THE IMPACT OF PENSION SYSTEMS ON FINANCIAL DEVELOPMENT: AN EMPIRICAL STUDY

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Abstract

The impact of pension assets on financial development is both quantitatively and qualitatively. On quantitatively, pension funds increase capital supply to financial market. On qualitatively, pension funds as institutional investors could promote corporate governance, information disclosure and transaction efficiency. Based on regression results of 55 countries and regions, we find that different pension systems formed different size of pension fund; every 1% increase of the pension funds' assets could bring about 0.15%-0.23% increase of the market value, which could explain cross-countries difference of financial development. Based on panel data analysis, we find that the impact of pension fund on financial development is very significant especially in civil law and underdeveloped countries. By using co-integration analysis and vector auto regression model (VAR) with time series data of Chile, we find positive relationship between pension funds and financial development again. The empirical results indicate that legal origin, endowment and pension fund views are not exclusive but compatible. A country cannot change its legal origin and endowment, but it can change pension policies and reform social security system. A funded pension system with accumulates pension assets could promote a country's financial development and economic growth.

Keywords: Legal Origin; Endowment; Pension Fund System; Financial Development

JEL Classification: G11, G12, G15, K23

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1. Introduction

What are major factors that affect a country's economic and financial development? This question is always bewildering scholars. A large number of economists find that economic growth is positively associated with financial development (Goldsmith 1969, Levine 1997), and recently a growing literature has examined the links between legal origins and financial development and finds that legal system development affects access to external finance, and that differences in financial development between countries are caused by different legal origins (La Porta *et al.* 1998, 1999, 2002). At the same time, the endowment hypothesis argues that financial development is indirectly dependent on natural resources, climate and other resource endowments through the property system.

In the past decades, confronting an aging population crisis worldwide, countries have adopted different measures and policies to manage this issue. In this chapter, we assume that the pension system determines financial development and present this as the pension fund hypothesis. Specifically, this applies to those countries that use an accumulated pension fund system. On the one hand, they accumulate considerable pension assets, which can supply stable investment capital to financial markets. On the other hand, as institutional investors, pension funds can improve corporate governance, promote innovation in financial products and improve the efficiency of financial markets. For the countries with a pay-as-you-go (PAYG) pension system, pension funds are paid in the current pay period, which will limit the surplus on the balance sheet or may even potentially result in a deficit. The pension fund thereby makes little contribution to financial markets.

This paper analyses the relationship between pension funds and financial development using cross-sectional, time series and panel data. The first academic contribution of this chapter is that it is one of the first studies to consider three factors, the legal origin, resource endowment and the pension system, in a cross sectional analysis of financial development. We find that that these three factors do not conflict but instead interact with financial development. The second contribution is derived from the empirical research conducted with panel data. We find that different pension systems have different impacts on financial development. Large pension funds bring a

greater positive influence on the financial development of non-common law countries with underdeveloped financial markets and low economic growth. The result shows that with the current aging population crisis, countries could reform and redesign their pension systems and try to use the accumulation system to enlarge the size of their pension funds, which could then be used for financial and economic development with the restriction of legal origins and resource endowment.

The structure of this chapter is as follows. Section 2 will propose the topics and review the related literature. Section 3 will introduce pension systems from an international perspective and explain how pension funds can influence financial development. Section 4 will present the empirical results, and several conclusions are reached in Section 5.

2. Literature Review

Economists have extensively studied the factors contributing to financial and economic development (Beck *et al.* 2003). John R. Hicks, a Nobel Prize winner, studied how finance stimulated the Industrial Revolution and found that the Industrial Revolution was not triggered by technological innovations but by financial reform because most new technology was invented or discovered before the revolution. Hicks (1969) believes that the legal and monetary systems are the foundations of a market economy. Goldsmith (1969) compares the financial interrelation ratios of 100 years and finds that financial development, to a large extent, reflects the country's economic development and that the two components are positively correlated. King and Levine (1993) analyze data of 80 countries over the period from 1960 to 1989, and their results show that more developed financial markets tend to experience faster economic growth Financial intermediaries are positively associated with economic development. The development of financial sectors could induce the development of other sectors, and financial development is a predictor of economic development.

Apart from the positive relationship between financial development and economic development, La Porta *et al.* (1998, 1999, 2002) propose the legal origin hypothesis. Different legal origins lead to differences in financial development: in common law countries, investors and creditors are better protected than in civil law countries. Accordingly, their financial development is better. More specifically, compared with civil law countries, especially French civil law countries, the English common law countries tend to provide stronger legal protection to shareholders and creditors. The common law has a capacity and flexibility that is oriented towards financial development. Britain's former colonies inherited the common law system; thus, their financial development began with an advantageous starting position. However, if a country was colonized by France, Spain, Portugal or other civil law countries, it will have a civil law tradition. Its financial market development level is therefore relatively low on average.

Acemoglu *et al.* (2001) propose the endowment hypothesis: during colonial expansion, European colonists adjusted the colonization according to the geographical and resource endowments. In those regions that shared a similar latitude to Europe and in which European colonists have low mortality rates, European settlers chose a resident colonization style to prevent the state from plundering individuals. The resident style also emphasizes freedom of contract, which helps to protect private property and benefits the development of financial markets. In epidemic regions at low latitudes, because of the harsh environment and high mortality, the European colonists had no intentions to create settlements; thus, the predatory style of colonization was applied. A few controllers were allowed to take advantage of their privilege and private property was less effectively protected, which slowed financial development. Therefore, different resource endowments led to different colonial policies, which in turn produced different legal systems in terms of property protection and thus determined the level of financial development.

In addition to the legal origin hypothesis and the endowment hypothesis, Stulz and Williamson (2003) have discussed the question of financial development from a religious and cultural point of view. They find that different religions have different attitudes towards the rights of creditors, resulting in different levels of financial development. Compared with Christian countries, Catholic and Islamic countries have negative attitudes regarding interest, and their credit is therefore at a relatively underdeveloped level. Using Switzerland as an example, Roe (2006) proposes a view that regards politics and war issues as the driving forces behind the government's willingness to open and develop capital markets, which subsequently determines the development of financial markets in different countries. Differences are therefore created for political reasons rather than driven by legal systems. Switzerland has a prosperous financial sector, though it is a civil law country, in part because it suffered lower losses during the two world wars. Moreover, Cheffins (2001) studies the history of the securities market in England and finds that ownership and control rights in terms of law have not been as important as the implications of the legal origin hypothesis. Coffee (1999, 2007) believes that although the relationship between the protection of investors' rights and the development of the stock market appears to be convincing, the legal origin hypothesis misplaces the causation as being the other way around.

3. Pension funds' impact on financial development: a new hypothesis

From the above discussion, many example countries can be identified that support the legal origin hypothesis and resource endowment hypothesis. However, these hypotheses cannot explain the differences across countries, and some countries such as Switzerland can only be regarded as exceptions. The critics of the legal origin and endowment hypotheses, who take religious, cultural,

political and war points of views, are reasonable. For example, the legal origin hypothesis cannot be applied to the Netherlands, Denmark and Switzerland, where financial markets are well developed. The endowment hypothesis does not work for Chile, which has a geography and a mortality rate similar to its neighbors but a stock market that performs well. Neither of the two hypotheses can explain why the stock market of Chile is much better than that of New Zealand when the former is a French civil law country with a high death rate. Davis and Hu (2008) have compared 18 OECD countries and 19 transforming countries. Their results indicated that the size of pension funds could be an explanatory variable for the differences in economic growth between countries, particularly for the transforming countries. If an accumulated scheme could be integrated into the system as part of a pension system reform, it will bring significant returns in the stock market and also to the national economy of a country. Therefore, based on the contribution of pension funds to economic growth, the legal origin hypothesis introduced by La Porta *et al.* should be revised to address the fact that pension funds can drive economic growth by providing financial support to the real economy. Following this point, the present chapter argues that in addition to the religious and cultural view and the political and militaristic view on the differences in financial development, the pension fund view can provide another explanation that is particularly useful for these exceptional countries.

Figure 1. Comparison of financial development in civil law countries and in Anglo-America countries
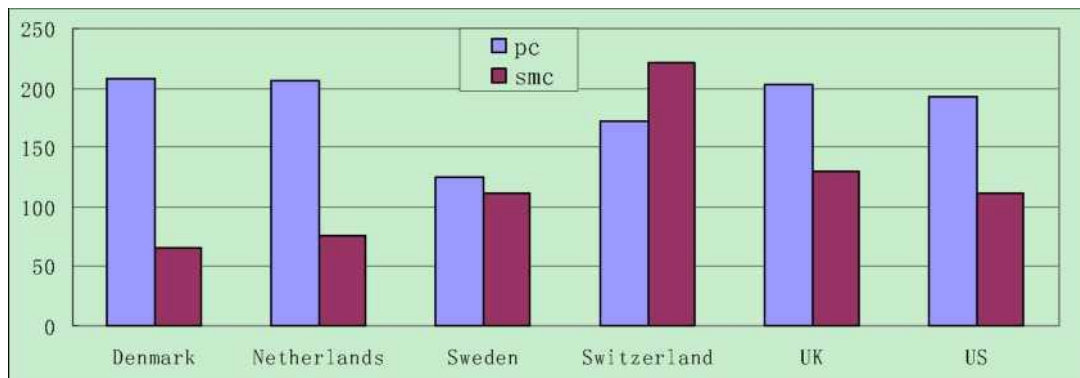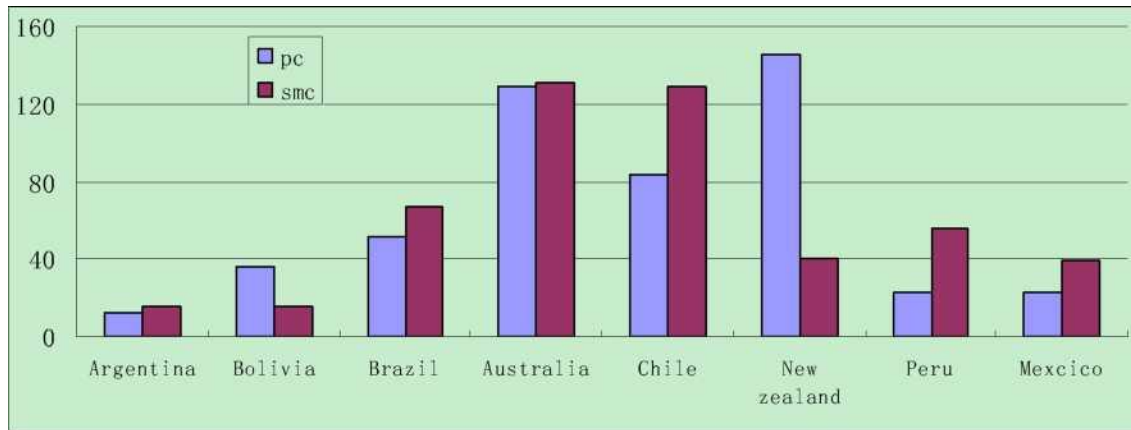

Source: World Bank, New Database on Financial Development and Structure (2012).

Figure 1 shows a comparison of the financial development between the UK, the US and some civil law countries. Switzerland is a German civil law jurisdiction, the Netherlands is a French civil law jurisdiction, and Denmark and Sweden are Nordic civil law countries. The indicators are the ratios of Private Credit (PC) and Stock Market Capitalization (SMC) over Gross Domestic Product (GDP). In the figure, the financial development of Switzerland outperforms that of the UK and the US. Denmark, the Netherlands and Sweden have development levels similar to the UK and the US. The legal origin hypothesis can only regard this situation as an exception because it does not capture the difference between these countries. Roe's Politics and War hypothesis works only for Switzerland but not for other Nordic countries.

Figure 2. Comparison of financial development in Australia and in Chile and their neighbors

Source: World Bank, New Database on Financial Development and Structure (2012).

Figure 2 displays a comparison of Chile and its neighboring countries together with Australia and New Zealand in the Southern Hemisphere. Chile and its neighbors not only share similar geography but also the same French legal tradition. According to data from Acemoglu *et al.* (2001), the death rates of the first group of settlers in those countries were more or less equal: 68.9 per thousand in Chile and Argentina and 71 per thousand in Bolivia, Brazil, Peru and Mexico. However, in terms of financial development, the PC/GDP ratio of Chile is 6.6 times that of Argentina, 2.3 times that of Bolivia and 3.7 times that of Peru. The SMC/GDP ratio of Chile is 8.6 times as that of Argentina, 8.4 times that of Bolivia, 2.3 times that of Peru and 1.9 times that of Brazil. Neither the legal origin hypothesis nor the endowment hypothesis can properly interpret those figures.

Similarly, the legal origin hypothesis and the endowment hypothesis do not address the fact that the Chilean stock market performs better than New Zealand's. New Zealand has a common law system and low settler mortality (8.55 per 1000 per year) compared with Chile (68.9 per 1000 per year). However, the SMC/GDP ratio in Chile is 2.2 times larger than that of New Zealand. These two theories cannot even address the differences between Australia and New Zealand, which have the common geography, language and legal origin. Nevertheless, the financial development of Australia is nearly the same as Chile and far better than New Zealand. What is the reason behind these differences?

If these hypotheses do not hold true in many cases, this elicits natural doubts about them in addition to new ideas: do any other factors address these exceptions? This is the key question of this research. Based on an understanding of pension funds and economic development, this paper presents a new hypothesis to address this issue.

3.1 Social security systems and pension funds

Almost all countries in the world have established various social security systems to meet the need of the aging population. The accumulated size of pension funds varies under different systems and policies. There are primarily five types of pension systems in terms of whether the funds are accumulated and how they are accumulated (Zheng 2005).

The Anglo-American model: in countries such as the US and the UK, the national pension scheme takes low fees and therefore provides a low substitution rate. The majority of pension funds come from corporate voluntary annuities.

The Continental model: in European countries as represented by Germany and France, the national public pension funds are pay-as-you-go. There is little surplus, and the retirement pension is frequently substituted. The corporate annuity contribution is relatively small; thus, the size of the accumulated funds is limited.

The Nordic European model: in the northern countries, aside from the corporate annuity, the government has established mandatory pension systems through legislation or work unions, which accumulate large pension funds. This system can be considered a mandatory pension model.

The Chilean model: in Latin America, the Middle East and Eastern Europe, the social security system requires people to have a personal account and to accumulate on a compulsory basis. The funds are completely tradable in the markets. In these countries, pension funds come from selfaccumulated personal accounts.

The Singaporean model: the government has both a national and a personal pension system. The central government controls the interest and announces it regularly, but the interest cannot reflect the real return. The Singaporean pension system is fully funded.

Table 1. Different social security models

Anglo American Model	Continental model	Nordic model	Chilean Model	Singaporean model
USA, UK, Canada, Ireland	France, German, Spain	Austria, Iceland, Switzerland	Chile, Peru, Argentina	Singapore

The different methods of raising and managing funds have resulted in different sized pension funds. According to data from international financial services organizations, global pension funds have grown from US$16.9 trillion to US$31.4 trillion, which is an increase of 85.8 per cent, from 2001 to 2007. The largest four countries, the US, the UK, Canada and Ireland, accounted for 78 per cent (US$24.5 trillion) of the total pension assets. The Anglo-American model takes the majority shares of all global funds (Xiong and Gao 2010).

3.2 Impact of pension funds on financial development

Pension funds have both quantitative and qualitative impacts on financial development. Quantitatively, pension funds increase the capital supply to financial markets. Larger financial markets are located in countries with large pension funds to GDP ratios. Qualitatively, the managing organizations of pension funds are institutional investors who influence corporate governance and information disclosure, and therefore help establish financial markets and improve the efficiency and depth of information. There is evidence supporting this point. In 2011, the weighted average ratio of pension funds to GDP for all OECD countries was 72.4 per cent, while the civil law countries, the Netherlands, Iceland and Switzerland, took the top 3 places with over 100 per cent. Other countries such as Australia, the UK, Finland, the US, Canada and Chile all exceeded 60 per cent. Greece has nearly no private pensions, but it has the highest public pension replacement rate (110 per cent); therefore, the Greek government's debt as related to public pensions aggravated its fiscal situation. Other European countries with a sovereign debt crisis such as Spain, Portugal and Italy (which, together with Greece, were called "the PIGS") had private pension assets only accounting for 7.8 per cent, 7.7 per cent and 4.9 per cent of their GDP, respectively. Hence, these countries must pay the public pensions for their retirees, which worsens fiscal sustainability (OECD, 2012). Compared with individual investors, pension funds as institutional investors have four advantages when promoting financial development as described below.

First, pension fund portfolios are held over a long period of time, which provides abundant funds to the financial market in the long term rather than providing short-term speculative capital. These funds are thus good for the stability of financial markets. For example, in the US, the 401k pension scheme brings substantial long-term investment capital to Wall Street, which provides IT companies such as Microsoft, IBM and Apple the opportunity to grow into industry leaders by taking advantage of the capital market. The pension-holding organizations become shareholders of the world's most promising companies. At the same time, the organizations obtain constant returns from these high- quality companies. The pension and capital markets interact positively and profitably.

Second, pension funds as large institutional investors are also large shareholders. Their influence on the board can help improve the governance structure of listed companies. Pension holding organizations can participate in nominating directors and amendments, proxy voting and drafting motions, all of which make information disclosure more transparent and improve corporate governance and financial conditions. For example, pension funds in California have been actively involved in corporate governance through an investment committee composed of an affiliated group of lawyers. This group participates in investment analysis, monitoring investment targets and the management team, and rejecting unfavorable motions together with small shareholders in general meetings (Hebb 2006). The positive impacts of institutional investors on corporate governance result in investment returns in the stock market, which once again enhances investor confidence in the financial markets.

Third, pension funds indirectly stimulate financial innovation. Bodie (1990) studies the relationship between pension funds and financial innovation and finds that pension funds in the US play a significant role in asset securitization, derivatives, debt and other financial innovations. Many new financial products in the US such as zero-coupon bonds, options and futures, guaranteed securities, guaranteed mortgages and forward contracts are being created to meet the demands of pension funds.

Finally, pension funds as managed by the government are supervised, and the financial markets they enter are also regulated by the government. The returns on investment of pension funds are essential for both the state and for individuals. In this context, supervision and regulatory systems receive widespread attention, which is helpful for developing

sound regulatory systems and policies for financial market development, such as more flexible taxation, more efficient and transparent transactions, and more risk management departments and advisory intermediaries. Thus, the development of pension funds is good for a country's financial innovation, the modernization of the infrastructure for security exchanges and the establishment of a sound settlement system.

4. Empirical results

From previous sections we have found that pension funds have different impacts on financial markets, particularly on security markets among different countries. Because the legal origin and endowment hypotheses do not support the observations, we proposed the pension hypothesis to explain these differences. Here, we use empirical analysis on cross sectional data, panel data and time series data, the results show that our hypothesis is valid.

4.1 Cross sectional data analysis

4.1.1 Data description

Two indicators measure financial development. The first indicator is the ratio of Private Credit (PC) to Gross Domestic Product (GDP), which measures the development of financial intermediaries. Private credit is defined as the credit issued by banks and other financial institutions to the private sector. The second indicator is the ratio of Stock Market Capitalization (SMC) to GDP. In the regression equation, the logarithms of the average values for these two variables from 2003 to 2005 are used; they are denoted by LPC and LSMC, respectively. The data are extracted from the New Database on Financial Development and Structure in the World Bank.

LPAP represents the logarithm of PAP(Pension Assets), which is the value of pension funds over GDP in 2002. The data from OECD countries are sourced from Pension Market in Focus 2003. The data from other countries come from Hu's research (2005).

ENGLISH is a dummy variable which is equal to 1 when the country's legal system originated from English common law, and 0 otherwise. LGNP is the logarithm of the average GNP from 1970 to 1995. Both ENGLISH and LGNP are from the data of La Porta *et al.* (1999).

LPR(Property Rights) measures property protection in 2002; it is the logarithm of the index of economic freedom, which comes from The Heritage Foundation (2001). There are only 24 cases with mortality rates in the sample of Acemoglu *et al.* (2001), and this paper thus uses property protection to replace mortality rate as a measure of endowments.

LINFL is the logarithm of the standard deviation of the inflation rate from 1980 to 1999. This variable measures the stability of macroeconomic policy, and it is from Penn World Table 6.1 (Heston *et al.* 2002).

4.1.2 Results

Table 2 presents the results of the Ordinary Least Square regression models. There are two groups of models based on the dependent variables LSMC and LPC. We can draw several conclusions from the regression results.

First, considering financial intermediaries, the impact of pension funds on the stock market is larger and stronger. In the LSMC models, the variable LPAP is significant in all five models, and the coefficients indicate that the elasticity of pension funds on the market value ranges from 0.15 to 0.23. In other words, when controlling for legal origin, property protection, GNP per capita and the standard deviation of the inflation rate, an increase of 1 per cent in pension fund assets will increase the stock market value by 0.15 to 0.23 per cent. In the LPC models, the elasticity of pension funds is much smaller, ranging from 0.09 to 0.036. If controlling for the legal origin and property protection, LPAP is no longer significant.

Second, similar to pension funds, the results show that the legal origin is more significant for the stock market value. When controlling other variables, if a country is a common law country, the ratio of stock market capital to GDP could increase as much as 59 per cent, while the ratio of private capital to GDP will increase by 30 per cent. In other words, the legal origin has twice the impact on the stock market as that of financial intermediaries, which is consistent with the conclusion of La Porta *et al.* (1999).

Third, if GNP per capita is the control variable, the variable of property protection is no longer significant because these two variables are highly correlated (0.73). When controlling for pension funds and legal origin only, the elasticity of property protection on stock market capital is 0.96, while its effect on private credit is 1.07, and both are statistically significant. When controlling for pension funds, legal origin, GNP per capita and the standard variance of the inflation rate, the impact of property protection on stock market capitalization becomes insignificant, but the impact on private credit remains significant with a lower confidence level.

Fourth, the variable of GNP per capita is significant in all models, which means that economic development is one of the most important factors in financial development. The impact of the standard deviation of inflation rates on private credit is significant but not the impact on stock market capitalization. This finding means that macroeconomic policy is very important to the development of financial intermediaries.

Table 2. OLS estimation results

Explanatory variables	Model A: dependent variable: LSMC					Model B: dependent variable: LPC				
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5
LPAP	0.23***	0.15**	0.17**	0.21***	0.15**	0.09**	0.06	0.05	0.07	0.036
	(3.57)	(2.05)	(2.46)	(2.99)	(2.09)	(2.04)	(1.20)	(1.05)	(1.53)	(0.74)
ENGLISH		0.46*	0.60**		0.59**		0.34*	0.33*		0.28
		(1.84)	(2.19)		(2.12)		(1.95)	(1.71)		(1.50)
LPR		0.96***		0.34	0.28		1.07***		0.62**	0.57**
		(3.34)		(0.84)	(0.72)		(5.53)		(2.46)	(2.30)
LGNP	0.29***		0.35***	0.22*	0.29**	0.27***		0.31***	0.14*	0.18**
	(3.32)		(3.97)	(1.75)	(2.34)	(4.67)		(5.05)	(1.80)	(2.22)
LINFL	-0.29		-0.10	-0.26	-0.08	-0.48***		-0.38***	-0.41***	-0.34**
	(-1.55)		(-0.52)	(-0.52)	(-0.42)	(-3.86)		(-2.80)	(-3.51)	(-2.62)
constant	0.24	-0.67	0.07	-0.53	-0.51	0.60	-0.53	0.50	-0.67	-0.66
	(0.30)	(-0.60)	(0.09)	(-1.38)	(-0.46)	(1.19)	(-0.70)	(1.00)	(-0.94)	(-0.95)
Obs	55	55	55	55	55	56	56	56	56	56
Adjusted R^2	0.42	0.42	0.46	0.42	0.46	0.54	0.51	0.56	0.58	0.59

***, **, * indicate significance at the 1%, 5% or 10% confidence level; the t value is shown in brackets.

4.2 Panel data analysis

In section 4.1, the cross sectional models test the legal origin, endowment and pension hypotheses on financial market development with a focus on the security market. As the sample size is limited to 55 or 56, it is not feasible to further examine the different types of pension systems. In this section, a panel dataset is used for empirical analysis on this point.

4.2.1 Regression model

Following the result of the previous Ordinary least squares (OLS) equations, this section regards the ratio of SMC to GDP as the dependent variable. The explanatory variables are the ratio of PAP to GDP, GDP per capita and government expenses to GDP (CG). Theoretically, the first two variables are positively associated with financial development and the last variable is negatively associated with financial development. For the convenience of calculating the elasticity, the logarithms of all items are taken and we have the estimated equation:

$$LSMC_{it} = a_i + P_1 LPAP_{it} + P_2 LGDP* + P_s LCG_{it} + u_{it}$$

where i is the country, t is the year, q is the intercept, $\&_2, \&$ are the coefficients of variables, and u_{it} is the error term.

The panel dataset is built on the data of 26 OECD countries from 2001 to 2008. The stock market capital data are sourced from the World Bank New Database on Financial Development and Structure (2012), the ratio of pension funds to GDP is sourced from OECD Pension Market in Focus (2012), and GDP per capita and government expenses to GDP are sourced from Penn World Table 7.1 (Heston et al. 2012).

In the sample of 26 countries, there are 7 of the Anglo American model, 9 of the Continental model, 5 of the Chilean model, and 5 of the Northern European model. This sample represents short panel data because the number of cases is fewer than the number of years. The F ratio rejects the hypothesis of mixed effect models but accepts that fixed effect models should be applied. Furthermore, the Hausman test shows that the model with all countries pooled, the model with only the Anglo American pension countries and the model with the Northern European pension countries should be applied to a fixed effect model. The Continental and Chilean models should be applied to a random effect model. In the estimate of the fixed effect, considering the differences in financial development across countries, the Generalized least squares (GLS) method (cross-section weights) is used.

4.2.2 Results

The results of the panel regression are displayed in Table 3.3. If GDP per capita and the government expense ratios are held constant, the sizes of the pension funds are significant in all models, with coefficients between 0.28 and 0.73. This result means that an increase of 1 per cent in the value of the

pension funds will result in an increase of 0.28 to 0.73 per cent in the total value of stock market capital. It is noted that this impact on financial development is less significant in the Anglo American countries where the financial markets are well developed and pension assets are at a larger scale. To the contrary, the impact is stronger in the less developed countries with smaller pension funds and less developed financial markets, such as the Continental countries, emerging Latin American countries and Middle Eastern countries. Without the effect of GDP per capita and government expenses, every unit of percentage increase will lead to an increase of 0.28 per cent in the Anglo American pension model, 0.33 per cent in the Continental model, 0.58 per cent in the Chilean model and 0.73 per cent in the Northern European model. This result means that the size of the pension funds has a more significant impact on the stock market in non-common law countries and in countries with less developed financial markets.

Additionally, GDP per capita is significant in the first four models. The elasticity on financial development is between 0.55 and 2.27, which means that the economic level is one of the most important factors in financial development. In the Northern European countries, GDP per capita is not significant because it is highly correlated with the other variable, government expenses to GDP ratio. The significance is reduced in the Chilean model for the same reason.

The variable of government expenses is significant in three of the five models, with coefficients ranging from -0.74 to -2.28. The negative sign shows that if the government interferes more substantially with social economic activities, financial development is more restrained. This result is consistent with the past literature. Once again, the collinearity in variables causes the government expense variable to be insignificant in the Chilean model.

Table 3. Estimation results from panel data

	All countries	The Anglo American pension model	The Continental model	The Chilean model	The Northern European model
LPAP	0.46***	0.28**	0.33***	0.58***	0.73**
	(7.08)	(2.26)	(3.26)	(9.93)	(2.56)
LGDP	0.96***	0.87***	2.27***	0.55**	0.24
	(4.79)	(3.10)	(4.33)	(2.52)	(0.31)
LCG	-0.85***	-2.28***	-0.74	-0.09	-1.45***
	(-4.24)	(-6.12)	(-1.44)	(-0.43)	(-2.68)
Constant	-5.48***	-1.31	-18.76***	-2.97	2.30
	(-2.63)	(-0.49)	(-3.49)	(-1.53)	(0.27)
Countries	26	7	9	5	5
Obs	208	56	72	40	40
Adjusted R^2	0.97	0.96	0.36	0.81	0.82

***, **, * indicate the significance at the 1%, 5% or 10% confidence levels; the t value is shown in the brackets.

4.3 Time series data analysis

The panel analysis shows that pension funds contribute more to financial development when they accumulate. For instance, from the view of legal origin, Chile is a French civil law country and has a similar geographic endowment to neighboring countries. In terms of economic development, Chile is not well developed. The pension reform in 1981 was a special case implemented by the Pinochet military government, but it inadvertently became a very successful and typical case in global pension reform.

The pension reform was an exogenous shock to the Chilean financial market. Therefore, in this context, Chilean pension reform provides a good case study for the impact on financial development.

Generally, after the 1981 pension reform, two fundamental features of Chile's social security system were established: first, personal accounts transformed the financing method from the traditional PAYG system to a funded system; second, pension management companies called *Administradoras de Fondos de Pensiones* shifted centralized management to decentralized management. The pension reform has

not only provided adequate pensions, supported retirees' lives, and maintained social stability, but it has also brought prosperity and stability to the capital markets and enhanced economic vitality.

To further test the pension hypothesis, cointegration and vector auto regression (VAR) analyses are applied to the data from after the pension reform in Chile from 1981 to 2009, for a total of 29 years. In this empirical study, the data sources are similar: the stock market capital (SMC) is from the World Bank; the value of pension funds (PAP) is from the International Federation of Pension Management (FIAP) and is converted to ratios to GDP according to PWT 7.1 (Heston *et al.* 2012); and GDP per capita is from the International Monetary Fund (IMF) World Economic Outlook database (IMF 2012).

4.3.1 *Cointegration and error correction model*

In the Unit Root tests, these two variables are non-stationary but in the first order. This paper uses a cointegration test based on VAR from Johansen (1988). The optimal lag is determined by the smallest Schwarz Criterion (SC) statistic. For the first order series, LSMC, LPAP and LGDP, the Johansen cointegration test is applied. The results show that the two variables are stable in the long term. The cointegration equations are

$$ecmt = LSMCt - 0.82LPAPt - 0.13LGDPt - 0.54$$

which can be rewritten as

$$LSMCt = 0.54 + 0.82LPAPt + 0.13LGDPt + ecmt.$$

The equation above shows the relationship between stock market capital, the value of pension funds and GDP per capita, in which the coefficients are the elasticity of the value of pension funds and GDP per capita. Specifically, if GDP remains constant, stock market capital will increase 0.82 per cent for each increase of 1 per cent in pension funds; if the size of pension funds remains constant, stock market capital will increase 0.13 per cent for each increase of 1 per cent in GDP per capita.

In the short term, these variables are not in equilibrium, although they are in equilibrium in the long term. However, they can be adjusted using the error correction model as below:

$$\Delta LSMC_t = 0.28\Delta LPAP_t + \Delta 0.82LGDP_t - 0.27ecm_{t-1}$$

$$(2.70) \quad (4.29) \quad (-2.05)$$

4.3.2 *VAR model and IRF and VD*

Based on the test above, the VAR model is built on the endogenous variables stock market capital, the value of pension funds and GDP per capita. According to the Lag Length Criteria, this paper uses the second order VAR model. As it passes the stationarity test, the model shifts to the Impulse Response Function (IRF) and Variance Decomposition (VD).

The Impulse Response Function is used to describe the effect that the random error term is applied to an external shock that equals the standard deviation and provides the current and future values of endogenous variables. This function captures the dynamic interactions between the variables. Figure 3.3 shows the response function of the stock market value to the external shocks of the pension funds and GDP per capita.

The first curve in the figure is the stock market under the change to itself. The middle curve is the impulse function of pension funds to external shocks caused by changes in stock market value. On this curve, when the current pension fund is shocked by a change in the standard deviation, the value of the stock market capital increases rapidly, reaching a peak in the fifth period. Then the value gradually declines, finally converging to zero. This process takes a long time. The bottom curve is the impulse function of GDP per capita to external shocks caused by changes in the stock market value. This curve shows that when the current GDP per capita suffers a shock reflected in its standard deviation, the stock market value starts to increase, but more slowly than the increase in pension funds, reaching a peak in the seventh period. The impulse is less intense. Thus, the impact of pension funds on stock market value is not only stronger but also longer.

Figure 3. Impulse responses of the stock market to shocks
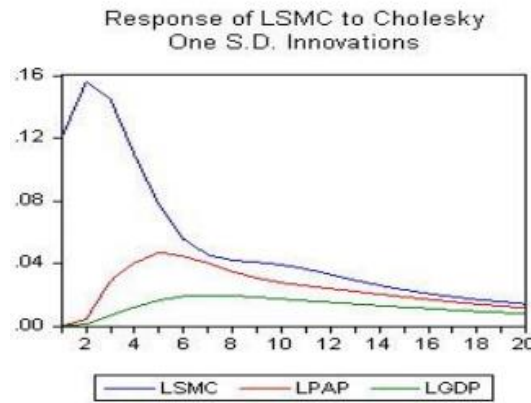
The Impulse Response Function describes the impact of the endogenous variables on other endogenous variables in a VAR model, while variance decomposition demonstrates the importance of different structural shocks by analyzing the contributions of endogenous variables on the changes from each structural shock.

Table 4. Variance decomposition of LSMC

Period	S.E.	LSMC	LPAP	LGDP	Period	S.E.	LSMC	LPAP	LGDP
1	0.12	100.00	0.00	0.00	11	0.32	86.15	11.47	2.38
2	0.20	99.95	0.05	0.00	12	0.32	85.64	11.80	2.55
3	0.25	98.52	1.40	0.07	13	0.33	85.21	12.09	2.70
4	0.27	96.41	3.34	0.25	14	0.33	84.84	12.33	2.82
5	0.29	93.76	5.68	0.56	15	0.33	84.53	12.54	2.93
6	0.30	91.49	7.58	0.93	16	0.33	84.28	12.70	3.02
7	0.30	89.70	8.99	1.31	17	0.33	84.07	12.83	3.09
8	0.31	88.41	9.94	1.65	18	0.33	83.90	12.94	3.16
9	0.31	87.47	10.59	1.94	19	0.33	83.76	13.03	3.21
10	0.32	86.74	11.08	2.18	20	0.33	83.64	13.10	3.25

From the variance decomposition of the stock market value in Table 3.4, among all factors that change the stock market value, the first one is the market itself. However, the stock market shows an attenuating trend that declines to 83.64 per cent by the twentieth period. In other words, the stock market is self-developing and self-reinforcing. The second factor, the impact of pension funds, is also significant; it becomes stronger, reaching 13.10 per cent in the twentieth period. The stock market value increases together with the pension funds but declines naturally with the attenuation, which shows that pension funds are becoming an increasingly important investor in the security market from another point of view. Finally, the influence from GDP per capita is minor, as it reaches 3 per cent in the twelfth period. The result is consistent with the theoretical analysis that the impact of pension funds on the stock market is positive in both quantity and quality, such as the innovation of financial products and improvement of corporate governance.

5. Conclusion

Against the background of the aging population crisis, many countries have applied different pension systems. The pension system changes financial development. An increase in the value of pension funds not only supplies the financial markets with more capital, but also produces innovations in financial products, improves corporate governance, and improves the supervision and regulatory system, which are all good for financial development. This chapter tested different hypotheses by modeling the impact of pension funds on financial development using cross-sectional, panel and time serial data.

The empirical analysis uses cross sectional data for 55 countries and regions in the regression model. The results show that the pension system and its value can explain differences between countries with respect to financial development and, more specifically, differences in stock markets. This is the first study to consider the legal origin, endowment and pension systems at the same time to analyze their

influence on financial development. Next, the panel regression models investigate financial development under different pension models. The results show that an increase in the size of pension funds signifies a greater boost in the development of financial markets for non-common law countries with underdeveloped financial and economic systems. Finally, this chapter uses the Chilean case between 1981 and 2009 in a time series analysis using a cointegration and vector autoregression model. The results also confirm the positive impact of pension funds on financial development. In all of these empirical studies, we have found that the legal origin, endowment and pension fund theories are not in conflict but complement one another. The implication of the pension hypothesis is that when the legal system and resource endowments are inherent and cannot be changed, given an aging population, applying a funded pension system is possibly a solution. A funded pension system also benefits the accumulation of pension funds, stimulates financial markets and accelerates economic growth.

These findings are of great value for China's pension system reform and development and China's financial development. China is not a common law country. Other theories such as resource endowments, religious and cultural differences, politics and war do not properly address China's financial development and rapid economic growth. These theories imply that China cannot perform well in its financial development. However, if China follows the pension theory, it has the potential to grow stronger in the future, as the benefits from pension funds are greater in non-common law and developing countries. In the developing country Chile, after pension system reform in the 1980s, its financial and economic achievements established it as a miracle in Latin America. Accordingly, Chile has become the first South American country to join the OECD.

In 1997, China formally established a pension system that is a combination of an overall social plan and individual accounts. The individual pension accounts are mostly in deficit, and there is no legal support for their investment in the capital market. Since 2004, China has had an enterprise annuity scheme; however, its size is relatively small, and the participation rate is low. The annuity, as the second pillar in the pension system, has not been functional. Without the investment of pension funds, the Chinese capital market is far behind in the development of the real economy. As the world's second largest economy, China will outperform Chile if it focuses on pension reform, and economic development and the security market will benefit. Therefore, China should provide an opportunity to invest in personal pension accounts, encourage corporate annuities, provide more methods for investment, supply more financial products and improve the investment environment. All of these changes will prompt pension funds and financial markets to interact in a positive manner.

Based on this paper, future work could focus on how to reform and improve China's pension system. A strong pension system will promote capital markets, financial development and economic growth and will also solve the problem of growing old before becoming rich.

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