Immigration vs. Foreign Investment to Ease the Aging Problems of an Aging Open Economy[1,2]

By

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Abstract:

This paper formulates an overlapping generations model of the world economy with two regions that vary in aging pattern: One region consists of Japan and other OECD countries with high life expectancy, low fertility rate, and high labor productivity, and the other region consists of the developing countries with low life expectancy, high fertility rate and low labor productivity. The paper shows that aging pattern such as in Japan can lead to dynamic inefficiency or capital over-accumulation, and insolvency of the publicly funded social security program. The paper studies the choice between investment of OECD countries' capital in developing countries and import of labor from developing countries to cope with the above aging problems. Under the assumption that international capital and labor markets are perfectly competitive, if imported labor from developing countries could be easily transformed into skilled workers, it is better for Japan and other OECD countries to import labor, otherwise it is better to invest capital in less developed countries. The paper also examines empirically why not much capital flows from OECD countries into less developed countries.

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[1] Raut is an Economist at the Social Security Administration (SSA). This paper was prepared prior to his joining SSA, and the analysis and conclusions expressed are those of the author and not necessarily those of SSA.

[2] Earlier drafts of this paper were presented at the Third and Fourth International Forums of the Collaborative Projects, sponsored by the Economic and Social Research Institute, Cabinet Office, Ministry of Japan, and subsequently at the Population Association of America 2004 Annual Meeting, Boston, and at the conference on "Improving Social Insurance Programs," University of Maryland, College Park, September 13-14, 2003. I am grateful to the participants and to the discussants of the forums and the conferences, and to an anonymous referee during the conference volume editorial process for many useful comments. I am especially grateful to Junichi Goto and Koichi Hamada for inviting me to collaborate on this project.

1. Introduction

In the past century the world has witnessed an unprecedented pattern of demographic transitions. Japan and other OECD countries have achieved very high life expectancies and very low total fertility rates. For instance, the life expectancy at birth in Japan increased from 64 years in the 1950s to 83 years in the late 1990s, and the total fertility rate dropped from 2.75 in the 1950s to 1.43 in the late 1990s, which is well below the replacement total fertility rate of 2. Other OECD countries have similar experiences. The aging pattern of the OECD countries has led to serious financing problems for their publicly provided social security and health care programs. The potential support ratio in Japan, defined as the number of persons aged 15-64 per person aged 65 or older, has fallen from 12.06 in 1950 to 3.99 in 2000, and the United Nations (UN) projects it to drop to 1.71 by the year 2050 (see United Nations (2000) for details).

Japan and most other OECD countries have very generous publicly provided old-age pension programs, which transfer a large amount of resources from the young to the old, and they also have generous publicly provided health care systems. In Japan, while a higher life expectancy and a lower fertility rate might have led to a higher savings rate and a current account surplus, the same aging process also led to economic problems involving a higher demand for labor services in the elderly care sector (see Sato (2001) for some estimates) and to heavier tax burdens on the young generation to provide for the promised pension benefits of the old. For instance, social security benefits as a percentage of national income totaled 17 percent in 1995 (9 percent in pensions, 6 percent in medical care and 2 percent in welfare) and are expected to rise to 33.5 percent in 2025 (16 percent in pension, 13 percent in medical care, and 4.5 percent in welfare). The above pattern of demographic transitions also has significant consequences on future population size. The United Nations (2000) projects that in the absence of immigration, the total population of Japan will decline from its current level of 127 million to 105 million in 2050.

In contrast, the contemporary developing countries have much higher fertility rates and much lower life expectancies, and thus much higher potential support ratios. Most

developing countries do not have a formal publicly provided social security program or a health care system that covers the majority of their populations.

Policy makers around the world have been debating on ways to cope with the "aging" problems of the OECD countries. The problems are threefold: *first*, there is a shortage of resources to provide for the consumption of the elderly, including their medical expenditures; *second*, there is also a shortage of labor services to provide for the elderly cares; *third*, because individuals expect longer retirements and higher elderly care costs, they save a higher percentage of their incomes, which in a closed economy can lead to dynamic inefficiency, i.e., an excessively high amount of capital formation compared to a socially optimal level. Some of the highly debated and highly recommended policy suggestions include reforming the pay-as-you-go social security program such as by reducing benefits, gradually increasing the retirement age, and partially privatizing social security by introducing personal savings accounts. The long-term solution to the problems of aging in OECD countries, however, inevitably requires tweaking the age-structure either by increasing fertility rates or by increasing immigration of foreign workers so that the potential support ratio is reasonably high. Since it is impossible to increase the fertility rate of OECD countries, the United Nations (2000) and other practitioners recommend that Japan and other OECD countries should seriously consider "replacement migration" as a way to increase population size and potential support ratio. It estimates that Japan will require approximately 312,000 immigrants each year to keep the population size constant, and approximately 10 million to keep the potential support ratio constant. The optimal population size for Japan, however, is not obvious because the concept of optimal population is a highly controversial issue in the economics literature.

Immigration of labor is one plausible solution to aging problems. Investment of capital in developing countries is another plausible solution. The main rational for this is that the demographic mismatch of OECD and developing countries would generally mean a higher rate of return from capital invested in a developing country. Thus, by investing part of its capital in developing countries or by allowing immigration of labor from developing countries, Japan could remove its dynamic inefficiency in capital over accumulation. Furthermore, Japan could use the gains from foreign capital incomes or payroll taxes of the

immigrant guest workers to finance its publicly provided social security program. Even a cursory look at the foreign investment and immigration statistics of Japan would tell us that Japan has very little foreign investment in the less developed countries and very few immigrant workers.

In this paper, I formulate an overlapping generations model to study the following policy issues surrounding Japan's aging problems:

- Out of the two options of foreign investment in developing countries and immigration of labor from developing countries, which is a better policy option from the perspective of aging problem in Japan?
- Why, contrary to the prediction of the neoclassical theory, does so little capital flow from Japan into less developed countries?

Section 2 of the paper describes a few stylized facts about Japan. In section 3, the basic theoretical framework is detailed. In section 4, I first briefly discuss the economic arguments from the international economics literature on the choice between foreign investment and immigration, and then I use the calibrated model to shed further light on the choice between the two from the public finance perspectives of the aging problems in Japan. In section 5, I carry out a cross country regression analysis to examine empirically the significant determinants of foreign capital flows to less developed countries.

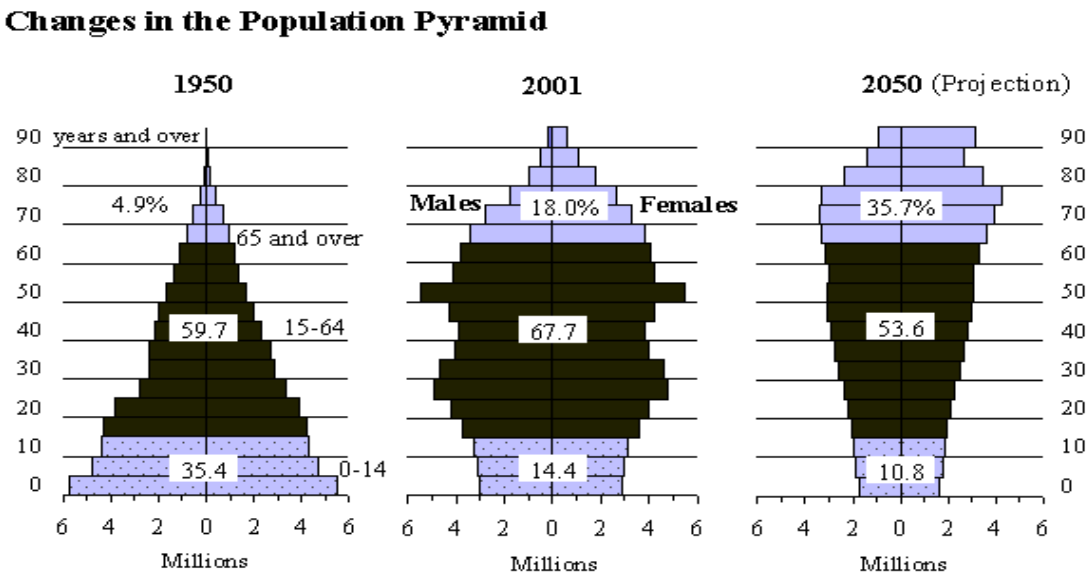
2. A Few Stylized Facts about Japan

Figure 1 depicts the population pyramid of Japan in 1950 and how it has changed in the past 50 years to the current age structure in 2001, and how it is expected to change in another 50 years as a result of the steady decline in fertility rate and increase in life expectancy. In the 1950's, 100 adults took care of only 8 elderly people, currently 100 adults take care of 26 elderly persons, and in another 50 years 100 adults will have to take care of 67 elderly persons. This will dwindle down the labor force of the productive sector. Figure 2 compares Japan's scenario with other OECD countries and India. It is clear that in 1950,

while all other OECD countries had much higher proportions of elderly population than Japan, by the year 2000 Japan began to surpass all other OECD countries. This was due to the fact that while other OECD countries experienced their demographic transitions (low mortality and fertility rates) slowly over a longer period of time, Japan had a very rapid demographic transition.

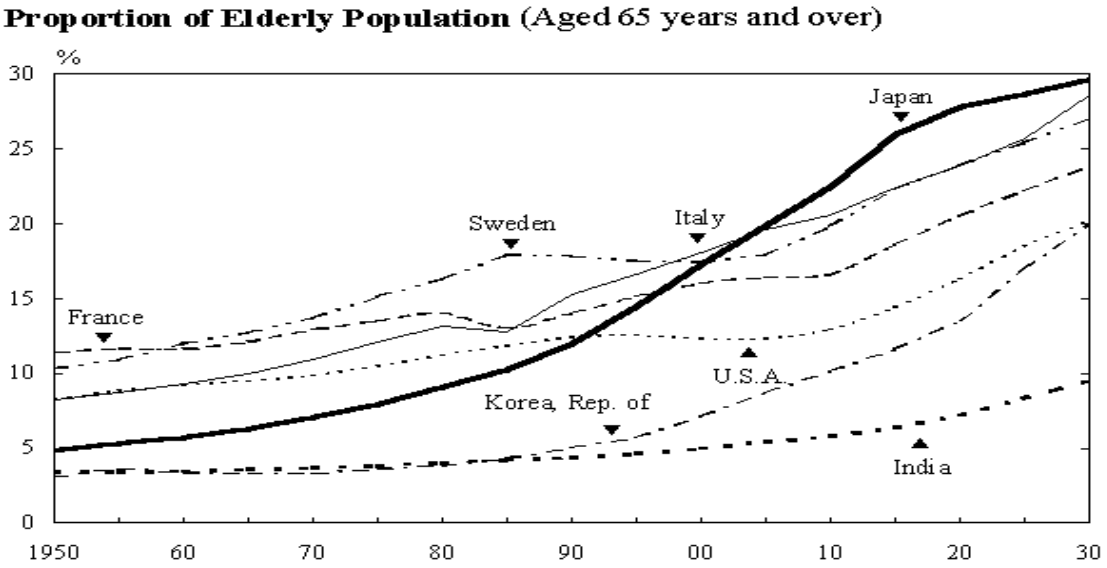
The figures 3-5 show some of the effects of Japan's demographic transitions on the resource and labor requirements for elderly care. Figure 3 shows that while in early 1980's only 10% of national income went for pension and medical care, by the year 2000 the share went up to more than 20% of national income. Figures 4 and 5 show that there are sharp increases in the demand for female and homecare nurses in the late 1990s. It is clear from these trends that, in another 50 years, a significantly high proportion of national income and the labor force need be devoted to elderly care sector.

Figure 1: Changes in population pyramid



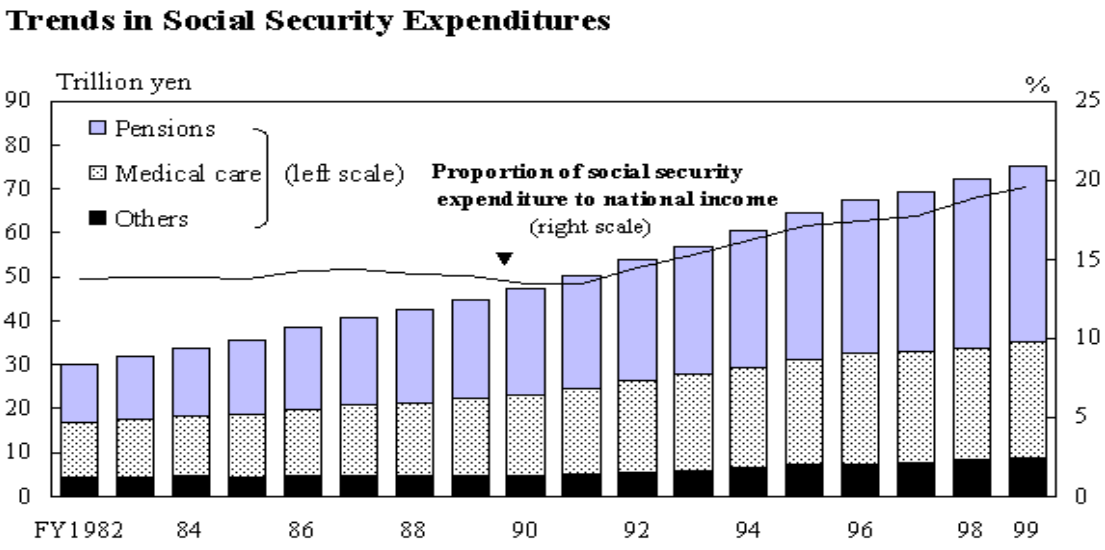
Source: Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications; Ministry of Health, Labour and Welfare.

Figure 2: Comparison of Japan's aging population with other countries



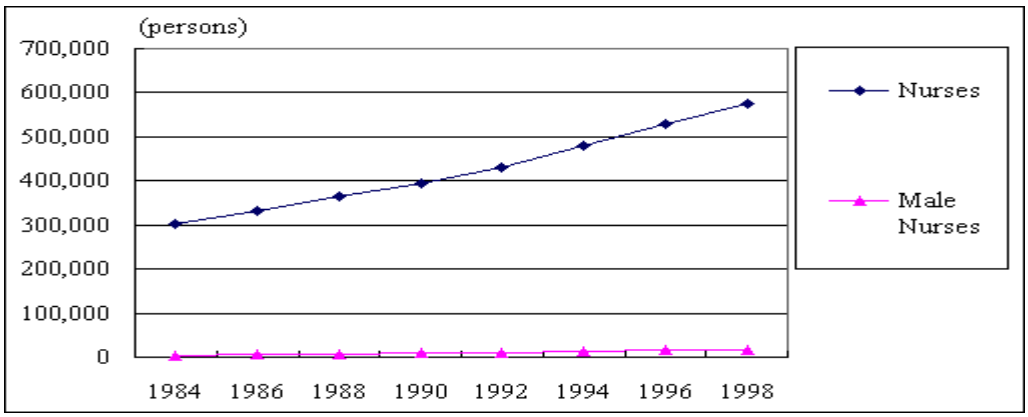
Source: United Nations; Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications; Ministry of Health, Labour and Welfare.

Figure 3: Trend in Social Security and Medical Care Expenditures



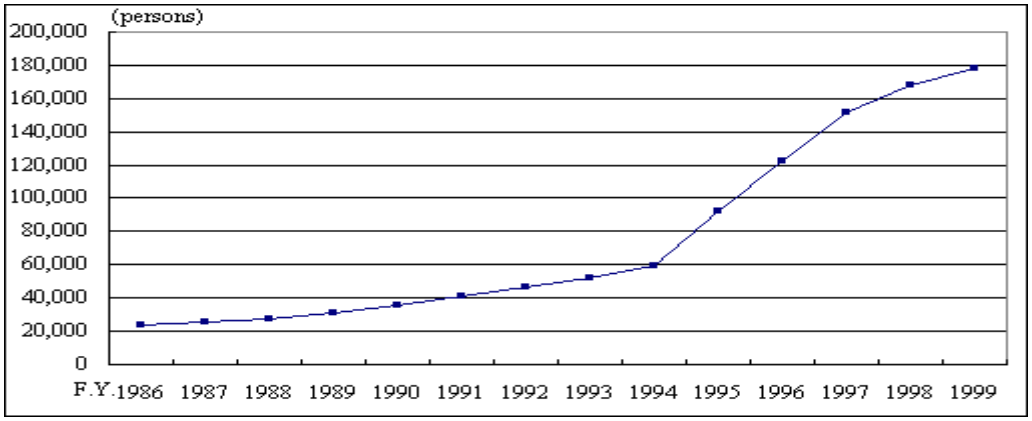
Source: Ministry of Health, Labour and Welfare.

Figure 4: Demand for nurses during 1984-1998



Source: Summary of Vital Statistics
The Statistics and Information Department,
Minister's Secretariat, Ministry of Health and Welfare

Figure 5: The demand for home care nurses during 1986-1999.



Source: Summary of Vital Statistics
The Statistics and Information Department,
Minister's Secretariat, Ministry of Health and Welfare

Another important development in Japan has been its persistent current account surpluses over the past several years (see figure 6). That means, Japan persistently invested abroad more than foreigners invested in Japan. International Investment Position (IIP) is defined as a stock variable consisting of the capital and financial accounts plus the reserve assets in the balance of payments. Table 1 shows the investment position and the composition of Japan's foreign investment in the second half of the nineties. From the table it is clear that Japan's stock of foreign assets, which went down a bit during the Asian crisis

years, has been growing over a long period of time at a high positive rate. Table 1 also shows the stocks of the three components of total foreign assets – (1) direct foreign investment, which is 9.25% of total assets, (2) portfolio foreign investment, which is 41.44% of total assets, and (3) other investments, which is 37.33% of total stock of foreign assets at the end of Year 2000.

Two sources of private capital flows – direct foreign investment and portfolio foreign investment - have grown substantially over the past several years. Where did most of these investments go? From table 2 it is clear that much of the Japanese direct foreign investments went to Europe and to the US, and very little went to less developed countries. Furthermore, even among developing countries, much of Japanese foreign investment went to East Asia.

Figure 6: Japan's current account surplus during 1986-2000.

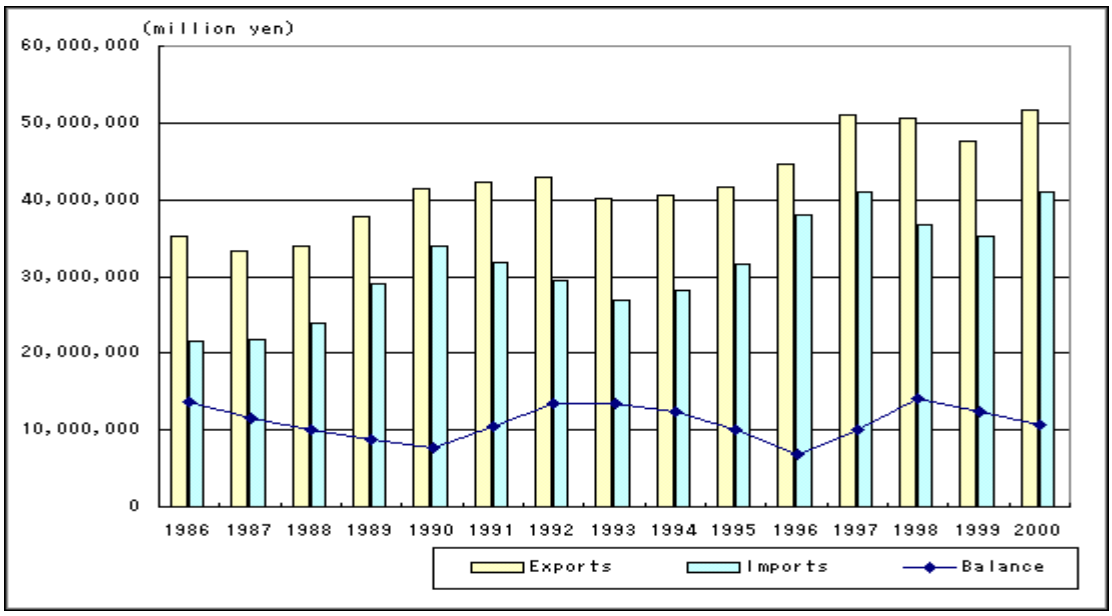


Table 1: International Investment Position of Japan (Asset in Billion Yen)

End of Year	Assets Total	1. Direct Investment	2. Portfolio Investment	(1) Equity Securities	(2) Debt Securities	3. Other Investment
1995	270,738	24,520	88,257	15,040	73,217	139,129
1996	307,703	29,999	108,711	17,968	90,743	143,751
1997	355,731	35,334	117,821	20,632	97,188	173,884
1998	345,132	31,216	122,719	24,205	98,515	166,335
1999	307,989	25,425	127,426	29,161	98,265	125,740
2000	346,099	31,993	143,420	30,130	113,290	129,208

Source: The Bank of Japan

Table 2: Percentage Distribution of Japan's Foreign Direct Investment

FY	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
North America	50.35	47.84	45.31	42.81	42.37	43.27	45.18	47.94	39.63	26.86	37.14	25.26
Latin America	7.74	6.33	8.00	7.95	9.37	12.85	7.55	9.26	11.74	15.86	11.15	10.77
Asia	12.18	12.38	14.26	18.77	18.48	23.56	24.05	24.19	22.57	16.02	10.74	12.21
Europe	21.84	25.11	22.57	20.71	22.17	15.24	16.71	15.35	20.76	34.38	38.69	50.24
Rest of the World	7.90	8.33	9.87	9.76	7.60	5.08	6.52	3.26	5.30	6.88	2.28	1.52

Source: The Bank of Japan

3. The Basic Framework

I consider a simple overlapping generations (OLG) model in which agents live for two periods, adult and old. To incorporate variations in life expectancy among countries, and to keep the analysis analytically manageable, I assume that agents survive the first period with probability one, and he survives the second period with probability π, $0 < \pi \leq 1$. A period in our model would typically mean about 40 years. Assuming that adulthood, i.e., period 1 of

the life-cycle in our model, starts at age 20, the life expectancy in our model is then given by 60 +40π. I assume that Japan has a much higher π than a representative developing country. While gender does not play any role in this paper, I will address everyone in this paper as he instead of she or (s)he.

Denote by c_t^t and c_{t+1}^t respectively the consumption in period *t* and *t* +1 of an adult of period *t*. I further assume that when an agent survives to be old, he does not work and he needs a fixed γ hours of nursing services, $0 < \gamma < 1$. For simplicity of exposition, I assume that it is fixed constant and not a choice variable.[3] A young worker has one unit of labor which he supplies inelastically either to the nursing/medical sector or to the production sector.

Let w_t be the wage rate in period *t*. A young worker earns w_t, pays social security taxes $\tau_t w_t$ and chooses to consume c_t^t and to save s_t. His savings are immediately put into an annuity market which promises to pay $1 + \rho_t$ for each unit of annuity until the agent dies.

The resolution of uncertainty and the savings decisions happen in the following order: First the agent decides his savings, which he immediately puts in the annuity market. Then the uncertainty about his death is resolved. If he survives, he receives $(1+\rho_t)s_t$ when he is old. If he dies, he receives nothing. I assume the existence of an annuity market as a modeling simplification. Other more realistic institutions could be introduced at the cost of extra complications. The agent's expected utility function is given by

(1) $$E(U^t) = u(c_t^t) + \beta\pi u(c_{t+1}^t),$$

He maximizes (1) subject to the following budget constraints:

(2) $$c_t^t + s_t = (1-\tau_t)w_t$$

and

(3) $$c_{t+1}^t + \gamma w_{t+1} = (1+\rho_{t+1})s_t + B_{t+1},$$

where B_{t+1} is the old-age security benefits he receives at his old age. Optimal savings s_t depends on the wage rates w_t and w_{t+1}, on the rate of returns from capital ρ_{t+1}, on the social security benefits B_{t+1} and on the survival probability π.

[3] See Hamada and Raut (2003) for a model in which γ is a choice variable and its implications on aging problems.

I assume that Japan has a defined benefits pay-as-you-go public pension program with the replacement rate μ, which means that a worker is promised by the social security administration to be paid a fraction μ of his adult age wage earnings when he retires. For the less developed countries, I assume that there is no formal social security program. The old-age pension related intergenerational transfers from young to old are, however, performed within the family. More specifically, I assume that an adult of generation *t* transfers a fraction $a_t, 0 < a_t < 1,$ of his wage earnings to his elderly parents. The fraction a_t is determined by social norms.[4] Informal transfers are generally lower than the formal transfers, and thus, the economies with informal system of old-age transfers experience higher fertility rates. I will not make fertility endogenous, but assume that it is higher in less developed countries than in Japan and other OECD countries. Assume that the population is growing exogenously at the rate of *n*, i.e., (*1+ n*) is the fertility rate. Assume that the private annuity markets are actuarially fair. Denote the interest rate between period *t* and *t* + 1 by r_{t+1}. Then the following holds for Japan,

(4J) $B_{t+1} = \mu w_t = (1+n)\tau_{t+1} w_{t+1} / \pi$

and the following for the less developed countries,

(4L) $B_{t+1} = (1+n) a_{t+1} w_{t+1} / \pi.$

Notice that equation (4J) for Japan implies that the social security tax rate is given by $\tau_{t+1} = \dfrac{\mu\pi}{(1+n)(1+g_{t+1})}$, where $1+g_{t+1} = w_{t+1}/w_t$ is the growth in wages between periods *t* and *t+1*. This implies that when fertility rate, *1+n*, goes down as in Japan, unless it maintains a high growth rate in productivity, g_{t+1}, the social security tax rate will be very high to provide the promised replacement rate μ. Notice also that the actuarially fair tax rate τ_{t+1} becomes higher, the higher is the life expectancy, i.e., higher is the survival probability π in our case. Thus, two critical elements of Japan's social security problems are drop in fertility rate *1+n*, and increase in life expectancy or survival probability π. We have assumed π and *n*

[4] See Raut (1991), Raut and Srinivasan (1994), for details of this line of modeling and Raut (1995) for an extended model in which a_t is endogenized by introducing two-sided altruism in a similar overlapping generations framework.

to be exogenously given and fixed over time. An immediate policy implication for aging crises is that Japan must maintain high growth rate of productivity and increase its fertility rate in order to keep the social security tax rate within a viable limit. Higher wage growth has also effect on savings s_t, because it increases the cost of nursing γw_{t+1} relative to w_t.

The assumption about actuarially fair annuity market implies the following:

$$(5) \quad (1+\rho_{t+1})s_t\pi_t L_t = (1+r_{t+1})L_t s_t \Rightarrow 1+\rho_{t+1} = \frac{1+r_{t+1}}{\pi}$$

3.1 Household Decisions

A representative adult of time period t maximizes his expected utility function (1) subject to budget constraints, (2) and (3).

From the budget set, it can be seen that an increase in π has income and substitution effects. Furthermore, the marginal rate of substitution of the expected utility function is also affected by π. I consider the Cobb-Douglas[5] utility function, $u(c) = \ln c$, to derive the optimal solution explicitly. The optimal savings of a representative agent is given by

$$s_t = (1-a_t)w_t - \frac{1}{1+\beta\pi}\left[(1-a_t)w_t + \frac{\pi}{(1+r_{t+1})}\cdot\left(B_{t+1} - \gamma w_{t+1}\right)\right]$$

Substituting the value of B_{t+1} from equation (4L) in the above expression, one has the following:

$$s_t = \frac{\beta\pi}{1+\beta\pi}(1-a_t)w_t - \frac{\left[(1+n)a_{t+1} - \pi\gamma\right]w_{t+1}}{(1+\beta\pi)(1+r_{t+1})}$$

(6)

$$= w_t\left[\frac{\beta\pi}{1+\beta\pi}(1-a_t) - \frac{\left[(1+n)a_{t+1} - \pi\gamma\right](1+g_{t+1})}{(1+\beta\pi)(1+r_{t+1})}\right].$$

It is clear from the above that household savings rate is higher for an economy that has a higher survival probability π or a higher need for nursing services γ; an economy with a lower fertility rate has also a higher savings rate; furthermore, an economy that transfers a higher amount of resources from the young to the old, (i.e., has a higher value for a_{t+1}), has a

[5] Cobb-Douglas utility function implies unit elasticity of inter-temporal substitution.

lower savings rate. In deriving these properties I assumed that w_{t+1} and r_{t+1} remained constant as a result of changes in the above parameters.

3.2 Autarky Equilibrium

Assume that all the economies use a common neoclassical constant returns to scale technology in production of GDP which uses capital and labor as inputs. Assume that the production of GDP is represented by the following production function,

(7) $Y_t = A_t F\left(K_t, b_t L_t\right),$

where A_t represents factor neutral productivity level. I assume it to depend on infrastructure and other social factors that affect the productivity of both capital and labor equally. The variable b_t denotes the efficiency level of a unit of labor in period t. I assume that b_t grows over time at the rate of φ per period, and this growth rate depends on the average education level of the work force of an economy. Notice that the difference in the level of b_t for Japan and a representative LDC determines the wage differences of the two economies, and the difference in the level of A_t determines the difference in interest rates between the countries in the free world capital market equilibrium. In this section, however, I assume that $A_t \equiv 1$ for all *t* and for all countries.

Denote by $\hat{x}_t$ the variable x_t in efficiency unit, i.e., $\hat{x}_t = x_t / b_t$. Let $\hat{y}_t = f\left(\hat{k}_t\right)$ be the output per unit of labor in efficiency unit when capital labor ratio in efficiency unit is $\hat{k}_t$.

I assume that capital lasts for one period and savings take one period to gestate before it becomes capital. The annuity firm invests all its receipts $L_t s_t$, in the capital market. Thus the next period's capital stock is given by $K_{t+1} = L_t s_t$. The labor in the productive sector is then given by

(8) $\overline{L}_{t+1} = (1+n)L_t - \pi\gamma L_t ,$

The second term in the above represents labor needed to meet nursing/medical care of the surviving olds.

Note that the capital labor ratio in efficiency unit $\hat{k}_{t+1}$ in period *t + 1* is then given by

(9) $$\hat{k}_{t+1} = \frac{K_{t+1}}{b_{t+1}\bar{L}_{t+1}} = \frac{s_t}{b_{t+1}\left[(1+n)-\pi\gamma\right]}.$$

Under the assumption that all markets are competitive, it follows that

(10) $$\hat{w}_t = f(\hat{k}_t) - \hat{k}_t f'\left(\hat{k}_t\right) \equiv \omega\left(\hat{k}_t\right),$$

and

(11) $$1 + r_t = f'(\hat{k}_t).$$

I denote the solution of equation (11) for $\hat{k}_{t+1}$ as a function of r_{t+1} by $\hat{k}_{t+1} = \kappa\left(r_{t+1}\right)$, which determines the demand for capital per unit of efficiency labor, and it can be shown easily that it is a standard downward slopping curve as shown in figure 7 below.

The supply of capital labor ratio in efficiency unit can be easily derived by substituting equation (6) in equation (9). I have shown the supply curves for Japan and a representative LDC in figure 7.

To study the equilibrium dynamics of the closed economy, I derive the fundamental difference equation of the economy in terms of capital labor ratio in efficiency unit. Note that from equation (9), it follows that $s_t = \left[\left(1+n\right)-\pi\gamma\right]\hat{k}_{t+1}b_{t+1}$. Substituting this in the first part of equation (6), one has

(12) $$\left[\left(1+n\right)-\pi\gamma\right]\hat{k}_{t+1} = \frac{\beta\pi}{1+\beta\pi}\left(1-a_t\right)\frac{\omega\left(\hat{k}_t\right)}{1+\phi} - \frac{\left[\left(1+n\right)a_{t+1}-\pi\gamma\right]R\left(\hat{k}_{t+1}\right)}{1+\beta\pi},$$

where $R(\hat{k}) = \left[f(\hat{k}) - \hat{k}f'\left(\hat{k}\right)\right] / f'\left(\hat{k}\right)$, the efficiency wage-rental ratio as a function of capital labor ratio in efficiency unit. Equation (12) implicitly defines a first order non-linear difference equation $\hat{k}_t$. For Cobb-Douglas production function, the above provides an explicit first order difference equation as follows:

(13) $$\hat{k}_{t+1} = \frac{\beta\pi\left(1-a_t\right)\sigma\left(1-\sigma\right)}{\left(1+\phi\right)\left[\left((1+n)-\pi\gamma\right)(1+\beta\pi)\sigma + \left((1+n)a_{t+1}-\pi\gamma\right)(1-\sigma)\right]} \cdot \hat{k}_t^{\sigma}.$$

The above difference equation exhibits the same type of phase diagram as in a standard neoclassical growth model. I assume that a_t is constant over time. Under this assumption, it is clear that the autarky equilibrium dynamics of the capital labor ratio in efficiency unit has same type of phase diagram as the neoclassical growth model. For the above Cobb-Douglas

case, the explicit solution for the steady-state capital labor ratio in efficiency unit, $\hat{k}^*$, is given by

$$(14) \qquad \hat{k}^* = \left[\frac{\beta\pi(1-a)\sigma(1-\sigma)}{(1+\phi)\left[((1+n)-\pi\gamma)(1+\beta\pi)\sigma+((1+n)a-\pi\gamma)(1-\sigma)\right]} \right]^{\frac{1}{1-\sigma}}.$$

It follows from equation (14) that the lower the population growth rate n, or the higher the life expectancy π, or the higher the social security transfers rate a is the higher is the balanced growth capital-labor ratio in efficiency unit $\hat{k}^*$ and the higher is the growth in capital labor ratio in efficiency unit. Thus Japan, expecting a higher life-expectancy and a lower fertility rate saved relatively more than a representative less developed country, even after countering the opposite effect of social security on savings. Since in each period the autarky interest rate in Japan is lower than in developing countries, there would be a drive for capital to flow from Japan to developing countries. See figure 7 for details.

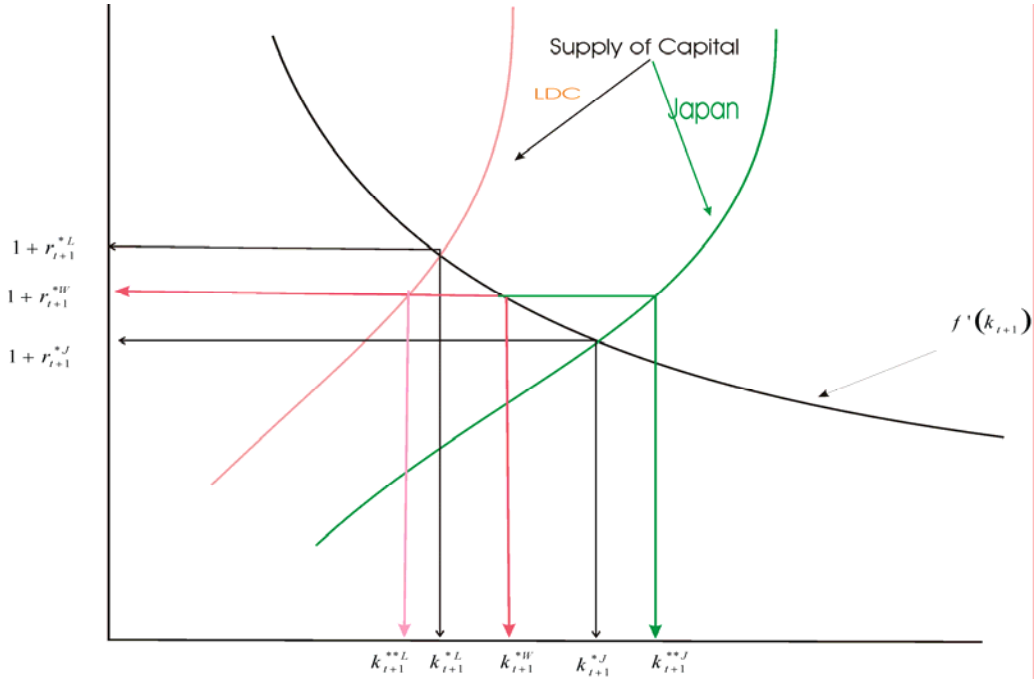


Figure 7: Determination of world interest rate and the direction of capital flow.

3.3 Predicted savings rate in the calibrated model.

There has been a long-standing controversy over Japan's high savings rate. Most studies find the Japanese household savings rate to be around 12% (see, for instance, Horioka (1997)), and the Japanese national savings rate to be a little less than 30% in the

nineteen eighties. Some argue that these savings figures are too high as compared to other OECD countries, and that the saving rate would be much smaller when depreciation and government expenditures are properly taken into account, see, for instance, Hayashi (1986, 1989). I use our highly aggregative model to compute the predicted household savings rates and national savings rates for Japan and the representative developing country after calibrating the model as follows:

I first assume that $\gamma = 0$. As I pointed out earlier, I take each of adulthood and old-age periods to be 40 years, and the young-age period to be 20 years. Taking Japan's life expectancy to be 80 years, and noting that life expectancy in our model is given by $60+40\pi$, I calibrate π for Japan to be $\pi = 0.5$. I assume the average annual growth rate of labor productivity to be 2.5%. I take the annual rate of time preference ρ to be .0075 which yields the discount factor in the utility function $\beta = 1/(1+\rho)^{40} = 0.7416$.

The two-tier social security program in Japan does not have an explicit replacement rule. But the benefits are estimated to be equivalent to a replacement ratio of around 70% (see Horlacher (undated). So I take $\mu = 0.70$. Furthermore, I take the annual growth rate of population to be 0.1% and the non-social security related payroll tax rate to be 15%. Given parameters μ, ϕ, π and n, one can find a corresponding social security tax rate a from equation (4J). For the above parameter values, assuming the economy is in the stationary state, the model predicts the household savings rate of Japan to be 9.91%, and assuming σ in the Cobb-Douglas production function to be 0.33, the model predicts the domestic savings rate to be 30.19%.

It is unrealistic to have $\gamma = 0$. To be more realistic and to examine the effect of elderly care on savings behavior, I assume that an elderly requires on the average an hour of nursing services a day which is about 5% of the 18 hour day of an adult, i.e. $\gamma = 0.05$. The calibrated model predicts the stationary state household savings rate in Japan to be 11.35% and the domestic savings rate to be 34.39%. The calibrated model gives us a capital labor ratio in efficiency unit of 0.0487, yielding an annual interest rate of 2.3%. I take these parameter values to calibrate the Japanese economy in the rest of the paper.

For the representative developing country, I take the parameter values to be the same as the Japanese parameter values with the following exceptions. I take the non-social

security pay-roll tax rate to be 5%, the social security replacement rate to be 30%, the life expectancy to be 65 years, the annual population growth rate to be 2%. The calibrated model of the representative developing country predicts its stationary state household savings rate to be 7.49%, the domestic savings rate to be 22.71%, capital labor ratio in efficiency unit to be 0.00493 and the annual interest rate to be 6.68%.

Both for Japan and the representative developing country, the predicted values are close to the observed values. From these simulated results it appears that the savings rates are higher for economies that have higher life expectancies, and lower fertility rates.

3.4 Aging and dynamic inefficiency

If workers expect to live longer, they would save a larger portion of their incomes to provide for their longer retirement years. Thus in an aging economy private decisions guided by self-interests may lead to socially undesirable outcomes of over-accumulation of capital in the sense that the marginal product of capital falls below the growth rate of the economy. This is known in the economics literature as dynamic inefficiency. In such economies if everyone were forced to consume more and save less, all the agents could be made better-off (Samuelson (1958), Diamond (1965)). In closed economy growth models, social security program can be designed to remove dynamic inefficiency. In the context of global aging there are, however, other ways to handle dynamic inefficiency. If part of the savings of the aging economy is invested in a developing country, or some immigrant workers are brought in from developing countries, the capital labor ratio of the aging economy will fall and the dynamic inefficiency could be removed. Furthermore, the taxes from the migrant workers and the excess interest incomes earned from exported capital could be used to finance social security. Which of these two options is better? In this section I first derive the condition for dynamic inefficiency and then examine if the calibrated Japanese economy inherits dynamic inefficiency. In the next section, I examine the choice between these two policy options.

To derive conditions for dynamic inefficiency one solves the social planner's problem in the stationary state. The social planner decides how much of the per capita output should be allocated for capital formation and how the remaining output for consumption should be

allocated between the young and the old in each period so that a representative individual attains the maximum welfare. More formally, the social planner's choices are c_y and c_o, the consumption level of a representative young and a representative old, and $\hat{k}$, the capital labor ratio in efficiency unit of an economy in stationary state. Then the welfare level of a representative agent is $u(c_y, c_o)$ and the feasible choices satisfy the following equation:

$$L_t c_y + \pi L_{t-1} c_o + L_{t+1} b_{t+1} \hat{k} = b_t L_t F(\hat{k}, 1)$$

which after algebraic manipulations becomes

$$\hat{c}_y + \frac{\pi}{1+n} \hat{c}_o = f(\hat{k}) - (1+n)(1+\phi)\hat{k}$$

Under the assumption that the utility function is homothetic, it is easily seen that social planner's problem is broken into two parts: The first problem is to choose the capital labor ratio in efficiency unit $\hat{k}$ such that $f(\hat{k}) - (1+n)(1+\phi)\hat{k}$ is maximized and the second problem is to divide this maximum available consumption between old and young. The first order condition for the first problem is given by $f'(\hat{k}) = (1+n)(1+\phi)$, which is known as the Golden rule of capital accumulation. Is it possible that in aging economies the private decisions may lead to excessive savings and hence too much capital labor ratio in efficiency unit such the marginal product of capital $f'(\hat{k})$ is smaller than the growth of the economy $(1+n)(1+\phi)$, i.e., the economy is dynamically inefficient? I investigate this using the calibrated models of Japan and the representative developing country.

For Japan, the stationary state capital labor ratio in efficiency unit is $\hat{k}_J = 0.04868636004$. The marginal product of capital over the 40 years period is 2.50 which is less than the growth rate of the economy $(1+n_J)(1+\phi_J) = 2.79$. Thus the Japanese economy inherits dynamic inefficiency. For the representative developing country, the stationary state capital labor ratio in efficiency unit is $\hat{k}_L = 0.004030703332$. The marginal product of capital over the 40 years period is 13.27 which is higher than the growth rate of the economy $(1+n_L)(1+\phi_L) = 5.93$. Thus the representative developing country does not exhibit dynamic inefficiency. I also found that if Japan had the population growth rate and life expectancy of the representative developing country, Japan would not have dynamic

inefficiency. Thus we conclude that in Japanese economy there is dynamic inefficiency and the dynamic inefficiency is the result of its aging population.

4. The World Capital and Labor Markets

To analyze whether foreign investment or immigration of labor could remove dynamic inefficiency of Japan and which of the two is a better choice from the point of view of social security financing, we need to examine the equilibrium in the world capital and labor markets. From equations (9) and (6) it is clear that Japan with a higher π and a lower fertility rate *n* will have a higher capital-labor ratio in autarky as compared to the rest of the world. That means, Japan's autarky interest rate is lower and the wage rate is higher than the rest of the world.

Suppose the world interest rate between period *t* and *t+1* is denoted by r^*_{t+1}. Let $w\left(r^*_{t+1}\right) \equiv \omega\left(\kappa\left(r^*_{t+1}\right)\right)$ be the corresponding wage rate (in the wage-rental rate frontier). The current account balance CA_t in period *t* is the net change in the value of its net claims on the rest of the world, which in our case is the total export after domestic absorption. The capital account balance in the balance of payment statistics is the net sale of assets to foreigners. Each dollar surplus of current account is a dollar negative sale (i.e., purchase) of foreign asset. In the one good case, which is used for both consumption and investment, exports of the good is same as the investment abroad, i.e., the payment for obtaining equal amount of foreign asset, measured in the unit of the good. Thus, in the simple one good case, it is enough to work with the current account balance. The current account balance at time t in our framework is given by,

$$(15) \quad \frac{CA_t\left(r^*_{t+1}\right)}{L_t} = \left[\frac{\beta\pi}{1+\beta\pi}(1-a_t)\hat{w}_t - \frac{\left[(1+n)a_{t+1} - \pi\gamma\right]\hat{\omega}\left(r^*_{t+1}\right)}{(1+\beta\pi)(1+r^*_{t+1})}\right] - (1+n)\hat{\kappa}(r^*_{t+1})$$

It is clear from the above that the current account balance over a long period of time and hence the international investment position over a long period of time is affected by the demographic factors such as fertility rate and life expectancy.

The world equilibrium interest rate between period t and t+1 r^*_{t+1} is obtained by solving the following:

(16) $$CA^J_t\left(r^*_{t+1}\right) + CA^L_t\left(r^*_{t+1}\right) = 0.$$

In the world equilibrium with free capital flows, capital would flow from Japan to the rest of the world. Figure 7 shows the potential amount of capital outflow in this period.

Note that under free capital mobility or free labor mobility or both, and under the assumption that there is no difference in technology or in infrastructure between countries, capital labor ratio in efficiency unit is going to be the same in all economies, and this common capital labor ratio in efficiency unit in period t+1 is given by

(17) $$\hat{k}_{t+1} = \frac{L^J_t \cdot s^J_t + L^L_t \cdot s^L_t}{\hat{L}^J_{t+1} + \hat{L}^L_{t+1}}.$$

After some algebraic manipulations (17) becomes,

(18) $$\hat{k}_{t+1} = \frac{\hat{s}^J_t + \hat{\theta}_t \cdot \hat{s}^L_t}{\left(1+\varphi^J\right)\left[\left(1+n^J\right) - \pi^J\gamma\right] + \hat{\theta}_t \cdot \left(1+\varphi^L\right)\left[\left(1+n^L\right) - \pi^L\gamma\right]},$$

where $\hat{\theta}_t = \frac{b^L_t}{b^J_t} \cdot \frac{L^L_t}{L^J_t}$. The first term in $\hat{\theta}_t$ also represents the ratio of wages between the representative LDC and Japan, and the second term represents the ratio of working population sizes of a representative LDC and Japan.

Substituting the values of $\hat{s}_t$ for Japan and the representative LDC from equation (6) in equation (18), and assuming Cobb-Douglas production function $f(k) = k^\sigma$, I derive the following first order difference equation for the world capital labor ratio in efficiency unit,

(19) $$\hat{k}_{t+1} = \frac{\left[\frac{\beta\pi^J}{1+\beta\pi^J}\left(1-a^J\right) + \hat{\theta}_t \frac{\beta\pi^L}{1+\beta\pi^L}\left(1-a^L\right)\right](1-\sigma)}{\frac{\left[\left(1+n^J\right)a^J - \gamma\pi^J\right]\left(1+\varphi^J\right)}{\sigma\left(1+\beta\pi^J\right)/\left(1+\beta\pi^J\sigma\right)} + \hat{\theta}_t \frac{\left[\left(1+n^L\right)a^L - \gamma\pi^L\right]\left(1+\varphi^L\right)}{\sigma\left(1+\beta\pi^L\right)/\left(1+\beta\pi^L\sigma\right)}} \cdot \hat{k}^\sigma_t.$$

The dynamics of the world economy depends on the exogenous dynamics of $\hat{\theta}_t$, and demographics and productivity growth rates of the economies. If we assume that $\hat{\theta}_t$ is constant over time, then the dynamics of the world capital labor ratio has the same standard properties of a neoclassical growth model.

It is not possible to determine the long-run behavior of the world economy without further assumptions about how the fertility rate and life expectancy in the developing country evolve over time. The crucial parameter is the dynamics of $\hat{\theta}_t$. For simplicity I assume that fertility and life expectancy in the representative developing country remains at its current level. Which means $\hat{\theta}_t$ tends to infinity, i.e., in the long-run the world economy will converge to the autarky steady-state of the representative developing country. We use this assumption to carry out our policy analysis.

4.1 Immigration or Foreign Investment?

Until the post World War II, Japan had mostly out migration of labor. After the war, and because of rapid demographic transitions, Japan faced labor shortages. To meet labor shortages Japan allowed limited immigration of foreign workers. The relative size of immigrant workers in Japan is, however, much lower than most OECD countries. There are many social factors and political factors that determine immigration policies. I will not get into the details in this paper. I use the current model to examine if immigration is a better option vis-à-vis foreign capital investment to cope with aging problems and to achieve economic efficiency.

Is it possible that a dynamically inefficient aging economy can achieve dynamic efficiency and hence Pareto optimality if the economy opens up its capital account or its door to immigration?[6] It is clear from figure 7 that Japan and other OECD countries will have a higher marginal product of capital once they invest abroad or allow immigration, and it is quite possible that the marginal product of capital as a result will become higher than the growth of the economy. Hence from efficiency point of view, it is better for an aging economy with over accumulated capital to allow immigration or invest abroad. Both policies will, however, lead to the same efficiency gains and thus the efficiency criterion by itself cannot sort out which of the two is a better policy option.

In an extreme case, however, our model has an unambiguous prescription for immigration over foreign capital investment. With a lower population growth rate, and a

[6] I am grateful to an anonymous referee who suggested that I explore this issue.

higher life expectancy in Japan, there is a higher demand for labor in the elderly care sector. This will lead to a huge shift of labor from industries to health and elderly care service sector. Consider the extreme case within our framework by supposing that $\gamma\pi L_t > (1 + n) L_t$, *i.e.*, hours needed to nurse the survived old is greater than the total hours available from all young adult population. In this extreme case it is obvious that immigration of workers is essential.

Suppose that the labor shortage is not a serious problem. Which of the two options is better for Japan? A number of authors in the international economics literature studied this issue from national advantage point of view. In a seminal paper, Ramaswami (1968) considered a world with two countries say Japan and a developing country, each producing a single good using identical technology, and two factors of production, capital and labor. He showed that a capital rich country such as Japan can ensure a higher gross national income by optimally taxing its capital outflow or immigration of labors as compared to using a quota for capital outflow or labor inflow. These policies are better than allowing capital and labor to move freely and competitively across the two regions. Between the options of foreign investment with optimal taxation and import of foreign labor with discriminatory taxation of labor, he established that import of labor can produce a higher income for Japan and other OECD countries than foreign investment. The economic intuition behind this result is as follows: Suppose Japan pulls out its foreign investment and the labor working on it from the less developed countries and invests in an isolated island in Japan. The capital labor ratio in this island will remain same as when this capital was invested in the less developed countries. Thus the income from this capital in the island after paying the imported labor their marginal product is going to be same as when this capital was invested in the developing country. If the capital and labor can now freely move between the island and the rest of Japan, there will be a uniform capital labor ratio which is higher than the capital labor ratio of the island and lower than the rest of the economy. This produces a higher level of income and a higher wage rate for the immigrants and a lower wage rate for the natives. If the foreign workers are taxed away the gains in their wages, Japan can ensure a higher income than what it obtained from foreign investment.

Discriminatory payroll taxation of foreign workers is, however, problematic for most

host countries. Furthermore, the well-being and income of which country - the host country or the country of origin – that the immigrants be counted in? Taking these issues into account, Bhagwati and Srinivasan (1983) further refined this line of research, again from the national advantage point of view. Bhagwati and Hamada (1982) extended this analysis to include brain-drain issues. This line of research, however, assumes that the OECD countries have national monopoly in implementing the optimal discriminatory tax policies. Given that there are many OECD countries which will compete for the same investment opportunities in the developing countries and for the same pool of immigrant labors from the developing countries, it is reasonable to assume that the world capital and labor markets are competitive. It is then well-known that under the assumption that all countries share the same technology and have the common labor productivity, there is no particular advantage for a country to export capital or import labor. Either of the two policies, or any mixture of the two will lead to the same gain in income (Bhagwati and Srinivasan (1983)). Furthermore, either policy will be also able to remove the dynamic inefficiency problem that I mentioned earlier. However, I would like to argue that when labor productivity differs between OECD and developing countries, two policies are not equivalent. Furthermore, these two policy options will differ from the point of view of the public social security finances.

To investigate this I assume that A_t is identically equal to 1 in all periods for all economies and that both Japan and the representative LDC are in their stationary states. Let $\hat{w}_J$ and $\hat{w}_L$ be the steady-state wage rates of a unit of efficiency labor in Japan and in the representative developing country as given in equation (10). From the calibrated model I estimate these to be $\hat{w}_J = 0.2471$ and $\hat{w}_L = 0.1086$. To calculate b_t^J, the labor productivity level in Japan in period t, and b_t^L, the productivity level of labor in period t in the representative developing country, I take the current wage rate of Japan to be w_t^J = \$14,740 and the current wage rate of the representative developing country to be w_t^L = \$2010. Note that in the stationary state we have $w_t^J = b_t^J \hat{w}_J$ and $w_t^L = b_t^L \hat{w}_L$ in period t. From these relationships, I estimate the current productivity level of a unit of labor to be $b_t^J = 59645.58$ in Japan and $b_t^L = 18507.41$ in the representative developing country. From these estimates

it appears that a unit of labor in Japan is b_t^J / b_t^L = 3.223 times more productive than a unit of labor in the representative developing country.

I now examine whether foreign investment or immigration of labor is a better solution to the aging problems in Japan. There are many effects of these policies, but I restrict only to the following partial equilibrium marginal analysis: Consider the option that Japan invests k_t^J amount of capital in the representative developing country and taxes the gains in capital incomes $(r_L - r_J)k_t^J$. Alternative policy option is that Japan brings in a guest worker from the representative developing country to work on the capital k_t^J and collects the social security taxes. Which option is better from the point of view of financing of social security? The answer depends crucially on the productivity level of the immigrant worker. What would be the productivity level of the immigrant labor in Japan? For simplicity I contrast two cases: <u>One</u>, the productivity level of the immigrant labor is same as in his home country and I interpret this as immigration of unskilled labor. <u>Second</u>, the productivity level of the immigrant labor is same as the productivity level of the Japanese worker after the worker moves to Japan and I interpret this as immigration of skilled labor. There are, however, other interpretations that are consistent with these assumptions and furthermore, the productivity level of the immigrant worker could be anywhere between these two extremes. While government also collects payroll taxes form the guest workers, I disregard this effect, assuming that the immigrant worker consumes public goods such as health care and education in commensurate with his payroll tax contribution. I also assume that in the long-run the developing countries dominate the world markets.

With respect to gains in income of each region of the world, two policies are equivalent under the first assumption, and the import of labor policy is better than the policy of foreign investment under the second assumption. With respect to public financing of social security for Japan, I will use the calibrated model to show that the foreign investment is a better policy option under the first assumption, and the import of labor is a better policy option under the second assumption.

From the calibrated model, I compute the current capital labor ratio to be k_t^J = 2903.9262. Over the 40 years period, the revenue from foreign investment of this much of

capital is $31,278.46. The contribution to social security by an immigrant worker over the 40 years period is $22,912.64 when the immigrant worker is an unskilled worker and is $73,842.74 when the immigrant worker is a skilled worker. Thus, if the immigrant worker's productivity level is close to or higher than the productivity level of a Japanese worker, the immigration of labor is a better option than foreign investment. But on the other hand, if the immigrant worker's productivity level in Japan is close to the productivity level in the representative developing country, foreign investment is a better option than immigration of labor.

There are other considerations in the choice between the two options. Many economists have argued that investment abroad is preferred over immigration since immigrant workers may cause social tensions in a homogeneous population such as in Japan. It is important to note that the investment abroad instead of immigration of workers has also its side effects on Japanese workers. For instance, with more foreign capital outflow, many Japanese workers will lose their jobs or will be forced to accept lower wages and benefits. This can happen even to skilled workers similar to what has been currently happening to skilled workers in the US software and telecommunications industries as more and more such jobs are outsourced to India and other developing countries.

While the model does not provide a clear-cut guidance for the choice and since immigration policies are more difficult to implement politically and socially, the foreign investment option may win a slight edge. It is, however, important to keep in mind that the US economy does not have serious aging problems because of their more liberal open door immigration policies. In the next section I turn to the empirical investigation of why then much of capital from Japan and other OECD countries do not flow into developing countries.

5. Why too little capital flows into less developed countries?

From figure 7 and the discussions in the previous section it is clear that demographic mismatch between Japan and LDCs creates an environment in which Japan would benefit from investing in less developed countries. In section 2 we saw, however, that not much capital flows from Japan to LDCs. **Why?**

Could it be due to lack of demand in LDCs? Even though many developing countries had misgivings about foreign capital, because of their past colonial bad experiences or some other internal vested interests, in recent years most developing countries welcome foreign capital since foreign capital if invested properly enhances economic growth. Direct foreign investment is likely to have higher impact on economic growth than portfolio foreign investment. To find empirical support for these claims, I carried out a cross country regression analysis to estimate the effect of two types of foreign investments and a few other standard determinants on economic growth. Table 3 shows the parameter estimates for two sets of countries – one set containing all LDCs with per capita income less than US$12000 (measured in constant 1995 US dollars) in 1997 and the second set consists of all countries, including the OECD countries. The estimates are based on the three years averages of all the variables from 1988 to 1997. I had to drop the countries with inadequate data and ended up with 96 countries in the first group and 111 countries in the second group. As determinants of growth, I included direct foreign investment as percent of GDP, private capital flow as percentage of GDP together with the other standard determinants of economic growth such as savings rate, population growth rate, public spending on education as percentage of GNP as a measure of investment in human capital. I also included among determinants the number of telephone mainlines per 1,000 population in each country as a measure of infrastructure.

It has been argued that governance plays a significant role in the growth process and in attracting foreign investment. There are many aspects of governance. The world Bank collected data on five aspects – (1) Voice Accountability (2) Political Stability (3) Government Effectiveness (4) Rule of Law and (5) Control of Corruption (see Kaufmann, Kraay and Zoido-Lobaton (2002) for details on how these variables were created). Since the standard socio-economic indicators that are generally used in cross country growth regressions might be correlated with these governance variables, I modify these variables by purging out the effects of the standard socio-economic indicators.

Table 3 reports the parameter estimates for both samples. From these estimates it appears that while direct foreign investment has positive effect on income growth, the other form of private capital flows has no significant effect. A country, especially a less developed

country generally prefers direct foreign investment over the other forms of private capital flows since FDI brings along better technology and management of the host country, and since the risk of the return from capital investment is borne by the source country, whereas in the other forms of private capital flows the risk is borne by the host country and furthermore the latter type of foreign investment introduces a greater risk of financial crisis.

Notice that out of the five aspects of governance, only the rule of law has a significant positive effect on growth in per capita income for both sets of countries, and the control of corruption has a positive effect on growth for less developed countries.

Table 3: The Determinants of Growth in Per Capita Income

Variables	Only LDCs	All countries
Intercept	2.420	3.043
	(2.05)	(3.09)
Direct Foreign Investment	1.123	0.527
	(4.03)	(2.83)
Private Capital Flow	-0.052	-0.015
	(1.20)	(0.49)
Savings Rate	0.0004	0.034
	(0.02)	(1.39)
Population Growth Rate	0.306	0.057
	(0.86)	(0.198)
Expenditure on Education	-0.711	-0.679
	(4.39)	(4.77)
Telecommunication	-0.005	0.001
	(0.77)	(0.30)
Per Capita Income	0.4E-3	-0.8E-5
	(1.76)	(0.38)
Voice Accountability	-0.311	-0.008
	(0.47)	(0.01)
Political Stability	0.038	-0.101
	(0.05)	(0.16)
Government Effectiveness	-0.109	-0.009
	(0.10)	(0.01)
Rule of Law	1.707	1.959
	(1.73)	(2.29)
Control of Corruption	2.236	1.433
	(1.76)	(1.34)
No. of countries	96	111
R^2	0.2272	0.1887

Note: Absolute value of the t-statistic is in parenthesis under a parameter estimate.

Based on our finding that the foreign direct investment has a significant positive effect on growth of per capita income after controlling for other standard determinants of growth, one would expect that much of the private capital flows, especially direct foreign investment would flow from Japan to less developed countries. But we saw in section 2 that the bulk of the Japanese DFI flew to other developed countries, and very little to less developed countries. The natural question is then what determines private foreign capital inflow of a host country?

The main determinants of any private investment are the rate of returns and the riskiness of the investment. In the international context, there is also empirical evidence for home bias. We saw in section 3 that the rate of returns in less developed countries would be higher than in Japan under the assumption that all countries share the same technology, infrastructure and technological capability. But in reality LDCs have poorer technology, infrastructure and technological capability than Japan and other OCED countries. I empirically examine the effects of these factors on foreign capital inflow of a country. Another important determinant of foreign investment is the risk perceived by the foreign investors. The main determinants of this type of risk are political instability, corruption and bad governance. I now examine how these factors affect foreign capital inflow into a host country.

There are several ways economists looked for determinants of capital flows. For instance, Higgins (998) used cross country regression to examine how age structure affects savings, and the savings investment gap, i.e., foreign capital inflow. Obstfeld and Rogoff (1996) employed a present value model of current account, Lane and Milesi-Ferretti (2001) used an error correction model (ECM) to empirically determine the nature of capital flows and some of the economic and demographic variables that are related to each other in the long-run. Urata (1998) used a survey of Japanese enterprises to determine statistically the most effective practices of the Japanese firms that lead to higher direct foreign investment of the Japanese multinationals.

I used the same two sets of sample countries mentioned earlier and ran regressions on the three year averages during 1988-1997 to examine the determinants of direct foreign investments and other forms of private capital flows. The results are shown in

table 4. The theory of section 3 predicted that higher is the population growth rate, the higher would be the amount of foreign capital flow into a country, and the opposite is the case with life expectancy. The parameter estimates, however, show that only the effect of population growth is significant and its sign is consistent with the prediction of the theory. The effect of life expectancy is, however, not significant in any of the regression estimates. The effects of other variables are discussed in the following subsections.

Table 4: Regression Estimates of the determinants of FDI and Private Capital flows

Variables	Direct Investment Foreign		Private Capital Flows	
	Only LDCs	All countries	Only LDCs	All countries
Intercept	0.270	-0.203	-6.816	-4.227
	(0.34)	(0.20)	(1.34)	(0.66)
Population growth rate	0.035	0.209	1.219	0.823
	(0.37)	(1.92)	(2.03)	(1.18)
Life Expectancy	-0.001	-0.005	0.067	0.026
	(0.13)	(0.39)	(0.91)	(0.28)
Expenditure on Education	0.081	0.125	0.637	0.765
	(2.00)	(2.52)	(2.45)	(2.40)
Telecommunication	0.002	0.006	0.024	0.026
	(1.40)	(4.66)	(2.41)	(3.03)
Per Capita Income	0.7E-4	0.3E-4	0.2E-3	0.0003
	(1.33)	(1.46)	(0.62)	(1.91)
Voice Accountability	0.179	-0.014	1.677	1.150
	(1.06)	(0.07)	(1.56)	(0.86)
Political Stability	-0.079	-0.03	1.188	1.392
	(0.42)	(0.14)	(1.00)	(0.94)
Government Effectiveness	-0.026	0.174	0.653	2.514
	(0.09)	(0.50)	(0.36)	(1.13)
Rule of Law	-0.126	-0.420	-1.978	-2.891
	(0.50)	(1.37)	(1.23)	(1.48)
Control of Corruption	0.622	1.071	-2.134	-0.975
	(1.93)	(2.80)	(1.03)	(0.40)
No. of countries	96	111	96	111
R^2	0.158	0.516	0.177	0.416

Note: Absolute value of the t-statistic is in parenthesis under a parameter estimate.

5.1 Corruptions and Poor Governance in the Host LDC

I used five revised measures of governance after purging out the effects of other right hand side variables that are listed in table 4. Out of the five aspects of governance, only the control of corruption has a significant positive effect on direct foreign investment for both sets of countries. None of these variables has significant effect on private portfolio capital investment.

5.2 Low human capital level of less developed countries

Assume that there are no barriers to free capital movement, and that both Japan and the representative LDC have the same level of infrastructure capital, and normalize this common level of infrastructure capital to $A_t = 1$ in all periods. Assume that the representative LDC and Japan, however, differ in their level of human capital b_t. Japan with much higher average education level has a higher growth rate of b_t and thus a much higher level of human capital in all periods. As shown in the previous section, when capital moves freely, the interest rates and hence capital labor ratio in efficiency units must equate between LDCs and Japan. If the human capital level of the representative LDC is very low relative to the human capital level of Japan, Japan will have substantially high number of effective labor, and the capital will rather flow from the representative LDC to Japan in that case, or at least it will reduce Japanese capital flow into the representative LDC. In this case, Japanese wage rate will also be substantially higher than that of the representative LDC. Thus, this explanation is also consistent with the observed wage differentials between Japan and LDCs. If this is the case, then the choice between immigration of workers and exporting capital is clear: It is beneficial to bring skilled workers, preferably temporary guest workers such as IT (Information Technology) specialists into Japan.

The parameter estimates show that the level of human capital has positive effect on both types of capital flows for both sets of countries.

5.3 Poor Infrastructure in less developed countries

In contrast to the previous two subsections, assume now that there is no difference in human capital level of Japan and the representative LDC, and without loss of generality normalize $b_t = 1$ for all t. Assume also that there are no barriers to capital flow but the infrastructure capital stock A_t is low in less developed country. Infrastructure in our set-up includes transportation system, telecommunication system, and legal system to enforce contacts. It follows then that the autarky interest rate and the wage rate in the representative LDC will be lower than those in Japan. This is consistent with the pattern of capital flow we saw in section 2 and the observed wage differentials between LDCs and OECD countries.

I did not readily find a good measure of infrastructure in the World Development Indicators database of the World Bank. I used a simple measure, namely the variable telecommunication, which measures the telephone mainlines (per 1,000 people). It appears that a better infrastructure of a host country attracts a higher level of foreign capital of both types.

In this case then what will be the right kind of policy for Japanese aging problem? The policy prescription would be that instead of investing only in manufacturing sector, as Japan has generally done so far, Japan should increase its capital flow into LDCs and allocate the investment funds appropriately between the manufacturing and the infrastructure sectors. This strategy can be shared with other official international investments or private investments from other countries. This strategy can produce a higher rate of returns from foreign investment in LDCs than the existing low rate. Moreover, it will ease the resource requirements of Japanese social security system. The populations of the less developed countries will benefit from such foreign investment. This kind of policies might be, however, hard to implement since it involves another sovereign government.

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