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WHO CARES ABOUT THE DAY AFTER TOMORROW? PENSION ISSUES WHEN HOUSEHOLDS ARE MYOPIC OR TIME INCONSISTENT

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Abstract

Pension economics has traditionally guided pension policy with the help of formal models based on individuals who think in a life cycle context with perfect foresight, full information, and in a time-consistent manner. This paper sheds light on selected aspects of pension economics when these assumptions do not hold. We focus on three aspects which are particularly relevant for the quickly aging Asian economies: the volume of savings for old-age provisions, international diversification of retirement savings, and global spillover effects of pension reforms.

Keywords: Population aging, social security, life-cycle saving, public insurance, pension reform, retirement age.

JEL Classification: C68, D91, E21, F21, H55, J11, J26

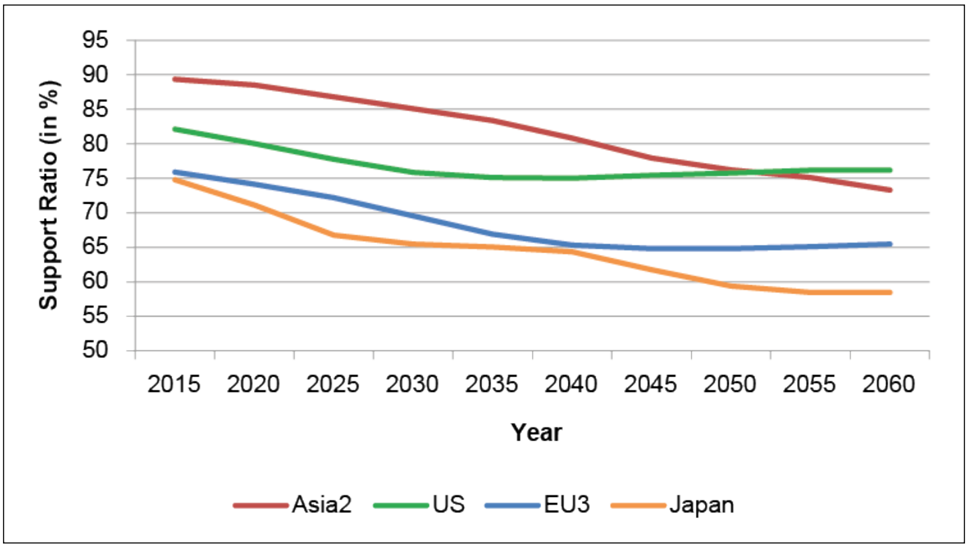
Contents

1. INTRODUCTION

The uncertain future of public and private pension systems is a topic of high priority and large controversy. The pressures on pension systems are particularly pronounced in Asia and Europe—in Europe, because the number of retirees per number of workers is already very high and still increasing until about 2050, and in Asia, because the speed of population aging is so fast. This strain will affect all types of pension systems, whether they are pay-as-you-go (PAYG), fully funded (FF), defined benefit (DB), or defined contribution (DC), albeit to a different extent.

Figure 1 shows the support ratio – the number of individual in working age, here defined as ages 15–64, divided by total population size—for four countries/country groups. Japan features the most progressed aging process in the world and has a large PAYG-financed public pension system. EU3 denotes the three largest countries of Continental Europe—France, Germany, and Italy. These countries have also substantially aged and have similarly large public PAYG pension systems as Japan. In turn, the United States (US) has a much smaller Social Security system and a much less pronounced population aging process. Finally, Asia2 denotes the People's Republic of China (PRC) and India, which have very small pension systems, are still young but will face a very fast aging process in the future. After 2050, the Asia2 countries will actually have a lower support ratio than the US.

Figure 1: Support Ratio in the US, EU, and Asia

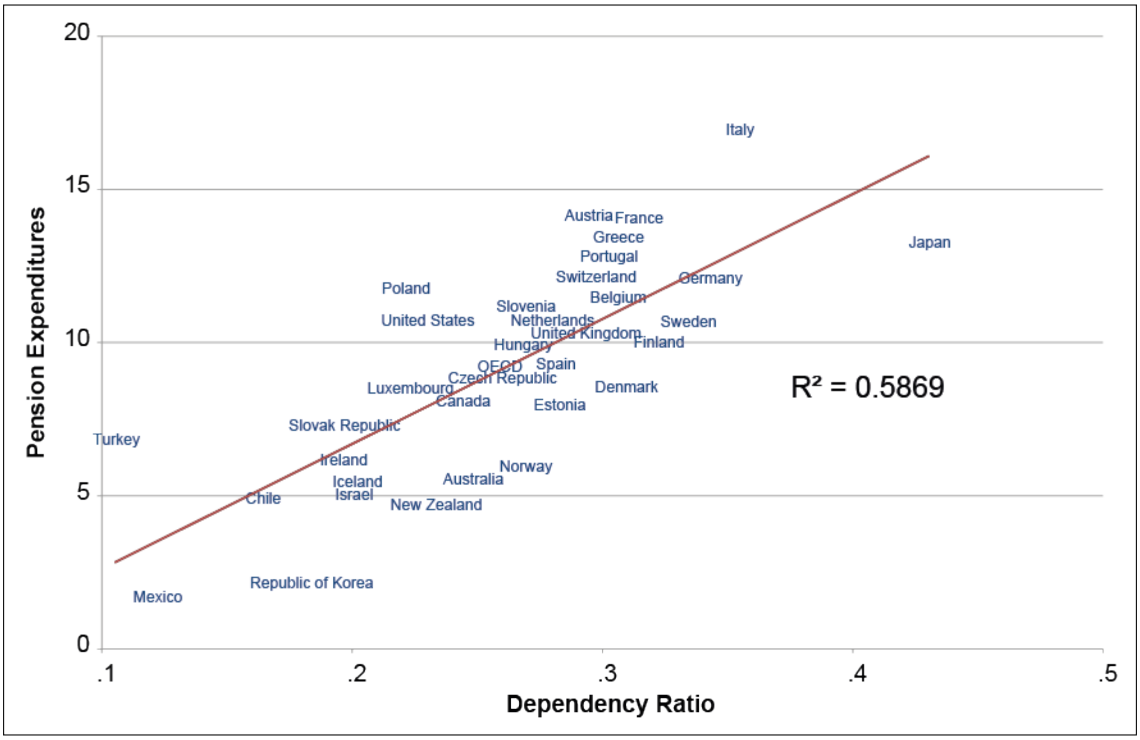


US = United States, EU = European Union.

Source: EU3 and US: Human Mortality Database. Japan and Asia2: UN Population Trends. Support ratio is population age 15–64 divided by total population size.

A large number of older individuals per working age population in a country exerts pressures on the economy of this country since pension expenditures demand a high share of gross domestic product (GDP). The alignment between the extent of population aging and pension expenditures, however, is far from perfect (Figure 2). Most European countries have pension expenditures significantly above the regression line (Italy, Austria, France, Poland), while most Asian countries have much smaller pension systems relative to their demographic status (Japan, Republic of Korea, Australia, New Zealand). This is mainly due to the many design differences between national pension systems. These design differences have strong implications for the impact of population aging on pension expenditures.

Figure 2: Pension Expenditures (% of GDP) **by Old-Age Dependency Ratio**



GDP = gross domestic product; OECD = Organisation for Economic Co-operation and Development.

Source: OECD Pensions at a glance (2015). Old-age dependency ratio is population age 65+ divided by population age 15–64 (2013 data). Public and private pension expenditures are share of GDP (2012 data).

Pension economics has traditionally guided pension policy with the help of formal models based on individuals who think in a life cycle context with perfect foresight, full information, and in a time-consistent manner. Opinions among citizens, however, range from complete ignorance about how serious the challenges are to the equally faulty belief that pension systems are doomed to completely fail (Boeri et al. 2001, 2002; Walker et al. 2014).

This paper sheds light on selected aspects of pension economics and pension policy when the traditional assumptions do not hold. We focus on three aspects that are particularly relevant for the quickly aging Asian economies: the volume of savings for old-age provisions (Section 2), international diversification of retirement savings (Section 3), and global spillover effects of pension reforms (Section 4).

Section 5 summarizes our main conclusions. First, and not surprisingly, the volume of savings for old-age provision is substantially lower in a world with many myopic households. This has repercussions on the interest rate and economic growth but also on the relative merits of pay-as-you-go versus fully funded pension systems. Second, international capital flows are substantially lower when households are present-biased since they are saving dramatically less. Third, parametric pension reforms in one part of the world will have global spillover effects. Changes in key labor market parameters, especially retirement age, in Europe also improve the sustainability of pension systems and economic growth in Asia.

2. SAVING BEHAVIOR WITH TIME-INCONSISTENT HOUSEHOLDS

Pension systems and individual saving behavior strongly interact. On the one hand, the provision of social insurance reduces risks for households which may be hard or even impossible to cover on an individual basis. On the other hand, it reduces the need for private saving in order to provide old-age consumption and may thus reduce the level of productive capital in an economy. Population aging tends to sharpen this trade-off. Traditional economics has modelled these trade-offs using the neoclassical model of the saving and consumption decisions of a household over its life course under the assumption of perfectly foresighted life-cycle planners. In this paper, we will take a radically different point of view in assuming that households fail to plan ahead. This fundamentally changes the trade-off and how it is affected by population aging. Which set of assumptions best describes reality and what should therefore be the foundation for pension system design decisions is at the core of some key controversies among economists interested in saving behavior and social insurance.

The typical life-cycle model has been used in the path-breaking general equilibrium models which have analyzed the effects of population aging on pension systems (Auerbach and Kotlikoff 1987; Feldstein and Samwick 1998). This textbook case may also be interpreted as a parable for decision making if households have subscribed to a perfect commitment device which nudges them into a perfectly time-consistent consumption and labor supply behavior (Rabin, 2013a; b). It has two strong predictions: perfect consumption smoothing over the life cycle and perfect substitution between pension benefits and private savings. Regarding perfect consumption smoothing, while Banks et al. (1998); Battistin et al. (2009); Bernheim et al. (2001); and Haider and Stephens (2007) report a sharp and sudden consumption decline after retirement in many countries (the “retirement consumption puzzle”), the continuation of active saving after retirement in many countries, especially Germany, Italy, and Japan, is harder to explain with conventional models (the “German saving puzzle,” Börsch–Supan et al. 2001; De Nardi et al. 2010; Rohwedder et al. 2006).

Concerning the perfect substitution between a PAYG system and private saving, one can observe in many countries a widespread failure to provide sufficiently early and consistently for retirement income in the sense that such saving is sufficient to offset actual and future benefit cuts (we refer to this as “filling the pension gap”: Börsch–Supan et al. (2015); Börsch–Supan et al. (2016a) for Germany; Knoef et al. (2016) for The Netherlands; and Crawford and O’Dea (2012) for the UK). In the US, such under-saving for retirement has received widespread attention (Poterba et al. 2012; Repetto et al. 1998; Madrian and Shea 2001).

Under a different perspective, Börsch–Supan et al. (2016b) have conducted an Internet survey among individuals aged 60 and older, which shows a substantial prevalence of regret over previous saving decisions. Of those who responded 60% wished that they had saved more when they were younger. This goes against the assumption of time-consistent carefully planning individuals. High demand for commitment devices, even when they are costly, provides more evidence to support this finding (Ashraf et al. 2006; Beshears et al. 2011).

In order to tackle this evidence, several strands in the literature emerged. While a first strand advocates that PAYG systems should be replaced by FF systems, a second strand enriches the neoclassical textbook model of time-consistent households by elements that justify the existence of a public pension system. Such elements include poverty alleviation and longevity risks (Börsch–Supan, Härtl, and Leite 2016), income risks, market failures and information costs (Chan and Stevens 2008; Bucher–Koenen and Lusardi 2011; Lusardi and Mitchell 2011, 2014; Lusardi et al. 2013).

This paper focusses on a third level of research which more radically replaces the neoclassical paradigm with models of imperfectly foresighted behavior. There are several avenues to model imperfect household decisions, such as myopia, present bias, and procrastination, each of which carries different implications for social insurance and population aging. These modeling approaches are by no means new but have only recently found widespread attention when they were applied to retirement saving in the US (Laibson 1997, 1998; Madrian and Shea 2001). The underlying behaviors have major implications for the design of pension systems and their interaction with population aging. Being the result of aggregate private savings decisions, capital flows are also strongly influenced by imperfect household decisions, which will be examined in Sections 3 and 4.

2.1 A Generalized Model of Household Behavior

A first and very simple way to model the failure to plan ahead is to extend the neoclassical model by assuming that welfare evaluation is still following a time-consistent perfect-foresight program although the actual decision function is subjected to individual shortsightedness. Household *i* at time *t* receives utility from consumption $c_{t,j}$ and leisure $1-l_{t,j}$ where $l_{t,j}$ is the time spent working. The most conventional specification is a per-period utility function given by

$$u(c_{t,j},1-l_{t,j})=\frac{1}{1-\theta}\left(c_{t,j}^{\varphi} \cdot \left(1-l_{t,j}\right)^{1-\varphi}\right)^{1-\theta}, \tag{1}$$

where risk aversion and intertemporal substitution are jointly described by the single parameter θ while ϕ denotes the utility weight of consumption versus leisure. The household solves a utility maximization program over the entire life-cycle, such that the maximization problem of a cohort born in period *t* at *j=0* is given by

$$\max\left\{u\left(c_{t,0},1-l_{t,0}\right) \; + \; \delta \; \sum_{j=1}^{J} \beta^{j}\sigma_{t+j,j}u\left(c_{t+j,j},1-l_{t+j,j}\right)\right\}. \tag{2}$$

There are three different elements of discounting the future utility from consumption and leisure. First, β represents the pure time discount factor:

$$\beta = 1/(1+\rho). \tag{3}$$

Second, households discount future utility with their unconditional survival probability $\sigma_{t,j}$, expressing the uncertainty about the time of death.

Third, the parameter $0 \leq \delta \leq 1$ defines the degree of shortsightedness or present bias. At one extreme, $\delta = 0$. In this case, the household is totally myopic and disregards all future utility. At the other extreme, $\delta = 1$, we are back to the neoclassical model of time-consistent behavior. In the intermediate cases, future utility is discounted more than exponentially relative to present utility.

We do not include intended bequests in our model and assume that accidental bequests resulting from premature death are taxed away by the government at a confiscatory rate and used for otherwise neutral government consumption.

Households earn an age-specific labor income $l_{t,j}$ $w_{t,j}$ until retirement age R (where $w_{t,j}$ denotes the hourly wage) and may then receive a public pension $p_{t,j}$ which is financed by a contribution proportional to the labor income at rate τ_t. Hence, current disposable non-asset income $y_{t,j}$ is

$$y_{t,j} = \lambda \cdot l_{t,j} \cdot w_{t,j} \left(1-\tau_t\right) + \left(1-\lambda\right) \cdot p_{t,j}, \tag{4}$$

where λ=1 for $j=0,\ldots,R$ and λ=0 for $j\geq R+1$.

Denoting total assets by $a_{t,j}$, maximization of the household's intertemporal utility is subject to a dynamic budget constraint given by

$$a_{t+1,j+1} = a_{t,j}\left(1+r_t\right) \ + y_{t,j} - c_{t,j}. \tag{5}$$

In some specifications, we will add a borrowing constraint

$$a_{t,j} \geq 0, \tag{6}$$

which is typically binding at the beginning of the economic life but also prevents borrowing against pension income.

In the extreme case of complete myopia, households focus on current utility only and ignore future utility. They therefore do not anticipate retirement and do not save. Without a pension system, they would suffer from starvation once deteriorating health forces them to retire. A mandatory pension system, whether PAYG or FF, DB or DC, thus has large beneficial effects. As opposed to the life-cycle model, a mandatory pension system has no negative incentive effects in this model (e.g., crowding out and moral hazard) since these myopic households would not save under any circumstance. Population aging will increase the financial volume of the pension system but there are no policy implications to be drawn as preventing starvation is indispensable. This arguably extreme example shows that welfare and policy implications are radically different from the perfect-foresight case.

2.2 Saving and Welfare when a Proportion of Households is Myopic

Total myopia is an extreme case in the aggregate. More realistically, different degrees of myopia prevail among households. Models with heterogeneous households are instructive because they show the trade-off between social protection and economic efficiency. By following Feldstein (1985), Börsch–Supan, Härtl, and Leite (2016) have shown that different degrees of myopia imply different life cycle consumption paths. They model a population which has two types of households. A fraction η of households are myopic (M) with $\delta \epsilon [0,1)$. The other households have perfect foresight (denoted by PF). While a PAYG-DB pension system is clearly beneficial for the M-households, this is different for the PF-households because they have to co-finance the M-households' pensions which reduces their utility. Moreover, the PAYG-DB system will crowd out private saving which may earn a higher rate of return.

As Börsch–Supan, Härtl, and Leite (2016) show, the higher the percentage of PF-households, the lower the consumption at the beginning of life, and the higher the consumption at middle age until late stages of life since PF-households prefer to postpone consumption and enjoy higher utility later in life. The crowding-out effects are clearly visible. If *r* is larger than the internal rate of return (*irr*) in the PAYG pension system, this reduces economic efficiency.

The beneficial effect of a PAYG-DB pension system depends on η and the difference between *r* and *irr*. In order to measure the impact of different combinations of *irr* in the PAYG-DB on welfare, Börsch–Supan, Härtl, and Leite (2016) apply consumption equivalent variation relative to a PAYG-DB system with an internal rate of return of 3%. Taking as a benchmark case a PAYG-DB system with an internal rate of return of 3%, if the share of myopic households is relatively large, a mandatory PAYG-DB system is always beneficial, even for low internal rates of return. In the extreme case in which all households are myopic, the lack of a pension system implies starvation at old age. Hence, all old-age consumption has to be provided to make these households as well off as in the benchmark case. The opposite extreme, when all households have perfect foresight, reflects the advantages of the annuitization provided by a PAYG-DB system relative to the pure saving case when the internal rate of return equals the market interest rate. This is not the case for a PAYG-DB system with lower internal rates of return.

2.3 Saving and Welfare when Households are Procrastinating

In contrast to myopia, another failure of the life-cycle model in describing reality may be that households have self-control problems. This time-inconsistent behavior has been subject of research of many studies (Thaler 1994; Laibson 1997, 1998; Angeletos et al. 2001; Choi et al. 2002; Rabin 2013a, b; Della Vigna and Malmendier 2006). The assumption relies on the idea that households plan according to the life-cycle model but then fail to execute their plan, e.g., by putting off the decision to set up and pay into a retirement savings account.

Strotz (1956), through hyperbolic discounting, and Phelps and Pollak (1968) and Pollak (1968) advanced the first theoretical frameworks. Later it was refined by Thaler and Shefrin (1981) and popularized by Laibson (1997, 1998). Time-inconsistent behavior is modelled as a continuing game between current and future self, where the immediate future is discounted more strongly relative to the present than two equally distant events further in the future. The model has three main features: (a) the addition of a present bias parameter δ which discounts the immediate future additionally to the standard discount factor β and mimics hyperbolic discounting, (b) the distinction between the present bias δ of the current self from the belief about the present bias of the future self, denoted by $\hat{\delta}$, and consequently, (c) the distinction between actual consumption behavior c_j from beliefs about future consumption behavior $\hat{c}_{j+1}$. The notion of different "selves" with changing preferences allows to model different features of individuals and how saving and consumption behavior changes due to these characteristics and the sequence of these "selves" with conflicting preferences and future beliefs. Because the behavior of these households moves away from traditional assumptions but still stems from such causes as monetary or psychic costs of decision making, we always refer to these households as time-inconsistent. In specifying future beliefs, according to O'Donoghue and Rabin (1999) it is possible to distinguish between "naïve" and "sophisticated" hyperbolic households. They only differ in their own perception of future preferences. While the naïve households believe that their future selves will behave in a time-consistent manner although they have consistently violated this belief in the past, i.e., $\hat{\delta} = 1$, the more sophisticated households correctly foresee that their future selves will also behave in a time-inconsistent way, i.e., $\hat{\delta} = \delta < 1$. Therefore, sophisticated households seek to overcome this misbehavior by constraining their future consumption. We therefore avoid terms such as "rational" and "irrational" behavior.

The current self at age *j* maximizes the objective function

$$\max\left\{u(c_j)+\delta\cdot\beta\cdot\sigma_{j+1}\cdot\hat{V}(z_{j+1})\right\} \tag{7}$$

by choosing current consumption c_j, subject to the budget constraint (equation 5), the borrowing constraint (equation 6) and his beliefs $\hat{V}(z_{j+1})$ about the behavior of his future selves for the future state z_{j+1}. The value function $\hat{V}(z)$ for future beliefs is computed recursively by

$$\hat{V}(z_j)=u(\hat{c}_j)+\beta\cdot\sigma_{j+1}\cdot\hat{V}(z_{j+1}). \tag{8}$$

Note that the present bias δ of the current self does not appear in the value computation. His future self who is at age *j* + 1 will maximize

$$\max\left\{u(\hat{c}_{j+1})+\hat{\delta}\cdot\beta\cdot\sigma_{j+2}\cdot\hat{V}(z_{j+2})\right\} \tag{9}$$

by choosing future consumption $\hat{c}_{j+1}$ where δ is replaced by $\hat{\delta}$ compared to (7). Finally, welfare is computed based on the actual behavior of households:

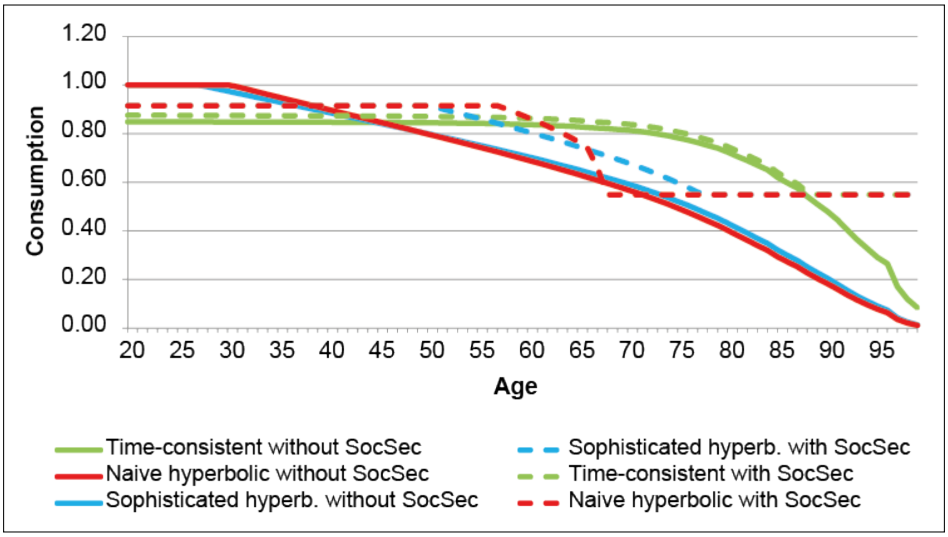
$$V(z_j)=u(c_j)+\beta\cdot\sigma_j\cdot V(z_{j+1}). \tag{10}$$

Preferences are time inconsistent because the present-bias parameters δ and $\hat{\delta}$ appear in the decision problems (7) and (9) but not in the calculation of the value functions (8) and (10). Sophisticated hyperbolic consumers (where $\delta=\hat{\delta}<1$) behave differently compared to time-consistent consumers (where $\delta=\hat{\delta}=1$). For naïve hyperbolic consumers (where δ < 1 and $\hat{\delta}=1$), however, the decision rules and the respective value functions of current and future selves do not coincide (Fehr et al. 2008; Imrohoroglu et al. 2003).

As Börsch–Supan, Härtl, and Leite (2016) show, both sophisticated and naïve hyperbolic households exhibit overconsumption in the beginning of life relative to time-consistent households (Figure 3). The simulation model is based on an interest rate *r* and discount rate ρ equal to 3% on an annual basis. θ is set to 2. Survival rates are taken from the Human Mortality Database. The benchmark is δ = 0.6. Lower values of δ exhibit more severe present bias while higher values denote moderate bias closer to a time-consistent behavior. Simulations with and without a PAYB-DB pension system with a replacement rate of 60% for each of the three household types (naïve hyperbolic, sophisticated hyperbolic, and time-consistent) are shown.

As seen above, given the existence of present bias, sophisticated hyperbolic households consume more than time-consistent households in order to constrain their time-inconsistent future selves. Naïve hyperbolic households also consume more but they do not realize that this higher consumption in earlier periods will reduce substantially their consumption in the future. They therefore overconsume until later ages than the sophisticated hyperbolic households and experience a sudden decline in consumption. Moreover, the lower *δ,* the smaller the consumption level in future periods since impatience leads households to be eager to consume the most possible in the present (not shown in the graphs). The distinction between naïve and sophisticated hyperbolic households becomes stronger for high present bias (low δ).

Figure 3: Consumption Profiles for Present Bias 60% with and without a PAYG Pension System

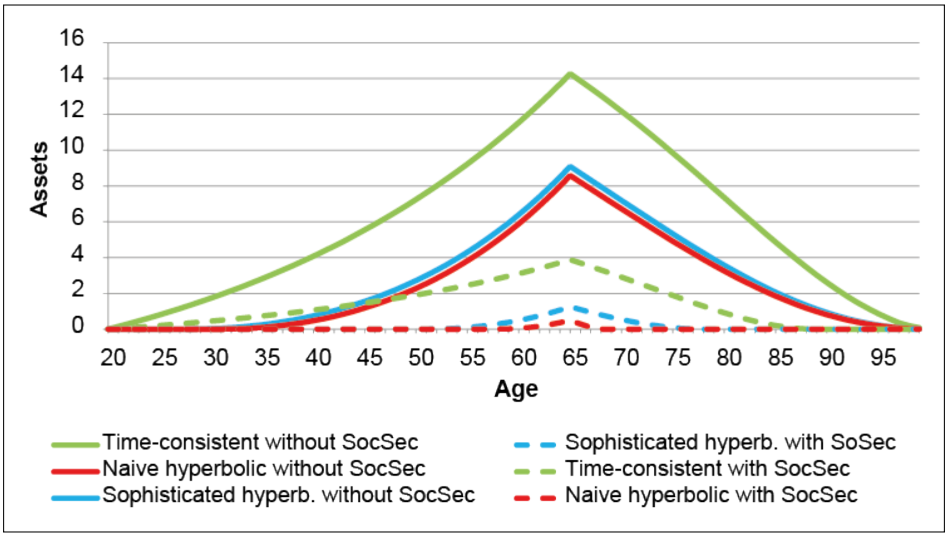


PAYG = pay-as-you-go; SocSec = social security.

Source: Computations from Börsch–Supan, Härtl, and Leite (2016).

Asset profiles therefore show undersaving for sophisticated and naïve hyperbolic households. The more short-sighted households are, the more prevalent is undersaving. Figure 4 also shows the extent of crowding out of private saving by the PAYG pension system, which is considerably stronger among sophisticated and naïve hyperbolic households than among time-consistent households. This crowding out effect also increases with the extent of present bias.

Figure 4: Asset Profiles for Present Bias of 60% with and without a PAYG Pension System



PAYG = pay-as-you-go; SocSec = social security.

Source: Computations from Börsch–Supan, Härtl and Leite (2016).

Finally, Table 1 computes welfare for each type of household with and without a PAYG-financed pension system, expressed as consumption equivalent variation. We assume an interest rate of 3%. A PAYG-DB system yields higher welfare than no pension system in most cases of Table 1. This holds even for low internal rates of return if the present bias is high. The highlighted numbers show the opposite case in which present bias and PAYG rates of return are low.

For a present bias of 0.6, a PAYG-DB pension system improves welfare for the sophisticated hyperbolic households if its internal rate of return is larger than 0.9%. For the time-consistent households, the internal rate of return must exceed 2.1% to improve the households' welfare vis-à-vis private saving at a 3% interest rate. For extreme short-sighted naïve and sophisticated hyperbolic households, welfare is always higher for any internal rate of return compared to a private saving scenario. The welfare gain of annuitization, however, is much larger for naïve hyperbolic households than for time-consistent or sophisticated hyperbolic households, and it increases with the extent of present bias. Note that for very high levels of present bias (δ = 0.1), welfare is very low without a pension system due to very low consumption levels in old-age.

Table 1: Welfare for each Type of Household

	No PAYG (%)	**PAYG-DB pension system with IRR=** (%)			
		1%	**2%**	**2.5%**	**3%**
		Full Model – Present bias high = 0.1			
Naive hyperbolic	–97.86	–8.29	–3.61	–1.70	Baseline
Sophisticated hyp.	–52.42	–8.28	–3.62	–1.68	Baseline
Time consistent	–3.44	–8.26	–3.60	–1.68	Baseline
		Full Model – Present bias = 0.6			
Naive hyperbolic	–8.81	–8.28	–3.60	–1.68	Baseline
Sophisticated hyp.	–8.03	–8.28	–3.59	–1.69	Baseline
Time consistent	–3.44	–8.26	–3.60	–1.68	Baseline
		Full Model – Present bias low = 0.85			
Naive hyperbolic	–3.61	–8.27	–3.58	–1.67	Baseline
Sophisticated hyp.	–3.75	–8.28	–3.62	–1.70	Baseline
Time consistent	–3.44	–8.26	–3.60	–1.68	Baseline

IRR = internal rate of return; PAYG = pay-as-you-go; DB = defined benefit.

Parameters: rho = r = 3%, theta = 2, replacement rate = 60%.

Source: Computations from Börsch–Supan, Härtl and Leite (2016).

3. DIVERSIFICATION OF RETIREMENT SAVINGS WHEN HOUSEHOLDS ARE TIME-INCONSISTENT

We now leave the microeconomic perspective and take a macroeconomic view. An important argument in favor of fully funded pension systems for countries with a strongly aging population is that the assets can be invested in countries which have a less pronounced aging process while pay-as-you-go-financed pension system depend on the size and productivity of the domestic work force. Earlier research has demonstrated the beneficial effects of such international diversification (Reisen 2000; Rios–Rull 2001; Brooks 2003; Börsch–Supan et al. 2006; Attanasio et al. 2007; Börsch–Supan and Ludwig 2009, 2013; Attanasio et al. 2016). This section investigates whether these results also hold when households are time-inconsistent. Specifically, we simulate the size of capital flows and the welfare when the share of time-inconsistent households differs between the capital exporting and the capital importing countries. We employ several variants of computational general equilibrium (CGE) models with an overlapping generations (OLG) structure that permits a quantitative assessment of capital flows and their welfare implications.

We do not model frictions to the capital market and allow for free capital flows across countries. This assumption appears to contradict the seminal work by Feldstein and Horioka (1980) who found a strong positive correlation between a country's investments and savings (for OECD countries) which was interpreted by the literature as evidence for lower than perfect capital mobility between countries. Contradicting conventional wisdom about free international capital flows, Obstfeld and Rogoff (2000) called this finding "The Feldstein–Horioka Puzzle" and included it in their list of the six major puzzles in international macroeconomics. A large follow-up literature tried to explain this observation. According to Coakley et al. (1998) and Apergis and Tsoumas (2009), the majority of studies in modern literature find theoretical or econometric explanations for this effect implying that Feldstein and Horioka's puzzle does not collide with the free capital flow hypothesis. This paper adds another explanation for relatively small international capital flows which is based on myopic behavior and/or procrastination.

The following subsection introduces the model. It uses the building blocks from Section 2 and closes the model with a simple production sector. We then compute the general equilibrium for the four countries/country groups introduced in Section 1 (Figure 1) with three dimensions of international exchange: First, there is trade in the goods and services produced by each country. Second, there are corresponding capital flows between countries. Saving and investment decisions are governed by a common global interest rate which, via international capital flows, equalizes the return to capital across countries. Assets held by households in a country are therefore not necessarily equal to the domestic capital stock in that country, nor does saving necessarily equal investment in a single country. Third, there is migration which we will treat as exogenous such that the international equilibrium is uniquely defined by the world interest rate.

3.1 Model Structure

The CGE model has four building blocks: demography, household behavior, pension system, and production sector.

Demography is described by the initial size of each cohort and the survival of that cohort. In the notation below, we abstract from migration although in our simulations we add the historical average of net migration as a constant to population size. Let $N_{t,j}$ denote the number of individuals of age j at time t. They were born in year $c = t-j$ and are the survivors of the original birth cohort $N_{c,0}$:

$$N_{t,j} = \sigma_{t,j} \cdot N_{c,0}. \tag{11}$$

Here $\sigma_{t,j}$ denotes the unconditional probability to survive until age *j* which will be in year *t.* The original cohort size for cohort *c* depends on the fertility of women aged *k* at time *c = t–j*:

$$N_{c,0} = \sum_{k=0}^{\infty} f_{c,k} \cdot N_{c,k}.^{1} \tag{12}$$

Population aging has therefore three demographic components which differ significantly across countries: past and future increases of *longevity*, expressed by $\sigma_{t,j}$; the *historical transition from babyboom to babybust* expressed by past changes of $f_{t,k}$; and *fertility* below replacement in many countries expressed by current and future low levels of $f_{t,k}$.

We treat all three demographic forces as exogenous. The actual data are the medium variants of the long-term population forecasts provided by the Human Mortality Database (EU3 and US) and the 2012 UN Population Trends (Japan and Asia2). Households are the decision units. They enter economic life at an age which we denote by *j*=0 and have a finite life span defined by the high mortality at very old age. This generates the OLG structure of the CGE model which is essential for modeling pension issues.

The second building block is *household behavior*. The benchmark model is described in Subsection 2.1. We first set $\delta = 1$ and apply the dynamic budget constraint (equation 5) but do not impose a borrowing constraint. We then deviate from this neoclassical set-up and model households which are time inconsistent due to present bias and procrastination as described in equations (7) through (10).

Parameters used are: discount factor $\beta = 0.99$, coefficient of relative risk aversion $\theta = 2$, and consumption share parameter $\phi = 0.6$. The benchmark value for the degree of present bias in the second set-up is $\delta = 0.7$.

The third building block is the *PAYG-DB pension system*. Revenue in year *t* is the product of the contribution rate τ_t, the average labor income $l_{t,j}\ w_t$ and the number of workers NW_t defined as:

$$NW_t = \sum_{j=0}^{R} N_{t,j}, \tag{13}$$

where *R* denotes the retirement age. Expenditure in year *t* is the product of the average pension benefit p_t and the number of pensioners NP_t defined as:

$$NP_t = \sum_{j=R+1}^{\infty} N_{t,j}. \tag{14}$$

This results in the PAYG budget equation:

$$\tau_t \cdot l_{t,j} \cdot w_t \cdot \sum_{j=0}^{R} N_{t,j} = p_t \cdot \sum_{j=R+1}^{\infty} N_{t,j}. \tag{15}$$

---

[1] We use the convenience of an infinite summation to avoid the assumption of a fixed time of death. The notation does not imply agents with infinite lifespans. Since $\sigma_{t,j}$ and $f_{c,k}$ become very small for *j*>100 and *k*>50, resp., $N_{t,j}$ is zero for large *j* and all sums in this chapter are finite.

The PAYG system is of the *defined benefit* type where a cohort of retirees is promised a pension benefit p_t defined by a replacement rate q_0 which is independent from the demographic and macroeconomic environment, $p_t = q_0 \cdot w_t$. The contribution rate to the system must then be adjusted up or down to keep the PAYG-DB system balanced such that current workers cover the demographic risk for the benefit of the retirees:

$$\tau_t = q_0 \cdot NP_t / NW_t. \tag{16}$$

As described in the introduction, the size of the PAYG-DB pension systems is very different across the four countries/country groups. Table 2 shows this, expressed as the replacement rate q_0:

Table 2: Replacement Rate of PAYG-DB Pension Systems

France	60%
Germany	60%
Italy	70%
Japan	60%
US	30%
PRC	10%
India	10%

PAYG = pay-as-you-go; DB = defined benefit; US = United States; PRC = People's Republic of China.

The fourth building block which closes the CGE model is the *production sector* of country *i.* It consists of a representative firm that uses a Cobb–Douglas production function given by

$$Y_{t,i} = F\left(A_{t,i}, K_{t,i}, L_{t,i}\right) = K_{t,i}^{\alpha}\left(A_{t,i}L_{t,i}\right)^{1-\alpha}, \tag{17}$$

where $K_{t,i}$ denotes the capital stock and $L_{t,i}$ is aggregate labor volume in country *i* at time *t*. α denotes the capital share (set to 33%) and $A_{t,i}$ the technology level of country *i* which is assumed to grow at an exogenous rate *g* which is assumed to be equal (1.5% p.a.) for all countries.[2] The initial technology levels $A_{t,i}$ are calibrated to reflect GDP per capita at the year 2005 and assume as benchmark the US technology level, see Table 3:

The firm's problem is static such that wages and the rate of return rates are given by

$$w_{t,i} = A_{t,i}(1-\alpha)k_t^{\alpha}, \tag{18}$$

$$r_t = \alpha k_t^{\alpha-1} - \Delta, \tag{19}$$

where k_t is the capital stock per productivity weighted unit of labor and Δ is the depreciation rate of productive capital, set to 5%.

---

[2] Börsch–Supan and Ludwig (2009) show the effect of different growth rates on returns. In this paper, we want to focus on the joint effects of demography and pension systems and therefore keep productivity growth fixed at a common level.

Table 3: Initial Technology Levels (Calibrated for 2005)

France	0.93
Germany	0.96
Italy	0.62
Japan	1.33
US	1.00
PRC	0.025
India	0.017

US = United States; PRC = People's Republic of China.

The solution of the CGE model is given by a set of equilibrium conditions. The outcome variables are sequences of disaggregate variables on the household level $\{c_{t,j,i},\ l_{t,j,i},\ a_{t,j,i}\}$, sequences of aggregate quantities $\{L_{t,i},\ K_{t,i}\}$ and prices for labor $\{w_{t,i},\ \tau_{t,i}\}$ on the country level, where the difference between the net and the gross wage is defined by the contribution rate to the pension system, and a sequence of interest rates $\{r_t\}$ on the global level. Given the initial capital stocks $K_{0,i}$ in each country, the general equilibrium of the world economy is obtained when households maximize their life-time utility subject to the constraints given by the two model variants, factor prices equal their marginal productivities, the PAYG-DB pension systems satisfy the balancing condition, and all markets clear in every country and every period:

$$L_{t,i} = \sum_{j=0}^{\infty} l_{t,j,i} N_{t,j,i} \text{ for all } t,i, \tag{20}$$

$$\sum_{i=1}^{I} K_{t+1,i} = \sum_{i=1}^{I} \sum_{j=0}^{\infty} a_{t+1,j+1,i} N_{t,j,i}, \tag{21}$$

$$\sum_{i=1}^{I} \sum_{j=0}^{\infty} c_{t,j,i} N_{t,j,i} + \sum_{i=1}^{I} K_{t+1,i} = \sum_{i=1}^{I} K_{t,i}^{\alpha} (A_{t,i} L_{t,i})^{1-\alpha} - (1-\Delta) \sum_{i=1}^{I} K_{t,i} \tag{22}$$

This CGE model has to be solved numerically. Our time line has four periods: a phase-in period, a calibration period, a projection period, and a phase-out period. First, we start calculations 110 years before the calibration period begins with the assumption of an "artificial" initial steady state in 1850. The time period between 1960 and 2005 is then used as calibration period in order to determine the structural parameters of the model. Our projections run from 2005 until 2050.[3]

We determine the equilibrium path of the overlapping generations model by using the modified Gauss–Seidel iteration as described in Ludwig (2007). The algorithm searches for equilibrium paths of capital to output ratios, and, in case there are social security systems, pension contribution rates in each country.

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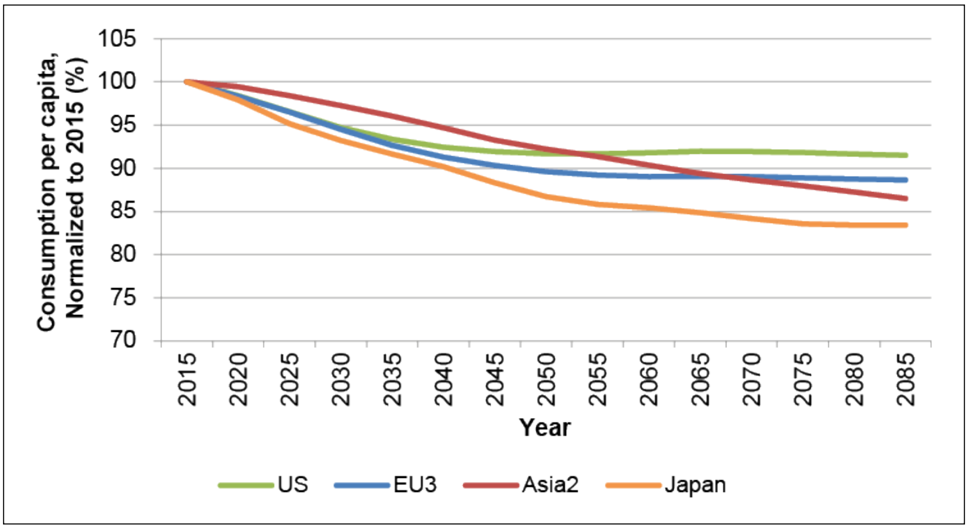
[3] For technical reasons, the model then runs further during a transition to a steady-state population in 2150 and an additional 100-year period until the model reaches its final steady state in 2250.

3.2 Conventional Model of Time-consistent Households

The baseline path assumes time-consistent behavior in all model countries. It continues the historical status quo around the year 2015. The subsequent trajectory is then determined by two exogenous forces: First, the general equilibrium is driven by *population aging* modelled as an increase in the survival rates $\sigma_{t,j}$ and a decrease in the fertility rates $f_{t,j}$. Note that demographic change occurs both during the life-cycle of each household and across cohorts of different households. Demographic change is most vividly expressed as the change in the support ratios depicted in Figure 1. Second, a constant replacement rate increases the contribution rate in the four countries/country groups' PAYG-DB *pension systems* according to equation (13). This in turn depresses labor supply and household saving. Since the pension systems have very different sizes as displayed in Table 2, effects vary greatly across the four countries/country groups.

To have a first glimpse of the impact of demography without the effect of the pension systems, Figure 5 isolates the demographic effect. In order to do so, we set the replacement rate in all countries to 30% (as opposed to the values in Table 2). We use consumption per capita as an indicator of living standards.

Figure 5: Baseline Consumption per Capita, Detrended, Demographic Effect Only



US = United States; EU = European Union.

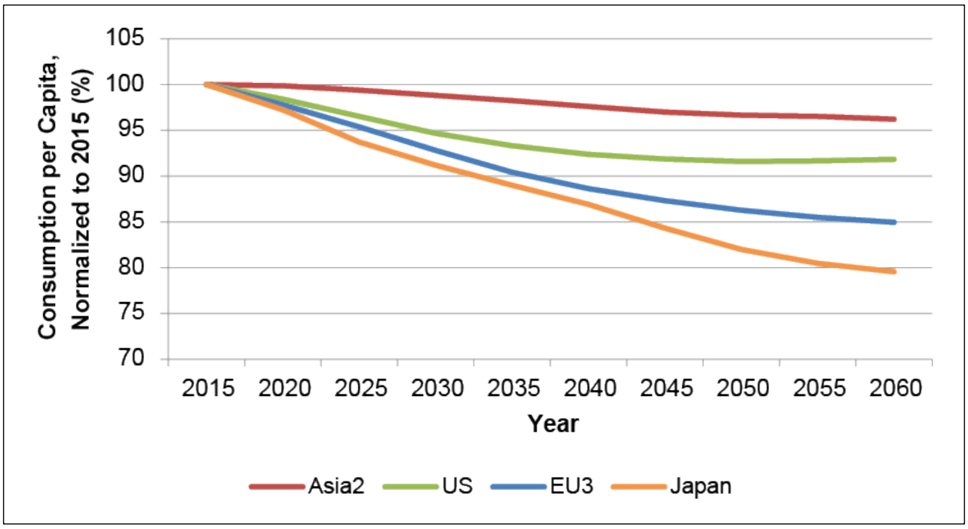
Source: Own computations.

Consumption per capita follows the trend of the support ratio (Figure 1), but the relative decline is smaller since increasing wages and decreasing returns induce capital–labor substitution offsetting some of the effects of a declining support ratio. Hence, GDP per capita will decline less than the support ratio. Furthermore, some of households' savings flow from the more aging countries to less aging countries. These savings will eventually be repatriated and will then increase consumption per capita stronger than per capita GDP. These two effects are described in detail in Börsch–Supan et al. (2014).

Figure 6 adds the effect of vastly different PAYG-DB pension systems. This figure differs notably from Figure 5 since the PRC and India have very small PAYG-DB systems effects (smaller than assumed in Figure 5) while they are large in Japan and the EU3 countries (larger than assumed in Figure 5). Relatively to the US (same as in

Figure 5), per capita consumption in the PRC and India suffers less from the effects of population aging while in Japan and the EU3 countries it suffers more.

Figure 6: Baseline Consumption per Capita, Detrended, Total Effect



US = United States; EU = European Union.

Source: Own computations.

Figure 7 shows the burden of the large PAYG-DB systems in another metric. It compares the global market interest rate with the internal rate of return of the PAYG-DB pension systems which is calculated by setting the expected present discounted value of the life-time contributions paid by a cohort *c* equal to the expected present discounted value of the life-time pension benefits received by that cohort:

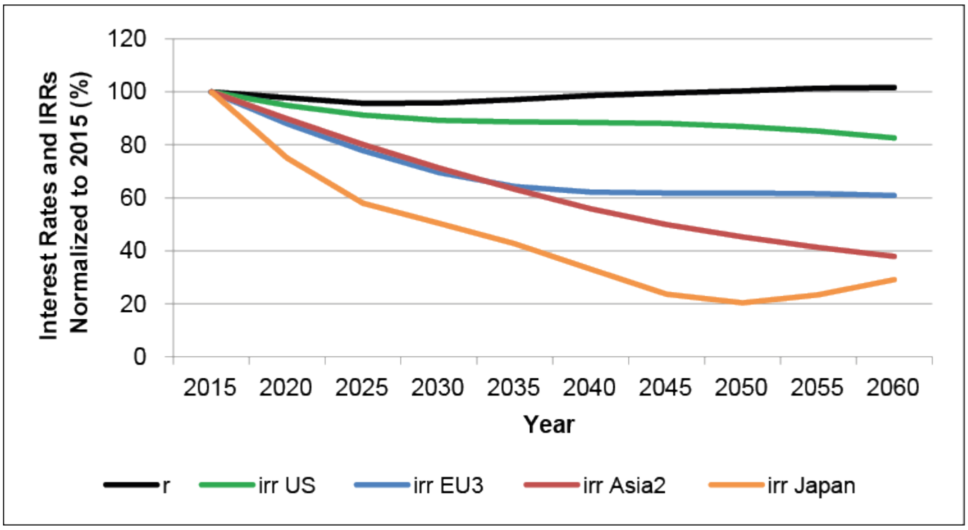
$$\sum_{j=0}^{R} \tau_{c+j} \cdot w_{c+j} \cdot \sigma_{c+j,j} \cdot (1/(1+irr_c))^j = \sum_{j=R+1}^{\infty} p_{c+j} \cdot \sigma_{c+j,j} \cdot (1/(1+irr_c))^j . \quad (23)$$

If wages grow at a constant rate *g*, if the relative number of workers grows at a constant rate *n*, and if the replacement rate is defined by the DB rule in equation (13), then the internal rate of return of the PAYG-DB system is roughly equal to the growth rate of the labor force *n* plus the growth rate of wages *g* experienced during the lifespan of this cohort:

$$irr = g + n. \quad (24)$$

The large and negative growth rate of the labor force *n* in Japan is reflected in the fast decrease of the Japanese internal rate of return of the PAYG-DB system. It also decreases quickly in the PRC and India, due to the rapid decline in their support ratios, only Japan fares worse. Such a significant decrease has, nevertheless, much less effect on per capita consumption than in Japan because the PRC's and India's pension systems are so small that their effect is mostly overcome by the capital–labor substitution effects referred to above.

Figure 7: Global Market Rate of Interest and Internal Rate of Return of PAYG-DB Pension Systems



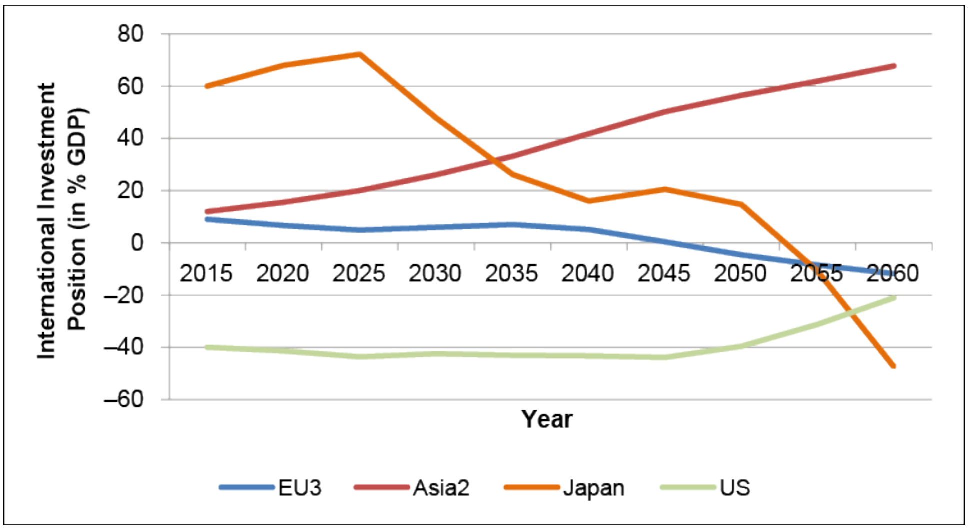
PAYG = pay-as-you-go; DB = defined benefit; IRR = internal rate of return; US = United States; EU = European Union.

Source: Own computations.

In this paper, we are especially interested in the implications for global capital flows. Figure 8 shows the net investment position of the four countries/country groups and how they change in the course of population aging. Net investment positions are calculated as:

$$NIP_t = \sum_{j=1}^{\infty} a_{j,t,i} - K_{t,i}. \quad (25)$$

Figure 8: International Investment Position



GDP = gross domestic product; US = United States; EU = European Union.

Source: Own computations.

Japan has large outflows, which have increased in the past to a first peak around this time. With the retirement of the early baby boomers, some of that capital is repatriated until those savings of the secondary baby boom which are invested abroad and then repatriated exhibit a similar up and down movement. The EU3 countries have a later baby boom and thus a later repatriation phase. They also start from a lower level of outflows. The PRC and India follow a path of steadily increasing investments abroad, while the US with its large GDP receives the foreign investments. This role is strongly declining in the period after 2045 when Europe and Japan repatriate their assets.

3.3 International Diversification when Households are Present-biased

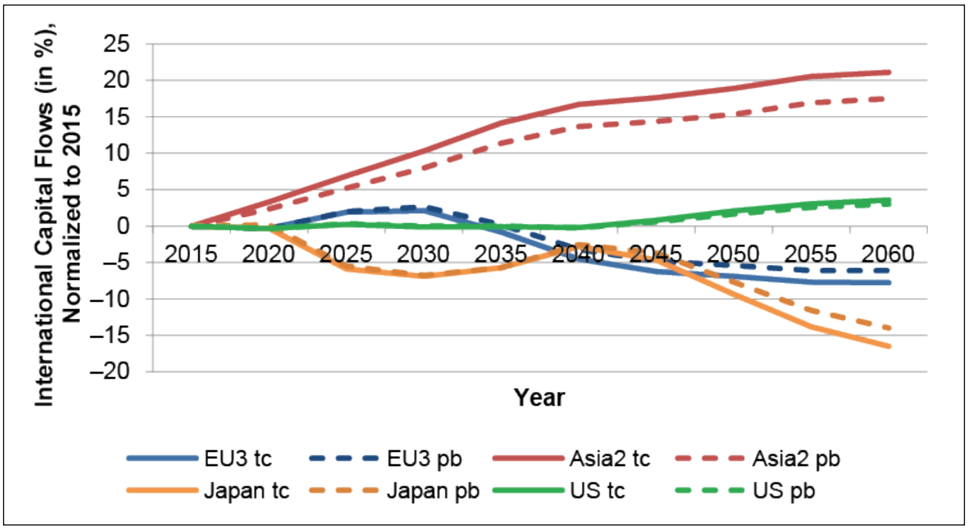
The second variant of our macro model assumes the saving behavior of present-biased households as described in Subsection 2.3. We first assume that all countries feature the same extent of present bias; to be specific, in all countries the share of time-consistent households is 20%, while 80% have a present-bias parameter $\delta = 0.7$. As we have seen in Section 2, the latter type of households saves substantially less. As a consequence, international capital flows, computed as

$$cf_{t,i} = SAV_{t,i} - INV_{t,i}, \tag{26}$$

where $SAV_{t,i} = \sum_{j=1}^{\infty} a_{j,t,i} - \sum_{j=1}^{\infty} a_{j,t-1,i}$ and $INV_{t,i} = K_{t,i} - K_{t-1,i}$,

are smaller than in the model with time-consistent households; see Figure 9. In contrast to Figure 8, we have normalized all capital flows to begin with zero in 2015 in order to isolate the difference between time-consistent and present-biased households in the effect of population aging on capital flows. This normalization removes the differences in the levels of the net positions between the model with time-consistent households and the model with present-biased households. The solid lines labeled with “tc” refer to the model with time-consistent households while the broken lines labeled with “pb” refer to the model with present-biased households.

Figure 9: International Capital Flows, Time-consistent, and Present-biased Households



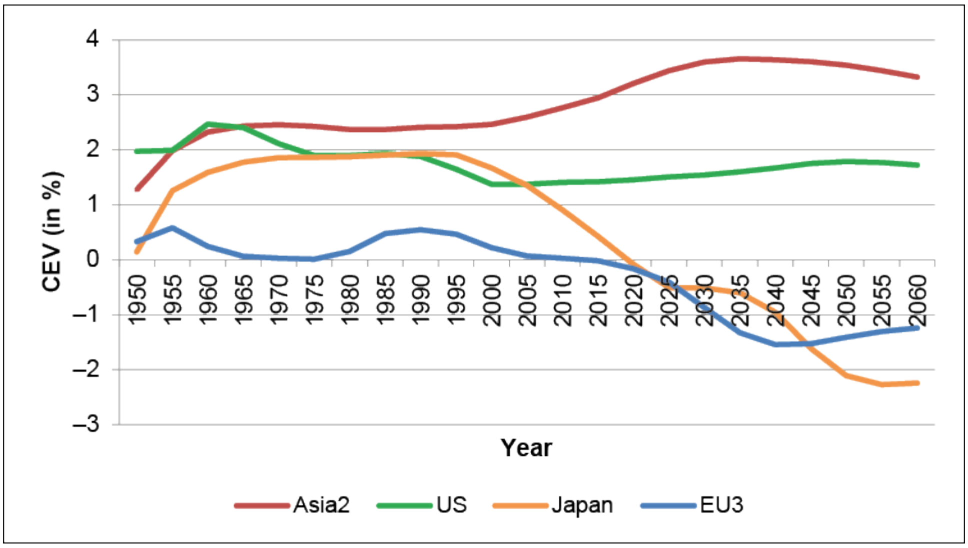
US = United States; EU = European Union.

Source: Own computations.

As we can observe in the figure above, there is an increment of inflows compared to outflows in the most aging blocks (EU3 and Japan). Asia2 faces growing outflows in the time range presented while the US has a more stable behavior as it will only face growing outflows later on when it starts to become the youngest region. Comparing both scenarios, as already advanced, capital flows are smaller, and we observe this through the shift of the lines downwards (lower expansion of outflows) or upwards (small increase on inflows).

Figures 10 and 11 show the relative welfare gains and losses of households between a scenario where each country/country group has a higher or lower share of present-biased agents. These gains and losses are created already in 2015 by different shares of present-biased agents in the economy and are then affected by population aging. Gains and losses are computed as the life-time consumption-equivalent variation (CEV) of a cohort of a specific type in a scenario in which present-biased households represent a share of 80% in the total population, compared to a scenario in which present-biased households represent only 20% of the population. A positive value means that households of a cohort entering the labor market at the given time in the first scenario (80% share of present-biased households) are better off than their equivalents in the second scenario (20% share of present-biased households). Since we cannot compare different types of individuals, we compare time-consistent households in Figure 10 and present-biased households in Figure 11.

Figure 10: Relative Welfare Gains and Losses Due to Population Aging – Time-consistent Households

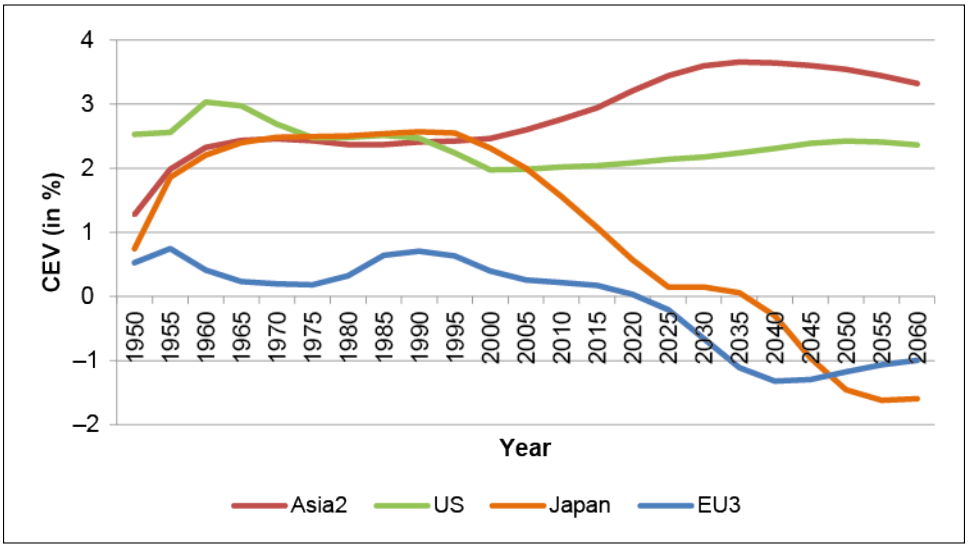


CEV = consumption-equivalent variation; US = United States; EU = European Union.

Source: Own computations.

Concerning time-consistent households, CEV is positive for all countries until around 2020. In Japan and the EU3 countries, only cohorts born after 2000 (entering the labor market after 2020) are worse off when there is a higher share of present-biased agents. For example, in 2015 one has to pay 3% of life-time consumption to a time-consistent household in the Asia2 countries, assuming that the share of present-biased households is 20%, to make him as well off as in a hypothetical situation in which 80% of households are present-biased. There are several mechanisms explaining this result. The interest rate is higher under a higher share of present-biased agents than in the case of lower share. Hence, countries with smaller pension systems benefit more from higher returns on savings. Second, the pattern of CEV over time depends on demographics. Countries with large pension systems will at some point have a big burden of contributions that may overcome the positive effect of the interest rate due to increasing contribution rates and negative labor effects over time in all countries.

Figure 11: Relative Welfare Gains and Losses Due to Population Aging – Present-biased Households



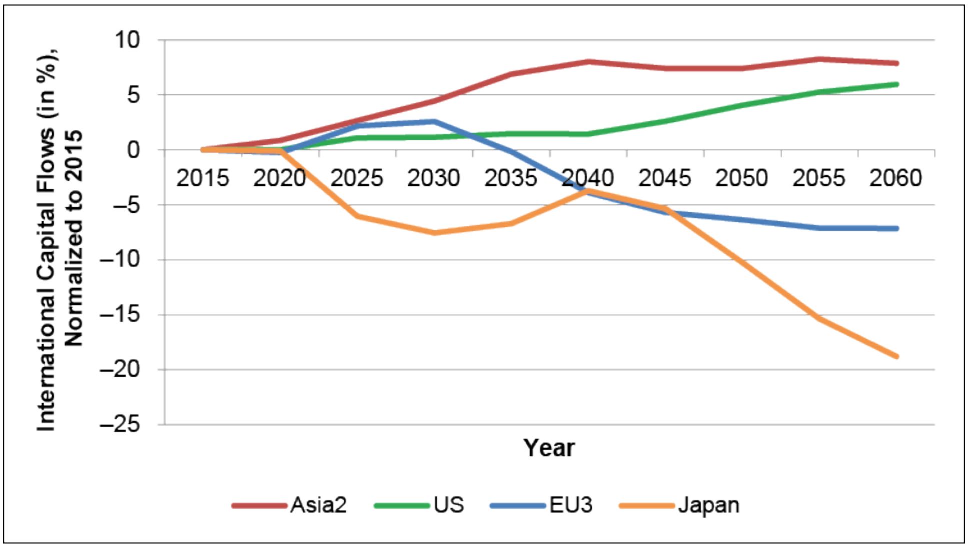
CEV = consumption-equivalent variation; US = United States; EU = European Union.

Source: Own computations.

In Figure 11, we compare present-biased households between a scenario where in the economy present-biased households represent only a 20% share of total population and a scenario where they represent 80% of the population. CEV is positive for all countries until around 2020. In EU3, only cohorts born after 2000 (entering the labor market after 2020) are worse off when there is a lower share of present-biased individuals. As for Japan, it happens some years later, around 2040. Besides the interest rate mechanism explained above, the demographic mechanism is here more relevant for time-consistent agents making them worse off earlier than the present-biased counterpart. Of course, countries with large pension systems will be the ones with the highest burden that overcomes the positive effect of the rates of return.

We finally investigate the sensitivity of international capital flows when the share of hyperbolically discounting households is asymmetric across countries. We model three asymmetric scenarios. All countries have a mix of time-consistent and present-biased households. As a baseline assumption, in all scenarios countries/country groups have a 20% share of present biased households while (a) the Asian countries, (b) the EU3 countries, and (c) the US have a share of 80% present-biased households. Figures 12 through 14 present the resulting capital flows.

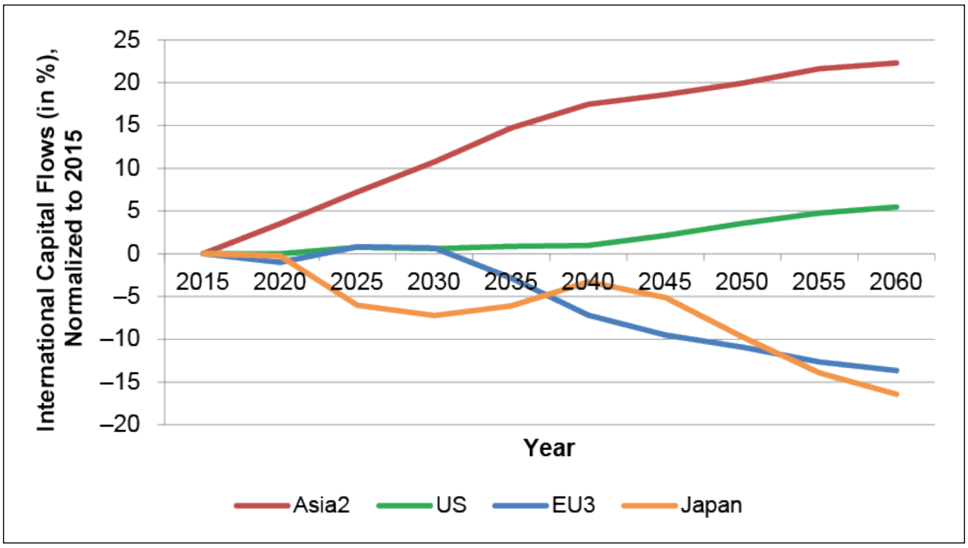
Figure 12: International Capital Flows when Asia has a Higher Share of Present-biased Households



US = United States; EU = European Union.

Source: Own computations.

Figure 13: International Capital Flows when EU3 has a Higher Share of Present-biased Households

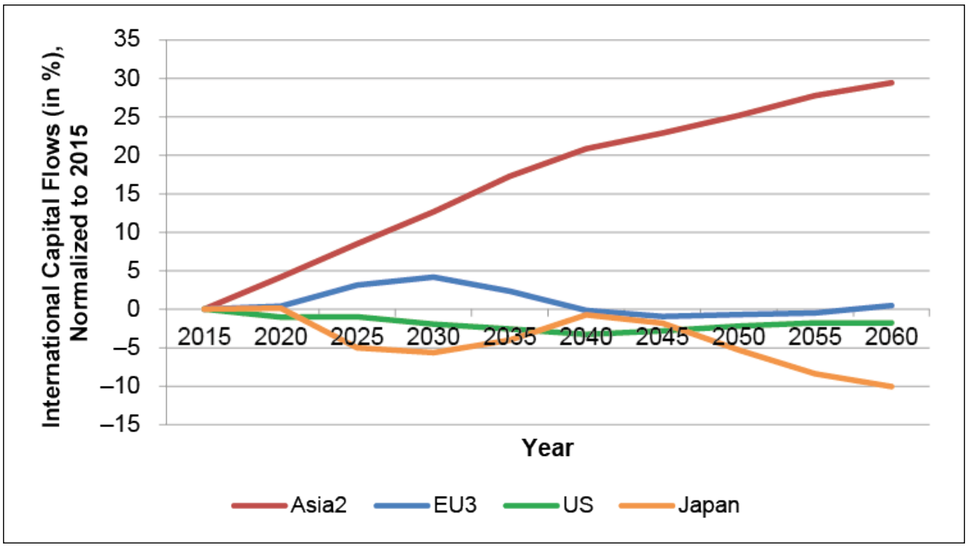


US = United States; EU = European Union.

Source: Own computations.

Since households who are time-consistent save dramatically more than present-biased households, the capital flows react very sensitively to asymmetric shares of present-biased households. The three figures clearly reflect which country is saving more than the other countries. Note that when Asia or the EU3 countries save relatively little due to their high share of hyperbolically discounting households (Figures 12 and 13), the US assumes the role of a capital exporting nation. This is of course reversed in Figure 14. All figures present the same pattern over time that indicates the demographic shift in these countries. EU3 and Japan are clearly the country group with a faster aging which propels them to negative capital flows (increasing inflows) due to repatriation of capital, while Asia2 and the US are still presenting relatively growing outflows due to their younger population. Moreover, since Asia2 and the US have high savings due to small pension systems, it takes longer to have the effect of aging strong enough to make it decline (years of decline are not shown in these graphs).

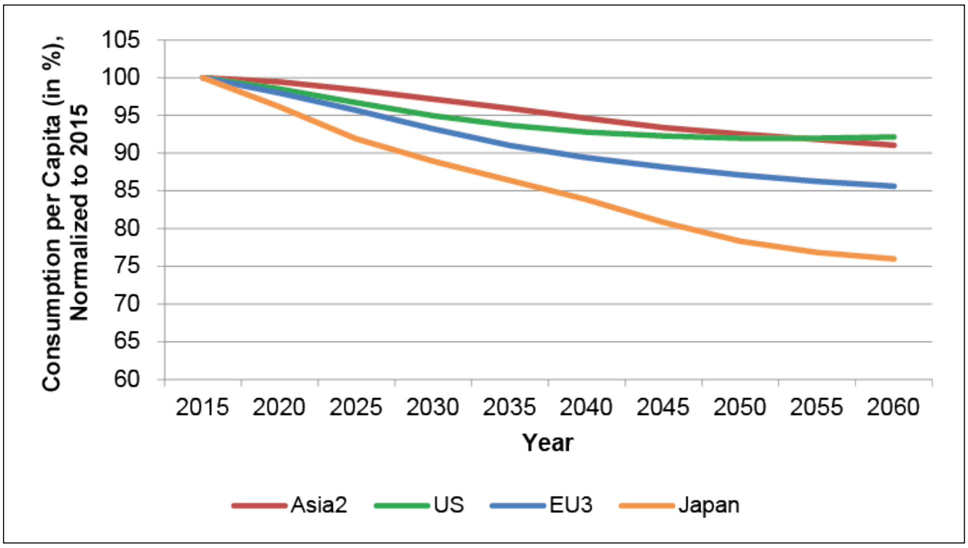
Figure 14: International Capital Flows when US has a Higher Share of Present-biased Households



US = United States; EU = European Union.

Source: Own computations.

Figure 15: Consumption per Capita when Asia has a Higher Share of Present-biased Households

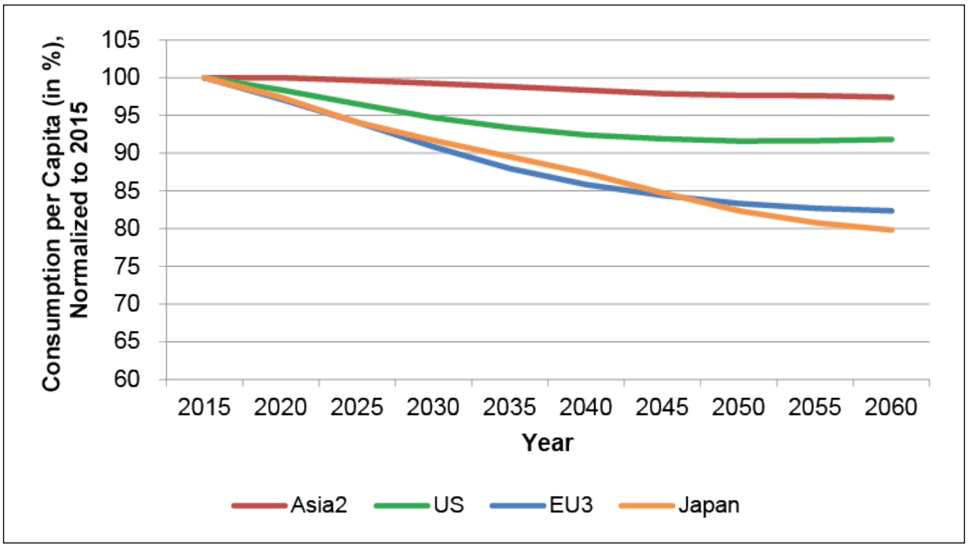


US = United States; EU = European Union.

Source: Own computations.

The implications for per-capita consumption are depicted in Figures 15 through 17. They reflect that a country with more present-biased households will experience a relatively larger decline in consumption per capita. These effects are large in all three country groups. For instance, in Figure 15, Asia2 has a sharp decline, bigger than in the US – they cross around the year 2050.

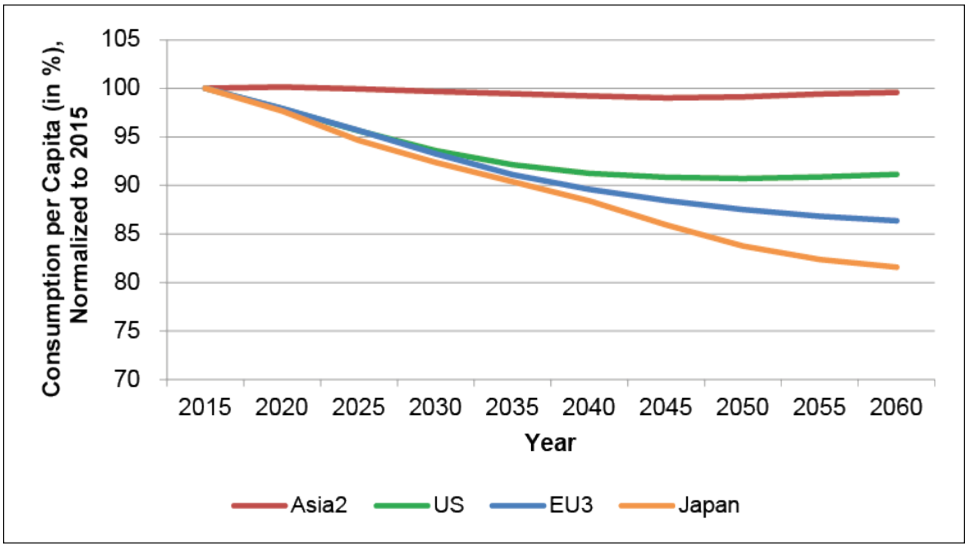
Figure 16: Consumption per Capita when EU3 has a Higher Share of Present-biased Households



US = United States; EU = European Union.

Source: Own computations.

Figure 17: Consumption per Capita when US has a Higher Share of Present-biased Households



US = United States; EU = European Union.

Source: Own computations.

The reason behind this larger decline when the majority of agents are present-biased is the balance between higher returns on savings (via interest rate) but lower savings due to present-bias. Present-biased agents save less and although consumption may increase via higher consumption shares, the interest rate effect is diluted and so there are lower assets accumulated that benefit from a higher rate of return – savings do not dampen the negative effects of aging as they did before. Therefore, the overall effect is a consumption per capita decline.

4. GLOBAL SPILLOVER EFFECTS OF PENSION AND LABOR MARKET REFORM

In Europe, parametric pension and labor market reform has been on the agenda since the 1990s in order to relieve some of the restrictions on labor markets. This increase of labor supply is supposed to offset the decline of the demographic support ratio in the course of population aging. The change in the high school and university system all across the EU starting in 2001 (the so-called Bologna process) is expected to decrease duration in schooling by about 2 years. In Germany, the so-called Hartz reforms announced in 2002 have dramatically reduced unemployment to a level which may be regarded as the long-term stable rate of unemployment.[4] Moreover, the German parliament decided in 2007 to gradually increase the statutory retirement age from 65 to 67 years until the year 2029. The French government increased the pensionable age of 60 to 62 in 2010. In Italy, the Monti-government 2011–2013 abolished several labor market restrictions and advanced the scheduled increase of the retirement age and abolished several pathways to early retirement. All three EU3 countries have experienced a strong increase in female labor force participation, partially due to improvements of the ability to combine job and family.

In this section, we demonstrate the international effects of a prototypical reform package that is motivated by these historical interventions. The key parameters to be changed are:

- An increase in the retirement age by 2 years;
- A decrease in the job entry age by 2 years;
- Convergence of female labor force participation to 90% of the rate for men;
- A reduction in unemployment to 4%.

All four parametric reform steps will together be phased in linearly between 2005 and 2050 in our EU3 model economies. We assume that labor supply is exogenous and abstract from "backlash" effects described by Börsch–Supan et al. (2014). Hence, the reforms increase labor supply to their full extent. Otherwise, the set-up is exactly the one of Section 3 with the four countries/country groups – US, EU3, Japan, and Asia2.

The main focus of this section is not on the effects of the reform on the EU3 economies, but on international spillovers.[5] Moreover, we want to understand whether these spillover effects are sensitive to the share of hyperbolically discounting households.

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[4] Defined as the rate of unemployment that prevents inflation from accelerating (NAIRU, Ball and Mankiw 2002).

[5] Cf. Börsch–Supan and Ludwig (2009).

4.1 Effects on Europe

The effects of reforms, which add additional labor supply to the European economies, have been described earlier (Börsch–Supan et al. 2014). The decline in the total labor volume due to population aging in the EU3 economies is offset by more than a half through the labor supply reform. In addition, saving and investment react to the parametric reform, leading to an increase in the domestic capital stock relative to a baseline scenario without reform. Since both factors of production increase, the effect of the reform package on GDP per capita is larger than the increase in employment. Since increasing labor also increases aggregate savings, some of households' savings flow from the aging EU3 countries abroad. As we have seen in Section 3, these savings will eventually be repatriated and will then increase consumption per capita stronger than per capita GDP. Therefore, when normalizing capital flows to 0% in 2015, the additional savings in the EU3 countries diminish capital inflow to Europe (see Figures 21–23, blue lines). This mostly happens after the year 2040 because the gradual shift in labor supply takes some time to substantially affect accumulated life-cycle savings. Moreover, the reform leads to an increase in the market interest rate because every unit of capital is getting more productive when more labor becomes available. The higher interest rate is especially beneficial for savers and allows them to increase their consumption further.

The overall effect is visible in Figure 18 where the thick lines represent EU3. Solid lines are pre-reform, broken lines after the labor supply reform. Rather than declining by 17%, consumption per capita only declines by about 8%; the reform thus offsets about half of population aging. The reform propels the EU3 countries from resembling Japan to resembling the US. This effect is not very sensitive to the fraction of hyperbolically discounting households in Europe or abroad (Figures 19 and 20). There is still a slightly larger effect in the scenario where the EU3 countries exhibit the largest share of hyperbolics. Instead of an increase of 8.5 percentage points in the all-time consistent-scenario, there is an increase of roughly 9 percentage points when the EU3 countries are mostly hyperbolic. The exogenous increase in labor supply and therefore labor income is most beneficial for hyperbolics because they consume a larger fraction of their income.

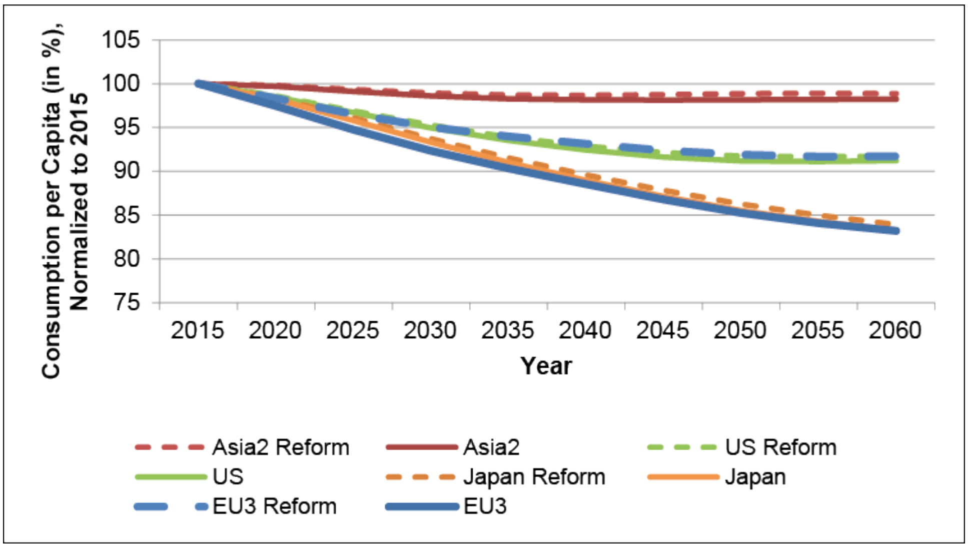
The negative effect of population aging on per capita consumption, however, itself is slightly stronger when a large fraction of Europeans has present bias. The reason is lower savings under time-inconsistency: savings can no longer serve as a buffer against aging effects in Europe by investing them abroad.

4.2 Effects on Asia

The spillover effects to the other countries are small but visible in Figures 18–20. They amount to about 1 percentage point of annual consumption. These positive spillover effects work through the interest rate channel: a higher labor force in Europe slightly increases the world interest rate because every unit of capital is getting more productive when there is more labor input. The higher interest rate, in turn, is beneficial for all countries, which is why they are all slightly better off in terms of consumption per capita.

The presence of hyperbolic consumers increases the interest rate because of lower savings at all times. This changes the path of consumption similar to what we have seen in Section 3. The spillover effects after the labor market reform, however, are similar in the two asymmetric scenarios, here defined as either a low (20%) or a high (80%) share of present-biased households.

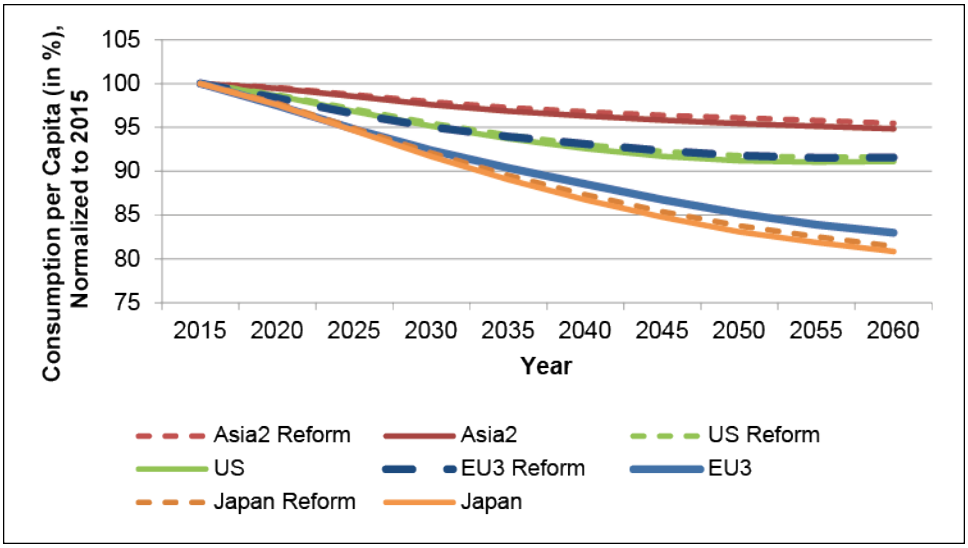
Figure 18: Reform Effects on Consumption per Capita, All Time-consistent



US = United States; EU = European Union.

Source: Own computations.

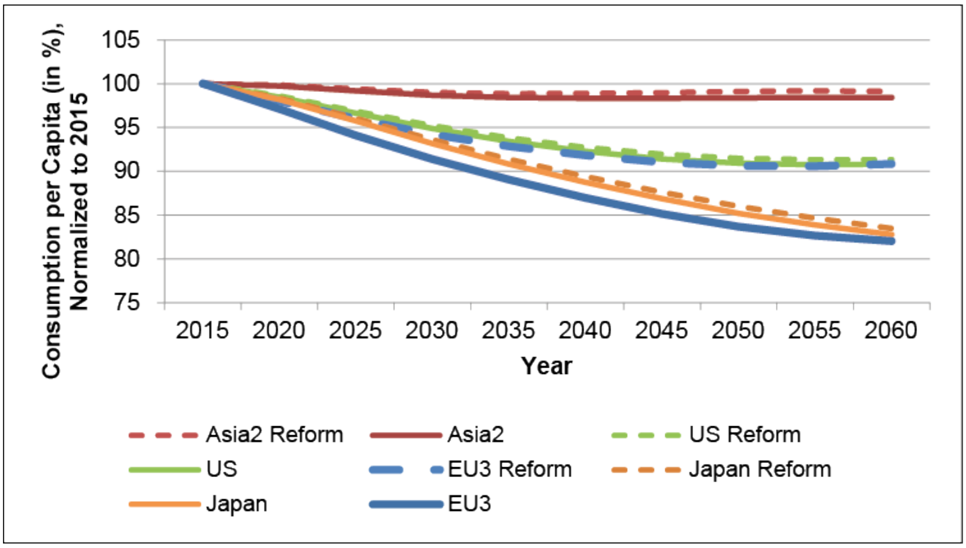
Figure 19: Reform Effects on Consumption per Capita, More Hyperbolics in Asia than in EU3



US = United States; EU = European Union.

Source: Own computations.

Figure 20: Reform Effects on Consumption per Capita, Fewer Hyperbolics in Asia than in EU3

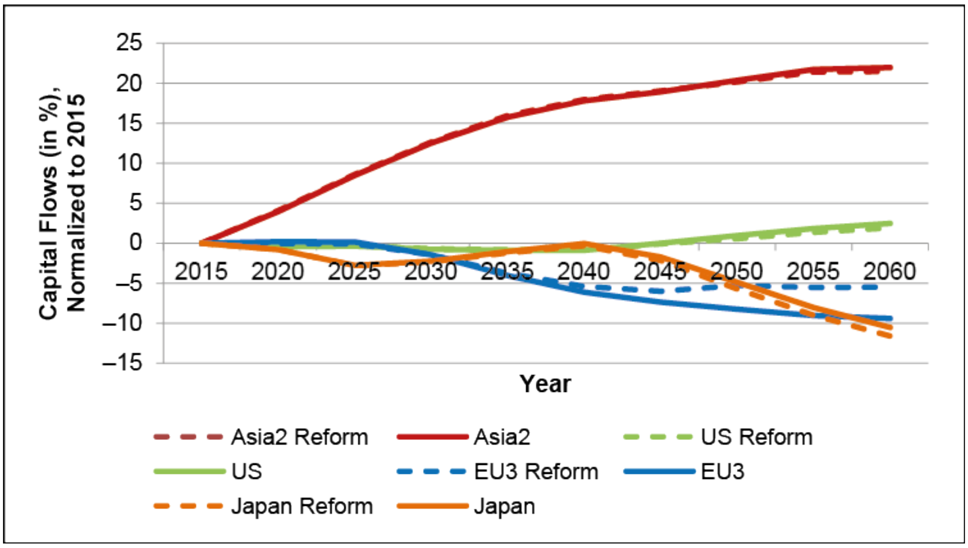


US = United States; EU = European Union.

Source: Own computations.

Finally, Figures 21 through 23 show the effect of the labor market reform in EU3 on international capital flows. Direct investments of the EU3 countries increase especially after 2040 due to the reform. The reason is, as mentioned before, the slow shift in the reform and its lag on life-cycle savings in Europe. Taking a mirror image to the EU3 countries, all the other countries show a decrease in outflows (increase of inflows in case of Japan) following the reform. Again, mirroring the development in Europe (see Section 4.1), the decrease in capital outflows is higher in the two hyperbolic scenarios after the labor market reform.

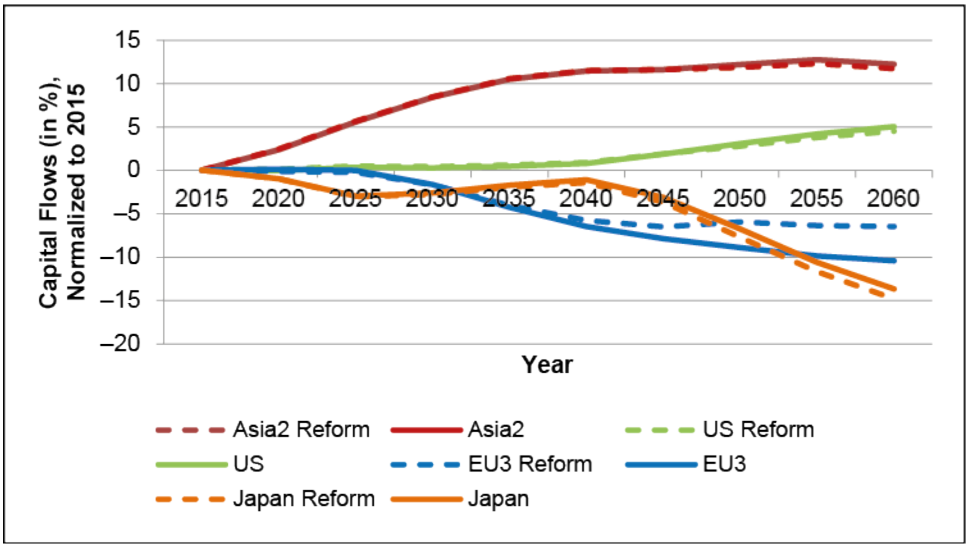
Figure 21: Reform Effects on Capital Flows, All Time-consistent



US = United States; EU = European Union.

Source: Own computations.

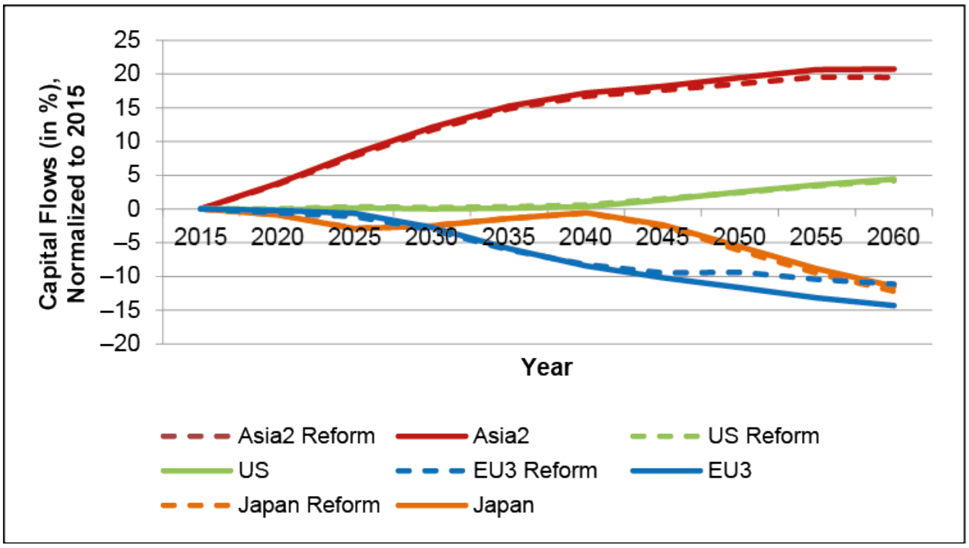
Figure 22: Reform Effects on Capital Flows, More Hyperbolics in Asia than in EU3



US = United States; EU = European Union.

Source: Own computations.

Figure 23: Reform Effects on Capital Flows, Fewer Hyperbolics in Asia than in EU3



US = United States; EU = European Union.

Source: Own computations.

Regarding welfare, there is a common pattern in all scenarios (not shown). Cohorts entering the labor market before 2005 are better off than in the no labor market-reform scenario; cohorts entering afterwards are slightly worse off. The reason is the increase of the interest rate because of the reform: cohorts that are already old and possess much savings profit a lot from a higher interest rate; young cohorts that may even go into debt are worse off if they face a higher interest rate early in life.

5. CONCLUSIONS

Pension economics has traditionally guided pension policy with the help of formal models based on individuals who think in a life cycle context with perfect foresight, full information, and in a time-consistent manner. This paper sheds light on selected aspects of pension economics when these assumptions do not hold. We focus on three aspects which are particularly relevant for the quickly aging Asian economies: the volume of savings for old-age provisions, international diversification of retirement savings, and global spillover effects of pension reforms.

Regarding the first aspect, we conclude that saving behavior is quite different from the textbook model when a substantial fraction of households is myopic or procrastinating with hyperbolic time preferences. The volume of savings for old-age provision is substantially lower in a world with many myopic households. This has repercussions on the interest rate and economic growth but also on the relative merits of pay-as-you-go versus fully funded pension systems.

Second, international capital flows are substantially lower when households are present-biased since they are saving dramatically less. We observed that asset markets play an important role in a world of aging populations. The logic of this is obvious because labor is becoming scarce. There are, however, two further reasons. Firstly, capital investments are the only way of distributing resources over time and between generations. More specifically, in the case of the demographic shift, capital investments are the vehicle that allows part of the earning power of baby-boomers to be used to finance their own pension instead of allowing the entire pension to be financed by those of the next generation, who will be completely overwhelmed because of their greatly reduced numbers. We therefore need a capital market so that the earning power of the younger generation is not overwhelmed by the excessive demands of the older generation.

The second reason lies in the international mobility of capital. As we know, mobility of the factor labor is not particularly good and aging countries cannot expect that younger countries will help to finance their pay-as-you-go systems, nor is it likely that a surge of migrants will pay their pension contributions. Capital, in contrast, can move around the globe and bring in earnings from countries abroad where labor is more plentiful than it is here. For “old countries” such as Germany, Italy, and Japan in particular, an open and globalized world can be of assistance during the aging process. Rich in consumers, poor in labor, these countries must have an intrinsic interest in boosting their imports. Free trading relations are therefore a substitute for inward migration. The capital invested abroad provides better production possibilities abroad and generates capital income for the retirees at home.

Regarding the third and final aspect of this paper, parametric labor market and pension reforms in one part of the world (Europe) will have global spillover effects through the global interest rate. Changes in key labor market and pension parameters, especially retirement age, in Europe also improve the sustainability of pension systems and economic growth in Asia.

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