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Globalization, Social Security, and Intergenerational Transfers

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Contents

Abstract

In this paper, we quantify the impact of globalization (i.e., integration of global capital markets) on intergenerational transfers mediated through Pay As You Go (PAYG) public pension systems in more developed countries (MDCs), as well as impacts on the intergenerational distribution of income and wealth. Our basic finding is that, while globalization is likely to erode the pension income of older persons, it will enhance their wealth, leaving their overall spending power little changed. The working age population, which earns lower wages, is an unambiguous loser from the globalization process, at least to the extent that we limit ourselves to a neoclassical analysis of the phenomenon.

The main impact of globalization is unlikely, however, to be captured by economy-wide averages such as those presented in this paper. This is the redistribution from lifetime non-savers, especially the poor, who depend on labor income while young and wage-based intergenerational transfers when old, to lifetime savers, who are able to take advantage of improved capital returns.

While we concentrate on MDCs in this paper, we make the point that economic impacts of globalization in less developed countries (LDCs) are opposite in sign and greater in relative magnitude. The latter is the case because reallocation of capital gives rise to a greater proportional change in the capital-output ratio in LDCs than in MDCs.

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Globalization, Social Security, and Intergenerational Transfers

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1. Globalization

Globalization has many dimensions, but we concern ourselves here with the increasing integration of global capital markets, and specifically, large financial flows from more developed countries (MDCs) to less developed countries (LDCS). This is driven by a number of fundamental factors, among them the nature of technical change, macroeconomic convergence, and the emergence of advanced information-technology intensive methods of financial and corporate management. A number of economic models also predict that capital should flow from rapidly aging countries to slowly aging countries, where faster labor force growth and the lower capital-output ratio should enable it to earn a higher rate of return (MacKellar and Reisen 1998a and b).[1]

The distributional impacts of globalization are much discussed, but the generational dimension seems to have escaped attention. In this paper, we employ a two-region, two-factor neoclassical economic-demographic growth model to highlight the simpler aspects of this dimension, concentrating on intergenerational transfers.

[1] In a closed economy, the neoclassical response to slowing labor force growth is to substitute capital for labor, leading to an increase in the capital-output ratio and a corresponding reduction in the rate of return to capital. *Pari passu*, the rate of return to saving declines, leading households to consume rather than save, so the economy's reduced demand for investment expenditure is matched by a reduced supply of savings. In long-run equilibrium, the result of population aging (independent of changes in the rate of growth of total population) is reduced per capita output and consumption. In an open economy, the situation is complicated, because households have the option of purchasing assets installed abroad, where the rate of return to capital may be higher. A number of studies (Cutler et al., 1990; Masson and Tryon, 1990; Yoo, 1994; Börsch-Supan, 1996; Higgins, 1997; OECD 1998) have concluded that global demographic divergences should stimulate capital flows from the most rapidly aging regions (especially Europe and Japan) to less rapidly aging regions (especially North America and the less developed countries), where the capital-output ratio is lower and the rate of return to capital is higher. With a significant proportion of MDC savings being invested in emerging markets, capital returns and saving rates, as well as per capita output and consumption, would be higher in the OECD *vis à vis* the autarchy case. However, simulations with the OECD Minilink model led the authors to caution that any benefits from investment abroad are likely to be small (OECD, 1998, p. 28). MacKellar and Reisen (1998a and b) came to the same conclusion.

2. Globalization, social security, and intergenerational transfers: theory

Globalization may have three types of effect on intergenerational transfers:

- Globalization may have an impact on formal social security transfer programs. An example of such a impact is the reduction in public Pay As You Go (PAYG) pension system transfers from workers to pensioners which would occur if such programs were cut as a result of the international competitive pressures associated with globalization.
- Globalization may have an impact on informal transfers, such as cash- or in-kind intrafamily transfers (i.e., current transfers) and bequests / inheritance (i.e., intergenerational capital transfers). For example, if globalization leads to reductions in formal transfers from young to old as described above, there might be a compensating increase in informal transfers from young to old. Alternatively, if public pension benefits are reduced, old persons might consume a greater portion of their wealth, resulting in a decline in bequests.
- Globalization may also effect implicit transfers of income and assets between young and old (i.e., shift the distribution of income and wealth). An example of such an implicit impact would be the transfer from workers to pensioners that would result if globalization drove down wages while welfare-state transfers to the elderly were maintained.

In this paper, we consider all three types of impacts. However, the first two sets of impacts are likely to be heavily conditioned by what is happening to the age-distribution of income and wealth. Ignoring dynamic efficiency gains in order to concentrate on the simple neoclassical analysis of the problem, the impact of increased capital mobility on the intergenerational distribution of income and wealth is theoretically ambiguous. In OECD countries, elderly persons' income depends on past earnings, which determine savings, the rate of return earned by these savings (both as they are accumulated and when they are annuitized), and *inter vivos* transfers mediated for the most part through public PAYG pension systems. Greater investment of MDC savings in the emerging markets of less developed countries (LDCs), the main aspect of globalization, should reduce the capital-labor ratio in the MDCs, thus reducing the wages of MDC workers

The lower wage bill in the MDCs will reduce PAYG pension system receipts. The impact on workers and pensioners will depend on policy makers' choice between higher payroll taxes, higher fiscal deficits, and lower pension benefits. *Prima facie*, the competitive pressures associated with globalization argue in favor of the third, implying an enhanced role for private saving.

Possible impacts on other cash and in-kind transfers between parents and children are much more speculative. Some of these impacts depend on the extent to which public expenditures substitute for private ones. For example, if there is considerable crowding-out, public pension (and health-care system) transfers would largely be replaced by intrafamily ones, both cash and in-kind, with little resulting impact on total intergenerational transfers. Other possible impacts are dependent on the

labor market. For example, globalization combined with rigid labor markets might lengthen the period of youth dependency by increasing the youth unemployment rate and encouraging delayed labor force entry.[2]

Lower wages will tend to reduce MDC workers' savings. However, those savings that are invested domestically will earn a higher rate of return and those savings that are invested in the LDCs will reap a premium to the extent that an interregional gap persists in the risk-adjusted rate of return. Because savings and the rate of return move in opposite directions as a result of globalization, the net impact on asset accumulation is theoretically ambiguous. Even more uncertain is the impact on the intergenerational transfer of wealth via bequests. Greater asset accumulation might translate into higher consumption in old age or higher bequests.

A similar story in reverse should apply in more slowly aging LDCs, the main difference being that intrafamily transfers play a larger role than the public pension and health systems, whose coverage is limited to elites in most countries (World Bank 1994, James 1998). Higher wages made possible by the increased capital-output ratio will permit greater saving, but lower rates of return to capital will retard accumulation (as well as reduce savings out of entrepreneurial income, a major source of capital in developing countries). Higher elderly labor force participation rates in developing countries should also accentuate the importance of wage income for the elderly population.

3. The IIASA model: general description[3]

The IIASA model (MacKellar and Ermolieva 1999, Westlund et al. 1999), based on work originally presented by Blanchet and Kessler (1992), is a neoclassical two-factor multiregional economic-demographic model with a particular focus on social security.[4] Its structure may be viewed on the World Wide Web at http//:www.iiasa.ac.at/~ermol. The model incorporates population projections, saving, labor force participation, and tax rates. Output in each region is represented as a function of capital and labor using a Cobb-Douglas production function. The wage rate and rate of return to capital are endogenously calculated as marginal products of labor and capital. Age-specific wages, calculated using a model earnings profile, are scaled up and down as a function of changes in the average wage rate.

The emphasis of the model is on tracking income and outlay of households by single-year age groups, as well as intergenerational transfers of resources via bequests. Households accumulate assets during working years and then "dissave" in retirement (i.e., sell assets to those in the accumulation phase and convert the proceeds into consumption), in addition to which, intergenerational transfers between the working and retired populations are mediated through the PAYG public pension system. While the

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[2] In this case, the implicit and explicit impacts might be in opposite direction. A lengthened period of youth dependency would increase explicit transfers to young persons, while weak labor market conditions for young persons would represent an implicit transfer from the young to the old.

[3] This section is based on MacKellar and Reisen (1998a and b).

[4] The application presented here is a two-region application, but the model is modularized and coded in such a way that disaggregation to cover more regions is not problem. The limitations of a two-region approach are not insignificant -- an old saying among modelers is that a 3-region world is closer to an n-region world than a 2-region world is to a 3-region one.

model is suited to a wide range of applications dealing with long-run economic growth, it is especially designed to simulate the effects of differing demographic and labor force scenarios, different mixes between accumulation-based and transfer-based pension systems, and different decisions regarding the geographic allocation of investment.

The IIASA model is essentially an accounting model based on the OECD National Accounts, which are based, in turn on the UN System of National Accounts (SNA). Age-specific saving and labor force participation rates are exogenous. In concentrating on age-composition effects while leaving aside changes in saving behavior, our work complements other analyses (e.g., Cutler *et al.*, 1990; Börsch-Supan, 1996), where the impact of population aging is mediated through the life-cycle hypothesis of household consumption. Closely related to these analyses are linked international macroeconomic model-based analyses (e.g., Masson and Tryon, 1990; OECD, 1998), in which the impact of aging is mediated through the major macroeconomic functions, particularly the aggregate consumption/saving function. Given theoretical ambiguities, a simple accounting model with abundant demographic detail provides a useful benchmark for work with more economically sophisticated, but demographically sparse, models.[5]

Savings are allocated to investment projects at home and abroad by means of exogenous capital-flow coefficients, and investment in each region is equal to domestic plus foreign savings. A rise in foreign savings is assumed to be mirrored by a corresponding rise in domestic capital formation: the possibility that additional foreign savings might merely inflate asset prices or fuel consumption is not allowed for and the current account is assumed to adjust passively to changes in capital inflows.[6] The exchange rate plays no explicit role, and all economic variables are expressed in 1995 US dollars.

The model tracks receipts and disbursements, and thus net savings, by institutional sector (persons by single-year age group, firms, and government). Net savings in each sector of the economy are defined, following the convention of the OECD national income accounts, as gross receipts minus depreciation minus current expenditure. The sum of net savings across sectors is equal to net saving for the economy as a whole (national disposable income minus private consumption minus government consumption), which is in turn equal to net capital formation, i.e. change in the capital stock. Savings of firms and government are imputed to households based on the population age distribution; thus, when government runs a deficit, the impact is lower capital formation.[7] Capital consists of residential capital (*KRes*), capital operated by private unincorporated enterprises (*KPvtUnincorpEnt*), and capital operated by firms

[5] It is worth summarizing the impact of age structure on per capita income for a given population size. This consists of three impacts: first, through the labor force as it affects the number of workers relative to non-workers; second, through capital formation, as it affects the number of savers relative to dissavers; and third (also through capital formation) as it affects the wage rate and rate of return to capital, which in turn determine the income streams out of which savings are drawn.

[6] However, to the extent that foreign capital inflows depress the rate of return to capital and thus the rate of profit on existing capital, the model incorporates a second-round offset in the form of lower domestic savings out of profits. This is in line with empirical evidence suggesting that only about one-half of a given increment to foreign savings is translated into added investment.

[7] Another way of putting it is that there is no explicit market in government debt. There is only one asset class, physical capital, which may be installed at home or abroad.

(i.e., corporate enterprises). Publicly-owned capital, such as infrastructure, is implicitly included in the latter category. Residential capital and capital operated by private unincorporated enterprises are installed exclusively in the home region; capital operated by firms is installed both at home and abroad. Claims on capital operated by firms are held on behalf of households by two financial intermediaries: the private pension system (*PvtPenSys*) and other financial institutions (*OthFinIns*). All claims consist of equity. Imputed rents (in the case of residential capital) and the profits of capital operated by private unincorporated enterprises accrue directly to households. Firms earn profits, pay taxes and distribute dividends to holders of claims. Direct taxation follows the principle of taxation at the source, meaning that capital returns are taxed only once, when and where they are earned.[8]

The *PvtPenSys* represents fully-funded, defined-contribution pension plans; the model does not specify a private PAYG, defined-benefit component. The rationale for not including a private PAYG component is twofold. First, the role of private PAYG pension funds is shrinking rapidly, as few new workers are being offered such arrangements. Second, the obligations of this component of the pension system are essentially underwritten by public authorities (e.g., the Pension Benefits Guarantee Corporation in the US), as a result of which, the distinction between the private and public PAYG systems is blurred. Implicitly, the private PAYG pension system is subsumed under the public PAYG pension system in our model.

OthFinIns are a residual sector in our model, covering banks, insurance companies, mutual funds, and other financial intermediaries apart from pension funds. Implicitly, *OthFinIns* also include individual households, to the extent that the latter hold financial claims directly.

The distinction between portfolio investment and foreign direct investment (FDI) is a significant one in long-run model simulations.[9] Investors who purchase shares of a domestic-based multinational firm are effectively acquiring an international asset to the extent that the firm operates globally. FDI, consisting mainly of the acquisition of fully-owned foreign subsidiaries by multinational firms, is one of the principal corporate globalization strategies. Thus, in the IIASA model, we recognize that firms earn profits both at home and abroad. In the two-region case, domestic firms are credited with profits earned on that portion of the domestic region's capital stock that is owned by foreign portfolio investors, and are debited with taxes and dividends paid out of these profits (to the government of the domestic region in the first case, to the *PvtPenSys* and *OthFinIns* of the foreign region, in the second case). However, profits on that portion of the domestic region's capital stock that represent FDI from abroad are credited to foreign firms. Taxes paid out of these profits are debited to firms in the foreign region and credited to the government of the domestic region. Firms in the foreign region reinvest a given share of these profits in the domestic region; the remainder they repatriate to the foreign region, where dividends are paid out to claimants.

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[8] Thus, households pay no taxes on dividends received, taxes have already been paid by firms when profits were earned. Elderly persons are also assumed to pay no capital gains tax when they divest themselves of accumulated assets.

[9] FDI is defined as the acquisition of 20% or more of the outstanding equity in a foreign corporation. Acquisition of less than 20% of the outstanding equity of a foreign firm is defined as portfolio investment.

Who are these claimants? Historically, *PvtPenSys* portfolio managers have engaged almost exclusively in portfolio investment. Almost all FDI has originated in firms, largely in the form of the acquisition of fully owned foreign subsidiaries. Since firms in our model only operate, but do not own, capital, we make the simplifying assumption that FDI is undertaken by corporate holding companies who are implicitly subsumed under *OthFinIns*, and the share of *OthFinIns* foreign assets consisting of FDI is an exogenous variable. Dividends paid out of repatriated profits on FDI from abroad are credited to *OthFinIns* in the foreign region. Symmetrically, profits on FDI from the domestic region in the foreign region are credited to firms in the domestic region, and dividends paid out of repatriated earnings are credited to *OthFinIns* in the domestic region.

The IIASA model tracks the downward pressure on household saving and capital accumulation that is expected as the baby boomers begin to retire (Schieber and Shoven, 1994). During working life, households accumulate savings through contributions to the *PvtPenSys*; after retirement, they receive pension benefits representing the drawing-down of this capital. Savings not captured by the pension system are distributed between the three remaining asset classes (*KRes*, *KPvtUnincorpEnt* and *KOthFinIns*) by means of share coefficients which sum to unity. These assets, too, are drawn down after retirement. Any assets remaining upon death are distributed to the surviving population as bequests. Persons receiving bequests in the form of inheritance are assumed to convert the inherited assets to cash, some of which is allocated to consumption, the remainder being allocated among the three non-pension forms of wealth. We describe the age-dynamics of capital accumulation in Annex 1.

Public pension income per capita for the population aged 60+ is scaled to the current wage rate at age 40.[10] The social security contribution rate required to meet total pension entitlements is then calculated and levied against wage income and income from private unincorporated enterprises. Pressures on the social security system are thus reflected in rising payroll tax rates. The other two possibilities, i.e. declining levels of benefit per member of the eligible population or higher government budget deficits, can be incorporated by means of minor modifications of model structure.

4. Simulation design

Model parameterization and scenario assumptions are presented in Annex 2. The simulation period is effectively from 1995 to 2050; however, we solved the model out to 2100. Most of the discussion will concentrate on the OECD.

The key to the simulation is changes in exogenous capital flow (i.e., investment allocation) coefficients, more specifically, changes in assumptions on the share of MDC annual asset acquisition that consists of capital installed in LDCs. The baseline scenario, which we label Autarchy, essentially holds current capital-flow share

[10] A full specification, not incorporated in this simulation, is as follows (MacKellar and Ermolieva 1999). Upon retirement, a public pension entitlement is calculated on the basis of past years of labor force participation and average wage earnings. During retirement, this entitlement is indexed to growth in average real wages using an assumed indexation factor. Thus, social security benefits for members of a given single-year age cohort are a weighted average over number of retirees, number of years of labor force participation (and average earnings) prior to retirement, number of years elapsed since retirement, the indexation factor, and growth in real wages since retirement.

coefficients constant. The alternative scenario, which we label Globalization, allows capital-flow share coefficients to rise in line with the growing share of LDCs in global stock market capitalization and GDP. The resulting global allocation of capital, which results from the combination of exogenous flow assumptions and the endogenous behavior of GDP growth rates, rates of return, etc., is shown in Table 1.

In simulating something as complicated as globalization, even having limited the analysis to impacts of changes in the global allocation of capital, many aspects must be held constant. In this analysis, there are no changes (on a baseline versus alternative basis) in labor force participation rates, saving / consumption rates, rates of productivity growth, and tax rates. As a result of such simplifications, it is probably safe to assume that the simulation results overstate impacts on the real economy. Government is assumed to target a constant pension replacement rate (pension income per capita over 60 relative to average wage) of 40 percent. While restrictive, this assumption is fairly reasonable in terms of political economy.

5. Results

The broad macroeconomic results, shown in Table 2, are consistent with the story which has been told by, among others, the OECD Economics Department (OECD 1998). Globalization reduces MDC GDP as a result of less capital installed at home while raising GNP slightly in the long run as a result of higher factor earnings from abroad. GDP in the LDCs is increased by the greater abundance of capital, as is GNP, the argument for the latter being that the increment to domestic factor incomes is greater than the increment to foreign (i.e., MDC) factor incomes. World GDP (not shown in Table 2) is increased in line with the global efficiency gain that results from reallocating capital to the region where its marginal product is highest. Globalization slightly raises the rate of return to capital in the MDCs, while substantially reducing it in the LDCs; this is due to the fact that capital is initially abundant in the first region and scarce in the second. The average wage, taken here simply as the age-specific wage at age 40, declines significantly in the MDCs and increases even more significantly (because of the greater relative impact on the capital-output ratio) in the LDCs..

The impacts of the globalization scenario on MDC saving rates are not strong enough to be suggestive (see Table 3). In the case of household saving rates, changes (on a baseline versus alternative basis) reflect changes in income and wealth, but not possible changes in age-specific saving rates. One might expect corporate savings to be a bit higher under the Globalization scenario than in the Autarchy scenario as a result of savings out of earnings on foreign direct investment, but this is not visible in Table 3. Government savings are subject to mixed influences. Indirect tax revenues are reduced by lower GDP, direct taxes out of wages are lower, and direct taxes out of profits are higher. On whole, the tax base (corresponding to GNP) is higher. The public PAYG social security system is by definition balanced in this simulation. The changes in public savings we see here certainly are not strong enough to support a view that globalization effects a large implicit intergenerational transfer mediated through the public sector deficit.

Tables 4 and 5 show impacts on the disposable incomes *per capita* of the 15-59 and 60+ populations, respectively. Globalization reduces wage earnings in the MDCs (on a baseline versus alternative basis) while increasing earnings related to capital; i.e., profits of private unincorporated enterprises and imputed housing services as well as

dividends accruing to *KPvtPenSys* and *KOthFinIns*. Since disposable income of the working age-population consists primarily of wages, the net effect is to reduce disposable income of the working-age population in the MDCs (and increase it, more substantially, in the LDCs). The total effect, while significant, is modest, roughly 2 per cent in the MDCs by the year 2030-50. In the case of adjusted disposable income, which includes changes in pension wealth, the impact is slightly attenuated by the fact that pension wealth is higher under the Globalization scenario.

In the MDCs, the largest component of the disposable income of persons over 60 (Table 5) is public pension benefits. Subject to our simplifying assumption of a fixed replacement ratio, the public pension income of the elderly would be lower in the alternative than in the baseline scenario by about 0.7 per cent in 2010, 2.6 percent in 2030 and 4.2 per cent in 2050. Looked at differently, the implied absolute reduction in annual public pension income is $71 in 2010, $394 in 2030 and $896 in 2050. The impacts on the social security contribution rate required to maintain system balance are not significant, but this again reflects our simplifying assumption: pensions and wages go down in lockstep, so the contribution rate necessary to maintain system balance is unaffected.

Impacts on income of the elderly in LDCs, like impacts on GNP and other macroeconomic variables, are greater than in the MDCs. Higher wages will benefit those elderly who continue to work and encourage intrafamily transfers from children to non-working parents (the latter effect is not incorporated in this simulation). The picture is complicated, however, by the possibility of a number of structural changes: declines in elderly labor force participation, changes in household living arrangements, development of social security and pension arrangements, changes in home-care of the elderly, etc.

When impacts of globalization on wage income, pension income, and returns to capital are taken together, disposable income of the elderly in the MDCs is very slightly reduced *vis à vis* the baseline, according to the results in Table 5. But resources available to the elderly for consumption consist in significant part of the proceeds of asset sales. While wages during the working life are reduced, resulting in lower pensions, the rate of return on capital is enhanced, resulting in greater accumulation of assets.

Table 6 shows "dissaving" (i.e., proceeds from the transfer of accumulated capital *via* asset sales), which in the alternative scenario is increased (relative to the baseline scenario) by 0.25 per cent in 2010, 1.7 percent in 2030, and 3.8 per cent in 2050.[11] In absolute difference terms, the corresponding figures are $19 in 2010, $175 in 2030 and $549 in 2050.

When changes in wealth are balanced against changes in public pensions, reallocation of capital in this simulation does not very significantly affect the average income of the elderly in the MDCs. They receive lower intergenerational transfer payments mediated through the PAYG social system, but earn an enhanced rate of return on their assets. Higher assets in old age could potentially translate into greater intergenerational transfer of wealth through bequests; in our simulation, however, the elderly are assumed simply to convert their higher net worth into consumption.

[11] The term "dissaving" is not quite correct, because only 90% of the proceeds of asset sales are assumed to be converted into consumption, with the remainder being reallocated into other asset classes.

To encapsulate the results above, comparing the alternative Globalization scenario with the baseline Autarchy scenario, and concentrating on the year 2030,

- MDC GDP is reduced 2.5 percent while GNP is increased by 0.25 percent..
- The rate of return to capital in the MDCs is 40 basis points higher.
- Saving rate impacts are marginal and ambiguous.
- Assuming the replacement rate in the public pension system is the same in the two scenarios, public pension income of the elderly is reduced by $400, or a little more than 2.5 percent.
- The adjusted disposable income per capita of the population aged 15-59 is 1.7 percent lower, and that of the elderly population is 0.6 percent lower (because wages, which comprise the bulk of the former, are more strongly affected than pensions, which comprise the bulk of the latter).
- Countervailing downward pressure on public pensions in the MDCs will be greater accumulation of assets which can be converted into consumption in old age. When "dissaving" of assets is added to disposable income, te total resources available for financing consumption of the population aged over 60 is virtually the same in the two scenarios.
- Each of the impacts above occurs in reverse in LDCs. In every case, the impact is stronger because the change in the capital-output ratio caused by globalization is greater.

In closing, we wish to make an important qualification to these results. Averages, such as these, can be misleading. In the MDCs, public pensions and intrafamily transfers comprise virtually the only source of income for the poor, and those who benefit from the enhanced rate of return to assets are under current institutional arrangements the well to do. Globalization rewards lifetime savers in the MDCs while punishing lifetime non-savers whose resources for consumption in old-age income depend are derived from wage-income based transfers.

6. Concluding comments

The results presented here suggest that the consequences of globalization for social security and intergenerational transfers in the MDCs are significant, but modest on average. However, the poor and near poor, who depend on labor income while working and public pensions when retired, will feel the most negative consequences. The well to do, who derive income from capital and can benefit from modern techniques of portfolio allocation, will reap the greatest benefits. Further research should quantify impacts by social group. While we have concentrated on the MDCs countries, our results suggest that impacts of globalization in LDCs are likely to be relatively greater.

References

Blanchet, D. and D. Kessler (1992), Pension Systems in Transition Economies: Perspectives and Choices Ahead, in P. Pestieau (ed.), *Public Finance in a World of Transition*, Supplement to Public Finances/Finances Publiques, Vol. 47.

Börsch-Supan, A. (1996), The Impact of Population Aging on Savings, Investment and Growth in the OECD Area, in OECD (ed.), *Future Global Capital Shortages: Real Threat or Pure Fiction?*, OECD, Paris.

Cutler, D., J. Poterba, L. Sheiner and L. Summers (1990), "An Aging Society: Opportunity or Challenge?", *Brookings Papers on Economic Activity*, 1990:1.

Higgins, M. (1997). "Demography, National Savings, and International Capital Flows," Federal Reserve Bank of New York, *Staff Reports*, No. 76.

James, E. (1998), New models for old-age security: experiments, evidence, and unanswered questions, *World Bank Research Observer* 13(2):271-301.

Larrain, G., Reisen, H. and J. von Malzen (1997). "Emerging Market Risk and Sovereign Credit Ratings," OECD Development Centre, *Technical Paper*, No. 126, OECD, Paris.

Mac Kellar, L. and T. Ermolieva (1999). The IIASA Social Security Reform Project Multiregional Economic-Demographic Growth Model: Policy Background and Algebraic Structure, IIASA Interim Report, IR-99-007/February.

MacKellar, L. and H. Reisen (1998a), A simulated model of global pension investment, OECD Development Centre, Technical Paper No. 137.

MacKellar, L. and H. Reisen (1998b), International diversification of pension assets is no panacea for population aging, IIASA Interim Report, IR-98-34/June.

Masson, P. and R. Tryon (1990), Macroeconomic effects of projected population aging in industrial countries. *IMF Staff Papers* 37(3): 453-85.

OECD (1998), *Maintaining prosperity in an ageing society*, OECD, Paris.

Schieber, S. and J. Shoven (1994), The Consequences of Population Aging on Private Pension Fund Saving and Asset Markets, *NBER Working Paper*, No. 4665.

Taylor, M. (1997). "International Capital Mobility in History: The Saving-Investment Relationship," *NBER Working Paper*, No. 5743.

A. Westlund, T. Ermolieva, L. MacKellar (1999), Analysis and Forecasting of Social Security: A Study of Robustness, IIASA Interim Report, IR-99-004/February.

World Bank (1994), Averting the old age crisis, World Bank, Washington, D.C.

World Bank (1997), *Private Capital Flows to Developing Countries: The Road to Financial Integration*, World Bank, Washington, D.C.

Yoo, P. (1994), "Boom or Bust? The Economic Effects of the Baby Boom", *Federal Reserve Bank of St. Louis Quarterly*, September/October 1994.

Tables

TABLE 1: Global Capital Flows

	1995	2010	2020	2030	2040	2050	2100
Net capital flows, MDCs to LDCs (bill. 1995 $)							
Private pension system							
Autarchy	16.08	238.23	230.35	233.65	215.98	171.97	-342.10
Globalization	16.08	568.57	841.70	1108.18	1310.38	1386.40	471.22
Difference (per cent)	0.00	138.67	265.40	374.29	506.71	706.20	-237.74
Other Institutions							
Autarchy	114.46	180.12	330.52	353.27	373.22	375.89	108.28
Globalization	114.46	445.07	670.12	900.46	1154.56	1352.91	1618.48
Difference (per cent)	0.00	147.10	102.75	154.89	209.35	259.93	1394.73
Total							
Autarchy	130.54	418.35	560.87	586.92	589.20	547.85	-233.82
Globalization	130.54	1013.64	1511.82	2008.64	2464.94	2739.31	2089.70
Difference (per cent)	0.00	142.30	169.55	242.23	318.35	400.01	-993.72
Net capital flows, MDCs to LDCs (per cent of MDC GDP)							
Private pension system							
Autarchy	0.05	0.53	0.43	0.38	0.31	0.22	-0.26
Globalization	0.05	1.27	1.61	1.87	1.98	1.89	0.37
Difference (per cent)	0.00	0.74	1.17	1.49	1.66	1.67	0.63
Other Institutions							
Autarchy	0.36	0.40	0.62	0.58	0.54	0.49	0.08
Globalization	0.36	0.99	1.28	1.52	1.74	1.85	1.28
Difference (per cent)	0.00	0.59	0.66	0.94	1.20	1.35	1.19
Total							
Autarchy	0.40	0.93	1.05	0.96	0.86	0.72	-0.18
Globalization	0.40	2.26	2.89	3.39	3.72	3.74	1.65
Difference	0.00	1.34	1.83	2.42	2.86	3.02	1.82
Net foreign assets: (per cent of GDP)							
MDCs							
Autarchy	2.73	11.70	18.08	23.15	25.72	25.91	9.75
Globalization	2.73	19.21	38.27	58.10	75.84	89.35	80.97
Difference	0.00	7.51	20.19	34.95	50.11	63.44	71.21
LDCs							
Autarchy	-13.21	-41.67	-48.52	-46.87	-39.83	-31.12	-5.09
Globalization	-13.21	-65.71	-95.06	-106.38	-104.83	-95.43	-39.54
Difference	0.00	-24.04	-46.54	-59.51	-64.99	-64.31	-34.45

cont'd

TABLE 1(cont'd): Global Capital Flows

	1995	2010	2020	2030	2040	2050	2100
Foreign portfolio share (foreign assets as per cent of total assets)							
MDCs							
Private pension system							
Autarchy	0.89	6.60	8.60	9.67	10.32	10.70	11.00
Globalization	0.89	11.36	18.80	25.60	32.38	39.08	60.17
Difference	0.00	4.76	10.20	15.93	22.07	28.38	49.17
Other Institutions							
Autarchy	3.49	8.22	11.32	14.25	16.11	17.26	18.41
Globalization	3.49	12.04	19.72	27.23	34.25	41.27	66.99
Difference	0.00	3.82	8.40	12.98	18.14	24.01	48.59
LDCs							
Private pension system							
Autarchy	0.32	3.12	6.36	8.04	8.81	9.13	9.25
Globalization	0.32	3.52	6.73	10.54	14.78	19.30	35.86
Difference	0.00	0.40	0.37	2.49	5.97	10.17	26.61
Other Institutions							
Autarchy	3.43	6.59	9.02	10.16	10.58	10.69	10.72
Globalization	3.43	6.59	9.15	10.54	11.17	11.38	11.20
Difference	0.00	0.00	0.14	0.39	0.60	0.69	0.49
Share in global market capitalization							
MDCs							
Autarchy	0.86	0.81	0.77	0.73	0.69	0.65	0.47
Globalization	0.86	0.77	0.70	0.62	0.55	0.49	0.37
Difference	0.00	-0.04	-0.08	-0.11	-0.14	-0.16	-0.10
LDCs							
Autarchy	0.14	0.19	0.23	0.27	0.31	0.35	0.53
Globalization	0.14	0.23	0.30	0.38	0.45	0.51	0.63
Difference	0.00	0.04	0.08	0.11	0.14	0.16	0.10

TABLE 2: Macroeconomic Aggregates

	1995	2010	2020	2030	2040	2050	2100
GDP (1995 $ per capita)							
MDCs							
Autarchy	26292.11	35035.07	40603.80	46027.25	52110.49	59222.92	109963.26
Globalization	26292.11	34795.16	39936.86	44824.42	50280.47	56735.58	106318.96
Difference (per cent)	0.00	-0.68	-1.64	-2.61	-3.51	-4.20	-3.31
LDCs							
Autarchy	1569.14	2329.55	3166.30	4268.46	5746.84	7668.24	27943.83
Globalization	1569.14	2408.81	3364.81	4595.85	6211.40	8262.16	28864.99
Difference (per cent)	0.00	3.40	6.27	7.67	8.08	7.75	3.30
GNP (1995 $ per capita)							
MDCs							
Autarchy	26375.18	35497.90	41433.16	47251.94	53702.24	61132.33	112373.74
Globalization	26375.18	35500.17	41459.93	47375.89	54065.84	61953.32	119086.27
Difference (per cent)	0.00	0.01	0.06	0.26	0.68	1.34	5.97
LDCs							
Autarchy	1545.09	2219.96	2992.73	4038.56	5475.03	7371.24	27624.26
Globalization	1545.09	2241.88	3046.06	4116.88	5565.01	7450.58	27172.36
Difference (per cent)	0.00	0.99	1.78	1.94	1.64	1.08	-1.64
Capital-output ratio							
MDCs							
Autarchy	3.22	3.47	3.77	4.00	4.15	4.23	4.21
Globalization	3.22	3.42	3.65	3.79	3.86	3.88	3.94
Difference	0.00	-0.05	-0.12	-0.21	-0.29	-0.65	-0.27
LDCs							
Autarchy	2.56	2.37	2.41	2.44	2.43	2.41	2.44
Globalization	2.56	2.54	2.73	2.83	2.85	2.81	2.61
Difference	0.00	0.17	0.32	0.39	0.42	0.40	0.17
Rate of return to capital							
MDCs							
Autarchy	0.103	0.095	0.087	0.083	0.080	0.078	0.078
Globalization	0.103	0.096	0.090	0.087	0.086	0.085	0.084
Difference	0.000	0.001	0.003	0.004	0.004	0.007	0.006
LDCs							
Autarchy	0.129	0.139	0.137	0.135	0.136	0.137	0.135
Globalization	0.129	0.130	0.121	0.116	0.116	0.117	0.127
Difference	0.00	-0.009	-0.004	-0.019	-0.020	-0.020	-0.008
Average wage							
MDCs							
Autarchy	36332.22	47113.96	56918.52	67966.67	80294.14	94095.75	180458.21
Globalization	36332.22	46791.33	55983.59	66190.50	77474.37	90143.77	174477.64
Difference	0.00	-0.68	-1.64	-2.61	-3.51	-4.20	-3.31
LDCs							
Autarchy	2440.97	3665.43	4967.09	6708.63	9000.34	12057.64	44505.90
Globalization	2440.97	3790.14	5278.50	7223.19	9727.91	12991.53	45973.02
Difference	0.00	3.40	6.27	7.67	8.08	7.75	3.30

TABLE 3: Savings

	1995	2010	2020	2030	2040	2050	2100
MDCs							
Total savings (per cent of GDP)							
Autarchy	9.37	10.84	9.16	7.81	6.50	5.47	5.48
Globalization	9.37	10.90	9.30	8.04	6.84	5.95	6.36
Difference	0.00	0.06	0.14	0.23	0.34	0.48	0.87
Households							
Autarchy	8.08	8.66	7.05	5.84	4.64	3.69	3.54
Globalization	8.08	8.70	7.10	5.87	4.67	3.68	3.06
Difference	0.00	0.04	0.05	0.04	0.03	-0.01	-0.48
Firms							
Autarchy	3.12	4.18	4.31	4.33	4.33	4.33	4.46
Globalization	3.12	4.16	4.29	4.34	4.38	4.50	5.56
Difference	0.00	-0.02	-0.02	0.01	0.06	0.17	1.11
Government							
Autarchy	-1.83	-2.00	-2.20	-2.36	-2.48	-2.55	-2.51
Globalization	-1.83	-1.95	-2.09	-2.17	-2.21	-2.23	-2.26
Difference	0.00	0.04	0.11	0.19	0.26	0.32	0.25
LDCs							
Total savings (per cent of GDP)							
Autarchy	4.55	8.40	8.72	8.62	8.44	8.23	7.22
Globalization	4.55	7.86	7.78	7.50	7.31	7.20	6.71
Difference	0.00	-0.54	-0.94	-1.12	-1.13	-1.03	-0.51
Households							
Autarchy	2.28	3.95	3.81	3.56	3.32	3.09	2.26
Globalization	2.28	3.60	3.37	3.14	2.92	2.72	2.07
Difference	0.00	-0.35	-0.43	-0.42	-0.40	-0.37	-0.19
Firms							
Autarchy	2.39	4.43	4.93	5.09	5.14	5.15	4.99
Globalization	2.39	4.36	4.65	4.68	4.73	4.79	4.80
Difference	0.00	-0.06	-0.27	-0.41	-0.42	-0.37	-0.19
Government							
Autarchy	-0.12	0.02	-0.01	-0.03	-0.02	-0.01	-0.03
Globalization	-0.12	-0.10	-0.25	-0.32	-0.33	-0.31	-0.16
Difference	0.00	-0.13	-0.24	-0.30	-0.31	-0.30	-0.12

TABLE 4: Disposable Income per capita, Population 15-59

	1995	2010	2020	2030	2040	2050	2100
Wages (1995 U.S. $)							
MDCs							
Autarchy	18291.67	23548.57	27375.72	31076.44	35228.61	40150.41	75686.14
Globalization	18291.67	23389.90	26933.86	30281.40	34021.12	38508.03	73247.55
Difference (per cent)	0.00	-0.67	-1.61	-2.56	-3.43	-4.09	-3.22
LDCs							
Autarchy	1265.88	1798.21	2396.70	3167.07	4187.70	5526.59	19111.52
Globalization	1265.88	1859.05	2546.09	3408.33	4523.56	5950.65	19730.09
Difference (per cent)	0.00	3.38	6.23	7.62	8.02	7.67	3.24
Imputed housing services (1995 U.S. $)							
MDCs							
Autarchy	1017.63	997.23	1050.47	1109.09	1154.31	1241.99	2205.36
Globalization	1017.63	1025.57	1131.11	1260.42	1386.52	1560.28	2685.73
Difference (per cent)	0.00	2.84	7.68	13.64	20.12	25.63	21.78
LDCs							
Autarchy	55.17	56.26	71.17	90.60	115.94	155.75	589.42
Globalization	55.17	49.01	53.85	62.68	77.24	104.39	479.03
Difference (per cent)	0.00	-12.88	-24.34	-30.82	-33.38	-32.98	-18.73
Entrepreneurial Income (1995 U.S. $)							
MDCs							
Autarchy	778.38	523.50	474.17	459.81	455.49	476.91	832.64
Globalization	778.38	538.47	510.72	522.83	547.58	599.81	1015.41
Difference (per cent)	0.00	2.86	7.71	13.70	20.22	25.77	21.95
LDCs							
Autarchy	47.83	33.27	36.78	44.54	55.74	73.58	260.43
Globalization	47.83	29.00	27.84	30.80	37.11	49.28	211.51
Difference (per cent)	0.00	-12.84	-24.31	-30.84	-33.42	-33.03	-18.78
Dividends, KOthFinIns (1995 U.S. $)							
MDCs							
Autarchy	189.04	207.29	228.37	249.83	267.94	294.08	518.34
Globalization	189.04	208.37	231.83	257.34	288.18	319.74	540.00
Difference (per cent)	0.00	0.52	1.51	3.01	7.55	8.73	4.18
LDCs							
Autarchy	9.75	11.12	14.27	18.11	23.08	30.93	116.99
Globalization	9.75	9.63	10.64	12.16	14.57	19.06	80.83
Difference (per cent)	0.00	-13.36	-25.42	-32.85	-36.88	-38.36	-30.91
Dividends, KPvtPenSys (1995 U.S. $)							
MDCs							
Autarchy	58.31	276.70	335.96	379.09	423.02	469.02	889.17
Globalization	58.31	283.74	354.39	416.07	489.52	575.79	1274.54
Difference (per cent)	0.00	2.55	5.49	9.75	15.72	22.76	43.34

(cont'd)

TABLE 4 (cont'd): Disposable Income per capita, Population 15-59

	1995	2010	2020	2030	2040	2050	2100
LDCs							
Autarchy	0.66	16.81	26.46	36.63	50.39	69.66	270.82
Globalization	0.66	14.86	21.29	28.14	38.24	53.18	218.75
Difference (per cent)	0.00	-11.58	-19.53	-23.16	-24.11	-23.66	-19.23
Disposable income (1995 U.S. $)							
MDCs							
Autarchy	20276.72	25276.58	29128.73	32895.17	37106.36	42163.38	79242.48
Globalization	20276.72	25162.31	28807.51	32321.99	36243.41	40987.86	77488.68
Difference (per cent)	0.00	-0.45	-1.10	-1.74	-2.33	-2.79	-2.21
LDCs							
Autarchy	1378.65	1898.86	2518.92	3320.33	4382.46	5786.84	20078.36
Globalization	1378.65	1946.69	2638.42	3513.97	4652.48	6123.38	20501.46
Difference (per cent)	0.00	2.52	4.74	5.83	6.16	5.82	2.11
PvtPenSys contributions out of wage income (1995 U.S. $)							
MDCs							
Autarchy	2393.87	3384.76	4128.47	4970.40	5868.67	6807.83	12856.54
Globalization	2393.87	3361.59	4060.66	4840.51	5662.58	6521.90	12430.46
Difference (per cent)	0.00	-0.68	-1.64	-2.61	-3.51	-4.20	-3.31
LDCs							
Autarchy	107.76	163.68	225.16	304.73	412.75	558.79	2141.72
Globalization	107.76	169.25	239.28	328.10	446.11	602.07	2212.32
Difference (per cent)	0.00	3.40	6.27	7.67	8.08	7.75	3.30
PvtPenSys contributions out of entreprenerial income (1995 U.S. $)							
MDCs							
Autarchy	151.44	97.35	90.01	92.91	95.98	102.07	180.30
Globalization	151.44	100.13	96.93	105.61	115.33	128.26	219.17
Difference (per cent)	0.00	2.86	7.70	13.67	20.15	25.66	21.56
LDCs							
Autarchy	5.75	3.81	4.27	5.37	6.83	9.15	35.10
Globalization	5.75	3.32	3.23	3.72	4.55	6.13	28.54
Difference (per cent)	0.00	-12.82	-24.26	-30.80	-33.36	-32.94	-18.68
Adjusted Disposable Income (1995 U.S. $)							
MDCs							
Autarchy	22880.34	29035.39	33683.17	38337.58	43494.04	49542.31	93168.48
Globalization	22880.34	28907.77	33319.49	37684.18	42510.83	48213.82	91412.86
Difference (per cent)	0.00	-0.44	-1.08	-1.70	-2.26	-2.68	-1.88
LDCs							
Autarchy	1492.82	2083.16	2774.81	3667.05	4852.43	6424.44	22526.01
Globalization	1492.82	2134.13	2902.23	3873.93	5141.39	6784.76	22961.07
Difference (per cent)	0.00	2.45	4.59	5.64	5.95	5.61	1.93

TABLE 5: Disposable Income per capita, Population 60+

	1995	2010	2020	2030	2040	2050	2100
Wages (1995 U.S. $)							
MDCs							
Autarchy	4817.71	5839.16	6615.47	6606.72	6764.63	7448.32	12534.12
Globalization	4817.71	5799.74	6508.44	6437.20	6531.96	7142.46	12128.59
Difference (per cent)	0.00	-0.68	-1.62	-2.57	-3.44	-4.11	-3.24
LDCs							
Autarchy	600.02	634.65	850.61	1086.25	1251.94	1595.71	4821.97
Globalization	600.02	656.13	903.65	1169.04	1352.42	1718.26	4978.32
Difference (per cent)	0.00	3.38	6.24	7.62	8.03	7.68	3.24
Imputed housing services (1995 U.S. $)							
MDCs							
Autarchy	1777.19	1640.46	1392.54	1263.94	1279.13	1361.27	2396.12
Globalization	1777.19	1691.97	1515.59	1465.67	1584.71	1781.64	3021.59
Difference (per cent)	0.00	3.14	8.84	15.96	23.89	30.88	26.10
LDCs							
Autarchy	220.81	187.94	170.68	190.04	250.08	322.11	1006.60
Globalization	220.81	161.15	123.11	122.81	153.22	197.19	780.82
Difference (per cent)	0.00	-14.25	-27.87	-35.38	-38.73	-38.78	-22.43
Entreprenerial Income (1995 U.S. $)							
MDCs							
Autarchy	1804.13	1932.30	1503.19	1210.50	1135.58	1175.71	2078.24
Globalization	1804.13	1993.56	1638.87	1408.50	1412.64	1546.82	2644.24
Difference (per cent)	0.00	3.17	9.03	16.36	24.40	31.56	27.23
LDCs							
Autarchy	224.14	235.30	186.57	171.32	208.57	266.39	843.53
Globalization	224.14	201.69	133.94	109.61	126.35	160.68	646.50
Difference (per cent)	0.00	-14.28	-28.21	-36.02	-39.42	-39.68	-23.36
Dividends, KOthFinIns (1995 U.S. $)							
MDCs							
Autarchy	400.89	462.51	435.30	432.55	471.12	529.32	959.11
Globalization	400.89	468.57	448.13	452.58	513.65	584.25	1049.85
Difference (per cent)	0.00	1.31	2.95	4.63	9.03	10.38	9.46
LDCs							
Autarchy	47.40	46.20	43.47	49.47	65.54	84.22	265.02
Globalization	47.40	40.27	32.94	33.79	42.17	53.05	184.39
Difference (per cent)	0.00	-12.85	-24.22	-31.70	-35.65	-37.01	-30.42

cont'd

TABLE 5 (cont'd): Disposable Income per capita, Population 60+

	1995	2010	2020	2030	2040	2050	2100
Dividends, KPvtPenSys (1995 U.S. $)							
MDCs							
Autarchy	123.64	306.53	485.37	590.78	682.81	784.76	1497.80
Globalization	123.64	314.31	512.93	648.13	785.89	953.21	2155.94
Difference (per cent)	0.00	2.54	5.68	9.71	15.10	21.47	43.94
LDCs							
Autarchy	3.21	19.23	40.34	62.98	89.12	119.53	405.51
Globalization	3.21	16.83	31.40	46.51	64.80	88.14	324.53
Difference (per cent)	0.00	-12.51	-22.16	-26.16	-27.29	-26.26	-19.97
Social security benefits (1995 U.S. $)							
MDCs							
Autarchy	7912.38	10241.07	12364.09	15076.33	18101.04	21352.97	41785.48
Globalization	7912.38	10170.94	12161.00	14682.34	17465.37	20456.16	40400.67
Difference (per cent)	0.00	-0.68	-1.64	-2.61	-3.51	-4.20	-3.31
LDCs							
Autarchy	480.97	778.55	1046.95	1421.72	1958.23	2632.40	9820.31
Globalization	480.97	805.03	1112.59	1530.77	2116.53	2836.28	10144.03
Difference (per cent)	0.00	3.40	6.27	7.67	8.08	7.75	3.30
Adjusted Disposable Income (1995 U.S. $)							
MDCs							
Autarchy	16712.31	20115.50	22310.59	24590.05	27751.51	31867.60	59753.06
Globalization	16712.31	20124.79	22272.04	24446.29	27508.34	31511.33	59244.94
Difference (per cent)	0.00	0.05	-0.17	-0.58	-0.88	-1.12	-0.85
LDCs							
Autarchy	1573.34	1882.64	2298.28	2918.80	3734.36	4900.84	16757.42
Globalization	1573.34	1864.28	2306.24	2966.02	3790.70	4965.47	16734.07
Difference (per cent)	0.00	-0.98	0.35	1.62	1.51	1.32	-0.14
Disposable Income (1995 U.S. $)							
MDCs							
Autarchy	17496.43	21213.12	24388.65	27589.26	31659.02	36669.97	69415.72
Globalization	17496.43	21223.11	24352.87	27449.88	31423.04	36325.49	69112.68
Difference (per cent)	0.00	0.05	-0.15	-0.51	-0.75	-0.94	-0.44
LDCs							
Autarchy	1592.06	1928.20	2401.95	3092.39	3990.27	5250.64	18018.16
Globalization	1592.06	1909.65	2408.97	3138.06	4044.20	5313.20	17985.99
Difference (per cent)	0.00	-0.96	0.29	1.48	1.35	1.19	-0.18

TABLE 6: "Dissaving" in Retirement

	1995	2010	2020	2030	2040	2050	2100
PvtPenSys assets (1995 U.S. $ per person over 60)							
MDCs							
Autarchy	784.12	1097.62	2078.06	2999.21	3907.51	4802.37	9662.66
Globalization	784.12	1098.33	2080.82	3003.58	3914.71	4814.16	9867.74
Difference (per cent)	0.00	0.06	0.13	0.15	0.18	0.25	2.12
LDCs							
Autarchy	18.72	45.56	103.67	173.60	255.91	349.81	1260.73
Globalization	18.72	45.37	102.72	172.04	253.51	347.73	1251.92
Difference (per cent)	0.00	-0.41	-0.91	-0.89	-0.94	-0.59	-0.70
OthFinIns assets (1995 U.S. $ per person over 60)							
MDCs							
Autarchy	2545.76	1957.60	2287.21	2644.06	3188.31	3836.31	7495.02
Globalization	2545.76	1959.08	2297.14	2675.16	3256.63	3980.38	9168.77
Difference (per cent)	0.00	0.08	0.43	1.18	2.14	3.76	22.33
LDCs							
Autarchy	277.33	129.31	130.39	153.36	207.46	271.95	921.15
Globalization	277.33	129.60	129.26	148.53	196.92	255.89	888.32
Difference (per cent)	0.00	0.22	-0.87	-3.15	-5.08	-5.90	-3.56
Residential assets (1995 U.S. $ per person over 60)							
MDCs							
Autarchy	3154.00	1992.28	2093.17	2228.30	2538.00	2936.93	5491.89
Globalization	3154.00	1999.29	2121.31	2289.28	2653.39	3124.13	5919.43
Difference (per cent)	0.00	0.35	1.34	2.74	4.55	6.37	7.78
LDCs							
Autarchy	360.92	152.18	144.71	162.51	215.66	281.32	948.38
Globalization	360.92	148.10	132.46	140.89	179.62	229.52	825.48
Difference (per cent)	0.00	-2.68	-8.47	-13.30	-16.71	-18.41	-12.96
PvtUnincorpEnt assets (1995 U.S. $ per person over 60)							
MDCs							
Autarchy	3330.32	2543.78	2590.70	2495.12	2602.85	2890.96	5399.09
Globalization	3330.32	2553.33	2630.15	2573.93	2736.01	3096.73	5892.34
Difference (per cent)	0.00	0.38	1.52	3.16	5.12	7.12	9.14
LDCs							
Autarchy	381.00	209.95	185.09	171.33	203.99	260.55	894.31
Globalization	381.00	204.33	168.61	146.61	167.23	208.62	765.08
Difference (per cent)	0.00	-2.68	-8.91	-14.43	-18.02	-19.93	-14.45

cont'd

TABLE 6 (cont'd): "Dissaving" in Retirement

	1995	2010	2020	2030	2040	2050	2100
Total (1995 U.S. $ per person over 60)							
MDCs							
Autarchy	9814.20	7591.28	9049.14	10366.69	12236.67	14466.58	28048.65
Globalization	9814.20	7610.03	9129.43	10541.95	12560.74	15015.40	30848.28
Difference (per cent)	0.00	0.25	0.89	1.69	2.65	3.79	9.98
LDCs							
Autarchy	1037.97	537.00	563.86	660.79	883.02	1163.62	4024.58
Globalization	1037.97	527.40	533.04	608.07	797.28	1041.77	3730.80
Difference (per cent)	0.00	-1.79	-5.47	-7.98	-9.71	-10.47	-7.30
Disposable Income							
MDCs							
Autarchy	17496.43	21213.12	24388.65	27589.26	31659.02	36669.97	69415.72
Globalization	17496.43	21223.11	24352.87	27449.88	31423.04	36325.49	69112.68
Difference (per cent)	0.00	0.05	-0.15	-0.51	-0.75	-0.94	-0.44
LDCs							
Autarchy	1592.06	1928.20	2401.95	3092.39	3990.27	5250.64	18018.16
Globalization	1592.06	1909.65	2408.97	3138.06	4044.20	5313.20	17985.99
Difference (per cent)	0.00	-0.96	0.29	1.48	1.35	1.19	-0.18
Income plus dissaving							
MDCs							
Autarchy	27310.62	28804.40	33437.79	37955.95	43895.69	51136.55	97464.37
Globalization	27310.62	28833.14	33482.30	37991.82	43983.78	51340.89	99960.96
Difference (per cent)	0.00	0.10	0.13	0.09	0.20	0.40	2.56
LDCs							
Autarchy	2630.03	2465.20	2965.81	3753.18	4873.29	6414.27	22042.74
Globalization	2630.03	2437.05	2942.01	3746.14	4841.48	6354.98	21716.80
Difference (per cent)	0.00	-1.14	-0.80	-0.19	-0.65	-0.92	-1.48

Annex 1: The life-cycle dynamics of capital accumulation

There are four different types of capital: residential capital (*KRes*), capital operated by private unincorporated enterprises (*KPvtUnincorpEnt*), capital operated by firms and held on households' behalf by the private pension system (*KPvtPenSys*), and capital operated by firms and held on households' behalf by other financial institutions (*KOthFinIns*). Corresponding to each of the four types of capital is an age-specific capital accumulation equation which tracks assets as the population ages. The major structural difference is between *KPvtPensSys* and the other three asset classes. Funds flow into *PvtPenSys* only through payroll deductions (including deductions from entrepreneurial income) on behalf of system participants. Dividends earned on assets held by the *PvtPenSys* remain within the system until the worker retires. By contrast, savings of all origins, not just captive retirement-related savings, flow into *KOthFinIns, KRes, and KPvtUnincorpEnt*. Dividends earned on assets held by *OthFinIns* may be allocated to consumption at any point during the life cycle, as may profits accruing to *KPvtUnincorp Ent* (implicit rents on *KRes* are assumed to be consumed in their entirety). If saved, dividends earned on assets held by *OthFinIns* may remain within *OthFinIns,* or be allocated to residential investment or investment in capital operated by *PvtUnincorpEnt.*

Private Pension System (*PvtPenSys*)

The private pension system is assumed to be a fully-funded defined contribution system. No distinction is made between workers' and employers' contributions and the contribution rates out of wages and entrepreneurial income are assumed to be identical. Contributions out of wage and entrepreneurial income are

$$PvtPenSysContWageY(age,t) = PvtPenSysContRate(age,t)\,WageY(age,t)$$

$$PvtPenSysContEntrY(age,t) = PvtPenSysContRate(age,t)\;EntrY(age,t)$$

The age-specific accumulation equation for the private pension wealth is

$$KPvtPenSys(age,t) = KPvtPenSys(t-1, age-1) + \Delta KPvtPensSys(age,t)$$

where

$$\begin{aligned}\Delta KPvtPenSys(age,t) &= ContPvtPenSys(age,t)\\ &+ DividPvtPenSys(age,t)\\ &- PvtPenSysBen(age,t) - BeqKPvtPenSys(age,t)\end{aligned}$$

In order, these components of change are:

- current contributions (zero for persons who have retired), receipt of dividends,
- dissaving via the conversion of retirees' accumulated assets into consumption, and finally,
- outflow of funds via death of claimants and ensuing pay-out of their accumulation.

Note that, for an individual cohort born in year *t = 0* whose last members die out in year *t = MaxAge*, lifetime pension contributions plus lifetime earnings on pension assets plus lifetime pension benefits received equals bequest of pension wealth; i.e.,

$$\sum_{t=0}^{MaxAge}\sum_{age=0}^{MaxAge}\Delta KPvtPenSys(age,t)$$
$$= \sum_{t=0}^{MaxAge}\sum_{age=0}^{MaxAge}\left[\begin{array}{l} ContPvtPenSys(age,t) \\ \quad + DividPvtPenSys(age,t) \\ \quad - PvtPenSysBen(age,t) - BeqKPvtPenSys(age,t)\end{array}\right] = 0$$

In accordance with the System of National Accounts, changes in pension fund equity are added to household savings from all other sources as an adjustment:

$$\begin{aligned} AdjNetSvngHH(age,t) &= NetSvngHH(age,t) \\ &+ ContPvtPenSys(age,t) + DividErngsFirmsKPvtPenSys(age,t) \\ &- PvtPenSysBen(age,t) - BeqKPvtPenSys(age,t)\end{aligned}$$

where *NetSvngHH* covers all savings excluding change in pension fund equity.

Other asset classes (KOthFinIns, KRes, KPvtUnincorpEnt)

For * = *KRes*, *KPvtUnincorpEnt*, and *KOthFinIns*, the age-specific accumulation equations are

$$
\begin{aligned}
&\Delta K*(age,t) = \\
&\quad K*Share(t)\left[NetSvngHH(age,t)+NetSvngFirms(age,t)+NetSvngGovt(age,t)\right] \\
&\quad -DisSvngK*(age,t) \\
&\quad +K*Share(t)\begin{bmatrix} DisSvngK\,\mathrm{Re}s(age,t) \\ +DisSvngKPvtUnincorpEnt(age,t) \\ +DisSvngKOthFinIns(age,t) \end{bmatrix} \\
&\quad -BeqK*(age,t) \\
&\quad +InhK*(age,t)-AssetSalesInhK*(age,t) \\
&\quad +K*Share(t)\begin{bmatrix} AssetSalesInhK\,\mathrm{Re}s(age,t) \\ +AssetSalesInhKPvtUnincorpEnt(age,t) \\ +AssetSalesInhKPvtPenSys(age,t) \\ +AssetSalesInhKOthFinIns(age,t) \end{bmatrix}
\end{aligned}
$$

The components of change are, in order:

- Unadjusted household net savings (i.e., not including savings captured by the private pension system) plus the imputed savings of firms and government. In imputing corporate and government savings to households by age group, shares drawn from the population age distribution are used. Another share variable, which sums to unity across the three forms of non-pension wealth, is used to apportion savings between $\bullet K_{Res}$, $\bullet KPvtUnincorpEnt$, and $\bullet KOthFinIns$. Note that allocation shares are not indexed by age. This simplification frees computer memory for tracking the results of numerous uncertainty simulations. Shares may be age-indexed in non-stochastic model application.
- The second line, of relevance only to retired households, subtracts "dissaving" in the form of sales of accumulated assets. The third line, also of relevance only for retired households, reflects the allocation of the proceeds of asset sales among the three forms of non-pension wealth. Consumption from the proceeds of asset sales is not subtracted because this consumption has already been factored into adjusted household net saving in the first line.
- The fourth line subtracts bequests, which represent a leakage of wealth out of the age group.
- The fifth line adds inheritance, an injection of wealth, and subtracts asset sales which occur in consequence of inheritance.
- The sixth and last line is analogous to the third line, but applies to households everywhere in the age spectrum and includes the disposition of inherited pension-, as well as non-pension, wealth.

Accounting consistency check

We now check that total net capital formation is equal to total net savings. First, adding across the three non-pension forms of wealth,

$$
\begin{aligned}
&\Delta K\,\mathrm{Re}s(age,t) + \Delta KPvtUnincorpEnt(age,t) + \Delta KOthFinIns(age,t) = \\
&\quad \left[NetSvngHH(age,t) + NetSvngFirms(age,t) + NetSvngGovt(age,t)\right] \\
&\quad - DisSvngK\,\mathrm{Re}s(age,t) - DisSvngKPvtUnincorpEnt(age,t) - DisSvngKOthFinIns(age,t) \\
&\quad + DisSvngK\,\mathrm{Re}s(age,t) + DisSvngKPvtUnincorpEnt(age,t) + DisSvngKOthFinIns(age,t) \\
&\quad - BeqK\,\mathrm{Re}s(age,t) - BeqKPvtUnincorpEnt(age,t) - BeqKOthFinIns(age,t) \\
&\quad + InhK\,\mathrm{Re}s(age,t) - AssetSalesInhK\,\mathrm{Re}s(age,t) \\
&\quad + InhKPvtUnincorpEnt(age,t) - AssetSalesInhKPvtUnincorpEnt(age,t) \\
&\quad + InhKOthFinIns(age,t) - AssetSalesInhKOthFinIns(age,t) \\
&\quad + AssetSalesInhK\,\mathrm{Re}s(age,t) + AssetSalesInhKPvtUnincorpEnt(age,t) \\
&\quad + AssetSalesInhKPvtPenSys(age,t) + AssetSalesInhKOthFinIns(age,t)
\end{aligned}
$$

Cancellations bring us to

$$
\begin{aligned}
&\Delta K\,\mathrm{Re}s(age,t) + \Delta KPvtUnincorpEnt(age,t) + \Delta KOthFinIns(age,t) = \\
&\quad \left[NetSvngHH(age,t) + NetSvngFirms(age,t) + NetSvngGovt(age,t)\right] \\
&\quad - BeqK\,\mathrm{Re}s(age,t) - BeqKPvtUnincorpEnt(age,t) - BeqKOthFinIns(age,t) \\
&\quad + InhK\,\mathrm{Re}s(age,t) + InhKPvtUnincorpEnt(age,t) + InhKOthFinIns(age,t) + InhKPvtPenSys(age,t)
\end{aligned}
$$

Adding pension wealth,

$$
\begin{aligned}
&\Delta KTot(age,t) = \\
&\quad \Delta KPvtPenSys(age,t) + \left[NetSvngHH(age,t) + NetSvngFirms(age,t) + NetSvngGovt(age,t)\right] \\
&\quad - BeqK\,\mathrm{Re}s(age,t) - BeqKPvtUnincorpEnt(age,t) - BeqKOthFinIns(age,t) \\
&\quad + InhK\,\mathrm{Re}s(age,t) + InhKPvtUnincorpEnt(age,t) + InhKOthFinIns(age,t) + InhKPvtPenSys(age,t)
\end{aligned}
$$

Based on the definition of adjusted net household savings given above,

$$
NetSvngHH(age,t) = AdjNetSvngHH(age,t) - \Delta KPvtPenSys(age,t) - BeqKPvtPenSys(age,t)
$$

so

$$
\begin{aligned}
&\Delta KTot(age,t) = \Delta KPvtPenSys(age,t) \\
&\quad + \left[\begin{array}{l} AdjNetSvgHH(age,t) - \Delta KPvtPenSys(age,t) - BeqKPvtPenSys(age,t) \\ \quad + NetSvngFirms(age,t) + NetSvngGovt(age,t) \end{array}\right] \\
&\quad - BeqK\,\mathrm{Re}s(age,t) - BeqKPvtUnincorpEnt(age,t) - BeqKOthFinIns(age,t) \\
&\quad + InhK\,\mathrm{Re}s(age,t) + InhKPvtUnincorpEnt(age,t) + InhKOthFinIns(age,t) + InhKPvtPenSys(age,t)
\end{aligned}
$$

• $KPvtPenSys$ is cancelled out, leaving the result

$$\begin{aligned}\Delta KTot(age,t) = \\ &+ \left[AdjNetSvgHH(age,t) + NetSvngFirms(age,t) + NetSvngGovt(age,t)\right] \\ &- BeqK\,\mathrm{Re}\,s(age,t) - BeqKPvtUnincorpEnt(age,t) - BeqKPvtPenSys(age,t) - BeqKOthFinIns(age,t) \\ &+ InhK\,\mathrm{Re}\,s(age,t) + InhKPvtUnincorpEnt(age,t) + InhKPvtPenSys(age,t) + InhKOthFinIns(age,t)\end{aligned}$$

In other words, change in wealth for members of an age group in a given year is equal to their net saving, including net saving through the private pension system and their imputed share of the net savings of firms and government, plus the sum across all asset classes of inheritance minus bequests.

Summing over age groups, inheritance and bequests cancel out, leaving us with

$$\Delta KTot(t) = AdjNetSvngHH(t) + NetSvngFirms(t) + NetSvngGovt(t)$$

Annex 2: Parameters and Scenario Assumptions

Parameterization and initialization assumptions are largely *ad hoc*, but this should not greatly affect the marginal simulation properties of the model. That is, refining the rough assumptions set forth below probably would not affect our baseline *versus* alternative scenario conclusions substantively.

Demography and labor markets

Demographic assumptions are taken from the IIASA Central Scenario population projection (Lutz, 1996). "MDC" and "LDC" regions correspond to "industrial" and "developing" countries in the IIASA projection.

Labor force participation rate projections (both sexes combined) were taken from the International Labour Organisation (1986). In the MDCs, over the prime labor force participation years (25-60), the labor force participation rate was approximately 75 percent; over 60, it was approximately 10 percent (staring at 30 percent at age 60, declining to 5 percent at 75 and zero thereafter). In the LDCs, the two corresponding figures were 75 percent and 15 percent, respectively, with the latter gradually declining to 10 percent over the simulation period.

The production function

The ß (capital) coefficient in the Cobb-Douglas production function was assumed to be 0.33 in both MDCs and LDCs. The rate of total factor productivity growth was assumed to be 1% per year in the MDCs and 2% per year in the LDCs. Information from various sources led us to initialize the model on 1995 per capita GDP levels of approximately $25,000 and $1,500 in the MDCs and LDCs, respectively.

Social insurance contribution rates

It was assumed in the MDCs that the rate of saving in private pension plans (out of both wage and entrepreneurial income) was 5 percent up to age 40 and 15 percent from age 40 until retirement. These assumptions were kept constant over the simulation period. In LDCs, the corresponding figures were assumed to be 5 percent and 10 percent. Public pension contribution rates were calculated to ensure PAYG system balance.

Public pension system benefit calculation

Pension payments per member of the population aged 60+ are set equal to 40 percent of the current-year wage at age 40.

Consumption/saving rates

In both regions, it was assumed for the population aged 15-59 that the average propensity to consume out of disposable wage income was 90%. In the MDCs, the average propensity to consume out of entrepreneurial income was set equal to 60 percent; in LDCs, the corresponding assumption was 70 percent. Propensities to consume are age-invariant. All imputed rental income was assumed to be consumed. The elderly are assumed to consume 90% of the proceeds of asset sales. 30% of inherited wealth was assumed to be converted into consumption, with the remainder being distributed among *KPvtUnincorpEnt*, *KRes*, and *KOthFinIns*.

Intergenerational capital transfers

In both regions, the population over age 60 was assumed to make annual unremunerated capital transfers of 3 percent of their residential capital assets and 5 percent of their *KPvtUnincorpEnt* assets. These transfers were allocated to the population aged over 15 according to age-specific population shares. No explicit transfers of income (apart from the PAYG pension mechanism) were included in the model.

Taxes and government consumption

The direct tax rate (relative to wages and profits) was assumed to be 15% in both the MDCs and LDCs. The indirect tax rate (relative to GDP) was set at 6% in the MDCs and 8% in the LDCs. Government consumption was assumed to be 20% of GDP in both regions.

Initializing capital stocks and claims

Total initial capital stocks were calculated based on the assumed per capita GDP levels given above and assumed capital-output ratios of approximately 3.2 in the MDCs and 2.5 in the LDCs. The depreciation rate was assumed to be 4% per year in the MDCs and 6% per year in the LDCs.

In both regions, it was assumed that 1% of all initial claims on capital consisted of claims on capital installed in the foreign region (i.e., $K_{12} / K_{1*} = 0.01$ and $K_{21} / K_{2*} = 0.01$). 33% of K_{*1} and 33% of K_{*2} were assumed to consist of residential capital; similarly, 33% of K_{*1} and 33% of K_{*2} were assumed to consist of capital operated by private unincorporated enterprises.

For the MDCs, total claims of the *PvtPenSys* were assumed to be approximately $8,000 billion based on data from InterSec Research Company (MacKellar and Reisen 1998). Based on World Bank (1997) estimates, $100 billion of this total was assumed to consist of claims on capital installed in the LDCs. Letting 1 index the MDCs and 2 index LDCs, this allowed calculation of $KPvtPenSys_{11}$, $KOthFinIns_{12}$, and $KOthFinIns_{11}$ as residuals. For the LDCs, total claims of *PvtPenSys* were assumed to be $300 billion based on the data in Table 1, and the initial-year value of $KPvtPenSys_{21}$ was assumed to be zero.

FDI claims were assumed to account for 50% of initial-year $KOthFinIns_{12}$ and $KOthFinIns_{21}$, gradually increasing as discussed in the text.

Residential investment and investment in private unincorporated enterprises

In both regions, the share of net domestic unadjusted savings (i.e., savings not counting changes in pension fund equity) allocated to residential investment was assumed to be 30 percent. 25 percent of remaining unadjusted savings were allocated to *KPvtUnincorpEnt*, leaving 75 percent to be invested in *KOthFinIns*.

Sharing out investment between regions

We estimate that, in 1995, 1% of all purchases of assets by MDC pension fund managers consisted of claims on capital installed in the LDCs. For *OthFinIns*, the corresponding figure was 15%, the higher number being largely due to the role of FDI.

In the baseline scenario, which corresponds roughly to a situation of autarchy, the foreign-investment share of the *PvtPenSys* is assumed to rise gradually to 10% between 1995 and 2005, then to remain constant through 2100. The foreign-investment share of *OthFinIns* is assumed simply to remain constant at 15%. The share of *OthFinIns* foreign assets consisting of FDI claims is assumed to remain constant at 50%, and the proportion of FDI earnings reinvested is kept constant at 20%.

In the alternative scenario, designed to illustrate the impacts of financial globalization, the allocation of MDC investment is shifted to reflect the share of LDCs in global stock market capitalization (estimated as total capital stocks minus residential capital stocks minus capital operated by *PvtUnincorpEnt*) and output. The alternative scenario can be envisioned as one based on lower estimates of sovereign risk. There is simultaneity, which the model captures, between capital-flow coefficients and regional market shares.

In the case of pension fund managers, the share of annual investment expenditure allocated to LDCs is set equal to that region´s share in global stock market capitalization, just under 15% in 1995, rising to almost 40% in 2050, and nearly 60% in 2100.[12] In the case of *OthFinIns*, the foreign investment share was taken as a weighted average of the emerging markets' shares in global stock market capitalization and in world GDP, the weights reflecting the portfolio-FDI split in foreign assets held by *OthFinIns*. The FDI share was assumed to rise linearly from 50% in 1995 to 67% in 2100, while the share of FDI earnings reinvested was set equal to emerging market economies' share in world GDP. The rationale behind these assumptions is that, in a totally integrated world market, the rigidities that lead international investors to prefer portfolio claims to FDI should diminish, as should the disincentives to reinvesting earnings in the host country. The impact is to raise the share of MDC *OthFinIns* assets located in LDCs to 42% in 2050 (as opposed to an estimated 3.5 percent in 1995 and a projected 17 percent under conditions of autarchy in the baseline scenario) and 67% in 2100 (compared to a baseline scenario level of 19%).

In the LDCs, aggregate GDP growth is likely to be more rapid than in the MDCs, per capita income levels are likely to rise substantially, and age-distribution trends are favorable for savings. On all three counts, aggregate savings in the emerging market economies are likely to play a growing role in the world economy, and

[12] All alternative assumptions are phased in gradually over the first ten years of the simulation period.

assumptions made regarding the behavior of LDC portfolio managers are an important aspect of scenario design.

In the Autarchy Scenario, the domestic investment share of LDC pension fund managers is assumed to decline gradually from 99% in 1995 to 90% in 2005, after which it remains fixed. The domestic investment share of *OthFinIns* is assumed to remain constant at 85% throughout the simulation period. These assumptions mirror those made for the MDCs.

An alternative scenario where MDC portfolio managers diversify while LDC portfolio managers continue to invest most of their capital domestically would give rise to a lopsided global picture over the very long term. Under such a scenario, net foreign assets of the MDCs would grow explosively, as would net factor payments from LDCs to MDCs, giving rise to unreasonable gaps between gross national product (GNP) and GDP in both regions. Moreover, recent experience indicates that when capital controls are lifted, portfolio managers in emerging economies have been eager to diversify into more mature financial markets.

Therefore, we assume in the Globalization Scenario that LDC portfolio managers also begin to diversify internationally, although less aggressively than their MDC counterparts. Whereas MDC portfolio managers are assumed to rationalize their investment allocation decisions instantly, LDC managers are assumed to do so slowly over the course of the simulation period. The domestic investment share of the *PvtPenSys*, after reaching 90% in 2005, is assumed to decline linearly by one-half percentage point per year until it equals the LDC region´s share in global stock market capitalization. After this point, the *PvtPenSys* domestic investment share is assumed to move in line with the LDC region´s share in global capitalization. Exactly the same assumption was made regarding the domestic investment share of *OthFinIns* in the LDCs, the only difference being that the target share reflected shares in both stock market capitalization and in world GDP. The share of FDI in *OthFinIns* foreign assets was assumed to rise linearly from 50% to 67% over the simulation period and the share of FDI earnings reinvested in the MDCs was set equal to the MDCs´ share in world GDP. These assumptions are identical to those made in the case of MDC portfolio management.

Firms in both regions were assumed to pay out 15% of pre-tax profits to holders of claims, as well as 15% of repatriated earnings on FDI abroad.