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RÉSUMÉ

A partir d'une analyse statistique de données internationales, ce document démontre l'existence d'une interaction entre les systèmes de retraite par capitalisation et l'épargne agrégée. Cette relation est établie après neutralisation des spécificités nationales et des autres déterminants de l'épargne identifiés dans des études comparatives internationales antérieures. Les données couvrent onze pays (Membres et non membres de l'OCDE), ce qui permet à l'analyse de compléter les travaux précédents fondés sur de simples études de cas (et donc contraintes par le petit nombre des degrés de liberté). Plusieurs variables approchées du capital retraite sont construite à partir de données internationales comparables sur les fonds de pension et les systèmes d'assurance-vie. Sur cette base est proposée une estimation de la relation entre les taux d'épargne agrégée et le capital retraite, à partir de la méthode des moindres carrés ordinaires et des doubles moindres carrés, sur la période 1982-93.

Cette analyse empirique conforte l'idée d'un modèle d'épargne simple en deux périodes sur le cycle de vie. Ce modèle inclut la fiscalité des revenus des avoirs de retraite, l'hétérogénéité de la population, les imperfections du marché financier et diverses caractéristiques des systèmes de retraite. Il apparaît fondamental de renforcer les avantages de l'épargne pour le groupe des petits épargnants et de limiter l'effet revenu négatif sur l'épargne des gros épargnants qui résulte de l'augmentation du taux de rendement implicite des systèmes par capitalisation exonérés d'impôt. Il en résulte que les systèmes de retraite par capitalisation devraient être obligatoires plutôt que volontaires, que les exonérations fiscales sur les revenus des placements de retraite devraient être réservées aux petits épargnants et que les avoirs de retraite obligatoire ainsi accumulés ne puissent servir de garantie d'emprunt. Si ces conditions ne sont pas respectées, les systèmes de retraite par capitalisation n'entraîneront pas une hausse de l'épargne.

SUMMARY

This paper provides statistically significant international evidence on the interaction between funded pensions and aggregate savings, after controlling for country-specific effects and for other saving determinants that have typically been identified in earlier cross-country studies. Using panel data for eleven countries (both OECD and non-OECD), this study goes beyond earlier work which has been based on individual country studies only (which have suffered from a small number of degrees of freedom). Building several proxies of pension wealth based on internationally comparable pension fund and life insurance data, the paper estimates the relationship between aggregate saving rates and pension wealth using ordinary least squares and two-stage least squares over the 1982-93 period.

The empirical analysis supports the predictions of a simple two-period life-cycle saving model that incorporates tax treatment of pension returns, population heterogeneity, capital market imperfection and various features of pension design. It is found crucial to stimulate a positive saving impact of funded pensions from the low-saver group and to limit the negative income effect on savings by the high-saver group that emanates from the higher implicit rates of return on tax-exempt funded pensions. This requires that funded pension schemes are mandatory rather than voluntary, that tax exemptions on pension returns are limited to low savers and that it is discouraged to borrow against the accumulated mandatory pension assets; otherwise, funded pension schemes will fail to stimulate savings.

PREFACE

An important target of recent pension reforms from unfunded to prefunded schemes has been the stimulation of private savings. In developing countries, evidence suggests that higher savings are required to finance investment and growth in the long term; in the rapidly ageing OECD countries, population ageing requires higher savings to pay for retirement income.

Although it is often assumed that the growth in funded pension assets represents a net increase in savings, such asset growth may simply reflect a shift in the form of saving, with pension funds displacing other savings. This study is the first to produce significant international statistical evidence in support of the premise that the development of funded pensions does, indeed, contribute to higher aggregate savings. The analysis identifies some major features of pension design that are likely to be most effective in stimulating private savings overall. The biggest impact on savings can be expected from funded pension schemes that are mandatory, that limit tax exemptions on pension returns to the low-saver group and that discourage borrowing against accumulated mandatory pension assets.

This paper, produced as part of the research programme on Macroeconomic Interdependence and Capital Flows, is also a contribution to the work on the economic impact of ageing being carried out within the OECD as a whole.

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December 1997

I. INTRODUCTION[1]

Although quite diverse in scope and nature, pension reforms world-wide share a common aim in that the majority of them strive to move towards a system that would rely more heavily on funded pensions. An important motivation underlying this policy goal is the notion that the accumulation of pension assets contributes to stimulating aggregate savings. In light of the steady decline in saving rates in all but a handful of countries around the world since the late 1970s, the issue of how to increase aggregate savings has become a major policy concern[2]. In the developing world, increasing savings is an important issue because it is believed that higher levels of domestic savings are necessary in order to finance higher levels of investment, which — together with the externalities on productivity that they entail — are thought to be central to the growth process[3]. In industrialised countries, on the other hand, the insight that population ageing requires higher savings for retirement is an important factor in motivating authorities to promote higher savings.

From a theoretical perspective, the effect of funded pension wealth on savings is a controversial question. This is due to the fact that the principal framework employed for analysing the interaction between pension wealth and savings — the life-cycle model — yields results that are very sensitive to modifications in its basic assumptions. In the simplest version of the life-cycle model, an increase in pension wealth has no impact on overall savings. This is because households simply decrease their non-pension wealth to fully offset any increase in pension wealth. By considering aspects such as taxation issues, heterogeneous agents and imperfect capital markets, however, the model can be altered so that an increase in pension wealth yields a positive, negative or ambiguous effect on savings. Given this theoretical ambiguity, the issue of the sign on the relationship between funded pension wealth and savings is clearly an empirical matter.

In contrast to the extensive empirical literature on the effects of social security programmes on savings, existing empirical work on the impact of funded pensions on savings is fairly limited[4]. Evidence at the household level, based on studies for a few industrialised countries, suggests that increases in pension wealth are not fully offset by declines in non-pension wealth[5]. These results are thus evidence in support of the premise that an increase in funded pensions would have a positive overall impact on household savings.

At the aggregate level, existing studies are limited to three countries that have had large-scale funded pension schemes in place over a reasonably long period of time — Chile, Malaysia and Singapore.

In their analysis of the Chilean experience, Corsetti and Schmidt-Hebbel (1996) and Morandé (1996) provide some support for the idea that the 1981 pension reform — and the subsequent growth in private pension funds — contributed to increasing private savings over the 1980s and early 1990s. Faruqee and Husain (1994) find evidence that provident fund saving had an impact on the private savings rate over the 1970-92 period in Singapore but not in Malaysia[6]. Finally, Husain (1995) found provident fund saving to be a statistically insignificant determinant of private consumption in Singapore, thus contradicting the results in Faruqee and Husain (1994). In addition to yielding mixed outcomes, these aggregate-level studies also suffer from an important shortcoming in that their econometric analysis is based on a relatively small number of degrees of freedom. Indeed, the time series employed are relatively short because annual figures related to funded pensions are, in general, not available for a very long time period. One way to overcome this problem would be to pool data across a group of countries. As far as we know, no existing study has investigated the role of funded pension wealth in the determination of aggregate savings in a cross-country context.

Our paper proposes to address this data limitation by examining the link between funded pension wealth and aggregate savings, using panel data for a group of eleven countries (both industrialised and emerging-market) over the 1982-93 period. Employing a panel data set enables us to draw on a variety of country experiences and, hence, to utilise a richer set of information in estimating the impact of increases in pension wealth on aggregate savings than would be available with any individual country. We build several proxies of pension wealth for this sample of countries based on pension fund and life insurance asset data. Using these constructed measures and controlling for other determinants of savings, we estimate the relationship between aggregate saving rates and pension wealth. Estimations are carried out using both ordinary-least squares (OLS) and two-stage least squares (2SLS). Heterogeneity among the cross-sectional units is accounted for by introducing country-specific fixed effects and by allowing for a differential impact of pension wealth on savings in the industrialised and emerging-market countries in our sample.

The organisation of this paper is as follows. Section 2 presents the data on funded pensions that was collected for the eleven countries in our sample. Section 3 discusses the theoretical literature and derives the conditions under which an increase in pension wealth would be expected to stimulate aggregate savings by drawing on a simple two-period version of the life-cycle model The methodology and estimation results are then presented in Sections 4 and 5, respectively. Section 6 concludes.

II. FUNDED PENSIONS IN A SAMPLE OF ELEVEN COUNTRIES

A funded pension plan is one in which pension obligations are covered, either partially or fully, by assets. In such a scheme, members make contributions to a fund during their working lives and receive a pension in the form of an annuity (or lump-sum payment) upon retirement. Pension contributions made by employees and/or employers are collected and invested usually by a financial intermediary such as a pension fund or a life insurance company[7]. Financial intermediaries that manage pension funds therefore have their own assets and liabilities and engage in financial transactions in the market on their own account (OECD, 1997*b*). Thus an important distinction between a funded pension plan and a pay-as-you go (PAYG) scheme is that in the former a pool of funds is generated which is used to acquire assets whereas in the latter worker contributions are transferred directly to pensioners.

Funded pension programmes around the world can take various forms. They are typically organised as occupational pension plans and can be sponsored by employers in both the private and public sectors. Occupational pension schemes are widespread in industrialised nations but they are also present in developing countries, although their coverage tends to be much more limited (World Bank, 1994). Funded pension programmes can also take the form of a personal savings plan where workers are required to save a portion of their wage income for retirement in individual accounts. These accounts can be managed either privately, as is the case in many Latin American countries — notably Chile — or publicly, as in countries like Singapore and Malaysia.

In this section, we present the data which were collected on funded pensions for eleven countries over the 1982-93 period and are employed in the regression analysis. These eleven countries, listed in Appendix I, were drawn from a larger group that comprises industrialised nations, on the one hand, and emerging-market economies in Latin America and Asia, on the other. We considered this group of nations only because we wanted to select a sample that represented a wide enough variety of country experiences and pension regimes without creating a sample where the countries had such dramatically different levels of development that the assumption of common slope parameters in the econometric analysis would become unreasonable. From this larger set, we drew the eleven countries for which internationally-comparable data on funded pensions were available for the time period chosen[8]. Of these eleven countries, seven were classified as industrialised over the sample period whereas the other four were categorised as being emerging-market economies.

Table 1.1. **Stock of Pension Fund Assets**
(as a proportion of GDP)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	0.19	0.04	0.14	0.03	0.02	0.27
1983	0.21	0.08	0.18	0.03	0.03	0.29
1984	0.21	0.11	0.19	0.03	0.03	0.29
1985	0.23	0.18	0.20	0.03	0.03	0.36
1986	0.25	0.22	0.21	0.03	0.03	0.44
1987	0.26	0.24	0.22	0.03	0.03	0.45
1988	0.26	0.25	0.22	0.03	0.03	0.45
1989	0.28	0.26	0.23	0.03	0.03	0.45
1990	0.30	0.32	0.25	0.03	0.03	0.45
1991	0.32	0.40	0.31	0.03	0.03	0.45
1992	0.34	0.36	0.34	0.03	0.03	0.48
1993	0.36	0.43	0.35	0.03	0.03	0.51
Average	0.27	0.24	0.24	0.03	0.03	0.41

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	0.57	0.03	0.48	0.31	0.29
1983	0.61	0.03	0.53	0.37	0.32
1984	0.65	0.03	0.57	0.43	0.32
1985	0.68	0.04	0.69	0.48	0.40
1986	0.72	0.04	0.75	0.56	0.40
1987	0.75	0.04	0.70	0.55	0.40
1988	0.79	0.04	0.63	0.57	0.37
1989	0.78	0.04	0.61	0.67	0.42
1990	0.75	0.04	0.60	0.56	0.43
1991	0.77	0.05	0.61	0.60	0.49
1992	0.79	0.05	0.64	0.65	0.51
1993	0.88	0.06	0.56	0.77	0.53
Average	0.72	0.04	0.62	0.52	0.39

Source: See Appendix II for data sources.

Table 1.2. **Stock of Pension Fund Assets**
(in US$ per working-aged person)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	3 867	157	2 467	397	79	1 085
1983	4 478	278	3 037	411	100	1 269
1984	4 737	353	3 204	402	113	1 397
1985	5 036	480	3 576	421	115	1 513
1986	5 623	613	4 924	622	155	1 620
1987	6 562	733	6 324	753	179	1 820
1988	7 662	873	7 565	843	240	1 914
1989	9 116	1 055	8 596	825	276	2 031
1990	9 993	1 369	11 164	1 010	317	2 231
1991	10 981	1 896	12 035	1 083	348	2 423
1992	11 215	2 071	11 651	1 230	379	3 028
1993	11 417	2 609	9 647	1 046	420	3 469
Average	7 557	1 041	7 016	754	227	1 983

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	9 372	749	4 966	4 799	6 888
1983	9 698	759	6 009	5 312	8 172
1984	9 509	806	6 663	5 818	8 791
1985	10 050	879	7 361	6 726	11 646
1986	14 635	1 143	7 834	9 558	12 198
1987	18 291	1 349	8 165	11 422	12 814
1988	20 233	1 598	8 790	14 447	13 708
1989	19 601	1 650	9 755	16 788	16 331
1990	23 104	2 079	11 518	16 152	17 127
1991	24 069	2 264	13 348	18 116	19 065
1992	27 085	2 687	15 483	20 026	20 860
1993	28 776	2 786	15 534	21 402	22 466
Average	16 877	1 451	9 081	11 742	13 418

Source: See Appendix II for data sources.

Table 1.3. **Stock of Pension Fund and Life Insurance Assets**
(as a proportion of GDP)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	0.35	0.05	-	0.16	0.06	0.31
1983	0.37	0.10	-	0.17	0.08	0.33
1984	0.38	0.13	-	0.18	0.09	0.33
1985	0.40	0.21	-	0.19	0.10	0.40
1986	0.43	0.26	-	0.20	0.12	0.50
1987	0.44	0.27	-	0.21	0.14	0.51
1988	0.45	0.29	-	0.22	0.15	0.50
1989	0.47	0.31	0.25	0.22	0.17	0.51
1990	0.50	0.38	0.28	0.22	0.19	0.51
1991	0.54	0.47	0.34	0.21	0.20	0.52
1992	0.57	0.43	0.37	0.21	0.21	0.54
1993	0.61	0.52	0.39	0.21	0.22	0.59
Average	0.46	0.29	0.33	0.20	0.15	0.46

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	0.78	0.16	0.51	0.60	0.47
1983	0.85	0.17	0.56	0.69	0.50
1984	0.90	0.18	0.60	0.79	0.50
1985	0.94	0.19	0.73	0.85	0.59
1986	0.99	0.22	0.79	0.97	0.61
1987	1.04	0.23	0.75	0.96	0.62
1988	1.10	0.24	0.68	1.00	0.59
1989	1.11	0.26	0.66	1.15	0.65
1990	1.08	0.27	0.66	0.98	0.67
1991	1.14	0.28	0.68	1.09	0.75
1992	1.18	0.29	0.71	1.20	0.78
1993	1.31	0.31	0.64	1.46	0.81
Average	1.01	0.23	0.67	0.93	0.61

- Not available.
Source: See Appendix II for data sources.

Table 1.4. **Stock of Pension Fund and Life Insurance Assets**
(in US$ per working-aged person)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	7 134	217	-	2 347	230	1 228
1983	8 022	332	-	2 432	303	1 443
1984	8 432	430	-	2 367	385	1 580
1985	8 964	555	-	2 486	440	1 712
1986	9 857	704	-	3 672	571	1 828
1987	11 369	852	-	4 745	787	2 066
1988	13 301	1 016	-	5 246	1 151	2 168
1989	15 542	1 242	9 342	5 281	1 574	2 304
1990	16 972	1 620	12 191	6 574	1 938	2 536
1991	18 674	2 225	13 157	6 993	2 312	2 766
1992	18 880	2 498	12 847	7 936	2 506	3 450
1993	19 043	3 136	10 741	7 971	2 723	3 972
Average	13 016	1 236	11 656	4 838	1 243	2 254

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	12 903	3 928	5 283	9 152	11 124
1983	13 356	4 050	6 378	9 846	12 820
1984	13 069	4 269	7 070	10 521	13 873
1985	13 805	4 848	7 793	11 893	17 381
1986	20 187	6 586	8 329	16 703	18 672
1987	25 277	8 258	8 762	20 083	19 949
1988	28 149	9 774	9 516	25 153	21 712
1989	27 799	10 639	10 648	28 943	25 133
1990	33 229	12 890	12 680	28 514	26 598
1991	35 361	13 490	14 779	32 651	29 347
1992	40 279	14 944	17 373	37 057	31 809
1993	42 997	14 622	17 983	40 602	34 407
Average	23 947	8 516	9 874	20 956	20 765

- Not available.
Source: See Appendix II for data sources.

We use the assets managed by pension funds as well those of life insurance companies in constructing our proxies for pension wealth in each country. Pension and life insurance assets are first shown as a percentage of GDP to give an indication of the magnitude of total pension wealth relative to the size of the economy. They are also represented as a proportion of the working age population as this is an appropriate measure of the pension wealth held by the portion of the population that works and saves. In addition to these proxies for the stock of pension wealth held in each country, we also develop measures to account for the flow of pension wealth.

The assets managed by pension funds are displayed as a percentage of GDP in Table 1.1 and as a proportion of the working age population in Table 1.2[9]. The pension figures for Canada, Finland, Germany, Korea, the Netherlands, Norway, the United Kingdom and the United States were obtained from OECD (1997*b*). This data does not cover pension arrangements which do not constitute a separately organised fund or those in which the reserves of the funds are simply added to the employer's own reserves or invested in securities issued by the employer. Nor do they include pension funds that are managed by other financial intermediaries such as life insurance companies. The figures for Chile, Malaysia and Singapore were obtained from national sources (see Appendix II for more details). In Chile, they represent the assets of the mandatory pension system administered by private pension funds. In Malaysia, they include the assets managed by a small group of provident and pension funds, the largest being the Employees Provident Fund (EPF)[10]. For Singapore, the assets of the compulsory Central Provident Fund (CPF) were employed[11].

The assets of life insurance companies are added to those of pension funds and shown as a proportion of GDP in Table 1.3 and as a proportion of the working age population in Table 1.4. We consider the life insurance sector in this context because, as mentioned earlier, the assets of certain pension schemes are managed by life insurance companies and are not included as part of the figures in Tables 1.1 and 1.2. In addition, certain pension plans are insured by life insurance companies which means that the plan sponsor uses the pension contributions to purchase an annuity policy from a life insurance company. Therefore by considering only the assets managed by pension funds, we would be underestimating the actual pension wealth in each economy. It should be noted that by including the total assets of life insurance companies — and not just those attributed to pension schemes — we are in fact overestimating the extent of pension wealth. Unfortunately, figures on the pension fund assets managed or insured by life insurance companies were not available. Given this data limitation and the fact that life insurance companies offer other saving instruments that are alternative means to finance retirement (and are hence close substitutes to pensions), it seems reasonable to consider the assets of life insurance companies in addition to those of pension funds in constructing our proxies for pension wealth.

Table 2.1. **Flow of Pension Fund Assets**
(as a proportion of GDP)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	0.027	0.028	0.000	0.006	0.007	0.052
1983	0.031	0.053	0.056	0.003	0.007	0.048
1984	0.025	0.043	0.024	0.003	0.005	0.038
1985	0.028	0.104	0.028	0.003	0.003	0.055
1986	0.033	0.082	0.025	0.003	0.010	0.057
1987	0.030	0.067	0.023	0.000	0.003	0.052
1988	0.023	0.065	0.028	0.003	0.006	0.050
1989	0.039	0.067	0.033	0.002	0.002	0.052
1990	0.025	0.109	0.035	0.002	0.006	0.052
1991	0.027	0.154	0.039	0.003	0.004	0.055
1992	0.028	0.049	0.023	0.002	0.005	0.077
1993	0.032	0.131	0.019	-0.003	0.005	0.082
Average	0.029	0.079	0.028	0.003	0.005	0.056

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	0.064	0.004	0.107	0.076	0.052
1983	0.067	0.004	0.105	0.082	0.055
1984	0.069	0.006	0.079	0.089	0.026
1985	0.067	0.005	0.107	0.082	0.101
1986	0.058	0.004	0.064	0.112	0.022
1987	0.033	0.003	0.029	0.040	0.023
1988	0.067	0.005	0.037	0.083	0.027
1989	0.038	0.004	0.059	0.142	0.071
1990	0.017	0.006	0.068	-0.068	0.024
1991	0.058	0.006	0.072	0.071	0.053
1992	0.051	0.007	0.068	0.066	0.048
1993	0.103	0.010	0.009	0.156	0.042
Average	0.054	0.005	0.072	0.071	0.046

Source: See Appendix II for data sources.

Table 2.2. **Flow of Pension Fund Assets**
(in US$ per working-aged person)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	544	119	0	80	24	207
1983	684	179	924	39	29	211
1984	557	136	416	39	19	180
1985	623	270	493	37	13	235
1986	758	223	581	57	45	209
1987	763	207	674	10	17	212
1988	697	232	943	81	42	217
1989	1 264	272	1 247	44	21	237
1990	861	465	1 548	58	61	257
1991	929	726	1 501	107	49	293
1992	924	282	814	85	59	488
1993	1 020	787	523	-110	60	557
Average	802	325	805	44	37	275

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	1 063	106	1 112	1 160	1 246
1983	1 053	100	1 186	1 180	1 391
1984	1 002	132	930	1 193	737
1985	987	119	1 142	1 156	2 970
1986	1 182	130	669	1 930	688
1987	807	104	338	841	745
1988	1 716	214	519	2 094	1 017
1989	958	155	953	3 575	2 751
1990	533	274	1 302	-1 976	947
1991	1 816	275	1 566	2 137	2 096
1992	1 754	345	1 646	2 054	1 972
1993	3 388	456	240	4 331	1 802
Average	1 170	178	1 033	1 395	1 505

Source: See Appendix II for data sources.

Table 2.3. **Flow of Pension Fund and Life Insurance Assets**
(as a proportion of GDP)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	0.04	0.03	-	0.02	0.02	0.06
1983	0.05	0.06	-	0.02	0.02	0.06
1984	0.04	0.05	-	0.02	0.02	0.04
1985	0.05	0.11	-	0.02	0.02	0.06
1986	0.05	0.09	-	0.02	0.03	0.06
1987	0.05	0.08	-	0.02	0.03	0.06
1988	0.04	0.08	-	0.02	0.04	0.06
1989	0.06	0.08	0.05	0.02	0.04	0.06
1990	0.04	0.13	0.04	0.02	0.05	0.06
1991	0.05	0.18	0.04	0.02	0.04	0.06
1992	0.04	0.07	0.03	0.01	0.03	0.09
1993	0.05	0.16	0.02	0.01	0.03	0.10
Average	0.05	0.09	0.04	0.02	0.03	0.06

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	0.08	0.02	0.11	0.14	0.07
1983	0.09	0.02	0.11	0.14	0.07
1984	0.09	0.03	0.08	0.15	0.04
1985	0.09	0.03	0.11	0.13	0.13
1986	0.08	0.03	0.07	0.19	0.05
1987	0.05	0.03	0.04	0.08	0.05
1988	0.10	0.03	0.05	0.14	0.05
1989	0.07	0.04	0.07	0.24	0.09
1990	0.04	0.03	0.08	-0.09	0.04
1991	0.11	0.02	0.08	0.15	0.08
1992	0.09	0.02	0.08	0.15	0.07
1993	0.16	0.04	0.03	0.32	0.07
Average	0.08	0.03	0.08	0.13	0.07

- Not available.
Source: See Appendix II for data sources.

Table 2.4. **Flow of Pension Fund and Life Insurance Assets**
(in US$ per working-aged person)

	Canada	Chile	Finland	Germany	Korea	Malaysia
1982	851	147	-	272	74	235
1983	1 022	195	-	230	93	245
1984	943	172	-	214	103	196
1985	1 110	299	-	227	93	267
1986	1 197	252	-	341	148	231
1987	1 204	248	-	358	190	251
1988	1 233	270	-	439	285	241
1989	1 910	331	1 993	425	346	272
1990	1 404	556	1 740	479	477	297
1991	1 603	841	1 654	637	482	344
1992	1 379	399	1 000	547	382	551
1993	1 541	939	679	512	338	654
Average	1 283	387	1 413	390	251	315

	Netherlands	Norway	Singapore	U.K.	U.S.A.
1982	1 400	563	1 164	2 173	1 692
1983	1 455	595	1 247	1 966	1 868
1984	1 352	672	986	1 948	1 238
1985	1 349	825	1 195	1 821	3 689
1986	1 707	992	743	3 216	1 495
1987	1 160	1 084	441	1 593	1 474
1988	2 560	1 305	641	3 433	1 955
1989	1 863	1 490	1 118	5 939	3 622
1990	1 217	1 252	1 529	-2 739	1 697
1991	3 356	1 161	1 808	4 443	2 996
1992	3 064	990	2 053	4 665	2 735
1993	5 241	1 662	821	9 012	2 895
Average	1 862	994	1 175	2 587	2 224

- Not available.
Source: See Appendix II for data sources.

As depicted in Tables 1.1 to 1.4, there is a great deal of variation in the extent of pension wealth in the eleven nations in our sample. At one end of the spectrum, countries like Germany, Korea and Norway had on average relatively small stocks of pension fund and life insurance assets over the 1982-93 period, while the Netherlands, Singapore, the United Kingdom and the United States, at the other end of the spectrum, had relatively large stocks of pension fund and life insurance assets over the sample period.

As pointed out by Davis (1995), several factors could explain differences in the size of the funded pension sector across countries. First, the scale of pension provision under the public PAYG social security programme is an important consideration as it represents the main alternative to a privately funded pension scheme. Second, the taxation and regulation of private pension plans influence the development of occupational pension plans by making it more or less attractive (and in some countries by making it mandatory) for firms to establish pension funds. Third, rates of return earned on pension assets obviously affect the growth of the funded pension sector. Finally, the average maturity of funded pension schemes in each country is an important factor in accounting for the relative size of the funded pension sector[12]. In a country with an immature system, pension fund assets will grow relatively rapidly as the ratio of contributors to retirees will be quite high; as the system matures and more individuals retire, pension assets will grow more slowly[13].

Tables 2.1 to 2.4 present our flow measures. Each flow variable was constructed by taking the difference between the corresponding stock at the end of two consecutive years. For instance, the flow of pension fund assets for 1982 used in Tables 2.1 and 2.2 is simply the difference between the stock of pension fund assets at the end of 1981 and the stock at the end of 1982; it is then deflated either by GDP or by the working age population for 1982. We employ these flow measures as proxies for changes in pension wealth. This procedure is justified by the fact that pension assets are most often reported at book rather than market value and therefore the flow measures — excluding asset appreciation — consist largely of net contributions.

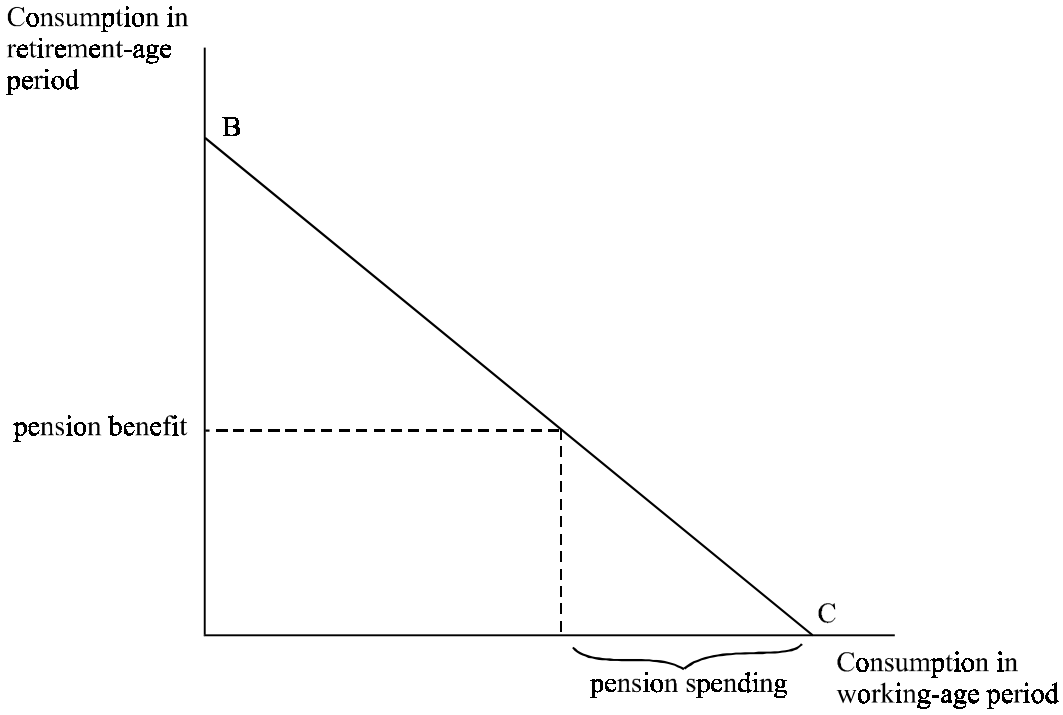
III. PENSION WEALTH AND SAVINGS: A THEORETICAL FRAMEWORK

The main framework employed for analysing the interaction between pension wealth and savings is the life-cycle saving model. In this model, which was first developed by Modigliani and Brumberg (1954) and later generalised by Feldstein (1974), individuals maximise their welfare by smoothing their lifetime consumption. They therefore save during their working lives to finance consumption during retirement; thus the only motivation for saving in this framework is to provide for retirement. Furthermore, it is assumed that it is this life-cycle saving by households which generates the capital stock and therefore that changes in household savings translate into changes in aggregate savings. The analysis thus abstracts away from corporate and government savings.

In its simplest version, the life-cycle model predicts that an increase in pension wealth will have no impact on overall savings. This is because households will simply alter their non-pension wealth to fully offset this increase in pension wealth. Even if households were forced to save more for retirement through pension contributions than they would have voluntarily, they could still offset this "excessive" amount of savings by borrowing at the market rate of interest. In this section, we introduce some modifications to this basic framework and examine the aggregate savings response to an increase in funded pension wealth in the context of a two-period version of the life-cycle model[14]. More specifically, we consider taxation issues, heterogeneous agents, imperfect capital markets, and specific characteristics of pension design.

Figure 1 depicts the individual's lifetime budget constraint in the two-period life-cycle model. Consumption spending for the first period (the working-age period) is represented on the horizontal axis whereas consumption spending for the second period (the retirement period) is shown on the vertical axis. At one extreme, all income is consumed during the working-age period and nothing is saved for retirement (point C). At the other extreme (point B), there is no consumption in the first period and all the savings are consumed, with the accumulated interest, in the second period. All the points that lie between these two extremes on the budget constraint BC entail varying levels of consumption and saving for retirement during the working period. The slope of the budget constraint is equal to (1+r) where r represents the rate of return on retirement savings. We do not draw indifference curves to keep the exposition simple.

Figure 1. The Two-Period Life-Cycle Model



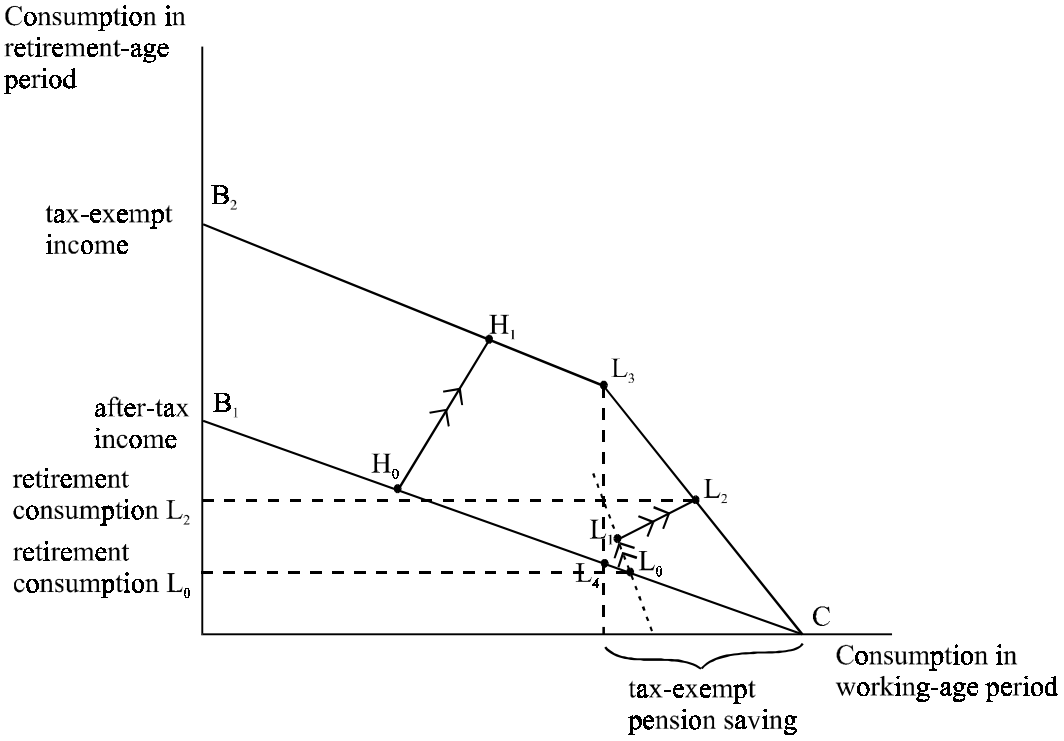
Source: Authors' calculation.

Figure 2 introduces tax breaks for pension savings and heterogeneity in the population. As pointed out in OECD (1997*a*), in the majority of OECD countries pension contributions and returns are generally tax-exempt, while most alternative saving instruments are subject to a marginal tax rate of anywhere between 20 to 40 per cent. The line B_1C in Figure 2 shows the budget constraint before the tax exemption of pension savings. With pension contributions (and returns) tax exempt up to a given ceiling, the budget constraint rises more steeply from C than before (CL_3). Beyond the ceiling for tax-exempt pension savings, the trade-off between present and future consumption remains the same as when savings are subject to taxes. The tax exemption produces a positive income effect, however, which produces a parallel shift of the budget constraint from B_1C to B_2L_3. The budget constraint with tax exempt pension savings is therefore the kinked line B_2L_3C.

We introduce heterogeneous agents by distinguishing between low and high savers. It is a well known stylised fact that many low-income households save very little or nothing at all. Before the introduction of a tax-exempt pension scheme, these low savers would be on point L_0. The introduction of the scheme produces both a substitution effect from L_0 to L_1 (along the steeper broken line parallel to the new budget constraint CL_3) and an income effect which moves the low savers to L_2. The net saving impact of the pension plan

is therefore ambiguous for low savers. It will only be positive if their marginal rate of substitution between present and future consumption is lower than the implicit rate of return of the tax exempt pension savings. A voluntary pension scheme then might fail to stimulate savings even for low-income households.

Figure 2. Tax Exempt Pensions with Low and High Savers



Source: Authors' calculation.

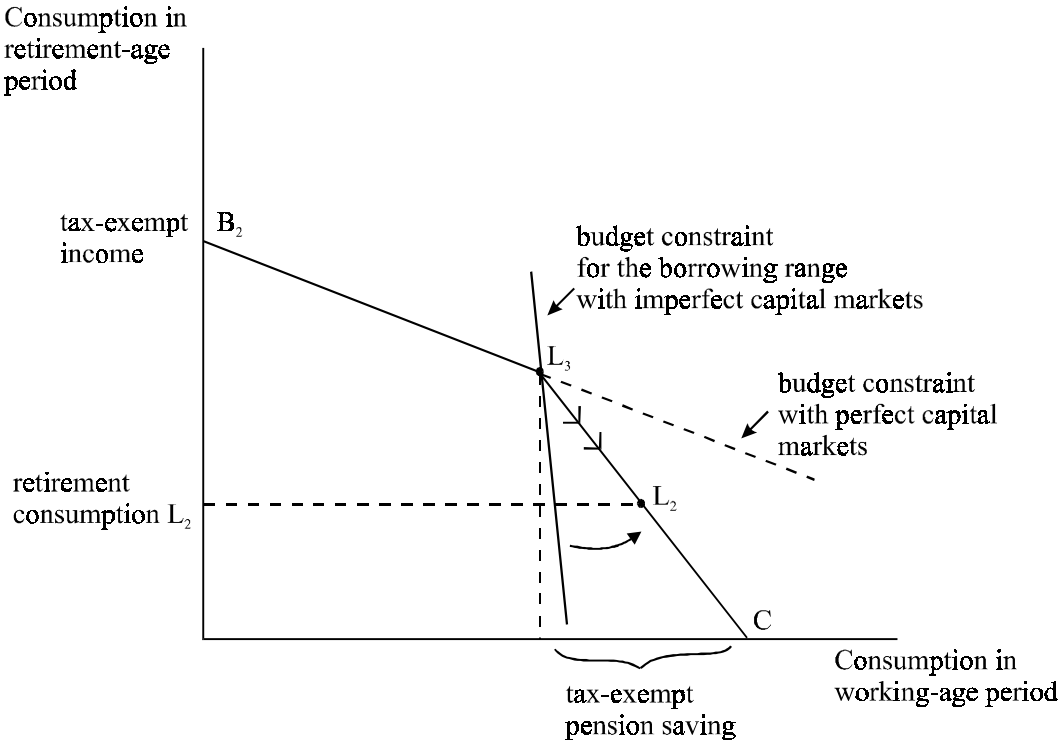
For the high-savers group, the introduction of a tax-exempt pension scheme will merely produce an income effect and consequently reduce overall savings. In Figure 2, the income effect is represented by the move from H_0 to H_1. There is no substitution effect for this high-saving group, as the pension scheme does not raise the rate of return in the relevant portion of their budget constraint. This would only be brought about by extending or abolishing any ceilings for the tax exemption of pension contributions. Since the high savers do the bulk of national private savings, we presume that net private savings will be lowered by tax-exempt voluntary pension plans with ceilings for tax-free contributions. Either, any ceilings should be abolished to produce a positive substitution effect on high savers; this, however, would reduce government savings considerably. Or, pension schemes have to be mandatory rather than voluntary to stimulate national private savings.

The mandatory status would shift the low savers unambiguously towards higher savings. With tax-exempt pensions, they would move from L_0 to L_3; without tax exemptions, the low savers would move to L_4, which represents precisely the same amount of additional private savings. The highest net stimulus to national private savings is obtained when pension returns are mandatory and subject to taxes as any other savings. Low savers then move to L_4, high savers stay at H_0 because they do not enjoy a saving-reducing income effect, and government savings will not be reduced by tax breaks. Note that this result holds only if the low-savers group cannot return to the level of voluntary savings (L_2 with tax breaks or L_0 without tax breaks) because they cannot borrow against the pension assets that they are forced to accumulate.

Next, we consider imperfect capital markets by introducing various degrees of borrowing constraints. This is depicted in Figure 3 where liquidity constraints are represented by the wedge between the rate of return on saving and the interest rate on borrowing. Tight liquidity constraints imply very high borrowing costs, such as those charged in the informal curb markets in many developing countries. In Figure 3, we discuss the case of mandatory tax-exempt pensions which have forced low savers to point L_3 (the high savers case is not relevant here). Through point L_3, a steep budget constraint for the borrowing range is drawn to represent tight liquidity constraints. Low savers cannot return to L_2 by borrowing against their pension assets, a point where they would enjoy higher utility as in point L_3. But to the extent that borrowing constraints are relieved (which, *inter alia*, may be the result of the intermediation of a growing pool of pension funds through the banking system), it will become less costly to borrow so that the budget constraint would start to flatten.

The looser liquidity constraint produces both an income effect (the budget constraint is moving out) and a substitution effect (the slope of the budget constraint for the borrowing range changes), which reinforce one another in stimulating present consumption and hence depressing savings. When the borrowing costs fall to the level of the implicit return on tax-exempt pensions, the low savers will return to L_2 (where the highest utility level is reached by definition). It can even be envisaged that borrowing costs fall *below* the implicit rate of return of tax-exempt pension savings, a clear invitation to arbitrage in a perfect capital market. We conclude therefore that mandatory pension schemes will stimulate private savings only if liquidity constraints remain sufficiently tight.

Figure 3. Pensions with Tight and Loose Borrowing Constraints



Source: Authors' calculation.

There are a few other issues that are not addressed in our simple two-period analysis that might influence the impact of an increase in funded pension wealth on savings that are worth mentioning. First, individuals may have other motivations for saving such as preparing for unforeseen contingencies by engaging in precautionary saving. Pension assets are rather poorly suited for these purposes and therefore households might prefer not to hold all (or a large majority) of their wealth in this form (Munnell, 1987). As a result, they might be reluctant to reduce their non-pension wealth when their pension wealth increases. Second, the development of funded pension schemes might raise awareness among the general population of the need to save for retirement (Cagan, 1965). This increased awareness might incite individuals to augment their voluntary savings.

Finally, the proliferation of funded pension plans is enabling many workers to retire earlier. As discussed by Feldstein (1974), households that decide to retire earlier can be expected to increase their savings during their working

years because they must accumulate a larger amount of assets over a shorter working life in order to finance a longer retirement. These same households, however, will also dissave a larger pool of assets over a longer retirement period. The net effect on aggregate savings will be positive as long as the population and/or per capita income are increasing in the economy (and thus the additional saving by workers will exceed the extra dissaving by retirees).

The hypotheses that we derive from our two-period analysis presented here are summarised in Table 3. Rising funded pension assets and flows can only be expected to stimulate aggregate savings unambiguously if the pension scheme is mandatory rather than voluntary, if borrowing constraints are tight enough to sufficiently discourage borrowing against accumulated pension assets and if pension returns are taxable like the returns on other saving instruments. Mandatory pension schemes will stimulate savings also with tax exempt returns if the coverage of low savers is high enough or if there are limits on eligibility so as to compensate or avoid the saving-reducing income effect of high savers enjoying tax breaks. Voluntary funded pension plans are unlikely to stimulate savings if returns are exempt from taxation.

Table 3. **The Impact on Savings of an Increase in Funded Pension Wealth in a Two-Period Life-Cycle Model**

Population	Low Savers	High Savers	Total
1. Voluntary system and tax exempt returns			
- with ceiling on contributions	+/-	-	-
- without ceiling on contributions	+/-	+/-	+/-
2. Mandatory system and tight liquidity constraints			
- with tax exempt returns	+	-	+/-
- with taxable returns	+	0	+
3. Mandatory system and no liquidity constraints			
- with tax exempt returns	+/-	-	+/-
- with taxable returns	+/-	0	+/-

Note: Where (+) and (-) denote positive and negative effects on savings, respectively, (+/-) denotes an ambiguous effect on savings and (0) denotes no effect on savings.

IV. METHODOLOGY

We employ a single-equation regression framework to estimate the relationship between funded pension wealth and aggregate saving rates in our panel of eleven countries using data over the 1982-93 period. An appropriate set of control variables (i.e. other determinants of saving rates) was selected by drawing on past empirical work that has investigated aggregate saving behaviour across nations[15]. Heterogeneity among the cross-sectional units is accounted for in two different ways. First, we include country-specific fixed effects in our regression specification. This enables us to capture any unobservable characteristics that vary across countries (but not over time) and that influence saving rates. Second, we let the effect of pension wealth on savings differ for our two major country groupings. As mentioned earlier, the countries in our sample can be classified as being either industrialised or emerging-market nations. Those countries that are categorised as being industrialised also happened to be members of the Organisation for Economic Co-operation and Development (OECD) during the sample period while the emerging-market economies were not[16]. We allow for a differential impact by interacting the pension wealth variables with two dummy variables that identify whether or not the country was a member of the OECD during the sample period.

The following equation describes the econometric specification employed:

$$sav_{it} = \alpha_i + \beta x_{it} + \gamma w_{it} + \delta t_{it} + \varepsilon_{it} \qquad (1)$$

where sav_{it} is the ratio of aggregate savings to GDP for country i and time period t, α_i is a country-specific constant, x_{it} is a variable that measures funded pension wealth (in either stock or flow form) for country i and time period t, w_{it} is a vector of other control variables for country i and time period t, t_{it} is a country-specific time trend that varies by country i and time period t and ε_{it} is a classical disturbance term. Country-specific time trends were introduced to address the problem of autocorrelation of the residuals. The fixed effects specification defined in equation (1) is a classical regression model and can thus be estimated using OLS.

Both private and national savings were employed in constructing our dependent variable. Even though our theoretical discussion in the previous section and our choice of control variables both reflect motivations for saving from the household's perspective, we do not use aggregate household savings because of the difficulties involved in obtaining internationally-comparable

figures for savings undertaken strictly by households. Indeed, changes in tax codes and different accounting conventions often blur the distinction between corporate and household savings. In using private or national savings as our dependent variable, we are implicitly assuming that household and corporate savings are perfect substitutes.

Vector *w* is comprised of seven variables that have been identified in the literature as being important determinants of saving rates across countries. They are: the dependency ratio, the growth rate of per capita GDP, the government budget surplus, the real interest rate, domestic credit as a proportion of GDP, per capita income, and government pension spending per retired person. A description of all the variables employed in the econometric analysis is provided in Appendix II. As discussed in Edwards (1995), from theory we expect the following coefficient signs on these explanatory variables:

a) *Dependency ratio:* Negative. According to the life-cycle hypothesis, a country with a relatively high proportion of dependants (i.e. inactive young and old) relative to the working — and thus saving — population will also experience relatively lower savings.

b) *Growth rate of per capita GDP:* Positive. Another implication of the life-cycle hypothesis is that in growing economy, saving by workers will increase relative to dissaving by the retired resulting in a rise in overall savings.

c) *Government budget surplus:* Negative. Government savings are expected to crowd-out private savings.

d) *Real interest rate:* Ambiguous. Depending on the relative magnitudes of the income and substitution effects, the impact of a real interest rate increase can be either positive or negative (or null if the two effects offset one another).

e) *Domestic credit as a proportion of GDP:* Negative. As credit markets develop (and thus domestic credit as a proportion of GDP increases), borrowing constraints are eased which should negatively impact savings.

f) *Per capita income:* Positive. It has been suggested that high-income households save a larger proportion of their income than do their low-income counterparts. At the macro level, this would imply that richer countries should save more than poorer ones.

g) *Government pension spending per elderly person:* Negative. According to the life-cycle hypothesis, if individuals anticipate higher benefits from the public PAYG pension system (proxied here by spending) they will reduce their savings.

The estimation of semi-reduced equations such as (1) generally present problems of endogeneity. As discussed in Carroll and Weil (1994), there are theoretical arguments to justify a two-way causality between the growth rate and savings. Such a two-way causality would result in the error term being correlated with the growth rate and the OLS estimates being biased and inconsistent. This problem is addressed by estimating (1) using two-stage least squares (2SLS) where population growth, the inflation rate and all the other exogenous explanatory variables are employed as instruments for the growth rate in the first stage.

V. ESTIMATION RESULTS

The estimation results, based on the estimation of (1) employing our eight different proxies for the stocks and flows of funded pension wealth, are reported in Tables 4.1 to 5.4. Each table focuses on a particular measure of pension wealth as the explanatory variable of interest and reports results for four different regressions. The first two regressions in each table are estimated using regular OLS whereas the latter two are estimated by instrumenting for the growth rate using 2SLS. In the second and fourth equations in each table, the impact of pension wealth on savings is allowed to differ for OECD and non-OECD countries. This is done by interacting the pension wealth variable with two different dummy variables: OECD (which takes on a value of 1 for OECD countries and 0 otherwise) and Non-OECD (which takes on a value of 1 for non-OECD countries and 0 otherwise).

We do not find any significant difference in the estimation results when we performed the regression analysis on national rather than private saving rates; we therefore only report the results of the estimations employing the private saving rate as the dependent variable. This finding suggests that government savings were not negatively affected by funded pensions in our sample in spite of the fact that the returns on pension savings were generally tax-exempt. The finding may rest on several explanations which have not been explored here: tax-exempt pension schemes may be self-financing as they foster capital accumulation, growth and higher corporate tax receipts; or they may be financed by reduced government spending rather than by a rise in government budget deficits.

The overall fit of our regressions are quite good as suggested by the high adjusted-R^2s. Indeed, the model we use explains over 90 per cent of the variation in private saving rates in our sample. This measure of goodness of fit, however, takes into account the variation explained by the country fixed-effects in addition to the other explanatory variables. The adjusted R^2s for the within-estimator — not reported here — were all between 60 per cent and 70 per cent, suggesting that the determinants of savings that we selected as explanatory variables do a good job in explaining the variation in our dependent variable.

Table 4.1. **Savings and the Stock of Pension Assets (relative to GDP)**
Panel estimates for 1982-93 using the private savings rate as the dependent variable

Estimation Method	R1 OLS	R2 OLS	R3 IV	R4 IV
Dependency ratio	0.0602 (0.2076)	0.0437 (0.2104)	0.2161 (0.2252)	0.2376 (0.2288)
Growth rate of real per capita GDP	-0.1042 (0.1527)	-0.1124 (0.1606)	0.2212 * (0.1369)	0.2300 * (0.1343)
Government budget surplus / GDP	-0.4794 ** (0.1038)	-0.4822 ** (0.1003)	-0.4817 ** (0.1061)	-0.4778 ** (0.1039)
Real interest rate	-0.0135 (0.0420)	-0.0154 (0.0443)	0.0300 (0.0367)	0.0323 (0.0385)
Domestic credit / GDP	-0.1195 ** (0.0326)	-0.1191 ** (0.0324)	-0.1125 ** (0.0324)	-0.1131 ** (0.0322)
Real per capita GDP	0.35E-5 ** (0.13E-5)	0.35E-5 ** (0.13E-5)	0.31E-5 ** (0.12E-5)	0.32E-5 ** (0.12E-5)
Public pension spending / population 65+	-0.41E-5 ** (0.20E-5)	-0.40E-5 ** (0.20E-5)	-0.28E-5 (0.20E-5)	-0.30E-5 (0.20E-5)
Pension fund assets / GDP	0.0410 (0.0588)		0.0800 (0.0630)	
OECD X (Pension fund assets / GDP)		0.0542 (0.0523)		0.0614 (0.0536)
Non-OECD X (Pension fund assets / GDP)		0.0296 (0.0966)		0.0954 (0.0978)
Obs.	132	132	132	132
Adj. R-squared	0.94	0.94	0.94	0.94
F(fixed effects)	37.40 **	23.05 **	38.25 **	24.46 **
F(time trends)	8.47 **	7.71 **	7.90 **	7.13 **

Notes: 1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R3 and R4.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Table 4.2. **Savings and the Stock of Pension Assets (demographically-adjusted)**

Panel estimates for 1982-93 using the private savings rate as the dependent variable

	R5	R6	R7	R8
Estimation Method	OLS	OLS	IV	IV
Dependency ratio	-0.1029	-0.4294 **	-0.0086	-0.3656 *
	(0.2033)	(0.2001)	(0.1984)	(0.1957)
Growth rate of real per capita GDP	-0.0860	-0.0668	0.2472 **	0.1904 **
	(0.1540)	(0.1499)	(0.1086)	(0.0891)
Government budget surplus / GDP	-0.4983 **	-0.5171 **	-0.5186 **	-0.5333 **
	(0.0983)	(0.0877)	(0.0991)	(0.0880)
Real interest rate	0.0164	0.0212	0.0651 *	0.0588
	(0.0417)	(0.0440)	(0.0400)	(0.0412)
Domestic credit / GDP	-0.1240 **	-0.1164 **	-0.1111 **	-0.1062 **
	(0.0342)	(0.0337)	(0.0331)	(0.0326)
Real per capita GDP	0.22E-5 *	0.46E-6	0.14E-5	-0.22E-6
	(0.12E-5)	(0.12E-5)	(0.12E-5)	(0.12E-5)
Public pension spending / population 65+	-0.60E-5 **	-0.19E-5	-0.47E-5 **	-0.83E-6
	(0.21E-5)	(0.19E-5)	(0.21E-5)	(0.20E-5)
Pension fund assets / population 19-65	0.79E-5 **		0.87E-5 **	
	(0.26E-5)		(0.26E-5)	
OECD X (Pension fund assets / pop. 19-65)		0.44E-5 **		0.49E-5 **
		(0.21E-5)		(0.21E-5)
Non-OECD X (Pension fund assets / pop. 19-65)		0.26E-4 **		0.27E-4 **
		(0.65E-5)		(0.65E-5)
Obs.	132	132	132	132
Adj. R-squared	0.94	0.95	0.94	0.94
F(fixed effects)	40.92 **	25.66 **	41.30 **	29.17 **
F(time trends)	9.20 **	10.32 **	8.61 **	10.03 **

Notes: 1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R7 and R8.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Table 4.3. **Savings and the Stock of Pension and Life Insurance Assets (relative to GDP)**

Panel estimates for 1982-93 using the private savings rate as the dependent variable

	R9	R10	R11	R12
Estimation Method	OLS	OLS	IV	IV
Dependency ratio	0.0220	0.0095	0.1384	0.1838
	(0.2124)	(0.2139)	(0.2194)	(0.2242)
Growth rate of real per capita GDP	-0.1275	-0.1354	0.2167	0.2314 *
	(0.1570)	(0.1661)	(0.1369)	(0.1381)
Government budget surplus / GDP	-0.4917 **	-0.4956 **	-0.4754 **	-0.4606 **
	(0.1359)	(0.1315)	(0.1396)	(0.1376)
Real interest rate	-0.0125	-0.0136	0.0305	0.0329
	(0.0434)	(0.0453)	(0.0392)	(0.0405)
Domestic credit / GDP	-0.1158 **	-0.1148 **	-0.1062 **	-0.1108 **
	(0.0323)	(0.0322)	(0.0323)	(0.0325)
Real per capita GDP	0.33E-5 **	0.32E-5 **	0.29E-5 **	0.30E-5 **
	(0.13E-5)	(0.13E-5)	(0.13E-5)	(0.13E-5)
Public pension spending / population 65+	-0.43E-5 **	-0.43E-5 **	-0.25E-5	-0.28E-5
	(0.21E-5)	(0.21E-5)	(0.21E-5)	(0.21E-5)
Pension and life insurance assets / GDP	0.0165		0.0444	
	(0.375)		(0.0408)	
OECD X (Pension and life insurance assets / GDP)		0.0209		0.0249
		(0.0314)		(0.0321)
Non-OECD X (Pension and life insurance assets / GDP)		0.0070		0.0817
		(0.0940)		(0.0947)
Obs.	125	125	125	125
Adj. R-squared	0.94	0.94	0.93	0.93
F(fixed effects)	39.68 **	20.44 **	40.91 **	21.38 **
F(time trends)	7.71 **	6.89 **	7.13 **	6.30 **

Notes: 1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R11 and R12.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Table 4.4. **Savings and the Stock of Pension and Life Insurance Assets (demographically-adj.)**

Panel estimates for 1982-93 using the private savings rate as the dependent variable

	R13	R14	R15	R16
Estimation Method	OLS	OLS	IV	IV
Dependency ratio	-0.1173	-0.4913 **	-0.0398	-0.4329 **
	(0.2045)	(0.2216)	(0.2018)	(0.2219)
Growth rate of real per capita GDP	-0.1123	-0.1022	0.2491 **	0.2081 **
	(0.1600)	(0.1562)	(0.1135)	(0.0912)
Government budget surplus / GDP	-0.4953 **	-0.5062 **	-0.4983 **	-0.5089 **
	(0.1313)	(0.1175)	(0.1334)	(0.1192)
Real interest rate	0.0187	0.0272	0.0695	0.0710
	(0.0445)	(0.0473)	(0.0438)	(0.0460)
Domestic credit / GDP	-0.1102 **	-0.1086 **	-0.0955 **	-0.0959 **
	(0.0333)	(0.0328)	(0.0326)	(0.0320)
Real per capita GDP	0.20E-5	0.10E-7	0.12E-5	-0.75E-6
	(0.14E-5)	(0.15E-5)	(0.14E-5)	(0.15E-5)
Public pension spending / population 65+	-0.62E-5 **	-0.25E-5	-0.46E-5 **	-0.99E-6
	(0.23E-5)	(0.21E-5)	(0.22E-5)	(0.21E-5)
Pension and life insurance assets / population 19-65	0.42E-5 **		0.48E-5 **	
	(0.16E-5)		(0.17E-5)	
OECD X (Pension and life ins. assets / pop. 19-65)		0.30E-5 **		0.34E-5 **
		(0.13E-5)		(0.14E-5)
Non-OECD X (Pension and life ins. assets / pop. 19-65)		0.19E-4 **		0.20E-4 **
		(0.63E-5)		(0.64E-5)
Obs.	125	125	125	125
Adj. R-squared	0.94	0.94	0.94	0.94
F(fixed effects)	39.81 **	27.15 **	41.10 **	30.91 **
F(time trends)	8.02 **	8.68 **	7.41 **	8.25 **

Notes: 1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R15 and R16.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Table 5.1. **Savings and the Flow of Pension Assets (relative to GDP)**
Panel estimates for 1982-93 using the private savings rate as the dependent variable

	R17	R18	R19	R20
Estimation Method	OLS	OLS	IV	IV
Dependency ratio	-0.0124	-0.0018	0.0939	0.0746
	(0.2112)	(0.1992)	(0.2097)	(0.1893)
Growth rate of real per capita GDP	-0.1093	-0.0311	0.2400 **	0.2288 **
	(0.1535)	(0.1396)	(0.1193)	(0.1064)
Government budget surplus / GDP	-0.4998 **	-0.5081 **	-0.5219 **	-0.5253 **
	(0.1005)	(0.0882)	(0.1015)	(0.0887)
Real interest rate	-0.0081	0.0203	0.0415	0.0607
	(0.0424)	(0.0474)	(0.0408)	(0.0468)
Domestic credit / GDP	-0.1089 **	-0.1102 **	-0.0929 **	-0.0992 **
	(0.0328)	(0.0323)	(0.0319)	(0.0309)
Real per capita GDP	0.32E-5 **	0.28E-5 **	0.25E-5 **	0.22E-5 **
	(0.12E-5)	(0.11E-5)	(0.12E-5)	(0.12E-5)
Public pension spending / population 65+	-0.39E-5 **	-0.33E-5 *	-0.24E-5	-0.21E-5
	(0.20E-5)	(0.18E-5)	(0.20E-5)	(0.19E-5)
Flow of pension assets / GDP	0.0773		0.1014	
	(0.0600)		(0.0656)	
OECD X (Flow of pension assets / GDP)		-0.0046		-0.0044
		(0.0315)		(0.0315)
Non-OECD X (Flow of pension assets / GDP)		0.3373 **		0.4067 **
		(0.1662)		(0.1707)
Obs.	132	132	132	132
Adj. R-squared (within)	0.94	0.94	0.94	0.94
F(fixed effects)	49.99 **	40.37 **	52.67 **	44.81 **
F(time trends)	7.71 **	5.60 **	7.12 **	5.38 **

Notes: 1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R18 and R20.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Table 5.2. **Savings and the Flow of Pension Assets (demographically-adjusted)**

Panel estimates for 1982-93 using the private savings rate as the dependent variable

	R21	R22	R23	R24
Estimation Method	OLS	OLS	IV	IV
Dependency ratio	-0.0112	-0.0583	0.1015	0.0228
	(0.2145)	(0.1934)	(0.2156)	(0.1852)
Growth rate of real per capita GDP	-0.1262	-0.0328	0.2336 **	0.2513 **
	(0.1581)	(0.1461)	(0.1197)	(0.1145)
Government budget surplus / GDP	-0.4997 **	-0.5204 **	-0.5225 **	-0.5399 **
	(0.1031)	(0.0799)	(0.1046)	(0.0801)
Real interest rate	-0.0142	0.0002	0.0356	0.0398
	(0.0416)	(0.0422)	(0.0391)	(0.0410)
Domestic credit / GDP	-0.1104 **	-0.1086 **	-0.0944 **	-0.0963 **
	(0.0331)	(0.0332)	(0.0323)	(0.0318)
Real per capita GDP	0.32E-5 **	0.25E-5 **	0.24E-5 **	0.18E-5
	(0.12E-5)	(0.11E-5)	(0.12E-5)	(0.12E-5)
Public pension spending / population 65+	-0.41E-5 **	-0.29E-5	-0.25E-5	-0.16E-5
	(0.20E-5)	(0.18E-5)	(0.20E-5)	(0.19E-5)
Flow of pension assets / population 19-65	0.21E-5		0.25E-5	
	(0.20E-5)		(0.21E-5)	
OECD X (Flow of pension assets / pop. 19-65)		-0.39E-6		-0.31E-6
		(0.11E-5)		(0.11E-5)
Non-OECD X (Flow of pension assets / pop. 19-65)		0.39E-4 **		0.43E-4 **
		(0.12E-4)		(0.12E-4)
Obs.	132	132	132	132
Adj. R-squared	0.94	0.94	0.94	0.94
F(fixed effects)	50.12 **	38.28 **	52.26 **	42.94 **
F(time trends)	8.39 **	7.48 **	7.59 **	6.97 **

Notes: 1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R22 and R24.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Table 5.3. **Savings and the Flow of Pension and Life Insurance Assets (relative to GDP)**

Panel estimates for 1982-93 using the private savings rate as the dependent variable

	R25	R26	R27	R28
Estimation method	OLS	OLS	IV	IV
Dependency ratio	-0.0116	0.0001	0.0768	0.0619
	(0.2102)	(0.1983)	(0.2097)	(0.1911)
Growth rate of real per capita GDP	-0.1295	-0.0403	0.2387 **	0.2236 **
	(0.1600)	(0.1455)	(0.1213)	(0.1037)
Government budget surplus / GDP	-0.4966 **	-0.5120 **	-0.4976 **	-0.5153 **
	(0.1341)	(0.1161)	(0.1364)	(0.1165)
Real interest rate	-0.0106	0.0238	0.0377	0.0624
	(0.0434)	(0.0487)	(0.0418)	(0.0485)
Domestic credit / GDP	-0.1108 **	-0.1120 **	-0.0949 **	-0.1015 **
	(0.0333)	(0.0330)	(0.0328)	(0.0318)
Real per capita GDP	0.32E-5 **	0.26E-5 **	0.25E-5 *	0.20E-5
	(0.13E-5)	(0.12E-5)	(0.13E-5)	(0.13E-5)
Public pension spending / population 65+	-0.42E-5 **	-0.34E-5 *	-0.22E-5	-0.19E-5
	(0.21E-5)	(0.19E-5)	(0.21E-5)	(0.20E-5)
Flow of pension and life insurance assets / GDP	0.0315		0.0459	
	(0.0374)		(0.0406)	
OECD X (Flow of pension and life insurance assets / GDP)		-0.0150		-0.0133
		(0.0201)		(0.0198)
Non-OECD X (Flow of pension and life ins. assets / GDP)		0.3366 **		0.3987 **
		(0.1622)		(0.1649)
Obs.	125	125	125	125
Adj. R-squared (within)	0.94	0.94	0.93	0.94
F(fixed effects)	47.31 **	38.19 **	48.87 **	41.49 **
F(time trends)	7.32 **	4.92 **	6.62 **	5.50 **

Notes:
1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R26 and R28.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Table 5.4. **Savings and the Flow of Pension and Life Insurance Assets (demographically-adj.)**

Panel estimates for 1982-93 using the private savings rate as the dependent variable

	R29	R30	R31	R32
Estimation Method	OLS	OLS	IV	IV
Dependency ratio	-0.0030	-0.1291	0.0910	-0.0663
	(0.2131)	(0.1919)	(0.2139)	(0.1863)
Growth rate of real per capita GDP	-0.1387	-0.0488	0.2385 **	0.2555 **
	(0.1619)	(0.1494)	(0.1226)	(0.1119)
Government budget surplus / GDP	-0.5016 **	-0.5378 **	-0.5046 **	-0.5433 **
	(0.1348)	(0.1017)	(0.1376)	(0.1020)
Real interest rate	-0.0129	0.0077	0.0362	0.0481
	(0.0432)	(0.0439)	(0.0415)	(0.0433)
Domestic credit / GDP	-0.1129 **	-0.1093 **	-0.0971 **	-0.0966 **
	(0.0334)	(0.0337)	(0.0330)	(0.0326)
Real per capita GDP	0.32E-5 **	0.18E-5	0.24E-5 *	0.11E-5
	(0.14E-5)	(0.12E-5)	(0.13E-5)	(0.13E-5)
Public pension spending / population 65+	-0.44E-5 **	-0.26E-5	-0.23E-5	-0.87E-6
	(0.21E-5)	(0.20E-5)	(0.21E-5)	(0.20E-5)
Flow of pension and life insurance assets / pop. 19-65	0.43E-6		0.74E-6	
	(0.11E-5)		(0.11E-5)	
OECD X (Flow of pension and life ins. assets / pop. 19-65)		-0.82E-6		-0.68E-6
		(0.67E-6)		(0.66E-6)
Non-OECD X (Flow of pension and life ins. assets / pop. 19-65)		0.42E-4 **		0.46E-4 **
		(0.12E-4)		(0.11E-4)
Obs.	132	132	132	132
Adj. R-squared	0.94	0.94	0.93	0.94
F(fixed effects)	47.11 **	36.74 **	48.50 **	41.01 **
F(time trends)	7.66 **	7.04 **	6.90 **	6.49 **

Notes:
1. Country-specific time trends and country-specific fixed effects were included in each regression.
2. The standard errors (corrected for heteroscedasticity using White's method) are in parentheses.
3. (**) and (*) indicate statistical significance at the 5 per cent and 10 per cent levels, respectively.
4. Population growth, the inflation rate and all the other exogenous explanatory variables were employed as instruments for the growth rate in regressions R30 and R32.
5. F(fixed effects) and F(time trends) are the F-statistics used to test the joint significance of the country dummies and country time trends, respectively.

Our results concerning the explanatory variables other than the funded pension wealth variables are generally consistent both with priors based on the life-cycle model and past empirical studies. The coefficients on the government savings rate and the domestic credit ratio are both negative, as expected, and statistically significant at the 5 per cent level in all the regressions. The coefficients on real per capita GDP and public pension spending per retired person are statistically significant at the 5 per cent level in many of the regressions and are also of the expected sign: positive for the former and negative for the latter. The coefficient on the growth rate of per capita GDP is positive and statistically significant at the 5 per cent or 10 per cent level in the 2SLS estimations only. Finally, the coefficients on the dependency ratio and the real interest rate are, in general, not statistically significant at conventional levels[17].

Our results suggest that the build-up of pension assets relative to the working-age population — but not relative to GDP — exerts a positive and statistically significant impact on aggregate savings rates. For example, in Table 4.2 the coefficient on the stock of demographically-adjusted pension wealth for the full sample (regression R7) is 0.0000087. Thus, a one dollar increase in the stock of pension assets per working-age individual will translate into a 0.00087 percentage point increase in the private saving rate. This implies that for the private saving ratio to increase by one percentage point, the stock of pension assets per working-age individual would have to increase by around US$1 150. Referring back to Table 1.2, we see that pension fund assets have increased by this amount or more in most of the sample countries over the 1982-93 period. If this growth continues, then this estimated coefficient would predict a substantial impact on private saving rates.

Furthermore, we find that the magnitude of the impact of pension asset accumulation (still relative to the working-age population) on savings is relatively larger in the non-OECD countries. For instance, in regression R8 in Table 4.2, the coefficient on the stock of demographically-adjusted pension wealth for the seven OECD countries is 0.0000049 whereas for the four non-OECD countries it is 0.000027. This means that for the private saving rate to increase by one percentage point, the stock of pension assets per working-age individual would need to grow by $2 040 in the OECD countries but only by $370 in the non-OECD countries.

By contrast, we do not find a statistically significant relationship between any of the pension flow variables and savings in the seven OECD countries or the eleven countries combined. We do, however, find a positive and statistically significant coefficient for the four non-OECD countries on the flow of pension assets whether they are measured relative to GDP or relative

to the working-age population. This outcome can be explained in the context of our two-period life-cycle saving analysis. Indeed, two out of the three factors that were found to be important in predicting a positive impact of funded pensions on savings were present in the four non-OECD countries over the sample period: tight borrowing constraints for most pension savers and the mandatory status of the funded pension schemes. Conversely, the seven OECD sample countries could be characterised by more developed capital markets and a higher degree of voluntarity in the decision to contribute to funded pension schemes.

VI. CONCLUDING REMARKS

Stimulating aggregate savings is an important motivation for governments who are encouraging the accumulation of funded pension assets. In OECD countries, it is the insight that population ageing requires higher savings for retirement which is largely driving such saving targets; in the slowly ageing emerging markets, such motivation stems rather from the evidence that higher domestic savings are required to finance investment and growth durably. The desire to increase aggregate savings by promoting the development of funded pensions, however, has been based on very limited empirical evidence thus far. The few aggregate-level studies on this issue have yielding mixed results and suffer from an important shortcoming in that the econometric analysis is based on too few degrees of freedom.

Based on the collection of comparable cross-country data of pension and life insurance assets for eleven countries over the 1982-93 period, this study has produced statistically significant international evidence in support of the premise that the development of funded pensions does indeed contribute to higher aggregate savings. A simple two-period life-cycle model, by introducing taxation issues, population heterogeneity, capital market imperfection and several important features of pension design, has yielded predictions that were largely found to be consistent with the subsequent empirical analysis.

This study permits the identification of some major features of pension design that are likely to be most effective in stimulating aggregate savings. Our analysis has shown that it is crucial to stimulate a positive saving impact from the low-savers group and to limit the negative income effect on savings that may be derived from higher implicit rates of return on tax-exempt funded pensions. This requires that funded pension schemes are mandatory rather than voluntary, that tax exemptions on pension returns are limited to low savers or that pension returns are taxable like the returns on other savings, and that it is discouraged to borrow against accumulated (and mandatory) pension assets. Mandatory pension schemes that effectively cover the low-savers group will not only stimulate current savings but they are also an important policy vehicle to help make retirement income levels and wealth distribution more equal between low and high savers.

NOTES

1. An earlier version of this paper was presented at the 1997 LACEA Meetings in Bogotá, Colombia. We would like to thank the LACEA seminar participants as well as our colleagues at the Development Centre — especially Sébastien Dessus, Monika Queisser and Julia von Maltzan — for helpful comments and suggestions. Any remaining errors or omissions remain ours.

2. See IMF (1995) for more details on this generalised decline in saving rates.

3. In theory, domestic investment can also be financed by external savings and hence low levels of domestic savings, *ceteris paribus*, need not necessarily lead to lower growth. In practice, however, few countries have been able to rely on substantial amounts of foreign capital to finance domestic investment over a considerable period of time [see Reisen (1996) for more details].

4. For a review of the former literature, see Magnussen (1994) and OECD (1997*a*).

5. See Gale (1995) and OECD (1997*a*) for a discussion of this literature.

6. Provident funds are defined as fully-funded and defined contribution schemes in which the funds are managed by the public sector. For more details on the provident funds established in Singapore and Malaysia, see Asher (1994).

7. Pension plan funds can also be managed in-house (i.e. managed directly by the sponsor).

8. We selected the time period that maximised the total number of observations. We were constrained to start the time period in the early 1980s because pension fund data was not available for most of our countries prior to that time. We could not extend our data set beyond 1993 because the figures on public pension spending for the OECD countries for 1994 were not yet available.

9. Pension assets relative to the working age population are expressed in a common currency, the US dollar. This means that some of the annual variation in these figures for all the sample countries except the United States will be the result of exchange rate fluctuations. Future research will address this problem by transforming the figures into a purchasing-power-parity-adjusted index.

10. Indeed, the EPF manages the majority of pension assets in Malaysia.

11. Although when the CPF was first established in 1955 its sole purpose was to provide lump sum retirement benefits, its scope has since broadened to include the financing of health care and government-built housing. See Asher (1996) for more details.

12. A mature pension scheme is one that has reached a long-term equilibrium ratio of workers to pensioners.

13. Closely related, the age composition of the population — in particular the ratio of prime savers (those in the 40-65 age group) to the retired population — will also help to determine the relative size of funded pensions across countries as well as through time.

14. Our analysis draws on the exposition of the two-period life-cycle model in Stiglitz (1993).

15. For recent examples, see Edwards (1995) and Masson, Bayoumi and Samiei (1995).

16. Although Korea is now (December 1997) a Member of the OECD, it was not a Member during the sample period.

17. We also tried replacing the dependency ratio with the prime savers ratio (i.e. the ratio of those 40 to 65 over those over 65) but this did not improve the results.

APPENDIX I. COUNTRY LISTS

Full Sample:
(11 countries)

Canada
Chile
Finland
Germany
Korea
Malaysia
Netherlands
Norway
Singapore
United Kingdom
United States

OECD Sample:
(7 countries)

Canada
Finland
Germany
Netherlands
Norway
United Kingdom
United States

Non-OECD Sample:
(4 countries)

Chile
Korea
Malaysia
Singapore

APPENDIX II. SOURCES AND DEFINITIONS OF VARIABLES

Dependent Variable:

1. *Private savings / GDP*
   [Calculated by adding investment (IFS line 93) to the current account (IFS line 78ald) and subtracting the budget surplus of the consolidated central government[1] (IFS line 80) and then dividing by GDP (line 99)]

Explanatory Variables:

2. *Dependency ratio* — ratio of the dependent population (persons under 19 and over 65) to the working-age population (persons between 19 and 65) [calculated using the U.N.'s *Population Statistics Data File*]
3. *Growth rate of real per capita GDP*
   [Calculated as the log difference of annual real per capita GDP using real GDP and population figures from IFS line 99]
4. *Government budget surplus / GDP* — the budget surplus of the consolidated central government as a proportion of GDP [IFS lines 80 and 99]
5. *Real interest rate* — Short-term interest rate less the CPI inflation rate [IFS lines 60 and 64]
6. *Domestic credit / GDP* — Domestic credit claims on the private sector as a proportion of GDP [IFS lines 32d and 99]
7. *Real per capita GDP* — Real GDP per capita (measured in US$) [Calculated using real GDP and population figures from IFS line 99 and exchange rates from IFS line rf]
8. *Public pension spending / population 65+* — Government spending on public PAYG pension schemes (measured in US$) as a proportion of population over 65
   [The public pension figures are from: *i)* OECD (1996) — for all OECD countries; *ii)* Espinoza and Marcel (1997) — for Chile; *iii)* Asher (1997) — for Malaysia; *iv)* Department of Statistics, Singapore (various years) — for Singapore; and the GDP figures are from IFS line 99]

9. *Pension fund and life insurance assets / GDP (Stocks and flows)*
[The pension fund and life insurance assets are from: *i)* OECD (1997*b*) — for all OECD countries; *ii)* Superintendencia de Administradores de Fondos de Pensiones (1996) and Ministerio de Hacienda — for Chilean pension fund and life insurance assets, respectively ; *iii)* Bank Negara Malaysia (various years) — for Malaysia; *iv)* Department of Statistics, Singapore (various years) — for Singapore; and the GDP figures are from IFS line 99]

10. Pension Fund Assets and life insurance assets / population 19-65 (Stocks and flows)
[See above for the sources of the pension and life insurance assets; the population figures were calculated using the U.N.'s *Population Statistics Data File*]

Instruments:

11. *Inflation rate* - CPI inflation rate
[IFS line 64]

12. Population growth rate
[Calculated as the log difference using population figures from IFS line 99]

Note: 1. The IFS defines the budget surplus of the consolidated central government as the difference between revenues and grants received on the one hand and expenditures and net lending on the other. Expenditures include spending for both current and capital purposes.

APPENDIX III. DESCRIPTIVE STATISTICS

Panel data for 11 countries over 1982-93

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Private savings / GDP	0.2537	0.074	0.0433	0.4223	132
National savings / GDP	0.2339	0.0854	0.0137	0.469	132
Dependency ratio	0.7348	0.1475	0.5376	1.1627	132
Growth rate of real per capita GDP	0.0113	0.0172	-0.0732	0.0449	132
Government budget surplus / GDP	-0.0198	0.0455	-0.1785	0.1553	132
Real interest rate	0.0488	0.0382	-0.0107	0.3874	132
Domestic credit / GDP	0.6846	0.186	0.3524	1.1708	132
Per capita GDP	13934	7776	2024	28845	132
Public pension spending / population 65+	7591	6210	97	22246	132
Pension fund assets / GDP	0.3222	0.2419	0.0216	0.879	132
Pension fund assets / population 19-65	6759	6890	79	28776	132
Pension and life insurance assets / GDP	0.502	0.3161	0.0507	1.4586	125
Pension and life insurance assets / population 19-65	11237	10384	217	42997	125
Flow of pension assets / GDP	0.0411	0.0367	-0.068	0.1556	132
Flow of pension assets / population 19-65	725	818	-1976	4331	132
Flow of pension and life insurance assets / GDP	0.0646	0.05	-0.0942	0.3238	125
Flow of pension and life ins. assets / pop. 19-65	1244	1351	-2739	9012	125
Inflation rate	0.0545	0.0535	-0.0139	0.307	132
Population growth rate	0.0051	0.0093	-0.0107	0.1021	132

Note: See Appendix I for a list of the 11 countries in the full sample and see Appendix II for the sources and definitions of the variables.

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