Finance and growth: new evidence on the role of insurance

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Abstract

This paper provides new evidence that sheds light on the the impact of insurance sector development on output growth, capital accumulation, and productivity improvement, using data from 51 countries (developed and developing) during 1981-2005. The dynamic panel data analysis results demonstrate that insurance sector development affects growth predominantly through productivity improvement in developed countries, while in developing countries it promotes capital accumulation.

Keywords: Insurance; financial development; economic growth; productivity growth; capital accumulation

JEL Classification Codes: G22; O16; O40

1. Introduction

Economists have long recognized the importance of financial markets in the development process. For instance, Schumpeter (1934) contends that the services provided by financial intermediaries are important for stimulating technological innovation and economic development. Banks are viewed as an important intermediating agent between lenders and borrowers. Hence, well-developed financial systems can channel financial resources to their most productive use, leading to the expansion of the economy.[1]

The link between financial development and economic growth has been tested using different procedures, data sets and time periods and there is overwhelming support for the critical role of financial development for economic growth. Financial markets are found to have a strong positive impact on output and productivity growth, as well as capital accumulation (see Ang, 2008, and Levine, 2005, and references therein). Financial innovations help to reduce transaction and information costs while larger and more efficient financial markets help economic agents to hedge, trade and pool risk, thus raising investment and economic growth. While there is a plethora of research on the influence of banks and stock markets on economic growth, the role of other intermediaries such as insurance institutions has been largely ignored (Ang, 2008). However, ignoring the role insurance market plays in the development process may lead to a significant underestimation of the overall impact of financial development on economic growth.

The importance of insurance sector for economic growth was first recognized by UNCTAD (1964), who acknowledged that "*a sound national insurance and reinsurance market is an essential characteristic of economic growth*". Ward and Zurburegg (2000) persuasively argue that insurance markets can have a positive impact on the economy by facilitating a myriad of economic transactions through risk transfer and indemnification. Additionally, insurance sector promotes financial intermediation similar to banking

[1] Robinson (1952), however, argues that that financial development does not lead to higher economic growth but is driven by growth. Nevertheless, most empirical evidence is consistent with the Schumpeterian view of finance-led growth.

institutions. Despite a rapid development of this sector during the past few decades, it is surprising that the impact of insurance on growth has not been analysed as rigorously as the role of banks. A review of the literature suggests only a few studies have examined this issue and they rely mainly on cross-section and time series approaches (Outreville, 1990, Ward and Zurburegg, 2000, Webb at al., 2002, and Kugler and Ofoghi, 2005). They all find that insurance sector development has a significant impact on economic growth.

The main objective of this paper is to examine whether insurance sector development has any impact on economic growth, distinguishing the specific impacts on productivity growth and capital accumulation across developed and developing countries. The paper contributes to the literature in several important aspects. First, it focuses on a different component of financial sector development. The existing literature has mainly focus on the roles of banks and stock markets in growth process and studies of insurance-growth nexus are very limited. By conducting an extensive study on the causal effects of insurance on economic growth, it is hoped that the finding of this study may shed new lights into the finance-growth debate. Second, it provides the first empirical evidence on the impact of insurance sector development on the growth channels (i.e. capital accumulation and productivity growth). Moreover, it examines the relative importance of insurance on growth channels at different stages of economic development. Third, it uses a panel dataset. The existing literature has mainly relied on cross-section and time series analysis. By utilizing information on both the intertemporal dynamics and the individuality of the insurance market, the efficiency of econometric results are greatly improved. Finally, it uses a dynamic panel data estimator which has a number of advantages over cross-section technique and traditional panel estimators. In particular, the panel estimator used here is able to control for endogeneity of all explanatory variables, account for unobserved country-specific effects and allow the inclusion of lagged dependent variables as regressors, which are typical issues when estimating growth model.

Our findings suggest a strong, positive impact of insurance sector development on economic growth, productivity improvement, and capital accumulation. In developed

countries insurance affects growth primarily through productivity growth, while in developing countries it improves capital accumulation. Our findings are strongly consistent with models that predict that financial intermediation ease information and transaction costs and in so doing improve the allocation of resources and economic growth.

The paper is structured as follows. Section 2 provides a review of the literature. Section 3 discusses the estimation procedures. Section 4 describes the data set. Section 5 presents the empirical results. The last section concludes.

2. Review of the literature

The importance of financial intermediaries for economic growth has been emphasized in several theoretical models (see for examples Pagano (1993), King and Levine (1993b), and Greenwood and Jovanovic (1990)). These models postulates that well-functioning financial intermediaries ameliorate information and transactions costs and in so doing promote efficient allocation of resources, leading to the expansion of the economy. On the role of insurance market, Webb *et al.*(2002) have modelled the role of financial intermediaries (banks and insurers) in promoting growth using a neo-classical framework. The model predicts that insurance activity promotes the productivity of physical capital, resulting in higher level of output. Likewise, a dynamic optimization model presented in Soo (1996) predict that policy changes in favour of the growth of life insurance market will have a positive impact on aggregate savings and consumption, leading ultimately to the expansion of the economy.

There are two channels via which financial intermediaries can spur growth: the capital accumulation channel and the productivity channel. The capital accumulation channel relies on the "debt-accumulation" hypothesis of Gurley and Shaw (1955) which focuses on the financial sector's ability to overcome indivisibility problems through saving mobilization. By channelling saving to the productive sector, it boosts capital accumulation and output growth. On the other hand, the productivity channel is based upon recent endogenous growth models (Greenwood and Jovanovic, 1990, King and Levine, 1993b)

which emphasize on the role of financial sector ability in financing innovative activities. In particular, the model by King and Levine (1993b) emphasizes on risk diversification as a channel via which financial intermediaries can accelerate technological change and economic growth. Economic agents are continuously trying to gain market niche through risky innovative activity. With access to external finance they are able to hold a diversified portfolio of productivity-enhancing innovative projects. Furthermore, the model by Acemoglu and Zilibotti (1997) predict that risky (but productive) projects with higher rates of return are indivisible and have minimum size requirements. Consequently, less developed countries that face limited diversification opportunities (due to limited funds) will typically pursue primitive capital accumulation strategy. Likewise, the model presented in Acemoglu *et al*. (2006) postulates that a developing country that is behind the technological frontier will usually pursue a capital accumulation growth strategy (i.e. investment-based growth). Meanwhile, industrial countries have a strong incentive for innovation and therefore savings are expected to be channelled to activities with larger productivity gains (i.e. innovation-based growth).

Ward and Zurburegg (2000) credibly argue that insurance activity may directly affect output growth via its functions as a provider of risk transfer and indemnification services, and financial intermediation services. By offering risk transfer and indemnification services, insurance markets enable risk-averse individuals to engage in risky but productive activities which eventually create positive externalities in terms of increased purchases, profits and employments, leading to the expansion of the economy. For instance, with product liability insurance pharmaceutical companies may be willing to invest in research and development activities to develop highly beneficial products. Further impacts from insurance are its potential to reduce risk in the economy. Since risk level is the main determinant of an insurance premium, risk-taking individuals face increased incentives to reduce their risk level. This is expected to positively affect the accumulation of productive capital in the economy. As financial intermediation agents, insurance companies create another dimension of competition in market for intermediated saving, which is expected to promote productive efficiency. Furthermore, improved financial intermediation

services allow investors to hold diversified investment portfolios, which facilitate a willingness to invest in risky high-productivity projects. Moreover, insurance markets boost liquidity which facilitates a smooth flow of funds to capital-accumulating projects, resulting in the expansion of the economy.

Insurance may also have an indirect impact on output growth via its potential impact on the development of banks and stock markets.[2] For example, the provision of protection services to customers against risks that might otherwise leave them unable to repay their debts may promote bank lending, leading to the expansion of the banking sector (Rule, 2001). Also, this services may encourage bank borrowing by reducing companies' cost of capital (Grace and Rebello, 1993). Likewise, property insurance may facilitate bank lending via credit collateralization, which would reduce bank's credit risk exposure (Zou and Adams, 2006).However, it should be emphasized that the development of insurance markets may also have a negative implication on banking development because of 'saving substitution effects'. In market for intermediated saving, insurance companies compete for funds (savings) and this could reduce bank's market share. With respect to its impact on stock markets, insurance activity could promote stock and bond markets by investing funds in stock and bond markets (Catalan *et al.*, 2000). This process would not only develop capital markets but also promote efficient allocation of funds in the economy because insurance companies would gather all relevant information to evaluate projects and firms before allocating their capital (Skipper, 1997). Moreover, increased level of monitoring by insurance companies in projects or firms that they have invested will improve the potential of the projects that they choose to fund (Conyon and Leech, 1994).

Despite the importance of the insurance activity for economic growth, relatively little research has been done to deepen our understanding of this issue. This topic has not been examined as extensively as the role of banks and stock markets. A review of the literature reveals only a handful of empirical studies. For instance, using a cross-sectional analysis Outreville (1990) finds a positive relationship between property-liability insurance

[2] The positive growth-effects of banks and equity markets have been widely recognized in the literature. Refer to Ang (2008) for a recent survey of the literature.

and GDP per capita in 55 developing countries. Ward and Zurbruegg (2000) analyse nine OECD countries and find that the insurance industry (represented by total insurance premia) *Granger*-causes real GDP in Canada and Japan. Causality is bi-directional in Italy, but no causal relation can be established for other countries.[3] Browne *et al*.(2000) find that non-life insurance consumption is associated positively with the income level for a sample of OECD countries over the 1986–1993 period. Using a sample of 55 countries and an iterated three-stage least squares simultaneous estimation technique, Webb *et al*. (2002) find that the life insurance penetration robustly predicts productivity increases. Kugler and Ofoghi (2005) examined the relationship between insurance and GDP growth in the UK under the lens of cointegration analysis. They find an overwhelming support for a long run relationship between different insurance sectors and economic growth.[4] Moreover, insurance activity is found to *Granger-cause* economic growth in most of the sectors. Although the aforementioned studies has made important contributions to the literature, empirical evidence on insurance-growth nexus remains limited in two aspects (i) panel evidence on causal effect of insurance on growth, and (ii) the impact of insurance on the growth channels namely, capital accumulation and productivity growth. Therefore, this issue deserves further examination.

With this backdrop, we contribute to the literature by examining the causal effect of insurance sector developments on output growth, using a panel of 51 developed and developing countries over 25 years (1981-2005). Furthermore, we assess the impact of insurance on capital accumulation and productivity growth across developed and developing countries.

3. Methodology

We use a generalized method of moments (GMM) dynamic panel estimator proposed by Holtz-Eakin *et al*.(1988) and subsequently extended by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). We choose this estimator because of the

[3] Other countries are Austria, Australia, Switzerland, France, United Kingdom, and the United States.

[4] Eight insurance sectors were analyzed: life; motor insurance; accident and health insurance; property; liability; pecuniary loss; reinsurance; and marine, aviation, and transport.

needs to eliminate country-specific effects and simultaneity bias. [5] [6] We consider the following equation:

$$y_{it} = \alpha y_{i,t-1} + \beta_1 INS_{it} + \beta_2 X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (1)$$

where y is real GDP per capita (in log), *INS* is an insurance indicator, X represents a set of explanatory variables which affect growth , η is an unobserved country-specific effects, and ε is the error term. To remove country-specific effects, we transform Equation (1) into first-difference form as follows:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{t,t-2}) + \beta_1(INS_{it} - INS_{i,t-1}) + \beta_2(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (2)$$

To eliminate simultaneity bias in Equation (2), the lagged levels of the regressors are used as instruments. This estimation strategy is known as difference GMM (D-GMM). Although the D-GMM estimator is able to remove country-specific effects and simultaneity bias, it was shown that the D-GMM estimation may lead to incorrect inferences when the explanatory variables are persistent. To overcome this problem, Arellano and Bover (1995) propose a system GMM (S-GMM) which combines the difference Equation (2) and the level Equation (1). For the level equation, the lagged differences of the regressors are used as instruments. The consistency of the GMM estimator is evaluated using two specification tests namely, Hansen (1982) *J* test of over-identifying restrictions and test of second-order serial correlation. Failure to reject the null of both tests provides support to the estimated model.

There are two variants of GMM estimators namely, one- and two-step estimator (Arellano and Bond, 1991). Theoretically, the two-step estimator is more efficient than the

[5] For instance, Fukuyama (1995) highlights the importance of culture in demand for insurance while Angeer (1993) argue that a country's regulation can facilitate as well as constrain insurance activities.

[6] Some authors have found that financial market indicators are endogenous as higher output may result in higher demand for insurance products (see a survey by Hussels *et al*., 2005).

one-step estimator because it employs optimal weighting matrices. However, its use in a small sample, as in our study, may lead to biased standard errors and estimated parameters (Windmeijer, 2005) and weakened overidentification test (Bowsher, 2002). To overcome these problems which are triggered by instrument proliferation, Roodman (2009b) suggests reducing the dimensionality of the instrumental variable matrix.

In this paper, we use the two-step S-GMM estimator. Following Roodman's (2009b) recommendation, we reduce the dimensionality of the instrumental variable matrix. All estimations were carried out using the *xtabond2* routine designed by Roodman (2009a).

4. Data set

The data set consists of panel observations from 51 countries. Appendix A1 lists all the countries in the sample. The panel covers the period 1981 – 2005, and is divided into five non-overlapping five-year periods (i.e. 1981-1985, 1986-1990,……, 2001-2005).[7] The dependent variable in our sample is the growth rates of real GDP percapita (chain-weighted), and is obtained from the Penn World Table (PWT). The life insurance penetration ratio, measured by the volume of life insurance premia as a share of GDP, is used to proxy for the development of insurance markets.[8] The data was taken from the *Financial Structure Database* of the World Bank.

Following Levine *et al*. (2000) and Beck *et al*. (2000), the remaining conditioning variables are initial income, life expectancy, government size (government spending/GDP), openness to trade ((exports + imports)/GDP), inflation rate, and the black market exchange rate premium. We include initial income to account for the "convergence effect" while life expectancy is used as a proxy for human capital.[9] Government size, the inflation rate, trade openness and black market exchange rate premium account for country-specific

[7] Most panel studies on growth cycles are based on 5-year averages as time unit to factor out the business cycle effect. In addition, in this study we lacked annual data for some of the variables of interest. As such this did not allow us to use annual data.

[8] We would like to use total (life plus non-life) insurance premia as it reflects more precisely the overall development of insurance sector. However, data for non-life insurance premia are not available for many of developing countries. Consequently, we use life insurance premia to proxy insurance sector development.

[9] Secondary school enrollment in the Barro-Lee dataset is a common proxy for human capital in the literature. Due to its unavailability for recent years, we use life expectancy instead.

government policies. The inflation rate and life expectancy were taken from the *World Development Indicators* database. The index of black market exchange rate premium from Gwartney and Lawson (2006) is scaled from 0 to 10, in which 10 means zero premium. The remaining data were taken from the PWT. All data, except for initial income which is GDP percapita at the beginning of each five-year period, are averaged over non-overlapping five-year period. Appendix A2 provides the summary of data sources.

Figure 1 displays output growth and the insurance penetration ratio for the sampled countries, averaged over the whole period (1981-2005). It shows that there is a positive relationship between the variables.[10] The figure shows that countries with higher level of insurance penetration ratio tend to enjoy faster growth over the chosen period. However, this simple correlation does not imply causation which is precisely the type of relation that we are interested in this study.

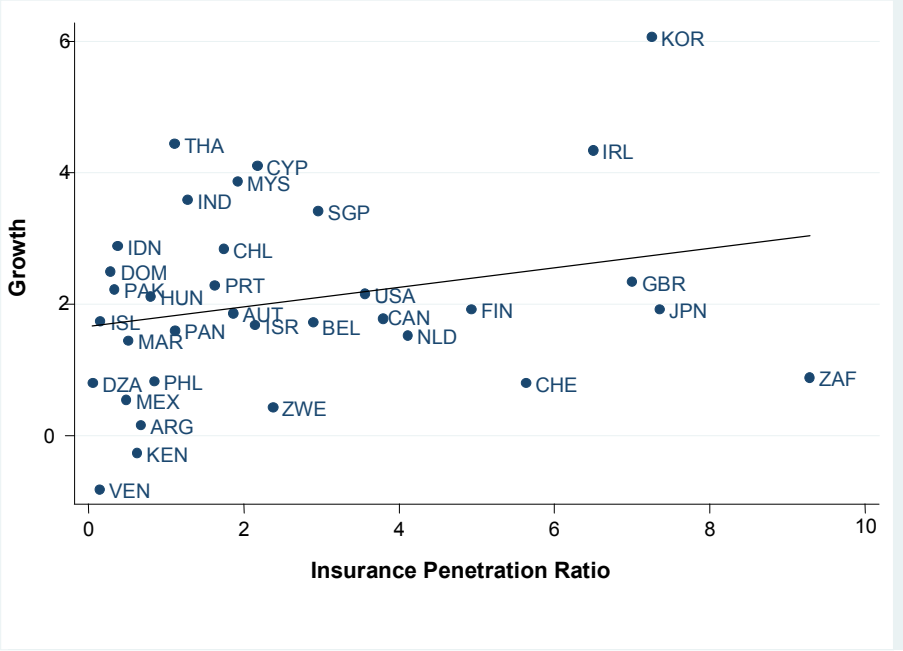

Figure 1: Scatter plot of growth vs. insurance penetration ratio

[10] We initially include China in our sample but graphical inspections show that China is a potential outlier as it falls relatively far from the rest. Over the sampled period, its average growth rate was exceptionally high (8.14%) but the insurance penetration ratio was relatively low (0.8%). To verify whether China is a true outlier, we formally compute the Cook distance statistic which identifies observation with high combination of residual and leverage. Clearly, the test suggests that China is an outlier and therefore excluded from the sample.

Table 1 provides informative descriptive statistics on growth variable and an insurance proxy (i.e. life insurance penetration ratio) reported for the whole sample. There are substantial variations among the countries in the growth and insurance indicators. Output growth ranges from -0.82% (Venezuela) to 6.06% (South Korea) and insurance penetration ratio ranges from 0.04% (Iran) to 9.28% (South Africa).

<Table 1 here>

5. Empirical results

Following earlier literature (e.g. King and Levine, 1993a; Levine and Zervos, 1998), the first part of our analysis involves a cross-sectional estimation. Although the cross-country estimator does not deal as rigorously as the panel estimators with simultaneity issues, omitted variables, and unobserved country-specific effects, it is useful in verifying the consistency of panel data findings. Following La Porta *et al*. (1997, 1998) – henceforth LLSV, we use legal origins to control for simultaneity bias. LLSV (1997) argue that a country's legal and regulatory system will fundamentally influence the ability of the financial system to provide high-quality financial services. Specifically, it will determine the ability of financial intermediaries to identify worthy firms, exert corporate control, manage risk, mobilize savings, and ease exchange. According to Reynolds and Flores (1996), legal systems with European origins can be classified into four major legal families: the English common law countries, and the French, German and Scandinavian civil law countries. This classification excludes countries with socialist and Islamic based legal systems. All four legal families descend from the Roman law as compiled by the Byzantine Emperor Justinian in the sixth century. In the last four centuries, the four legal families have evolved differently. The Scandinavian countries formed their own legal codes in the 17^{th} and 18^{th} centuries. The French Civil Code was written in 1804 and later spread to other countries (especially Latin American and African countries) through occupation and colonization. The German Civil Code was completed almost a century later in 1896. It has had a great influence on Austria and Switzerland. It also heavily influenced Japanese Civil Code which later spread to Korea. Unlike the civil law countries, the English legal system was developed based on common law, where the main source of law was jurisprudence, i.e.

judges sentences in particular cases. Through colonialism, it was spread to many Asian and African countries, North America, Australia, and New Zealand.

There are two conditions under which the legal origins can be appropriate instruments for insurance sector development. First, legal origins must be exogenous to economic growth during the chosen sample period. Second, they must be correlated with insurance sector development. Regarding the exogeneity, we take the legal origins as exogenous because they were spread through colonialism and occupation. Moreover, we provide the specification test for checking the validity of these instruments using the Hansen overidentification test. In terms of the link between legal origins and insurance sector development, a growing body of literature has shown that legal origins help shaping the development of the financial system. LLSV (1998) show that the legal origins materially influence the legal treatment of shareholders, the efficiency of contract enforcement, the law governing creditor rights, and accounting standards. Statistically, several studies have shown that these legal and regulatory characteristics influence financial sector developments (Levine *et al*., 2000, Beck *et al*., 2000). Although the literature on the legal system and insurance markets development is less developed, Browne *et al*.(2000) show that a country's legal system is a significant determinant of demand for automobile and general liability insurance.

To test whether legal origins have any influence on insurance sector development, we conduct a regression of the insurance penetration ratio on the dummy variables for English, French, German, and Socialist legal origins relative to Scandinavian legal origin (reference group). The results which are summarized in Table 2 suggest that legal origins explain a significant fraction of cross-country differences in insurance activity, indicated by the R-square and *F*-test. Thus, there is strong connection between legal origins and insurance sector developments. This finding conforms to the view that a country's legal and regulatory system is an important determinant of the ability of financial system to provide high-quality financial services.

<Table 2 here>

We next use legal origins as instruments and proceed to examine the impact of insurance on growth using two-stage least square (2SLS) technique. Table 3 presents our results. As shown in the table, the estimated coefficient for insurance is positive and statistically significant at the 5% level. An improvement in insurance sector by 1 percentage-point would lead to 0.012 percentage-point higher output. This suggests that there is a strong connection between the exogenous component of insurance sector development and long-run output growth. Furthermore, the Hansen test suggests that the instruments are not correlated with the error term as the null cannot be rejected at the usual level. This finding together with instruments being highly correlated with insurance indicator (Table 2) provides evidence in favour of the validity of instruments. Therefore, the strong positive effect on insurance development on output growth is not due to simultaneity bias. The estimated coefficient can be interpreted as the effect of the exogenous component of insurance sector development on output growth.

<Table 3 here>

The second part of our analysis, which is our preferred estimation, is to examine the growth-effect of insurance using the two-step S-GMM panel estimator. Following the recommendation by Roodman (2009b), we reduce the dimension of the instrumental variables matrix. The purpose is to avoid biases caused by the proliferation of instruments as discussed in section 3. The results of this exercise are reported in Table 4. The results show that the coefficient on insurance is positive and statistically significant at the 5% level. Moreover, most of the conditioning variables enter the regression equation with the correct signs and statistically significant, except for openness, inflation, and black market premium which turn out to insignificant. Specifically, we find that a 1 percentage-point improvement in insurance sector will increase output growth by 0.010 percentage-points. The magnitude of the impact is close to the cross-country estimates. The *p*-values of second-order serial correlation and the Hansen overidentification tests indicate that the model is correctly

specified. This finding is consistent with Levine *et al*. (2000) who find that a well-developed banking sector is important for long term output growth. Therefore, it supports the view that insurance sector development is needed to promote output growth.

<Table 4 here>

Several papers (Levine and Zervos, 1998, Beck and Levine, 2004) have assessed the growth effects of bank-based measures of financial development along with stock markets (i.e. market-based). Although these studies find that the overall financial development, captured by the joint significance of banks and stock markets indicators, has a positive and significant impact on growth, there is no clear evidence as to whether a bank-based or a market-based financial system exerts stronger effects on growth. In line with this literature, we include the both bank and stock market indicators in the econometric specifications to disentangle the contribution of insurance sector development from bank or stock market development. Also, several recent papers show that financial development and liberalization produce different effects. For instance, Ang (2010a) show that although financial development positively affects private savings, the impact of financial liberalization is negative. The negative impact of financial liberalization was further supported by Ang (2010b,c). This suggests the need to control for financial liberalisation, which capture changes in the policy environment, in our econometric specification.

Following the literature (e.g. Beck *et al*., 2000 and Levine *et al*., 2000), we use private sector (henceforth PRC) as a proxy variable of banking sector developments. PRC measures the value of credit issued by financial intermediaries to the private sector, expressed as a ratio to GDP. PRC isolates credit issued to the private sector, as opposed to credit issued to governments, government agencies, and public enterprises. Furthermore, it excludes credit issued by the central bank. Beck *et al.* (2000) convincingly argues why this measure reflects more accurately the efficiency of banking institutions in providing credit. We proxy the degree of stock market development by a broadly used measure of stock market liquidity: the total volume of shares traded divided by domestic

GDP (henceforth TST). For financial liberalisation (henceforth REF), we use a widely used index from Abiad *et al.* (2010). The authors consider seven policy dimension in the index construction: (1) credit controls and reserve requirement; (2) interest rate restraints; (3) entry barriers in the banking sector; (4) prudential regulations and supervision; (5) privatisation in the financial sector; (6) restriction on international capital flows; and (7) securities market policy. Each policy dimension is assigned a score of three (fully liberalised), two (partially liberalised), one (partially repressed), or zero (fully repressed). The aggregation of these seven dimensions is used to construct an overall index of financial liberalisation. For this analysis, our sample is restricted to 41 countries due to limited availability of stock market indicators.

The estimation results of adding PRC, TST, and REF are reported in Table 5. As shown in the table, the coefficients on PRC and TST are positive and statistically significant. This conforms to the widely accepted view that financial development is growth-enhancing. However, the coefficient on REF is negative and statistically significant. This finding is consistent with Ang (2010a,b,c) who also find the detrimental effects of financial liberalization on economic activities. More importantly, the inclusions of PRC, TST, and REF did not affect the sign and statistical significance of the coefficient for insurance. Interestingly, the magnitude of the impact remains the same. This implies that insurance sector development exerts an independent influence on output growth. This finding is consistent with the view that insurance markets and institutions exert a direct impact on growth via risk transfer and indemnification services that they provide. Also, they help to foster financial intermediation which allows a more efficient allocation of savings in the economy. These eventually lead to the expansion of the economy. This finding, however, is not consistent with the prediction of many studies which suggests that insurance effect on growth is indirect in nature through its influence on stock market and bank developments.

<Table 5 here>

Several studies have assessed the impact of banks and stock markets development on the channels of growth: capital accumulation and productivity growth (e.g.

Levine and Zervos, 1998; Beck *et al*, 2000; Rioja and Valev, 2004). They generally find that the developments of both banking institutions and stock markets exert positive impacts on both capital accumulation and productivity growth.[11] In line with this literature, Table 6 presents our empirical results of the impact of insurance on capital accumulation and productivity growth. We find that insurance sector development has a significant positive effect on both capital accumulation and productivity improvement. Overall, this finding is consistent with the above-mentioned studies that use bank and stock market indicators.

<Table 6 here>

Several models indicate that there may be differences in the relative important of growth channel for countries at different stages of economic developments. For instance, the theoretical model presented in Acemoglu *et al*. (2006) predicts that a developing country that is behind the technological frontier will typically pursue a capital accumulation growth strategy (i.e. investment-based growth). Therefore, funds are expected to be channelled for capital accumulation purpose. In contrast, industrial countries that are at the technological frontier have a strong incentive for innovation and funds are expected to flows to activities with larger productivity gains (i.e. innovation-based growth).

To examine possible differential effects of insurance on growth channels across developed and developing countries, we follow an approach adopted in Azman-Saini *et al.* (2010) by using a dummy variable. In so doing, we managed to avoid sample splitting which may exacerbate biases caused by the proliferation of instrumental variables. Specifically, a dummy variable was created for developed countries (*HIGH*) with developing countries serving as the reference group.[12] HIGH is assigned a value of 1 for developed countries and zero otherwise. Then, the HIGH dummy is interacted with insurance

[11] Capital stocks were generated from the aggregate real investment series from the PWT following the perpetual inventory method. Then, per capita capital stock is expressed as a ratio of capital stock to total population. For TFP, we follow Beck *et al*. (2000) and compute productivity growth rate as *TFP growth* = *Output Growth* – 0.3**Capital Growth,* where all variables were expressed in per capita term.

[12] Countries are divided according to 2005 GNI per capita, calculated using the World Bank Atlas method. The groups are developing (i.e. middle- and low income) if GNI per capita is $10,725 or less and developed (i.e. high-income) if the GNI per capita is more than $10,725.

penetration ratio and added to the estimated model as follows: $\beta_1 Insurance + \beta_2 Insurance\ x\ HIGH$. With this specification, the impact of insurance on growth in developed countries is measured as $\beta_1+\beta_2$ and in developing countries as β_1.

The results of this exercise are presented in Table 7. The results of estimating capital stock equation show that only the estimated coefficient on "*Insurance"* is positive and statistically significant at the 5% level but the one on "*Insurance x HIGH"* is statistically insignificant. The estimated coefficient on "*Insurance"* is 0.014 which suggests that a 1-percentage-point improvement in insurance sector development increases the per capita capital stock in developing countries by 0.014-percentage-points. Since the impact on capital stock for developed countries is measured by $\beta_1+\beta_2$, it also increases by the same magnitude. In contrast, the results of estimating TFP equation reveal that the estimated coefficient is only positive and statistically significant for the "*Insurance x HIGH"* but the one on *"Insurance"* is insignificant. This result suggests that productivity growth in developed countries will increase by 0.016-percentage-points if an insurance sector development improves by 1-percentage-point. However, our result indicates that insurance sector development has no impact on productivity improvement in developing countries. These findings suggest that the richer the country the higher the effect of insurance sector development on productivity growth, consistent with the theoretical results advanced by Acemoglu *et al*. (2006). Importantly, the *p*-values of second-order serial correlation and the Hansen over identification tests indicate that both models are adequately specified.[13]

<Table 7 here>

[13] We also checked the potential non-linear impact of insurance development on growth by estimating an augmented model that includes INS^2 term. However, we failed to establish the non-linear impact of insurance development as the coefficient on INS^2 is insignificant.

6. Conclusions

Although the finance-growth nexus has been heavily researched at both theoretical and empirical levels, the impact of insurance development on growth has so far received much less attention. This paper provides empirical evidence in support of a robust positive effect of insurance sector development on growth, exploiting data from a panel of 51 developed and developing countries over the 1981-2005 period. Importantly, its impact on growth is independent of bank and stock market development indicators. In addition, we quantify the impact of insurance on the growth channels (capital accumulation and productivity growth) and find that the effects are positive and significant. We also assess the relative importance of the different transmission channels (capital accumulation versus TFP growth) and discover that their relative importance in promoting growth varies with the degree of development of the countries in the sample. Consistent with the theoretical work by Acemoglu *et al*. (2006), we observe that in developed countries, insurance sector development enhances GDP growth through TFP, while in developing ones, insurance has a positive effect on GDP growth by facilitating capital accumulation. It thus appears that the strong contribution of insurance development to productivity growth does not occur until a country has reached a certain income level, roughly in the range that defines developed countries. Until then, most of effect occurs through capital accumulation. By and large, our findings are strongly consistent with models that predict that well-functioning financial systems ease information and transaction costs, thereby improving the allocation of resources and economic growth. It is our hope that they also offer a new perspective on the finance and growth debate.

Appendix A1: List of countries

Developed Country	code	Legal Origin	Developing Country	code	Legal Origin
Australia	AUS	English	Algeria	DZA	French
Austria	AUT	German	Argentina	ARG	French
Belgium	BEL	French	Brazil	BRA	French
Canada	CAN	English	Chile	CHL	French
Cyprus	CYP	English	Colombia	COL	French
Denmark	DNK	Scandinavian	Dominican, Rep.	DOM	French
Finland	FIN	Scandinavian	Egypt	EGY	French
France	FRA	French	Hungary	HUN	Socialist
Greece	GRC	French	India	IND	English
Israel	ISR	English	Indonesia	IDN	French
Italy	ITA	French	Iran	IRN	French
Japan	JPN	German	Kenya	KEN	English
Korea, Rep.	KOR	German	Malaysia	MYS	English
Netherlands	NLD	French	Mexico	MEX	French
New Zealand	NZL	English	Morocco	MAR	French
Iceland	ISL	Scandinavian	Nigeria	NGA	English
Ireland	IRL	English	Pakistan	PAK	English
Norway	NOR	Scandinavian	Panama	PAN	French
Portugal	PRT	French	Peru	PER	French
Singapore	SGP	English	Philippines	PHL	French
Spain	ESP	French	South Africa	ZAF	English
Sweden	SWE	Scandinavian	Thailand	THA	English
Switzerland	CHE	French	Tunisia	TUN	French
United Kingdom	GBR	English	Turkey	TUR	French
United States	USA	English	Venezuela	VEN	French
			Zimbabwe	ZWE	English

Appendix A2: Data sources

Variable	Source	Unit of Measurement
Life insurance penetration ratio	Financial Structure Database	% of GDP
Real GDP per capita	Penn World Table	PPP price
Life expectancy	World Development Indicators	Years
Inflation	World Development Indicators	rate
Openness	Penn World Table	% of GDP
Government expenditure	Penn World Table	% of GDP
Black market premium	Fraser Institute	Index (0 – 10 scale)
Private credit	Financial Structure Database	% of GDP
Total share traded	Financial Structure Database	% of GDP
Legal origins	La Porta *et al*. (1999)	Dummy variable

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Table 1: Summary statistics

	Mean	Std. Dev.	Min	Max
Output growth	1.902	0.179	-0.82	6.060
Insurance/GDP	2.193	0.316	0.047	9.288

Table 2: Legal Origins and Insurance Sector Development

	Coefficient	S.e	*p*-value
Constant	2.671	0.736	0.001
ENGLISH	0.321	0.963	0.740
FRENCH	-1.642	0.776	0.040
GERMAN	2.853	1.381	0.044
SOCIALIST	-1.871	0.736	0.014
Observations	51		
F-test (p-value)	0.000		
R-square	0.36		

Notes: The dependent variable is the life insurance penetration ratio. S.e. are robust standard errors. ENGLISH = English legal origin. FRENCH = French legal origin. GERMAN =German legal origin. SOCIALIST = Socialist legal system. Scandinavian legal origin is the reference group.

Table 3: 2SLS estimation: Insurance and economic growth

	Coefficient	S.e	*p*-value
Insurance[†]	0.012	0.005	0.011
Initial GDP per capita[†]	-0.090	0.025	0.000
Life expectancy[†]	0.547	0.204	0.007
Government size[†]	0.001	0.024	0.959
Inflation rate[††]	0.024	0.017	0.180
Openness[†]	0.028	0.016	0.087
Black market premium[†]	-0.012	0.008	0.131
Observations	51		
J-test (*p*-value)	0.664		

Notes: All data averaged over 1981-2005 (except initial income which is GDP per capita at the start of 1976) and the legal origins from LLSV (1999) are used as instruments for insurance variable [†] and [††] indicate variables are included as log(variable) and log(1+variable), respectively. *J*-test is the Hansen overidentification test.

Table 4: GMM estimation: Insurance and economic growth

	Coeff.	S.e	*p*-value
Insurance [T]	0.010	0.003	0.001
Initial GDP per capita [T]	-0.033	0.010	0.001
Life expectancy [T]	0.323	0.127	0.011
Government size [T]	-0.155	0.069	0.027
Inflation rate [TT]	0.004	0.009	0.647
Openness [T]	0.023	0.038	0.543
Black market premium [T]	-0.005	0.010	0.579
AR(2) test (*p*-value)		0.514	
J- test (*p*-value)		0.187	

Notes: S.e. denotes heteroskedasticity-robust standard error. *AR(2)* is test of second-order residual serial correlation. *J*-test is the Hansen overidentification test. Time dummies are included to capture period-specific effect but are not reported. [T] and [TT] indicate transformations of the variables as log(variable) and log(1+variable), respectively.

Table 5: GMM estimation: Adding bank and stock market indicators

	Coeff.	S.e	*p*-value
Insurance [T]	0.010	0.003	0.006
Initial income [T]	-0.015	0.007	0.047
Life expectancy [T]	0.058	0.054	0.284
Government size [T]	-0.181	0.048	0.000
Inflation rate [TT]	-0.020	0.004	0.000
Openness [T]	-0.033	0.031	0.287
Black market premium [T]	-0.003	0.004	0.412
PRC [T]	0.021	0.005	0.000
TST [T]	0.004	0.002	0.026
REF [T]	-0.010	0.005	0.038
AR(2) test (*p*-value)		0.653	
J-test (*p*-value)		0.415	

Notes: S.e. denotes heteroskedasticity-robust standard error. *AR(2)* is test of second-order residual serial correlation. *J*-test is the Hansen overidentification test. Time dummies are included to capture period-specific effect but are not reported. [T] and [TT] indicate transformations of the variables as log(variable) and log(1+variable), respectively. PRC denotes private credits expressed as ratios to GDP. TST denotes the number of shares traded over GDP. REF indicates financial liberalisation index (scale 0 to 21).

Table 6: GMM estimation: Insurance and economic growth channels

	Capital Accumulation			Total Factor Productivity		
	Coeff.	S.e	*p*-value	Coeff.	S.e	*p*-value
Insurance[I]	0.018	0.007	0.016	0.004	0.002	0.097
Initial income[I]	-0.028	0.020	0.162	-0.031	0.013	0.021
Life expectancy[Ī]	0.403	0.212	0.057	0.220	0.094	0.020
Government size[Ī]	-0.021	0.066	0.744	-0.141	0.075	0.061
Inflation rate[ĪĪ]	0.019	0.014	0.194	-0.001	0.009	0.943
Openness[Ī]	0.102	0.052	0.052	0.005	0.046	0.906
Black market premium[I]	0.002	0.007	0.760	-0.011	0.009	0.249
AR(2) test (*p*-value)		0.191			0.349	
J-test (*p*-value)		0.109			0.175	

Notes: S.e. denotes heteroskedasticity-robust standard error. *AR(2)* is test of second-order residual serial correlation. *J*-test is the Hansen overidentification test. Time dummies are included to capture period-specific effect but are not reported. [Ī] and [ĪĪ] indicate transformations of the variables as log(variable) and log(1+variable), respectively.

Table 7: Insurance and growth across developed and developing countries

	(i) Capital Accumulation			(ii) Total factor Productivity		
	Coeff.	S.e	*p*-value	Coeff.	S.e	*p*-value
Insurance[Ī]	0.014	0.006	0.016	0.003	0.007	0.607
Insurance[Ī] x HIGH	0.003	0.010	0.765	0.016	0.009	0.074
Initial income[Ī]	-0.020	0.010	0.060	-0.046	0.014	0.001
Life expectancy[Ī]	0.318	0.134	0.018	0.111	0.144	0.437
Government size[Ī]	-0.138	0.081	0.090	-0.060	0.095	0.525
Inflation rate[ĪĪ]	0.010	0.012	0.423	-0.015	0.008	0.080
Openness[I]	0.104	0.050	0.037	0.016	0.039	0.673
Black market premium[I]	0.005	0.007	0.460	-0.008	0.007	0.251
AR(2) test (*p*-value)		0.312			0.541	
J-test (*p*-value)		0.354			0.283	

Notes: S.e. denotes heteroskedasticity-robust standard error. *AR(2)* is test of second-order residual serial correlation. *J*-test is the Hansen overidentification test. Time dummies are included to capture period-specific effect but are not reported. [Ī] and [ĪĪ] indicate transformations of the variables as log(variable) and log(1+variable), respectively. HIGH is a dummy variable and assigned a value of 1 for developed countries and zero otherwise.