.33*	*-0.07*	*0.21*
FBA		-2.28**		-2.55***		-1.29		-3.15**	-1.56
		-2.28		*-2.74*		*-0.67*		*-2.70*	*-0.89*
Sample Size	42	42	42	42	21	21	24	24	24
R^2	0.49	0.55	0.02	0.14	0.79	0.79	0.05	0.22	0.30
Adjusted R^2	0.39	0.44	-0.05	0.04	0.67	0.65	-0.09	0.06	0.10

Note: White heteroskedasticity-consistent standard errors, t-Statistics in italics, * 10%, ** 5%, *** 1%.

regression (3) and foreign bank assets is insignificant.[18] When the simple set of control variables is used, with Haiti again excluded from the sample, we get a robust result that foreign bank assets is significant, regression (4). Although, when government is added to this specification the statistical significance of foreign bank assets disappears.

Thus, it seems that foreign bank assets has a negative impact on growth. This could, though, reflect reverse causation here where struggling economies invite in foreign banks. This is a plausible interpretation as the causality issue has been less adequately dealt with here given the general time period (1990 - 1998) and that of the foreign bank assets variable (1988 - 1995). Therefore, foreign banks do not necessarily decrease domestic economic growth.

5.9 Conclusion

Two key results emerge from this study. The first is the fragility of the relationship private credit has with economic growth. This relationship has been one of the key findings in this

[18] In regression (3) we find that private credit is significant with a negative coefficient. This could represent evidence of lending booms as our private credit measure can be used as an indicator in that context. Furthermore, lending booms are more prevalent in non-OECD countries (by the relative deviation definition) and experienced a peak in the mid-1990s (Gourinchas et al., 2001). This result, however, is not robust to use of the simple set, regression (4).

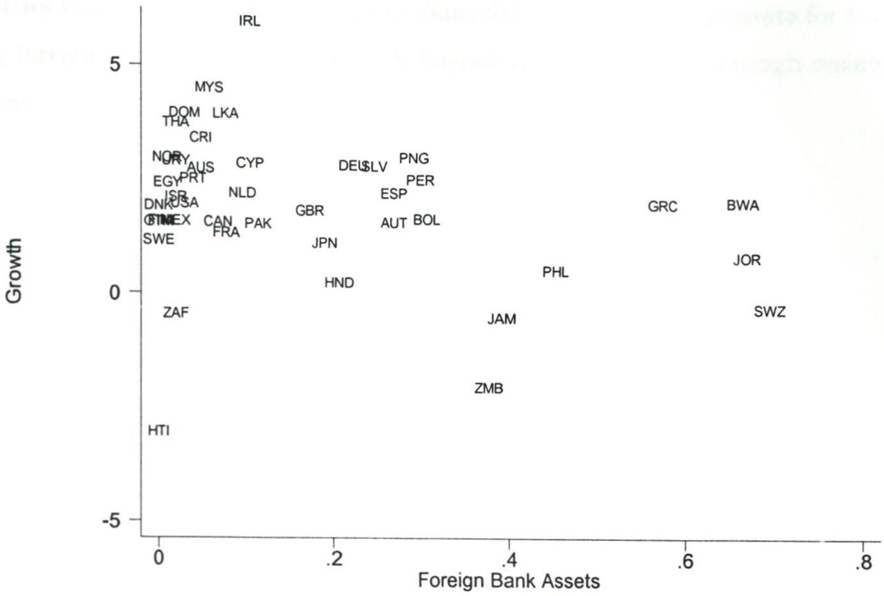

Figure 5.4: Growth and Foreign Bank Assets, 1990 - 1998: Regression (1)

research area. Here it has been shown that this relationship does not hold for more recent time periods. Furthermore, in the longest time period, 1960 - 1995, it does not hold when the OECD countries are omitted from the regression. The variation in private credit does not explain variation in growth among non-OECD countries.[19]

The other interesting result concerns the focus of the paper: the role of foreign finance in growth. The only positive, statistically significant and robust result is for foreign liabilities in the period 1960 - 1995. This shows that foreign finance does influence economic growth. The result is for non-OECD countries which use foreign liabilities to compensate for underdeveloped domestic financial systems.

We also find evidence for a negative effect of foreign finance on growth. For the period 1980 - 1998, it seems that foreign credit to the domestic non-bank sector had a negative influence on economic growth. This again is for the non-OECD sample. This possibly reflects the dangers of exposure to extreme currency movements. This result does not occur when the variable foreign liabilities is examined for the same time period. Foreign liabilities measures foreign finance to resident financial institutions. This implies that when foreign finance is intermediated through such institutions, rather than lent directly to the domestic non-bank sector like foreign credit, more of the risks are hedged.

[19] Levine et al. (2000) do not use a non-OECD subsample in their sensitivity analysis.

Countries with a relatively poor domestic financial system can compensate for this shortcoming using foreign finance. It is best if such finance comes indirectly through resident financial institutions.

5.A Data Appendix

Section 5.5 details the financial variables employed in this paper. We would like to thank Claessens et al. (2001) for generously providing the foreign bank assets data. The other variables used are from the following data sources:

- Growth in GDP and initial GDP are based on GDP per capita (constant 1995 US$) from the World Bank's World Development Indicators 2001 (WDI).
- Human capital is "Average years of secondary schooling in the total population over age 25" from Barro and Lee (1993).
- Trade is expressed as a percentage of GDP and is from the WDI.
- Government Size is "General government final consumption expenditure", and is also expressed as a percentage of GDP and taken from the WDI.
- Inflation is based on the consumer prices and is the log difference of line 64 from the IFS.
- Black market premium is based primarily on data received from Thorsten Beck. Its sources are described as follows: Levine and Renelt; World Currency Yearbook (for 1985, 1990 - 93); and Adrian Wood, Global trends in real exchange rates: 1960 - 84, WB Discussion paper no. 35. 1988 (filling in missing observations in the entire sample). More recent data is taken from the variable "Official exchange rate to parallel exchange rate ratio" from the WDI.

For the period 1960 - 1995 we use the dataset of Levine, Loayza and Beck (2000) which we thank them for sharing. The original sources of their data are the same as those recorded above for the other time periods. The exception is black market premium which, as stated, uses recent data from the WDI, in addition to that supplied by Thorsten Beck.

Also the data for Ireland for the variable private credit is actually taken from the IFS 2001 Yearbook, due to an error on the IFS CD-Rom. This data, however, only goes back to 1971. So for 1960 - 1971 the IFS CD-Rom data is used and is corrected by multiplying it by the average ratio of the two series during their overlap period.[1]

5.B Sample Appendix

Table 5.B.1 lists the countries that are included in the dataset:

[1]This average figure is 1.46 and varies within a small range of 1.42 to 1.53 during the period 1971-1981.

Table 5.B.1: Countries Included in the Dataset

Country	1960 - 1995	1980 - 1998	1990 - 1998
Australia	x	✓	✓
Austria	✓	✓	✓
Barbados	x	✓	x
Belgium	✓	x	x
Bolivia	✓	✓	✓
Botswana	x	✓	✓
Canada	✓	✓	✓
Chile	✓	✓	x
Colombia	✓	✓	x
Costa Rica	✓	✓	✓
Cyprus	x	✓	✓
Denmark	✓	✓	✓
Dominican Republic	✓	✓	✓
Egypt	x	x	✓
El Salvador	✓	✓	✓
Finland	✓	✓	✓
France	x	✓	✓
Gambia	x	✓	x
Germany	✓	✓	✓
Ghana	✓	✓	x
Greece	✓	✓	✓
Guatemala	✓	✓	✓
Guyana	✓	x	x
Haiti	✓	✓	✓
Honduras	✓	✓	✓
Iran	x	✓	x
Ireland	✓	✓	✓
Israel	✓	✓	✓
Italy	✓	x	x
Jamaica	✓	✓	✓
Japan	✓	x	✓
Jordan	x	✓	✓
Kenya	✓	✓	x

Table 5.B.1 continued

Country	1960 - 1995	1980 - 1998	1990 - 1998
Malawi	x	✓	x
Malaysia	✓	✓	✓
Malta	✓	✓	x
Mauritius	✓	✓	x
Mexico	x	x	✓
Nepal	x	✓	✓
Netherlands	✓	✓	✓
New Zealand	✓	x	x
Norway	✓	✓	✓
Pakistan	✓	✓	✓
Papua New Guinea	x	✓	✓
Paraguay	✓	✓	x
Peru	✓	✓	✓
Philippines	✓	✓	✓
Portugal	✓	✓	✓
Rwanda	x	✓	x
South Africa	x	✓	✓
Spain	✓	x	✓
Sri Lanka	✓	✓	✓
Sudan	✓	x	x
Swaziland	x	✓	✓
Sweden	✓	✓	✓
Switzerland	✓	✓	x
Syria	x	✓	x
Thailand	x	✓	✓
Trinidad and Tobago	✓	✓	x
United Kingdom	✓	✓	✓
United States	✓	✓	✓
Uruguay	✓	✓	✓
Venezuela	✓	✓	x
Zambia	x	x	✓
Zimbabwe	x	✓	x

Chapter 6

Finance and Growth: A Sectoral Approach

6.1 Introduction

The relation between finance and growth has become a burgeoning area of economic research. Microeconomic theory has proposed channels whereby a good financial system can spur economic growth (e.g. Stulz, 2001). Empirical macroeconomics has provided evidence for this general relation (e.g. Levine et al., 2000). Most of the existing empirical research, however, has focused on finance's effect on overall economic growth. This paper adds to the literature by using a sectoral approach.

We employ data from the OECD's Intersectoral Database (ISDB) for finance and a range of other sectors. We look at the cross-country evolution of productivity in finance by examining convergence. Then we look at linkages between finance and the other sectors, drawing on the literature related to Baumol's cost disease. We find that finance has been a relatively non-progressive sector and, thus, it has not been a cause of cost disease. Furthermore, it has aided productivity growth in other sectors.

This paper proceeds by first examining relevant background literature: Section 6.2 provides some background to Baumol's theory; econometric issues relating to convergence are examined in Section 6.3; and Section 6.4 reviews pertinent empirical literature. The data is introduced in Section 6.5. The next two sections outline the empirical strategy and some descriptive statistics. Section 6.8 looks at convergence and Sections 6.9 and 6.10 look at Baumol's disease and positive spillovers, respectively. Finally, Section 6.11 concludes.

6.2 Theoretical Background

The basic logic behind Baumol's cost disease and the Balassa-Samuelson effect is the same. Higher productivity in one sector (progressive / tradeables e.g. manufacturing) results in higher wages. It is assumed that these wages are matched in the other sector (non-progressive / non-tradeables e.g. services) to attract labour, but the productivity is not matched. Thus, the costs and the subsequent prices in the non-progressive sector increase.[1,2]

Balassa (1964) and Samuelson (1964), contemporaneously but independently, use this logic to explain cross-country prices differences and the failure of purchasing power parity (PPP).

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[1] Both Balassa and Samuelson refer to nontraded goods as services.

[2] Baumol (1967) says that his model is based on only one "really essential" assumption: that economic activities can be grouped into technologically progressive and non-progressive activities (p415). The price elasticity of demand and the income elasticity of demand of the service produced in the non-progressive sector will determine the impact of its rise in cost per unit. The rise in cost will result in a decline in demand and output (perhaps resulting, ultimately, in the disappearance of that sector), or an increase in the percentage of the labour force in the non-progressive sector if demand is maintained.

Rich countries have higher labour productivity, thus, by the above logic, they have higher prices in non-tradeables and therefore higher prices overall. This explains the empirical phenomenon that price levels are positively related to the level of income per capita (Heston, Nuxoll and Summers, 1994).

Alternatively, Baumol's disease (1967) is used to explain why public sector costs increase continually. Baumol starts from the empirical regularity that public sector activities, such as education and healthcare, are labour intensive industries. As such, they have low productivity and thus their relative costs increase due to the above logic. Therefore, Baumol adds to the main argument by noting where non-progressive sectors reside, while Balassa and Samuelson both note where progressive sectors naturally reside.

A recent paper by Oulton (2001) has challenged a conclusion of Baumol's disease: that the rate of aggregate productivity growth will steadily fall to that prevailing in the non-progressive sectors. He finds that when the role of intermediary goods are accounted for, within Baumol's framework, the story changes. "If resources are shifting towards industries like financial and business services, whose productivity is growing slowly, the aggregate growth rate of productivity need not fall," because the output of these sectors is used as inputs in the progressive sectors.[3] These intermediate inputs are employed as substitutes for primary inputs resulting in an increase in the rate of productivity growth in these progressive sectors.[4] This compensates for the reduction in the weight given to the progressive sectors in determining aggregate productivity growth. Thus, the share of aggregate productivity growth coming from the progressive sectors is constant while that coming from the non-progressive sectors increases as they, and their subsequent weights, expand.

Furthermore, Baumol's original conclusion on the aggregate productivity growth rate depends on the further assumption that the output ratio for the two sectors is held constant. Recent research, however, finds that this does not hold in the case of the United States. Whelan (2001) shows that, in the USA, the real output of the durable goods sector, the progressive sector, has grown significantly faster than the real output of the rest of the economy. He also shows that the main piece of Baumol's disease does hold for the USA: the technological progress in the durable goods sector has been accompanied by a decrease in the relative price of durable goods.

Thus, Baumol's disease leads to higher prices in the overall economy but, both theoretically and empirically, need not lead to lower aggregate productivity growth.

[3] Oulton (2001, p626).

[4] Oulton's proof of this relies on distinguishing between gross output TFP and value added TFP.

6.3 Econometric Issues

The above section highlights the importance of the evolution of sectoral productivity. Any cross-country analysis of productivity will naturally involve questions of convergence. The issue of convergence raises contentious econometric issues which will be dealt with in this section.

We start by looking at β-convergence and σ-convergence, the two main concepts in classical cross-sectional convergence. We follow Sala-i-Martin (1996) in defining these concepts.[5] Absolute β-convergence exists if poor economies tend to grow faster then rich ones. This derives its name from a negative β coefficient in the following regression:

$$y_{i,t,t+T} = \alpha - \beta\left(y_{i,t}\right) - \epsilon \tag{6.1}$$

where $y_{i,t,t+T}$ = the average growth rate, and $y_{i,t}$ = the initial level of output. σ-convergence is when the dispersion of the real per capita GDP levels of a group of economies tends to decrease over time. Dispersion is measured by the cross-country standard deviation, σ, of the log of real per capita GDP. β-convergence is a necessary condition for σ-convergence.[6] The existence of β-convergence "will tend to generate" σ-convergence but it is not a sufficient condition.

Bernard and Durlauf (1996b) note that cross-section methods can give evidence for convergence while time series analysis of the same data supports no such thing. The technical requirement for β-convergence is a weighted average of countries with above average initial incomes growing at a slower rate than the mean growth for the cross section. As such, β-convergence can occur when only some pairs of countries, but not all, are converging. Cross-section tests cannot identify groupings of countries that are converging. Furthermore, Quah (1993) showed that a negative beta is compatible with a stable cross-section variance in output levels, because shocks to country-specific growth rates can offset the negative beta.[7]

These criticisms, however, affect how we interpret the convergence that β-convergence offers, rather than demonstrating that β-convergence says "nothing about whether there is convergence or divergence."[8] Sala-i-Martin explains that β-convergence "relates to the mobility of different *individual* economies within the given distribution of world income."[9] Whereas σ-convergence examines whether the cross-country dispersion of world income decreases over time. To state that a negative beta is compatible with a constant cross-section variance seems to say no more

[5] This terminology was first introduced by Sala-i-Martin in his Ph.D. dissertation (1990) at Harvard University.

[6] Rassekh et al. (2001) extend traditional σ-convergence analysis by splitting up any decline in dispersion into a part due to traditional determinants of growth and an unexplained component. The unexplained component is then attributed to convergence forces.

[7] Togo (2001) is one example of a paper that follows Quah and uses a transition matrix and ergodic distributions. He finds that manufacturing does not display convergence.

[8] Quah (1993, p3).

[9] Sala-i-Martin (1996, p1022, my italics).

than that β-convergence is a necessary but not sufficient condition for σ-convergence. Which is why some studies, such as Bernard and Jones (1996b), look at both β-convergence and σ-convergence.[10]

Friedman's (1992) criticism of the β-convergence method refers to Galton's regression fallacy. His key point is that if the average growth rates are regressed against the terminal values, rather than the initial values, the statistically significant negative relationship disappears. To do this, however, is to ask a different question by reversing the temporal causation of the regression equation. His advice, drawing on Hotelling, is that the real test of a tendency to converge is a consistent diminution of variance among individuals, i.e. the σ-convergence we have already introduced. Cannon and Duck (2000) explain Friedman's point by showing that his suggested regression, using the terminal values of income, is always consistent with σ-convergence, unlike the conventional β-convergence method. As such, it seems there is no benefit to using Friedman's regression when σ-convergence is employed in tandem with β-convergence.

Further criticism of cross-sectional convergence methods concerns the role of unobserved differences across countries. It has been argued that standard methods do not adequately allow for this, whereas panel data studies can incorporate fixed effects. Papers such as Islam (1995) and Caselli et al. (1996) use these methods and find far quicker convergence, which is to different steady states. A recent survey by de la Fuente (2000), however, draws on research which argues that such methods are more likely to capture short term adjustments around trend, rather than long run growth.[11] Furthermore, these models have low explanatory power as most of the observed variation in productivity is attributed to the country dummies.

Bernard and Durlauf (1996b) also conclude that there is still room for β-convergence in empirical work. Time series tests may have poor power properties when applied to data from economies in transition. Thus, the choice of test depends on the characteristics of the data. Use cross-sectional techniques when data are in transition towards a limiting distribution and use time series techniques when data are near the limiting distribution. They warn that neither testing framework will yield unambiguous conclusions. Furthermore, in reconciling the inconsistency between cross-section and time series results, Bernard and Durlauf omit the explanation offered by Carlino and Mills (1993) and Loewy and Papell (1996). These studies find that when trend breaks are included in the unit root tests, using US cross regional data, stochastic convergence is found to be present.

An important limitation of β-convergence is its relation to economic theory. The neoclassical model only predicts conditional β-convergence, that the growth rate of an economy is positively

[10] Bernard and Jones (1996b, p1226).

[11] This research includes Shioji (1997a and b) and de la Fuente (1998).

related to the distance of that economy from its own steady state. It is only if all economies converge to the same steady state that the empirical β-convergence we have discussed, or absolute β-convergence, is theoretically predicted. Where multiple steady states exist, economies are not heading to the same destination. Consequently, by only focusing on the role of initial values of output, the empirical absolute β-convergence, we cannot talk with confidence about convergence because we do not know where they are converging to. Therefore, to reconcile the empirical absolute β-convergence analysis with the theoretical conditional β-convergence prediction, we need to have a common steady state. Sala-i-Martin notes that one way of doing this is to empirically analyse a set of countries where the assumption of similar steady states is not unrealistic. This condition, necessary for use of the empirical β-convergence technique, is met in our OECD study.[12]

6.4 Previous Literature

In this section, we review some existing literature that is related to our study. First, we examine papers that look at productivity in finance. Second, we review some work that deals with productivity convergence. Finally, some Balassa-Samuelson related research is considered. Some of these papers employ the dataset used in this paper: the OECD's ISDB.

6.4.1 Finance

Neusser and Kugler (1998) directly examine the financial sector using this ISDB data. They engage in a standard time series analysis of the finance-growth hypothesis. The distinctiveness of their research, relative to the finance-growth literature, is the data that they use. They measure financial development by the GDP of the financial sector. Manufacturing GDP and manufacturing Total Factor Productivity (TFP) are used as growth measures, reflecting their belief in the primacy of technical progress in stimulating economic growth. They find some evidence of cointegration between financial sector GDP and manufacturing GDP and TFP, but their results vary according to the technique employed.

Fecher and Pestieau (1993) examine efficiency in the financial sector using the ISDB data. Their starting point is Baumol (1991), which states that low productivity growth in financial services is an example of cost disease and not managerial slack. They employ best practice frontier analysis. Here, the computed production frontier represents the "best practice" to which each country is compared. The gap between the observed output and the benchmark

[12] One could argue, however, that the USA may have a noticeable different steady state for the financial sector as it is a major financial centre. This shall be accounted for in the econometric analysis.

output results from technical inefficiency. The only way for efficient units to improve their productivity is through technological innovations. Inefficient units can realize productivity gains either through technological progress or by adopting existing technologies. Hence, multifactor productivity growth is made up of technical change and efficiency change. This distinction can be used to test Baumol's hypothesis. Technical change relates to whether a sector is progressive or not (and thus cost disease), and efficiency change is affected by management quality and competition. They find that most of the poor performance in financial services is actually due to inefficiency.

Similar methods are used by Gouyette and Perelman (1997). They find that the services sector has higher efficiency levels than manufacturing. The TFP growth rates, in most countries, are not similar in both activities. The slight TFP increase in services is due to efficiency improvements, whereas the bigger TFP increase in manufacturing is due to technological innovations. They also found convergence in services TFP. This is used to confirm the finding that TFP growth in services is mainly due to efficiency improvements. Furthermore, efficiency catch-up was found in services, measured by the change in the ratio of the minimum to the maximum scores and the change in the mean score for the entire sample. The converse result is found for manufacturing in all these tests. They also use data envelopment analysis (DEA) as a robustness check and find similar results.

6.4.2 Productivity Convergence

Bernard and Jones (1996b) use this sectoral data from the OECD to examine convergence. Their cross-section methods include both β-convergence and σ-convergence, they use the same equations as Sala-i-Martin (1996), except of course substituting productivity for output. They find that "many sectors, such as services, show evidence of convergence at least as strong as that found in the aggregate. In contrast, [they] find that manufacturing does not display the pattern of convergence in labour and technological productivity found in other sectors."

Sorenson (2001) questions the key manufacturing result of Bernard and Jones. He criticises the use of GDP-based conversion factors in the construction of the ISDB dataset. Producer prices should be employed and they should be sector-specific. These conversion factors may be appropriate for some sectors, but they are not appropriate for manufacturing, as it fails some consistency checks.

In a sister paper, Bernard and Jones (1996a) use time series techniques to analysis the same data. These techniques are explored in Section 6.8.3. They also decompose aggregate TFP growth into within sector and between sector components, and find that shifting sectoral shares play a minor role. They also note that sectoral convergence should be positively related to the extent of trade, as trade is a source of knowledge dispersion.

In a third paper, Bernard and Jones (1996c), they examine the role technology plays in convergence. In their framework, technology varies due to different abilities to adopt the leading technology and due to different product and industry composition. In the empirical section, they record what they call a "substantial variation" in technology across countries, measured by the standard deviation of the log of total technological productivity.[13] It is of a similar order of magnitude to the variation in labour productivity and the respective changes in dispersion of these two variables seem to correspond closely.

Carree, Klomp, Thurik (2000) extend the analysis of Bernard and Jones (1996) by looking at the spread of convergence across manufacturing industries using the OECD's STAN database. Using value added per employee as a measure of labour productivity, they analyse both β-convergence and σ-convergence. They find that the spread of the speed of convergence across industries is large. Moreover, industries with high levels of labour productivity are associated with low rates of productivity convergence, according to their correlation coefficients. The authors suggest that the level of labour productivity may serve as a proxy for knowledge or capital barriers which prevent quick catch-up.

Dollar and Wolff (1988) examine convergence using data taken from the UN Yearbook of Industrial Statistics. They find that labour productivity is converging in virtually every industry and convergence is strongest in the light industries, implying convergence is related to capital intensity. In 1963 the US was productivity leader in virtually every industry, but by 1982 this didn't hold in "quite a few industries."

Further papers examining convergence are Doyle and O'Leary (1999) and Wei-Kang Wong (2002). They also fail to break down the services sector to examine the financial sector by itself.

6.4.3 Balassa-Samuelson

The ISDB data has also been used to test the Balassa-Samuelson hypothesis. Canzoneri et al. (1999) look separately at two components of Balassa-Samuelson. The first is that productivity differences determine the domestic relative price of non-tradeables. These two variables are found to be cointegrated, using residual based tests and Pedroni (1996) panel tests. Furthermore, the slope, β, of the cointegrating relationship is found to be 1.0, as predicted by Balassa-Samuelson. The ratio of the average products of labour is used for productivity differences. This relies on the assumption that marginal products are proportional to average products. Lane and Milesi-

[13] Total technological productivity (TTP) represents the amount of output produced by an economy with a specified quantity of capital and labour and is constructed in Bernard and Jones (1996b).

Ferretti (2002), using panel DOLS, also show that relative sectoral productivity is important in determining the relative price of non-tradeables. De Gregorio, Giovanni and Krueger (1994) provide further evidence for the Balassa-Samuelson effect.

There are, of course, studies which present other factors which cause inflation differentials. Estrada and Lopez-Salido (2001) focus on another explanation of dual inflation (sectoral inflation differentials): imperfect competition using sectoral mark-ups as a proxy. The correlation between the deviation of relative prices from Balassa-Samuelson and relative mark-ups is close to one. Huther (2000) highlights these other explanations in his model to examine cost disease. He makes explicit assumptions of perfectly mobile labour, competitive labour markets and competitive product markets to rule out increased profit and wage differentials.

6.5 Data

The data we use, as stated previously, are taken from the OECD's International Sectoral Database (Version 98.1). This dataset is for a range of variables with a breakdown for different sectors. Our main focus is on the sector denoted FNS, which consists of financial institutions and insurance. Data are not available for all the countries in the dataset for this sector. Therefore, only the following countries are included: Belgium, Denmark, Finland, France, Western Germany, Italy, Sweden, and the United States.[14] The main limitation of this is that two important financial centres, the United Kingdom and Japan, are omitted. We partially solve this problem by also analysing the broader industry variable FNI. As well as including the United Kingdom and Japan in the study, this serves as a general robustness test of the main results.[15] The drawback of FNI is that it includes real estate and business services in addition to finance and insurance.[16]

We examine the financial sector in comparison with the following sectors: manufacturing,

[14] The U.K.'s O.N.S. deems it "inappropriate to produce a productivity estimate" for finance and business services. The main reason is that, in some parts of these industries, employee numbers are used as a direct output indicator. This results in a loss of independence between the output and labour parts of the productivity calculation (Daffin et al., 2002). Furthermore, of the available experimental series, the industry coverage of the output and labour figures do not match.

[15] The complete list of countries included in the FNI dataset is: Australia, Canada, Denmark, Finland, France, Japan, Sweden, the United Kingdom and the United States.

[16] Using the five countries that are present in both samples, we can quantify the relationship between FNS and FNI. On average FNS makes up 24% of FNI value added and 36% of employment. This means that FNS's labour productivity is, on average, equal to 68% of FNI's. The two labour productivity measures generally move together too. For Denmark, Finland and France the correlation coefficients range between 0.84 and 0.89. Sweden and the USA, however, have values of -0.62 and 0.54 respectively.

services, and total industry.[17] The period of our study is from 1970 - 1993.[18]

6.6 Empirical Strategy

The empirical analysis that follows focuses on labour productivity in the financial sector. We ask three related questions:

1. Is labour productivity growth in the financial sector caused by convergence across countries?
2. Does this labour productivity growth have a negative effect through cost disease?
3. Does it have a positive effect through spillovers?

Our analysis focuses on non-stationary panel techniques applied to the FNS dataset. We then repeat these procedures on our FNI dataset. The results are presented in Appendix 6.B. Finally, parallel time series analysis is applied to the individual countries in both datasets. These results are presented in Appendix 6.C.

We proceed by examining some general trends in the data with particular regard to the FNS dataset.

6.7 Descriptive Statistics

6.7.1 Value Added and Employment

On average, the contribution of the financial sector to value added and total employment, relative to total industry, is rising over the period. This is shown in Figure 6.1.

This masks the diverse behaviour of value added across the countries in the sample (see Figure 6.2). Denmark experiences a sharp decrease in 1986 which is due to a fall in the absolute

[17] The services variable is close to that used in Bernard and Jones (1996b). It is an aggregate of retail trade (RET), transport / communication (TRS), and other services (SOC). We exclude finance, unlike Bernard and Jones, as we examine it separately. McDonald and Ricci (2001) provide evidence to suggest that the behaviour of retail trade is closer to that of a tradables sector, not a non-tradables (services) sector. In some trial results, however, there is no noticeable difference in the results for a services minus retail trade measure and our standard services variable.

For our FNI analysis, our services measure just includes transport / communication (TRS) and other services (SOC), as the retail trade (RET) variable is not available for Japan.

We also follow Bernard and Jones in measuring total industry by the variable TIN which excludes the government. It is used in preference to GDP, as GDP also includes various additional elements, such as import duties which are not reflective of productive capacity (Wong, 2002 p11).

[18] Only some data are available until 1997, so a longer dataset, in terms of time, is offset by a narrower dataset, in terms of countries.

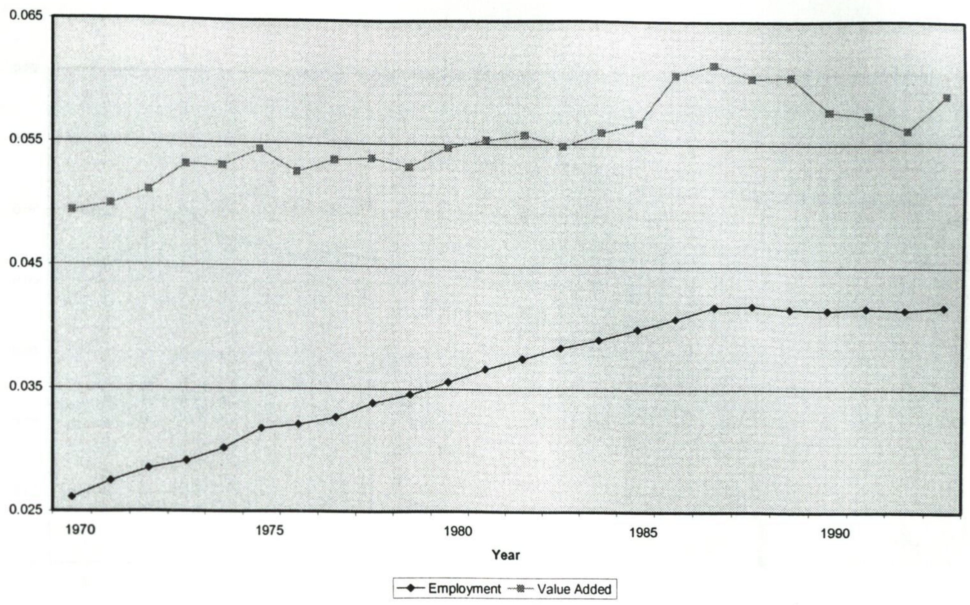

Figure 6.1: Ratios of the Financial Sector to Total Industry (sample average)

value of value added in the financial sector. This is not, however, mirrored by a fall in the level of employment in the financial sector (Figure 6.3). The Italian figure peaks in 1973, experiences a slight decline and then stays reasonably constant thereafter. The ratio is relatively constant for the USA for the time period, while the German figure rises steadily.

In contrast, the evolution of the share of employment in the financial sector (Figure 6.3) seems quite similar across countries. It is increasing at a steady rate for all countries, with Denmark showing a slightly bigger increase than the rest.

6.7.2 Productivity

Turning to productivity, we examine the behaviour of labour productivity rather than total factor productivity. We follow Canzoneri et al. (1999) in this primarily because sectoral data on value added and employment are likely to be more reliable than data on sectoral capital stocks.[19] Labour productivity, LP, is measured by value added per employee, in 1990 US dollars. The variable "total employment" (ET) is used to measure employment, rather than

[19]Canzoneri et al. (1999) note additional reasons for their choice.

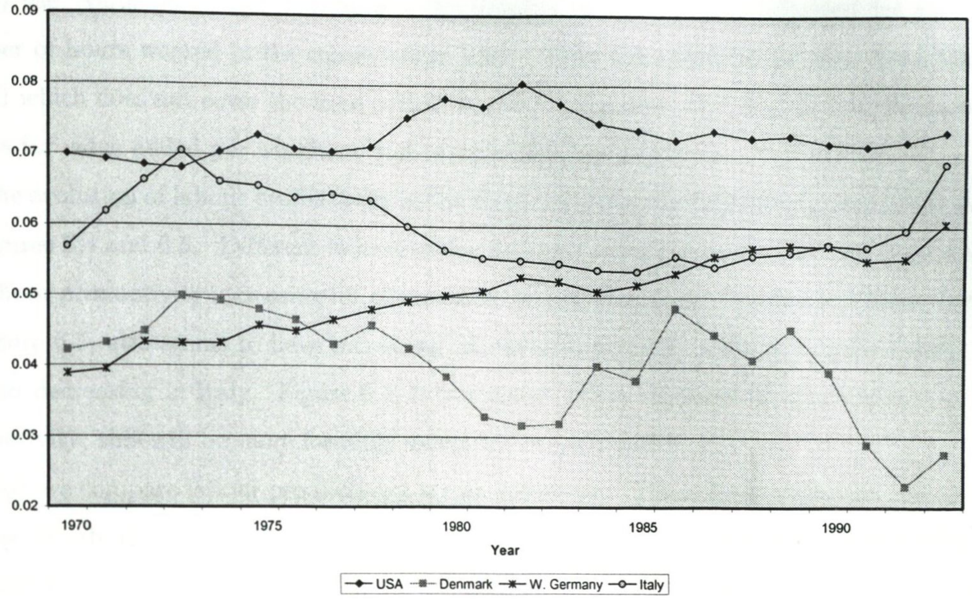

Figure 6.2: Value Added: Ratio of the Financial Sector to Total Industry

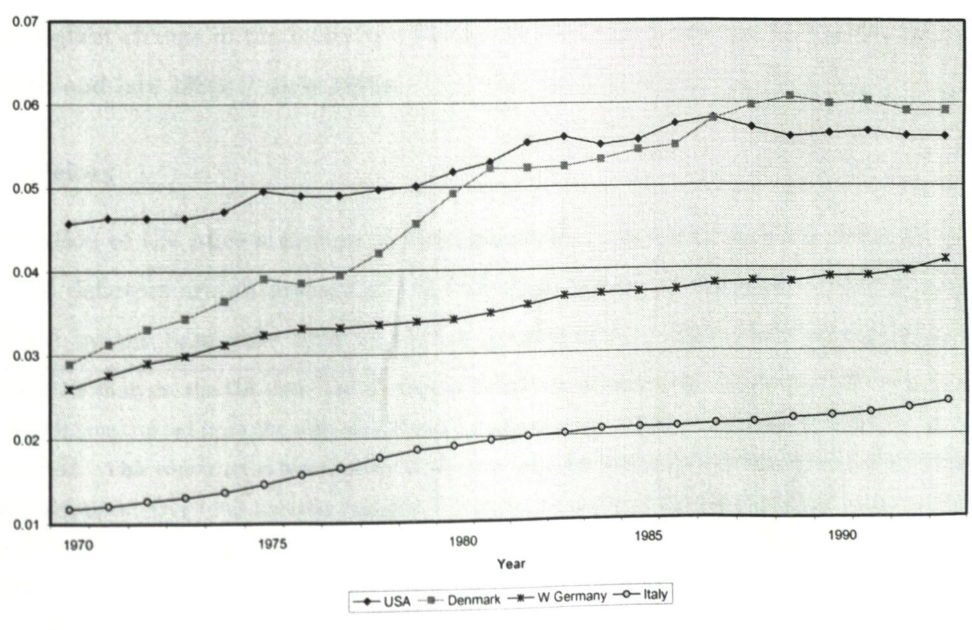

Figure 6.3: Employment: Ratio of the Financial Sector to Total Industry

"number of employees" (EE).[20] This follows Bernard and Jones (1996b).[21] Dollar and Wolff (1988) use "value added per workhour": the number of employees is adjusted for the average number of hours worked in the country that year. They take their hours data from Maddison (1982) which does not cover the time period we use.[22] Anyway, they find little difference in the results for value added per workhour and value added per employee.

The evolution of labour productivity in the financial sector for individual countries is graphed in Figures 6.4 and 6.5. Different behaviour for different countries is evident. In Figure 6.4, we see labour productivity increasing for all countries except Denmark. Sweden and West Germany, in Figure 6.5, also seems to have increasing labour productivity, while it is quite steady in the US and decreasing in Italy. Figure 6.4, in particular, offers evidence for convergence in labour productivity; this will be more formally examined in Section 6.8.

Next we compare labour productivity across industries. These figures plot the cross-country average of labour productivity for different industries over time. Finance is clearly the most productive sector in Figure 6.6. Figure 6.7 then looks at productivity growth. This clarifies the trends we see in Figure 6.6. Finance is the most volatile of the sectors, which is to be expected given its compensation structure. Of the other three sectors, manufacturing is the most progressive (highest productivity growth), followed by the total industry measure and then services. Finance cannot be incorporated simply into this ranking due to its volatility. It records the lowest growth in productivity for over half of the period studied, yet, on occasion, it has the highest change in productivity. Finance is particularly affected by the recessions of the mid-1970s and late 1980s / early 1990s.

6.7.3 Prices

The evolution of the price structure of these industries is shown by sectoral deflators in Figure 6.8. The deflators are an average of the individual indices of the eight countries. They are all defined by the base year 1990 which has a value of 1. Thus, they only give us relative

[20] In our FNI analysis, the UK data for ET stops at 1990 for most industries. Therefore, ET data for the years 1991 - 1993 is constructed from the variable EE using a simple ratio of these two variables derived from a suitable overlap period. This construct is trustworthy as the two variables have a correlation coefficient in excess of 0.99 for most industries. Our total industry variable TIN is the exception to this: its correlation coefficient between ET and EE is 0.77. We proceed, however, with the same methodology here for two reasons: first, the correlation coefficient for the last nine years of overlap is 0.99; second, the ET data for TIN actually extends to 1992 thus 1993 is the only year of data which is constructed.

[21] Wong (2002) also uses total employment, while Dollar and Wolff (1988) and Carree, Klomp, and Thurik (2000) both use number of employees.

[22] Another problem with hours worked data is that it can reflect hours paid for, as opposed to hours actually worked.

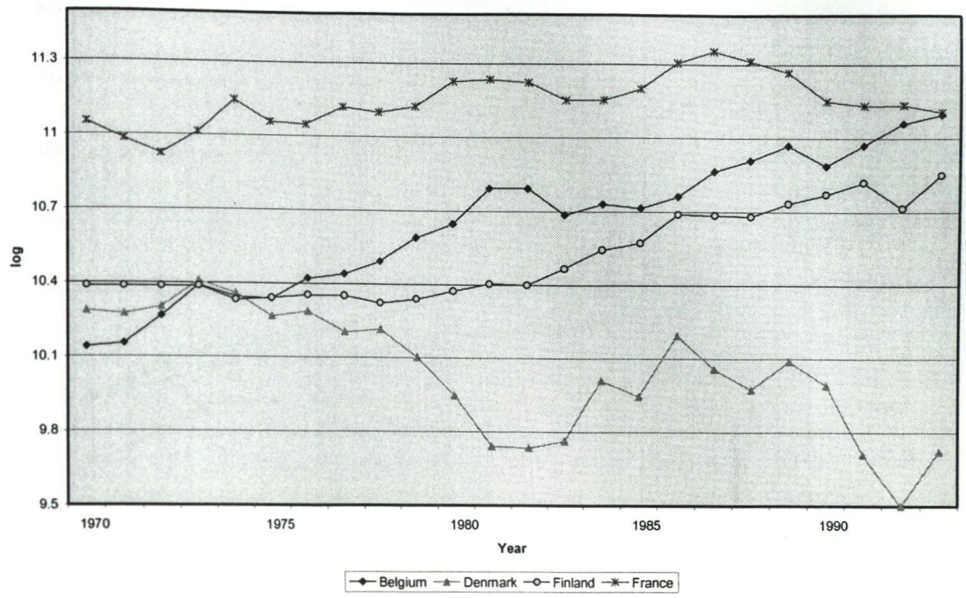

Figure 6.4: Labour Productivity in Finance

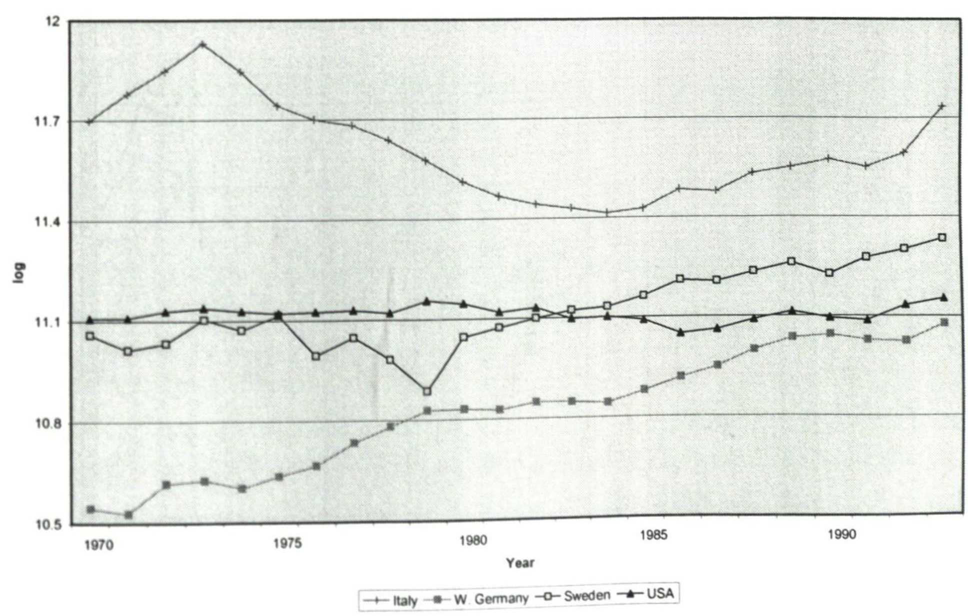

Figure 6.5: Labour Productivity in Finance

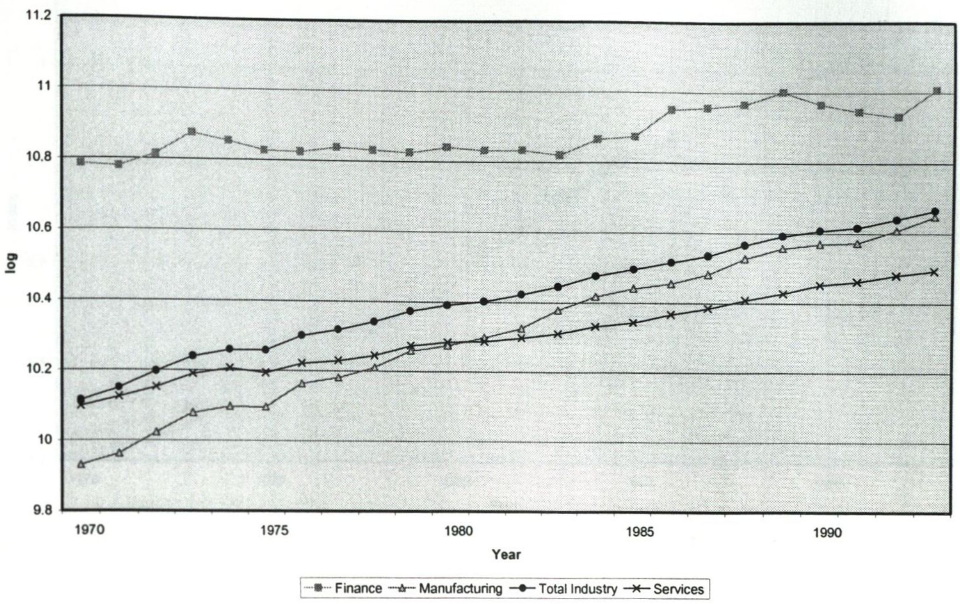

Figure 6.6: Labour Productivity Levels (sample average)

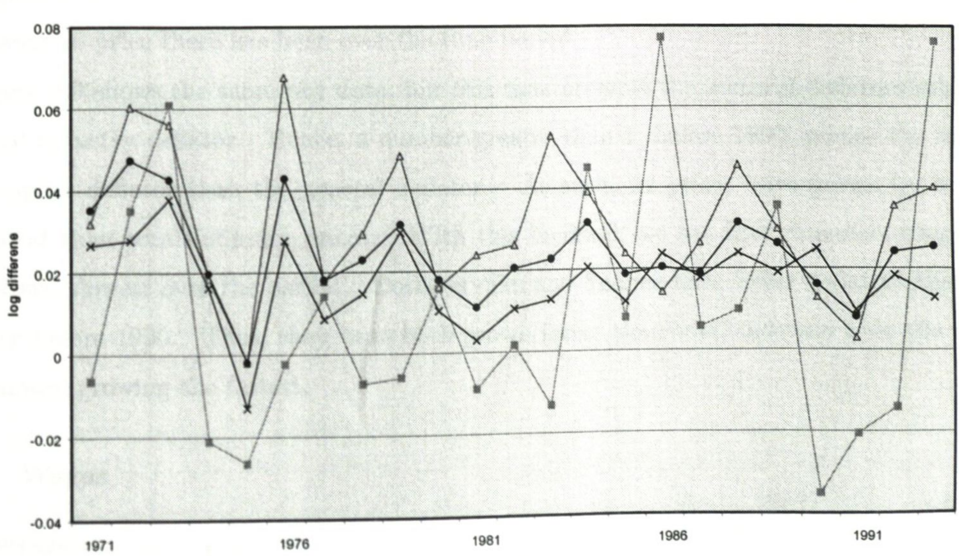

Figure 6.7: Labour Productivity Growth (sample average)

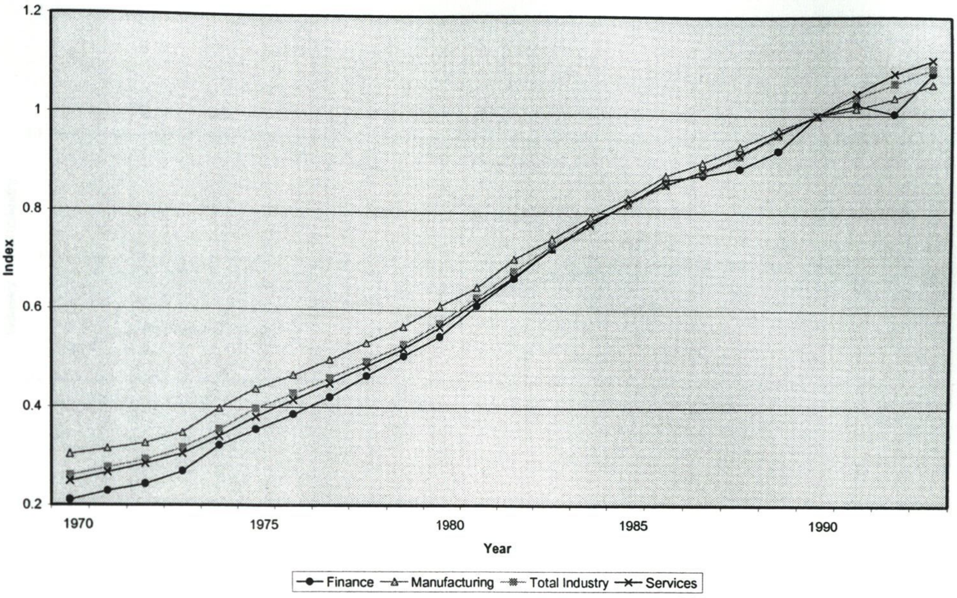

Figure 6.8: Sectoral Deflators: Industry Index

information: they tell us how quickly or slowly prices have increased over the period, but they do not tell us anything about the absolute level of prices. The closer an observation is to 1 (i.e. the higher a figure is if it is less then 1 or the lower a figure is if it is greater than 1) then the less change in price there has been over the time period.

Figure 6.9 shows the same raw data, but this time presents the sectoral deflators relative to the total industry deflator. Hence, a number greater than 1, before 1990, means the industry has a higher deflator than the general deflator. As such, its prices have grown by less over the period than total industry prices. With this in mind, we see that manufacturing prices have grown slowest over the period. Both services and finance have lower deflators than total industry before 1990. Thus, they have both grown faster than total industry over the period, with finance growing the fastest.

6.7.4 Wages

The average real wage is in index form, with 1990 again the base year.[23] No wages data for France are available for FNS. In consequence, FNI data are used instead for France as it moved

[23]Nominal wages are deflated by the most general deflator for which data is available, TET. This is because the real wage is set to attract labour and will be spent in all sectors of the economy. TET includes the producers of government services and other producers, in addition to total industry.

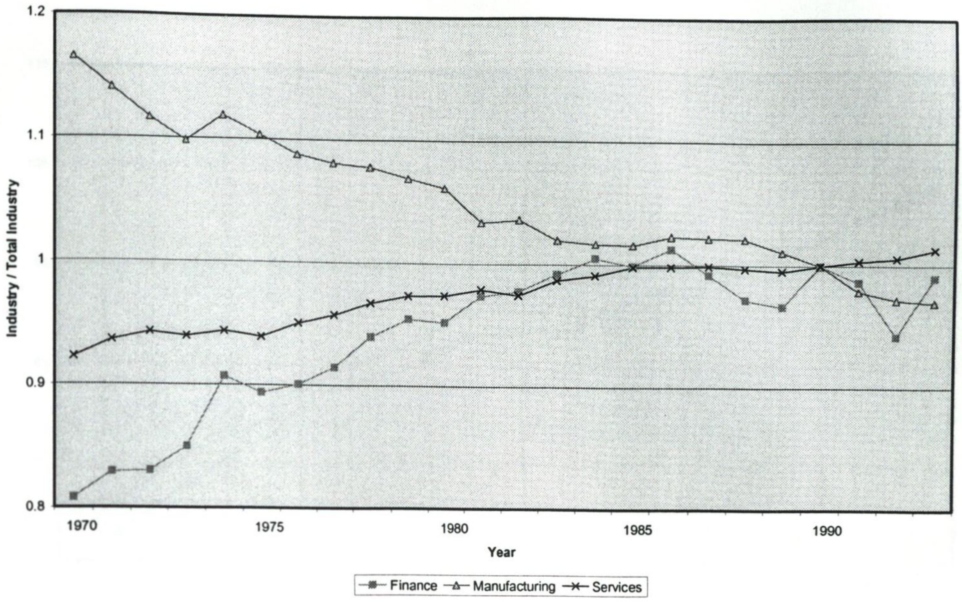

Figure 6.9: Sectoral Deflators: Industry Index relative to Total Industry

in line with the standard data for the other countries.[24] In addition, there are no French wages data for 1993, for any sector. Therefore the time period is reduced to 1970 - 1992 for this section.

The comparative wage levels are shown in Figure 6.10. Again the indices shown are cross-country averages. It is striking how the different indices move together, within a narrow range of values, indicating a close relationship among wages across sectors. This is important as a key assumption of Baumol's model of unbalanced growth is wage equality across sectors. This will be tested formally in Section 6.9.1.

This close relationship is again highlighted in Figure 6.11 where the indices are presented relative to total industry. This is especially evident when one considers the notably diverse behaviour of prices in Figure 9. Furthermore, the range of values in Figure 6.11 is very narrow.

6.8 Convergence in Labour Productivity

In this section we ask the question has the productivity of finance converged across the OECD? This is in light of the work by Bernard and Jones (1996b) which shows convergence in most industries over the period 1970 to 1987. We examine the behaviour of labour productivity in the financial sector using absolute β-convergence, σ-convergence and time series convergence.

[24] The correlation coefficients between wages without France and wages including France (using FNI data for France for the financial sector) are 0.99 for all sectors.

Obviously for our FNI analysis, FNI data is used for all countries.

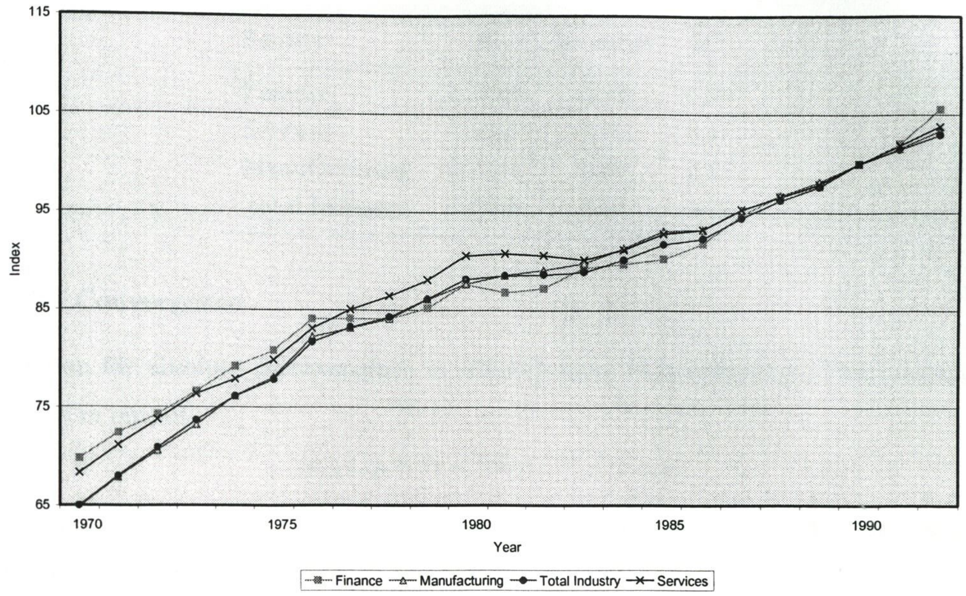

Figure 6.10: Wages: Industry Index

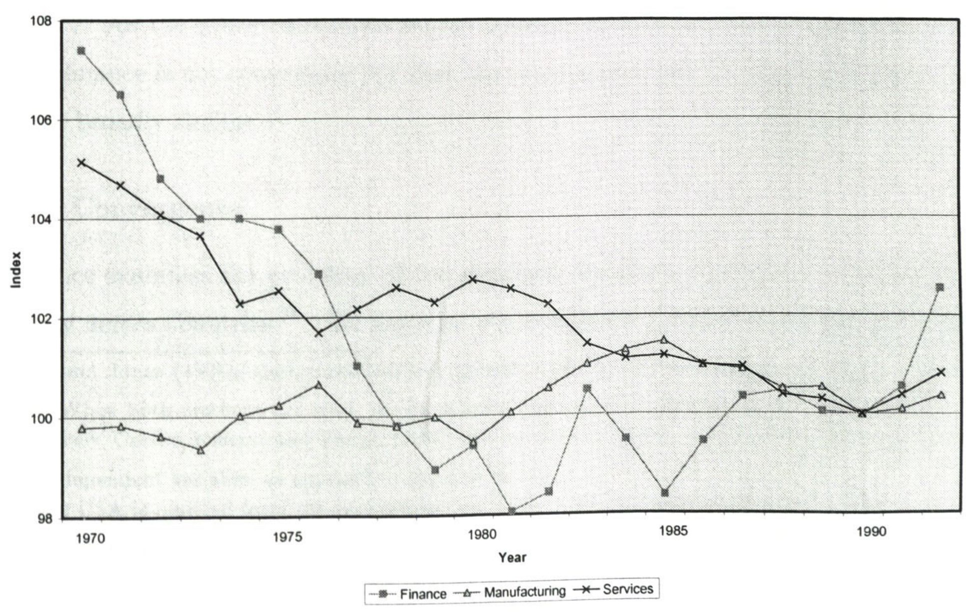

Figure 6.11: Wages: Industry Index relative to Total Industry

Table 6.1: Beta Convergence of Labour Productivity

Sector	β	**p-value**	R^2
Finance	-0.0108	0.46	0.09
Services	-0.0167	0.01	0.81
Manufacturing	-0.0218	0.07	0.45
Total Industry	-0.0226	0.01	0.79

6.8.1 β - Convergence

Our equation for absolute β-convergence is adapted from Sala-i-Martin's (1996) equation for convergence in output,

$$lp_{i,t,t+T} = \alpha - \beta \log(LP_{i,t}) + \epsilon_{i,t} \tag{6.2}$$

where $lp_{i,t,t+T} \equiv \log(LP_{i,t+T}/LP_{i,t})/T$ is economy i's annualised growth rate of labour productivity between the years t and t + T.[25] The natural log of the initial value of labour productivity is given by $\log(LP_{i,t})$. β-convergence in labour productivity is found if $\beta > 0$, using the ordinary least squares regression technique. This is the same equation as that used in Bernard and Jones (1996b).[26]

The results are shown in Table 6.1. It is evident that the result for finance is markedly different than that of the sectors. The β for finance is insignificant and the regression has a very low R^2. All the other regressions report strongly significant βs and high R^2s. Hence, it seems that finance is not converging but that the other sectors are.[27] The results from the FNI analysis are broadly similar.

6.8.2 σ - Convergence

σ-convergence examines the evolution of the standard deviation, σ, of the natural log of labour productivity across countries.[28] We say that σ-convergence is found if the standard deviation

[25] Bernard and Jones (1996a) derive productivity growth rates by regressing productivity on a constant and time trend. When both methods are used, the correlation between the respective growth rates is 0.99.

[26] Alternatively, Carree, Klomp, and Thurik (2000) use the level of labour productivity in the last period in the study as the dependent variable, as opposed to the growth rate.

[27] When the USA is omitted from the regressions (see Table 6.A.1 in Appendix 6.A), manufacturing and total industry are marginally insignificant at a ten per cent level. This is because the USA is the leader to which the other countries are converging. With finance, one could postulate a different scenario: the USA is a financial centre serving many countries and perhaps the financial sector of other countries may never converge to that of the USA. Maybe this could explain the lack of convergence in finance we noted above. This is shown, however, not to be the case in Table 6.A.1: there is no convergence in finance, with or without the USA.

[28] A similar method that could be used here is to examine the coefficient of variation, CV, which is defined as follows: $CV_t = \sigma_t/Mean_t$. In this dataset, however, there is very little difference between the standard deviation

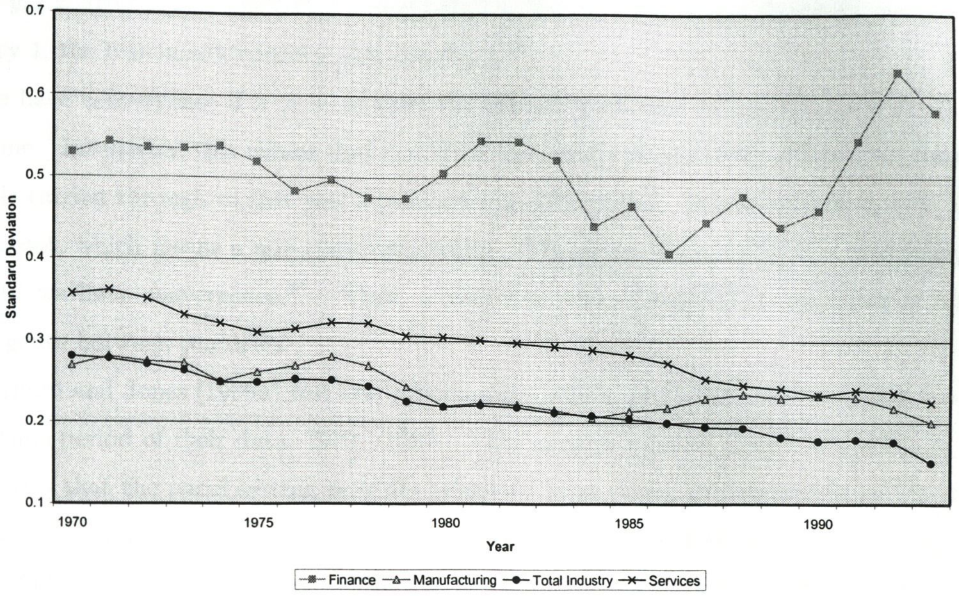

Figure 6.12: Sigma Convergence of Labour Productivity

decreases over time:

$$\sigma_{t+T} < \sigma_t \tag{6.3}$$

The results are shown graphically in Figure 6.12, and seem to be in agreement with those of the previous section: convergence is present in all sectors apart from finance. σ-convergence allows us to observe the evolution of the dispersion of productivity levels in finance over time. We see that there have been times of convergence in finance (1974 - 1979, 1981 - 1986) but also times of divergence (1979 - 1981, 1986 - 1992). These balance out to show a lack of convergence over the whole period.[29]

There is a difference here when we examine the FNI data. Divergence over the period 1982 - 1993 turns into convergence when the financial centres are omitted. This could be due to the inclusion of more financial centres (Japan and the U.K.) in this dataset. Also the absolute size of the standard deviation for finance is notably smaller for FNI.

6.8.3 Time Series Convergence

The time series test utilises this equation adapted from Bernard and Jones (1996a):

$$y_{i,t} = (1 - \lambda)y_{i,t-1} + \varepsilon_{i,t} \tag{6.4}$$

and the coefficient of variation.

[29]The result for finance does not change when the USA is omitted from the dataset (Figure 6.A.1). The results for manufacturing and total industry, again, do change.

where $y_{i,t} = \log(\widehat{LP_{i,t}}) = \log(LP_{1,t}) - \log(LP_{i,t})$ = the difference in productivity levels between country 1, the benchmark country, and country i.[30]

We have convergence if $\lambda > 0$, as then the overall coefficient on $\log(\widehat{LP_{i,t-1}})$, (1-$\lambda$), is less than one. Intuitively, this means that not all of last year's productivity differential (only (1-λ) of it) is carried through to this year's productivity differential. Statistically if $\lambda = 0$, we have a unit root, which means a non-stationary series. Therefore, if $\log(\widehat{LP_{i,t}})$ is a stationary series ($\lambda > 0$) we have convergence.[31] Thus, a unit root test of $\log(\widehat{LP_{i,t}})$ can serve as a test of convergence between countries.

Bernard and Jones (1996a) test this relationship using a panel data unit root test due to the short time period of their data, 1970 - 1987. They employ a result from Levin and Lin (1992) which says that the panel setting provides relatively large power improvements and it provides asymptotic normality for panel unit root tests in some common settings.

We follow Bernard and Jones (1996a) in our choice of benchmark countries. We pick the most productive country in 1970 and also the median country in terms of productivity in 1970. Following Ben-David (1996), we also use the average of the sample's productivity levels instead of a benchmark country. Two separate unit root tests are employed: Hadri (2000) and Levin and Lin (1992). We do not include a time trend in these tests as trend-stationarity does not imply convergence since productivity differentials could then be increasing around a trend. Furthermore, it has been shown that the inclusion of a time trend decreases the power of a test for at least some panel unit root tests in small samples.[32] We again follow Bernard and Jones in including country-specific intercepts. This makes sense as we have no theoretical reason, or empirical evidence, to believe that the productivity differential will be homogeneous across countries.[33]

Accordingly, we use the following models:[34]

- Hadri (2000) which is a residual based Lagrange multiplier test utilising the equation

$$y_{it} = r_{0i} + e_{it} \tag{6.5}$$

where

$$e_{it} = \sum u_{it} + \epsilon_{it} \tag{6.6}$$

[30] Strictly speaking, convergence also requires that the asymptotic growth rates of productivity are the same.

[31] This is a weak definition of convergence, more precisely it means that the data are not diverging.

[32] Baltagi, (2001, p243).

[33] These decisions are important as Levin and Lin is sensitive to the specification of the deterministic terms. Breitung (2000) says the tests suffer from a dramatic loss of power if individual specific trends are included (Baltagi, p239).

[34] The package NPT 1.1 is used to perform all non-stationary panel tests in this paper.

The null hypothesis is that the individual observed series are stationary around a deterministic level against the alternative of a unit root in panel data. The disturbance terms can be heteroscedastic and serially correlated.

- Levin and Lin (1992) Model 5:

$$\triangle y_{it} = \alpha_{0i} + \beta y_{it-1} + \zeta_{it} \tag{6.7}$$

Note that the coefficient of the lagged dependent variable, β, is assumed to be homogeneous across all cross-section units of the panel. Consequently, the null hypothesis is that each series contains a unit root against the alternative that all individual series are stationary. This test depends upon a cross-sectional independence assumption.[35]

The results are recorded in Table 6.2. For all variables the non-stationary null in Levin and Lin is rejected, thus, they are deemed stationary and converge. The results from the Hadri test are quite different. For most industries the result depends on the benchmark used. Furthermore the industry which has a consistent result - total industry when the USA is omitted - is diverging, contrary to our previous results.[36]

The two different techniques give different results. We side with the cross-sectional results, as this time series analysis is based on a weak definition of convergence. Furthermore, the instability of the mean growth rates of labour productivity (see Figure 6.7) imply that the data are not yet near their limiting distributions and thus cross-section tests are more appropriate.[37] Thus, judging by the cross-sectional results, convergence seems to be present in all sectors apart from finance. In Section 6.7.2, we noted that finance is the sector with the highest level of labour productivity. This concords with Carree, Klomp, Thurik (2000) who find that industries with high levels of labour productivity are associated with low rates of productivity convergence.

[35] We do not employ the tests designed by Harris and Tzavalis (1999) and Im, Pesaran and Shin (1995). The Harris and Tzavalis test is built on the assumption that time is fixed, which is more natural when N is large relative to T. As such, it is commonly used in microeconometric studies and is not suitable for our situation. Im, Pesaran and Shin is based on averaging individual unit root test statisitics. It uses a null hypothesis that each series contains a unit root against an alternative that at least one series is stationary,

$$\triangle y_{it} = \alpha_i + \beta_i y_{i,t-1} + \sum \rho_{ij} \triangle y_{i,t-j} + \varepsilon_{it} \tag{6.8}$$

β_i can vary across N. In our study, this translates to a null that each series is diverging and an alternative that at least one series is converging to the benchmark. This alternative is hardly enough to state with confidence that convergence is happening in an industry. Therefore, this test is deemed not suitable for our study. This problem also occurs in Levin and Lin (1993) when heterogeneous coefficients are introduced, but, as already stated, does not affect the two tests we employ.

[36] See Table 6.A.2 in Appendix 6.A for the results when the USA is omitted.

[37] Bernard and Durlauf (1996, p171).

Table 6.2: Labour Productivity Convergence - Time Series

Sector	Benchmark	Levels		First Differences	
		Levin and Lin	Hadri	Levin and Lin	Hadri
Finance	Average	s	n	s	s
	Most Productive	s	s	s	s
	Median Productive	s	n	s	s
Services	Average	s	n	s	s
	Most Productive	s	n	s	s
	Median Productive	s	s	s	s
Manufacturing	Average	s	n	s	n
	Most Productive	s	s	s	s
	Median Productive	s	s	s	n
Total Industry	Average	s	n	s	s
	Most Productive	s	s	s	s
	Median Productive	s	n	s	s

They suggest that the level of labour productivity may serve as a proxy for knowledge or capital barriers which prevent quick catch-up.

6.9 Baumol's Disease

We now examine whether there has been cost disease in the sectors we are studying. First, we build up a more formal argument for Baumol's disease than the one presented in Section 6.2. We start with the following labour market condition: in a competitive economy the value of labour's marginal product, $VMPL$, equals the wage,

$$W_i = VMPL_i = P_i \times MPL_i \tag{6.9}$$

We then assume that the nominal wage rate, W, is equal across sectors due to labour mobility.[38] This implies that the value of marginal product of labour is equal across sectors,

$$VMPL = P_i \times MPL_i = P_j \times MPL_j \tag{6.10}$$

As a result, when prices and labour productivities are compared across sectors (between finance and manufacturing for example) we get the following relationship

$$\frac{MPL_{fin}}{MPL_{manuf}} = \frac{P_{manuf}}{P_{fin}} \tag{6.11}$$

$$\ln\left[\frac{MPL_{fin}}{MPL_{manuf}}\right] = \ln\left[\frac{P_{manuf}}{P_{fin}}\right] = -\ln\left[\frac{P_{fin}}{P_{manuf}}\right] \tag{6.12}$$

[38] This assumption is subsequently tested in Section 6.9.1 below.

Table 6.3: Baumol's - Panel Unit Root Tests

Variable	Hadri	LL 92	LL 93	IPS 95	IPS 97	IPS 97 LM
Prices						
Manufacturing	n	n	s	n	n	n*
Services	n	s	s	n	n	n*
Total Industry	n	s	s	n	n	n*
Productivities						
Manufacturing	n	n	s	n	n	n*
Services	n	n	s	n	n	n*
Total Industry	n	n	s	n	n	n

Note: s = stationary, n = non-stationary, n* = non-stationary if independent errors

Table 6.4: Baumol's - Panel Cointegration Tests

Variable	Pedroni 95	Kao DF_ρ	Kao DF_t	Kao DF^*_ρ	Kao DF^*_t	Kao ADF
Manufacturing	c	n	n	c	c	c
Services	c	n	n	c	c	c
Total Industry	c	n	n	c	c	c

Note: c = cointegrated, n = not cointegrated.

This relationship encapsulates Baumol's disease. If productivity in finance grows faster than productivity in manufacturing, then the relative price of manufacturing has to increase. We test for this long-run relation, equation (6.12), in the dataset between finance and each of the other sectors in turn. Following Canzoneri et al. (1999), we use the average product of labour to measure productivity and not the marginal product of labour as in equation (6.12). The sectoral deflators introduced in Section 6.7.3 are used to measure prices.

We find that the relation between finance and other sectors of the economy is very similar across the other sectors. In Table 6.3, all the relative productivities and relative prices are found to be non-stationary according to the tests developed by Hadri (2000) and Im, Pesaran

Table 6.5: Baumol's Restriction - Panel Unit Root Tests

Variable	Hadri	LL 92	LL 93	IPS 95	IPS 97	IPS 97 LM
Manufacturing	n	s	s	s	s	s*
Services	n	s	s	s	s	s*
Total Industry	n	s	s	s	s	s

Note: s = stationary, n = non-stationary, s* = stationary if independent errors and Shin (1995, 1997).[39] We then test for cointegration, Table 6.4, using the following methods: Kao's (1999) DF and ADF tests and Pedroni (1995).[40] Cointegration is present between relative productivities and relative prices for finance and manufacturing, finance and services, and finance and total industry.[41] We also perform a stronger test for a Baumol's relation by examining whether the slope of the cointegrating regression, β, is equal to 1.0 as theory predicts. Again following Canzoneri et al., we do this by testing whether the restriction $\beta = 1.0$ is consistent with the data.[42] To do so, we subtract relative productivities from relative prices and test for unit roots in the difference, $y - x$. All the unit root tests presented in Table 6.5, apart from Hadri, provide evidence for stationarity and thus Baumol's disease.

The Granger Representation theorem states that, if a set of variables are cointegrated of order one, then there exists a valid error-correction representation of the data (Engle and Granger, 1987). We can use the residual from the cointegrating regression as an instrument for the error-correction term so the error-correction models (ECMs) take the following form:

$$\triangle y_{it} = \alpha + \mu_y e_{it-1} + \sum \beta_{t-j} \triangle x_{i,t-j} + \sum \lambda_{t-j} \triangle y_{i,t-j} + \epsilon_{1it} \tag{6.13}$$

$$\triangle x_{it} = \delta + \mu_x e_{it-1} + \sum \theta_{t-j} \triangle x_{i,t-j} + \sum \rho_{t-j} \triangle y_{i,t-j} + \epsilon_{2it} \tag{6.14}$$

The results of these panel ECMs are presented in Table 6.6.[43] When prices are the dependent variable, the error-correction term is always significant, at a one per cent level, and its coefficient has the correct sign. The error-correction term is never significant when productivity is the

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[39] Tests by Levin and Lin are denoted by LL and tests by Im, Pesaran and Shin are denoted by IPS. Most of the variables are deemed stationary by Im, Pesaran and Shin's (1997) LM test when serially correlated errors are used. Furthermore, all variables are stationary using Levin and Lin (1993), which allows for serially correlated errors. Levin and Lin (1992), allowing for a country-specific intercept, find the variables to be non-stationary except for relative prices when total industry or services is the numerator.

[40] Cointegration is not present according to the first two of the four Kao (1999) DF tests, DF_ρ and DF_t. Nevertheless, the tests for which cointegration is present, DF^*_ρ and DF^*_t, have better size and power properties (Kao, 1999).

[41] These results are robust to repeating the empirical procedure with the relative productivities multiplied by weights to account for the absolute size of the financial sector in the respective countries. The weights we employ are a ratio of value added of the financial sector to value added of the other sector. Hence, this weight increases the value of the observations in the panel of those countries with a larger than average financial sector. This compensates for the panel econometric techniques employed, which impose homogenous coefficients across countries.

[42] Canzoneri et al. also use a second method here. They estimate β using FMOLS and then test the null hypothesis of $\beta = 1.0$. When the two methods disagree, however, they favour the first one which we perform.

[43] The general-to-specific methodology is used to determine the appropriate lag length for all the ECMs in this paper, for both panel and individual country time series. As part of this methodology we impose a sign restriction: only positive lags are included in the specification chosen by general-to-specific. In all the ECMs that we run, a negative lag is counter-intuitive and interpreted as a sign of an overspecified model.

dependent variable. These results are for all industries at any possible combination of lag lengths. This confirms our above cointegration results and provides us with a very strong causality result: relative prices are being driven by the deviation from the long-run cointegrating relationship. Thus, Baumol's disease is present in this dataset.

In our FNI analysis we find similar, although slightly weaker, results.[44] When prices are the dependent variable, the EC term is significant, with the correct sign on the coefficient, for both manufacturing and services. This is not true for total industry. It has a significant EC term when productivity is the dependent variable but it has a negative sign. Therefore, it does not actually restore the system to equilibrium.

Further corroborating evidence is supplied by the parallel time series analysis of the individual countries (see Appendix 6.C). In the five ECMs presented in Table 6.C.7 we find that, in three cases, relative prices respond quickest to deviations from equilibrium.[45] Stronger evidence comes from the FNI analysis. In seven of its twelve ECMs, only relative prices respond to deviations from the cointegrating relationship. Thus, the time series analysis agrees that relative productivity is the causal factor.[46]

6.9.1 Wages

We now turn to analysing the long-run relationship between wages across sectors.[47] This serves two purposes. First, it tests the assumption that wages equalize across sectors, which underlies the Baumol's disease analysis carried out above.[48] Second, the issue of causality can be further addressed by seeing which sector is driving wage growth. Under gradual adjustment, wage growth occurs first in the progressive sector to match productivity, this then *causes* wage growth in the other sectors as they try to attract and retain labour.

[44] The evidence for non-stationarity in the FNI dataset is weaker overall, but the Hadri test always rejects the null of stationarity. The subsequent cointegration analysis finds slightly stronger evidence than in the FNS sample.

[45] In these three ECMs the error-correction term is significant with the correct sign regardless of which variable is the dependent variable. Thus, we evaluate the speed of adjustment coefficients: on two occasions the coefficient is three times bigger when prices are the dependent variable; once it is twice as big.

Of the other two ECMs, only relative productivities responds to deviations from equilibrium in one and the other is inconclusive. Manufacturing for Denmark is the inconclusive result and it has quite a weak cointegration result.

[46] One of the further ECMs four are inconclusive and in the remaining one both variables respond to the error-correction term, but relative productivities has the larger coefficient.

[47] The contruction of the average real wage is described in Section 6.7.4.

[48] The level of wages may of course differ across sectors due to reasons such as ability and qualifications. The assumption of exact wage equality across sectors is for workers who are commensurate in these characteristics. As the average real wage data is in index form this constant difference is eliminated.

Table 6.6: Baumol's - Panel Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Finance / Manufacturing						
P	LP	-0.11*** *-4.15*	0.09	1.73**	0,0	No
LP	P	-0.01 *-0.35*	0.01	1.84**	0,0	No
Finance / Services						
P	LP	-0.12*** *-4.18*	0.12	1.73**	-	Yes
		-0.15*** *-4.96*	0.13	1.79**	0,1	No
LP	P	-0.02 *-0.65*	0.03	1.84**	-	Yes
		-0.02 *-0.62*	0.05	1.91**	1,0	Yes
Finance / Total Industry						
P	LP	-0.13*** *-4.69*	0.11	1.74**	0,0	No
LP	P	-0.03 *-1.10*	0.01	1.83**	0,0	No

Note: balanced panel, 184 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown

Table 6.7: Wages - Panel Unit Root Tests

Variable	Hadri	LL 92	LL 93	IPS 95	IPS 97	IPS 97 LM
Finance	n	n	s	s	s	n
Manufacturing	n	s	n	s	s	s
Services	n	s	n	s	s	s
Total Industry	n	s	s	s	s	s

Note: s = stationary, n = non-stationary, n* = non-stationary when allow for serially correlated errors

Table 6.8: Wages - Panel Cointegration Tests

Variable	Pedroni 95	Kao DF_ρ	Kao DF_t	Kao DF^*_ρ	Kao DF^*_t	Kao ADF
Manufacturing	c	n	n	c	n	n
Services	c	n	n	c	n	n
Total Industry	c	n	n	c	n	n

Note: c = cointegrated with finance, n = not cointegrated with finance.

We proceed by examining the long-run properties of the data using panel unit root tests. The results are presented in Table 6.7. The results are mixed when the Levin and Lin (1992, 1993), with a country-specific intercept, and Im, Pesaran and Shin (1995, 1997) tests are used.[49] Nevertheless, wages are found to be non-stationary in all sectors according to Hadri (2000). Thus, we test for cointegration between wages in different sectors. Bivariate cointegration is found to be present between wages in the financial sector and wages in the other sectors. This is according to the tests developed by Pedroni (1995), see Table 6.8. Furthermore, cointegration was found in a multivariate setting between wages in finance, manufacturing, and services using Pedroni's (1999) tests.[50] For these reasons, we conclude that wages move together across sectors in the long-run. This result strengthens the above Baumol's analysis by providing evidence for one of its crucial assumptions. It also leads on to the issue of causality.

The results of the ECMs for the bivariate cointegrating relationships are presented in Table 6.9.[51] We find that the EC term is always significant with the correct sign regardless of which variable is the endogenous variable. Thus, we analyse the speed of adjustment, the size of the coefficient of the EC term, and find that wages in the financial sector always respond quicker to deviations from equilibrium. In general, the adjustment is twice as quick. A similar pattern

[49] If we use a time trend, all series are non-stationary using Levin and Lin (1992), Im, Pesaran and Shin (1995) and Im, Pesaran and Shin (1997). Conversely, the Im, Pesaran and Shin (1997) LM test still finds most of the series to be stationary as does the Levin and Lin (1993) test which allows for serially correlated errors.

[50] This is consistent across all seven specifications of the test when an intercept is included.

[51] An unbalanced panel for the period 1970 - 1993 is used here as French data stop at 1992. Likewise, in the time series analysis, the period 1970 - 1993 is used for all countries except France.

of results emerges in our FNI analysis.[52] The difference is that when the services sector is the dependent variable, the EC term is not significant. This all suggests that finance is not the causal industry in the Baumol's relation we have found.

We then examine time series ECMs for the individual countries. Here we find further evidence that wage growth in the other sectors is causing wage growth in the financial sector. In the eight ECMs recorded in Table 6.C.12, there are two cases where manufacturing / total industry is the causal factor: in one case, only finance responds to deviations from equilibrium, and in the second, both variables respond but finance responds three times faster. There are four cases of bidirectional causality, where both variables respond with a similar speed of adjustment, and in one ECM, finance is the causal factor.[53] In the parallel FNI analysis (Table 6.C.28) thirteen ECMs are examined. Seven of these have manufacturing / services / total industry as the causal factor, four are bidirectional, and two have finance as the causal factor.[54] The interesting result is that all three of the cases where wage growth in finance is causing wage growth in another sector (services / total industry) are for the USA.

Thus, overall finance does not seem to be the causal factor in the Baumol's relation we have discovered. This is consistent with our description of the productivity data in Section 6.7.2 where we noted that finance is generally the least progressive sector of the four in terms of productivity growth (Figure 6.7). The exception to this is the USA, the world's premier financial centre.[55] Here finance is the causal industry according to our ECM analysis however, the data in Figure 6.13 does not support this view as relative labour productivity is decreasing.

We have established that cost disease is present in this dataset and that finance is not the causal industry. This is illustrated for us in Figure 6.14. When the ratios for finance over total industry are graphed, we see that relative productivity is decreasing. Therefore, productivity is growing faster in total industry and this leads to cost disease in finance as demonstrated by rising relative prices.

[52] Stronger evidence for non-stationarity, according to the standard tests, is present in the FNI sample. This is also true for the subsequent cointegration analysis.

[53] In the remaining ECM no obvious result emerges.

[54] In five of the seven ECMs where finance is the *caused* sector, finance is the only variable to respond to deviations from the cointegrating relationship. In the other two, finance responds notably quicker than the other variables.

[55] In the time series analysis we only found a Baumol's relation for the USA for services and total industry using FNI. The other main financial centres in this dataset are the UK and Japan. For the UK, wages in finance are caused by wages in all three of the other industries. For Japan causality is always bidirectional.

Table 6.9: Wages - Panel Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Finance	Manufacturing	-0.07*** *-2.61*	0.23	1.84**	-	Yes
		-0.08*** *0.30*	0.09	1.95**	1,0	No
Manufacturing	Finance	0.05*** *4.44*	0.24	1.67**	-	Yes
		0.05*** *3.48*	0.25	2.09**	0,1	Yes
Finance	Services	-0.08*** *-2.40*	0.24	1.89**	-	Yes
		-0.09*** *-2.85*	0.24	1.96**	1,0	Yes
Services	Finance	0.05*** *2.84*	0.24	1.54**	-	Yes
		0.04** *1.99*	0.27	2.16**	0,1	Yes
Finance	Total Industry	-0.08*** *-2.99*	0.27	1.89**	-	No
		-0.09*** *-3.02*	0.12	2.03**	0,1	No
Total Industry	Finance	0.06*** *4.94*	0.27	1.43*	-	Yes
		0.04*** *3.04*	0.33	2.17**	0,1	Yes

Note: unbalanced panel, 183 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

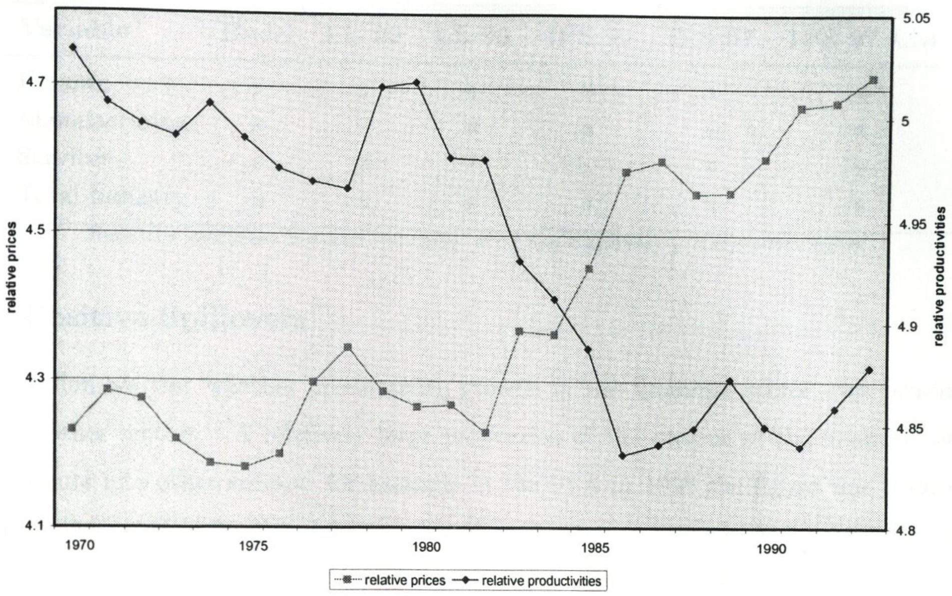

Figure 6.13: Baumol's Disease USA: Finance / Total Industry

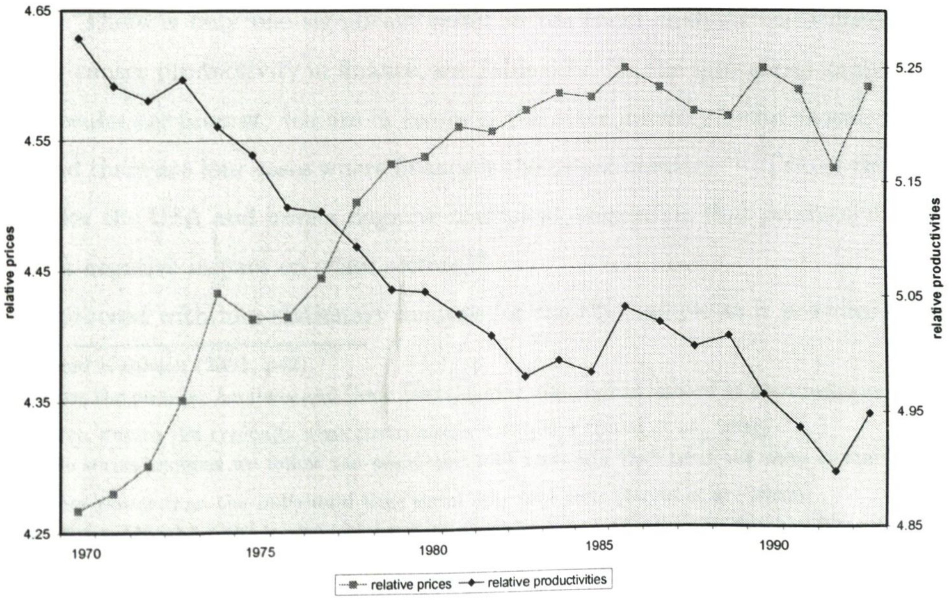

Figure 6.14: Baumol's Disease (sample average): Finance / Total Industry

Table 6.10: Positive Spillovers - Panel Unit Root Tests

Variable	Hadri	LL 92	LL 93	IPS 95	IPS 97	IPS 97 LM
Finance	s	s	s	s	s	s
Manufacturing	n	s	s	s	s	s
Services	s	s	s	s	s	s
Total Industry	n	s	s	s	s	s

Note: s = stationary, n = non-stationary, n* = non-stationary if independent errors

6.10 Positive Spillovers

In this section we test whether productivity growth in the financial sector aids productivity growth in other sectors. A relatively large proportion of the output of the financial sector is used as inputs into other sectors: for example in the USA in 1998 the figure was twenty eight per cent.[56] As noted in Section 6.2, these intermediate inputs are employed as substitutes for primary inputs which increase the rate of productivity growth in these other sectors (Oulton, 2001). Also, labour productivity in finance serves as a general proxy for the quality of the financial sector. A better financial system should lead to more efficient resource allocation which increases productivity in other sectors.

First, we analyse the stationarity of labour productivity in these sectors. The results suggest the data are stationary (see Table 6.10) so we revert to Granger causality tests on VARs in levels.[57] There is only one significant result in the panel analysis: manufacturing labour productivity causes productivity in finance, see Table 6.11. In the time series analysis, nineteen significant results are present: ten are in favour of the other industry being causal, five are bidirectional, and there are four cases where finance is the causal industry.[58] Two of these later four cases occur for the USA and have a negative coefficient, suggesting that productivity growth in finance has a negative impact on other sectors.[59]

We can proceed with non-stationary analysis for the FNI sample as it provides evidence for

[56] Planting and Kuhbach (2001, p42).

[57] We don't use the popular Arellano and Bond (1991) GMM estimator in light of its poor behaviour, particularly in small samples, due to the typically weak instruments it employs (Bond et al., 2001).

[58] In the time series analysis we follow the panel unit root tests and thus treat the data as stationary. These tests have higher power than the individual time series unit root tests (Levin et al., 2002).

[59] There are five cases where the lagged independent variables have a negative coefficient. The other three cases are for Denmark where finance is the *caused* industry. This may explain why Denmark is the only country where labour productivity decreases over the period (Figure 6.4). In previous literature Gemmell, Lloyd and Mathew (2000), when examining inter-sectoral linkages between agriculture, manufacturing and services in Malaysia, note the possibility of resource competition between sectors in the short run.

Table 6.11: Positive Spillovers - Granger Causality Tests - Panel

Other Variable	Y = finance			Y = other variable		
	k = 1	k = 2	k = 3	k = 1	k = 2	k = 3
Manufacturing	0.20	0.07*	0.02**	0.49	0.75	0.88
Services minus finance	0.30	0.69	0.56	0.79	0.73	0.28
Total Industry	0.30	0.33	0.28	0.95	0.98	0.95

Note: recorded results are p-values of Wald tests on all the coefficients of the independent variable.

non-stationarity. We also find strong evidence for cointegration and some evidence for finance being the causal industry here. When finance and total industry are examined we have causality from finance to total industry. For the other two ECMs, finance with manufacturing and services respectively, no EC term is significant at the lag specification decided by the general-to-specific methodology.[60] When no lags are used we find that labour productivity in finance *causes* labour productivity in services. A similar result for manufacturing holds at a significance level of eleven per cent.[61] In our parallel time series analysis for FNI, we have results suggesting the opposite. There are seven ECMs: only one provides evidence for finance being the causal industry whereas there are two cases of the reverse.[62] Furthermore, this one case is for Denmark, the only country with negative labour productivity growth in finance over the period studied.[63]

Thus, FNI finds finance to be the causal industry in the panel analysis but this does not hold in the time series analysis, while the FNS analysis generally favours finance as the *caused* industry. The reconciliation of these results seems to lie with the role of financial centres. FNI differs from FNS for two reasons: the inclusion of Japan and the UK in the data set, among other countries, and the inclusion of real estate and business services in a broader industry definition. The latter reason cannot explain the difference between the FNI panel results and the FNI time series results, as it effects both. This leaves us with the inclusion of more financial centres. It can explain why the FNI panel analysis differs from the FNI time series analysis as it is not a factor in the time series analysis, except for the cases of the financial centres themselves. In addition, it can explain why the FNS results are different. Further evidence for this interpretation is

[60] We do not employ a sign restriction on the ECMs here, as a negative lag is theoretically possible. This has no effect on the results.

[61] It holds at the ten per cent level when the contemporaneous change in financial labour productivity is excluded. Under the general-to-specific methodology, however, this term should be included.

[62] In addition, finance is the causal industry for Denmark for total industry at an eleven per cent significance level: the ECM term is significant at the eleven per cent level when total industry is the dependent variable. Of the remaining cases, there is one birectional case and two inconclusive results.

[63] Finance here means FNS. Denmark also experiences negative labour productivity growth in FNI, as do the UK and USA.

found in the FNS time series results. There we saw that the main country which found finance as the causal industry was the USA, a financial centre.

Therefore, we conclude that, in general, labour productivity in other sectors *causes* labour productivity in finance. One obvious example of this is the impact developments in information technology have had on financial services. The financial sector does aid productivity in other sectors, but that this occurs predominantly in countries which act as financial centres. On occasion, it seems that this can be a negative effect. Possibly this occurs due to resource competition, for example labour productivity in finance may rise due to the hiring of talented labour at the expense of other sectors.

6.11 Conclusion

This paper examines labour productivity with particular regard to the financial sector. We find evidence that labour productivity in the financial sector leads to labour productivity in other industries, what we term positive spillovers. Second, we show that cost disease, the potential negative effect of financial labour productivity, is not present in this dataset. Cost disease does exist here, but finance is not the causal industry. This result is due to relatively low productivity growth in finance. This is partly explained by our third finding: the lack of convergence in financial labour productivity across countries. This implies that one possible source of productivity growth, technology transfer (Bernard and Jones, 1996c), is not being fully exploited. This could be due to knowledge or capital barriers (Carree, Klomp, Thurik, 2000).

Finally, this paper highlights the role of financial centres. We find that finance is more likely to cause positive spillovers in countries that act as financial centres. Also, some countries, notably the USA, may experience negative effects of productivity growth in finance, possibly through resource competition. Furthermore, the USA, the world's biggest financial centre, is the one country where we found some evidence to suggest that finance may be causing cost disease in other sectors.

6.A Robustness Appendix

Table 6.A.1: Beta Convergence of Labour Productivity (USA omitted)

Sector	β	p-value	R^2
Finance	-0.0100	0.55	0.08
Services	-0.0156	0.01	0.82
Manufacturing	-0.0308	0.11	0.43
Total Industry	-0.0155	0.12	0.41

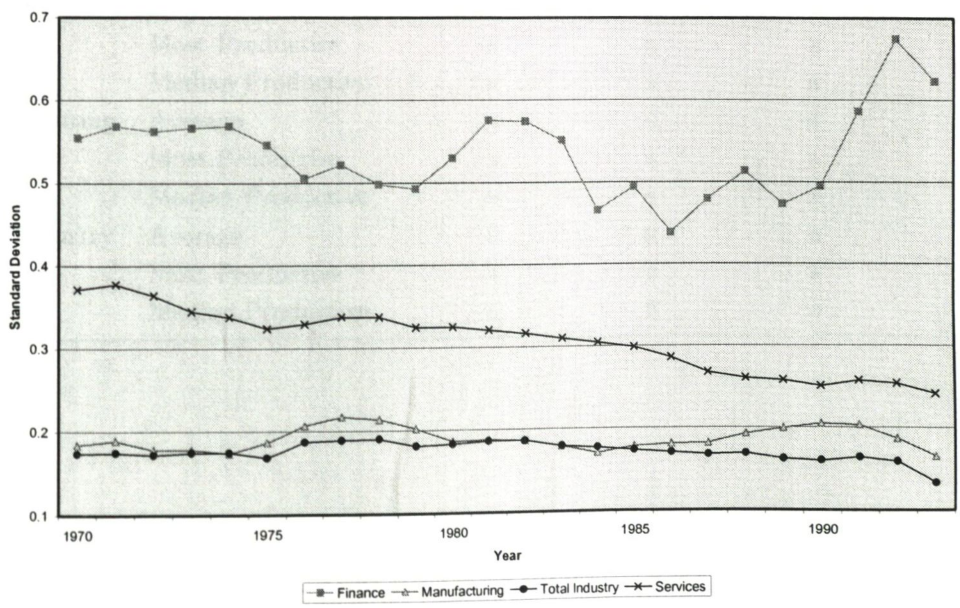

Figure 6.A.1: Sigma Convergence of Labour Productivity (USA omitted)

Table 6.A.2: Labour Productivity Convergence - Time Series (USA omitted)

		Levels		First Differences	
Sector	**Benchmark**	**Levin and Lin**	**Hadri**	**Levin and Lin**	**Hadri**
Finance	Average	s	n	s	n
	Most Productive	s	s	s	s
	Median Productive	s	s	s	s
Services	Average	s	n	s	s
	Most Productive	s	n	s	s
	Median Productive	s	s	s	n
Manufacturing	Average	s	n	s	s
	Most Productive	s	s	s	s
	Median Productive	s	s	s	s
Total Industry	Average	s	n	s	n
	Most Productive	s	n	s	s
	Median Productive	s	n	s	s

6.B FNI Appendix

Table 6.B.1: FNI - Beta Convergence of Labour Productivity

Sector	β	p-value	R^2
FNI	-0.0212	0.27	0.17
Services	-0.0185	0.14	0.28
Manufacturing	-0.0179	0.05	0.45
Total Industry	-0.0257	0.01	0.78

Table 6.B.2: FNI - Beta Convergence of Labour Productivity (financial centres omitted)

Sector	β	p-value	R^2
FNI	-0.0046	0.74	0.03
Services	-0.0189	0.12	0.50
Manufacturing	-0.0201	0.21	0.36
Total Industry	-0.0310	0.03	0.72

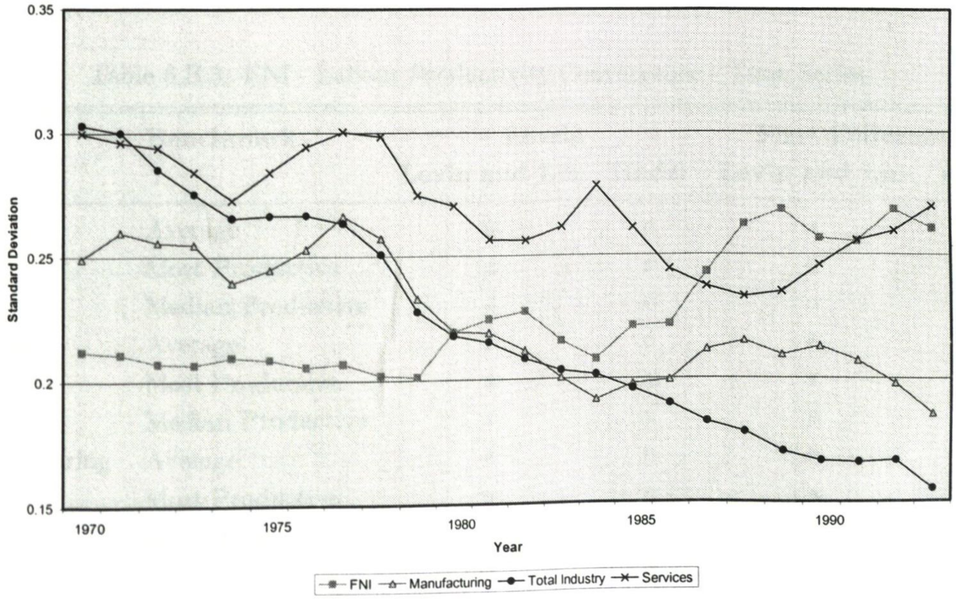

Figure 6.B.1: FNI: Sigma Convergence of Labour Productivity

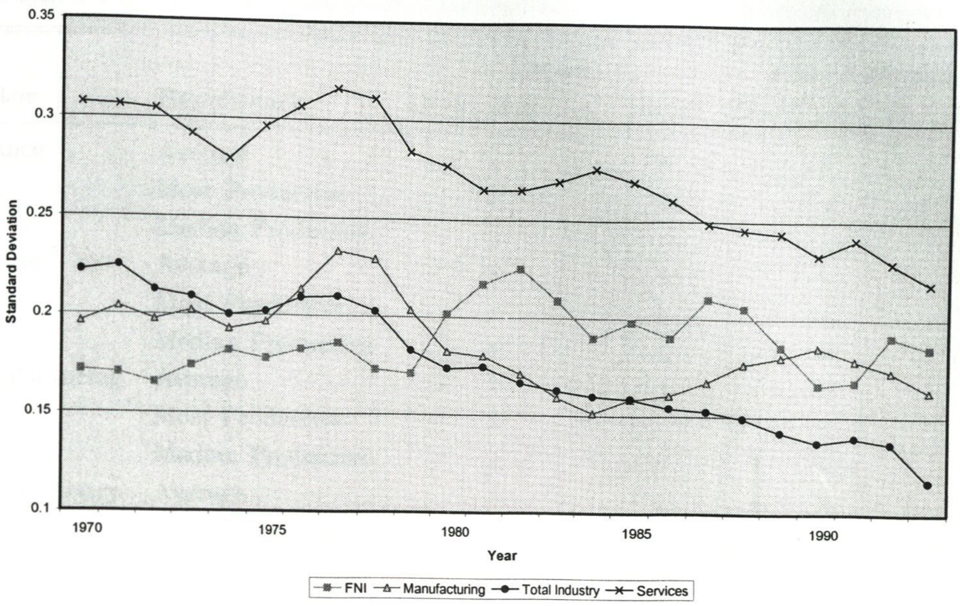

Figure 6.B.2: FNI: Sigma Convergence of Labour Productivity (financial centres omitted)

Table 6.B.3: FNI - Labour Productivity Convergence - Time Series

Sector	Benchmark	Levels		First Differences	
		Levin and Lin	Hadri	Levin and Lin	Hadri
Finance	Average	n	n	s	s
	Most Productive	s	s	s	s
	Median Productive	s	s	s	s
Services	Average	s	n	s	n
	Most Productive	s	s	s	n
	Median Productive	s	s	s	s
Manufacturing	Average	s	n	s	s
	Most Productive	s	s	s	s
	Median Productive	s	s	s	s
Total Industry	Average	n	n	s	s
	Most Productive	s	n	s	s
	Median Productive	s	s	s	s

Table 6.B.4: FNI - Labour Productivity Convergence - Time Series (financial centres omitted)

		Levels		First Differences	
Sector	**Benchmark**	**Levin and Lin**	**Hadri**	**Levin and Lin**	**Hadri**
Finance	Average	s	n	s	s
	Most Productive	s	n	s	s
	Median Productive	s	n	s	n
Services	Average	s	s	s	s
	Most Productive	s	s	s	s
	Median Productive	s	n	s	s
Manufacturing	Average	s	s	s	s
	Most Productive	s	s	s	n
	Median Productive	s	n	s	n
Total Industry	Average	s	n	s	s
	Most Productive	s	n	s	s
	Median Productive	s	n	s	s

Table 6.B.5: FNI - Baumol's - Panel Unit Root Tests

Variable	**Hadri**	**LL 92**	**LL93**	**IPS 95**	**IPS 97**	**IPS 97 LM**
Prices						
Manufacturing	n	s	s	s	s	s
Services	n	s	s	s	s	s
Total Industry	n	s	s	s	s	s
Productivities						
Manufacturing	n	s	s	s	s	s
Services	n	n	s	s	s	n*
Total Industry	n	n	s	s	s	s

Note: s = stationary, n = non-stationary, n* = non-stationary if independent errors

Table 6.B.6: FNI - Baumol's - Panel Cointegration Tests

Variable	**Pedroni 95**	**Kao DF$_\rho$**	**Kao DF$_t$**	**Kao DF$^*_\rho$**	**Kao DF$^*_t$**	**Kao ADF**
Manufacturing	c	c	n	c	c	c
Services	c	n	n	c	n	n
Total Industry	c	n	n	c	c	c

Note: c = cointegrated, n = not cointegrated.

Table 6.B.7: FNI - Baumol's Restriction - Panel Unit Root Tests

Variable	Hadri	LL 92	LL93	IPS 95	IPS 97	IPS 97 LM
Manufacturing	n	n	s	n	n	n
Services	n	n	s	n	n	s**
Total Industry	n	s	s	s	s	s

Note: s = stationary, n = non-stationary, s** = stationary when allow for serially correlated errors

Table 6.B.8: FNI - Baumol's - Panel Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Finance / Manufacturing						
P	LP	-0.04* *-1.67*	0.12	1.73**	-	Yes
		-0.07** *-2.37*	0.05	1.98**	0,1	No
LP	P	-0.03 *-0.93*	0.12	1.65**	-	Yes
		-0.02 *-0.89*	0.14	1.99**	0,1	Yes
Finance / Services						
P	LP	-0.05*** *-2.85*	0.32	1.82**	-	Yes
		-0.08*** *-4.01*	0.10	1.82**	1,0	No
LP	P	-0.03* *-1.95*	0.30	1.61**	-	Yes
		-0.02 *-0.93*	0.31	1.95**	0,1	Yes
Finance / Total Industry						
P	LP	-0.01 *-0.62*	0.12	1.57**	-	Yes
		-0.02 *-1.05*	0.16	1.87**	0,1	Yes
LP	P	-0.05** *-2.48*	0.15	1.59**	-	Yes
		-0.04* *-1.91*	0.17	1.98**	0,1	Yes

Note: balanced panel, 207 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown

Table 6.B.9: FNI - Wages - Panel Unit Root Tests

Variable	Hadri	LL 92	LL93	IPS 95	IPS 97	IPS 97 LM
Finance	n	n	s	s	s	n
Manufacturing	n	s	s	n	n	s
Services	n	s	n	n	n	n
Total Industry	n	s	s	n	n	s

Note: s = stationary, n = non-stationary, n* = non-stationary if independent errors

Table 6.B.10: FNI - Wages - Panel Cointegration Tests

Variable	Pedroni 95	Kao DF_ρ	Kao DF_t	Kao DF^*_ρ	Kao DF^*_t	Kao ADF
Manufacturing	c	c	c	c	c	c
Services	c	n	n	c	n	n
Total Industry	c	c	c	c	c	c

Note: c = cointegrated with finance, n = not cointegrated with finance.

Table 6.B.11: FNI - Wages - Panel Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Finance	Manufacturing	-0.21*** *-3.63*	0.28	1.73**	0,0	Yes
Manufacturing	Finance	0.09*** *3.05*	0.19	1.46*	-	Yes
		0.09*** *2.56*	0.24	1.96**	0,1	Yes
Finance	Services	-0.08*** *-2.45*	0.15	1.79**	0,0	Yes
Services	Finance	0.02 *2.84*	0.11	1.61**	-	Yes
		0.05 *1.58*	0.14	2.02**	0,1	Yes
Finance	Total Industry	-0.14*** *-3.20*	0.37	1.77**	-	Yes
		-0.11** *-2.17*	0.08	2.10**	0,1	No
Total Industry	Finance	0.07*** *2.80*	0.33	1.16	-	Yes
		0.06** *2.19*	0.46	1.92**	0,1	Yes

Note: unbalanced panel, 206 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.B.12: FNI - Positive Spillovers - Panel Unit Root Tests

Variable	Hadri	LL 92	LL93	IPS 95	IPS 97	IPS 97 LM
Finance	n	n	s	n	n	n*
Manufacturing	n	s	s	s	s	n*
Services	n	s	s	s	s	n*
Total Industry	n	n	s	s	s	n*

Note: s = stationary, n = non-stationary, n* = non-stationary if independent errors

Table 6.B.13: FNI - Positive Spillovers - Panel Cointegration Tests

Variable	Pedroni 95	Kao DF_ρ	Kao DF_t	Kao DF_ρ^*	Kao DF_t^*	Kao ADF
Manufacturing	c	n	n	c	c	n
Services	c	n	n	c	c	c
Total Industry	c	n	n	c	c	n

Note: c = cointegrated with finance, n = not cointegrated with finance.

Table 6.B.14: FNI - Positive Spillovers - Panel Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Finance	Manufacturing	-0.01 *-0.49*	0.04	1.42*	-	Yes
		-0.01 *-1.05*	0.10	1.88**	0,1	Yes
Manufacturing	Finance	-0.01 *-1.59*	0.05	1.54**	-	Yes
		-0.01 *-1.30*	0.10	1.88**	0,1	Yes
Finance	Services	-0.01 *-0.47*	0.01	1.38*	-	No
		-0.01 *-1.14*	0.08	1.85**	0,1	No
Services	Finance	-0.01* *-1.89*	0.02	1.46*	-	No
		-0.01 *-1.40*	0.09	2.04**	0,1	Yes
Finance	Total Industry	-0.01 *-0.01*	0.14	1.46*	-	Yes
		-0.01 *-1.14*	0.22	1.94**	1,1	Yes
Total Industry	Finance	-0.03*** *-5.76*	0.26	1.45	-	Yes
		-0.02*** *-3.09*	0.32	1.92**	1,0	Yes

Note: balanced panel, 184 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

6.C Time Series Appendix

Table 6.C.1: Labour Productivity - Unit Root Tests

Industry	Country	ADF Test	
		k = 1	k = 3
Manufacturing	Belgium	-2.08	-2.13
	Denmark	-1.20	-1.61
	Finland	-1.27	-1.22
	France	-0.75	0.52
	Germany	-1.29	-1.02
	Italy	-2.30	-3.38**
	Sweden	-1.34	-1.32
	USA	-0.72	-0.26
Services	Belgium	-1.17	-0.49
	Denmark	-0.82	-0.97
	Finland	-2.90*	-2.21
	France	-1.33	-0.40
	Germany	-3.02**	-2.41
	Italy	-1.75	-3.67**
	Sweden	-2.41	-2.98*
	USA	-1.24	-1.10
Total Industry	Belgium	-1.03	-0.24
	Denmark	-0.86	-1.13
	Finland	-3.01**	-2.75*
	France	-0.61	0.63
	Germany	-2.65*	-3.60**
	Italy	-2.20	-3.81***
	Sweden	-2.31	-2.47
	USA	-1.09	-0.98

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.2: Prices - Unit Root Tests

Industry	**Country**	**ADF Test**	
		k = 1	**k = 3**
Manufacturing	Belgium	-1.89	-2.39
	Denmark	-0.42	-0.37
	Finland	-2.00	-0.89
	France	-0.42	0.65
	Germany	-2.58	-3.47**
	Italy	-1.76	-3.28**
	Sweden	-2.33	-1.72
	USA	0.21	0.55
Services	Belgium	1.27	0.62
	Denmark	-1.55	-1.93
	Finland	-3.70**	-3.26**
	France	-1.21	-0.81
	Germany	-2.74*	-4.20***
	Italy	-2.20	-3.97***
	Sweden	-2.63	-2.19
	USA	0.03	0.02
Total Industry	Belgium	-0.35	-1.27
	Denmark	-1.07	-1.78
	Finland	-2.92*	-2.17
	France	-0.18	0.12
	Germany	-2.58	-3.85***
	Italy	-2.13	-4.52***
	Sweden	-2.59	-1.99
	USA	0.04	0.14

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.3: Baumol's - Engle-Granger Cointegration

Industry	**Country**	**ADF Statistic**			
		G to S	**k**	**k = 0**	**k = 1**
Manufacturing	Belgium	-2.42	0	-2.42	-2.28
	Denmark	-0.57	2	-0.47	-0.41
	Finland	-5.40***	1	-4.99***	-5.40***
	France	-2.61	0	-2.61	-2.17
	Germany	-1.98	1	-1.83	-1.98
	Italy	-3.64**	3	-2.85	-2.85
	Sweden	-3.20*	0	-3.20*	-3.32*
	USA	-2.49	1	-1.83	-2.49
Services	Belgium	-1.93	3	-0.75	-0.79
	Denmark	-1.16	0	-1.16	-1.54
	Finland	-0.82	2	-4.28***	-3.52**
	France	-2.19	0	-2.19	-1.80
	Germany	-3.97***	3	-1.96	-2.79
	Italy	-2.29	0	-2.29	-2.59
	Sweden	-2.50	0	-2.50**	-2.07
	USA	-1.71	2	-0.51	-0.92
Total Industry	Belgium	-2.13	3	-0.58	-0.88
	Denmark	-1.12	0	-1.12	-1.11
	Finland	-0.46	2	-5.19***	-4.77***
	France	-2.46	0	-2.46	-1.83
	Germany	-1.95	0	-1.95	-2.10
	Italy	-2.67	0	-2.67	-2.85
	Sweden	-3.10*	0	-3.10*	-2.78
	USA	-1.51	1	-1.83	-1.51

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 6.C.4: Baumol's - Johansen Cointegration

Industry	Country	Trace	Max	k
Manufacturing	Belgium	19.91	15.44	1
	Denmark	17.94	16.46**	1
	Finland	35.09***	23.53***	1
	Finland	12.64	7.95	2
	France	9.46	8.21	1
	France	6.50	4.57	2
	Germany	11.10	9.12	1
	Italy	21.80**	15.80**	1
	Sweden	21.56**	17.07**	1
	Sweden	17.11	12.81	2
	USA	14.32	10.61	1
Services	Belgium	11.96	7.49	1
	Denmark	7.60	4.40	1
	Finland	20.94**	13.60	1
	Finland	16.25	14.47	2
	France	12.28	8.07	1
	Germany	18.67	10.63	1
	Italy	17.22	13.62	1
	Sweden	16.05	11.45	1
	Sweden	14.63	10.61	2
	USA	11.61	8.29	1
Total Industry	Belgium	9.24	7.59	1
	Denmark	13.15	10.65	1
	Finland	33.06***	20.82***	1
	Finland	11.81	10.45	2
	France	7.85	7.11	1
	France	6.33	4.93	2
	Germany	17.04	11.84	1
	Italy	23.10**	17.65**	1
	Sweden	20.62**	14.68	1
	Sweden	17.71	13.44	2
	USA	12.71	9.45	1

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67.

Table 6.C.5: Baumol's Restriction - Unit Root Tests

Industry	Country	ADF Statistic			
		G to S	k	k = 0	k = 1
Manufacturing	Belgium	2.16	0	2.16	-2.10
	Denmark	-0.44	0	-0.44	0.74
	Finland	-4.36***	0	-4.36***	-4.21***
	France	-2.36	0	-2.36	-1.94
	Germany	-1.61	0	-1.61	-1.74
	Italy	-1.26	0	-1.26	-1.37
	Sweden	-2.12	2	-1.88	-2.66*
	USA	-0.08	0	-0.08	-0.37
Services	Belgium	-1.81	0	-1.81	-2.34
	Denmark	-0.34	0	-0.34	-0.52
	Finland	-1.51	2	-3.94***	-3.54**
	France	-2.67*	0	-2.67*	-2.25
	Germany	-1.90	0	-1.90	-2.48
	Italy	-1.56	0	-1.56	-1.70
	Sweden	-2.00	2	-1.80	-2.51
	USA	0.70	0	0.70	0.62
Total Industry	Belgium	-1.92	0	-1.92	-2.17
	Denmark	-0.35	0	-0.35	-0.64
	Finland	-1.11	2	-4.17***	-3.66**
	France	-2.36	0	-2.36	-1.69
	Germany	-3.12**	3	-1.87	-2.25
	Italy	-1.09	0	-1.09	-1.21
	Sweden	-1.99	2	-1.85	-2.65
	USA	0.53	0	0.53	0.25

Note: The ADF tests for unit roots have a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.6: Baumol's - Cointegration Summary

Industry	Country	Engle-Granger	Johansen	Baumol's Restriction
Manufacturing	Belgium	x	x	x
	Denmark	x	✓	x
	Finland	✓	✓	✓
	France	x	x	x
	Germany	x	x	x
	Italy	✓	✓	x
	Sweden	✓	✓	✓
	USA	x	x	x
Services	Belgium	x	x	x
	Denmark	x	x	x
	Finland	✓	✓	✓
	France	x	x	✓
	Germany	✓	x	x
	Italy	x	x	x
	Sweden	✓	x	x
	USA	x	x	x
Total Industry	Belgium	x	x	x
	Denmark	x	x	x
	Finland	✓	✓	✓
	France	x	x	x
	Germany	x	x	✓
	Italy	x	✓	x
	Sweden	✓	✓	x
	USA	x	x	x

Table 6.C.7: Baumol's - Time Series Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Manufacturing - Denmark						
P	LP	-0.05 *-0.40*	0.01	1.70**	-	No
LP	P	0.12 *0.25*	0.01	1.77**	0,0	No
Manufacturing - Finland						
P	LP	-0.63*** *-4.81*	0.52	2.07**	0,0	No
LP	P	0.31** *2.26*	0.20	2.29**	0,0	No
Manufacturing - Sweden						
P	LP	-0.45*** *-2.80*	0.34	1.71**	0,0	Yes
LP	P	0.15** *2.28*	0.27	2.00**	0,0	Yes
Services - France						
P	LP	-0.12 *-0.86*	0.14	1.48**	-	No
		-0.09 *-0.67*	0.27	1.32*	0,1	Yes
LP	P	0.61** *2.61*	0.33	1.64**	0,0	Yes
Total Industry - Sweden						
P	LP	-0.47*** *-3.08*	0.36	1.78**	0,0	Yes
LP	P	0.13* *1.96*	0.21	2.00**	0,0	Yes

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.C.8: Wages - Unit Root Tests

Industry	**Country**	**ADF Test**	
		k = 1	**k = 3**
Finance	Belgium	-2.61	-1.89
	Denmark	0.76	1.32
	Finland	0.57	0.89
	France	-2.74*	-4.35***
	Germany	-2.27	-1.50
	Italy	-1.36	-2.03
	Sweden	-0.19	-0.02
	USA	1.15	1.18
Manufacturing	Belgium	-5.17***	-3.12**
	Denmark	-2.14	-2.58
	Finland	-0.33	0.83
	France	-2.94*	-3.13**
	Germany	-3.66**	-2.19
	Italy	-2.87*	-1.23
	Sweden	-0.81	-0.62
	USA	-0.71	-0.54
Services	Belgium	-2.80*	-1.95
	Denmark	-1.46	-1.93
	Finland	-1.22	-0.99
	France	-4.47***	-2.75*
	Germany	-2.51	-0.85
	Italy	-1.56	-0.34
	Sweden	-1.77	-1.76
	USA	-0.49	1.94
Total Industry	Belgium	-4.36***	-2.76*
	Denmark	-1.21	-1.51
	Finland	-1.21	-0.63
	France	-2.85*	-2.29
	Germany	-3.35**	-1.70
	Italy	-2.60	-0.62
	Sweden	-1.66	-1.70
	USA	-0.08	1.64

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.9: Wages - Engle-Granger Cointegration

Industries	**Country**	**ADF Statistic**			
		G to S	**k**	**k = 0**	**k = 1**
Finance + Manufacturing	Belgium	-1.64	0	-1.64	-1.86
	Denmark	-0.50	0	-0.50	-0.87
	Finland	-4.02***	0	-4.02***	-4.25***
	France	-3.62**	2	-3.12*	-2.41
	Germany	-1.74	0	-1.74	-1.73
	Italy	-2.44	0	-2.44	-1.83
	Sweden	-2.99*	0	-2.99*	-2.25
	USA	-1.77	3	-0.89	-1.68
Finance + Services	Belgium	-2.71	0	-2.71	-2.49
	Denmark	-0.85	0	-0.85	-1.26
	Finland	-2.58	0	-2.58	-1.99
	France	-2.90	0	-2.90	-2.64
	Germany	-1.85	0	-1.85	-1.55
	Italy	-2.14	0	-2.14	-1.58
	Sweden	-1.72	0	-1.72	-1.55
	USA	-2.21	0	-2.21	-2.34
Finance + Total Industry	Belgium	-2.67	0	-2.67	-2.05
	Denmark	-0.97	0	-0.97	-1.36
	Finland	-2.62	2	-3.04*	-2.88
	France	-3.49**	2	-3.06*	-2.42
	Germany	-1.50	0	-1.50	-1.79
	Italy	-2.30	0	-2.30	-1.72
	Sweden	-2.19	0	-2.18	-1.50
	USA	-2.29	0	-2.29	-2.79

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 6.C.10: Wages - Johansen Cointegration

Industries	Country	Trace	Max	k
Finance + Manufacturing	Belgium	28.15***	24.21***	1
	Denmark	14.70	10.06	1
	Finland	33.39***	20.07**	1
	France	19.84	13.55	1
	France	30.87***	17.66**	2
	Germany	20.86**	13.97	1
	Italy	23.02**	16.67**	1
	Sweden	16.18	10.37	1
	USA	23.85**	17.04**	1
	USA	19.10	12.52	3
Finance + Services	Belgium	17.07	11.11	1
	Denmark	16.26	11.98	1
	Finland	25.40***	16.35**	1
	France	28.47***	21.90***	1
	Germany	18.19	15.57	1
	Italy	14.88	10.36	1
	Sweden	15.69	8.77	1
	USA	22.59**	16.07**	1
Finance + Total Industry	Belgium	21.41**	16.62**	1
	Denmark	17.10	12.87	1
	Finland	27.29***	20.76***	1
	Finland	28.26***	22.24***	2
	France	16.97	11.41	1
	France	24.81***	16.37**	2
	Germany	20.81**	18.32**	1
	Italy	21.45**	15.37	1
	Sweden	15.21	8.80	1
	USA	25.95***	19.05**	1

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67.

Table 6.C.11: Wages - Cointegration Summary

Industries	Country	Engle-Granger	Johansen
Finance + Manufacturing	Belgium	x	✓
	Denmark	x	x
	Finland	✓	✓
	France	✓	✓
	Germany	x	✓
	Italy	x	✓
	Sweden	✓	x
	USA	x	✓
Finance + Services	Belgium	x	x
	Denmark	x	x
	Finland	x	✓
	France	x	✓
	Germany	x	x
	Italy	x	x
	Sweden	x	x
	USA	x	✓
Finance + Total Industry	Belgium	x	✓
	Denmark	x	x
	Finland	✓	✓
	France	✓	✓
	Germany	x	✓
	Italy	x	✓
	Sweden	x	x
	USA	x	✓

Table 6.C.12: Wages - Time Series Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Finland						
Finance	Manufacturing	-0.47*** *-2.18*	0.23	2.21**	0,0	Yes
Manufacturing	Finance	0.45*** *4.12*	0.46	1.70**	0,0	Yes
Sweden						
Finance	Manufacturing	-0.38*** *-3.25*	0.37	1.55**	0,0	Yes
Manufacturing	Finance	0.08 *0.62*	0.03	1.63**	0,0	No
USA						
Finance	Manufacturing	-0.06 *-0.83*	0.49	0.80**	-	No
		-0.11 *-1.50*	0.62	1.28**	0,1	Yes
Manufacturing	Finance	0.04 *1.19*	0.50	1.58**	0,0	Yes
Finland						
Finance	Services	-0.27** *-2.47*	0.39	2.35**	0,0	Yes
Services	Finance	0.32*** *3.36*	0.47	1.60**	0,0	Yes
USA						
Finance	Services	0.25*** *4.07*	0.25	1.52**	0,0	No
Services	Finance	0.17*** *4.56*	0.40	2.42**	-	No
		0.22*** *5.68*	0.49	1.92**	1,0	No

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.C.12 continued

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Finland						
Finance	Total Industry	-0.33*** *-3.26*	0.35	2.24**	0,0	Yes
Total Industry	Finance	0.32*** *2.80*	0.39	0.97	-	Yes
		0.25* *2.00*	0.49	1.82**	0,1	Yes
Italy						
Finance	Total Industry	-0.38*** *-3.04*	0.38	2.51**	-	Yes
		-0.48*** *-2.96*	0.43	2.40**	1,0	No
Total Industry	Finance	0.13** *2.33*	0.22	1.53*	-	Yes
		0.04 *0.80*	0.35	2.54**	0,1	No
USA						
Finance	Total Industry	-0.08 *-0.67*	0.45	1.06	-	Yes
		-0.32* *-1.93*	0.59	1.42*	0,1	Yes
Total Industry	Finance	0.13** *2.42*	0.58	2.20**	-	Yes
		0.21*** *5.92*	0.72	1.90**	0,1	Yes

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.C.13: Positive Spillovers - Unit Root Tests

Industry	**Country**	**ADF Test**	
		k = 1	**k = 3**
Finance	Belgium	-1.07	-0.25
	Denmark	-1.40	-1.57
	Finland	0.79	-0.02
	France	-2.35	-1.92
	Germany	-1.26	-0.78
	Italy	-1.75	-2.66*
	Sweden	-0.16	-0.11
	USA	-1.90	-1.57
Manufacturing	Belgium	-2.97*	-2.08
	Denmark	-1.80	-1.56
	Finland	0.96	2.18
	France	-1.69	-1.49
	Germany	-2.72*	-2.04
	Italy	-1.45	-1.11
	Sweden	0.95	1.42
	USA	-0.34	0.72
Services	Belgium	-0.60	-0.33
	Denmark	0.44	1.87
	Finland	-0.30	0.81
	France	-0.69	0.10
	Germany	-0.11	0.70
	Italy	-0.65	-0.96
	Sweden	-1.01	0.13
	USA	-0.97	-0.08
Total Industry	Belgium	-2.73*	-2.08
	Denmark	-1.04	-0.20
	Finland	0.42	1.22
	France	-2.61	-1.71
	Germany	-2.09	-1.56
	Italy	-1.08	-0.28
	Sweden	-0.39	0.35
	USA	-0.42	0.83

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.14: Positive Spillovers - Granger Causality Tests - Finance and Manufacturing

Country	Y = finance			Y = Manufacturing		
	k = 1	k = 2	k = 3	k = 1	k = 2	k = 3
Belgium	0.10*	0.02**	0.09*	0.26	0.57	0.59
Denmark	0.04**	0.08*	0.02**	0.01***	0.01***	0.02**
Finland	0.01***	0.02**	0.01***	0.91	0.52	0.82
France	0.47	0.54	0.20	0.36	0.12	0.13
Germany	0.03**	0.22	0.01***	0.34	0.13	0.44
Italy	0.53	0.66	0.26	0.33	0.40	0.19
Sweden	0.01***	0.02**	0.10*	0.10*	0.30	0.09**
USA	0.90	0.85	0.90	0.02**	0.21	0.18

Note: recorded results are p-values of Wald tests on all the coefficients of the independent variable.

Table 6.C.15: Positive Spillovers - Granger Causality Tests - Finance and Services

Country	Y = finance			Y = Services		
	k = 1	k = 2	k = 3	k = 1	k = 2	k = 3
Belgium	0.72	0.87	0.95	0.03**	0.31	0.22
Denmark	0.04**	0.11	0.17	0.97	0.82	0.65
Finland	0.02**	0.05**	0.04**	0.05**	0.02**	0.05**
France	0.54	0.28	0.50	0.99	0.88	0.04**
Germany	0.07*	0.02**	0.26	0.29	0.13	0.06*
Italy	0.78	0.96	0.83	0.99	0.82	0.52
Sweden	0.05**	0.04**	0.02**	0.14	0.24	0.13
USA	0.88	0.28	0.33	0.29	0.48	0.39

Note: recorded results are p-values of Wald tests on all the coefficients of the independent variable.

Table 6.C.16: Positive Spillovers - Granger Causality Tests - Finance and Total Industry

Country	Y = finance			Y = Total Industry		
	k = 1	k = 2	k = 3	k = 1	k = 2	k = 3
Belgium	0.06*	0.17	0.19	0.20	0.27	0.31
Denmark	0.04**	0.04**	0.11	0.14	0.42	0.60
Finland	0.01**	0.03**	0.01***	0.37	0.14	0.45
France	0.41	0.54	0.24	0.90	0.18	0.48
Germany	0.01***	0.06*	0.01***	0.76	0.42	0.23
Italy	0.75	0.48	0.08*	0.94	0.15	0.29
Sweden	0.03**	0.02**	0.06*	0.06*	0.29	0.08*
USA	0.81	0.92	0.67	0.02**	0.10*	0.12

Note: recorded results are p-values of Wald tests on all the coefficients of the independent variable.

Table 6.C.17: FNI - Labour Productivity - Unit Root Tests

Industry	Country	ADF Test	
		k = 1	**k = 3**
Manufacturing	Australia	-1.02	-1.71
	Canada	0.29	0.78
	Denmark	-1.28	-1.99
	Finland	0.24	1.55
	France	-0.51	0.36
	Japan	-1.26	-1.83
	Sweden	0.55	0.39
	UK	0.46	1.40
	USA	-0.38	0.36
Services	Australia	-0.23	-1.00
	Canada	-1.85	-2.38
	Denmark	0.66	0.69
	Finland	-0.39	0.82
	France	-0.12	1.04
	Japan	-1.82	-0.96
	Sweden	-0.88	-0.87
	UK	-1.65	-1.51
	USA	-1.69	-1.14
Total Industry	Australia	-0.90	-2.01
	Canada	-0.10	0.29
	Denmark	-0.12	-0.71
	Finland	-1.00	0.06
	France	-0.37	0.61
	Japan	-1.53	-1.43
	Sweden	-0.23	-0.30
	UK	-0.13	0.43
	USA	-0.52	-0.01

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.18: FNI - Prices - Unit Root Tests

Industry	**Country**	**ADF Test**	
		k = 1	**k = 3**
Manufacturing	Australia	-0.57	0.58
	Canada	-2.47	-0.01
	Denmark	-2.24	-1.73
	Finland	-0.08	0.95
	France	-0.40	0.26
	Japan	0.74	1.01
	Sweden	1.16	1.13
	UK	-0.39	-0.41
	USA	0.06	0.68
Services	Australia	-0.37	0.62
	Canada	-1.31	-1.55
	Denmark	-0.19	-0.10
	Finland	-1.62	-2.11
	France	0.28	0.79
	Japan	-2.51	-2.35
	Sweden	-0.02	-0.58
	UK	-1.00	-0.74
	USA	-0.43	-0.57
Total Industry	Australia	-0.20	0.95
	Canada	-2.07	-0.47
	Denmark	0.76	0.93
	Finland	0.16	-0.01
	France	0.77	1.20
	Japan	-1.72	-1.73
	Sweden	1.18	1.32
	UK	-0.40	-0.57
	USA	-0.29	-0.25

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.19: FNI - Baumol's - Engle-Granger Cointegration

Industry	**Country**	**ADF Statistic**			
		G to S	**k**	**k = 0**	**k = 1**
Manufacturing	Australia	-2.04	0	-2.04	-2.19
	Canada	-3.52**	1	-1.94	-3.52**
	Denmark	-3.53**	0	-3.53**	-3.80**
	Finland	-2.13	1	-1.45	-2.13
	France	-3.51**	3	-2.53	-3.43**
	Japan	-0.45	0	-0.45	-0.85
	Sweden	-2.98	3	-1.68	-2.30
	UK	-2.17	3	-1.58	-1.60
	USA	-1.71	0	-1.71	-2.10
Services	Australia	-3.21*	0	-3.21*	-2.90
	Canada	-3.54**	0	-3.54**	-2.98
	Denmark	-2.52	0	-2.52	-2.93
	Finland	-1.70	1	-1.70	-1.13
	France	-2.30	0	-2.30	-2.30
	Japan	-2.56	1	-1.85	-2.56
	Sweden	-1.52	0	-1.52	-1.68
	UK	-1.10	0	-1.10	0.39
	USA	-2.10	0	-2.10	-2.52
Total Industry	Australia	-1.73	0	-1.73	-1.70
	Canada	-2.10	0	-2.10	-2.81
	Denmark	-1.81	0	-1.81	-1.68
	Finland	-1.21	3	-0.30	-0.87
	France	-2.52	0	-2.52	-2.62
	Japan	-1.58	0	-1.58	-2.59
	Sweden	-2.82	3	-1.63	-1.73
	UK	-2.08	3	-1.54	-1.36
	USA	-1.95	3	-1.93	-2.66

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 6.C.20: FNI - Baumol's - Johansen Cointegration

Industry	Country	Trace	Max	k
Manufacturing	Australia	21.86**	17.88**	1
	Canada	18.53	15.17	1
	Denmark	26.38***	15.49	1
	Finland	13.74	8.03	1
	France	16.29	13.44	1
	France	27.50***	21.18***	3
	Japan	14.11	10.69	1
	Sweden	16.68	10.60	1
	Sweden	14.36	10.44	3
	UK	12.28	9.65	1
	UK	32.90***	23.45***	3
	USA	13.66	9.30	1
Services	Australia	11.96	7.49	1
	Canada	14.08	14.52	1
	Denmark	12.88	8.69	1
	Finland	15.95	12.39	1
	France	10.37	6.82	1
	Japan	18.87	11.83	1
	Sweden	16.18	11.18	1
	UK	4.90	3.20	1
	USA	24.31**	18.80**	1
Total Industry	Australia	16.60	13.46	1
	Canada	17.20	11.80	1
	Denmark	18.25	15.02	1
	Finland	10.91	7.04	1
	Finland	50.02***	36.95***	3
	France	13.01	9.28	1
	Japan	13.66	10.18	1
	Sweden	13.03	8.77	1
	Sweden	13.70	9.28	3
	UK	14.11	10.40	1
	UK	28.28***	18.83**	3
	USA	27.28***	20.49***	1
	USA	22.80**	19.06***	3

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67.

Table 6.C.21: FNI - Baumol's Restriction - Unit Root Tests

Industry	**Country**	**ADF Statistic**			
		G to S	**k**	**k = 0**	**k = 1**
Manufacturing	Australia	-1.97	0	-1.97	-2.12
	Canada	-1.50	0	-1.50	-1.38
	Denmark	-1.07	0	-1.07	-1.15
	Finland	-1.82	3	-1.37	-1.64
	France	-1.12	0	-1.12	-1.22
	Japan	-0.80	0	-0.80	-1.35
	Sweden	-1.67	0	-1.67	-1.77
	UK	-0.53	2	-0.60	-1.48
	USA	-2.25	0	-2.25	-2.25
Services	Australia	-1.88	0	-1.88	-1.72
	Canada	-3.79***	0	-3.79***	-3.46**
	Denmark	-0.47	0	-0.47	-0.60
	Finland	-1.46	1	-1.46	-1.05
	France	-1.59	0	-1.59	-1.76
	Japan	-1.76	0	-1.76	-2.45
	Sweden	-3.80**	3	-1.75	-2.10
	UK	-0.11	0	-0.11	0.76
	USA	-2.68*	0	-2.68*	-3.75***
Total Industry	Australia	-1.83	0	-1.83	-1.73
	Canada	-2.53	0	-2.53	-2.71
	Denmark	-0.78	0	-0.78	-0.90
	Finland	-2.88*	0	-2.88*	-2.10
	France	-0.67	2	-1.35	-1.12
	Japan	-2.38	1	-1.66	-2.38
	Sweden	-2.11	0	-2.11	-1.72
	UK	-2.89*	0	-2.89*	-1.28
	USA	-3.38**	0	-3.38**	-4.65***

Note: The ADF tests for unit roots have a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.22: FNI - Baumol's - Cointegration Summary

Industry	Country	Engle-Granger	Johansen	Baumol's Restriction
Manufacturing	Australia	x	✓	x
	Canada	✓	x	x
	Denmark	✓	✓	x
	Finland	x	x	x
	France	✓	✓	x
	Japan	x	x	x
	Sweden	x	x	x
	UK	x	✓	x
	USA	x	x	x
Services	Australia	✓	x	x
	Canada	✓	x	✓
	Denmark	x	x	x
	Finland	x	x	x
	France	x	x	x
	Japan	x	x	x
	Sweden	x	x	✓
	UK	x	x	x
	USA	x	✓	✓
Total Industry	Australia	x	x	x
	Canada	x	x	x
	Denmark	x	x	x
	Finland	x	✓	✓
	France	x	x	x
	Japan	x	x	x
	Sweden	x	x	x
	UK	x	✓	✓
	USA	x	✓	✓

Table 6.C.23: FNI - Baumol's - Time Series Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Manufacturing - Australia						
P	LP	-0.41** *-2.50*	0.23	1.84**	0,0	No
LP	P	-0.08 *-0.75*	0.03	2.53**	0,0	No
Manufacturing - Canada						
P	LP	-0.33* *-1.95*	0.26	1.32*	-	Yes
		-0.59*** *-3.55*	0.49	1.65**	0,1	No
LP	P	0.26 *1.58*	0.22	1.95**	-	Yes
		-0.13 *-0.73*	0.34	2.31**	1,0	No
Manufacturing - Denmark						
P	LP	-0.48*** *-2.75*	0.26	1.87**	0,0	No
LP	P	0.38 *1.10*	0.05	1.73**	0,0	No
Manufacturing - France						
P	LP	-0.41** *-2.39*	0.21	1.33*	-	No
		-0.51*** *-3.18*	0.42	1.84**	0,1	No
LP	P	0.11 *0.37*	0.01	1.36*	0,0	No
Manufacturing - UK						
P	LP	-0.16 *-1.03*	0.48	1.75**	0,0	Yes
LP	P	-0.11 *-0.76*	0.46	1.43*	0,0	Yes
Services - Australia						
P	LP	-0.49** *-2.73*	0.26	1.54**	-	No
		-0.67*** *-3.66*	0.43	1.92**	0,1	No
LP	P	0.14 *1.15*	0.06	2.13**	0,0	No
Services - Canada						
P	LP	-0.44** *-2.14*	0.24	2.24**	0,0	Yes
LP	P	0.90*** *3.05*	0.36	1.51*	0,0	Yes

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.C.23 continued

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Services - Sweden						
P	LP	-0.12 *-0.81*	0.03	2.24**	0,0	No
LP	P	0.17 *0.93*	0.04	1.65**	0,0	No
Services - USA						
P	LP	-0.26** *-2.07*	0.46	1.92**	0,0	Yes
LP	P	0.19 *1.03*	0.38	1.59**	0,0	Yes
Total Industry - Finland						
P	LP	-0.03 *-0.31*	0.01	1.01	-	No
		-0.09 *-0.86*	0.24	1.55**	0,1	No
LP	P	-0.03 *-0.33*	0.01	1.23	-	No
		-0.04 *-0.40*	0.15	1.81**	1,0	No
Total Industry - UK						
P	LP	-0.18 *-1.44*	0.45	1.52*	0,0	Yes
LP	P	0.06 *0.41*	0.40	1.32*	0,0	Yes
Total Industry - USA						
P	LP	-0.14 *-1.66*	0.64	1.31*	-	Yes
		-0.27** *-2.30*	0.40	1.97**	0,1	No
LP	P	0.05 *0.67*	0.60	1.46*	-	Yes
		-0.09 *-0.85*	0.25	1.61**	1,0	No

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.C.24: FNI - Wages - Unit Root Tests

Industry	Country	ADF Test	
		k = 1	k = 3
Finance	Australia	-0.35	0.34
	Canada	-1.64	0.55
	Denmark	0.54	0.74
	Finland	-0.88	-0.83
	France	-2.74*	-4.35***
	Japan	-3.21	-2.25
	Sweden	-1.01	-1.07
	UK	-1.13	-1.35
	USA	1.25	0.82
Manufacturing	Australia	-2.26	-2.20
	Canada	-0.39	0.30
	Denmark	-2.14	-2.58
	Finland	-0.33	0.83
	France	-2.94*	-3.13**
	Japan	-2.75*	-1.67
	Sweden	-0.81	-0.62
	UK	-1.22	-0.31
	USA	-0.71	-0.54
Services	Australia	-2.08	-2.26
	Canada	-2.69*	-1.19
	Denmark	-0.94	-1.58
	Finland	0.22	1.91
	France	-3.90***	-1.74
	Japan	-1.56	-0.34
	Sweden	-1.12	-1.18
	UK	-0.96	-1.41
	USA	-0.99	0.87
Total Industry	Australia	-1.75	-1.26
	Canada	-0.86	-0.28
	Denmark	-1.21	-1.51
	Finland	-1.21	-0.63
	France	-2.85*	-2.29
	Japan	-1.93	-1.90
	Sweden	-1.66	-1.70
	UK	-2.21	-1.34
	USA	-0.08	1.64

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.25: FNI - Wages - Engle-Granger Cointegration

Industries	Country	ADF Statistic			
		G to S	k	k = 0	k = 1
Finance + Manufacturing	Australia	-1.35	0	-1.35	-1.00
	Canada	-5.50***	1	-3.41**	-5.50***
	Denmark	-1.01	1	-0.94	-1.01
	Finland	-2.93	0	-2.16	-2.93
	France	-3.62**	2	-3.12*	-2.41
	Japan	-3.31*	3	-3.13*	-3.42**
	Sweden	-1.86	0	-1.86	-2.11
	UK	-3.56**	0	-3.56**	-1.52
	USA	-2.84	3	-1.52	-1.77
Finance + Services	Australia	-1.44	0	-1.44	-1.01
	Canada	-0.79	3	-2.23	-2.95
	Denmark	-1.55	0	-1.55	-1.26
	Finland	-1.81	0	-1.81	-2.10
	France	-3.80**	1	-3.80**	-3.22
	Japan	-3.09*	0	-3.09*	-2.04
	Sweden	-1.76	0	-1.76	-2.33
	UK	-2.97	1	-4.03***	-2.97
	USA	-2.11	1	-2.60	-2.11
Finance + Total Industry	Australia	-1.73	0	-1.73	-1.31
	Canada	-4.58***	1	-2.53	-4.58***
	Denmark	-1.37	0	-1.37	-1.47
	Finland	-3.21*	1	-3.21*	-2.33
	France	-3.49**	2	-3.06*	-2.42
	Japan	-3.85	3	-1.77	-2.65
	Sweden	-2.08	1	-1.61	-2.08
	UK	-2.26	3	-2.82	-1.35
	USA	-2.46	0	-2.46	-2.72

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 6.C.26: FNI - Wages - Johansen Cointegration

Industries	Country	Trace	Max	k
Finance + Manufacturing	Australia	12.46	10.64	1
	Canada	31.53***	28.32***	1
	Denmark	15.79	9.84	1
	Finland	18.39	11.71	1
	France	19.84	13.55	1
	France	30.87***	17.66**	2
	Japan	23.27**	12.49	1
	Japan	21.64**	13.78	3
	Sweden	20.38**	17.65**	1
	UK	20.51**	18.49**	1
	USA	20.92**	11.22	1
	USA	20.72**	11.20	3
Finance + Services	Australia	10.10	8.51	1
	Canada	20.74**	14.86	1
	Canada	10.34	8.06	3
	Denmark	16.50	11.91	1
	Finland	13.68	8.43	1
	France	32.56***	21.04***	1
	Japan	16.23	11.84	1
	Sweden	14.50	10.69	1
	UK	11.87	9.34	1
	USA	29.35***	21.03***	1
Finance + Total Industry	Australia	10.13	8.38	1
	Canada	24.55**	19.64**	1
	Denmark	17.93	13.06	1
	Finland	16.21	10.43	1
	France	16.97	11.41	1
	France	24.81***	16.37**	2
	Japan	17.92	10.36	1
	Japan	28.02***	21.62***	3
	Sweden	20.45**	16.69**	1
	UK	14.20	12.08	1
	UK	21.53**	13.44	3
	USA	25.20***	17.05**	1

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67.

Table 6.C.27: FNI - Wages - Cointegration Summary

Industries	Country	Engle-Granger	Johansen
Finance + Manufacturing	Australia	x	x
	Canada	✓	✓
	Denmark	x	x
	Finland	x	x
	France	✓	✓
	Japan	✓	✓
	Sweden	x	✓
	UK	✓	✓
	USA	x	✓
Finance + Services	Australia	x	x
	Canada	x	✓
	Denmark	x	x
	Finland	x	x
	France	✓	✓
	Japan	✓	x
	Sweden	x	x
	UK	✓	x
	USA	x	✓
Finance + Total Industry	Australia	x	x
	Canada	✓	✓
	Denmark	x	x
	Finland	✓	x
	France	✓	✓
	Japan	x	✓
	Sweden	x	✓
	UK	x	✓
	USA	x	✓

Table 6.C.28: FNI - Wages - Time Series Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Canada						
Finance	Manufacturing	-0.39***	0.41	1.54**	-	Yes
		-3.47				
		-0.46***	0.50	1.84**	0,1	Yes
		-4.16				
Manufacturing	Finance	0.05	0.01	1.02	-	No
		0.49				
		0.51***	0.64	2.16**	0,1	Yes
		5.68				
Sweden						
Finance	Manufacturing	-0.42***	0.30	2.07**	0,0	No
		-2.81				
Manufacturing	Finance	-0.17	0.09	1.88**	0,0	No
		-1.28				
UK						
Finance	Manufacturing	-0.51***	0.46	1.37*	0,0	Yes
		-3.12				
Manufacturing	Finance	0.21**	0.27	2.25**	0,0	Yes
		2.05				
USA						
Finance	Manufacturing	-0.09*	0.43	1.04	0,0	Yes
		-1.72				
Manufacturing	Finance	0.06*	0.43	1.39*	0,0	Yes
		1.88				
Japan						
Finance	Services	-0.45***	0.47	2.16**	-	Yes
		-2.23				
		-0.21	0.27	1.86**	1,0	No
		-0.91				
Services	Finance	0.48***	0.55	1.32*	-	Yes
		3.02				
		0.17	0.61	1.43*	1,0	Yes
		1.44				
UK						
Finance	Services	-0.43**	0.22	1.24	0,0	No
		-2.74				
Services	Finance	-0.37**	0.20	1.91**	0,0	No
		-2.75				
USA						
Finance	Services	-0.05	0.24	1.17*	0,0	Yes
		-0.60				
Services	Finance	0.19***	0.50	1.77**	0,0	Yes
		4.01				

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.C.28 continued

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Canada						
Finance	Total Industry	-0.35** *-2.23*	0.53	1.46*	-	Yes
		-0.17 *-0.67*	0.19	1.49**	0,1	No
Total Industry	Finance	0.19 *0.52*	0.44	1.21	-	Yes
		0.34*** *4.78*	0.65	1.35*	0,1	Yes
Finland						
Finance	Total Industry	-0.38** *-2.41*	0.57	1.49*	-	Yes
		-0.68** *-2.74*	0.36	2.15	0,1	No
Total Industry	Finance	0.26 *1.50*	0.52	1.27*	-	Yes
		0.16 *0.99*	0.53	1.88**	0,1	Yes
Japan						
Finance	Total Industry	-0.57** *-2.30*	0.62	1.81**	-	Yes
		-0.49 *-1.47*	0.32	1.82**	1,0	No
Total Industry	Finance	0.34** *2.18*	0.56	1.18*	-	Yes
		0.26** *2.61*	0.76	2.50**	0,1	Yes
Sweden						
Finance	Total Industry	-0.34* *-2.01*	0.39	1.54	0,0	Yes
Total Industry	Finance	-0.04 *-0.24*	0.28	0.93	0,0	Yes
UK						
Finance	Total Industry	-0.33** *-2.07*	0.39	1.21*	0,0	Yes
Total Industry	Finance	0.09 *1.55*	0.25	1.76*	0,0	Yes
USA						
Finance	Total Industry	-0.10 *-1.32*	0.58	0.87	0,0	Yes
Total Industry	Finance	0.13** *2.48*	0.66	1.67**	0,0	Yes

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Table 6.C.29: FNI - Positive Spillovers - Unit Root Tests

Industry	**Country**	**ADF Test**	
		k = 1	**k = 3**
Finance	Australia	-2.33	-2.49
	Canada	-3.89***	-2.42
	Denmark	-1.11	-1.11
	Finland	0.72	0.90
	France	-2.66*	-2.19
	Japan	-1.34	-0.25
	Sweden	-1.62	-2.28
	UK	-0.71	-0.58
	USA	-0.73	-0.89
Manufacturing	Australia	-0.69	0.04
	Canada	-0.44	0.34
	Denmark	-1.80	-1.56
	Finland	0.96	2.18
	France	-1.69	-1.49
	Japan	-1.89	-1.11
	Sweden	0.95	1.42
	UK	0.31	1.50
	USA	-0.34	0.72
Services	Australia	0.43	0.86
	Canada	-2.49	-2.59
	Denmark	-1.96	0.90
	Finland	1.52	3.21**
	France	-0.80	-0.15
	Japan	-0.96	0.07
	Sweden	-1.40	-0.88
	UK	-2.08	-1.81
	USA	-3.09**	-1.79
Total Industry	Australia	-0.39	-0.34
	Canada	-0.88	-0.30
	Denmark	-1.04	-0.20
	Finland	0.42	1.22
	France	-2.61	-1.71
	Japan	-1.48	-0.58
	Sweden	-0.39	0.35
	UK	-0.87	-0.47
	USA	-0.42	0.83

Note: The ADF test for unit roots include a constant.

* 10% level, ** 5% level, *** 1% level

Table 6.C.30: FNI - Positive Spillovers - Engle-Granger Cointegration

Industries	**Country**	**ADF Statistic**			
		G to S	**k**	**k = 0**	**k = 1**
Finance + Manufacturing	Australia	0.86	3	-0.36	-0.62
	Canada	-0.87	0	-0.87	-0.77
	Denmark	-3.32*	0	-3.32*	-3.60**
	Finland	-3.45**	2	-1.91	-2.43
	France	-1.58	1	-0.71	-1.58
	Japan	-1.89	0	-2.14	-1.89
	Sweden	-0.71	0	-0.76	-0.71
	UK	-1.60	0	-1.74	-1.60
	USA	-2.61	1	-3.01	-2.61
Finance + Services	Australia	-0.05	1	-0.08	-0.05
	Canada	-2.24	0	-2.24	-2.69
	Denmark	-1.24	0	-1.24	-1.13
	Finland	-4.23***	2	-2.14	-3.18
	France	-1.29	1	-0.45	-1.29
	Japan	-3.12*	1	-2.08	-3.12*
	Sweden	-1.75	0	-1.75	-1.76
	UK	-2.16	1	-1.71	-2.16
	USA	-2.95	0	-2.95	-2.23
Finance + Total Industry	Australia	1.15	3	-0.57	-0.31
	Canada	-1.38	0	-1.38	-1.28
	Denmark	-2.97	0	-2.97	-3.36**
	Finland	-3.50**	2	-2.17	-2.67
	France	-0.59	0	-0.59	-1.46
	Japan	-2.94	1	-1.94	-2.94
	Sweden	-1.01	1	-1.44	-1.01
	UK	-1.30	0	-1.30	-2.00
	USA	-2.71	0	-2.71	-2.50

Note: All the cointegrating regressions include a constant.

The ADF tests for unit roots have no constant and no trend.

* 10% level, ** 5% level, *** 1% level

Table 6.C.31: FNI - Positive Spillovers - Johansen Cointegration

Industries	Country	Trace	Max	k
Finance + Manufacturing	Australia	27.09***	20.90***	1
	Australia	13.74	9.46	3
	Canada	19.09	16.45**	1
	Denmark	19.12	11.80	1
	Finland	28.07***	23.11***	1
	Finland	36.91***	26.26***	3
	France	23.75**	15.20	1
	Japan	16.70	12.60	1
	Sweden	12.95	7.91	1
	UK	13.54	10.02	1
	USA	17.33	14.50	1
Finance + Services	Australia	14.88	10.08	1
	Canada	26.08***	16.02**	1
	Denmark	13.79	10.67	1
	Finland	14.89	10.01	1
	Finland	29.70***	17.54**	2
	France	20.69**	15.47	1
	Japan	19.64	15.22	1
	Sweden	17.51	14.64	1
	UK	10.85	8.11	1
	USA	19.30	14.08	1
Finance + Total Industry	Australia	26.39***	19.36**	1
	Australia	24.09**	17.13**	3
	Canada	17.53	14.35	1
	Denmark	32.82***	22.10***	1
	Finland	19.91	15.32	1
	Finland	44.04***	30.99***	2
	France	22.11**	13.25	1
	Japan	15.05	10.90	1
	Sweden	14.42	9.43	1
	UK	12.24	6.81	1
	USA	15.95	14.03	1

Note: ** 5% level, *** 1% level. The critical values are taken from Case 1* in Osterwald-Lenum (1992). For the trace statistic the 1% value is 24.60 and the 5% value is 19.96. For the max statistic the 1% value is 20.20 and the 5% value is 15.67.

Table 6.C.32: FNI - Positive Spillovers - Cointegration Summary

Industries	Country	Engle-Granger	Johansen
Finance + Manufacturing	Australia	x	✓
	Canada	x	✓
	Denmark	✓	x
	Finland	✓	✓
	France	x	✓
	Japan	x	x
	Sweden	x	x
	UK	x	x
	USA	x	x
Finance + Services	Australia	x	x
	Canada	x	✓
	Denmark	x	x
	Finland	✓	✓
	France	x	✓
	Japan	✓	x
	Sweden	x	x
	UK	x	x
	USA	x	x
Finance + Total Industry	Australia	x	✓
	Canada	x	x
	Denmark	✓	✓
	Finland	✓	✓
	France	x	✓
	Japan	x	x
	Sweden	x	x
	UK	x	x
	USA	x	x

Table 6.C.33: FNI - Positive Spillovers - Time Series Error-Correction Models

Y	X	EC term	R^2	DW	X,Y lags	D(X)
Australia						
Finance	Manufacturing	0.01 *0.34*	0.15	2.03**	0,0	Yes
Manufacturing	Finance	-0.01 *-0.27*	0.01	2.65**	0,0	No
Denmark						
Finance	Manufacturing	-0.13** *-2.10*	0.19	2.01**	0,0	No
Manufacturing	Finance	-0.14*** *-3.70*	0.25	1.23	0,0	No
Finland						
Finance	Manufacturing	0.06 *1.68*	0.31	1.28*	-	Yes
		0.07* *1.78*	0.35	1.85**	0,1	No
Manufacturing	Finance	-0.11 *-1.41*	0.27	1.75**	0,0	Yes
Japan						
Finance	Services	0.22 *1.56*	0.04	1.43*	-	No
		0.46** *2.43*	0.38	2.07**	1,1	No
Services	Finance	-0.20 *-1.67*	0.12	1.37*	0,0	No
Australia						
Finance	Total Industry	0.01 *0.18*	0.01	2.02**	0,0	No
Total Industry	Finance	-0.02 *-0.88*	0.11	2.83**	0,0	Yes
Denmark						
Finance	Total Industry	-0.06 *-0.93*	0.49	1.84**	0,0	Yes
Total Industry	Finance	-0.04 *-1.66*	0.53	2.31**	0,0	Yes
Finland						
Finance	Total Industry	0.07* *1.94*	0.11	0.94	-	No
		0.09* *1.91*	0.33	1.75**	0,1	No
Total Industry	Finance	-0.10* *-1.82*	0.32	1.40*	0,0	Yes

Note: 23 observations when no lags, White heteroskedasticity-consistent standard errors, t-statistics in italics, * 10% level, ** 5% level, *** 1% level. DW statistic: ** means d>du (no autocorrelation), *means dl<d<du (inconclusive). Both the cointegrating equations and the ECM equations include a constant and are estimated by ordinary least squares. The result with no lags is shown first, then the result with G to S lags. If these two results are the same then only one result is shown.

Chapter 7

Conclusion

Goldsmith (1969), in his seminal empirical contribution to the finance and growth literature, poses the question: "does finance make a difference?"[1] The subsequent literature has generally given a positive answer to this question. This thesis adds to the literature in a number of ways.

The first aim of this research is to apply the literature to Ireland: does finance make a difference in Ireland? Our first two empirical papers address this question.

Chapter Three shows that the addition of finance to a standard growth model helps to explain Ireland's growth performance. Ireland's economic growth performance is less distinctive when finance is included as a regressor. We examine this distinctiveness using both the residuals for Ireland and a dummy variable for Ireland. Both measures decrease when finance is added to the model.

In particular, it is Ireland's level of financial development in 1960 that seems to be important. Ireland appears to have a well developed financial system at the start of the period of our study. Unfortunately, the exact size of this development and thus its effect, cannot be accurately determined due to a data problem.

The original question becomes more interesting when one considers the change in Ireland's economic fortunes. Did finance play a role in this improvement? We find that the financial sector has played a part in the *Celtic Tiger*. Our key result, that Ireland's growth performance is less distinctive when finance is accounted for, holds in a fixed effects regression. Improvements in Ireland's financial system help to explain improvements in Ireland's growth rate. Furthermore, when Ireland's growth rate increases, during the period 1986 - 1995, our key result again holds. Nonetheless, it is of a smaller magnitude, relative to the full period: 1960 - 1995.

Our next paper explores the time series dimension of the data, to confirm this result. It provides strong evidence that finance and growth in Ireland are cointegrated. This means that they move together and have a long-run equilibrium relationship. We also find that foreign financial systems play an important role in this process.

Chapter Four also allows us to be more precise in answering the original question: does finance actually *make* a difference or does it merely follow growth? Time series analysis is more adroit than cross-sectional methods in addressing the causality issue. We find that growth is the causal variable in this relationship. Finance does not Granger cause growth in Ireland. Nevertheless, it has played a supportive role and has not hindered economic development in Ireland.

There are possibilities for future research in this direct area. For example the range of financial activity that is being captured by the financial proxies could be increased. Stock market measures such as stock market capitalization, liquidity and volatility could be used.

[1] Goldsmith (1969, p408).

The thesis then turns its attention back to the international literature on finance and growth. In the next two empirical papers we address some imbalances in this literature.

The majority of the empirical studies to date use proxies for finance which measure the role of domestic institutions. In Chapter Five we look at the impact of foreign institutions on growth. We find a positive result for foreign liabilities in the period 1960 - 1995. This result is for non-OECD countries, who use foreign liabilities to compensate for underdeveloped domestic financial systems.

Our other significant result shows that it is important how this foreign finance is intermediated. In the sub-period 1980 - 1998, foreign credit to the domestic non-bank sector has a negative influence on economic growth. This is also for the non-OECD sample. We interpret this to reflect the dangers of exposure to extreme currency movements. Interestingly, we find that this result does not occur when foreign liabilities is examined for the same time period. Foreign liabilities measures foreign finance to resident financial institutions. This implies that when foreign finance is intermediated through such institutions, rather than lent directly to the domestic non-bank sector like foreign credit, more of the risks are hedged. Thus, we conclude that countries with relatively shallow domestic financial systems can compensate for this shortcoming using foreign finance. It is best if such finance is intermediated through resident financial institutions.

Chapter Five also finds some new results on the relation between domestic finance and growth. Private credit is the main domestic finance measure in the literature and its relation with economic growth is one of the key findings in this research area. We show that this relation is fragile in certain respects. It does not seem to hold in more recent time periods or in a non-OECD subsample for the longest time period, 1960 - 1995.

The majority of the existing finance-growth literature looks at finance's effect on the overall economy. Chapter Six adds to this literature by using a sectoral approach. This paper focuses on labour productivity in the financial sector and its relation with other sectors. We find a number of interesting results here. First, as expected, we find evidence that labour productivity growth in the financial sector leads to labour productivity growth in other industries. Second, we show that the potential negative effect of financial labour productivity is not present in this dataset. Cost disease does exist here but finance is not the causal industry. This result is due to relatively low productivity growth in finance. This is partially explained by our third finding: the lack of convergence in financial labour productivity across countries. This implies that one possible source of productivity growth, technology transfer (Bernard and Jones, 1996c), is not being fully exploited.

Chapter Six also highlights the role of financial centres. We find that finance is more likely to cause positive spillovers in countries that act as financial centres. In addition, some countries, notably the USA, may experience negative effects of productivity growth in finance, possibly through resource competition. Furthermore, the USA, the world's biggest financial centre, is the one country where we found some evidence to suggest that finance may be causing cost disease in other sectors.

This thesis extends the existing literature in several respects. In applying this literature to Ireland we find that finance is important. It may be more accurate, however, to say that finance facilitated a difference, rather than making a difference per se. When extending the literature to include foreign finance, we see that finance does make a difference. In this case the difference can be negative or positive, depending on how finance is intermediated. With regard to the final strand of this thesis, the sectoral approach, we can more confidently answer Goldsmith's question in the affirmative: finance does make a difference.

References

[1] Acemoglu, D., S. Johnson and J.A. Robinson (2001). "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review*, Vol. 91, No. 5, pp. 1369-1401.

[2] Acemoglu, D. and F. Zilibotti (1997a). "Was Prometheus Unbound by Chance? Risk Diversification and Growth." *The Journal of Political Economy*, Vol. 105, No. 4, pp. 709-751.

[3] Acemoglu, D. and F. Zilibotti (1997b). "Agency Costs in the Process of Development." Mimeograph, Massachusetts Institute of Technology.

[4] Acemoglu, D. and F. Zilibotti (2001). "Productivity Differences." *Quarterly Journal of Economics*, Vol. 116, pp. 563-606.

[5] Adler, M. and B. Dumas (1983). "International Portfolio Choice and Corporation Finance: A Synthesis." *Journal of Finance*, Vol. 38, No. 3, pp. 925-984.

[6] Agung, J. and J.L. Ford (1998). "Financial Development, Liberalisation and Economic Development in Indonesia, 1966-1996: Cointegration and Causality." Economics Discussion Paper 98-12, The University of Birmingham.

[7] Agung, J. and J.L. Ford (1999). "Economic Development, Financial Development and Deregulation: Japan, 1960-1996." Economics Discussion Paper 99-04, The University of Birmingham.

[8] Arestis, P. and P. Demetriades (1997). "Financial Development and Economic Growth: Assessing the Evidence." *The Economic Journal,* Vol. 107, May, pp. 783-799.

[9] Arellano, M. and S. Bond (1991). "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *Review of Economic Studies*, Vol. 17, pp. 277-297.

[10] Arellano, M. and O. Bover (1995). "Another Look at the Instrumental-Variable Estimation of Error-Components Models." *Journal of Econometrics*, Vol. 68, pp. 29-52.

[11] Asea, P.K. and W.M. Corden (1994). "The Balassa-Samuelson Model: An Overview." *Review of International Economics*, Vol. 2, No. 3, pp. 199-200.

[12] Asea, P.K. and E.G. Mendoza (1994). "The Balassa-Samuelson Model: A General Equilibrium Appraisal." *Review of International Economics*, Vol. 2, No. 3, pp. 244-267.

[13] Atje, R. and B. Jovanovic (1993). "Stock Markets and Development." *European Economic Review*, Vol. 37, pp. 632-640.

[14] Balassa, B. (1964). "The Purchasing-Power Parity Doctrine: A Reappraisal." *The Journal of Political Economy*, Vol. 72, No. 6, pp. 584-596.

[15] Baltagi, B.H. (2001). *Econometric Analysis of Panel Data.* Chichester: Wiley.

[16] Banerjee, A. (1999). "Panel Data Unit Roots and Cointegration: An Overview." Oxford Bulletin of Economics and Statistics, special issue, pp. 607-629.

[17] Banerjee, A. J. Dolado, J.W. Galbraith and D.F. Hendry (1993). *Cointegration, Error Correction and the Econometric Analysis of Non Stationary Data.* Oxford: Oxford University Press.

[18] Barro, R.J. (1991). "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics,* Vol. 106, pp. 407-444.

[19] Barry, F. (1999). *Understanding Ireland's Economic Growth.* London: Macmillan.

[20] Baumol, W.J. (1967). "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis." *American Economic Review*, Vol. 57, Issue 3, pp. 415-426.

[21] Baumol, W.J. (1991). "Technological Imperatives, Productivity and Insurance Costs." *The Geneva Papers*, Vol. 59, pp. 154-165.

[22] Bayoumi, T. (1990). "Saving-Investment Correlations: Immobile Capital, Government Policy or Endogenous Behaviour?" *IMF Staff Papers*, Vol. 37, No. 2, pp. 360-387.

[23] Beck, T., A. Demirguc-Kunt and R. Levine (1999). "A New Database on Financial Development and Structure." Mimeograph, University of Minnesota.

[24] Beck, T., A. Demirguc-Kunt and R. Levine (2002). "Law, Endowments, and Finance." Mimeograph, University of Minnesota.

[25] Beck, T. and R. Levine (2001). "Stock Markets, Banks and Growth: Correlation or Causality." Mimeograph, University of Minnesota.

[26] Beck, T., R. Levine and N. Loayza (2000). "Finance and the Sources of Growth." *Journal of Financial Economics*, Vol. 58, pp. 261-300.

[27] Ben-David, D. (1996). "Trade and Convergence Among Countries." *Journal of International Economics*, Vol. 40, pp. 279-298.

[28] Bencivenga, V.R. and B.D. Smith (1991). "Financial Intermediation and Endogenous Growth." *The Review of Economic Studies*, Vol. 58, No. 2, pp. 195-209.

[29] Benhabib, J. and M.M. Spiegel (2000). "The Role of Financial Development in Growth and Investment." *Journal of Economic Growth*, Vol. 5, pp. 341-360.

[30] Berger, A.N. and G.F. Udell (1995). "Relationship Lending and Lines of Credit in Small Firm Finance." *Journal of Business*, Vol. 68, No. 3, pp. 351-381.

[31] Berkowitz, D., K. Pistor and J-F. Richard (2002). "Economic Development, Legality and the Transplant effect." *European Economic Review*, forthcoming.

[32] Bernard, A.B. and S.N. Durlauf (1996a). "Convergence in International Output." *Journal of Applied Econometrics*, Vol. 10, No. 2, pp. 97-108.

[33] Bernard, A.B. and S.N. Durlauf (1996b). "Interpreting Tests of the Convergence Hypothesis." *Journal of Econometrics*, Vol. 71, pp. 161-173.

[34] Bernard, A.B. and C.I. Jones (1996a). "Productivity Across Industries and Countries: Time Series Theory and Evidence." *The Review of Economics and Statistics*, Vol. 78, No. 1, pp. 135-146.

[35] Bernard, A.B. and C.I. Jones (1996b). "Comparing Apples to Oranges: Productivity Convergence and Measurement Across Industries and Countries." *American Economic Review*, Vol. 86, No. 5, pp. 1216-1238.

[36] Bernard, A.B. and C.I. Jones (1996c). "Technology and Convergence." *The Economic Journal*, Vol. 106, No. 437, pp. 1037-1044.

[37] Bernard, A.B. and C.I. Jones (2000). "Comparing Apples to Oranges: Reply." Mimeograph, Stanford University.

[38] Blanchard, O. (2000). "Country Adjustments Within Euroland. Lessons After Two Years." Mimeograph, Massachusetts Institute of Technology.

[39] Bond, S., A. Hoeffler and J. Temple (2001). "GMM Estimation of Empirical Growth Models." Mimeograph, University of Bristol.

[40] Bonser-Neal, C. and K.L. Dewenter (1996). "Does Financial Market Development Stimulate Savings? Evidence From Emerging Market Stock Markets." Federal Reserve Bank of Kansas City Research Working paper RWP 96-09.

[41] Breitung, J. (2000). "The Local Power of Some Unit Root Tests for Panel Data." *Advances in Econometrics*, Vol. 15, pp. 161-177.

[42] Brock, P.L. (1994). "Economic Development and the Relative Price of Nontradables: Global Dynamics of the Krueger-Deardorff-Leamer Model." *Review of International Economics*, Vol. 2, No. 3, pp. 268-283.

[43] Brock, P.L. and S.J. Turnovsky (1994). "The Dependent-Economy Model with Both Traded and Nontraded Capital Goods." *Review of International Economics*, Vol. 2, No. 3, pp. 306-325.

[44] Cameron, R. (1967). *Banking in the Early Stages of Industrialization.* New York: Oxford University Press.

[45] Campbell, J.Y. and P. Perron (1991). "Pitfalls and Opportunities: What Macroeconomists Should Know about Unit Roots." *NBER Macroeconomics Annual*, London: MIT Press.

[46] Cannon, E.S. and N.W. Duck (2000). "Galton's Fallacy and Economic Convergence." *Oxford Economic Papers*, Vol. 52, pp. 415-419.

[47] Canzoneri, M.B., R.E. Cumby and B. Diba (1999). "Relative Labor Productivity and the Real Exchange Rate in the Long Run: Evidence for a Panel of OECD countries." *Journal of International Economics*, Vol. 47, pp. 245-266.

[48] Caprio, G. and P. Honohan (2001). *Finance for Growth.* Washington: The World Bank, and New York: Oxford University Press.

[49] Carlino, G.A. and L.O. Mills (1993). "Are U.S. Regional Incomes Converging? A Time Series Analysis." *Journal of Monetary Economics*, Vol. 32, pp. 335-346.

[50] Carlino, G.A. and L.O. Mills (1996). "Are U.S. Regional Incomes Converging? Reply." *Journal of Monetary Economics*, Vol. 38, pp. 599–601.

[51] Carree, M.A., L. Klomp and A.R. Thurik (2000). "Productivity Convergence in OECD Manufacturing Industries." *Economics Letters*, Vol. 66, pp. 337-345.

[52] Caselli, F. G. Esquivel, and F. Lefort. (1996). "Reopening the Convergence Debate: A New Look at Cross-Country Growth Empirics." *Journal of Economic Growth*, Vol. 1, No. 3, pp. 363-90.

[53] Central Bank of Ireland (1983). *Annual Report 1983.* Dublin: Central Bank of Ireland.

[54] Charemza, W.W. and D.F. Deadman (1997). *New Directions in Econometric Practice.* Cheltenham: Edward Elgar.

[55] Chiang, M-H. and C. Kao (2000). "Nonstationary Panel Time Series Using NPT 1.1 - A User Guide." Mimeograph, Center for Policy Research, Syracuse University.

[56] Claessens, S, A. Demirguc-Kunt, and H. Huizinga (2001). "How Does Foreign Entry Affect Domestic Banking Markets?" *Journal of Banking and Finance*, Vol. 25, pp. 891-911.

[57] Cochrane, J.H. (1991). "Comment on Pitfalls and Opportunities: What Macroeconomists Should Know about Unit Roots." *NBER Macroeconomics Annual.* London: MIT Press.

[58] Cumby, R.E. and F.S. Mishkin (1986). "The International Linkage of Real Interest Rates: The European-U.S. Connection." *Journal of International Money and Finance*, Vol. 5, No. 1, pp. 5-23.

[59] Cumby, R.E. and M. Obstfeld (1984). "International Interest-Rate and Price-Level Linkages Under Flexible Exchange Rates: A Review of Recent Evidence." In J. Bilson and R. Marston (eds.) *Exchange Rate Theory and Practice.* Chicago: University of Chicago Press.

[60] Cuthbertson, K., S.G. Hall and M.P. Taylor (1992). *Applied Econometric Techniques.* London: Harvester Wheatsheaf.

[61] Daffin, C., G. Reed and P. Vaze (2002). "Labour Productivity Measures for the Non-Production Industries." *Economic Trends*, No. 579, pp. 41-56.

[62] Davidson, R., and J.G. MacKinnon (1993). *Estimation and Inference in Econometrics.* New York: Oxford University Press.

[63] de la Fuente, A. (1998). "What Kind of Regional Convergence." CEPR Discussion Paper No. 1543.

[64] de la Fuente, A. (2000). "Convergence Across Countries and Regions: Theory and Empirics." CEPR Discussion Paper No. 2465.

[65] de la Fuente, A. and X. Vives (1997). "The Sources of Irish Growth." In A. W. Gray (ed.) *International Perspectives on the Irish Economy.* Indecon Public Policy Series.

[66] De Gregorio, J. (1998). "Financial Integration, Financial Development and Economic Growth." Mimeograph, Universidad de Chile.

[67] De Gregorio, J., A Giovannini and T.H. Krueger (1994). "The Behaviour of Nontradable-Goods Prices in Europe: Evidence and Interpretation." *Review of International Economics*, Vol. 2, No. 3, pp. 284-305.

[68] De Gregorio, J., A Giovannini and H.C. Wolf (1994). "International Evidence on Tradables and Nontradables Inflation." *European Economic Review*, Vol. 38, pp. 1225-1244.

[69] De Gregorio, J. and P.E. Guidotti (1995). "Financial Development and Economic Growth." *World Development,* Vol. 23, No. 3, pp. 433-448.

[70] Demetriades, P.O. and K.A. Hussein (1996). "Does Financial Development Cause Economic Growth? Time Series Evidence from Sixteen Countries." *Journal of Development Economics,* Vol. 51, pp. 387-411.

[71] Demirguc-Kunt, A and R. Levine (2001). *Financial Structure and Economic Growth.* Massachusetts: MIT Press.

[72] Demirguc-Kunt, A. and V. Maksimovic (1998). "Law, Finance and Firm Growth." *The Journal of Finance*, Vol. 53, No. 6, pp. 2107-2137.

[73] Dollar, D. and E.N. Wolff (1988). "Convergence of Industry Labor Productivity among Advanced Economies 1963-1982." *The Review of Economics and Statistics*, Vol. 70, Issue 4, pp. 549-558.

[74] Dooley, M., J. Frankel and D.J. Mathieson (1987). "International Capital Mobility: What do the Saving-Investment Correlations Tell Us?" *IMF Staff Papers*, Vol. 34, No. 3, pp. 503-530.

[75] Doyle E. and E. O'Leary (1999). "The Role of Structural Change in Labour Productivity Convergence among Euopean Union Countries: 1970-1990." *Journal of Economic Studies*, Vol. 26, No. 2, pp. 106-120.

[76] Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2002). "Courts: the Lex Mundi Project." Mimeograph, Harvard University.

[77] Easterly, W. and R. Levine (2001). "Its Not Factor Accumulation: Stylized Facts and Growth Models." *World Bank Economic Review*, Vol.15, pp. 177-219.

[78] Enders, W. (1995). *Applied Econometric Time Series.* New York: John Wiley and Sons.

[79] Engle, R.F and C.W.J. Granger (1987). "Co-integration and Error Correction: Representation, Estimation and Testing." *Econometrica*, Vol. 55, No. 2, pp. 251-276.

[80] Estrada, A. and J.D. Lopez-Salido (2001). "Understanding Spanish Dual Inflation." Mimeograph, Banco de Espana.

[81] Fecher, F. and P. Pestieau (1993). "Efficiency and Competition in OECD financial services." In H.O. Fried, C.A. Knox Lovell and S.S. Schmidt (eds.) *The Measurement of Productive Efficiency.* Oxford University Press: New York.

[82] Feldstein, M.S. and C. Horioka (1980). "Domestic Savings and International Capital Flows." *Economic Journal,* Vol. 90, pp. 314-329.

[83] Fernandez, D.G. and A. Galetovic (1994). "Schumpter Might be Right - but Why? Explaining the Relation Between Finance, Development and Growth." Mimeograph, The John Hopkins University.

[84] Fischer, S. (1993). "The Role of Macroeconomic Factors in Growth." *Journal of Monetary Economics,* Vol. 32, pp. 485-512.

[85] Ford, J.L. (1997). "Economic Development, Financial Development and Liberalisation: Taiwan, 1960-1995." Economics Discussion Paper, 97-25, The University of Birmingham.

[86] French, K.R. and J.M. Poterba (1991). "Investor Diversification and International Equity Markets." NBER Working Paper No. 3609.

[87] Friedman, M. (1992). "Do Old Fallacies Ever Die?" *Journal of Economic Literature,* Vol. 30, pp. 2129-2132.

[88] Fry, M. J. (1997). "In Favour of Financial Liberalisation." *The Economic Journal,* Vol. 107, pp. 754-770.

[89] Galetovic, A. (1996). "Finance and Growth: A Synthesis and Interpretation of the Evidence." *Banca Nazionale del Lavoro Quarterly Review,* No. 196, pp. 59-86.

[90] Gallagher, L. (1995). "Interdependencies Among the Irish, British and German Stock Markets." *The Economic and Social Review,* Vol. 26, No. 2, pp. 131-147.

[91] Gemmell, N., T.A. Lloyd and M. Mathew (2000). "Agricultural Growth and Inter-Sectoral Linkages in a Developing Economy." *Journal of Agricultural Economics,* Vol. 51, No. 3, pp. 353-370.

[92] Gertler, M. (1988). "Financial Structure and Aggrgate Economic Activity: An Overview." *Journal of Money, Credit and Banking,* Vol. 20, No. 3, pp. 559-596.

[93] Goldsmith, R.W.(1969). *Financial Structure and Development.* Hew Haven: Yale University Press.

[94] Gordon, R.H. and A.L. Bovenberg (1996). "Why is Capital so Immobile Internationally? Possible Explanations and Implications for Capital Income Taxation." *American Economic Review,* Vol. 86, No. 5, pp.1057-1075.

[95] Gourinchas, P.O., R Valdés and O. Landerretche (2001). "Lending Booms: Latin America and the World." *Economia,* Vol. 1, pp. 47-99.

[96] Gouyette, C. and S. Perelman (1997). "Productivity Convergence in OECD Service Industries." *Structural Change and Economic Dynamics,* Vol. 8, pp. 279-295.

[97] Graff, M. (1999). "Financial Development and Economic Growth - A New Empirical Analysis." Dresden Discussion Papers in Economics No. 5/99.

[98] Graff, M. (2001). "Causal Links Between Financial Activity and Economic Growth: Empirical Evidence from a Cross-Country Analysis, 1970-1990." *Bulletin of Economic Research,* Vol. 54, No. 2, pp. 119-133.

[99] Graff, M. and A. Karmann (2001). "Does Financial Activity Cause Economic Growth?" Dresden Discussion Papers in Economics No. 1/01.

[100] Granger, C.W.J. (1988). "Recent Developments in a Concept of Causality." *The Journal of Econometrics,* Vol. 39, pp. 199-211.

[101] Granger, C.W.J., B-N. Huang and C.W. Yang (1998). "A Bivariate Causality between Stock Prices and Exchange Rates: Evidence from Recent Asian Flu." Mimeograph, The University of California, San Diego.

[102] Greene, W.H. (2000). *Econometric Analysis.* New Jersey: Prenctice-Hall.

[103] Greenwood, J. and B. Jovanovic (1990). "Financial Development, Growth, and the Distribution of Income." *The Journal of Political Economy,* Vol. 98, No. 5, pp. 1076-1107.

[104] Greenwood, J. and B.D. Smith (1997). "Financial Markets in Development, and the Development of Financial Markets." *Journal of Economic Dynamics and Control,* Vol. 21, pp. 145-181.

[105] Grubert, H., T. Goodspeed and D. Swenson (1993). "Explaining the Low Taxable Income of Foreign-Controlled Companies in the United States." In A. Giovanni, R.G. Hubbard

and J. Slemrod (eds.) *Studies in International Taxation.* Chicago: University of Chicago Press.

[106] Gujarati, D.N. (1995). *Basic Econometrics.* Singapore: McGraw-Hill.

[107] Gurley, J.G. and E.S. Shaw (1955). "Financial Aspects of Economic Development." *American Economic Review*, Vol. 45, Issue 4, pp. 515-538.

[108] Hadri, K. (2000). "Testing for Stationarity in Heterogeneous Panel Data." *Econometrics Journal*, Vol. 3, pp. 148-161.

[109] Hair, J.F., R.E. Anderson, R.L. Tatham and W.C. Black (1998). *Multivariate Data Analysis.* New Jersey: Prentice Hall.

[110] Hall, R.E. and C.I. Jones (1999). "Why do Some Countries Produce so Much More Output per Worker Than Others?" *Quarterly Journal of Economics,* Vol. 114, pp. 83-116.

[111] Hamilton, J.D. (1994). *Time Series Analysis.* New Jersey: Princeton University Press.

[112] Hansson, P. and L. Jonung (1997). "Finance and Economic Growth. The Case of Sweden 1834-1991." Stockholm School of Economics Working Paper No. 176.

[113] Harris, R.D.F. and E. Tzavalis (1999). "Inference for Unit Roots in Dynamic Panels Where the Time Dimension is Fixed." *Journal of Econometrics*, Vol. 91, pp. 201-226.

[114] Harris, R.I.D. (1995). *Using Cointegration Analysis in Econometric Modelling.* London: Prentice Hall / Harvester Wheatsheaf.

[115] Harris, R.S. and D. Ravenscraft (1991). "The Role of Acquistions in Foreign Direct Investment: Evidence from the U.S. Stock Market." *Journal of Finance*, Vol. 46, No. 3, pp. 825-844.

[116] Haslag, J.H. and J. Koo (1999). "Financial Repression, Financial Development and Economic Growth." Mimeograph, Federal Reserve Bank of Dallas.

[117] Haug, A.A. (1996). "Tests for Cointegration: A Monte Carlo Comparison." *Journal of Econometrics*, Vol. 71, pp. 89-115.

[118] Hayashi, F. (2000). *Econometrics.* New Jersey: Princeton University Press.

[119] Hellwig, M. (1991). "Banking, Financial Intermediation, and Corporate Finance." In A. Giovannini and C. Mayer (eds.) *European Financial Integration.* Cambridge: Cambridge University Press.

[120] Heston, A., D.A. Nuxoll and R. Summers (1994). "The Differential-Productivity Hypothesis and Purchasing-Power Parities: Some New Evidence." *Review of International Economics*, Vol. 2, No. 3, pp. 227-243.

[121] Holtz-Eakin, D., W. Newey and H. Rosen (1990). "Estimating Vector Autoregressions with Panel Data." *Econometrica*, Vol. 56, pp. 1371-1395.

[122] Honohan, P. and B. Walsh (2002). "Catching up with the Leaders: The Irish Hare." Presented at the Dublin Economics Workshop.

[123] Huther, J. (2000). "Relating labor productivity to wages in service sectors: a long-run approach." *Economic Inquiry*, Vol. 38, No. 1, pp. 110-122.

[124] Im, K.S., M.H. Pesaran and Y. Shin (1995). "Testing for Unit Roots in Heterogeneous Panels." Mimeograph, University of Cambridge.

[125] Im, K.S., M.H. Pesaran and Y. Shin (1997). "Testing for Unit Roots in Heterogeneous Panels." Mimeograph, University of Cambridge.

[126] Islam, N. (1995). "Growth Empirics: A Panel Data Approach." *Quarterly Journal of Economics*, Vol. 110, No. 4, pp 1127-1170.

[127] Jappelli, T. and M. Pagano (1996). "Saving, Growth and Liquidity Constraints." *Quarterly Journal of Economics*, Vol. 109, No. 1, pp. 83-109.

[128] Jayaratne, J. and P.E. Strahan (1996). "The Finance-Growth Nexus: Evidence from Bank Branch Deregulation." *Quarterly Journal of Economics*, Vol. 111, No. 3, pp. 639-670.

[129] Johansen, S. (1988). "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231-254.

[130] Johnston, J. and J. DiNardo (1997). *Econometric Methods.* Singapore: McGraw Hill.

[131] Jorgenson, D.W. and K.J. Stiroh (1999). "US economic growth at the industry level." Mimeograph, Harvard University.

[132] Julius, D. (1999). "Inflation and growth in the services industries." Vital topics lecture delivered to the Manchester Business School, 23 March 1999.

[133] Juselius, K. (1999). "Models and Relations in Economics and Econometrics." Mimeograph, European University Institute, available at http://www.econ.ku.dk/okokj.

[134] Kaminsky, G. and C.M. Reinhart (1999). "The Twin Crises: The Causes of Banking and Balance of Payments Problems." *American Economic Review*, Vol. 89, No. 3, pp. 473-500.

[135] Kao, C. (1999). "Spurious Regression and Residual Based Tests for Cointegration in Panel Data." *Journal of Econometrics*, Vol. 90, pp. 1-44.

[136] Kennedy, P. (1998). *A Guide to Econometrics.* Oxford: Blackwell Publishers.

[137] Khan, A. (2000). "The Finance and Growth Nexus." *Business Review*, Federal Reserve Bank of Philadelphia, January / February 2000.

[138] Khan, M. S. and A. S. Senhadji (2000). "Financial Development and Economic Growth: An Overview." IMF working paper 00/209.

[139] King, R.G. and R. Levine (1993a). "Finance and Growth: Schumpeter might be Right." *Quarterly Journal of Economics,* Vol. 108, No. 3, pp. 717-737.

[140] King, R.G. and R. Levine (1993b). "Finance, Entrepreneurship, and Growth." *Journal of Monetary Economics,* Vol. 32, pp. 513-542.

[141] Klenow, P. and A. Rodríguez-Clare (1997). "The Neoclassical Revival in Growth Economics: Has It Gone Too Far?" *NBER Macroeconomics Annual*, London: MIT Press.

[142] Knack, S. and P. Keefer (1995). "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures." *Economics and Politics*, Vol. 7, No. 3, pp. 207-227.

[143] La Porta, R. F. Lopez-de-Silanes, A. Shleifer and R.W. Vishny (1998). "Law and Finance." *The Journal of Political Economy*, Vol. 106, Issue 6, pp. 1113-1155.

[144] Landesmann, M.A. and R. Stehrer (2001). "Convergence patterns and switchovers on comparative advantage." *Structural Change and Economic Dynamics*, Vol. 12, pp. 399-423.

[145] Lane, P.R. and G.M. Milesi-Ferretti (2002). "External Wealth, the Trade Balance, and the Real Exchange Rate." *Eurpoean Economic Review*, Vol. 46, pp. 1049-1071.

[146] Levin, A., C.F. Lin (1992). "Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties." Discussion Paper 92/93, University of California at San Diego.

[147] Levin, A., C.F. Lin (1993). "Unit Root Tests in Panel Data: New Results." Discussion Paper 93/56, University of California at San Diego.

[148] Levin, A., C.F. Lin and C.S.J. Chu (2002). "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties." *Journal of Econometrics,* Vol. 108, pp. 1-24.

[149] Levine, R. (1997). "Financial Development and Economic Growth: Views and Agenda." *Journal of Economic Literature,* Vol. 35, pp. 688-726.

[150] Levine, R. (1998). "The Legal Environment, Banks, and Long-Run Economic Growth." *Journal of Money, Credit and Banking,* Vol. 30, No. 3, pp. 596-620.

[151] Levine, R. (2001). "International Financial Liberalization and Economic Growth." *Review of International Economics,* Vol. 9, No. 4, pp. 684-698.

[152] Levine, R., N. Loayza and T. Beck (2000). "Financial intermediation and growth: Causality and causes." *Journal of Monetary Economics,* Vol. 46, pp. 31-77.

[153] Levine, R. and D. Renelt (1992). "A Sensitivity Analysis of Cross-Country Growth Regressions." *American Economic Review,* Vol. 82, pp. 942-963.

[154] Levine, R. and S. Zervos (1998a). "Stock Markets, Banks and Economic Growth." *American Economic Review,* Vol. 88, Issue 3, pp. 537-558.

[155] Levine, R. and S. Zervos (1998b). "Capital Control Liberalization and Stock Market Development." *World Development,* Vol. 26, pp. 1169-1183.

[156] Li, H., L. Squire and H. Zou (1998). "Explaining International and Intertemporal Variations in Income Inequality." *The Economic Journal,* Vol. 108, pp. 26-43.

[157] Li, Q. and D. Papell (1999). "Convergence of International Output: Time Series Evidence for 16 OECD Countries." *International Review of Economics and Finance,* Vol. 8, pp. 267-280.

[158] Loewy, M.B. and D.H. Papell (1996). "Are U.S. Regional Incomes Converging? Some Further Evidence." *Journal of Monetary Economics,* Vol. 38, pp. 587-598.

[159] Luintel, K.B. and M. Khan (1999). "A Quantitative Reassessment of the Finance-Growth Nexus: Evidence from a Multivariate VAR." *Journal of Development Economics,* Vol. 60, pp. 381-405.

[160] MacDonald, R.and L. Ricci (2001). "PPP and the Balassa Samuelson Effect: the Role of the Distribution Sector." International Monetary Fund working paper No. 01/38.

[161] MacSharry, R. and P.A. White (2000). *The Making of the Celtic Tiger.* Dublin: Mercier Press.

[162] Maddala, G.S. and I.M. Kim (1998). *Unit Roots, Cointegration and Structural Change.* Cambridge: Cambridge University Press.

[163] Maddison, A. (1982). *Phases of Capitalist Development.* Oxford: Oxford University Press.

[164] Mankiw, N. G., D. Romer and D.N. Weil (1992). "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics*, Vol. 107, No. 2, pp. 407-437.

[165] Mayer, C.P. (1990). "Financial Systems, Corporate Finance and Economic Development." In G. Hubbard (ed) *Information, Capital Markets and Investment.* Chicago: Chicago University Press.

[166] McGowan, P. (1990). *Money and Banking in Ireland.* Dublin: Institute of Public Administration.

[167] McKinnon, R.I. (1973). *Money and Capital in Economic Development.* Washington, D.C., The Brookings Institution.

[168] Mishkin, F.S. (1984). "Are Real Interest Rates Equal Across Countries? An Empirical Investigation of International Parity Conditions." *Journal of Finance*, Vol. 39, No. 5, pp. 327-342.

[169] Modigliani, F. and M. Miller (1958). "The Cost of Capital, Corporation Finance and the Theory of Investment." *Amercian Economic Review*, Vol. 48, No. 3, pp. 261-297.

[170] Neusser, K. and M. Kugler (1998). "Manufacturing Growth and Financial Development: Evidence from OECD Countries." *Review of Economics and Statistics*, Vol. 80, No. 4, pp. 638-646.

[171] O'Donnell, M. (1998). "Ireland's Export Performance: Three Empirical Essays." Unpublished Ph.D. thesis, University of Dublin, Trinity College.

[172] Ó Gráda, C. and K. O'Rourke (1996). "Irish Economic Growth." In N. F. R. Crafts and G. Toniolo (ed.) *Economic Growth in Europe since 1945.* Cambridge: Cambridge University Press.

[173] O'Hagan, J.W. (ed.) (2000). *The Economy of Ireland.* Dublin: Gill and MacMillan.

[174] O'Sullivan, M. (2000). "Industrial Development: A New Beginning?". In J.W. O'Hagan (ed.) *The Economy of Ireland.* Dublin: Gill and MacMillan.

[175] Osterwald-Lenum, M. (1992). "A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics." *Oxford Bulletin of Economics and Statistics*, Vol. 54, No. 3, pp. 461-472.

[176] Oulton, N. (2001). "Must the Growth Rate Decline? Baumol's Unbalanced Growth Revisited." *Oxford Economic Papers*, Vol. 53, pp. 605-627.

[177] Pagano, M. (1993). "Financial Markets and Growth: An Overview." *European Economic Review*, Vol. 37, pp. 613-622.

[178] Papell, D.H., C.J. Murray and H. Ghiblawi (1999). "The Structure of Unemployment." Mimeograph, University of Houston.

[179] Pedroni, P. (1995). "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis." Economics Working Paper, University of Indiana.

[180] Pedroni, P. (1996). "Fully Modified OLS for Heterogeneous Panels." Economics Working Paper, University of Indiana.

[181] Pedroni, P. (1997). "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis. New Results." Economics Working Paper, University of Indiana.

[182] Penati, A. and M. Dooley (1984). "Current Account Imbalances and Capital Formation in Industrial Countries, 1949-81." *IMF Staff Papers*, Vol. 31, No. 1, pp. 1-24.

[183] Peterson, M.A. and R.G. Rajan (1994). "The Benefits of Lending Relationships: Evidence from Small Business Data." *Journal of Finance*, Vol. 49, No. 1, pp. 3-37.

[184] Planting, M.A. and P.D. Kuhbach (2001). "Annual Input-Output Accounts of the U.S. Economy, 1998." *Survey of Current Business*, December 2001, Bureau of Economic Analysis.

[185] Quah, D.T. (1993). "Galton's Fallacy and Tests of the Convergence Hypothesis." Mimeograph, London School of Economics.

[186] Rajan, R.G. and L. Zingales (1998). "Financial Dependence and Growth." *American Economic Review*, Vol. 88, No. 3, pp. 559-586.

[187] Rajan, R.G. and L. Zingales (2001). "The Great Reversals: The Politics of Financial Development in the 20th Century." Mimeograph, University of Chicago.

[188] Rassekh, F., M.J. Panik and B.R. Kolluri (2001). "A Test of the Convergence Hypothesis: The OECD Experience, 1950-1990." International Review of Economics and Finance, Vol. 10, pp. 147-157.

[189] Razin, A., E. Sadka and C.W. Yuen (1998). "A Pecking Order of Capital Inflows and International Tax Principles." *Journal of International Economics*, Vol. 44, pp. 45-68.

[190] Romer, D. (1996). *Advanced Macroeconomics.* New York: McGraw-Hill.

[191] Roubini, N. and X. Sala-i-Martin (1992). "Financial Repression and Economic Growth." *Journal Of Development Economics*, Vol. 39, pp. 5-30.

[192] Rousseau, P.L. and P. Wachtel (1998). "Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries." *Journal of Money, Credit and Banking*, Vol. 30, No. 4, pp. 657-678.

[193] Rousseau, P.L. and P. Wachtel (2000). "Equity Markets and Growth: Cross-country Evidence on Timing and Outcomes, 1980-1995." *Journal of Banking and Finance*, Vol. 24, pp. 1933-1957.

[194] Rousseau, P.L. and P. Wachtel (2001). "Inflation, Financial Development and Growth." In T. Negishi, R. Ramachandran and K. Mino (ed.) Economic Theory, Dynamics and Markets: Essays in Honor of Ryuzo Sato. Boston: Kluwer Academic Publishers.

[195] Sala-i-Martin, X.X. (1996). "The Classical Approach to Convergence Analysis." *The Economic Journal*, Vol. 106, Issue 437, pp. 1019-1036.

[196] Samuelson, P.A. (1964). "Theoretical Notes on Trade Problems." *Review of International Economics*, Vol. 2, No. 3, pp. 201-226.

[197] Samuelson, P.A. (1994). "Facets of Balassa-Samuelson Thirty Years Later." *The Review of Economics and Statistics*, Vol. 46, Issue 2, pp. 145-154.

[198] Shaw, E.S. (1973). *Financial Deepening in Economic Development.* New York: Oxford University Press.

[199] Shioji, E. (1997a). "Convergence in Panel Data: Evidence from the Skipping Estimation." Mimeograph, Universitat Pompeu Fabra, Barcelona.

[200] Shioji, E. (1997b). "It's Still 2%. Evidence of Convergence from 116 Years of the US States Panel Data." Mimeograph, Universitat Pompeu Fabra, Barcelona.

[201] Sims, C.A., J.H. Stock and M.W. Watson (1990). "Inference in Linear Time Series Models with Some Unit Roots." *Econometrica,* Vol. 58, No. 1, pp. 113-144.

[202] Smith, R.P (1999). "Unit roots and All That: The Impact of Time Series Methods on Macroeconomics." *Journal of Economic Methodology,* Vol. 6, No. 2, pp. 239-258.

[203] Sorensen, A. (2001). "Comparing Apples to Oranges: Productivity Convergence and Measurement Across Industries and Countries: Comment." *American Economic Review,* Vol. 91, Issue 4, pp. 1160-1167.

[204] Spiegel, M.M. (2001). "Financial Development and Growth: Are the APEC Nations Unique?" Pacific Basin working paper PB01-04, Federal Reserve Bank of San Francisco.

[205] Stiglitz, J.E. and A. Weiss (1981). "Credit Rationing in Markets with Imperfect Information." *American Economic Review,* Vol. 71, No. 3, pp. 393-410.

[206] Stulz, R. (2001). "Does Financial Structure matter for Economic Growth? A Corporate Finance Perspective." In A. Demirguc-Kunt and R. Levine (ed.) *Financial Structure and Economic Growth.* Massachusetts: MIT Press.

[207] Tesar, L.L. and I.M. Werner (1994). "International Equity Transactions and U.S. Portfolio Choice." NBER Working Paper No. 4611.

[208] Toda, H.Y. and P.C.B. Phillips (1993). "Vector Autoregressions and Causality." *Econometrica,* Vol. 61, No. 6, pp. 1367-1393.

[209] Togo, T. (2001). "Productivity Convergence in Japan's Manufacturing Industries." *Economics letters,* Vol. 75, No. 1, pp. 61-67.

[210] Townsend, R.M. (1979). "Optimal Contracts and Competitive Markets with Costly State Verification." *Journal of Economic Theory,* Vol. 21, No. 2, pp. 265-293.

[211] Tsuru, K. (2000). "Finance and Growth: some Theoretical Considerations and a Review of the Empirical Literature." OECD Economics Department Working Paper No. 228.

[212] Verbeek, M. (2000). *A Guide to Modern Econometrics.* Chichester: Wiley.

[213] Wachtel, P. (2001a). "Growth and Finance: What do we Know and How do we Know it?" *International Finance,* Vol. 4, No. 3, pp. 335-362.

[214] Wachtel, P. (2001b). "Globalization of Banking: Why does it Matter?" Mimeograph, New York University. Presented at symposium on Presente y Futuro del Sistema Financiero en Paises Emergentes, Caracas, Venezuela, October 25-26, 2000.

[215] Whelan, K. (2001). "A Two-Sector Approach to Modelling U.S. NIPA Data." Finance and Economics Discussion Series Paper 2001-4, Federal Reserve Board.

[216] Wong, W. (2002). "Did the Manufacturing Sector Contribute to Convergence Among the OECD Countries? Decomposing β-convergence into Effects due to Sectoral Contribution, Productivity Growth, and Employment Shift." Mimeograph, University of Berkeley.

[217] Wurgler, J. (2000). "Financial Markets and the Allocation of Capital." *Journal of Financial Economics*, Vol. 58, pp. 187-214.

[218] Zivot, E. and D.W.K. Andrews (1992). "Further Evidence on the Great Crash, the Oil Price Shock, and the Unit Root Hypothesis." *Journal of Business and Economic Statistics*, Vol. 10, No. 3, pp. 251-270.