Preliminary – comments welcome

DEMOGRAPHIC AND PENSION-SYSTEM CHALLENGES TO FINANCIAL AND MONETARY STABILITY

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Introduction

Against the background of forthcoming population ageing, the Lisbon Agenda – and later EU pronouncements – have challenged Member States to meet coming challenges in this field, with aims such as "to carry out pension reforms to ensure adequate pensions, financial sustainability and modernity of the retirement systems in the long run". The process of such pension reform is well advanced in the New Member States of the EU, albeit much less so in many of the "older" ones. Consequently, as noted by Regling and Costello (2003) of the European Commission, "a clear and unequivocal risk of unsustainable public finances exists in at least half of EU Member States". Attempts to raise effective retirement ages, also required for a sustainable response to ageing, have been even less successful to date.

Whereas ageing is inevitable and pension reform is essential for fiscal sustainability, the literature on the economic and financial implications of such developments is in our view unbalanced. There is extensive work on fiscal implications of ageing and pension systems, see Dang et al (2001) for a recent example. The link between changing demographic structure and macroeconomic performance has also been widely studied; see for example Turner et al (1998), Kohl and O'Brien (1998) and McMorrow and Roeger (2003). Furthermore, there is a growing field of work on financial implications of ageing (such as Poterba (2001) and other studies surveyed in Davis and Li (2003)). On the other hand, work on implications of ageing and pension systems for central bank policy, both in the field of monetary and financial stability, is rather poorly developed. Against this background, this paper seeks to probe the implications of ageing itself, of a "no-reform" scenario and of the growth of pension funds following a successful reform, for financial stability and for monetary policy. It draws on existing work on macroeconomic, fiscal and financial implications, but seeks to illustrate how they could also combine to render the task of central banking more complex as the ageing process accelerates, depending on reform.

1 Effects of ageing on macroeconomic performance

Essential background is the overall impact of ageing on macroeconomic performance. We may summarise current views on the latter as follows:

As regards *growth*, it is widely considered that it will decelerate as ageing proceeds, principally because of lower labour-force growth. There will also be lower growth in living standards (i.e. GDP per head) than has been the case in recent decades, reflecting the accompanying increase in the dependency ratio. Effects on growth of a fall in labour force growth are unlikely to be offset by higher *investment*. Indeed, investment is itself likely to decline given a lesser need for capital widening, while capital deepening is likely to be limited by diminishing returns. Moreover, slower growth will tend to reduce returns on capital directly, thus again putting downward pressure on investment. The example

of slower Japanese output and investment growth since 1970, and accompanying lower returns to capital, may be cited in this context. Lower private and public saving (with high government borrowing), as discussed below, may crowd out investment. On the other hand, higher *labour force participation* could help to underpin growth. Another unknown factor in this context is the response of *productivity* of labour or capital to ageing and its impact on growth.

An important element in assessing *private saving* is the view taken of the life cycle hypothesis, which postulates initial dissaving in young adulthood, followed by saving for retirement and finally dissaving in retirement. Most estimates of the determination of saving based on macro evidence imply that this pattern holds, implying that an older population will save less. For example Masson and Tryon (1990) find an elasticity of -1 from the dependency ratio to the savings rate using pooled cross-section and time series data for industrial countries, although later work by Masson et al (1995) and Loayza et al (2001) reduced this estimate to around -0.2. McMorrow and Roeger (2003) found an average elasticity of –0.75 across existing studies. The implication is that ageing will sharply reduce private saving. Note however that the process may not be monotonic, since peak saving is usually by those in later working life. Hence, in the current decade saving may increase as the baby boom generation reaches maturity and saves for retirement.

Micro results are much more equivocal in terms of the life cycle, with much evidence suggesting that the elderly may not save less than the working population (Poterba 2001). Furthermore, the negative effect on saving may be partly attenuated by pension reform. Disney (2000) offers evidence that reform of public pension systems may have the effect of boosting private saving, also highlighting a study of Italy (Attanasio and Brugiavini 1999), which supports the hypothesis. Furthermore, and more tentatively, funding should tend to reduce the cost and increase the availability of equity and long term debt financing to companies, and hence may raise productive[2] capital formation. Economically efficient capital formation could in turn raise output and "endogenously", growth itself (Holzmann 1997). Higher growth will of course feed back on saving.

As the population ages, the public sector will tend to lower its saving, ceteris paribus. Such trends in *public saving* are largely driven by the scale of the public pension system in the light of ageing and the means of financing adopted (e.g. taxation versus debt finance). Recent estimates include those in Dang et al (2001) and McMorrow and Roeger (2002). Debt finance would imply a greater fall in public saving. Rapid increases in the proportion of the population over 65 (the dependency ratio) combined with generous social security pension schemes are particularly threatening. It is this aspect which is encouraging governments to scale down public pension commitments and switch to funding. If, as suggested above, funding also boosts private saving, the benefit to domestic saving is compounded.

[2] This also requires allocation of funds to their most profitable uses and adequate shareholder-monitoring of the investment projects, which should also tend to occur in capital markets dominated by pension funds.

External balances will be driven by the combination of domestic saving and investment (see Bikker 1996). After an initial surplus while baby-boomers reach peak saving (as recently in the case of Japan), it is generally accepted that ageing will lead to a greater fall in saving than investment, implying balance of payments deficits, which may themselves entail exchange rate pressures.

Illustrating these patterns, Turner et al (1998) provided a simulation of the global effects of population ageing (both focusing on changing population growth and age structure) using the OECDs international dynamic general equilibrium macromodel MINILINK. Reflecting the declining labour supply with ageing, economic growth is forecast to decline to 0.25% per annum in Japan, 1% in Europe and 1.4% in the United States by around 2030.

The slowdown in growth reduces investment needs directly. Furthermore, a decline in the weight of the OECD in the world economy tends to improve OECD current accounts (and hence saving-investment balances) as non-OECD imports rise faster than OECD import demand. The US, Europe and Japan all generate balance of payments surpluses of 2-3% of GDP up to 2025, as saving is initially boosted by the high proportion of high-saving age groups while growth potential and hence investment weaken, thus building up net external assets which help to buttress GNP.

On the other hand, eventual downwards pressures on public and private saving are greater in the OECD than elsewhere, generating – in combination with exchange rate appreciation – deficits for the three OECD regions after 2025. As world investment in this simulation falls less than saving, world real interest rates are expected to rise slightly, reinforcing the decline in investment. Reflecting differing returns on capital, interest rates are higher in Emerging Market Economies (EMEs) than in the OECD. The authors note that higher saving in OECD countries could generate quite different results, with lower real interest rates and consequently higher investment and capital-labour ratios. There would also be greater net external assets, boosting OECD GNP via inflows of interest, profits and dividends[3]. As we noted above, some limited boost to saving could be anticipated from a switch from pay-as-you-go to funding.

Note that the above is just one example of global projections – others differ in details. For example, McMorrow and Roeger (2003) concur that the EU and Japan will run surpluses for some time, but expect the US to run ongoing deficits, reflecting growth differentials and an assumption that the absorptive capacity of slow ageing EMEs is limited. They also note that such a continued concentration of capital flows within the OECD is more likely to generate downward pressure on rates of return and a risk of bubbles.

[3] The return on such investments will depend on factors such as labour and product market reforms in the EMEs as well as the overall size of such flows from the OECD (if the flows are sufficiently sizeable, they will depress the return on capital in the EMEs).

2 Ageing, the no-reform case and financial stability

With the above macroeconomic projections as background, we now go on to assess risks for financial stability that could concern central banks. It is clear that ageing – which is most acute in Europe among OECD countries - will generate sharp changes in quantities and prices in EU financial markets As discussed in Davis (2002), and Section 1, a possible effect on financial stability can be traced for the "general case" of ageing and for countries where pay-as-you remains dominant as well as where funding is introduced (Sections 3 and 4). Such instability is obviously of major interest to central banks. No system is likely to be unscathed, but issues are far more serious for pay-as-you-go.

Looking first at financial stability issues linked to the general case of ageing, it is widely anticipated that saving will rise in the next few years owing to the "baby boom generation" entering peak saving age, while potential growth declines. Then, like Japan in the 1980s and 1990s, the EU could face an external surplus and loss of competitiveness with currency appreciation, aggravated by home bias due to uncertainty on the part of pension funds. This may in turn generate excess liquidity and loose macroeconomic policies (if a structural surplus is mistaken for a cyclical one). In turn, this could generate a financial bubble (as already observed in Japan), whose deflation entails financial instability. Later, as baby boomers retire, there could be a balance of payments deficit, with risks of currency crises and exchange rate volatility accompanying banking crises.

The volatility in external flows and asset prices would be ameliorated by growth-promoting domestic policies (such as boosting the labour supply, raising saving and investment and reforms seeking to increase productivity) that would limit saving-investment imbalances, as well as policies to improve the absorption capacity of slow-growing poorer countries so flows are not kept largely within the OECD (McMorrow and Roeger 2003). This is in a sense a "first best solution" that is in the interests of central banks to encourage. But some volatility seems inevitable, which would require careful monitoring by central banks. It may need a greater focus on asset price movements and monitoring of lending during periods of asset price volatility. Lender of last resort would of course not necessarily be an appropriate response in the case that the volatility generates insolvency rather than illiquidity.

Risks in pay-as-you-go may be best traced in the extreme case of no-reform. They will be attenuated to the extent that reforms reducing benefits and/or increasing effective retirement ages take place. One aspect is that the inevitable uncertainty about future pensions in unreformed systems will lead to heightened precautionary saving. If directed to banks, this may lead to underpricing of risk in domestic credit or international interbank markets, again as in Japan (see Hargraves et al 1993), with similar implications for financial stability. Life insurers could invest in high yield bonds and property, and be vulnerable to credit cycles, with consequences for their solvency also.

Turning to fiscal effects themselves, if there is tax finance when ageing occurs (i.e. a marked rise in contribution rates) there may be major economic difficulties owing to adverse effects of high and distortionary taxes on economic performance, generating credit losses and falls in asset prices, which are unlikely to be accurately anticipated by lenders. Underlying and accompanying these problems, capital as well as labour could translocate from the country concerned, especially if the tax burden is weighted towards these factors of production, as opposed to being in the form of consumption taxes.

In the case of bond finance, (i.e. whereby governments run deficits and accumulate debts when there is strain on pay-as-you-go systems during ageing), one may in due course expect a sharp rise in long term interest rates, loss of credit rating of the government, crowding-out, and a recession. Hence major credit losses for lenders may arise as borrowers face adverse economic conditions and higher interest costs. We note that most past fiscal crises as in Italy were with unliberalised banking systems, and hence are not a sufficient prediction of likely consequences. In this context, the government's ability to recapitalise banks in difficulty would decline with its borrowing capacity and credit rating. Ultimately, as interest rates rise and growth falls while deficits rise and debts accumulate, there may be a fiscal-solvency crises, which could be contagious, "snowball" and give rise to a temptation to monetise, or leave EMU. There would obviously be major challenges to the financial stability responsibilities of central banks as well as monetary stability difficulties (see Section 5). All of the adverse effects will of course take place at an earlier stage if governments fail to consolidate the fiscal position in advance of the onset of ageing.

The pension issue linked to unreformed pay-as-you-go is arguably the most intractable one facing the single currency. Given the need to finance the transition, even a country reforming a generous social security system and shifting to funding will not entirely escape some of these difficulties outlined for pay-as-you-go. Meanwhile, countries that have reformed would suffer from higher long term interest rates and other adverse spillovers in the case of a crisis elsewhere.

3 Pension funds, financial structure and financial stability

We now turn to implications of pension reform for financial stability. A reasonable scenario, as suggested in McMorrow and Roeger (2002) is partial replacement of social security by funded pensions, with contributions to the former frozen at current levels as a proportion of wages, and current pension promises made up by appropriate funding. Such a reform would markedly ease the fiscal burden of ageing, reducing the risks outlined above, and would also tend both to boost private saving and change the size and composition of household asset accumulation.

As noted by McMorrow and Roeger (2003), a significant proportion of extra asset accumulation generated by a partial shift to funding in the EU would be invested internationally, with a benefit in terms of interest income accruals and also risk diversification. This proportion will be markedly higher if EU countries do not undertake labour and product market reforms making it attractive to invest domestically. Growth of pension funds following reform is also likely to entail a partial displacement of other forms of saving (Boersch-Supan and Winter 2001), notably bank deposits, leading to an acceleration of the shift in EU financial systems from bank and loan basis to a securitised and institutional investor basis (Davis 1999).

In general, a financial system characterised by institutional investors and extensive capital market financing may be more stable than a bank-based one, especially if there is mispriced safety net protection in the latter and low values of banking charters. For in normal times, pension funds, having good information and low transactions costs, are likely to speed the adjustment of asset prices to fundamentals; this should entail price volatility only to the extent that fundamentals are themselves volatile. Moreover, the diversity in types and sizes of institutional investors - in their liabilities, incentives, and consequent attitudes to risk - should be stabilizing to financial markets. The liquidity that institutional activity generates may dampen volatility, as is suggested by lower share price volatility in countries with large institutional sectors (Davis and Steil 2001).

It can, moreover, be argued that securitized financial systems have important stabilizing features, such as ease of marking to market, matched assets and liabilities and – notably for mutual funds and defined contribution pension funds - distance from the safety net. There are wider opportunities to diversify and spread risk. Furthermore, the “multiple channels of intermediation” available to the corporate sector in securitized financial systems will reduce the impact of any crises which affect either banks or securities markets (see Greenspan (1999), Davis (2001)).

On the other hand, notably during the transition, risks may arise for the banking sector following pension reform. Disintermediation, with a lesser proportion of saving being channelled via banks, given lower deposit inflows and greater competitiveness of capital market financing, may give rise to banking crises. This is because banks in such a situation may take increased risks so as to boost their profitability in a highly competitive market situation, while higher quality credits seek capital market financing. Indeed, it can be argued that the banking crises in a number of countries in the late 1980s were linked to the heightened competition banks faced from the capital markets (Davis and Steil 2001). Again there are precedents in Japan (Hoshi et al 1993). In this context, note that a number of authors such as Demirguc-Kunt and Detragiache (1998) have looked at the effect of financial liberalisation on systemic risks, and found that banking crises were more likely to occur in liberalised financial systems. Crises tended to occur a few years after liberalisation, and were linked to a decline in bank franchise value, because monopoly power is eroded (see Hellman et al 2000). Securities

market competition driven by growth of pension funds can arguably have a similar effect to deregulation on franchise values and risk taking. A number of EU banking systems already suffer from low profitability and excess capacity and could be vulnerable in this context (Bank of England 2003). The traditional instruments of emergency liquidity assistance, as well as fiscal headroom for bailouts, could be called upon if such risks materialise.

Pension funds and other institutional investors which are vehicles for retirement saving may also give rise to unfamiliar types of financial instability from the point of view of regulators and market players, which would be accentuated as they grew during the expansion of precautionary saving and/or funding. These would pose challenges to central banks in terms of adaptation of macroprudential analysis[4] and response to crises. Already in existing experience of financial instability one can distinguish two particular types of financial turbulence they give rise to:

A first type involves extreme market price volatility after a shift in expectations and consequent changes in institutional investors' asset allocations. Such crises are focused mainly on the consequences for financial institutions of sharp price changes which result from institutional "herding", as groups of such institutions imitate one another's' strategies for reasons related to the information and agency problems between the investors and the asset managers (see the summary in Davis and Steil (2001)). Whereas misaligned asset prices and sharp price movements during corrections may not in themselves have systemic implications[5], these may emerge when such movements threaten e.g. institutions that have taken leveraged positions on the current levels of asset prices. Examples are the stock market crash of 1987, the ERM crisis, the 1994 bond market reversal and the Mexican crisis (Davis 1995). There were also elements of this in the Asian crisis. Indeed, EME securities markets, as well as those for forex, derivatives, bonds and equities in OECD countries, could be vulnerable to these shifts, not least if a large proportion of pension-financing is directed to EMEs. The challenge here is the appropriate monetary policy response to the preceding misalignment, as well as possible need for emergency liquidity assistance for institutions facing difficulty after the adjustment.

A second type involves protracted[6] collapse of market liquidity and issuance (Davis 1994). Again often involving one-way-selling by institutional investors as they seek to shift asset allocations simultaneously, the distinction is often largely one of whether markets are sufficiently resilient, and whether market maker structures are suitably robust. Also, such crises tend to characterise debt markets rather than equity or foreign exchange. The risks are acute not only for those holding positions in the market but also for those relying on the market for debt finance or liquidity – which increasingly include banks. Examples in the past have tended typically to be rather specific and

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4 See Davis (1999a)

5 They may, however, lead to resource misallocation.

6 It is not denied that all sharp price changes will tend to affect market liquidity to a greater or lesser degree

idiosyncratic markets, which by nature relied on a narrow investor base, market maker structure and/or issuer base (junk bonds, floating rate notes, Swedish commercial paper, ECU bonds). Central banks have tended justifiably to leave the market to sort out its own difficulties. However, the events following the Russian default and the rescue of the hedge fund LTCM were much more serious, as liquidity failure was threatened in markets such as the US repo, swaps, CP, corporate and Treasury bond market (see IMF (1998), Davis (1999b)). US monetary policy makers cut rates repeatedly in the wake of the crisis, partly out of concern that borrowers from bond markets would not find sufficient lending capacity from banks. In this context, note that real estate crises, which could also follow institutional herding, have elements of illiquidity as well as price declines.

Owing to their impact on the availability and price of credit, as well as liquidity of assets, price-volatility and market-liquidity based crises may threaten EMEs, banks and the non-financial sector more than pension funds and other institutional investors themselves. These could naturally be matters of central-bank concern. Long term institutions can “sit out” such crises given their long-term liabilities.

But institutional investors may also tend to focus increasingly on debt claims as members approach retirement, while competition in asset management may lead investment managers also to be willing to take heightened credit risks in order to maximise their return on assets (Bishop (1998), Allen and Gale (1999)). In countries such as the US, defined benefit pension funds have pension benefit insurance that may generate significant moral hazard (Bodie and Merton 1992). This suggests that institutional investors could increasingly invest in high yield bonds and EME sovereign and corporate debt, and thus be vulnerable to credit risk to a greater extent than was the case in the past. Credit cycles could, in other words, affect institutional investors as well as banks. Solvency could be threatened directly for life insurance companies and defined benefit pension funds if a significant proportion of their assets defaulted. Equally, besides market and credit risk, errors on the asset or liability side (e.g. in terms of guaranteed returns or mortality projections) could also threaten solvency of a range of institutional investors, as has been seen already in Japan and with certain UK companies such as Equitable Life (see IMF .

Three points may mitigate related systemic concerns, first that insurance companies and defined benefit pension funds are not easily subject to runs on suspicion of insolvency given, they have matched and long term assets and liabilities, while mutual funds and defined contribution pension funds are not themselves subject to solvency risks – credit risks are passed directly to the household sector. Second, most institutional-investor claims are not insured, or the insurance is mutual, thus generating incentives for interfirm monitoring. Third, given the ease of adopting market value accounting for securitised claims, it can be argued that debt crises are much less likely in corporate bond markets than for banks where the deterioration of credit quality is hidden from view in the

balance sheet (Davis 2001). Markets can still make mistakes however, as witness the repeated bond-based debt crises of the late Victorian period; and US experience suggests bond markets generally find rescheduling after financial distress difficult (Gilson et al 1990). Furthermore, whereas central banks may not be directly concerned with insolvency of institutions per se (since they are not subject to panic runs), they may be concerned about abrupt changes in saving levels and saving patterns that could accompany loss of confidence in long term institutions.

4 Pension funds, asset prices and financial stability

Beyond the changing nature of the financial system, the expanded asset flows from pension saving during ageing as foreshadowed in Section 1 may entail financial instability in terms of volatility of asset prices, which agents in the economy may not correctly anticipate.

There is evidence of such patterns from recent financial history. It is widely suggested that asset flows from institutions driven by ageing may have driven the last bull market in equities in countries such as the US (Shiller 2000). Work on savings flows such as Poterba (2001) does imply that high levels of retirement saving in the form of securities may have driven up market prices. It may be the case that the institutionalisation of saving has boosted equity prices via a fall in the risk premium (Blanchard 1993), reflecting better diversification and lower risk aversion of collective investment vehicles. Such tendencies can overshoot, leading to bubbles. On the other hand, most work on the relation of equity prices to mutual fund flows suggests that direct effects of inflows on prices are hard to detect (Fortune (1998), Engen et al (2000)).

While the above discussion is largely focused on equity, asset bubbles could also accompany the pension asset build-up to the extent that retirement investment focuses on debt or real estate claims. The property market might be particularly susceptible. Finance of property development by bond issue or direct institutional investment are two possible channels. This could leave insurers as well as banks vulnerable to a downturn in the property cycle, as was the case in the Jamaican insurance crisis of 1996 (IMF 2001).

Following Allen and Gale (1999, 2000), if institutions become significantly involved in property investment and related credit finance, the massive inflows to pension funds as well as insurance companies could generate expectations of ongoing boosts to credit flows into property. There may also be increasing uncertainty about future such flows as ageing progresses. These in the past have tended to foreshadow asset bubbles generated by such credit flows. Externalities in property lending are significant, owing to the effect of new construction on the profitability of contiguous buildings. Since banks would remain exposed to property prices via collateral, and would probably also lend to higher-

risk projects, they could be badly hit when decumulation occurs, or earlier if institutional investors seek to adjust their asset allocation away from property for any reason.

A large share of pension saving in EMEs can also lead to bubbles and financial stability risks in the latter owing to institutional behaviour, even before an eventual repatriation of funds. Owing, for example, to autonomous shocks affecting national or regional profitability and creditworthiness, such as local wars, there may be flight of investable funds back to the OECD or to other EMEs. In this context, note that securities are in principle much easier to repatriate than bank loans. Indeed, behaviour of OECD institutional investors is already widely considered to destabilise EMEs, not least owing to their tendency to invest in EMEs as a bloc rather than focusing closely on individual countries' fundamentals (Buckberg 1996). These patterns of volatility are underpinned by the sharp difference in relative size of EMEs and OECD institutional investors, which may expand as pension funds grow during population ageing.

Beyond the issue of changing asset allocation decisions, which can drive price falls even if pension saving is still rising, there are also arguments suggesting that asset prices will fall during the process of ageing itself, as it interacts with pension funding. A fundamental aspect is that the return on capital may fall as a consequence of a lower labour supply and lower growth during ageing, for example Cutler et al (1990) see the real return on capital halving. An issue for funding is whether it can generate offsetting increases in efficiency and resource allocation, e.g. via growth of capital markets, that may help to offset this by boosting productivity and investment.

Besides the return on physical capital, a key issue is whether asset prices will also be put under downward pressure in coming decades by declining saving or allocation of funds to equities in OECD countries implicitly affecting the real interest rate or the risk premium. Brooks (2000) argues that because there is a smaller generation of investors to sell their assets to, this would put downward pressure on asset prices. Also there will be excess demand for bonds and excess supply of equities in coming decades, as the elderly take annuities of seek safe assets with a marked decline in the returns on the retirement savings of baby boomers held in equities. Shieber and Shoven (1994) developed a similar argument suggesting that in the future, defined benefit pension systems will become net sellers, with the structure and pattern of flows from defined benefit pension plans means asset prices will be depressed. Poterba (2001) argues that the meltdown hypothesis is inconsistent with empirical survey data. Consumers decumulate assets at a less rapid rate than the life cycle suggests. This is because the life cycle model takes no account of the bequest motive and lifetime uncertainty. Hence, although asset demands have risen to fuel the recent boom, they will not fall in the future. However, Abel (2001) using a rational expectations model, which took account of the bequest motive, found stock prices are still expected to fall when baby boomers retire despite high projected asset demands owing to shifts in the supply of capital in response to changes in its price.

Davis and Li (2003) give econometric evidence that demographics have had a significant impact on US, panel and aggregated international stock prices and bond yields, even in the presence of standard additional independent variables. The international results are of interest given the logic of international financial integration. We reproduce a table of their results below for the US, showing that the 40-64 cohort has a strong important positive influence on asset prices, a support that would be removed as its share of the population declines.

Table 1: Demographic effects on real stock prices and bond yields for the US (1950-1999)

Independent variables	Log difference of US real stock prices	Independent variables	US real bond yields
Constant	-2.97 (0.64)**	Constant	12.3 (4.0)**
AGE20	-0.0024 (0.0098)	AGE20	0.266 (0.052)**
AGE40	0.108 (0.02)**	AGE40	-0.239 (0.084)**
DYHP	-3.4 (6.5)	DSR	0.628 (0.1)**
DDIFY	-1.28 (0.97)	TS(-1)	-0.73 (0.125)**
RLR	0.03 (0.009)**	DLCPI(-1)	-109.1 (9.7)**
VOL	-1.19 (0.62)*	DDLCPI	-142.6 (10.0)**
DY (-1)	0.092 (0.026)**	DYHP	-197.3 (58.9)**
		DDIFY	-5.8 (6.4)
R^2	0.54		0.98
RSS	0.58		4.9
SE of regression	0.12		0.4
F-statistic (7,50)	6.0 (0.0)**		102.9 (0.0)**
Wald test for exclusion of AGE40	15.2 (0.0)**		16.2 (0.0)**
R-bar-squared	0.45		0.97
Serial correlation (2)	1.1 (0.36)		1.8 (0.19)
Normality	1.53 (0.28)		0.045 (0.97)
Heteroscedasticity	0.53 (0.47)		0.06 (0.81)
Stability (RESET)	2.4 (0.09)*		1.98 (0.14)
Stability (Chow forecast)	0.81 (0.62)		0.74 (0.67)
Unit root test	-5.9		-3.7

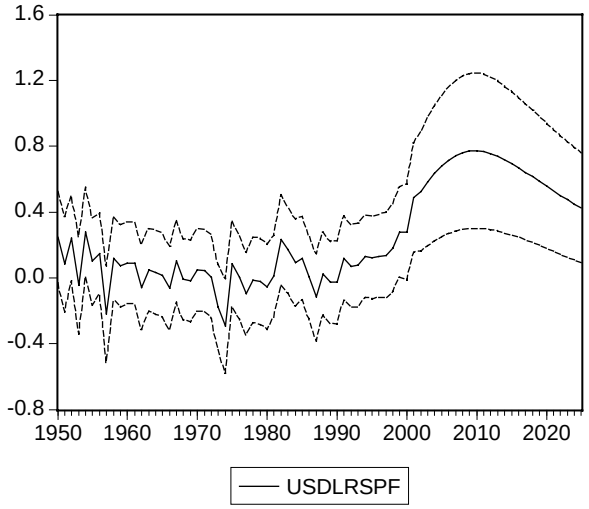
Notes: DDIFY difference of log difference of real GDP from HP filter; DYHP trend growth derived from HP filter on log difference of real GDP; DY dividend yield; DLCPI log difference of CPI index; DLRSP log difference of real share prices, derived as nominal share index divided by CPI; RLR real bond yield, derived as nominal yield to maturity less current CPI inflation; VOL real equity price volatility, derived as variance of log of monthly change in share prices divided by CPI within each year; AGE20 population aged 20-39 as a percent of the total; AGE40 population aged 40-64 as a percent of the total; AGE65 population 65+ as a percent of the total, DSR is the first difference of the nominal short term interest rate, TS is the term structure (long rate less short rate) and DDLCPI is the acceleration of the CPI index (log second difference). Standard errors in parentheses, except for diagnostics where the P values are shown. * indicates significance at 90% and ** at 95%. Serial correlation test is the LM (2) test; normality is the Jarque Bera statistic; heteroskedasticity is ARCH (1); stability is the RESET (3) test and the Chow forecast test over 1990-99; unit root is the ADF.

Meanwhile Chart 1 which follows shows that results shown above with AGE65 excluded do not indicate a substantial weakening of asset prices in coming decades. The share price rises sharply in the period up to 2010, then increases fall back while remaining above zero. The bond yield falls to remain around 2% up to 2025. On the other hand, Chart 3 shows that with AGE65 included, the equity price is set to decline from 2015 onwards, while the real interest rate rises to historic peaks only previously seen in the early 1980s. These tentative results including estimated effects of the over-65 cohort in the

US suggest a more severe downturn is possible, thus underlining the potential market risks associated with sole reliance on fully funded pension schemes.

Chart 1: Projected US asset prices for equations excluding AGE65 (source, Davis and Li 2003)

Change in real equity prices



Real bond yields

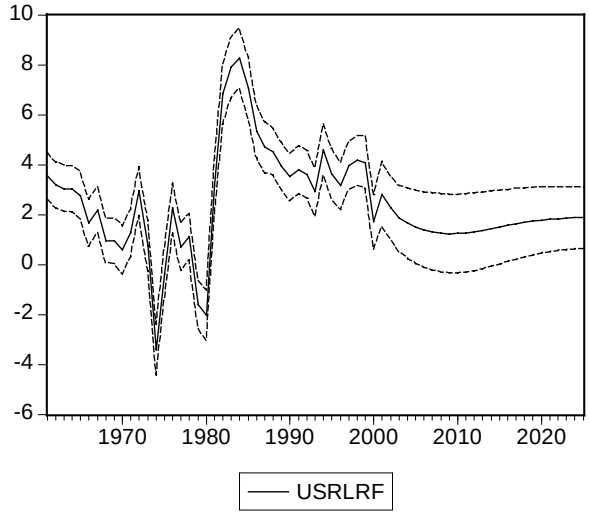
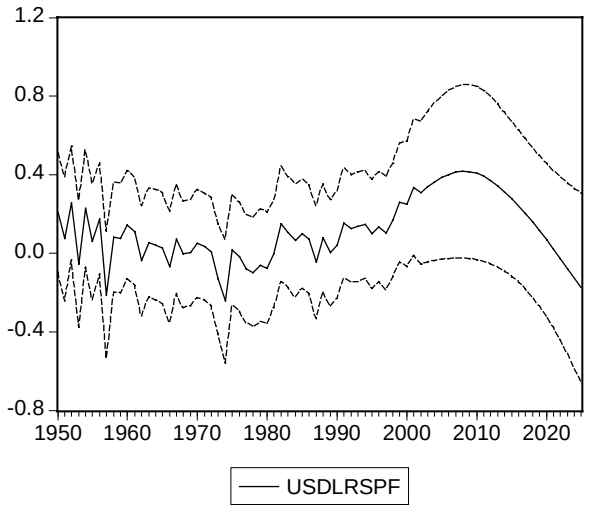
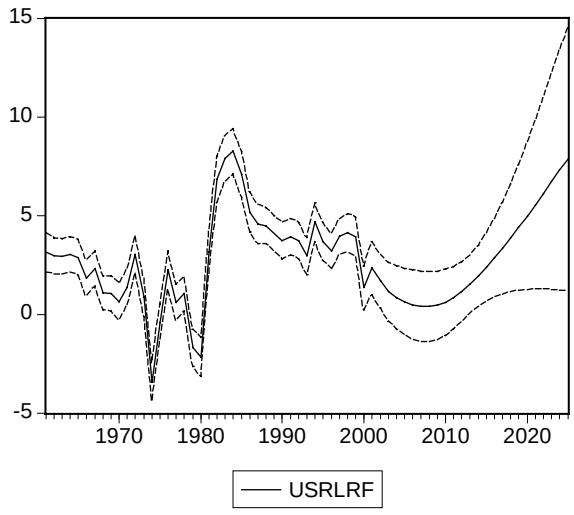


Chart 2: Projected asset prices for equations including AGE65 (source, Davis and Li 2003)

Change in real equity prices



Real bond yields



In this context, solvency could be threatened for life insurance companies and defined benefit pension funds that had made undertakings based on expected returns on assets formed during the bull period (as has been the case recently for the Japanese life insurers and pension funds, see Fukao (2002)).

Of course, the "meltdown" highlighted above might be attenuated by the growing maturing and wealth of populations of emerging market economies (EMEs) such as China in the coming decades, who would purchase shares sold in OECD countries. Meanwhile, productivity changes as the population

ages could offset declines in the return on equity owing to demand side factors, as suggested by Cutler et al (1990). Monetary policy may be expected to respond to high real interest rates by an appropriate loosening, which will help attenuate the peaks (Poterba 2001). Central banks would also need to be vigilant for shorter term financial stability risks during this process. Investor demand would be likely to switch in the light of relative returns, for example to buy high-yield bonds in the later years. Neuberger (1999) argues that the increase and subsequent decrease in flows will be balanced by rises and falls in equity issues, with little effect on prices and returns. Young (2002) notes that demographics are only one determinant of asset prices and their effect may be overwhelmed by other changes (although the equations in Table 2 seek to allow for other determinants). Finally, since financial markets tend to be efficient and forward looking, and because demographic changes are slow moving and predictable, the market meltdown could be forestalled with rational expectations.

In general, we are sympathetic to the view that even if there are price changes with the decumulation of pension funds, they will not necessarily be precipitate, and hence the issue may be one affecting the level of retirement income and the welfare of pensioners rather than systemic financial market stability. On the other hand, the tendency of markets to overreact in both directions is apparent from the recent boom in IT stock prices, and hence vigilance is needed. If there are indeed such sharp changes in market prices during ageing, they may give rise to losses threatening solvency on the part of financial institutions or investors taking leveraged positions, possibly requiring emergency liquidity assistance. It would also impact on the adequacy of funding and replacement rates offered by pension funds and life insurance companies. Such a sharp shift away from securities could extend to other asset markets, notably those for commercial property and possibly to residential property. These effects would be compounded if, for example, the older population had a lower demand for housing services. Mankiw and Weil (1989), for example, made controversial[7] projections of lower house prices in the US as a consequence of ageing. The banks, which hold such property as security, would find credit quality declining as a consequence.

5 Pension funds, ageing and inflation

The implications of pension funds for monetary stability have also to be seen in the context of the macroeconomic effects set out in Section 1. We divide them into challenges in respect of ageing per se and possible changes in the transmission process. We note that this is an area where extant applied work as well as theoretical work is quite scarce – in our view, further research is needed in a number of areas.

To begin, we may note that experience of countries such as Japan has shown that an ageing population may for some time entail an increased savings propensity, especially if there is uncertainty about

[7] Engelhardt and Poterba (1991) and Hendershott (1991) provide counter evidence to this suggestion.

future pensions. Notably if combined with lower potential growth owing to lack of structural reform, this may entail downward pressure on prices. Central banks concerned then have the issue of dealing appropriately with deflation, which Japanese experience shows is complex, especially if combined with a lax fiscal situation.

On the other hand, we have also noted that older households will tend to dissave under a standard life cycle approach to consumption over a lifetime. In due course this implies a lower overall savings propensity for an ageing population. Depending on the behaviour of investment and net trade, this could entail excess demand (Fitoussi 2003). If ageing leads to excess demand for goods and services then there is likely to be enhanced inflationary pressures. This may be aggravated if current account deficits from lower saving entail downward pressure on the exchange rate. These would require a tight monetary stance to offset them.

Excess demand may be aggravated if there is a shrinkage on the supply side, with a decline in output growth from ageing owing to a smaller workforce which is not offset by increased capital formation. Indeed, it is suggested by Bonello (2003) that ageing is a negative supply shock, which is worsened if higher consumption tends to crowd out investment. This may be complemented in terms of inflationary pressures by a tighter labour market owing to ageing, as workers gain enhanced bargaining power owing to their scarcity. The need for higher labour force participation and higher effective retirement age is underlined, reversing the recent trend in the EU for those over 55.

A key issue is whether productivity responds to ageing in a positive manner or not. If productivity were to respond positively to ageing, then higher wages may not entail inflation and excess demand will be attenuated. It would also boost the demand for capital and sustain capital returns. Some authors suggest ageing slows technical progress as innovation becomes less profitable with a shrinking market for capital goods and owing to the lesser dynamism of an ageing population (Wattenberg 1987). In contrast, Cutler et al. (1990) suggest that innovation increases as labour gets scarce. It is suggested by Disney (1996) that there is no link detectable from ageing to productivity, implying investment rates will be crucial to growth, not least given possible “endogenous” links from investment to productivity. This underlines the need for structural reform to permit growth in productivity, as well as raising investment and saving.

The supply shock may be reduced if there is an effect of pension reform on fixed investment, via greater supply of funds overall or greater provision of risk capital. Growth of pension funds may also attenuate inflationary pressures if the use of bond investment makes for political resistance to erosion of asset values. This effect would be much reduced if PAYG systems are not reformed. Then the pensions being indexed and “wealth” being largely in implicit claims, the population would be more relaxed about inflation.

If realised, the financial stability risks highlighted in Sections 2-4 above would generally tend to have a negative effect on inflation and could ultimately lead to challenges of deflation as in Japan. Some, such as short term volatility, market liquidity and banking crises, could be dealt with by emergency liquidity intervention that is later sterilised. But if there are major effects on the macroeconomy affecting inflation prospects, then interest rate policy may need to respond in a counter cyclical manner. The possibility of an asset price collapse with ageing as outlined above is a much more protracted challenge and could need prolonged periods of low short term interest rates. How this would interact with the potential inflationary pressures would need careful judgement

There is a particular threat to monetary stability in the case that there is bond finance of social security pension system (and health system) deficits, with no reform affecting spending such as lower benefits or a higher effective retirement age. Given the scope of projected increases in expenditures, such structural deficits could become extremely large, and corresponding debt accumulation also. Effects on monetary stability can be traced via the inflationary impact of deficit financing. At a basic level, deficits may generate excess demand and effects on inflation if central banks "give in" to pressure to accommodate and households do not simply reduce expenditures to offset government spending in a Ricardian manner. Higher long-term interest rates accompanying large structural deficits would reduce investment, enhancing the supply shock of ageing and consequent inflation risks. When debts are sufficiently high, such pressures may be complemented by political pressures from governments to accommodate deficits and ultimately to monetise the debt, if one recalls that for very high debt levels, unsustainable debt dynamics can only be reversed for the inflation rate high enough (or if the interest rate is low enough). Note that tax finance would not necessarily avoid fiscal problems for monetary stability when tax rates rise to high levels, since "factor flight" would likely entail growing fiscal deficits as economic activity slows.

The standard assumption is that if central banks resist pressures to accommodate, then inflation will not rise, since inflation is a monetary phenomenon. This implies governments will have to obey intertemporal budget constraints and ultimately reduce debts and deficits to sustainable levels. On the other hand, the literature also highlights the so-called "fiscal theory of the price level" (see Woodford (2001) and references). It suggests that the price level adjusts in order to ensure the value of nominal government debt, divided by the price level equals the real present value of future government surpluses. The so-called "Non-Ricardian" assumptions needed for this to apply are strong and controversial (see Afonso (2002) for a summary of criticisms), while empirical work has not been strongly supportive. Nevertheless the theory remains of potential importance since a corollary is that the burden of lax fiscal policies could overwhelm even stability oriented monetary policies (in some papers, fiscal policy determines the price level independently of the path of the money supply). Given rational expectations such an outcome would be perceived well ahead (Salo 2003). Furthermore there

may be important spill over effects from a country running an unsustainable fiscal policy in a Monetary Union (Andres et al 2002). Certainly, past hyperinflations tended to be linked to unsustainable fiscal policies. Further work is in our view needed to assess the degree of applicability of the fiscal theory of the price level to the risks to unsustainable pension systems during ageing, given these are the greatest fiscal challenges and also the most obvious case where the intertemporal budget constraint may be breached. At least, this risk to monetary stability further underlines the importance of pension reform.

Ageing may also alter the monetary transmission process, although arguably this will be sufficiently gradual to allow central banks time to adapt. As noted by Miles (2001), changes in interest rates are likely to have a different effect on consumption of young and old individuals. The former are more likely to be credit constrained, while interest rate changes will have the effect of changing the cost of consumption at different points in the life cycle. For older persons, the impact might arise more via asset price changes induced by monetary policy (the young own relatively few non-human assets). This asymmetric effect might be a marked feature if the elderly hold a larger proportion of bonds than equities in their portfolios, while the former are more affected by interest rates than the latter. When there is ageing, the channel of transmission to consumption would hence be more via wealth effects and less via credit constraints and intertemporal substitution.

Hence the population distribution would affect the impact of interest rates on consumption. Miles (2001) estimates that the impact on consumption both of a rise and decline in interest rates will be greater when the population ages, owing to the asset price effect being larger than the credit constraint and intertemporal substitution. Also, the impact will be greater, the further pension reform has been pursued, as this raises the stock of assets held, and reliance on them for income by the elderly (for estimates of future assets see McMorrow and Roeger 2003). This result relies on a sufficiently large wealth effect on consumption by the old as well as, perhaps, a lack of annuitisation. It will be of particular importance as reformed pension systems tend to be defined contribution. It implies that monetary policy, pace Miles, might come under pressure to take more account of asset price effects.

We noted above that inflationary pressures may accompany ageing. As discussed by Fitoussi (2003), a continued high level of unemployment in Europe would limit wage pressures, although it would be expected that a fall in labour supply owing to retirement would facilitate absorption of the unemployed. An issue for the transmission mechanism in this context is whether ageing will increase the NAIRU, if for example an older workforce is less willing to move house or occupation in response to redundancy. High employers' social security contributions could affect the NAIRU via labour demand

The change in financial structure that is ongoing from bank to market based intermediation will be accelerated by ageing, if it is accompanied by pension reform. This again poses an issue of adaptation by monetary policy makers because firms (and possibly households via securitisation) will be financed by money and bond markets and not via banks. Different key interest rates and also scope of credit rationing (a lesser importance of the "credit channel") may be entailed. The issue of substitutability of bank and bond market finance will also become of major importance for monetary policymakers (Greenspan ibid).

Other transmission process changes can also be envisaged. Exchange rate dynamics will differ with large foreign assets of pension funds, and their reallocation. Mortgage debt may be lower with a smaller younger generation, which will change the income gearing effect of monetary policy, especially in countries where mortgages are floating rate. Money demand itself is likely to differ between young and old consumers, meaning ageing will change its characteristics.

Given the lack of research in this area, it is of interest to undertake some exploratory regressions on the relationship between age structure and selected key variables for monetary stability, namely inflation, growth, productivity and house prices. We have undertaken simple seemingly-unrelated (SUR) panel regressions on seven major OECD countries, the UK, US, Germany, Japan, Italy, Spain and France over 1950-2000 (1970-2000 for house prices). SUR is appropriate given likely contemporaneous correlations due to common economic shocks and feasible given that we are working with N (number of cross section observations) far below T (time series observations). The estimates utilise United Nations (1998) data on the size of age cohorts 20-39, 40-64 and 65 and over relative to the population as a whole. The residual is the young dependent cohort aged 0-19. These are the same data definitions as used in the above-mentioned work by Davis and Li (2003). The work is purely illustrative and intended to provoke discussion and further research.

We regress inflation, growth, labour productivity growth, TFP growth and real house price growth on their own lags in an ARMA process together with the age structure variables, first in levels then in differences. Hence the issue is simply whether a high proportion or increase in proportion of a given age group has been associated over the past half century with high or low CPI or house price inflation, economic growth or productivity growth. Causality is not proven and further work is needed, as in Davis and Li (2003) with demographic variables included in fully specified equations or models for the variables concerned. Caution is also needed as the AGE65 cohort is not stationary – hence more credence should be given to the results in differences.

Concerning results in levels, as shown in Tables 2, the results suggest that there is a tendency for the high-saving age group 40-64 to accompany relatively low inflation, with the other age groups having no effect. Growth is relatively low when the retired proportion of the population is high, with also

some negative effect from the 40-64 age group. This supports the arguments for slower growth presented in Section 1 as ageing proceeds. Furthermore, over the last 50 years, a high proportion of elderly persons has accompanied low productivity growth, implying further risks to performance as the population ages. This is true both of labour productivity and total factor productivity. This is despite the fact that a larger retired share of the population may entail a smaller labour force relative to the population. Note on the other hand that there is no major differential between the younger and older working population, contrary to the idea that older workers are less adaptable. Finally in terms of house price increases, the younger cohort exerts a negative influence, being less wealthy, creditworthy and liquid than their older counterparts, as does the elderly cohort.

Table 2: Panel estimation results for levels of demographics and key macroeconomic variables

SUR, Fixed effects. * Indicates significant at 90% and ** at 95%. Standard errors in parenthesis.

Independent variables	Inflation	Growth	Total factor productivity growth	Labour productivity growth	Real house price growth
DV(-1)	0.751**	0.327**	0.164**	0.139**	0.573**
DV(-2)	-0.102**	-0.101**	-0.0427	0.0985**	-0.163**
DV(-3)	-0.00643	0.168**	0.112**	0.0459	-0.178**
AGE20	9.84E-05	-0.000543	-0.0559	-0.0583	-0.00335**
AGE40	-0.00128**	-0.000998*	-0.0542	-0.038	0.00147
AGE65	0.000298	-0.00237**	-0.305**	-0.301**	-0.0043**
R squared	0.667	0.405	0.271	0.347	0.134
SE of regression	0.0249	0.0208	2.10	2.31	0.068
No of observations/countries	343/7	350/7	350/7	329/7	195/7

Table 3: Panel estimation results for differences of demographics and key macroeconomic variables

SUR, Fixed effects. * Indicates significant at 90% and ** at 95%. Standard errors in parenthesis.

Independent variables	Inflation	Growth	Total factor productivity growth	Labour productivity growth	Real house price growth
DV(-1)	0.754**	0.361**	0.193**	0.182**	0.49**
DV(-2)	-0.101**	-0.0714**	0.00654**	0.134**	-0.0837**
DV(-3)	0.0109	0.194**	0.152	0.0873**	-0.212**
AGE20	0.00303	0.00322	-0.46	-0.00799**	0.0409**
AGE40	-0.00908	-0.00195	-1.709**	-0.0197**	0.0964**
AGE65	-0.0236**	-0.0136	-3.09**	-0.0334**	0.152**
R squared	0.667	0.349	0.2	0.311	0.186
SE of regression	0.025	0.0218	2.2	2.38	0.066
No of observations/countries	343/7	350/7	350/7	329/7	195/7

In most cases, the results in differences are consistent with those in levels. Notably, the growth as well as the size of the elderly cohort exerts a negative influence on labour productivity and total factor productivity. There are no significant effects on growth, while for inflation the growth of the elderly

cohort exerts a negative influence, consistent with common beliefs about the preferences of the elderly for low inflation. In terms of house prices, there is a larger positive effect from the older cohort and the smallest from the younger one, consistent with relative resources albeit not with the levels result. As noted, the difference result using non stationary variables may be more statistically credible.

Conclusions

Pension reform is essential for the future stability of the EU in general and EMU in particular, and its progress is of major concern to central banks as well as Ministries of Finance. We have highlighted a number of risks to financial stability that may occur due to ageing itself, with pension reform, and notably when there is a continued reliance on unsustainable pay-as-you-go pension systems. These all require vigilance by central banks, and may require sterilised liquidity assistance or even adjustments in interest rate policy. There are also challenges for counter-inflation policy during the ageing process, as at different points it may generate deflationary and inflationary pressures, while a fiscal crisis would have major repercussions for monetary stability. The transmission process of monetary policy will also enter a state of flux with ageing, although arguably this may be sufficiently gradual to allow central banks time to adapt.

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