Spillover Effects of Pension Funds on Capital Markets
-The Mechanism and Preconditions

Hee-Sik Kim*

Abstract

This paper analyzes the mechanism and preconditions whereby pension funds contribute to the development of capital markets. It posits that pension funds contribute to development of the capital markets by helping them to internalize the pecuniary external effects innate in the process of industrial investments. It also argues that the mechanism entails fulfillment of both a 'size condition' regarding the critical mass of pension funds to have significant effects on capital markets and an 'institutional precondition' regarding pension fund management. Results from empirical analyses confirm the 'externality hypothesis' for the Anglo-Saxon countries, but not for the Continental European countries and Japan. It has been argued that the difference stems from the different degrees to which the two preconditions are satisfied. These results imply that achieving a critical mass of pension funds and securing the market mechanism regarding management of pension funds may suffice for pension reforms to succeed in contributing to the development of capital markets.

Field : Economic Development

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Key Words : Pension funds, risk-taking, capital markets, financial system

* Senior Economist, Institute of Monetary and Economic Research of the Bank of Korea. Contact hkims@bok.or.kr

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□. Introduction

Funded pension schemes in which assets are managed by privately-run pension funds is drawing attention as an alternative to the financially unstable pay-as-you-go public pension programs. It is alleged that the private pension programs bring about positive spillover effects on the economy through various channels for example through increased maturity of the aggregate savings or through development of domestic capital markets[1].

This argument has been inspired by the example of Chile's success in pension privatization. Many countries including Latin American countries and East European countries have implemented pension reforms similar to Chile since 1990s. Those countries, mostly faced with the insolvency of social security pension programs, replaced all or part of them with private ones. But there are other countries that stick to the old regime of PAYG public pension like the Republic of Korea.

Even though the Chilean experience of pension reform has been intensively documented, the role of pension funds in the development of capital markets in advanced countries are less studied. There are some empirical analyses showing that development of pension funds has been conducive to the development of domestic capital markets (Walker and Lefort 2002, Impavido, *et al*. 2003, among others). Pension funds especially those in Anglo-Saxon countries seem to play a substantial role in the development of domestic and global capital markets. In particular, funded corporate pension funds, first instituted by ERISA of 1974 in the U.S.A., are said to have contributed to the institutionalization and globalization of the financial systems (Davis and Steil 2001, Franko 2004).

But the idea is still foreign to countries like the Republic of Korea where the main pillar of pension system is the partially funded public pension program which is still in its immature stage. Moreover, the mechanism by which pension funds stimulate development of capital markets does not seem to be articulated in the literature yet.

In this regard, this paper delves into the questions: Does the impacts of pension funds on capital markets come as an external effect? If so, what is the mechanism? How and under what conditions can the external effect be internalized? Theoretically it follows suit Vittas (1999) and others in arguing that the growth of pension funds bring about development of domestic capital markets through spillover effects. It tries to articulate the mechanism by which pension funds exert positive spillovers on capital markets; it is argued that pension funds help a market-based financial system in its early stage of development overcome the obstacles of too little risk taking by investors as described by the models of Acemoglu and Zilibotti (1997) or by Martin and Rey (2004). According to Acemoglu and Zilibotti(1997), "the opening of an additional

[1] See e.g. Holzmann and Hinz (2005) for general discussion for this issue.

sector creates a positive pecuniary externality on other potential projects since consumers now bear less risk when they buy these securities" due to widened set of asset diversification opportunities. But a decentralized market fails to internalize the pecuniary externality and the economy suffers from investors' risk taking level short of a critical mass. This paper posits that introduction of mandatory corporate pension plans or private pension plans with preferential tax treatment can help this out; and that if the size of pension funds exceeds a critical mass (the size condition) and the regulations are conducive to efficient management of the pension funds (the conducive regulation condition or institutional precondition).

The empirical analysis applies Arellano and Bonds' (1991) methodology to an unbalanced panel data of the 16 OECD countries for which relevant data are available. The analysis focuses on detecting the dynamic relations between the development of pension funds and capital markets. Besides, it examines whether the role of pension funds in developing capital market is different from that of life insurance by estimating the effect of life insurance on the capital market development and comparing them to those of pension funds.

In order to show the impact of different institutional settings on the realization of spillover effects, the 16 OECD countries are divided into two groups - 4 Anglo-Saxon countries and 11 Continental European countries and Japan. This method has been adopted to take the complementarity of pension funds and the market-based, rather than bank-based, financial system into account.

The main contribution of this paper is as follows. It provides a sketch of the mechanism through which development of pension funds brings about that of capital markets and the preconditions for the mechanism. The paper also provides empirical evidences to back up the arguments; that is, it shows positive spillover effects and the importance of initial size of pension funds for the effects extant the Anglo-Saxon sample and absent in the Continental European Countries and Japan sample. The differences between the two sample attest to the importance of the 'institutional precondition.' Lastly, it implies that pension reforms with a view to fostering pension funds industry can be a measure to transform a bank-based economy like Korea to a market-based one open to the global financial markets.

□. Pension Funds and Capital Markets

1. Pension System and Capital Markets

A. Old-Age Income Security and Private Flow of Funds

Private, corporate or individual, mandatory or voluntary, pension plan can be one of the main sources of income in old age. Whereas the public pension plans are mostly on pay-as-you-go basis, private pension plans are generally funded fully or partially.

Similar to funded private pension, life insurance can also be a source of income for the elderly. Life insurance differs from private pension in that it mainly evolves in the financial markets, whereas private pension funds grow dependent on the nature of social policy or the policy to correct the market failure for pension funds or annuities. For example, political choice of pension system, private or public, funded or PAYG, etc, critically determines the genesis and growth of pension fund industry. By contrast, once established, life insurance can become the target of policy mostly for prudential supervision purposes.

The degree of dependence on private pension, public pension and life insurance is diverse among OECD countries (OECD 2005c). Most Anglo-Saxon countries have high dependency rate on private pension plans whereas European countries and Japan have high dependency rate on public pension plans and life insurance. The particular structure i.e., which institutions a country depends for old age income security matters for the development of capital market since they will either amplify or dampen the private flow of funds within the economy. It is because contributions to a PAYG public pension are transferred through the fiscal system, rather than through the financial system, to the pensioners, while those to a private pension will nourish the private flow of funds by increasing the maturity, if not the level, of aggregate savings.

B. Growth of Pension Funds and Global Capital Market

Some Anglo-Saxon countries began to strengthen private pension system in response to the trend of rapid population aging in the 1970s. This measure has been functioning as the major factor to facilitate the development of global capital market since then. The funded defined-benefit corporate pension plan originates from the enactment of the Employee Retirement Income Security Act (ERISA) of 1974 in the U.S.A. And the 401(k) was introduced in 1982 to give preferential tax treatment for defined-contribution corporate pension plans. After that, assets of private pension in the US have drastically increased.

Besides, many other Anglo-Saxon countries did similarly; for example, Great Britain in 1967 and in 1986, Canada in 1967, and Australia in 1992. By contrast, the similar pension reform came only recently in several Continental European countries and Japan; for example, Sweden in 1999, Germany and Japan in 2001. Despite these efforts by these countries, the influence of pay-as-you-go public pension system is still overwhelming in them.

By the end of 2004, total asset of pension funds of the OECD countries is approximately $ 14 trillion, amounting to 43.2% of market capitalization of listed stocks in the world as can be seen in <Table 1>. Of total asset of pension funds of OECD countries, those of 4 Anglo-Saxon countries occupy 85%. Thus, it may be said that the growth of pension funds is dominantly an Anglo-Saxon phenomenon.

The growth of pension funds is spectacular. The pension funds grew on average 14.1% a year from 1997 to 2004 in asset size, while the market capitalization of stock in 98 nations increased on average 9.8% a year. Whether the size of pension funds led to or was led by the development of stock markets is subject to an empirical test.

<Table 1> Level and Growth of Stock Market Capitalization and Assets of Pension Funds

($ billiion, %)

	Aggregated value of listed stock(A)		Annual average growth rate	Pension assets(B)		Annual average growth rate	B/A	
	1997	2004		1997	2004		1997	2004
4 Anglo-Saxon countries2)	14,119	20,980	6.9	7,076	13,919	13.8	50.1	66.3
(Ratio, %)	(62.3)	(55.0)		(85.3)	(84.8)			
World/OECD total1)	22,701	38,214	9.8	8,291	16,496	14.1	36.5	43.2

Sources: OECD (2005a), WDI (2005).

2. Characteristics of Pension Funds[2]

A. An Institutional Investor

Pension funds are institutional investors[3] managing funds on behalf of members and paying the resulting returns and principal to them after retirement. In defined-benefit corporate pension funds, the sponsor guarantees a certain level of benefits and, therefore, the employer takes the financial risks. These are regulated to hold minimum amount of reserves like banks. In contrast to this, in defined-contribution pension plans, workers take financial risks.

The advantage of pension funds as institutional investors over banks derives from the fact that their debts are long-term. Although banks hold reserves and have deposit insurance system, their capacity to invest large scale funds for the long term is limited due to the likelihood of a bank run. By contrast, pension funds tend to invest in long term assets to match the maturities of asset and liabilities. Under market discipline, pension funds are forced to pursue high risk-adjust rate returns through risk pooling and diversification.

Although both pension funds and life insurance companies are long-term institutional investors, differences in the characteristics of the liabilities let them behave differently. Pension funds with their liabilities usually linked to the earned income prefer stocks, while life insurance companies with their liabilities defined in nominal terms prefer bonds.

Pension funds contrast also with mutual funds in that their liabilities are illiquid while those of mutual funds are mostly liquid. Thus their investment time horizon is usually longer than mutual funds. However, defined- contribution pension funds are likely to behave similarly with mutual funds because the fund managers are rewarded on the basis of short-term performances (Miles 1993).

Pension funds are more active in portfolio strategy and public pension funds that are managed by public sector.[4] It is not only because pension funds are less constrained in their investment by social objectives but also because pension funds, in particular defined-contribution ones, have to compete with each other for higher rate of risk-adjusted returns. According to Iglesias and Palacios (2000) investments of public pension funds are

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[2] The explanation on the characteristics of pension funds as institutional investors relies on Davis and Steil (2001) and thus can be skipped by well informed readers.

[3] Pension funds in this paper refers to autonomous pension funds as in OECD (2003).

[4] Public pension funds strategy such as California Public Employees' Retirement System(CalPERS) and New York State Common Retirement System (NYSCRS) are active in fund management. Thus they are treated as pension funds rather than public pension plans in the empirical chapter.

concentrated mainly on government bonds. Consequently, the real rates of returns of public pension funds are very low in 22 countries where the data are available.

Comparison of the portfolio by the institutional investors and banks in the Table 2 hints the uniqueness of pension funds as institutional investors. In bank portfolio, loans are largest and stocks and mutual funds are scanty, whereas stocks and mutual funds are largest in the portfolio of pension funds, and bonds are largest in the portfolio of insurance companies.

<Table 2> Portfolio Composition of Bank, Life Insurance and Pension Fund in the U.S.A.

(end of 2003, %)

	cash de posit	public bonds	corporate bond	loans	insurance	stock	mutual funds	Others
bank	0.9	16.1	6.2	56.4	-	0.2	0.2	19.6
Life insurance company	5.2	13.3	42.9	9.7	-	24.4	2.4	2.0
pension funds	7.1	4.9	4.8	0.2	8.7	48.2	21.3	4.8

Sources: OECD(2005a), *Flow of Funds Statistics of the United States*, FRB of the U.S.A

B. Behavioral Characteristics

The asset management of pension funds varies among countries depending on the country's regulations on pension funds, industrial structure of asset management industry, and the demand for securities (Davis and Steil 2001). Pension funds in Anglo-Saxon countries such as Great Britain and the U.S.A. may invest in a different manner from those in Continental European countries such as Germany and France due to differences in the financial systems[5].

In fact, the portfolio of pension funds in Anglo-Saxon countries differ substantially from those in Continental European countries and Japan as shown by the OECD (2005a) statistics on pension funds in Table 3. Generally speaking, the degree of asset diversifications is high in the former than in the latter. The share of risky assets such as stocks and mutual funds is high in the former and low in the latter. Instead, the share of bonds is high in the latter. These differences

[5] Financial system carries out functions such as payments, pooling of assets, allocation of resources between different points of time and industries, coordination of decentralized decision-making through price discovery and signaling, and coping with incentive problems (Merton and Bodie 1995).

are closely related to the fact that the former has market-based financial systems while the latter has bank-based financial systems.

<Table 3> Portfolio of Pension Funds

(as the end of 2003, %)

		cash deposit	public bonds	corporate bonds	Loans	Insura-nce	stock	mutual fund	real estate	others
Anglo-Saxon Countries	Canada	4.9	18.7	5.4	-	-	23.6	36.7	3.5	7.2
	UK	2.6	14.5	4.7	0.5	6.2	53.8	11.4	4.3	2.0
	US	7.1	4.9	4.8	0.2	8.7	48.2	21.3	0.8	4.0
Europe and Japan	Germany	2.6	36.3	0.0	27.0	-	12.7	7.8	6.2	7.4
	Italy	9.1	33.0	0.5	0.0	20.4	5.8	4.3	11.0	15.9
	France[1)]	1.3	34.7		-	-	14.8	-	4.0	45.1
	Japan[2)]	5.0	34.0		14.0	-	23.0	-	0.0	24.0

Note: 1) as of 2000(Davis 2002), 2) as of 1998(Davis and Steil 2001)
Source: OECD(2005a), Davis(2002), Davis and Steil (2001)

The behavior of banks or insurance companies in asset management is also different depending on the economic systems. For example, there is a noticeable difference in the asset management of bank and insurance company between the US and Germany as shown in Table 2 and Table 4. In Germany not only banks but also insurance companies show tendency to have high proportion of assets in cash and deposits compared to those in the U.S.A. German pension funds hold less the proportion assets in stocks and mutual funds than do the insurance companies. The results seem to reflect in part stricter regulation on the investments of pension funds in Germany as indicated by Roldos (2004).[6] In contrast, there is no quantitative regulation on investments of pension funds in Anglo-Saxon countries; rather the 'prudent person rule'[7] is applied. If the quantitative regulation is imposed on asset management of pension funds

[6] In Germany and Japan, there is a limit that the investment in stocks and overseas securities cannot exceed 30% of the total asset respectively (Roldos 2004).

[7] 'Prudent person rule' requires fund managers only the duty of fidelity, integrity and responsibility.

as it is in Germany, 'herd behavior' of fund managers might be prevented but it can lower the expected rate of return by constraining the efficient allocation of portfolio.

<Table 4> Comparison of Asset Allocation of Banks, Life Insurances and Pension Funds in Germany

(end of 2003, %)

	Cash deposits	bonds	loans	stocks	mutual funds	others
bank	13.4	20.6	56.4	4.6	2.4	2.6
insurance company	32.9	10.1	12.7	17.9	20.7	5.6
pension funds	2.6	36.3	27.0	12.7	7.8	13.6

Source: Financial Accounts for Germany, Deutsche Bundesbank, each issue.

□. Mechanism and Preconditions

1. Externalities Hypothesis

This chapter provides a sketch of the mechanism in which pension funds contribute to the development of capital markets in the context of a market-based financial system's evolution. Introduction of pension funds into the financial development model suggested by Acemoglu and Zilibotti (1997, AZ)[8] or Martin and Rey (2004, MR)[9] would lead to this mechanism.

[8] In the AZ model, individuals living two periods spend with the income obtained through labor during their youth and save the rest of it. Savings can be held in the form of either low-risk low-return liquid assets or high-risk high-return risky assets i.e., stocks. In the real sector, there are a final good sector with constant returns to scale technology, and numerous intermediate goods sector that require different minimum scale capital investments. Businessmen raise capital for the production of intermediate goods through stock issue. The size of aggregate capital stock in the economy is determined by the sum of liquid assets in the previous period and the total savings of individual investors in the current period.

[9] In the MR model, individual investors allocate asset among real investment projects, domestic stocks and overseas stocks to diversify risks. Under such a specification, capital moves from the less developed countries to advanced countries to take advantage of asset diversification opportunities.

In the model of AZ, there are numerous intermediate goods industries with fixed costs; they finance investments by issuing stocks. Since rates of stock returns are imperfectly correlated, an increase in the number of listed stocks widens opportunities for asset diversification. This in turn will increase the demand for risky assets. Thus an increase in the aggregate demand for stocks or risky assets would enable more projects in intermediate goods sector to be undertaken[10]; internalization of the pecuniary externalities or realization of economies of scale by firms thus achieved would bring about increasing returns at the aggregate level.

However, it is impossible to make this happen through capital markets especially if the economy has accumulated little savings in the early stage of economic development. The reason is that individual investor does not take the positive externalities of their investments into account. Thus risky projects are undertaken too little. AZ demonstrated that introduction of investment funds cannot prevent capital markets from failing. In the same context, MR suggests a solution: that is to subsidize purchase of stocks with lump-sum tax in order to encourage risk taking.

An alternative to the subsidy to long-term investments would be introduction of mandatory funded private pension programs or subsidy or tax incentives to private pension plans. Suppose that pension funds are more capable of investing in risky assets than individuals. Then introduction of mandatory defined-contribution corporate pension plan would increase long-term savings and investments in risky assets. Furthermore, when appropriately designed, the new pension system will also help development of annuity markets as seen in the case of Chile.

Against this background, the mechanism by which capital markets internalize pecuniary external effects with the momentum generated by introduction of private pension schemes such as mandate retirement pension plans in Australia or the 401(k) in the U.S.A. can be sketched as follows. First, continuous accumulation of pension funds raises the level of investments in high-risk high-return securities in the economy as a whole. This makes possible more intermediate goods industries finance their minimum efficiency scales. Moreover, the widened opportunity for risk diversification by the new issues of stocks or the increase in the number and kinds of stocks enables investors to allocate larger portion of total savings to stocks. The increase in the demand for stocks facilitates new innovative firms to start up in the intermediate goods industry.

This argument can be summarized into a hypothesis, so called externalities hypothesis, that development of pension funds industry in a market-based financial system leads to the development of stock markets through internalizing the pecuniary externalities innate in risk taking activities. This hypothesis is divided again into the externalities hypothesis pertaining to capital markets, so called 'hypothesis-A' and the externalities hypothesis pertaining to real sector, so called 'hypothesis–B'. The former captures the virtuous circle between demand

[10] Development of secondary markets for stocks would thus facilitate the degree of roundabout-ness in production to increase.

expansion in capital markets and improvements in expertise in the supply side of financial services or the increased specialization in the asset management industry. The latter catches the aspect that pension funds assist the realization of economies of scale by firms in the real sector.

Existence of the positive externalities of pension funds on the real sector (hypothesis-B) can be a test bed for the sustainability of the effects of pension funds on capital markets. Unless the effect spills over to the real sector, the boost-up effects of pension funds will be short-lived, merely amplifying the volatility of capital markets. If asset management of pension funds is exposed to agency problem or short-termism, the negative side effects are more likely to occur. On the other hand, if the pension funds promotes investments in innovative projects directly or indirectly through the development of capital markets, the effect of pension funds on the development of capital market will sustain. Thus, the paper changes the 'hypothesis-B' into a testable form as follows. That is, 'the higher the degree of pension funds development, the higher the share of total savings invested in research and development in a market-based financial system, if not in a bank-based financial system.'

2. Preconditions

A. Size Condition

The possibility of pecuniary externalities comes from the potential economies of scale property innate in the investment projects or in the development of the asset management industry. Thus given the active-ness of the pension funds in risk taking, it can be said that the larger the aggregate fund size, the bigger the effects of pension funds on capital markets. This complies with the argument posited by Vittas (1999) that a critical mass is required for such effects to prevail. Moreover the increase in the size of pension funds to a critical mass may bring about endogenous evolution of institutions favorable to the efficient management of pension funds. For example, Some e.g., Davis and Steil (2001) maintain that in a sense the rapid growth of institutional investors led to the deregulation of interest rate control and capital controls in advanced countries during the period from 1960 to 1980.

When applied to the two-country open economy model of AZ, the 'scale condition hypothesis' can be restated; the larger the initial size of the pension funds of a country relative to other countries, the larger impact of pension funds on the development of capital market.' The rationale may be found from the proposition in the AZ and the MR open economy models that, when liberalized, capital moves from the country with less diversifications opportunities to the

country with more diversification opportunities. This reinforces the likelihood[11] that the pecuniary externalities of risk taking may be internalized and the capacities of asset management industry as a whole may be improved.

B. Institutional Precondition

Not only 'scale condition' but also 'institutional precondition' needs fulfilled so that pension funds have the positive spillover effects on capital markets.[12] According to North (1990), institutions matter for economic development if there exist opportunities of increasing returns. In other words, 'institutional precondition' for pension funds to have positive effects on the development of capital markets can be stated as follows; that is, pension system and financial system should be designed such that competitive allocation of pension funds is guaranteed.'

The possibility that 'institutional preconditions' obtain is much higher under private management of pension funds than under public management of pension funds. It is because public pension funds except some public employee pension funds of the U.S.A. and Canada Pension Plan are mostly managed by the government entities, and thus lacks market disciplines.

The possibility for 'institutional precondition' to obtain may depend also on whether financial system is market-based or bank-based. Especially in the bank-based financial system of the European Continent and Japan, the influence of universal banks seems so strong that infrastructures for capital markets are poorly developed relative to those in U.S.A.[13]

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[11] In the efficient financial market, it is impossible to achieve the excess return without taking higher risks. According to an analysis of the US domestic banks during the period 1993 to 2003, however, large banks with asset size bigger than $10 billion have not only lower volatility of profits, but also higher profitability, compared with those of small banks with less than $500 million (De Young and Rice, 2004). It can be regarded as one of the evidences supporting the argument that asset size may be important in lowering risk of asset management as well as raising earning rate.

[12] 'Institutional preconditions' for pension funds to have positive effects on capital markets correspond to the 'institutional precondition for financial development' suggested in the literature on financial liberalization. According to Lee (2001), it includes 'the establishment of financial infrastructure such as legal/accounting system, credit ratings system and information circulation channel (Villanueva and Mirakhor 1990)'and 'establishing contract enforcement system and fostering dynamic borrower base (Gertler and Rose 1994)'or 'the securing appropriate capital adequacy ratio, human capital in financial sector, information capital stock and governance structure (Caprio, *et al*. 1994).

[13] Germany implemented measures such as regulation on insider trading, reinforcement of duty of disclosure and enhancement of punishment on market manipulation during the period 1994 to 2002. According to La Porta, Lopez-De-Sikanes, Shleifer,

Consequently this condition has a low possibility to be satisfied there. In this case, even if pension funds grow, their effects on the capital market may be weak since most of the funds will be invested in government bonds and bank deposit rather than in stocks.

Besides, the rapid growth of pension funds may weaken the complementarity between banks and firms. Shifts of funds among banks and institutional investors may even bring out financial instability. According to Baliga and Polak (2004), the bank-based system of finance in Germany emerged because of the unique situation of the German late industrialization. That is, the investment opportunities were large in scale, small in number, and high in the likelihood of success, so that monitoring of borrowing firms by universal banks was an optimal solution to finance the investment projects. The Japanese banking crisis in the 1990s after the financial liberalization is one of the examples which show the potential instability of bank-based financial system in the face of rapid growth of institutional investors (Davis 2005).

From these discussions, a hypothesis is derived that the likelihood of the pecuniary externalities' internalization by pension funds is higher in market-based financial system than in bank-based one.

3. Related Literature

In the literature, pros and cons exist for the effects of pension funds on the development of capital market. The pros emphasize the positive external effects of pension funds. Examples include empirical analyses by Catalan *et al*. (2000), Walker and Lefort (2002), Impavido, Musalem, and Tressel (2003). They used cross-country panel data to show that the effects of pension funds on the development of capital market exist. Gillan and Starks (2000) show that pension funds improve the corporate governance. Bodie (1990) found that pension funds promote financial innovations. Furthermore, Impavido, Musalem, and Tressel (2001) found that growth of pension funds increased competitive pressure for banks and consequently that efficiency of bank operation was improved.

But, since most of these take partial equilibrium approach, they cannot provide us with a full explanation of the mechanism in which such effects arise. Hence the alleged preconditions could not be subject to empirical test. Besides, the most empirical analyses with panel data focus on the effects of contractual savings, using the ratio of contractual savings to GDP or the share of total financial assets occupied by contractual savings asset as explanatory variables

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Vishny(1997), the reason that the capital market system is weak in Germany is that the legal tradition of civil law that stipulates financial affairs with list system has played an important role.

(Impavido, et al. 2001, 2003). Considering the difference in industrial structure and fund management between pension funds and life insurance, the uniqueness of pension funds cannot be analyzed accurately with this approach. Moreover, the tests of Granger causality between the ratio of pension funds assets to GDP and the ratio of stock market capitalization to GDP by Catalan, et al. (2000) does not control the effect of other variable that affects the development of stock markets such as the demographic structure, real economy, inflation, and interest rate.

Meanwhile, the cons emphasize the agency problem of pension funds. Miles (1993) showed that defined contribution pension funds invest like mutual funds in order to show attractive rate of returns within short time span. Lakonishok *et al.* (1991) argued that fund managers allocate assets in similar portfolios to each other and this causes 'herding' by fund managers. Harichandra and Thangavelu(2004) draw inferences from analysis of OECD countries that pension funds behave like mutual funds rather than employing 'buy and hold' strategy. In addition, Sias (1996) found that the stock prices of corporations with high ownership by institutional investors show high volatilities.

Davis (2003) also showed that the country with higher ratio of contractual savings assets to stock market capitalization were subject to stock price volatility. However, these criticisms are also limited in that they do not take a general equilibrium perspective into account, while concentrating on the irrational investment behavior caused by agency problems. Thus, a general equilibrium perspective considering the effects of pension funds to the real sector investments is needed to check whether the effects are temporary or permanent.

□. Empirical Analysis

1. Data

The meaning and calculation method of variables used in the empirical analyses is shown in <Appendix 1>. Data for 21 OECD member countries in which time series data is available are used. Data on the ratio of autonomous pension funds to GDP is drawn out from OECD (2003, 2005a). Other data are from World Development Indicators (2005). The time period spans from 1991 to 2003.[14]

The time series average from 1991 to 2003 of the ratio of pension fund assets to GDP in 21 OECD member countries is 26.6%, which corresponds to 38.6% of time series average of the ratio of stock market capitalization to GDP as shown in Table 5.

[14] This period includes the downturn of stock market caused by the collapse of IT bubble after 1999.

<Table 5> Average Level of Major Variables

(1991~2003 average, %)

	k (A)	μ (B)	A/B	α	π	i	FS	y (1000U$)	o
21 OECD countries[1)]	26.6	68.9	38.6	35.3	3.8	5.9	66.7	22.4	20.4
4 Anglo-Saxon countries[2)]	54.9	102.1	53.7	45.7	2.6	5.6	96.5	22.3	19.8
12 countries in Europe and Japan[3)]	23.0	62.5	36.8	35.3	3.3	6.4	59.5	25.0	20.9

Note: 1) AUS, AUT, BEL, CAN, CZE, DNK, FIN, FRA, DEU ,HUN, ITA, JPN, KOR, MEX, NLD, POL, PRT, SWE, CHE, GBR, USA

2) USA, CAN, AUS, GBR

3) BEL, DNK, FIN, FRA, DEU, ITA, JPN, MEX, NLD, POL, PRT, CHE

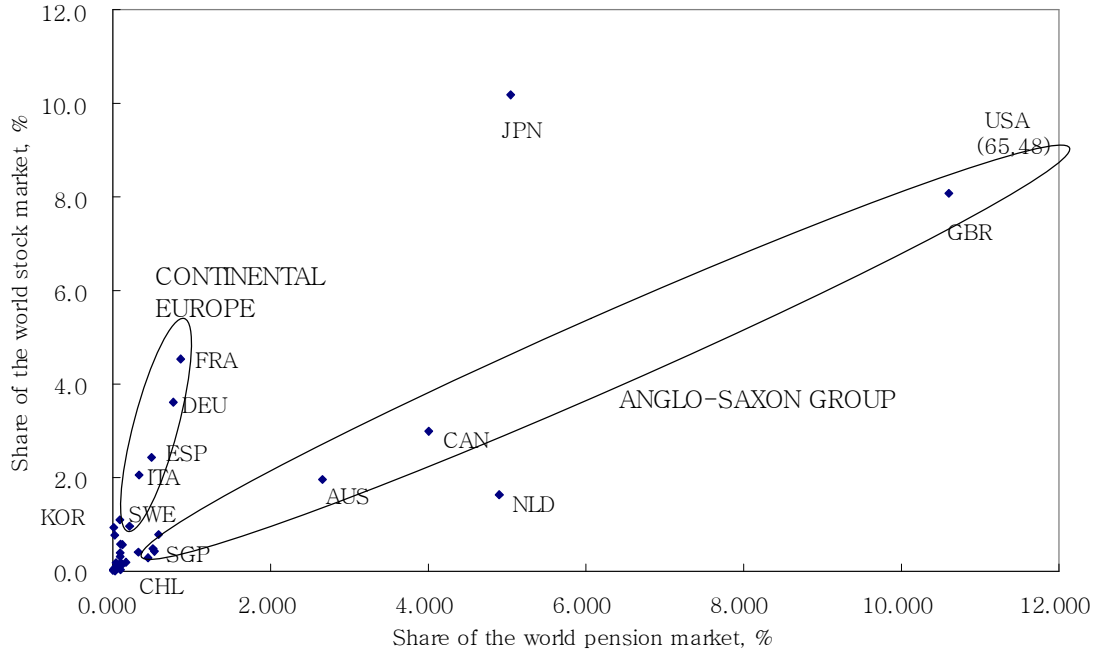
The entire sample is divided into two samples, i.e., the 4 Anglo-Saxon countries including Australia, Canada, Great Britain, and U.S.A. and the 11 Continental European countries and Japan. In the 4 Anglo-Saxon countries the ratio of pension fund asset to GDP is 54.9%, and the ratio of pension funds assets to stock market capitalization is 53.7%. In the 12 Continental European Countries[15], the ratio of pension funds asset to GDP is only 23.0%, and and the ratio of pension funds assets to stock market capitalization amounts to 38.6%. The average ratio of stock market capitalization to GDP of 21 countries is only 68.9% whereas that of 4 Anglo-Saxon countries reaches 102.1% and that of the 12 countries of Continental Europe and Japan comes to merely 62.5%.

The ratio of private credit by banks to stock market capitalization in Anglo-Saxon countries amounts to 96.5% whereas that in the 12 countries of Continental Europe and Japan amounts to 59.5%. It can be interpreted to result from the fact that the Continental European countries and Japan have bank-based financial system, while Anglo-Saxon countries have market-based financial system,

[15] 12 countries in the European continent and Japan are BEL, DNK, FIN, FRA, DEU, ITA, JPN, MEX, NLD, POL, PRT, CHE. Among those countries, Netherlands and Denmark are categorized in this group due to the similarity of social security system, financial system and real economy structure although homogeneity in pension system is low because the pension funds have accumulated early on.

The plotting of each country's share of global pension funds and its share of global stock market capitalization provides us with some idea for dividing the entire sample into the two samples; i.e., the 4 Anglo-Saxon countries and the 12 countries of Continental Europe and Japan. Countries seem homogenous within a group and heterogeneous between groups as shown in Figure 1.

<Figure 1> Relations Between Size of Pension Funds and Size of Market Capitalization of Listed Stocks



Note : as of 2003

Source: World Development Indicators 2005, World Bank, OECD(June 2005)

2. Empirical Tests

A. On Externalities of Pension Funds on Capital Market

(Model Specification)

To test 'hypothesis-A' afore mentioned, a model of stock market development is specified. The effect of the pension fund asset/GDP ratio (k) on the development of stock markets (μ) is tested after controlling the effects of other factors (z), such as population aging and the degree of development of real economy. This can be expressed as the reduced form equation (1). There the dependent variable $\mu_{i,t}$ is the ratio of market capitalization of listed stocks to GDP of country i in period t. This captures the depth or breadth of stock markets. The explanatory variable $k_{i,t}$ is the ratio of pension funds to GDP of i country in period t, representing the degree of development of pension fund industry.

$$\mu_{i,t} = \beta(k) \cdot k_{i,t} \cdot z_{i,t} \qquad (1)$$

The parameter β represents a response coefficient of the market capitalization/GDP ratio to the ratio of pension funds/GDP ratio. If pension funds have positive spillover effects on capital markets, the response coefficient β becomes an increasing function of k

$$\beta = \beta(k), \ \partial\beta(k) = \partial(k) > 0 \qquad (2)$$

Given that the influence of other factors on the development of capital markets are properly controlled, the elasticity of the degree of capital market development to the degree of pension fund industry development b becomes bigger than 1 ($b > 1$) if pension funds have positive externalities on capital markets ($\partial\beta(k)/\partial(k) > 0$). With logarithmic total differentiation of equation (1) the elasticity b can be expressed as follows.

$$b \equiv \frac{\partial\mu}{\partial k} / \frac{\mu}{k} = \frac{\partial\beta(k)/\partial k}{\beta} \cdot k + 1 \qquad (3)$$

On the contrary, if pension funds fail to generate synergy effects, then $b < 1$ will obtain with diminishing returns to pension funds accumulation ($\partial\beta(k)/\partial(k) < 0$).[16] For empirical analysis, the model for stock market development is specified as follows. All variables are in logarithmic value.

[16] If the asset management industry is subject to constant returns to scale, and the hypothesis of Modigliani-Miller that 'financial structure does not affect the value of a firm' applies, β would be fixed at the ratio of pension fund asset to market capitalization of listed stocks.

【 Econometric Model □】

$$\mu_{i,t} = \alpha\mu_{i,t-1} + \beta k_{i,t} + \gamma_1 \pi_{i,t} + \gamma_2 i_{i,t} + \gamma_3 y_{i,t} + \gamma_4 o_{i,t} + f_i + \varepsilon_{i,t} \quad (4)$$

The lagged dependent variable captures the effect of path dependence in the development of stock markets. The inflation rate $\pi_{i,t}$ controls the effects of inflation on the development of stock market.[17] The real interest rate $i_{i,t}$ controls the effect caused by the change in the yields of bonds as substitutes of stocks.[18] Real GDP per capita $y_{i,t}$ controls the effect of real sector productivity on stock market development.[19] The ratio $o_{i,t}$ of population over age 65 to age 15~64 controls the effect of population aging on capital market development.[20] In addition, f_i captures the unobserved fixed effects unique to the country i and $\varepsilon_{i,t}$ is the error term.

As for the estimation method, the Generalize Method of Moments for dynamic panel model developed by Arellano and Bond (1991) is employed. This method eliminates the influence of the unobserved fixed effect f_i of each country *i.* by first-order differencing of all the variables. The endogeneity problem due to the inclusion of lagged dependent variable as explanatory variable is coped with choice of two-or-more periods lagged dependent variables as instrumental variables.

$$\Delta\mu_{i,t} = a\Delta\mu_{i,t-1} + b\Delta k_{i,t} + c_1\Delta\pi_{i,t} + c_2\Delta i_{i,t} + c_3\Delta y_{i,t} + c_4\Delta o_{i,t} + \Delta\varepsilon_{i,t} \quad (5)$$

(Estimation Result)

17 If, in response to the inflation expectation, the demand for stocks increases, then the coefficient for the inflation rate will have positive sign (Impavido, et al. 2003). On the country, if the inflation exceeds certain level to deteriorate the performance of financial system, then the coefficient will have negative sign (Boyd, Levine, and Smith 2001).

18 It is expected to have a negative sign theoretically.

19 The effect of GDP per capita on the development of capital market would be positive, but it could turn out negative when the market capitalization increases slowly compared to the growth of GDP.

20 The ratio of population aging is expected to have a negative effect if aging causes savings to decline or if bond holding are substituted for stock holdings as the ratio of population over 65-age becomes higher. However, in case the size of asset saved by over 65 age is extremely large compared to the population of 15~64 age group or if the incentive to increase precautionary savings is huge then it is expected to have a positive sign

The estimation results for the entire 21 OECD countries show that the coefficient of $\Delta k_{i,t}$ is not statistically significant (See first and third row in Table 6).[21] However, when a cross term of the financial structure variable (FS_i) and the pension funds/GDP ratio is added, the cross term turns out significantly positive. This hints that structure of a financial system matters for the pension funds to have positive effects on capital markets.

Now that the 4 Anglo-Saxon countries and the 12 countries of Europe and Japan have different characteristics of financial system, the econometric model 1 is estimated with respected to each sub-sample. [22][23] As for the effects of control variables on the development of capital markets, those of inflation rate are estimated positive in both systems and those of real interest rate and GDP per capita turn out negative as shown in Table 7. The positive contribution of the inflation rate may reflect that the demand for stocks as substitutes of bonds increases as inflation rate is becomes higher. The negative contribution of the GDP per capita to stock market development seems to reflect the difficulty of achieving additional productivity growth. The effects of population aging on the capital market development are estimated differently for each group; negative in the Anglo-Saxon countries sample, positive in the countries of Continental Europe and Japan. This pattern seems to be closely related with the fact that the relatively young population in Anglo-Saxon countries saves more by means of pension funds which actively invest in stocks than by other means of savings and the fact that when old people choose more liquid assets than stocks. The opposites seem to apply in the countries of

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[21] A cross-section analysis of the econometric model □, using for each variable the time-series means for the period from 1991 to 2003 shows a significantly positive estimate for *b*.

[22] There is a possibility that the response coefficient as well as fixed effect f_i may be different among countries; i.e., that $\beta_i \neq \beta_j$. And figure 1 hints homogeneity within each group and heterogeneity between the two groups of Anglo-Saxon countries and the European Continent and Japan. Although Japan is located somewhere in the middle of the two groups, Japan is included in the latter group in consideration of Japan's bank-based financial system. In addition, a Chow test is applied to the hypothesis that all coefficients in econometric model Ⅰ (with $y_{i,t}$ and $o_{i,t}$ included) are the same in both samples. The hypothesis can be rejected at the 5% significance level. The Chow test statistics is 2.91, which generates a probability value of 0.01 with an F test. This result implies that the mechanisms of capital market development are different in the two economic systems.

[23] For this, it also estimates the model excluding $y_{i,t}$ and $o_{i,t}$ in the metroeconomic model□. In this case, it measures the effect of pension funds on stock market development under the condition that b does not control the effect of population aging and the degree of real economy development

Continental Europe and Japan; that is, precautionary savings for old age by means of life insurance and mutual funds contribute to stock market development.

In the first and the fourth rows in Table 7, the estimates for the effect of pension funds on capital markets, i.e., the coefficient *b* turns out significantly positive in the 4 Anglo-Saxon countries, the estimate being 1.80 when population aging and GDP per capita are controlled and 1.48 when they are not controlled. Moreover a Wald test rejects the hypothesis of b=1. Therefore, the hypothesis ('hypothesis-A') that accumulation of pension funds in a market-based financial system exerts positive spillover effects on the development of stock markets' seem to obtain.

The fifth and seventh rows in Table 7 show that the estimate of *b* is positive, but not bigger than 1 in the 12 countries of Europe and Japan. The implication is that, in a country with bank-based financial system, there exist some positive effects pension funds on stock markets but not as large as to have pecuniary externalities internalized.

<Table 6> Estimation Result of Econometric Model (21 OECD countries) □

	Dynamic analysis(GMM)				Cross section analysis(OLS)		
	$\Delta\mu_{i,t}$ (1)		$\Delta\mu_{i,t}$ (2)		Dependent variable	μ_i	
$\Delta\mu_{i,t-1}$	0.34**	0.33**	0.04	-0.02	constant term	3.26***	3.31***
	(2.15)	(2.13)	(0.11)	(-0.09)		(9.69)	(6.41)
$\Delta k_{i,t}$	0.12	1.00*	0.25	0.08	k_i	0.38***	0.34***
	(0.63)	(1.70)	(0.77)	(0.72)		(6.09)	(4.68)
$\Delta\pi_{i,t}$	-0.04***	-0.02	-0.13*	-0.07	π_i	-0.02***	-0.02***
	(-2.85)	(-1.36)	(-1.89)	(-1.40)		(-4.22)	(-3.15)
$\Delta i_{i,t}$	0.00	0.02	0.09	0.01	i_i	-0.03	-0.03
	(0.04)	(1.01)	(1.40)	(0.14)		(-0.56)	(-0.63)
$\Delta y_{i,t}$			-6.19**	-2.26	y_i		0.00
			(-2.54)	(-1.16)			(1.06)
$\Delta o_{i,t}$			16.79**	4.07	o_i		-1.12
			(2.38)	(1.14)			(-0.50)
$FS_i \cdot k_{i,t-1}$		0.78*		0.34***			
		(1.87)		(4.33)			
Number of observation	192	192	159	166	Number of observation	21	21
Standard error	0.3	0.4	0.29	0.29	*correction* R^2	0.80	0.79
J-statistics	123	70.1	21.7	17.3			
(degree of freedom)	(34)	(34)	(19)	(21)	F-statistics	152.5	16.1
					p value	0.0	0.0
p-value	0.00	0.00	0.30	0.69			

Note: t value in parentheses, ***, ** and * stand for 1%, 5% and 10% significance level respectively

<Table 7> Estimation Result of Econometric Model □

	4 Anglo-Saxon Countries				12 Countries of Europe and Japan			
	$\Delta\mu_{i,t}$		$\Delta\mu_{i,t}$		$\Delta\mu_{i,t}$		$\Delta\mu_{i,t}$	
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$\Delta\mu_{i,t-1}$	0.04	0.18***	0.37**	0.33***	0.36***	0.32**	0.30**	0.27*
	(0.67)	(4.74)	(2.57)	(4.30)	(2.87)	(2.11)	(2.17)	(1.90)
$\Delta k_{i,t}$	1.48***	0.83***	1.80***	0.99***	0.24	-0.23	0.86**	0.27
	(6.50)	(2.87)	(4.04)	(2.81)	(1.59)	(-0.85)	(2.28)	(0.70)
$\Delta\pi_{i,t}$	0.03	0.02***	0.06***	0.03***	0.05	0.07***	0.12*	0.08
	(1.56)	(2.54)	(3.02)	(2.42)	(1.26)	(2.74)	(1.71)	(1.48)
$\Delta i_{i,t}$	0.01	-0.00	-0.01	-0.02**	-0.06***	-0.04	-0.16**	-0.10*
	(0.50)	(-0.15)	(0.81)	(-0.49)	(-3.67)	(-1.04)	(-2.14)	(-1.94)
$\Delta y_{i,t}$	-	-	-0.71	-0.58	-	-	-10.25***	-3.47*
			(-0.90)	(-2.47)			(-3.90)	(-1.83)
$\Delta o_{i,t}$	-	-	-8.69***	-2.60**	-	-	9.63**	0.64*
			(-6.11)	(-2.47)			(2.36)	(0.17)
$\omega_{k0} \cdot \Delta k_{i,t}$	-	1.85***	-	1.70***	-	1.01*	-	0.86*
		(5.28)		(3.42)		(1.72)		(1.85)
Number of observation	49	45	45	45	108	89	95	89
Standard error	0.20	0.14	0.16	0.16	0.30	0.30	0.22	0.36
J-statistics (degree of freedom)	32.00 (21)	41.90 (29)	19.37 (23)	35.22 (34)	71.30 (23)	18.50 (19)	12.28 (24)	13.97 (24)
p-value	0.06	0.06	0.68	0.41	0.00	0.49	0.98	0.95
H_0:b=1 *p*-value	0.04		0.08		0.00		0.71	

Note: 1) Refer to footnote of <Table 5> for specification of sample countries

2) Only 11 countries are included due to the availability of data(CHE excluded in 12 countries)

3) Due to the lack of data in 1993, the annual average during 1991~2001 is used for ω_{k0} in Europe and Japan

4) t value in parentheses, ***, ** and * stand for 1%, 5% and 10% significance level respectively.

B. On the Initial Size Condition

(Test Method)

The 'size condition' hypothesis is that the larger the initial size of pension funds of a country, the larger the effects of pension funds on capital markets. This hypothesis can be tested with the interaction term of $\Delta k_{i,t}$ and $\omega_{k0,i}$, the initial share of world pension funds held by county *I,* in equation (6). The coefficient b_2 measures this effect.

$$\Delta\mu_{i,t} = a\Delta\mu_{i,t-1} + (b_1 + b_2\omega_{k0,i})\cdot\Delta k_{i,t} + c_1\Delta\pi_{i,t} + c_2\Delta i_{i,t} + c_3\Delta y_{i,t} + c_4\Delta o_{i,t} + \Delta\varepsilon_{i,t} \quad (6)$$

$\omega_{k0,i}$ the initial share of world pension funds held by country i

(Estimation Result)

The coefficient estimates of the interaction term in equation (6) for both groups of countries are significantly positive as shown in the even rows of Table 7. However, after the interaction term is added to the equation (5), even though the b_1 coefficient remains significant in the Anglo-Saxon countries sample, it becomes insignificant in the other sample; moreover, the magnitude of coefficient b_2 of the former is larger than that of the latter. This difference seems attributable to the highly active investments by the pension funds in the former and relative inactiveness of those in the latter.[24]

These results imply that the initial level of industrial development of pension funds matters for later development of the asset management industries; besides, that the effects are larger in market-based financial system than in bank-based financial system.

C. On Effects of Pension Funds on the Share of Investments in Innovative Activities

(Test Method)

24 According to OECD (2003), the share of portfolio invested in stocks by pension funds is 44.7% on average in the 4 Anglo-Saxon countries, but merely 28.5% on average in the 12 countries of Europe and Japan as of the end of 2001.

In order to test the hypothesis of positive externalities from pension funds on the real sector, the 'hypothesis-B' is transformed to one stating that the higher the share of pension funds in financial sector, the higher the share of aggregate investments in innovative activities given that the financial system is a market-based one. 'Econometric model □' is set up to test this. The GMM estimation method invented by Arellano and Bonds (1991) is adopted for this too

.

【 Econometric Model □ 】

$$(RD/I)_{i,t} = \alpha(RD/I)_{i,t-1} + \beta h_{i,t} + \gamma i_{i,t} + \delta g_{i,t} + f_{i,t} + \varepsilon_{i,t} \qquad (7)$$

where $h_{i,t}$ denotes the share of pension funds assets in the assets of financial sector of country i in period t, $g_{i,t}$ is growth rate of real GDP, and $f_{i,t}$ is the unobserved individual effects. $(RD/I)_{i,t}$ is the ratio of R&D investments to the total investments.[25] If the estimate of coefficient β is significant, it can be induced that the increased role of pension funds in the financial system facilitates directly, or through increased pressure for banks, long-term investments in innovative activities.

(Estimation Results)

In the table 8. estimation results of the 'econometric model □' are reported. The estimate of β is not significant in the entire 12 countries sample[26]. It is insignificant and negative in the sample of 8 countries including countries of Continental Europe, Japan and Korea. But, it is significantly positive in the sample of Anglo-Saxon countries. These together can be interpretation as meaning that, even though in bank-based financial system growth of pension funds does not have positive effects on long-term investments, it does in a market-based financial system. The channels of such an effect may be through pension funds' investments in private equity funds or through role of pension funds in improving the functional efficiency of capital markets.

25 Since the gestation period of R&D investment is long, the ratio of R&D investment to gross investment can be considered as the proxy for long-term investments (Aghion, Angeletos, Banerjee, and Manova 2005). In others such as Shin et al(2005), it is interpreted as R&D investment intensity.

26 Due to the availability of data, 8 countries are included in the sample of Continental Europe , Japan, Korea (BEL, DNK, DEU, ITA, JPN, KOR, NLD, NOR).

<Table 8> Estimation Result1) of Econometric Model □

Model	12 OECD countries	4 Anglo-Saxon countries	8 Countries of European/Korea/ Japan	4 Anglo-Saxon countries (VAR)	
Dependent variable	$\Delta\log(RD/I)_{i,t}$	$\Delta\log(RD/I)_{i,t}$	$\Delta\log(RD/I)_{i,t}$	$\Delta\log(RD/I)_{i,t}$	$\Delta h_{i,t}$
$\Delta\log(RD/I)_{i,t-1}$	0.99***	0.80***	1.17***	0.40***	-0.07
	(6.91)	(7.75)	(7.88)	(3.08)	(-0.36)
$\Delta h_{i,t}$	0.47	0.50***	-0.38*		
	(0.83)	(4.41)	(-1.95)		
$\Delta i_{i,t}$	-0.04**	0.02***	-0.03**		
	(-2.18)	(2.81)	(-2.24)		
$\Delta g_{i,t}$	-0.01	-0.00	-0.01**		
	(-1.61)	(-0.30)	(-6.62)		
$\Delta h_{i,t-1}$				1.04***	0.76***
				(3.51)	(6.40)
$\Delta i_{i,t-1}$				-0.02*	0.00**
				(-1.97)	(2.76)
$\Delta g_{i,t-1}$				0.01***	0.02
				(3.01)	(5.47)
Number of observation	84	24	57	27	24
Standard error	0.2	0.1	0.1	0.1	0.06
J-statistics	25.5	15.0	20.1	14.8	15.0
(degree of freedom)	(13)	(11)	(13)	(14)	(11)
p-value	0.02	0.18	0.09	0.40	0.18

Note:1) Sample period: 1991 ~ 2003

2) Sample country: 4 Anglo-Saxon countries(AUS, CAN, GBR, USA), 8 countries in Europe, Korea and Japan(BEL, DNK, DEU, ITA, JPN, KOR, NLD, NOR)

3) t value in parentheses, ***, ** and * stand for 1%. 5% and 10% significance level

In addition, a vector autoregressive model version of the 'econometric model □' is estimated for the sample of Anglo-Saxon countries with the GMM estimation methods in order to test the

significance of ‘hypothesis-B'’ in terms of Granger-causality in that sample. As shown in the fourth and the fifth row of the table 8, the share of pension funds in financial sector unilaterally Granger-cause the long-term investments in R&D activities. Consequently, the 'hypothesis-B'’ is supported by the data of Anglo-Saxon countries. This means that the expanded demand for risky securities due to rapid growth of pension funds is matched by a corresponding increase in risky projects by firms. Thus this seemingly tells against the assertion that in the Anglo-Saxon countries pension funds stimulate short-termism in both capital markets and corporate sector and thus inhibit long-term investments. On the country, it can be argued on this background that under the institutional environments similar to those countries the positive spillover effects of pension funds enrich development of not only capital markets but also real sector; moreover that the impacts of pension funds on the capital market can be sustained in the long run due to these real-side effects .

D. On Dynamic Effects of Pension Funds on Capital Markets

(Test Method)

A vector autoregressive model version of the 'econometric model □' is estimated for the sample of both Anglo-Saxon countries and 12 countries of Continental Europe and Japan with the GMM estimation methods in order to test the significance of ‘hypothesis-A'’ in terms of Granger-causality in that sample. The hypothesis states that the introduction and growth of funded private pension programs exogenously triggered the rapid development of capital markets in the period since 1990s.

(Estimation Results)

The estimation results of the VAR model for the Anglo-Saxon sample are reported in the first four columns of the table 9. They show that the ratio of pension fund assets to GDP unilaterally Granger-cause the ratio of stock market capitalization to GDP both in the model which includes $y_{i,t}$ and $o_{i,t}$ and in the model which does not include them. Thus, an increase in the ratio of pension funds assets to GDP helps predict the ratio of stock market capitalization to GDP.[27] This implies that the dynamic version of the

[27] That the development of stock markets in the US was led by institutional investors during this period can also be induced from the fact the rate of returns of large-cap stock which institutional investors prefer was higher than that of small-cap stock from 1994 to 1999, whereas the rate of returns of small-cap stock was higher than that of large-cap stock from

hypothesis A, i.e., hypothesis-A', on the positive spillover effects obtains in Anglo-Saxon countries.

In contrast, the estimation results for the sample of 12 countries of Continental Europe and Japan as shown in the last four columns of the table 9 show different pattern of Granger-causality. That is, the ratio of pension funds assets to GDP bilaterally Granger cause the ratio of stock market capitalization to GDP ratio in the model with $y_{i,t}$ and $o_{i,t}$ included as explanatory variables; and the lagged effects of the pension funds on the capital market turn out negative. The contrasting results for the two groups are consistent with the interpretation that, under such financial and old-age income security systems as those of Anglo-Saxon countries, the development of capital markets are initiated by the growth of pension funds, whereas, under those of European countries and Japan, pension funds may interact negatively with capital markets due for example to overly restrictive regulation on asset management or to excessive conservatism of fund managers. If this is the case, it attest to the validity of the ‘institutional precondition hypothesis'

1975 to 1980 (Dent 2005).

<Table 9> Estimation Results of VAR Model Versions of 'Econometric Model □'

	4 Anglo-Saxon countries				12 countries in Europe and Japan			
	VAR 1		VAR 2		VAR 1		VAR 2	
	$\Delta\mu_{i,t}$	$\Delta k_{i,t}$	$\Delta\mu_{i,t}$	$\Delta k_{i,t}$	$\Delta\mu_{i,t}$	$\Delta k_{i,t}$	$\Delta\mu_{i,t}$	$\Delta k_{i,t}$
$\Delta\mu_{i,t-1}$	0.22	0.05	0.26***	0.05	0.53***	0.16***	0.65*	0.12**
	(0.83)	(0.53)	(3.74)	(0.50)	(3.41)	(3.11)	(1.96)	(2.35)
$\Delta k_{i,t-1}$	1.04**	0.65***	0.50***	0.53***	-0.31	0.37***	-0.94*	0.37***
	(2.45)	(3.83)	(12.50)	(3.31)	(-1.46)	(3.10)	(-1.78)	(3.52)
$\Delta\pi_{i,t-1}$	-0.05***	-0.02	-0.07***	-0.01	-0.13***	-0.02	-0.15***	-0.02
	(-4.23)	(-1.50)	(-2.62)	(-0.61)	(-3.09)	(-0.60)	(-3.25)	(-0.60)
$\Delta i_{i,t-1}$	0.04***	0.00	0.05**	0.01	-0.01	-0.00	0.00	-0.02
	(3.78)	(0.14)	(2.64)	(1.44)	(-0.28)	(-0.19)	(0.06)	(-0.05)
$\Delta y_{i,t-1}$			0.24	0.17			-0.06	-0.01
			(0.81)	(0.55)			(-0.02)	(-0.02)
$\Delta o_{i,t-1}$			3.28	1.60			4.92	-0.41
			(0.81)	(1.13)			(1.65)	(-0.37)
Number of observation	39	39	44	44	102	102	89	90
Standard error	0.2	0.1	0.19	0.11	0.3	0.2	0.22	0.15
J-statistics (degree of freedom)	28.7	29.1	34.3	32.9	51.5	37.8	18.6	30.3
	(22)	(22)	(33)	(33)	(22)	(26)	(22)	(24)
p-value	0.15	0.14	0.41	0.47	0.00	0.06	0.67	0.18

Note: t value in parentheses, ***, ** and * stand for 1%. 5% and 10% significance level

3. On Effects of Life Insurance on Stock Markets

(Test Method)

In order to compare the role of insurance companies to that of pension funds in developing stock markets, the same model as 'Econometric Model □' except that the variable $k_{i,t}$ is replaced with $a_{i,t}$, the logarithmic value of the ratio of insurance company assets to GDP, is estimated. The new model is called the 'econometric model □.'

【 Econometric Model □ 】

$$\mu_{i,t} = \alpha\mu_{i,t-1} + \beta k_{i,t} + \gamma_1\pi_{i,t} + \gamma_2 i_{i,t} + \gamma_3 y_{i,t} + \gamma_4 o_{i,t} + f_i + \varepsilon_{i,t} \quad (8)$$

where $a_{i,t}$ is the logarithmic value of the ratio of insurance company's assets to GDP of country i in period t.

(Estimation Result)

The estimation results of the 'econometric model □,' are reported in the table 10. As for the control variables, the estimation results are similar to those from the estimation of the 'econometric model □' except that the coefficient of population aging index is negative in the sample countries of Europe and Japan. A possible interpretation of this is that, there, the means for people to prepare for old age other than life insurance are mostly bank deposits and pension funds whose assets are invested heavily in non-stock assets. Thus even though population aging increases bank deposits and pension funds, the demand for stocks may decrease, thus affecting the stock markets negatively.

Next, As for the life insurance, the coefficients are estimated to be positive in both models which include $y_{i,t}$ and $o_{i,t}$ and those exclude them. In addition, since there are cases where *b* is bigger than 1, the growth of life insurance also seems to have positive spillover effects on the development of stock markets.

Besides, it is notable that the coefficient of the interaction term of $a_{i,t}$ and the initial share of a country's insurance assets ($\omega_{a0,i} * \Delta a_{i,t}$) is significantly positive in 4 Anglo-Saxon countries, but not significant in 12 countries of Europe and Japan.[28] This implies

[28] In the latter, the coefficient of the ratio of insurance assets to GDP increases from 0.97 to 1.48

that the initial size of life insurance assets relative to other countries affected positively later evolution of stock markets in the Anglo-Saxon countries, but not in the European countries and Japan.

<Table 10> Estimation Results of Econometric Model [1)]

	4 Anglo-Saxon countries				12 countries in Europe and Japan			
	$\Delta\mu_{i,t}$				$\Delta\mu_{i,t}$			
$\Delta\mu_{i,t-1}$	0.18***	0.12***	0.47***	0.37***	0.25**	0.09	0.37*	0.57**
	(4.87)	(5.01)	(3.48)	(10.36)	(2.23)	(0.43)	(1.92)	(2.15)
$\Delta a_{i,t}$	1.88**	-0.35	2.24**	0.04	0.97***	1.48**	2.18***	1.78**
	(2.48)	(-0.54)	(2.38)	(0.05)	(3.48)	(2.08)	(2.84)	(2.09)
$\Delta\pi_{i,t}$	0.02	0.03***	0.04***	0.05***	-0.02	-0.02	-0.04	-0.06
	(1.06)	(3.09)	(4.41)	(4.92)	(-0.56)	(-0.62)	(-0.87)	(-1.01)
$\Delta i_{i,t}$	0.01	-0.03**	-0.01	-0.04**	-0.02	-0.02	-0.03*	-0.03*
	(0.25)	(-2.09)	(-0.18)	(-2.55)	(-1.24)	(-1.20)	(-1.76)	(-1.96)
$\Delta y_{i,t}$			-0.56	-0.73*			-1.90	-0.78
			(-1.02)	(-1.76)			(-1.06)	(-0.60)
$\Delta o_{i,t}$			-7.23***	-4.94			-8.09	-16.28**
			(-3.60)	(-1.60)			(-1.38)	(-2.50)
$\omega_{a0,i} * \Delta a_{i,t}$		0.22***		0.21***		-0.09		0.37
		(3.46)		(3.16)		(-0.59)		(1.61)
Number of observation	44	40	40	40	121	112	112	112
Standard error	0.1	0.2	0.15	0.45	0.3	0.3	0.27	0.27
J-statistics (degree of freedom)	19.7	8.5	13.5	6.0	53.1	45.7	22.8	15.8
	(18)	(15)	(20)	(20)	(18)	(15)	(20)	(20)
p-value	0.35	0.90	0.85	0.99	0.00	0.00	0.30	0.73

Note: 1) Sample period is from 1992 to 2001

2) t value in parentheses, ***, ** and * stand for 1%, 5% and 10% significance level respectively

A vector autoregressive model version of the 'econometric model □' is estimated for the sample of both Anglo-Saxon countries and 12 countries of Continental Europe and Japan with the GMM estimation methods. This is to check whether life insurances play the same role as pension funds in initiating the development of capital markets.

According to the estimation results reported in the table 11, in the sample of Anglo-Saxon countries, a different pattern of Granger-causality is observed from that observed in the estimation of the 'Econometric Model □.' That is, unlike pension funds, life insurance has a bilateral Granger-causality with capital market development; life insurance has a positive effect on capital market development with a lag, but the development of capital markets has a negative impact on the development of life insurance. The results for the sample of 12 countries of Europe and Japan are similar to those for the Anglo-Saxon countries.

<Table 11> Estimation Results of VAR Model Versions of 'Econometric Model □'

	4 Anglo-Saxon Countries				12 Countries in Europe and Japan			
	VAR 1		VAR 2		VAR 1		VAR 2	
	$\Delta\mu_{i,t}$	$\Delta a_{i,t}$	$\Delta\mu_{i,t}$	$\Delta a_{i,t}$	$\Delta\mu_{i,t}$	$\Delta a_{i,t}$	$\Delta\mu_{i,t}$	$\Delta a_{i,t}$
$\Delta\mu_{i,t-1}$	-0.03	-0.09*	0.36*	-0.23***	0.31***	-0.17***	0.49**	-0.09
	(-0.09)	(-1.80)	(1.99)	(-3.05)	(3.11)	(-7.32)	(2.44)	(-1.20)
$\Delta a_{i,t-1}$	2.12**	0.98***	1.25**	0.79***	0.83***	1.09***	1.20	1.12***
	(2.25)	(9.71)	(2.47)	(13.10)	(4.53)	(7.76)	(1.24)	(4.91)
$\Delta\pi_{i,t-1}$	-0.04	-0.01*	-0.04*	-0.01*	-0.01	-0.02	-0.02	-0.02
	(-1.16)	(-1.97)	(-1.71)	(-1.26)	(-0.62)	(-0.83)	(-0.84)	(-0.92)
$\Delta i_{i,t-1}$	0.10***	0.01	0.11***	0.02**	0.00	-0.02	0.02	-0.01
	(3.89)	(2.67)	(3.28)	(2.39)	(0.05)	(-1.27)	(1.01)	(-0.67)
$\Delta y_{i,t-1}$			-0.99	0.68**			-5.50***	-1.28***
			(-1.67)	(2.75)			(-2.92)	(-2.99)
$\Delta o_{i,t-1}$			4.05	2.51*			1.83	0.46
			(1.57)	(1.88)			(0.37)	(0.65)
Number of observation	48	44	40	36	129	118	112	101
Standard error	0.2	0.1	0.17	0.07	0.3	0.1	0.27	0.10
J-statistics (degree of freedom)	19.0 (20)	28.3 (18)	15.5 (20)	20.1 (18)	106.7 (20)	29.1 (18)	45.04 (20)	21.6 (18)
p-value	0.52	0.06	0.74	0.33	0.00	0.05	0.00	0.25

Note: t value in parentheses, ***, ** and * stand for 1%, 5% and 10% significance level respectively

The test results in the above are summarized in the table 12. Even though the effects of pension funds on the capital markets were absent in the entire sample, they emerged when the sample divided into Anglo-Saxon and Non-Anglo-Saxon countries. Moreover the effects for the two economic systems turned out to be different.[29] The main hypothesis

[29]. It may be said that this result has deepened the existing literature researches which focus on the effect of contractual savings on the capital markets.

that continuous accumulation of assets by pension funds is conducive to the development of capital markets by internalizing pecuniary or technological external effects seems supported at least in the Anglo-Saxon countries. Estimation results supportive of this hypothesis include positive spillovers of pension funds on the development of stock markets, increase in the ratio of R&D investment to total investments initiated by the development of pension funds industry, unilateral Granger-casualty from pension funds to stock markets, fulfillment of the 'size condition' i.e., the fact that the larger the initial size of pension funds relative to those in other countries, the larger the spillover effects of pension funds on capital markets.

By contrast, the hypothesis seems not supported in the case of Continental Europe and Japan. There are some positive effects of pension funds on the development of stock markets; but, the effects are not large enough to internalize the pecuniary or technological external effects.

Differing patterns of dynamic relationship between the development of pension funds industry and the development of capital markets for the two economic systems imply that satisfying the 'size condition' and 'institutional condition' is prerequisite for an economy to benefit from growth of pension funds.

Meanwhile, the effect of life insurance on the capital markets turns out similar for both regimes and apparently constrained by the development of the capital markets, since some negative feedbacks are observed from the development of capital markets to the development of life insurance industries. Thus while internalization of spillover effects may be a policy target with regard to the policy of fostering pension funds industry, it can not be one for the life insurance industry. It seems that markets for life insurance evolve endogenously.

<Table 12> Summary of Test Results

Externalities	Effect of Pension Funds		Effect of Life Insurance	
	Anglo-Saxon	Europe and Japan	Anglo-Saxon	Europe and Japan
On capital markets : Hypothesis-A	Exist	Not exist	exist	Not exist
(Scale condition)	Satisfied	-	Satisfied but not applicable	Not satisfied
On real sector : Hypothesis-B	Exist	Not exist	-	-
Dynamics: hypothesis-A‘	Unilateral Granger-causality	no causality	Bilateral Granger-causality	Bilateral Granger-causality
Dynamics: hypothesis-B‘	Unilateral Granger-causality	no causality	-	-
(Institutional precondition)	satisfied	maybe not satisfied	Not applicable	Not applicable

□. Conclusion

The role of pension funds for capital market development has attracted attention with the recently intensified integration and growth of global capital markets. This paper has raised the theoretical possibility that continuous accumulation of assets by pension funds initiated development of capital markets through internalizing pecuniary or technological externalities. Together with this ‘externality hypothesis’ two preconditions – size condition and institutional condition – are suggested for these effects to obtain. The former implies that pension funds should be large enough to exceed a critical mass; the latter implies that pension and financial systems should be designed such that competition rules in the asset management industry as well as pension funds industry.

The paper has examined whether these hypotheses are backed up empirically. It has estimated models explaining the role of pension funds on the development of capital markets while controlling other factors such as population aging and degree of economic development. In order to control the influences of institutions of old-age income security and financial system of Anglo-Saxon countries and the countries of Continental Europe and Japan, the entire sample has been divided as such. The results confirm pecuniary and technological externalities and scale effects of pension funds in the Anglo-Saxon countries; but not in the countries of Continental Europe and Japan. Furthermore, the development of pension funds has a unilateral Granger-causality for the long-term investments in innovative activities as well as for the development of capital markets. Compared with the estimation results for similar model for life insurance, the results for pension funds are unique; continuous growth of pension funds is a shock to capital markets while life insurance evolves endogenously. The results for pension funds do not necessarily exclude the possibility that growth of pension funds makes the capital market volatile from time to time; but they confirm the possibility that development of pension funds stimulate the development of both capital markets and real economy in the long term.

Differing patterns of pension funds' role in developing capital markets between the two regimes can be attributed to the differences of the economic system, especially financial system. This point of view leads to the interpretation that it is market-based financial system that enabled synergy effects between asset management of pension funds in the Anglo-Saxon countries; similarly, it is the bank-based financial system that hampered the same synergy effects in the countries of Continental Europe and Japan since 'institutional condition' is not readily satisfied under a bank-based financial system.

Given that the 'externality hypothesis' obtains, it follows from the North (1990) that institutions matter for the internalization of the externalities; specifically, a country needs to accumulate assets over a critical mass in pension funds and to secure market discipline for management of the assets. Another implication is that strengthening fully funded private pension plans may be an efficient policy response to lack of risk-taking by investors; introduction of mandatory retirement pension while fulfilling the preconditions may save an economy from a low growth trap because increased risk taking by investors with assets being well diversified will improve risk-adjusted rate of returns for the economy as a whole.

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< Appendix >

<Table A1> Yield Method of Variable and Used Data

Variable	Meaning	Yield Method(Source)
$\mu_{i,t}$	Development degree of stock market	Logarithmic value of aggregate market value of stock/GDP ratio (WDI 2005)
$k_{i,t}$	Development degree of pension funds	Logarithm of size of autonomous pension funds over GDP (OECD 2003, OECD 2005)
$\pi_{i,t}$	Rate of return of currency as alternative asset of stock	Consumer Price Index Growth Rate (WDI 2005)
$i_{i,t}$	Yield of bonds and deposits as alternative asset of stock	Real interest rate(WDI 2005)
FD_i	Development degree of finance in country	Sum of aggregate market value of stock and bank credit loan in private sector during 1991~2003/time series average of GDP(WDI 2005)
FS_i	Financial structure of country(development degree of capital market over bank)	Aggregate market value of listed stock during 1991~2003/time series average of bank credit loan to private sector(WDI 2005)
$a_{i,t}$	Development degree of insurance industry	Logarithmic value of insurance company's asset over GDP (OECD 2003)
$\omega_{k0,i}$	Early world pension market share of country	Proportion each country occupies out of the sum of total pension funds of OECD countries in 1993(OECD 2003)
$\omega_{a0,i}$	Early world insurance market share of country	Proportion each country occupies out of the sum of total insurance asset of OECD countries in 1993(OECD 2003)
$\log(RD/I)$	Ratio of long-term or innovative investment	R&D expenditure(OECD.STAT country statistical profiles 2005)/logarithmic value of nominal investment(WDI 2005)

$g_{i,t}$	Economic Growth Rate	Real GDP Growth Rate(WDI 2005), IFS(IMF)
$y_{i,t}$	Real GDP per capita	Real GDP per capita(US$, 2000=100, WDI 2005)
$o_{i,t}$	Ratio of Population Aging	Ratio of population over 65 age to 15□64