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# Trend Report

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# Demography, savings and yields: long-term outlook

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## IMPRINT

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# Trend Report

## Demography, savings and yields: long-term outlook

# 1 Executive summary

- Over the next three decades the industrial world will see a marked shift in the age-composition of its societies with the share of elderly people increasing vis-à-vis the share of working age people. This process is already well under way in Japan, with the US (after 2010) and Europe (after 2020) set to follow.

- The most visible and most debated consequence of this secular trend is that there will be fewer workers per person of retirement age and thus an increasing demographic burden on the mostly publicly provided pension and health care systems. The latter is actually likely to see a disproportionate increase in costs given that the bulk of expenditures is concentrated at the end of the individual lifespan.

- In reaction to these trends, governments in most industrial countries have started to shift the responsibility for old-age provision away from the public and into the private sphere. Both for the individual and for societies as a whole this means that investment and savings will have to be stepped up in order to provide for the future.

- This gives rise to some major questions both for the macroeconomy and from the financial investor's point of view. Is there not a risk that yields will tumble when production is based on greater capital input and less labor? Might not yields on financial investments and real capital drift drastically apart ("bubble formation") if substantially more savings flood on to the financial market than the real economy can sensibly absorb? How risky are international diversification strategies in view of exchange rate fluctuations? How high is the risk that, at the end of the day, yields will be eroded by inflation?

- To explore these questions, we focus on the yield which in turn is derived from the macro trends affecting both saving and investment. For the most part, we have to rely on qualitative rather than quantitative assessments. While there have been fluctuations in the population size in the past, we have never seen persistent shifts in the age structure of societies that could give us definite guidance.

- Our findings show that, while there will be a significant initial increase (and later decrease) in aggregate savings in industrial countries as a result of both the different age structure and the shift towards funded pensions, this is unlikely to take the form of a tidal wave in financial markets. So fears that the industrial world is heading for an initial rapid (and yield depressing) inflow followed by an asset price meltdown are exaggerated.

- The swings in prices and yields induced by higher saving will be mitigated still more by factors affecting capital demand such as technological progress and human capital formation. It seems most likely that the increase in the real stock of capital will at least partly be matched by an increase in the quality of labor. So while the law of diminishing returns does apply, the reduction in the rate of return should be lessened by the increase in the quality of labor.

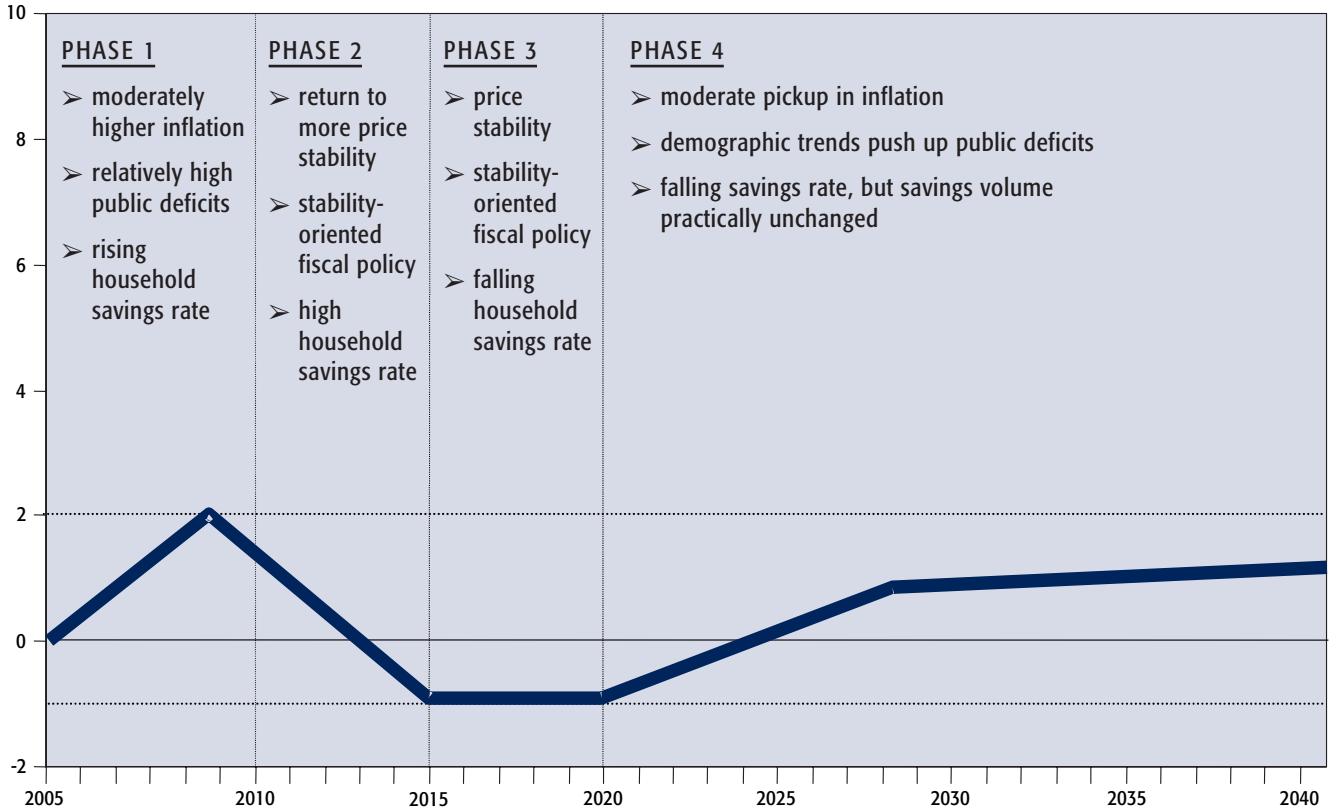
- Furthermore international portfolio diversification at the international investor level will not necessarily spark a massive shift in the international balance of payments position on the macro level which in turn triggers major exchange rate adjustments. Capital will continue to flow to wherever it generates the highest yield. Indeed, we think it fairly unlikely that the current surplus position of emerging markets will be transformed into a deficit by money from industrial countries chasing higher returns. The aggregate surplus position of emerging markets is due both to cultural and political factors that are unlikely to change dramatically even in the longer term.

- With regard to inflation as a risk factor for a funded system our findings suggest that the current state of price stability seems to be well anchored. Not least because the independence of central banks has spawned a virtuous circle of entrenched private sector expectations of price stability and an attendant reduction in macroeconomic volatility, a circle which is set to remain in place. However, past achievements cannot be taken entirely for granted. For the more immediate future there is the risk that the excess liquidity generated since 2001 could spill over into price increases. For the longer term, there are risks that we could see more intrinsic price pressures building from raw materials and/or an end to the disinflationary process from ever intensifying globalization in addition to demographically strained public budgets.

- Given these factors, the period to 2010 should see slightly decreasing real rates of return as industrial societies start to build up their nest eggs. This will probably be countered in nominal terms by higher inflation as a result of excess liquidity. The following decade should then see more or less stable real rates of return while the inflation component is likely to diminish. After 2020 both capital supply and demand argue for rising real rates of return coupled with risks pointing to higher inflation and thus higher nominal yields.

- Demography-induced fluctuations in both saving and investment patterns are therefore unlikely to unhinge world capital markets. While we find that additional savings will exert downward pressure on returns, this will not take the form of a tidal wave. As in the past, there will be offsetting factors that will keep fluctuations within certain limits. Funded pension provision therefore remains indispensable – not least because public pension systems are creaking.

## PROJECTED LONG-TERM CHANGES IN CAPITAL MARKET YIELDS
– IN PERCENTAGE POINTS –



# 2 Subject outline

Across the world higher life expectancy and declining birth rates are pushing up the median age of populations. The age structure of societies around the globe is set to change significantly over the next decades, with almost all countries facing a tremendous shift in the ratio of working age population to retirees. Today, this ageing process is most advanced in the industrialized countries. Some of these, most prominently Japan, Germany, Italy and Spain, are forecast to experience an absolute decline in population – a development almost without historical precedent, apart from the plague which struck Europe in medieval times.

Such seminal changes affect almost all corners of the economy and society. Today, one of the most prominent aspects under discussion is the impact of population ageing on social security systems, i.e. health care and pension systems. Governments react by scaling back the generosity of benefits. Pay-as-you-go pension systems, which are most negatively affected by the projected demographic changes, will be scaled back. A higher share of pension income will come from funded schemes as individuals save more to finance their standard of living after retirement. This means that an increasing proportion of retirement income and therefore of household income will hinge on developments on the capital markets.

For all kinds of investors – both institutional and private – it is essential to have an idea how the returns of different asset classes will develop in the future. Interest rates play a prominent role in almost every asset allocation decision. Therefore it is important to understand which factors will influence the long-run development of interest rates in view of the demographic changes set to take place. The interest rate is the price which clears the market of capital supply and demand. To understand changes in the interest rate, these underlying factors have to be analyzed. This study focuses on the variables which affect capital demand and supply in the medium to long run.

A key component of capital supply is household saving. Since deficits in government budgets in almost all industrialized countries are more the rule than the exception and the corporate sector is in the long run no net-saver, private households are the ultimate provider of capital. To get an idea of the future development of capital supply we need to gauge how household saving will evolve over time. Unfortunately, less is known about saving than might be expected. The theoretical model, the life-cycle hypothesis of saving, cannot be validated by the available data. However, it is obvious that individual saving rates vary over the lifespan. How will aggregate saving be affected by changes in the demographic texture of a population? Will industrialized countries save more or less due to demographic reasons? This question is addressed in chapter 5.

Chapter 6 looks at capital demand. Given the demographic changes, we expect that governments will – on average – tap the capital markets for additional funding. No profound changes from the developments seen during the last twenty years are expected to happen over the coming decades. But how will the corporate sector behave? Will fewer people in the industrialized countries mean that less capital is needed or will the shrinking labor force be replaced by more and more

computers and robots, ultimately increasing the demand for capital? To answer this question it is necessary to look at technical progress, the only factor which can boost output apart from an increase in labor or capital input. But technical progress itself could be dependent on the age structure of a country's population. We try to shed some light on these issues.

The problems of the industrialized countries are not the only problems of the world. How will emerging markets fare and, in particular, will emerging markets be the place where the augmented savings of ageing Europeans and Americans can be gainfully invested? We look at these issues before we try to draw all the strands together and present some thoughts on the effects these developments will have on the interest rate. What will cause the rate to increase or to decrease? Will future returns be higher or lower than in the past? Although no precise answer can be given, some trends can be distinguished. That is done in chapter 7.

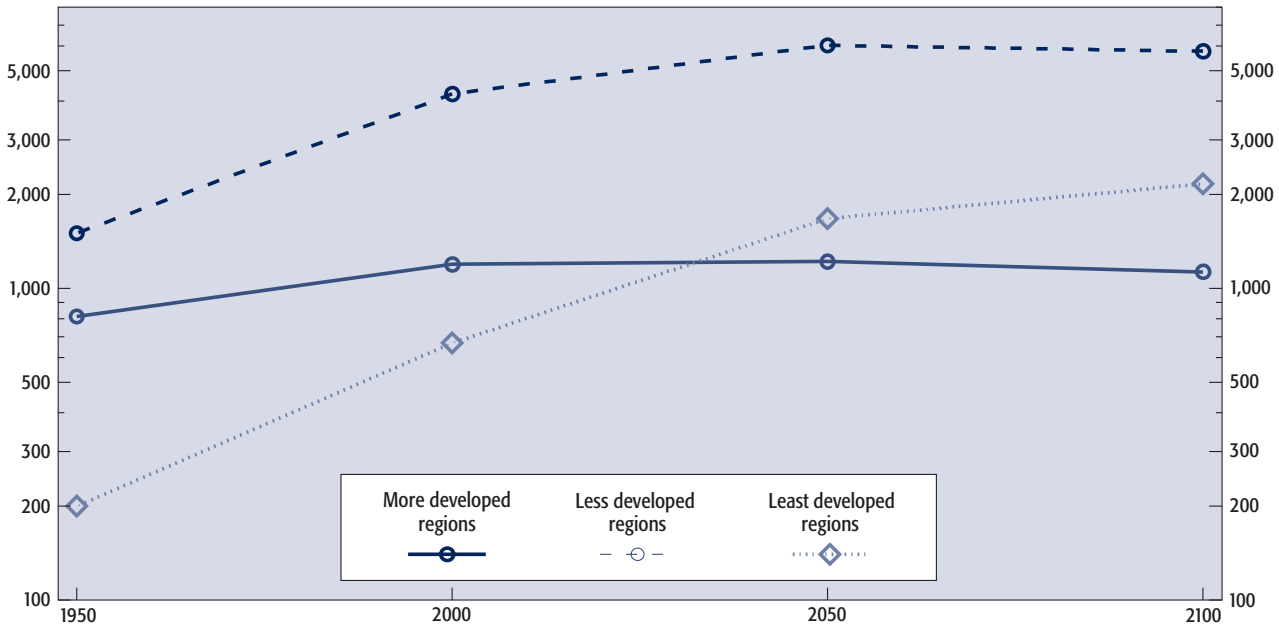
However, before we start we have to take into account that the interest rate as observed on capital markets is the sum of two different developments: the real interest rate and inflation, of which only the former determines the future purchasing power associated with the returns of an investment. Inflation, however, is important in determining the course of monetary policy and thereby influencing economic growth and, at least temporarily, the real interest rate. Even more importantly, the savings behavior of individuals seems to be affected by inflation. Any analysis of interest rates would be incomplete if inflation were not taken into account. This therefore is the topic of the next two chapters.

## ON WORLD POPULATION DEVELOPMENT

According to estimates by the United Nations (UN), the world population in 2003 totaled around 6.3 billion. Whereas up to the 18th century the number of people on earth increased only moderately, since then improvements in the standard of living, the reduction in famine and the containment of epidemics in some parts of the world have led to a steady escalation in population growth. In the decade from 1990 to 2000 alone, the net addition to the human race was roughly on a par with that between the birth of Christ and the Industrial Revolution.

Particularly in recent times, a shift has taken place in regional weighting. Since 1950 Europe's share of the world population has halved to 12 percent, while at the same time the average age of Europeans has soared by almost 30 percent, faster than anywhere else on the globe. In all, fewer than 20 percent of the world's population now live in the developed countries.

### WORLD POPULATION, 1950 – 2100
– IN MILLIONS, LOG SCALE –

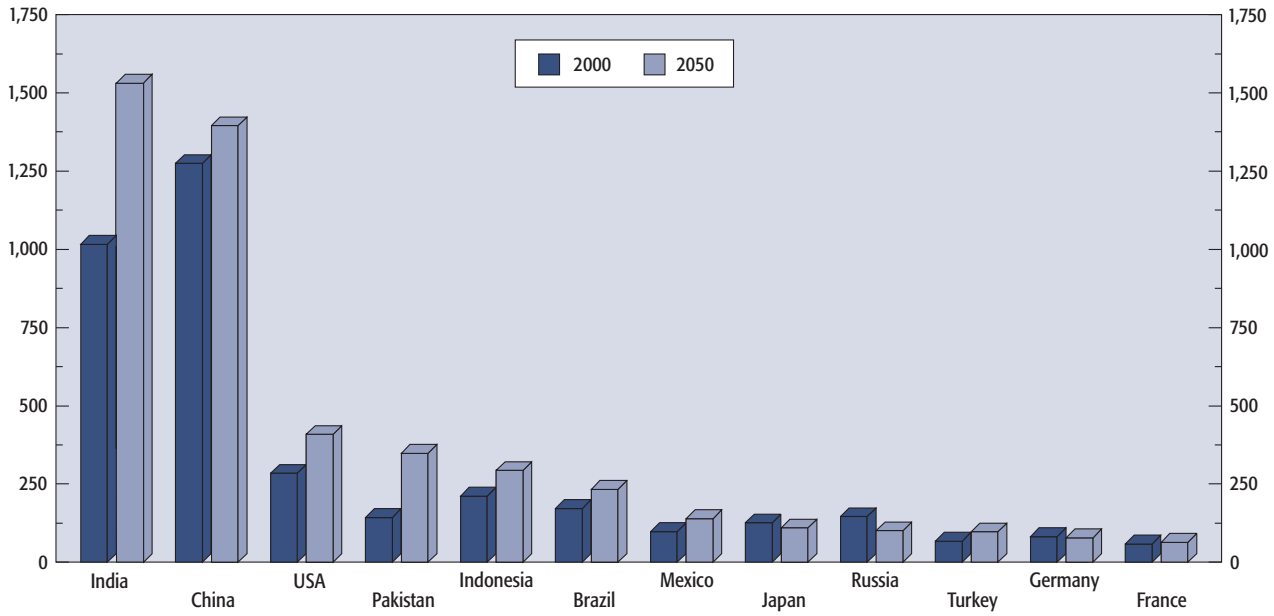



Source: United Nations, medium scenario.

In its long-range projections[1], the UN assumes a further increase in life expectancy and hence in the aging of societies on all continents, whereby the trend is most pronounced in the least developed countries. In the medium scenario, by 2050 the share of over 60 year-olds in the total world population will already have more than doubled on the year 2000 to just over 21 percent, with a fourfold increase in the share of over 80 year-olds to 4 percent. The global population will reach an interim peak in 2075. On the assumption that no cross-border migration takes place after 2050, the provisional population climax is expected – for 2065 already in Asia and Latin America, but not until 2100 in Africa.
While extremely robust population growth is projected for the USA up to 2050, with a significant slowdown thereafter, Europe must resign itself to a process of demographic contraction up to 2100.

[1] *United Nations* (2003; 2004).

## POPULATION OF SELECTED COUNTRIES IN 2000 AND 2050
– IN MILLIONS –




Source: United Nations, medium scenario.

In regional terms, the demographic emphasis will shift further in the coming decades towards the developing countries and emerging markets. In 2050 almost 60 percent of the world's population will live in Asia, one-third alone in India and China. Then a mere 7 percent will have their home in Europe, with an average age still way higher than on other continents.

## AVERAGE AGE OF THE POPULATION BY REGIONS*

| | 2000 | 2050 | 2100 |
|---|---|---|---|
| World | 26 | 37 | 44 |
| Africa | 18 | 27 | 41 |
| Asia | 26 | 39 | 45 |
| Europe | 38 | 48 | 44 |
| Latin America and Caribbean | 24 | 40 | 46 |
| North America | 35 | 40 | 44 |
| Oceania | 31 | 40 | 45 |

*Median age, in years (medium scenario).

Source: United Nations.

# 3 Inflation: Drivers and likely scenarios

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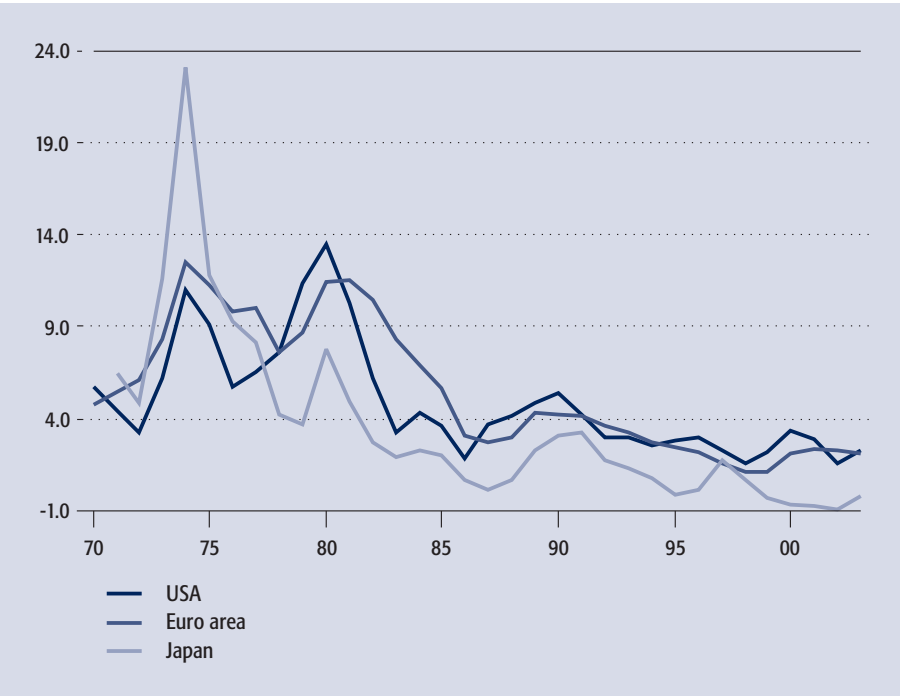
## REVIEW AND OUTLOOK UP TO 2010

What will follow the global disinflation process? In recent years, fears of deflation have alternated with concerns over inflation, with public debate wavering between the two extremes. What we can say for sure, echoing the Bank for International Settlements (72nd Annual Report, July 2002) or the International Monetary Fund (World Economic Outlook, April 2002), is that monetary policy is having to confront an altered environment posing new challenges. In comparison to earlier decades, we now have a situation of low and less volatile inflation rates. This means, first, that it has become more important to take a symmetrical view, also allowing for deflationary dangers instead of just waging the familiar, one-sided war on inflation (until Japan's very recent history deflationary processes were commonly assigned nothing more than historical relevance). Second, the very topical question arises as to whether a resurgence of inflation might now be hovering in the wings at the very time it has been declared defunct.

## CONSUMER PRICES PERCENTAGE CHANGE OVER PREVIOUS YEAR



Before starting to consider possible future trends, it seems appropriate first to illuminate the reasons behind past developments. Literature on the subject frequently attempts to clarify whether we owe lower volatility in economic growth and inflation rates than in the past chiefly to structural changes, improved macroeconomic policies or good luck (less frequent and/or smaller exogenous shocks). Were the latter the case, there would be no reason why the future should not turn out differently again. As so often, research has come up with different findings, and all three aspects certainly go some way to offering an explanation. But Fed governor Ben S. Bernanke (The Great Moderation, Remarks at the meetings of the Eastern Economic Association, February 2004), for example, concludes that the reduced volatility of macroeconomic variables can be ascribed mainly to improved monetary policy.

## PROGRESS IN MONETARY POLICY AS CAPITAL FOR THE FUTURE

INFLATION EXPECTATIONS NOW FIRMLY ANCHORED

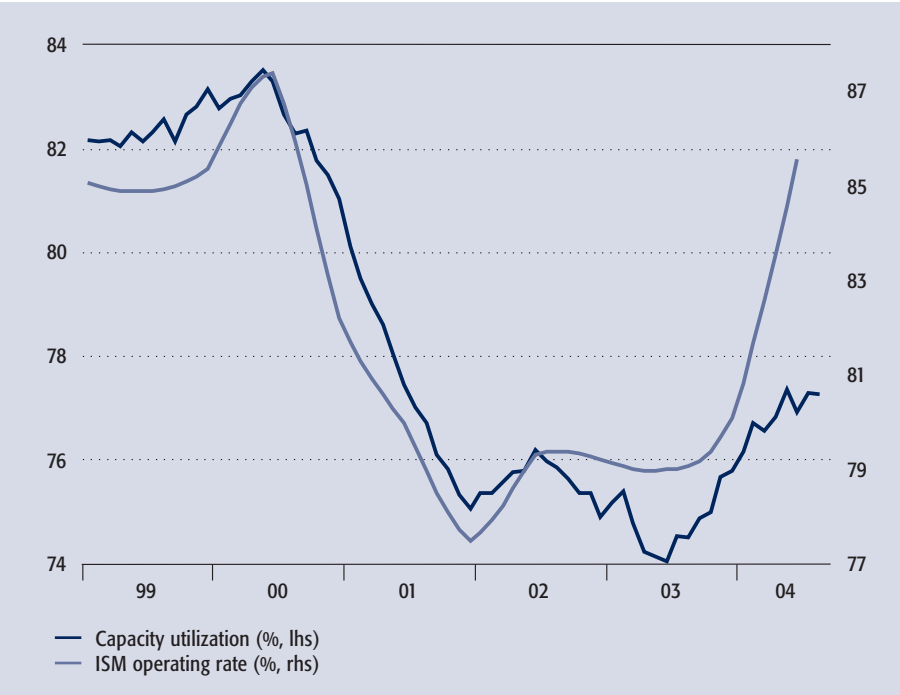
Moving forward, this instills confidence. An important element in this context is the stability culture established over time. Following the period of high inflation in the 1970s, leading central banks in the industrial countries have gained credibility in combating inflation. Through the reputation they have built up, inflation expectations these days are firmly anchored, encouraging economic agents to behave in conformity with stability. What is more, instead of resting on their laurels, the central banks are also driven by public opinion to seek further ways of refining their monetary policy. A good example of this is the recurrent recent debate on setting an inflation or stability target to lay down the clearest possible markers for economic agents.

In slightly different form, the possible existence of a “virtuous circle” can be explained as follows: When both rates of inflation and their volatility are low, inflation expectations will tend to stabilize. This, in turn, enables the central bank to respond to fluctuations in the economic cycle with minor adjustments to its monetary policy to obtain the desired effect. So the virtuous circle comes about as successful monetary policy helps stabilize the macroeconomic environment, which in turn boosts the efficiency of monetary measures.

## CAUTION STILL RECOMMENDED

But that is not to say everything in the garden is rosy. Decisions today more often than not have to be taken with uncertainty about the “true” state of the economy. So monetary policy has to act on the perceptions of this state. This Kantian dilemma can be exemplified by the current state of the US economy. The chart below depicts both the commonly used gauge of capacity utilization in US industry, with a value of 82 % considered to be the level at which the sector is operating normally. At 77.3 % the current reading seems to be nowhere close to a level where a major inflationary impulse is likely to develop intrinsically. The chart also contains the operating rate in the manufacturing sector taken from the ISM business survey, i.e. companies’ own assessment of the rate of capacity utilization. While both measures moved in sync from 1999 to mid-2003 they have diverged sharply of late. The ISM measure is clearly indicating that, to keep price rises under control, faster and more pronounced rate hikes are needed than the capacity utilization figures would suggest.

## WHAT IS THE CORRECT GAUGE ON OVERHEATING?




Athanasios Orphanides (Monetary Policy Rules and the Great Inflation, The Federal Reserve Board: Finance and Economics Discussion Series, January 2002), for one, concludes from his research that the policy mistakes of the 1970s in the US possibly occurred even though the Fed pursued a monetary approach considered correct by present-day economists. The problem at that time lay primarily in a continuous misperception of the true state of the business cycle, or to be more precise, in errors in estimating natural unemployment in particular. This misperception was then exacerbated by the fact that inflation was blamed on factors beyond the monetary authorities' realm of influence, such as oil price shocks, rather than on intrinsic factors such as overly accommodative monetary policies. But is there ever any safeguard against shortcomings of this kind, or can history repeat itself at any time in a different guise? In its latest Annual Report the BIS writes that accurately estimating potential growth or full employment has become more difficult. And when explaining the rationale behind its two-pillar strategy, the ECB has good reason to point repeatedly to various elements of uncertainty making it necessary to observe a whole raft of indicators in an attempt to obtain a proper picture.

## PRICE DRIVERS VERSUS PRICE CHECKS

With regard to the inflation outlook up to the end of this decade, the following are possible inflation drivers (setting aside demographic developments and public debt for the time being, as they are not likely to make a major impact until later): The surplus liquidity available globally could spill over into demand as the economy rebounds, or economic agents could run down their cash holdings again as uncertainty is dispelled or they become accustomed to heightened uncertainty. Second, cost-push shocks can occur at any time. At present, the thought immediately springs to mind here of increasingly scarce natural resources owing to demand from booming emerging markets such as China or India. And wage-price spirals

are still also possible. Key to these are inflation expectations, which may be fanned by accommodative monetary and fiscal policy.

These factors contrast with inflation checks, foremost among which is continued technological progress. Then there is the ongoing process of globalization, and with it the intensification of competition. This is highlighted by the current debate on international outsourcing to low-wage countries, widening the range of tradable goods. Enlargement of the EU, and subsequently EMU, may also generate downward price pressure in the "old" member states.

## MONETARY VARIABLES AS AN INDICATOR OF THE MEDIUM-RANGE PRICE OUTLOOK

In the following we shall take a closer look at the liquidity aspect, which is of interest for various reasons. That monetary aggregates or liquidity measures are of informative value for future price trends continues to be corroborated by the results of recent research. This indicative property applies in particular from a period of around two years, i.e. going beyond the horizon customarily covered by central banks' inflation forecasts (i.a. ECB: Overview of the background studies for the reflections on the ECB's monetary policy strategy, May 2003; Annual Report of the Sachverständigenrat [Germany's panel of economic advisors] 2002/03).

MONETARY VARIABLES PLAY KEY ROLE

In principle, all central banks take monetary variables into account; but the ECB gives them a comparatively prominent role, which is why we shall now examine its approach in greater depth. The ECB has set a reference value for monetary growth (4.5 %), to be interpreted as a guideline rather than a target. This reference value is calculated from estimated trend real GDP growth in the euro area (2–2.5 %), the ECB definition of price stability (below, but close to, 2 %) and the trend reduction in the velocity of circulation of money (0.5–1 %). The notion behind this is that inflation risks occur when money supply grows at a faster rate than potential economic output. If monetary expansion is above or below the reference value for some time, a liquidity surplus or deficit respectively will accumulate. To gauge this, the ECB applies the nominal and real money gap. The nominal money gap is the difference between the actual nominal monetary aggregate M3 and the aggregate that would have resulted from M3 growing since December 1998 in line with the ECB's reference value. The real money gap additionally takes account of discrepancies between the actual rates of inflation and the ECB's inflation norm, whereby stronger price inflation is seen as absorbing liquidity. Thus, the real money gap is calculated as the deviation of the effective real stock of M3, nominally deflated by the euro area HICP, from the real M3 level that would have resulted had monetary expansion since December 1998 taken place at the reference value and EMU inflation been identical to the definition of price stability.

## NOMINAL AND REAL MONEY GAP IN THE EURO AREA AS A PERCENTAGE OF THE STOCK OF M3


As is clearly evident from the chart, a substantial liquidity surplus has built up since 2001 that is not yet being run down again. Must this automatically be taken to imply that a period of higher inflation is now imminent? A word first on the concept of the money gap: Changes in the money gap are more significant than its size, which is, anyway, questionable for a variety of reasons, not least because opinions differ on the exact level of the M3 reference value. Added to which is the issue of the stability of money demand in the euro area.

### HOW STABLE IS MONEY DEMAND?

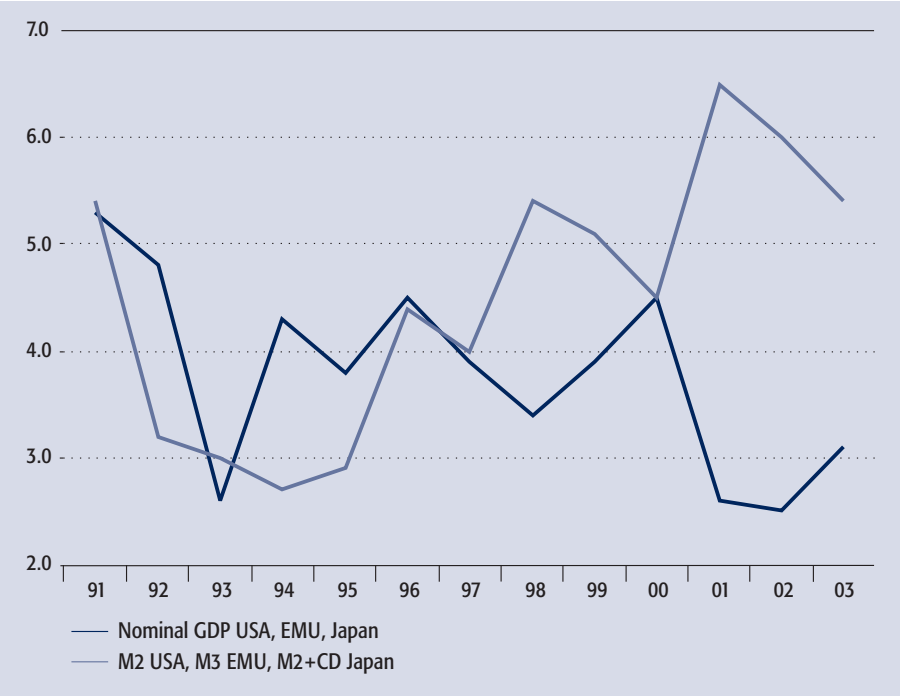
Although the ECB does not target money supply as part of its strategy, for which stable money demand would be a necessary requirement, determination of the reference value for M3, and hence the money gaps, is based on the assumption of stability in money demand over the long term. According to research so far, the short-term instability lately identified does not argue against a stable long-term relationship between monetary growth and the rate of inflation in the euro area. However, in other countries structural changes (e.g. financial market deregulation and financial innovations) have ultimately led to unstable money demand. For this reason, the way that the ECB calculates the money gap cannot be applied one-to-one to the US or the UK for instance. And secondly, it is clear that the ECB must constantly monitor whether the stability of money demand is still a given for the euro area. Consequently, the money gaps may prove to be in need of revision, indeed it may one day even transpire that the ECB's concept is no longer applicable.

## CLEAR DECOUPLING OF MONETARY AND ECONOMIC GROWTH

Of course there are other ways of measuring money or price gaps, but these will not be discussed here, because the chart overleaf clearly gets to the heart of the matter: Viewed globally, there is a yawning chasm between monetary expansion

and nominal GDP growth. This naturally raises the question as to how the two curves can be brought into sync again. For the global liquidity surplus to be worked off, growth in the money stock would even need to remain below the nominal increase in GDP for a while.

## TRIAD: MONEY SUPPLY AND GDP PERCENTAGE CHANGE OVER PREVIOUS YEAR




Various ways of achieving this are conceivable (also see ECB Monthly Report October 2003): 1) The ideal solution would be for real economic growth to absorb the surplus liquidity inflation-free. There is a good chance of this as long as the capacities available are underutilized. When this is no longer the case, the important factor is how liquidity impacts demand. If it is used mainly for consumption, there is a greater danger of inflationary effects than if it is allocated to investment, which would boost capacities and the economy's potential growth. 2) But rising nominal GDP growth is also possible as a result of surging inflation, which is traditionally fueled by the economy's overheating. Undesirable as this inflationary scenario may be, the central banks would at least be treading familiar territory. 3) They would have less experience with a situation in which, instead of surplus liquidity being reflected primarily in the prices of goods and services, slowing monetary expansion stemmed chiefly from massive rises in share or bond prices. (A real estate boom would also be conceivable, but this would probably not reduce the liquidity overhang.)

## MONETARY INDICATORS AS A MEANS OF IDENTIFYING BUBBLES

In fact, the policy of cheap money in the United States in particular initially played a role in driving up prices on the bond market and has since been bolstering them for the past year. This situation will now be reversed, with the Fed embarking on a cycle of rate hikes and the euro area shaping up to tighten the monetary reins.

So as matters stand at present, the third scenario would be a greater source of disquiet in terms of the stock market. After the dramatic collapse in share prices triggered when the stock market bubble burst in 2001, the share markets started to bounce back in 2003. But the portfolio adjustments from liquid assets into equities since then simply mark a return to normal as uncertainty ebbs around the globe. There need be no concern until another bubble begins to form.

### BUBBLE RETHINK

Most central banks used to take the view that they were no more capable of recognizing exaggerations than the markets and consequently made no attempt to do so. In the meantime, though, some rethinking has taken place. Of course there is no way of clearly identifying an asset price bubble; but a central bank may be in a position to determine in relatively timely fashion when signs of financial instability are building up. Monetary data would seem a useful tool for this. Empirical findings point to a clear link between credit expansion (one counterpart to the development in money supply) and asset prices (BIS Working Papers No. 114, July 2002; No. 127, February 2003; No. 157, July 2004).

## UPWARD PRICE PRESSURES POTENTIALLY PRESENT, BUT DRASTIC ACCELERATION IN INFLATION UNLIKELY

All in all, the liquidity overhang flags upside rather than downside risks to price stability in the period up to 2010. Yet monetary and economic growth curves can still return to sync with comparatively little friction, although we do not expect the first of the three possible alternatives described, the ideal scenario, to come about. The “gentle” absorption of liquidity through more than one channel, viz. a combination of all three possibilities, appears quite conceivable. In our opinion, a return to high inflation is not therefore to be expected in the coming years, with consumer prices edging up only moderately faster than in the last five to six years.

Even so, the experiences of the 1970s should certainly not be consigned to oblivion: A central bank that is too sure of itself may take risks it would not otherwise have contemplated. In particular, attempts to fine-tune the economic cycle on the basis of indicators such as the output gap should be avoided. And the Bank for International Settlements’ recent warning against asymmetric monetary policy should be taken seriously. The BIS writes in its latest Annual Report that leading central banks, mindful of the fact that on the whole inflation was kept well under control during the past decade, eased their monetary policy during the economic downswing more than they had tightened it in the preceding upswing. As a result, key interest rates in major industrial countries are comparatively low at present, leaving limited scope to respond to further negative shocks. Moreover, we see a danger with the central banks’ asymmetric behavior of their jeopardizing the anchoring of inflation expectations around stability through over-confidence in their own ability to keep a grip on upward price pressures even with relatively low interest rates.

# 4 Longer-term inflation perspectives

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## DETERMINANTS AND A POSSIBLE SCENARIO

Beyond this decade, the outlook on inflation is necessarily clouded, because we do not even have any exact knowledge what the baseline scenario will then be. But an examination of structural parameters can shed light on this. In our estimation, this includes both the challenges to the public budgets posed by demographic change and an assessment of the role that globalization and technology have played, and will continue to play, in inflation trends.

Our analysis is centered around a simple inflation model in which companies set their price level as a percentage mark-up on unit wage costs and workers set the nominal wage level as a mark-up on goods prices. The size of the relative mark-ups is determined by the current economic environment. High mark-ups are consistent with good possibilities for setting prices, either because capacities are fully utilized and/or the macroeconomic policy constellation is accommodating. This framework allows us to track down the three most common causes of inflation: demand-pull, price-push and an over-accommodative economic policy.

## PUBLIC BUDGETS AND INFLATION

So far, analysis has largely disregarded the role of public budgets in the inflation process. However, historical experience suggests that periods of strong growth in government activity frequently precede periods of high inflation. In an institutional system that allows government spending to be funded directly by printing money, this appears quite logical. But in the more recent past such unsound fiscal policy has been contained more narrowly than it used to be by the independence of central banks and the greater control exercised by financial markets and rating agencies. As we shall see in the following, though, even the independence of the central bank cannot directly guarantee that a government's budgetary policy will not give rise to inflationary dangers.

In a longer-range assessment, however, we are also obliged to address this issue, for even now it is apparent that unless very sweeping reforms are implemented on the expenditure side, demographic change will impose enormous additional burdens on the social security systems. It will affect the pension systems, for one, as a growing share of the population draws benefits from them, and the health system for another. Indeed, health spending is likely to rise at an even faster rate than the old age dependency ratio, given that the bulk of expenditure on medical care is concentrated at the end of an individual's lifespan.

The following table gives a rough impression of the likely development in costs relative to economic output up to 2050, on the assumption that welfare legislation in the industrial countries remains unchanged.

## INCREASE IN AGE-RELATED SPENDING FROM 2000 TO 2050

| | 2000 (percentage of GDP) | Increase in pension payments (percentage points) | Increase in health spending (percentage points) | Total increase (percentage points) |
|---|---|---|---|---|
| Germany | 24.0 | 5.0 | 1.4 | 6.4 |
| Spain | 21.3 | 7.9 | 1.7 | 9.6 |
| France | 26.5 | 3.8 | 1.7 | 5.5 |
| Italy | 24.2 | 0.3 | 1.9 | 2.2 |
| USA | 7.6 | 1.8 | 7.2 | 9.0 |

Sources: Congressional Budget Office (2002, 2003); Economic Policy Committee (2003).

This raises the question as to how the public budgets will cope with these pressures. Apart from spending cuts that would check the increase itself, there is of course also the option of funding through higher revenues or higher deficits. Whereas there is no empirical evidence for a correlation between the size of the public budget on the one hand and the development in prices and interest rates on the other (Han/Mulligan 2002), that is not so with the option of deficit financing. Historical experience suggests that the larger the financial burdens that have to be shouldered, the more inclined social policy will be to sidestep the distribution conflicts associated with spending cuts or revenue hikes by resorting to deficit financing. In examining the inflation trend, we must therefore seriously address the correlation between upward price pressures and deficit financing, given the high probability of the latter, at least in periods of very rapid population aging.

### CORRELATION BETWEEN PUBLIC DEFICITS AND INFLATION

Particularly at the beginning of the 1980s, there was intensive academic debate on the correlation between public deficits and inflation. Sargent und Wallace (1981), for example, presented a monetarist model that led them to conclude that if

a) the rate of interest is higher than the rate of growth in the nominal gross domestic product,

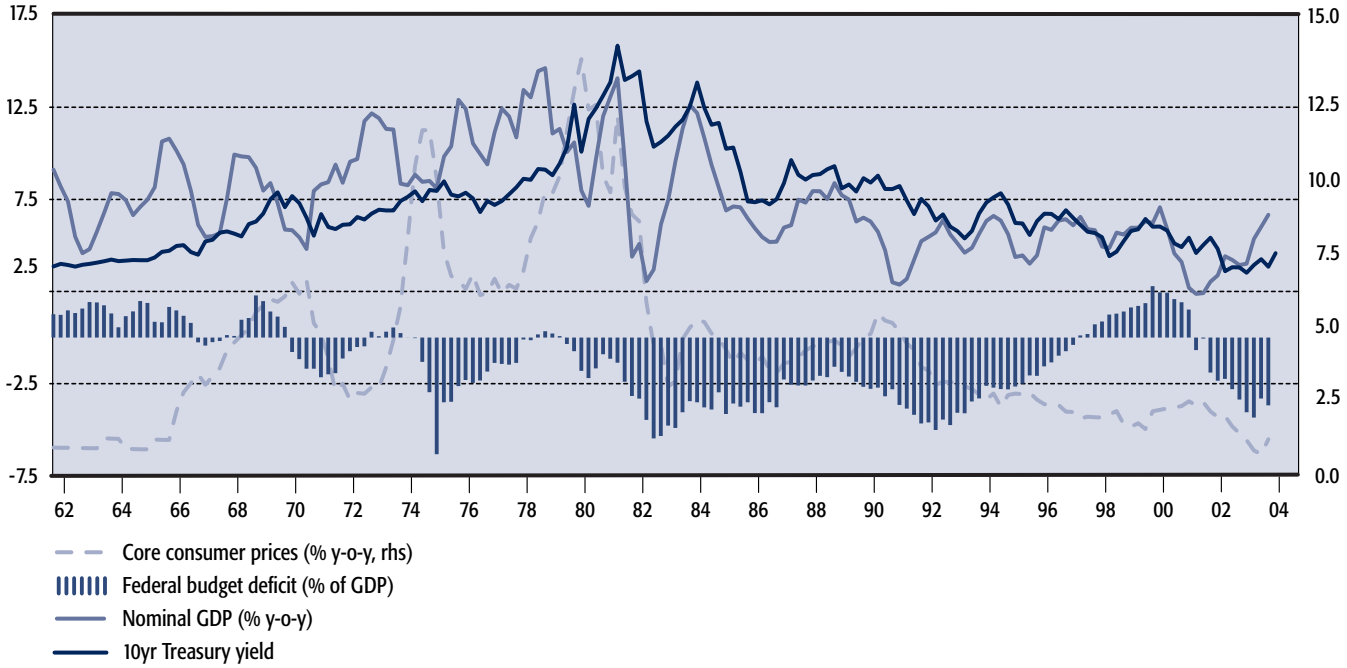
b) the national budget is running a primary deficit (fiscal balance excluding interest payments), and

c) the private sector's absorption capacity for government bonds is finite,

the only choice for the central bank is whether to monetize public debt immediately or later, taking the resultant inflation as a given. This is because the combination of conditions a) and b) leads to convergence at some point in infinity of the level of government debt relative to nominal economic output. However, condition c) puts a definite cap on the debt ratio as from which government cannot incur further debt. The only way out is thus a jump in the level of prices, keeping the debt ratio below this ceiling. So in the long term, even an independent central bank would be confronted with the dilemma of either having to tolerate the collapse of the state or monetizing the jump in prices. Sargent and Wallace therefore describe a monetary and fiscal policy mix that is unsustainable in the long term.

Now, the assumptions in the model described are extremely strict and were quite rightly criticized by Darby (1984). Nonetheless, a soft formulation of the model results is still very useful for analytical purposes: The coincidence of a monetary policy with a level of expansion at an interest rate below the rate of growth of the nominal gross domestic product, and ongoing deficit financing in the public budgets produces conditions highly favorable to the development of intrinsic price inflation.

## THE POLICY MIX AND INFLATION

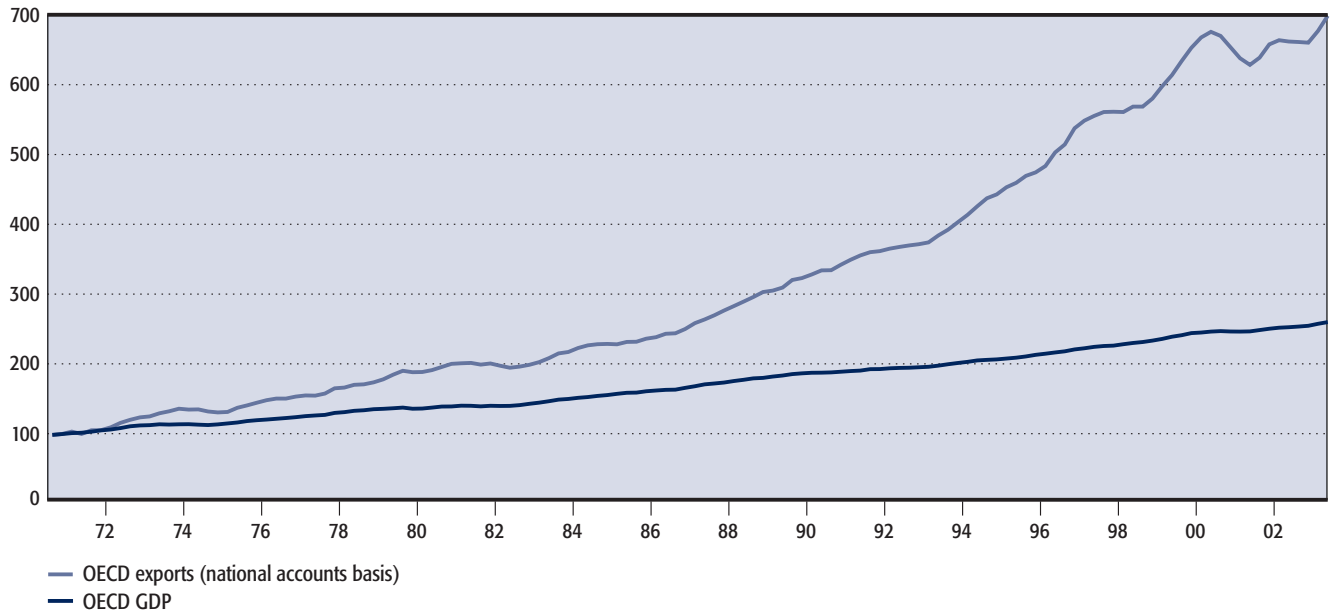



For the United States we can see that the entire period of high inflation in the 1970s is characterized by the coincidence of both conditions. But the disinflationary period since 1979 features a rate of interest well above nominal GDP growth in some cases. Although the gap had narrowed again by the end of the 1990s, at the same time the public sector had swung back to a surplus position. For a given rate of interest a sustained expansion in the budget deficit therefore gives companies and workers greater scope for price mark-ups and, by implication, heightens the risk of inflation.

## TECHNOLOGY AND GLOBALIZATION

Over the past three decades world trade has been growing much faster than economic output. While exports by the OECD countries, for instance, are now roughly seven times higher than in 1971, their GDP has risen just 2.5-fold. This development is a clear sign that value chains have been diversified globally, with each country contributing what it can do best. This international division of labor takes two forms: intra- and inter-industry trade. With the former, each country will manufacture the kinds of goods in which it has a comparative cost-advantage, either due to the availability of natural resources or the relative production factors. With inter-industry trade the same sectors in different countries compete for price and quality.

## EXPORTS ARE GROWING FASTER THAN GDP
– INDEX 1971 = 100 –




No matter what specific form this international division of labor takes, economic theory points to two major outcomes. First, there is increased competition in the goods market. Within our framework model this means companies are less able to mark up their prices. Second, factor price differentials across the globe will tend to equalize with the establishment of international trade relations. This means that, even if there is no factor mobility between countries, the pricing power for the factor that has become more abundant will be eroded. For industrial countries, with their comparatively high capital stock per workplace, the establishment of trade relations with countries that have a large number of workers per unit of capital thus reduces labor's pricing power.

Taken together, the two effects deliver a disproportionate downward impetus on prices as the industrial countries' pricing power is diminished (Greenspan 2004). What we have is a level effect with unique strong downward pressure that will subsequently be followed by a resumption in price increases. This is because global competition has led to a one-off reduction in pricing power for both workers and companies. Ultimately, though, the cost factors being passed on remain the key determinant. If they continue rising at the same pace, the rates of increase in wages and goods prices will follow the same path, but just at a lower level. We are familiar with the phenomenon from the liberalization of our domestic markets. In Germany, for example, prices for telecommunications services dropped a stunning 27 % between 1999 and mid-2001 as the market was opened up. But since then they have edged up again by 3.2 %, which is slightly more than customary in the regulated market between 1991 and 1999.

This automatically raises the question as to whether globalization and the attendant disinflationary effects might have a finite end. To answer this question, we must take a closer look at the drivers of the globalization process. Three factors deserve more detailed examination here: the opening of economies to world trade, domestic deregulation and technological development.

In the past, the opening of economies to international trade and domestic deregulation have gone hand in hand, as the "Washington Consensus" on economic

development has spread around the globe since the early 1980s. We can identify three distinct periods for this: In the 1980s Latin America abandoned its attempt to industrialize using a strategy of import substitution by building national champions in key industries, shifting instead towards an export-oriented development strategy. The 1990s saw the fall of the Iron Curtain in Europe and integration of the former communist states into the global economy. At the start of this decade China, India and the communist part of southeast Asia followed suit, leaving Africa as the last region still broadly cut off from global trade.

GLOBALIZATION SPREADING

In purely geographical terms, it seems that sooner or later the world will have reached the limits of globalization. But this is likely to take some time yet, given that broad swathes of the rural population in a number of emerging markets have still barely been incorporated into the global economy (e.g. communist China). Technology is another important driver of global economic integration whose potential is far from exhausted. In the first instance it was technological improvements in the transport sector that made the spatial division of labor possible at all. Today, with the advent of the internet and more sophisticated communications technologies, international trade is able to spread to the hitherto little affected services sector rather than concentrating solely on manufacturing. Global networking and information processing are also encouraging catch-up regions to boost their growth and prosperity by integrating into world trade.

While it would therefore be premature to postulate an end to the process of globalization, nor can we take its permanent advance for granted. We would also do well to bear in mind that global financial market integration has led to more synchronized business cycles across the globe, thus fanning simultaneous calls for protectionism in times of economic stress. The Great Depression triggered by the stock market crash of 1929 was considerably exacerbated and prolonged by a surge of protectionism in practically all countries, and a repeat response can never be ruled out unequivocally. Another aspect worth remembering is that the fruits of globalization are not shared equally among all those concerned. While the vast majority of participants certainly benefit to a varying extent, there are some losers, even in absolute terms. Purely commodity-based economies serve as a good example. As the global economy becomes more sophisticated and efficient, the use of raw materials per unit of output falls. The possibility of continued flat, or even falling, prices cannot therefore be dismissed. Add (fast-) growing population numbers, and this can easily mean a decline in the standard of living per head. An illustration of this is Saudi-Arabia, where nominal GDP per capita has plummeted from USD 17,500 in 1980 to USD 8,500 today. Circumstances like these can cause social upheaval that, in its worst form, could also lead to a pull-back from globalization.

HIGHER COMMODITY PRICES ON THE CARDS

In the case of non-renewable resources such as oil, though, it must be said that the trend to relatively stable price levels can be maintained only for as long as more efficient use and production costs permit. It is an irrefutable fact that absolute reserves will become scarcer with time. If the advance in use efficiency fails to keep pace with the depletion of deposits, the resource will become relatively more scarce and hence relatively more expensive. Once this process sets in, higher commodity prices can be expected to generate further price pressures; through the mark-ups described in our theoretical construction, this would likely lead to higher – and, indeed, potentially accelerating – rates of inflation in the event of steadily rising commodity prices.

## A SCENARIO FOR THE PERIOD 2010 TO 2050

Given the environment outlined in the above, we expect that from 2010 inflation-curbing effects will initially keep the upper hand. Once the surplus liquidity has been worked off, the positive fallout from intensified international competition will continue to act for a while. The most significant factor will be the growth in the effectively available workforce, stemming from ongoing integration of the rural areas in China and India into the global division of labor. It would also seem plausible to assume that fiscal policy will respond to the foreseeable demographic challenges by taking steps to keep costs under control and hence prevent budgets from slipping so deeply into the red. This will result in a less inflationary policy mix.

That said, we cannot expect these trends to persist much beyond 2020. For one thing, the purely geographical dimension of the international division of labor will reach its limits. The only price-curbing effects can then come from technological progress. Second, we must expect at least some of the demographic burdens on the welfare systems to be financed by higher deficits. On the fiscal side at least, the macroeconomic policy mix will therefore tend to start nudging up inflation again.

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# 5 Demography and savings

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## INTRODUCTION

In this section we try to assess the long-term factors determining the savings rate of private households. Income levels, interest rates, and uncertainty along with a host of other variables, including the design of the pension system, are prominent determinants of the savings rate. However, for long-term assessments stretching two decades or more into the future, demography becomes an increasingly important aspect in forecasting the development of household savings. First of all, demographic developments affect the savings rate directly as discussed below, they can be more readily forecast than economic factors and demographic change will trigger an array of changes in other policy areas, notably pensions, in almost all industrialized countries over the coming years. This will lead to changes in individuals' savings behavior with regard to the amount they save at different ages and with regard to the products in which these funds will be invested.

Demographic changes will affect a country's savings rate through various channels. This chapter tries to illuminate the processes lying behind these changes and gives an assessment of how the savings rate, and with it the supply of capital in the major industrialized countries of the world, is about to change. For this purpose we look at the demographic developments in the US, Japan, and the EU (due to better data availability we stick to the old EU-15 countries; since the new members' share of EU output and saving is negligible in a global context, this restriction will not alter the results). We then give some reasons why we think that saving behavior will change and we calculate the resulting effect on the household saving rate. First of all, however, we will give a brief overview of the relationship between age and savings.

## AGE AND SAVINGS – THE LIFE-CYCLE HYPOTHESIS

Over the lifespan of an individual his or her ability to save varies substantially. This is usually depicted in the traditional life-cycle model as described by Ando and Modigliani 1963.

People start life without own income, being dependent on transfers from their parents. As earnings increase in the course of a lifetime, reaching a maximum normally in the age bracket 45 to 55, so does saving. At the start of a person's career income is low and saving is low or even negative, for example due to loans for the acquisition of real estate, a car etc. As income increases in the course of a person's career so does saving, reaching its maximum between 45 and 65. After age 65 savings are used to finance retirement and the saving rate turns negative.

## SAVINGS-PROFILE ACCORDING TO THE LIFE-CYCLE HYPOTHESIS


The rationale behind this is the attempt to smooth consumption over a lifetime i.e. holding the level of consumption fairly constant and the fact that income can vary substantially, normally being lower after retirement than before. Although this model rests on many strict assumptions, it provides a good starting point for analysis.

Many attempts have been made to test this model empirically. These can be divided into two different approaches. The first approach looks at macro-data, aggregate saving at the national level is related to the demographic composition of the population in question. The other approach looks at micro-data. Here the savings at the household level are related to the age composition of the household. In theory both approaches look at the same issue only at different levels of aggregation and should therefore render the same results. In practice they do not. Whereas the life-cycle hypothesis is usually verified using the macro approach, no convincing results can be found in the micro-data. Theoretically this discrepancy can be at least partly attributed to bequests but in practice this leads to a host of new problems.

The main finding in the micro-data which contradicts the life-cycle hypothesis is that the old do not dissave. For most countries household data show that the saving rate for the elderly actually increases rather than decreases. A comparative study of seven countries (USA, Japan, Germany, France, UK, Italy, the Netherlands) by Börsch-Supan and Lusardi (2002) finds only in the Netherlands a saving pattern that more or less matches the life-cycle hypothesis.

At the macro-level the picture is more comforting. There exists a host of studies for different countries as well as across countries which identify the life-cycle hypothesis in the data. However, only an indirect test is possible, which does not take into account detailed differences in the saving behavior of different age groups.

DEMOGRAPHIC CHANGES WILL INFLUENCE SAVINGS PATTERNS

Usually the analysis is done by regressing an array of variables on the saving rate, a good example of this approach is Loayza, Schmidt-Hebbel, Servén (2000). The elderly-dependency ratio, that is the ratio of people over age 65 to the number of people of working age, usually those between 15 and 64, turns out to be significant in explaining the saving rate. This means that a change in the demographic composition of the population will affect savings. An increase in the share of elderly or, more precisely, the shift of a part of the population from working age to retirement will reduce the saving rate. This is taken as evidence that the life-cycle hypothesis is correct.

On the other hand, a mere increase in the average age of the population might have a different effect. If a larger share of the population reaches the high-income age window between 45 and 55, savings will increase. Only when this age group retires is the saving rate set to decline again. This development is to be expected in many countries since the baby-boom generations are now entering the high-income phase of their lives. We take a closer look at demographic developments in the following section.

## DEMOGRAPHIC CHANGE

Longer life expectancy almost throughout the world and falling birth rates are leading to a rapid aging of societies. Since each of these effects increases the average age of a population the current situation in many countries is best described by the term “double aging”. As a consequence the elderly dependency ratio (i.e. the ratio of the population aged 65 and older to the population aged 15-65) in the world will double from about 12 % today to 25 % in 2050. This process is not confined to the industrialized countries. For example the UN forecasts that the elderly dependency ratio in China will be higher than in the USA after 2040 – a consequence of the Chinese one-child policy.

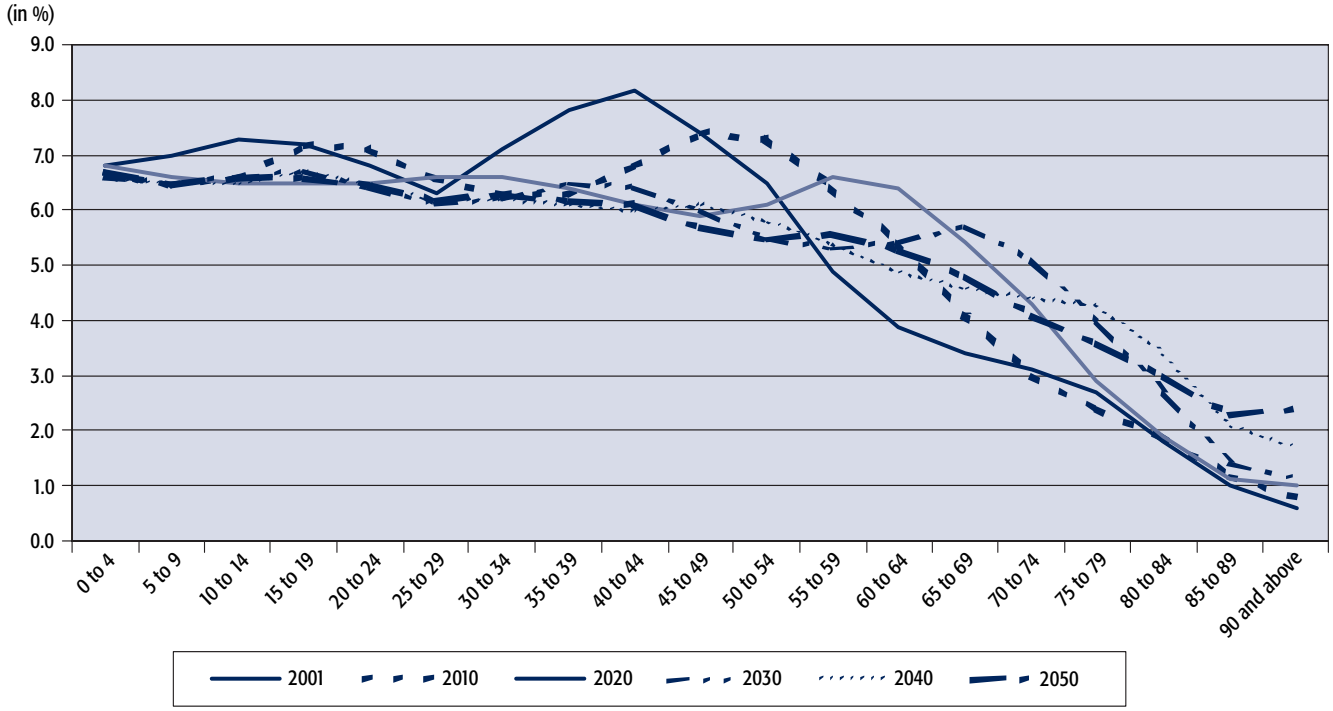
Special attention is focused on the baby-boom generations. In the US they are the result of a significant increase in fertility after the Second World War. It reached its peak in the second half of the 1950s and then petered off over the next decade to the current level of about 2 children per woman. As can be seen in the following chart, the baby boomers will form the strongest cohorts in the US population for more than the next decade, only after 2020 will younger age groups take over.

The baby boomers exist in Europe, too. However, the increase in fertility happened about 5 to 10 years later than in the US. What is more important, the slide in the birth rate in many EU countries did not stop at around 2 children per woman, which is almost sufficient to keep population constant, but declined further reaching 1.3 in Germany or even lower in Italy or lately in Spain. As can be seen from the next chart, the baby boomers will form the most numerous cohorts in the EU for the next 40 years.

The picture for Japan differs slightly. Japan experienced a baby-boom after the end of the Second World War. So the cohorts of the 50 to 55 year-olds in 2000 are the most numerous age groups in Japan. Their children, born in the 1970s, are again cohorts which are larger than those born directly before or after this time. In the graph the two peaks in the distribution of the population among age groups, separated by 25 to 30 years, can be clearly seen.

## SHARE OF AGE GROUP IN TOTAL POPULATION USA

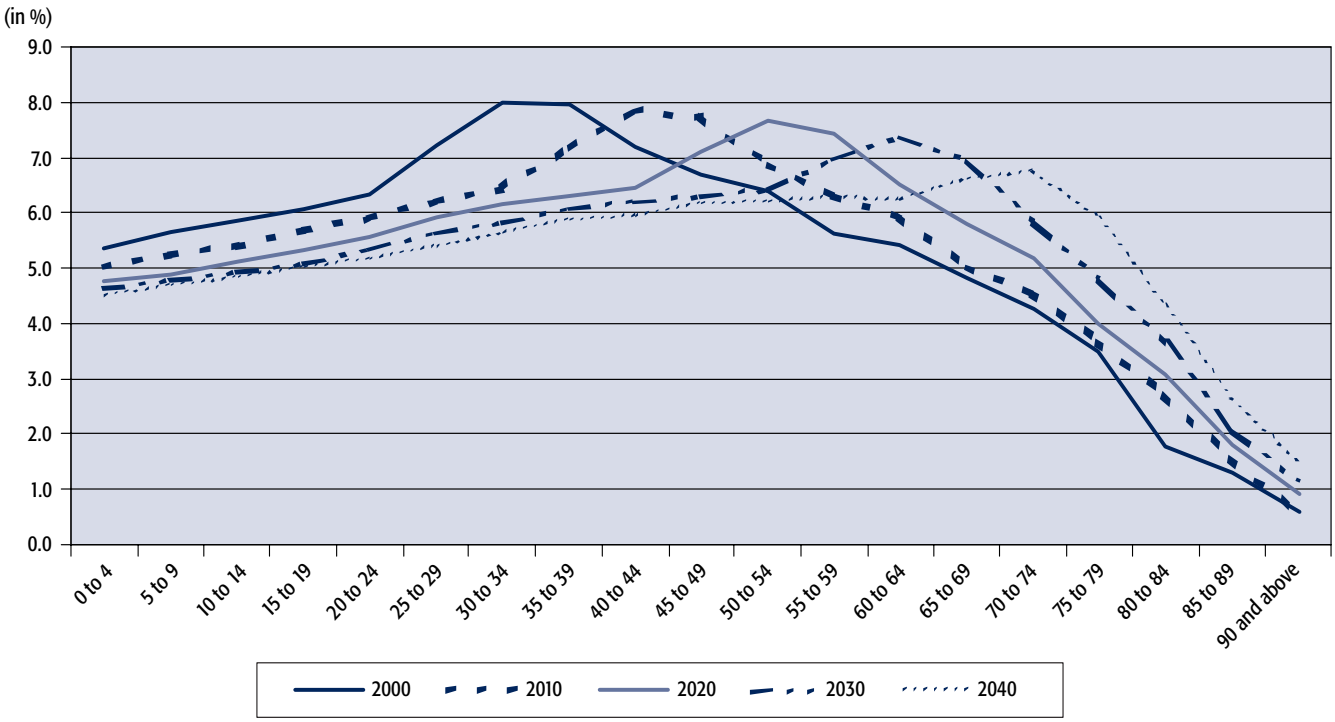
– 2001 TO 2050 –




Sources: US Census Bureau, own calculations.

## SHARE OF AGE GROUP IN TOTAL POPULATION EU-15

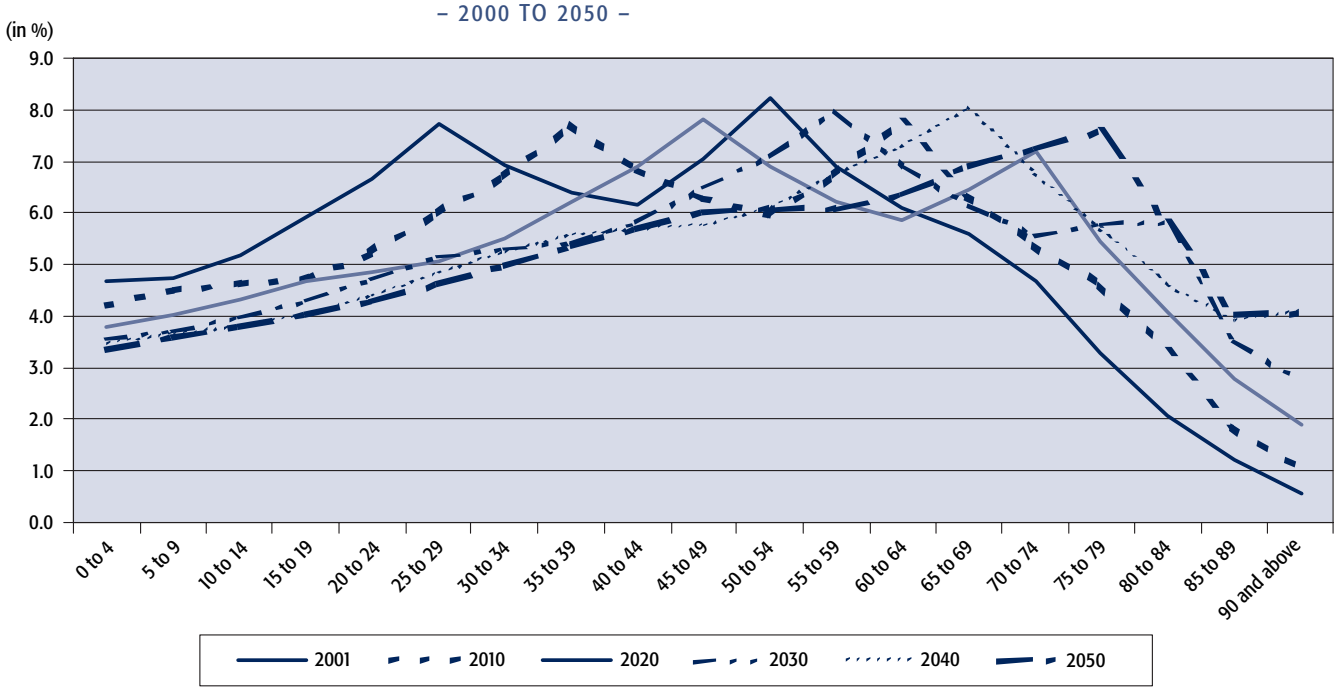
– 2000 TO 2040 –




Sources: Eurostat, own calculations.

## SHARE OF AGE GROUP IN TOTAL POPULATION JAPAN

– 2000 TO 2050 –



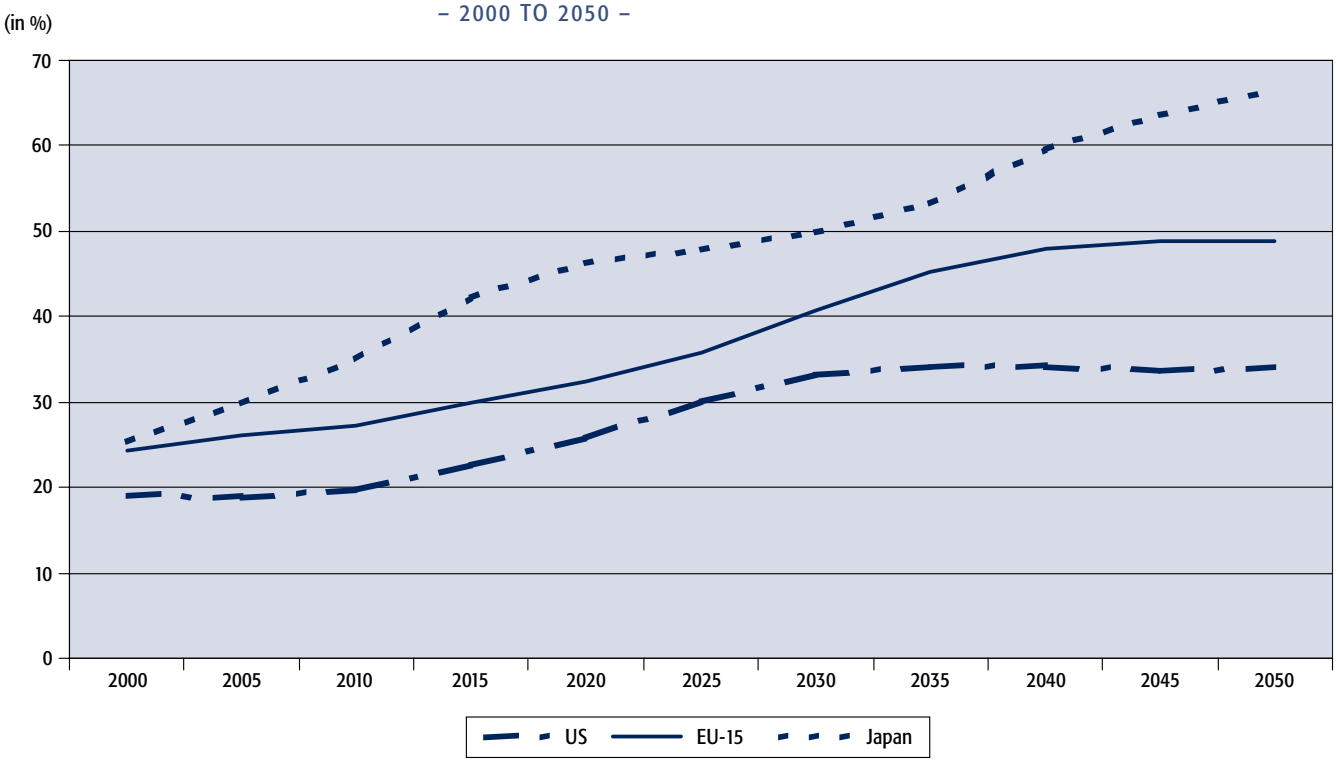

Sources: National Institute of Population and Social Security Research, own calculations.

Over the next 4 to 5 decades the world population will keep on growing (the UN estimates a decline in the world population growth rate from 1.2 percent today to 0.3 in 2050 in its medium variant of the world population prospects). Decelerating population growth will be accompanied by an aging process which will be very pronounced in Japan, most parts of Europe and later in China. So aging is a global phenomenon which will affect almost all countries. However, the same is not true for population growth, which will turn negative among major countries only in the EU, Japan, China and Russia in the course of the next 25 years. By contrast, the US along with most other countries is expected to see population growth.

The UN expects the US population to increase from 290 million today to over 400 million in 2050. In contrast the population of the old EU-15 countries will stay roughly constant at 380 million people for a long time and then decline to 365 million in 2050. However, the age structure will change considerably over time. In the US the share of people aged 65 and over to the working age population between 15 and 64 will increase from 19 % today to about 34 % in 2050, reaching 26 % in 2020. The old EU-15 already have a dependency ratio of 26 % which will rise to 32 % 2020 and reach 48 % in 2050. Even this huge increase is well below the development in Japan which has the most severe demographic problems. Currently the dependency ratio in Japan already stands at 30 % and will top 65 % in 2050.

In all industrialized countries the share of the population in retirement will increase. This process will be accompanied by an absolute decline in the working age population in the EU and Japan whereas in the US the number of working age people will increase by 20 % from 200 million to 240 million. In this respect, the US will see a very different population development compared to Japan and the EU-15. It is in a much more comfortable position.

## OLD-AGE DEPENDENCY RATIOS
### 65+/15-64
– 2000 TO 2050 –




Sources: UN Population Division, national statistical offices, own calculations.

## IMPACT ON SAVINGS

The process of global population aging poses a wide array of questions with respect to the future development of key economic and policy variables. Pay-as-you-go pension systems in particular are regarded as extremely ill-suited to cope with demographic change. Most EU countries are facing severe challenges with regard to the long-term viability of their pension systems and the sustainability of public finances. The standard prescription to cure these problems has been to lower the benefit level provided by state pension systems and increase private provision for old-age. In other words a shift from unfunded to more funded pension systems was recommended. A look at the pension reforms enacted in Europe over the past decade shows that governments heeded the advice. A host of countries introduced pension reforms aimed at bolstering the funded pension system either by promoting occupational pensions or through incentives to increase individual provision for old age or both.

### HEALTH EXPENDITURE AND AGE

Along the same lines changes in the health system can be expected. Health expenditure is strongly correlated with age. Those countries with a comprehensive health insurance will be forced to either increase contributions or restrict coverage. It can be expected that in future an increasing share of health expenditure will have to be borne by the individual. This is the trend in Germany. But more and more people are looking for additional private insurance in countries like the UK in order to skip long waiting lists. A general overhaul of the Dutch health system is also pending, therefore it looks like a general trend. The concept of medical saving accounts, which would allow the tax-exempt accumulation of capital to pay for health expenditure, is being discussed in more and more countries. Since the

MORE PRIVATE SAVINGS NEEDED FOR RETIREMENT

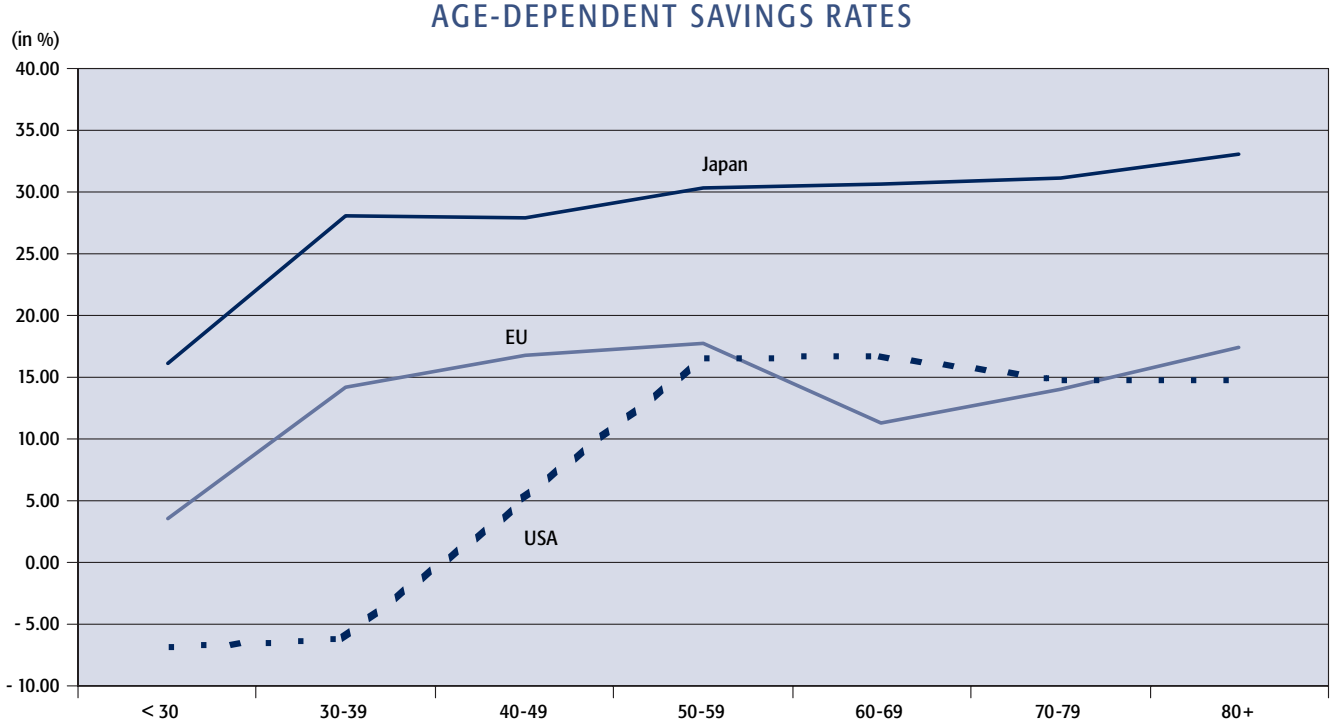
bulk of health expenditure is spent in old age the saving pattern on these accounts would mimic those for retirement. These changes in pay-as-you-go financed social security systems are not confined to Europe, even Alan Greenspan, chairman of the Federal Reserve, demanded changes in Social Security and Medicare (the US health system for the elderly) in his recent speech in Jackson Hole in August 2004. In most industrialized countries, state welfare will be reined in because of demographic changes, leaving individuals with an increasing need to insure themselves against risks. The need to take more provisions for old age individually will leave its mark on the savings behavior of individuals. In future more private savings will be needed to secure a comfortable life in old age.

## MICRO APPROACH

Currently the theoretical saving pattern according to the life-cycle model cannot be found when looking at household data. Analyses by Börsch-Supan and Brugiavini, Börsch-Supan and Lusardi show that, in general, saving rates do not turn negative after retirement as predicted by theory. Actually it does not even decline in all countries. Data for Japan show an increase in the household saving rate with age. For the UK and Italy the experience is mixed and even in the US different data sources show different developments but none of these shows a pronounced decline in the household savings rate after retirement, let alone a negative rate. However, a significant decline in the saving rate can be found in Germany – but again, it stays well in positive territory – and in the Netherlands where negative rates can actually be found in the data.

Due to the reasons given above a change in household savings behavior over the next decade can be expected. The need to save more individually for retirement and probably for health care, too, will increase saving rates during working age. Given the tax incentives introduced in many European countries (notably Germany

### AGE-DEPENDENT SAVINGS RATES



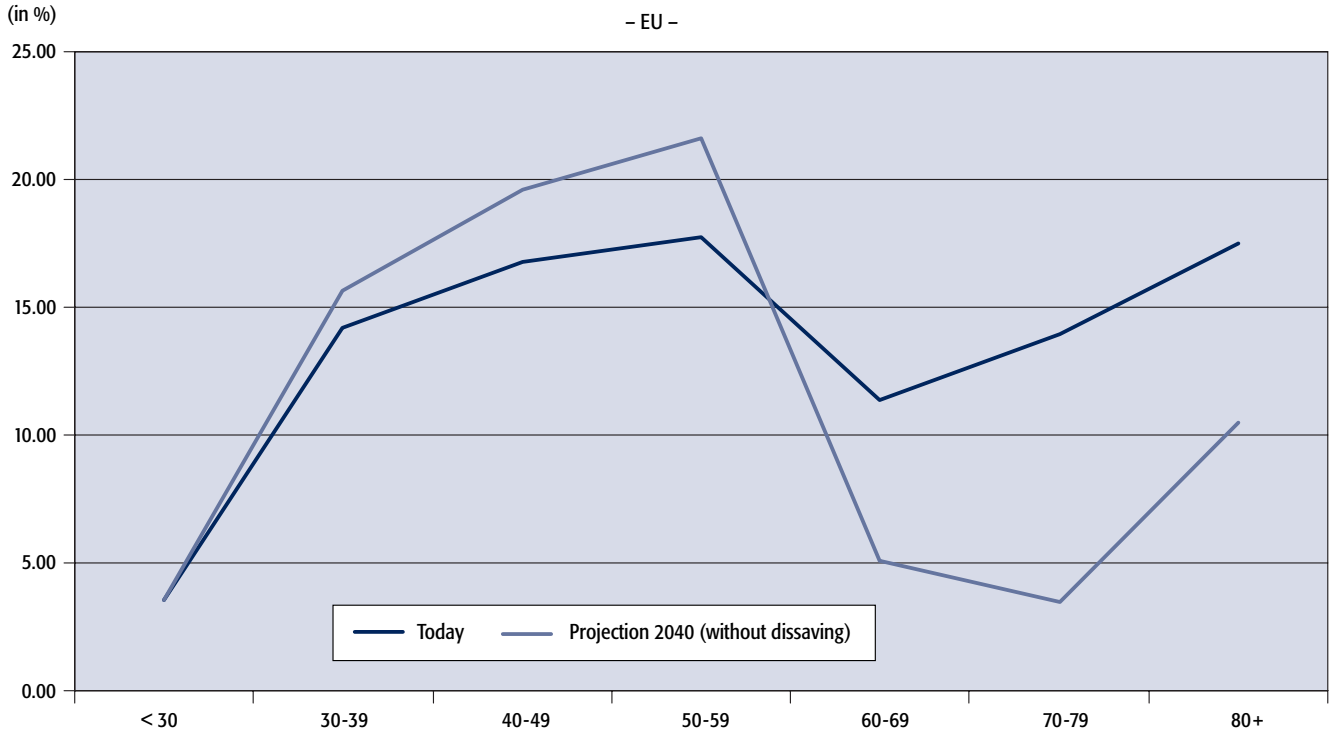

Sources: MEA, own calculations.

and France) to foster old-age provision, higher saving rates will be seen earlier during working-life, whereas the need to top up dwindling state pensions in the future will lower the saving rate after retirement. If an increasing share of health expenditure has to be financed out of pocket, even a negative saving rate is imaginable. Since age-dependent saving rates were not available for all old EU-15 countries the figures for the EU were approximated with data for Germany, UK, and Italy. Data refer to the period from the late 1970s to the mid 1990s and were taken from the homepage of the Mannheim Institute of the Economics of Ageing (MEA). The data are household survey data for six countries, for example the Expenditure and Consumption Survey for the USA and the income and expenditure survey *(Einkommens- und Verbrauchsstichprobe)* for Germany.

In view of less generous pension systems in the future, there is ample need for younger cohorts to save more than their elders. Simultaneously these generations will need more of their income or even their wealth to support their standard of living once they are retired. We believe that this will change their saving behavior. The kind of change we think most likely is depicted in the following graph. We use this projected age-specific saving behavior to assess the impact of demographic change on the aggregate household saving rate in the future. Of course other developments are possible, but since we do not see actual dissaving in the data today we abstain from using it for our calculations. However, we assume a significant decline in the saving rate for the elderly. For simplicity we calculate the same proportional changes in each age group in each of the three countries. The following chart shows the age-dependent household saving rate for the EU-15 (as described above) for the year 1998 and the projected rate in the years starting 2020. By then saving behavior should have adapted to the new pension environment. We predict that saving rates during working life will increase. After retirement, however, people will save substantially less than today, but they will not dissave.

## SHIFT IN AGE-DEPENDENT SAVING-RATES

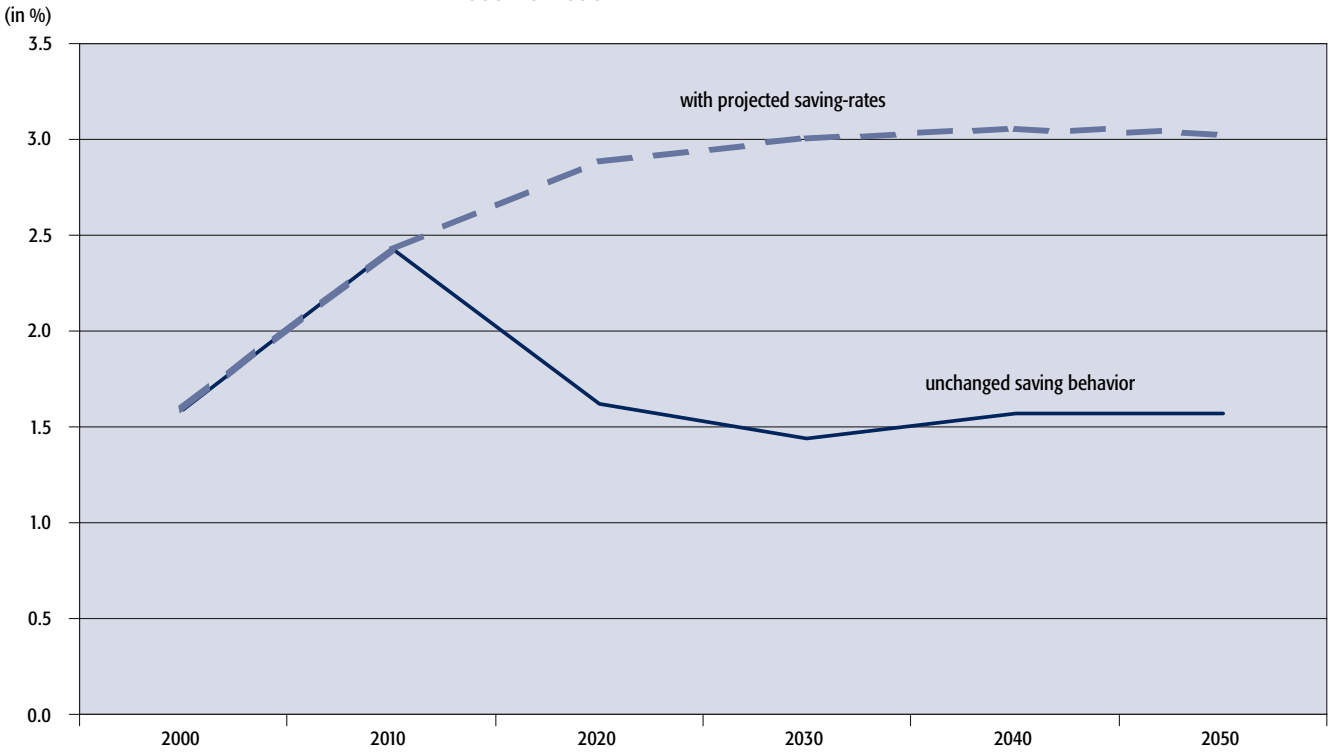
– EU –




Sources: Eurostat, Nat. Instit. of Population and Social Security, MEA, own calculations.

## AGGREGATE SAVING-RATES USA

– 2000 TO 2050 –

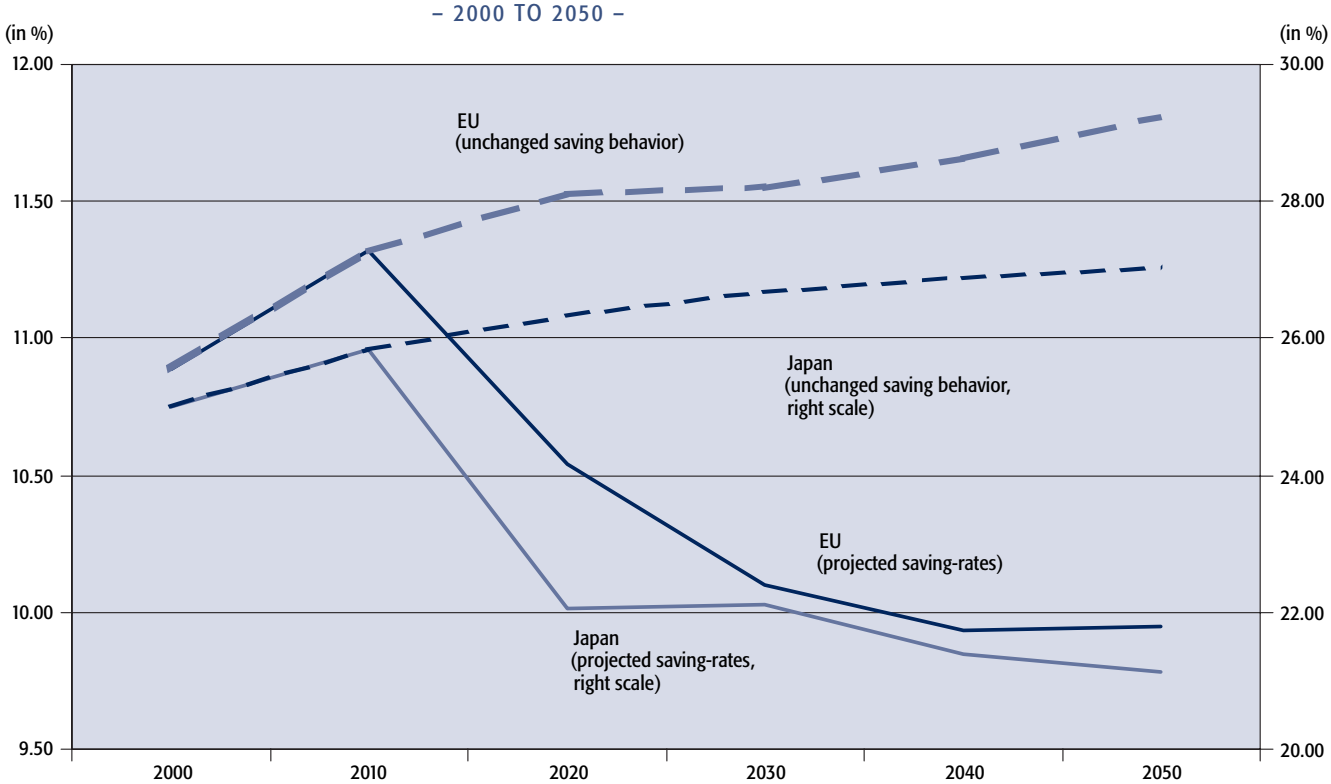



Sources: US Census Bureau, own calculations.

Taking into account the strength of the different age groups in future an aggregated

## AGGREGATE SAVING-RATES EU AND JAPAN

– 2000 TO 2050 –



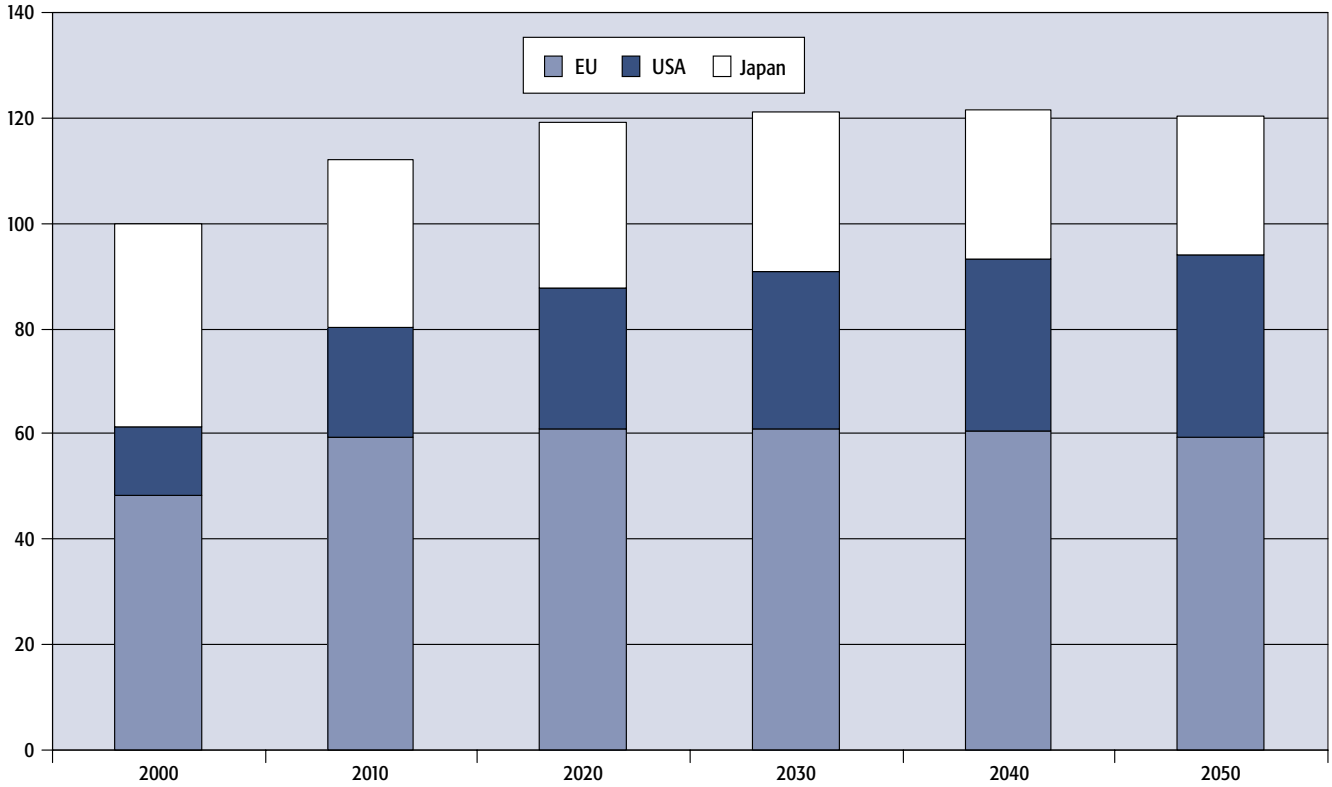

Sources: Eurostat, Nat. Instit. of Population and Social Security, MEA, own calculations.

saving rate can be calculated. Depending on the assumed underlying age-specific saving rates different aggregate saving rates for each country are calculated. This is done in a first step by taking the age specific saving rates as described above, this means that no changes are assumed in the future. This approach leads to an increase in the aggregate saving rate. However, if we use the projected saving rates a completely different picture appears. For the EU-15 this leads to a pattern of the overall savings rate which shows an increase in the beginning until 2010 as more and more people grow into high-saving ages, and than declines again as more and more people retire. In the USA, the pattern is similar whereas in Japan not much of an increase can be seen early on.

However, to assess the impact of demographics on capital supply it is not so much the saving rate but rather the amount of savings which is important. The latter is determined first of all by income developments. Higher income will lead to higher savings (and a higher saving rate) if everything else remains unchanged. The same holds true for demographics, more people will lead to higher savings if all other household variables remain unchanged (i.e. average income per capita stays constant, etc.). If we take population growth into account and assume no change in age-specific saving rates we will see an increase in savings purely for demographic reasons. The following picture shows how gross household savings will change over time for purely demographic reasons. It takes into account the change in the aggregate saving rate due to changes in relative cohort strength over time, and overall population growth. To get an idea how overall saving will evolve over time, the development in each of the three countries is weighted

## DEMOGRAPHY INDUCED DEVELOPMENT OF AGGREGATE SAVINGS

### – UNCHANGED AGE-SPECIFIC SAVINGS BEHAVIOR –



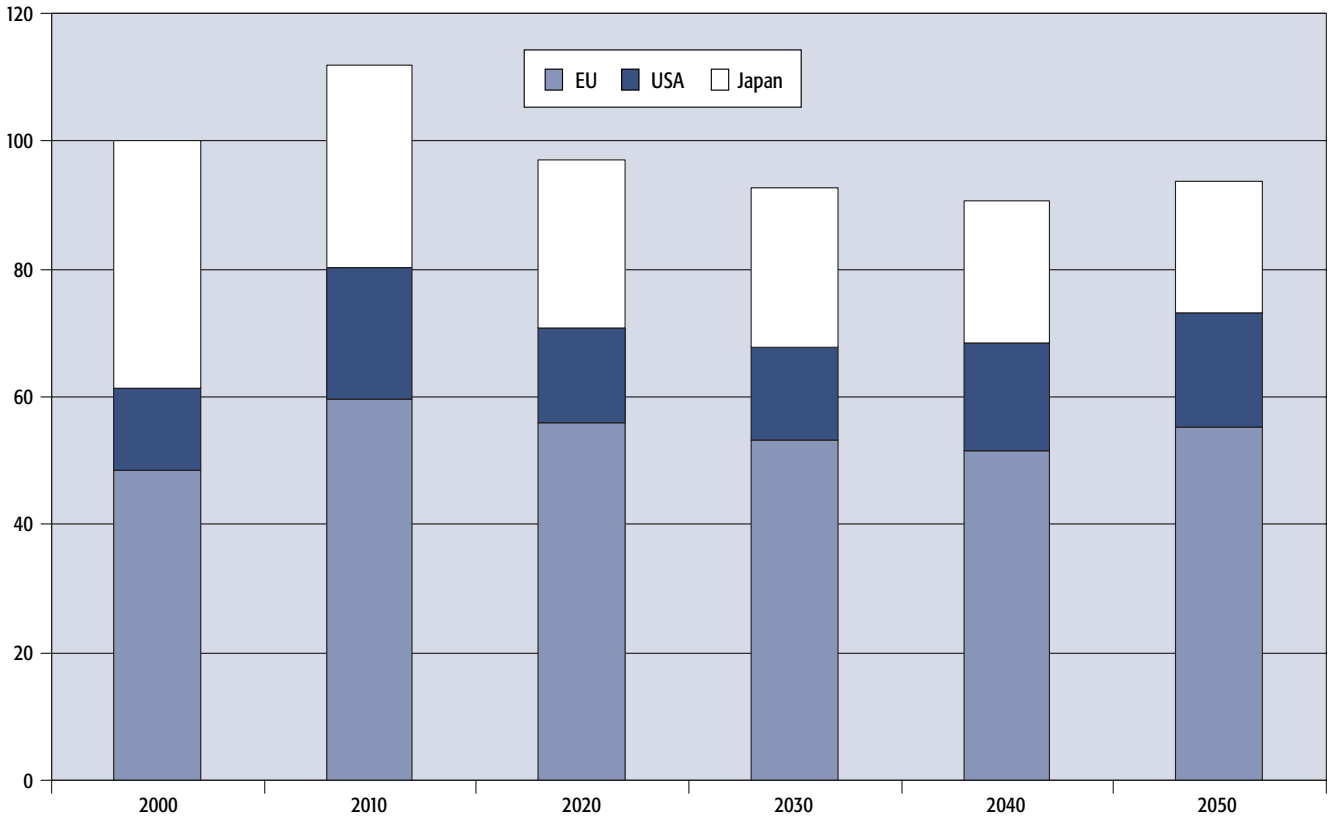

Source: Own calculations.

by the respective average of household gross savings between 2000 and 2003. As a result we see that overall savings are set to increase by 20 % over time. This outcome goes along with a strong increase in saving in the USA due to an increase in the aggregate saving rate and strong population growth, whereas in Japan savings are set to decline. Europe will see an increase up to 2020 and then a rather flat development as the effect of population decline is countered by a slight increase in the aggregate saving rate.

However, this picture changes significantly if we take the projected changes in the age-specific saving profiles into account. In that case the overall saving in the countries under consideration will decrease after an immediate slight increase. Especially the share of the USA in overall savings will be significantly lower, whereas the developments in Japan and Europe differ less from the case depicted above. But both will see a decrease in saving starting 2020.

## DEMOGRAPHY INDUCED DEVELOPMENT OF AGGREGATE SAVINGS

### – PROJECTED AGE-SPECIFIC SAVINGS BEHAVIOR –




Source: Own calculations.

Over the coming decades substantial changes in savings can be expected. We believe that people will adapt their savings behavior to the changes in pension schemes. Therefore we expect a slight decrease in overall saving in the countries reviewed in the medium term. Short-term there will be in any case an increase in saving and therefore capital supply.

## MACRO APPROACH

The evidence from macro-data with regard to the impact of demographic change on savings is more clear-cut than from micro-data. In general these studies identify a significant negative relationship between the age structure of a population and the household savings rate or the national savings rate, see for example Loayza, Schmidt-Hebbel, Serven (2000), Horioka (1997), Weil (1994).

A summary of this strand of literature is given in McCarthy, Neuberger (2004). They conclude that in OECD countries, looking at cross-country analyses, the data suggest that a shift of 1 % of population from working class to elderly reduces the private savings rate between 0.5 and 0.9 percentage points. For our analysis we assume the lower value which is consistent with the result of Loayza, Schmidt-Hebbel, Serven for OECD countries. However, since the share of the elderly in the total population increases as baby-boomers retire, this line of reasoning leads to an ever-decreasing savings rate. For example, in the EU the household savings rate would decline by 2.5 percentage points until 2020 and a further 3 percentage points in the 20 years thereafter. The picture for the US and Japan looks similar.

These results contradict those from the micro-level analysis for the more immediate future. Furthermore they cannot take into account changes in household behavior due to changes for example in the pension system. We believe therefore that the micro-approach is better suited to assess the impact of demographic developments and population aging on savings and therefore capital supply.

## CONCLUSION

Demographic developments are forcing most industrialized countries to scale back pay-as-you-go pension schemes. In order to support their standard of living after retirement households will adapt their saving behavior, saving more while working and less once they are retired. Under these assumptions and due to demographic reasons household saving rates will increase slightly in the next decade and then move down again. Demographic developments will therefore fuel an increase in capital supply over the next decade. In the more distant future changes in the age structure in the US, Japan and the EU will have a negative influence on the overall saving rate. In addition, population growth will leave its mark. Shrinking populations in Europe and Japan, combined with a decrease in the aggregate saving rate under the assumption of changes in individual age-specific saving rates, will result in a drop in overall saving. This will occur despite a substantial increase in the US population. In the short term, however, an increase in savings can be expected.

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# 6 Productivity, human capital and technological progress

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The longer-term trend in capital market yields also hinges crucially on the productivity of the real capital deployed in the output of goods and services. The key factors influencing capital productivity include the capital resources per unit of labor (capital intensity of production), the level of training and education of the labor force (human capital), as well as technological innovation (technical advancement). How have these core variables developed and what changes are to be expected in the light of demographic trends?

## INTERNATIONAL PRODUCTIVITY DEVELOPMENT

Over a long-term retrospective view, growth in labor productivity in the industrialized countries has slowed, although it has developed differently from region to region. One notable exception to this trend has been the USA, where the rise in productivity per hour worked has actually accelerated. According to calculations by the Bank for International Settlements (BIS) and the OECD, trend growth in total factor productivity, which is taken as a measure of technological progress, has risen in the USA, Canada, France and Sweden, whereas it has fallen in the United Kingdom and most EMU countries.[1]

## PRODUCTIVITY IN SELECTED INDUSTRIALIZED COUNTRIES*

| | Labor productivity** | | | | Total factor productivity | | | |
|---|---|---|---|---|---|---|---|---|
| | Previous trend | from | Current trend | from | Previous trend | from | Current trend | from |
| **USA** | 1.2 | 1974 | 2.8 | 1998 | 1.0 | 1983 | 2.1 | 1998 |
| **Euro area** | 2.6 | 1979 | 1.5 | 1996 | 1.4 | 1988 | 0.7 | 1994 |
| **Germany** | 3.5 | 1989 | 1.6 | 1995 | 2.4 | 1988 | 1.0 | 1994 |
| **United Kingdom** | 0.8 | 1985 | 2.0 | 1991 | 2.1 | 1970 | 1.0 | 1984 |
| **Japan** | 4.0 | 1986 | 2.0 | 1994 | 1.3 | 1985 | 0.1 | 1994 |

*Change in % p.a., annual averages. **Corporate sector.

Source: BIS/OECD.

Productivity growth in the USA is often attributed to the increased use of information and communication technology equipment. In fact, however, market deregulation and greater pressure for innovation outside the IT sector in the face of growing competition may also have played a role.

[1] *BIS* (2004).

PRODUCTIVITY GAINS LOWER THAN MIGHT HAVE BEEN EXPECTED

A number of productivity studies have concluded that the use of modern information and communication technology over recent decades has not actually generated the productivity gains that might have been expected in theory. In fact, they even claim that the use of such technology has been accompanied in part by slowing growth in total factor productivity (the so-called IT productivity paradox). A number of key reasons are given for this:

- *Time lags* between the introduction of IT and its impact on productivity,
- Inadequate *measurement of input or output data* (increases in product diversity, quality improvements, IT has allowed the provision of many services that would not otherwise be possible),
- *Mismanagement* in the introduction and application of new technologies, competitive effects (productivity gains of individual companies are achieved to the detriment of others),
- *A surfeit of information,* consolidation and network effects (failure to adapt organizational structures to new technologies),
- *Follow-up costs,* which would not have been incurred without IT (additional personnel requirements).[2]

In the developing countries and emerging markets, aggregate productivity – measured in terms of real GDP per head of the population – has also developed at different rates on a longer-term comparison. According to figures released by the International Monetary Fund (IMF), the Asian economies still lead the field, despite slowing productivity growth. In Latin America, the momentum (which was already moderate) has waned further, while the Middle East has significantly improved its position and Africa has been able to turn its downtrend into a modest rise.

## REAL GDP PER HEAD – INDUSTRIALIZED VERSUS DEVELOPING COUNTRIES*

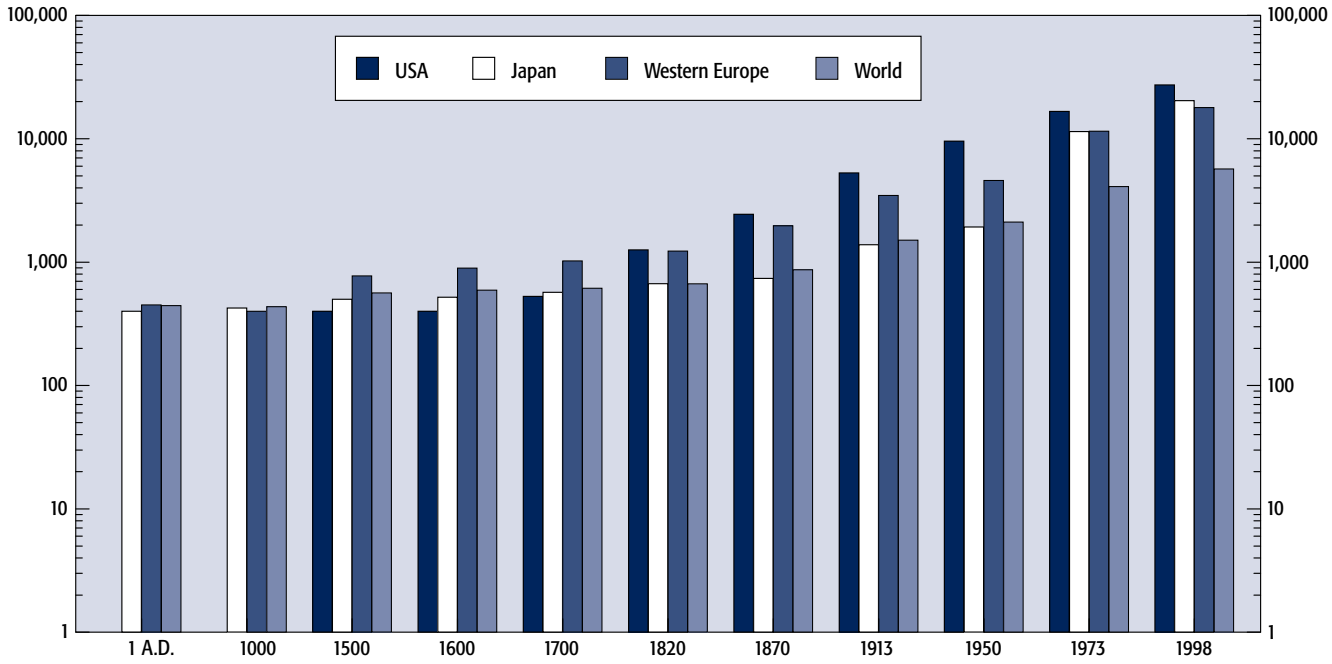
| | 1986-1995 | 1996-2005 |
|---|---|---|
| **USA** | 1.7 | 2.4 |
| **European Union** | 2.1 | 1.9 |
| **Japan** | 2.8 | 1.3 |
| **Major industrialized countries (G7)** | 2.1 | 2.1 |
| **Young Asian industrialized countries**** | 7.0 | 3.5 |
| **Emerging markets and developing countries** | 1.9 | 3.6 |
| **Central and Eastern Europe** | 0.1 | 3.1 |
| **Asia** | 5.9 | 5.2 |
| **Latin America and the Caribbean** | 1.0 | 1.0 |
| **Middle East** | 0.0 | 2.4 |
| **Africa** | -0.9 | 1.6 |

*Change in % p.a., annual averages. **Hong Kong, South Korea, Singapore, Taiwan. Source: IMF.

[2] *Piller* (1997).

## PRODUCTIVITY IN A MILLENNIAL PERSPECTIVE

GDP PER CAPITA, IN INTERNATIONAL DOLLARS AND 1990 PRICES – LOG SCALE –




Source: OECD, The World Economy: A Millennial Perspective, and own calculations.

## GLOBALIZATION, INFORMATION NETWORKS AND KNOWLEDGE APPLICATION

GLOBAL NETWORKS GROWING

Since the mid-1980s, goods, labor and financial markets have grown together – beyond all political boundaries – to an unprecedented degree. Privatization and liberalization are creating more scope for private economic activity and international direct investment. The dismantling of trade barriers and increasing regional economic integration are expanding opportunities for the international division of labor, and are boosting global productivity. The opening up of national financial markets to international investors has made capital more mobile than ever, and scarce financial resources can more easily be shifted to regions which promise the highest returns and the most efficient deployment. The international credit volume is growing at a faster pace than world trade, and the growing importance of cross-border investment is also serving to make capital market transactions more significant.

On top of this, there have been quantum leaps in information and communication technology, allowing the development of global electronic networks. The broader and more rapid flow of information certainly makes it more difficult for individuals to select the specific information they need, but it ultimately also makes markets more transparent, and reduces information and transaction costs within the economy. E-commerce, e-banking and online services of various types enable labor to be shared across national boundaries without it necessarily becoming physically more mobile.

## NUMBER OF INTERNET HOSTS (IN THOUSANDS)

| | 1991 | 1996 | 2001 |
|---|---|---|---|
| **North America** | 549 | 10,718 | 109,091 |
| **Europe** | 128 | 3,603 | 15,217 |
| **Asia/Oceania** | 44 | 1,586 | 13,037 |
| **Latin America** | 0 | 164 | 3,408 |
| **Middle East and Africa** | 3 | 179 | 635 |
| **World total** | **724** | **16,250** | **141,388** |

Source: World Resources Institute.

The new media are accelerating the global diffusion of knowledge, making areas of production which rely heavily on capital and know-how even more knowledge-intensive. Value added generated by information processing and knowledge application is becoming increasingly important. Companies can access key decision-making parameters just in time via global networks. They can respond more rapidly to changing market situations, channel their resources more efficiently, and further optimize their operating processes. The same is true of private households.

According to estimates, the number of Internet users worldwide has more than doubled in the past four years, reaching over 700 million. Despite this impressive growth rate, this figure still represents only 11% of the global population. In the world's most populous countries, China and India, the level of Internet use is still very low. However, strong economic growth in these – and in other emerging – economies is likely to act as a further stimulus to the spread of the Internet over the coming decades, quite apart from the momentum it has developed in regions where it is already established.

## THE INTERNATIONAL DEVELOPMENT OF HUMAN CAPITAL

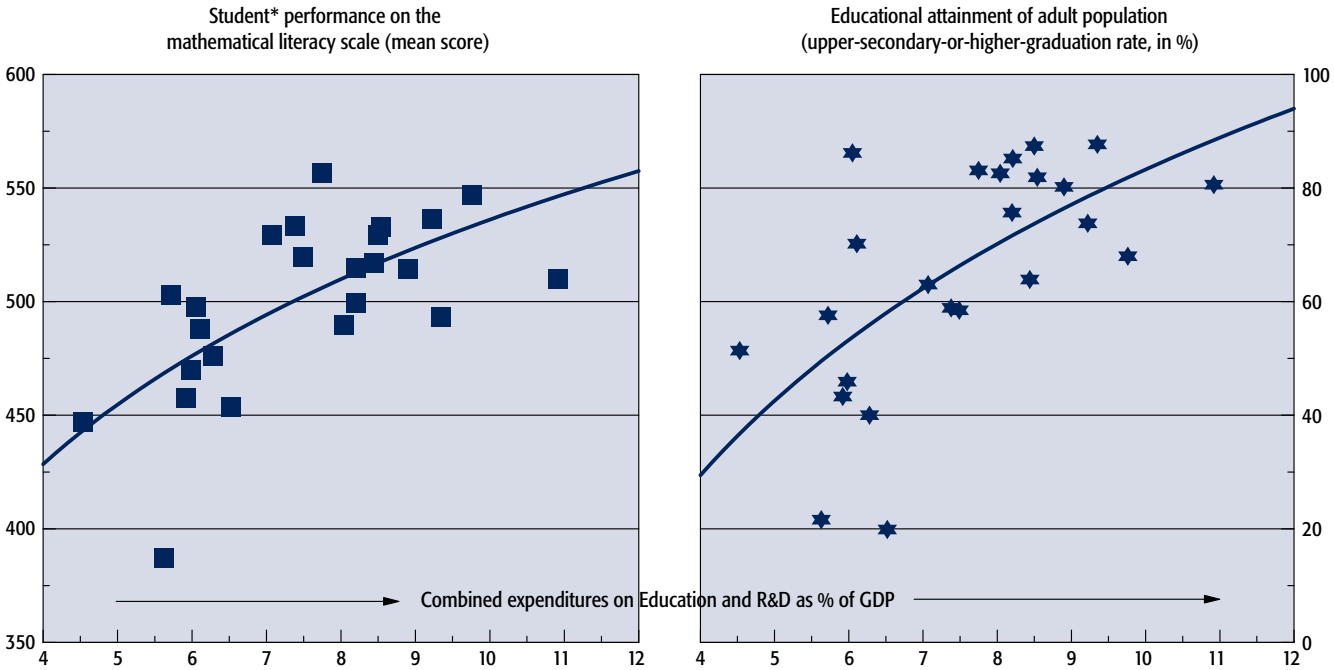
PIONEERING INVENTIONS RESULT IN LONGER INNOVATION CYCLES

The human capital stock has grown continuously in the course of human history. This trend has developed in line with technological progress. However, its development has not been constant over time, nor spread evenly around the globe. Some capabilities and skills were, for a very long time, restricted to individual regions – China, for example, introduced paper, book printing and the magnetic compass centuries before Europe – and only spread to other cultures in the wake of migration and growth in international trade. On the other hand, pioneering inventions have always resulted in longer innovation cycles (so-called "Kondratieff cycles": steam engine, railway/steel, electrical engineering/chemicals, petrochemicals/automobile, information technology/microelectronics)[3]. We are currently assumed to be in the "sixth Kondratieff", which is expected to reach its first peak around 2010 and is characterized primarily by innovations in the medical sector.

Today, the global human capital stock is distributed very unevenly across the continents. Even among the industrialized countries, significant differences are apparent in education systems and education policy, and hence also in the level of education.

[3] Theory of long waves, named after *Nikolai Dmitrijewitsch Kondratieff (→ J.A. Schumpeter).*

## HUMAN CAPITAL IN INDUSTRIAL COUNTRIES: INPUT AND OUTPUT




* At age 15.

Source: OECD, The World Economy: A Millennial Perspective, and own calculations.

## GROSS ENROLMENT RATIOS 2000* – INDUSTRIALIZED VERSUS DEVELOPING COUNTRIES

| | Secondary education | Tertiary education |
|---|---|---|
| **North America and Western Europe** | 106 | 55 |
| **Central and Eastern Europe** | 86 | 36 |
| **Central Asia** | 82 | 32 |
| **Latin America and the Caribbean** | 81 | 21* |
| **East Asia and Pacific region** | 77 | 22 |
| **Arab countries** | 70 | 22 |
| **Southern and Western Asia** | 50 | 7 |
| **Sub-Saharan Africa** | 27 | 3 |

*Median, in %. Rates above 100 % are due to statistical reasons.

Source: United Nations; *World Bank.

In many developing countries, the population explosion of recent decades has led to a precarious situation in the education system. Where mere survival is the main priority, the opportunity costs of human capital formation are especially high. On the other hand, the expected return on human capital is particularly high in developing countries, especially in the field of primary education. Government action, including international development aid, is especially important in this area.

In the meantime, however, the situation also seems to be improving in the world's poorer regions as a whole. This is indicated – despite the reservations one may have about the comparability of education systems – by United Nations surveys.[4]

[4] *United Nations* (2003/4).

LITERACY RATES SET TO RISE

According to the UN, in the period 1990-2000 the gross school enrolment ratios at primary and secondary level rose in most regions of the world. Although they are still below the world average in the Arab countries, in Southern and Western Asia, and above all in Africa, the absolute gap between the industrialized countries and the developing nations has narrowed overall. All told, the UN expects global literacy rates to continue to increase until the year 2015: among young people (15 to 24-year-olds) in Central and Eastern Europe, Central Asia and the East Asian-Pacific region it will reach approximately the level seen in North America and Western Europe.

The situation is also improving in the sector of tertiary education. However, at the same time the global divide is widening in absolute terms. In the period 1990-2000, the gross enrolment ratio in higher education in the developed countries climbed from 36 to 56 percent, while it rose from 24 to 33 percent in the reform countries and from 5 to 10 percent in the developing nations (in sub-Saharan Africa the figure rose from 1½ to 2½ percent). In the wake of globalization, international student mobility is also increasing. Whereas a few decades ago virtually all students from developing countries came from political elites and returned home after their studies, today – so the UN observes – such periods of study abroad form part of employment-driven long-term migration.

## ENDOGENOUS ECONOMIC GROWTH, FACTOR INPUT RATIO AND CATCHING UP

The input of human capital in the production process plays a central role in the theoretical explanation of endogenous technical progress, endogenous economic growth, factor input ratios, and thus also in factor prices including the rate of return on investment. In this context, the question also arises as to how knowledge and technological progress spread in a national economy, and – on a wider scale – in the global economy.

HUMAN CAPITAL INCREASINGLY IMPORTANT

In entrepreneurial decisions on the deployment and application of innovations, human capital is increasingly competing with real capital, and the factor input ratio is changing. Through the process of learning by doing, the quality and structure of the labor supply are improving, and the human capital stock is growing.[5] As human capital becomes more important, so too does the role of services – not least due to the use of modern information and communication technology. This, in turn, boosts the importance of human capital.

These – and other – structural changes, combined with external effects (for example network effects), produce feedback into research and development, additional knowledge formation, knowledge diffusion, technical progress and economic growth. These thus become endogenous, in contrast to their interpretation in traditional (neoclassical) growth theory, which regards technological progress as exogenously given and thus assumes that it requires no further explanation. In other words: real and human capital formation in period t actually depend on production in period [t-1].[6,7]

[5] "Skill-biased technical change", cf. page 4.
[6] *Delsen/Schonewille* (1999).
[7] In this context, discussion also focuses on whether economic growth depends primarily on the human capital stock [*Nelson/Phelps* (1966)] or rather on ongoing human capital formation [*Lucas* (1988)].

INDIVIDUAL KNOWLEDGE BECOMES "PUBLIC GOOD"

A long-term change in the factor input ratio in favor of human capital also leads to changes in factor price ratios. Where individual knowledge is made accessible to others, external effects ensure that it becomes a "public good". The capital yield curve and the factor price margin move upwards, and factor input generates increasing returns to scale. The marginal product on rising human and real capital input does not then fall, but remains constant or increases. This increases the demand for human capital, which means that payment for qualified work also tends to rise as the marginal product rises. At the same time, the expectation of an attractive net capital value increases the incentive to invest in knowledge and education – in other words, it encourages investors to withhold their own savings from the capital market, or to borrow externally for financing purposes.

These effects are, however, somewhat cushioned by the fact that in reality only part of all individual knowledge is diffused.[8] Discussing development policy, *Gundlach* points out that the values accruing to the developing countries "in the form of freely accessible knowledge … [allow] them to catch up only very slowly … , that the natural catching-up rate is at most 2 %."[9] Given annual growth of 2 percent, real per capita income would double around every 35 years. In fact, though, India – from the point of view of 2003 – achieved this growth rate in 20 years, while South Korea did so in 15 and China actually managed it in only 10 years. Some of the Latin American countries, on the other hand, needed much longer (e.g. Chile 24, Brazil 35 and Mexico 40 years).

## THE EFFECTS OF A DECLINING LABOR FORCE ON PRODUCTION PROCESSES

How will the corporate sector in the industrialized nations react to increasing shortages in the domestic labor force? Up to a certain point, production processes can be adapted, for example by increasing the capital resources of individual workplaces by utilizing the available real capital stock. This conversion to more capital-intensive means of production goes hand in hand with the expansion of labor productivity, whereas capital productivity tends to diminish during this phase.

OUTSOURCING INCREASINGLY ATTRACTIVE

The declining workforce is also likely to spark reactions on the wage front and an increase in unit labor costs. The attendant deterioration in the cost situation initially boosts the commercial attractiveness of outsourcing. In the short term foreign labor is a comparatively flexible production factor which can be integrated into existing production workflows. As part of this restructuring process, labor-intensive stages of production in particular are outsourced to other economies. It is possible that this increased division of labor on a global scale will help these economies to catch-up technologically, which tends to be accompanied by increasing investment.

Domestic labor shortages also lead to a shift in cost structure, to the detriment of labor and the benefit of capital. The associated cost pressure means that a gradual conversion to new, less labor-intensive technologies is more likely. As a result of improved capital resources, the productivity of individual workplaces increases further. This transition to more capital-intensive means of production boosts demand for capital throughout the entire national economy.

[8] Due to companies' efforts to protect intellectual property (patents, licenses, → WTO rules).
[9] *Ibid.*

The question remains, however, concerning the degree to which future shortages in the domestic workforce can be offset through the utilization of more capital. Information technology is already making it easier to process and transfer knowledge. Skills that could previously only be accumulated through years of experience, can now be supplanted in part through intelligent software (e.g. artificial intelligence methods, fuzzy logic methods, expert systems). Related individual studies for Japan provide hard evidence of the opportunities for substituting labor with real capital. They show investment in IT to be a proven substitute for a younger, less qualified workforce, and demonstrate how labor shortages – primarily in the less-qualified section of the workforce – can be offset through utilizing more capital. These opportunities for substitution are not evident in other segments. Hence it must be assumed that there are going to be growing shortages of highly-qualified labor despite an increased utilization of capital. Because this production factor is deemed to be extremely internationally flexible, the coming decades are likely to see global competition for highly-qualified workers.

LABOR SHORTAGES CAN BE OFFSET BY MORE CAPITAL

## HUMAN CAPITAL FORMATION: RISK AND RETURNS

Microeconomic decisions on education/training, work and leisure – like those on consumption and saving – are driven primarily by the individual's subjective time preference and risk propensity, as well as by the more or less objectively definable market risk of human capital.

In principle, human capital carries a higher idiosyncratic risk than real or financial capital[10]. Vocational training and higher education are – for reasons of time alone – much less diversifiable than a financial portfolio, and are also less fungible than financial investments. While the financial markets offer a variety of hedging instruments, there is practically no market for hedging the labor income risks to which individuals are exposed when they invest in a specific form of human capital[11].

All things being equal, the risks of human capital formation will fall in line with increasing life expectancy and potential working life, as well as with greater politically sanctioned scope in research and development, in the production and marketing of future-oriented goods and services, and in the application of new production processes. At the same time, the net capital value derived from education spending – with its expected returns in later working life – will rise to the same degree. The size of the (microeconomic and macroeconomic) return also depends on education and labor market policy and on the shape of the tax and welfare system. The greater the potential return is, the greater the incentive to invest more in human capital will be.

THE GREATER THE POTENTIAL RETURN, THE GREATER THE INCENTIVE TO INVEST

Empirical studies show[12] that both the private and overall public returns on investment in human capital – regardless of the level of education – are higher the less developed the economy in question is. Given the public subsidy of the education sector, the private returns are always higher than the overall public, i.e. the macroeconomic returns.[13] As one would expect, in both the industrialized

[10] Cf.. *Krebs* (2003). See also *Palacios-Huerta* (2003).

[11] i.e. labor market risks, the risk-return trade-off of individual training schemes, the hog cycle of surplus and deficit situations. The trend towards more interdisciplinary training could reduce such risks.

[12] Due to not inconsiderable methodological problems, the numerical results of such calculations should be taken cum grano salis.

[13] Private returns are calculated on the basis of the individual income achievable after education and training and the costs incurred by the individual for education and training (e.g. school fees, rents, opportunity costs of lost income). Public returns are based on the private returns generated and all (i.e. private and public) costs.

countries and the developing nations, the return on primary education is highest, while the private return on higher education (tertiary level)[14] is higher than that on high school education (secondary level).

## RETURNS ON HUMAN CAPITAL INVESTMENT*

| I: Primary level; II: Secondary level III: Tertiary level | Private return | | | Public return | | |
|---|---|---|---|---|---|---|
| | I | II | III | I | II | III |
| **OECD countries** | 13.4 | 11.3 | 11.6 | 8.5 | 9.4 | 8.5 |
| **Europe, Middle East, North Africa** | 13.8 | 13.6 | 18.8 | 15.6 | 9.7 | 9.9 |
| **Asia** | 20.0 | 15.8 | 18.2 | 16.2 | 11.1 | 11.0 |
| **Latin America and the Caribbean** | 26.6 | 17.0 | 19.5 | 17.4 | 12.9 | 12.3 |
| **Sub-Saharan Africa** | 37.6 | 24.6 | 27.8 | 25.4 | 18.4 | 11.3 |
| **World** | 26.6 | 17.0 | 19.0 | 18.9 | 13.1 | 10.8 |

*Averages in % p.a., latest available figures.

Source: Psacharopoulos/Patrinos, World Bank (2002).

However, it should be noted that knowledge and skills[15] – like physical capital goods – are subject to constant reduction in value, which depends on the type of know-how involved (practical relevance), technological progress (ageing), the time path (forgetting, non-retention of material learned) and the particular values of the period in question (market value versus non-material value) and can also serve to reduce the return on human capital. The more intensive market competition is, the greater the pressure will be on the individual to retain human capital that has already been acquired, or to acquire new capital, by engaging in further training/education.

## IDLE HUMAN CAPITAL – IDLE WEALTH RESERVES: THE CASE OF GERMANY

Since the beginning of the 1990s, **Germany's education reserves** have ceased to grow. Today, around one third of the western German population of working age has no vocational qualifications. Three quarters of that number are German, despite the generally poor qualifications of the foreign population. A **shortage of skilled labor** looks increasingly likely even in the medium term. According to forecasts published by the IAB[16] employed people between the ages of 50 and 64 will have by far the best qualification structure of all age groups by the year 2015.

- According to IAB[17] calculations, **22 percent of 50 to 64-year-old** (and 19 percent of 35 to 49-year-old) **people in employment** will have a degree from a university or a university of applied sciences by the year 2015. At the same time, only **9 percent of 50 to 64-year-olds**, but **15 percent of 35 to 49-year-olds** will have **no vocational training.**
- It has been estimated that, in the year 2000, the largely idle **human capital of the individual age cohorts** over the age of 60 was worth between almost **EUR 250bn (60-year-olds)** and a not inconsiderable **EUR 100bn (80-year-olds)**, compared with a maximum of around EUR 300bn for 35-year-olds.[18]

[14] The subject-specific variation in returns is considerable. In Germany it ranges from –5.7% for German/English Studies to 6.2% (Business Management) and 11.6% (Dentistry), cf. *Ederer/Schuller/Willms* (2002).

[15] Levels of individual human capital formation: a) Parental home; b) Primary school, secondary school, higher education institution; c) Job; d) Leisure.

[16] *Institut für Arbeits- und Berufsforschung der Bundesagentur für Arbeit (IAB);* Kurzbericht 9/7.7.2003.

[17] *Ibid.*

[18] In each case the total of private and public investment in education. *Ederer/Schuller/Willms* (2002).

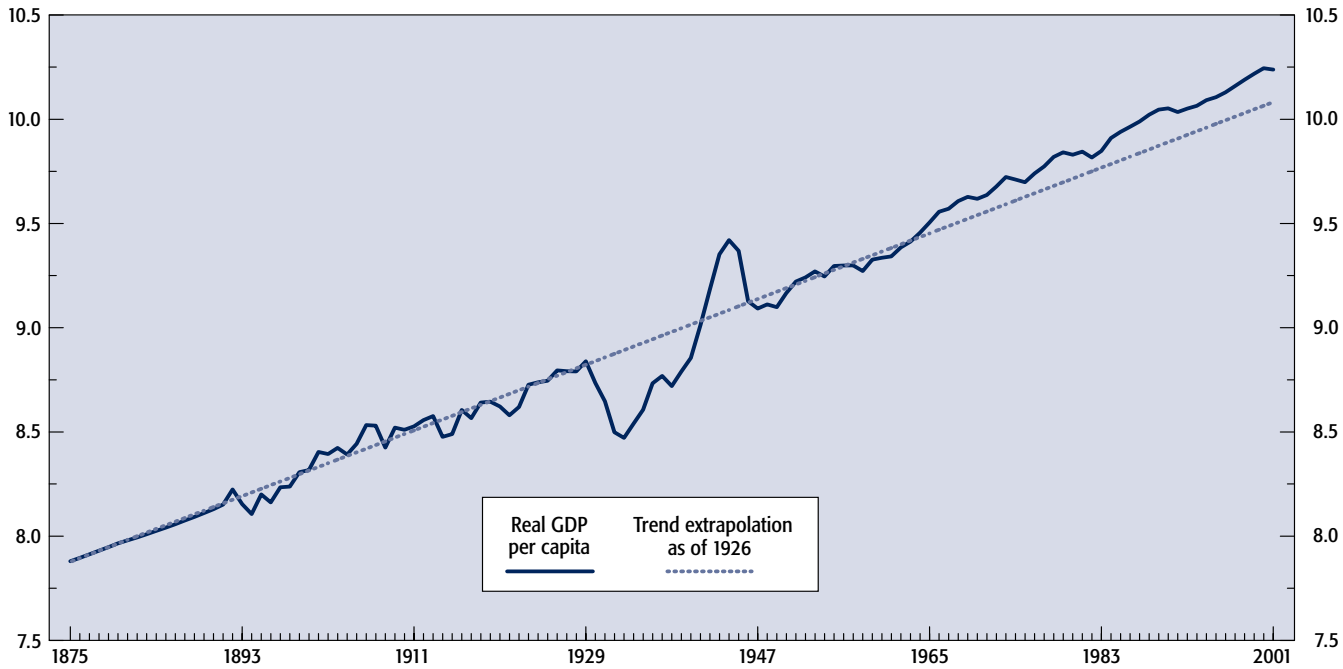
## DECLINING POPULATION – THE END OF TECHNOLOGICAL PROGRESS?

Macroeconomic development of labor and capital productivity depends on a population's accumulation of human capital through further education, on the one hand, and on the momentum of technological innovation on the other. In this context, the theory is often put forward that a drop in the pace of technological progress is to be expected as a consequence of declining growth in the labor force of industrialized nations. This is a major issue for longer-term interest rate trends that has no clear theoretical or empirical solution.

More dated economic literature, which mostly focuses on closed economies, works on the assumption that population development and technical progress are closely linked. The main argument was that research and development demanded enormous financial burdens; these expenses, for basic research in particular, were a fixed cost base. If the population were to shrink, then the associated burden on individuals, for example through taxes, would become unbearable if not intolerable. This approach deems a declining population to be inherently linked with reduced spending on R&D. A further perspective is offered by several endogenous growth models. According to the argumentation here, if the workforce shrinks, then the number of individuals employed in research and development shrinks accordingly. This scenario would also result in a drop in the pace of technical advancement.

Can technical advancement really be deduced from a simple headcount? Looking at the USA for instance, this is doubtful as the following example illustrates. Let us assume an economist from 1926 is tasked with forecasting the per capita GDP of the USA for 2001. A simple extrapolation of trends in the historical data leading up to 1926 would have produced the result depicted in the following graph:

### US GDP PER CAPITA: THE 75-YEAR FORECAST
– LOG SCALE –

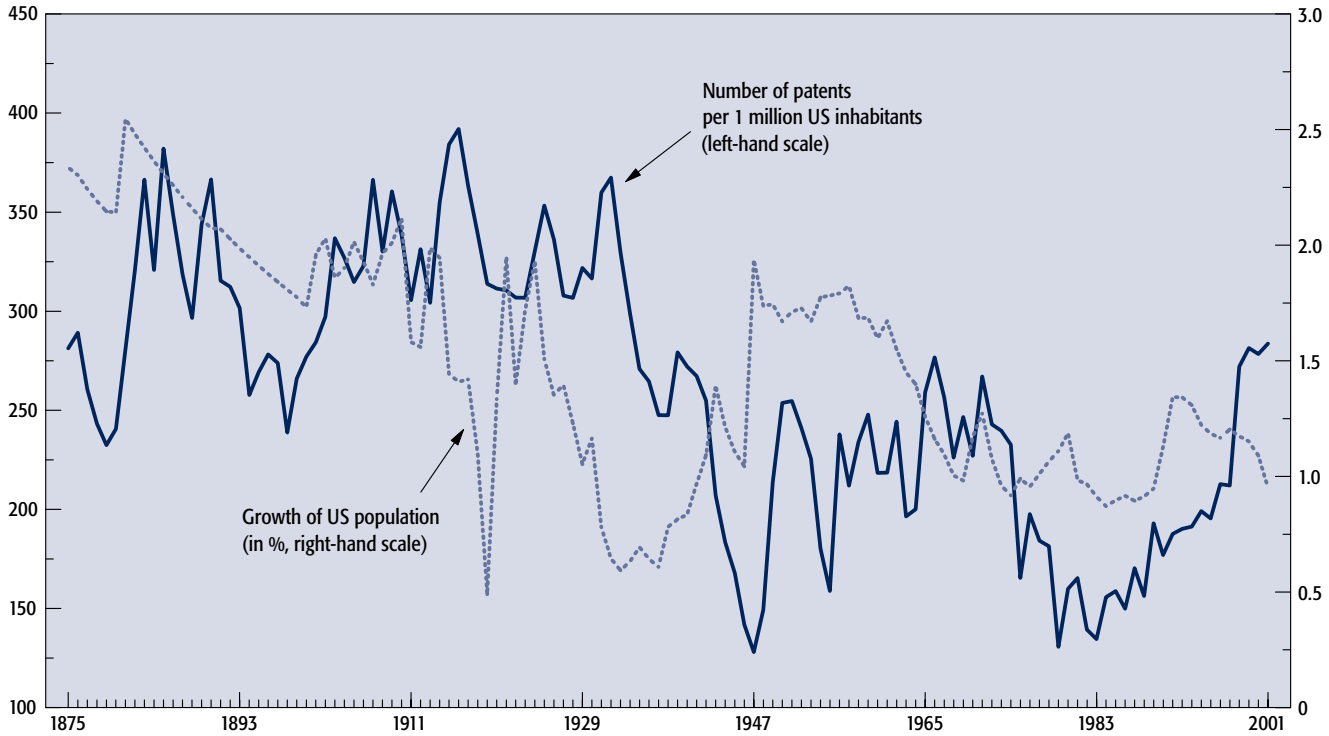



Source: EcoWin and own calculations.

This result has to be interpreted in light of the fact that between 1950 and 1992, for example, the number of scientists and engineers involved in R&D in the USA increased more than fivefold. Any notable impact on trend growth, let alone a fivefold increase in per capita GDP, patently failed to appear. Macroeconomic investment in human capital may well have an influence on the level of per capita GDP, but not necessarily on the trend growth rate. As a result, the number of people employed in research and development does not appear to be the decisive parameter for technical advancement and productivity growth. No slowdown in technological progress can therefore be deduced from the impending decline in the labor force.

This theory is corroborated by another investigation. The number of patents issued provides a yardstick for the output of spending on research and development. As a blueprint for new technologies, patents can be referred to in order to gauge technological advancement. In terms of this parameter, the relationship between population size and technological advancement appears equally tenuous. Periods exhibiting an inverse relationship between the number of patents per capita and the growth of the population can sometimes be discerned in the case of the USA.[19]

## POPULATION GROWTH AND PATENTS




Sources: US Census Bureau, United Nations: Population Division.

Along with the theoretical approaches outlined above, arguments also exist which validate the opposing theory, that necessity is the mother of invention – as suggested by the research performed by Cutler, Poterba, Sheiner, and Summers (1990). The authors come to the conclusion that a one percentage point decline in the workforce will not reduce productivity growth, but actually provides a boost of around 0.5 percentage points.

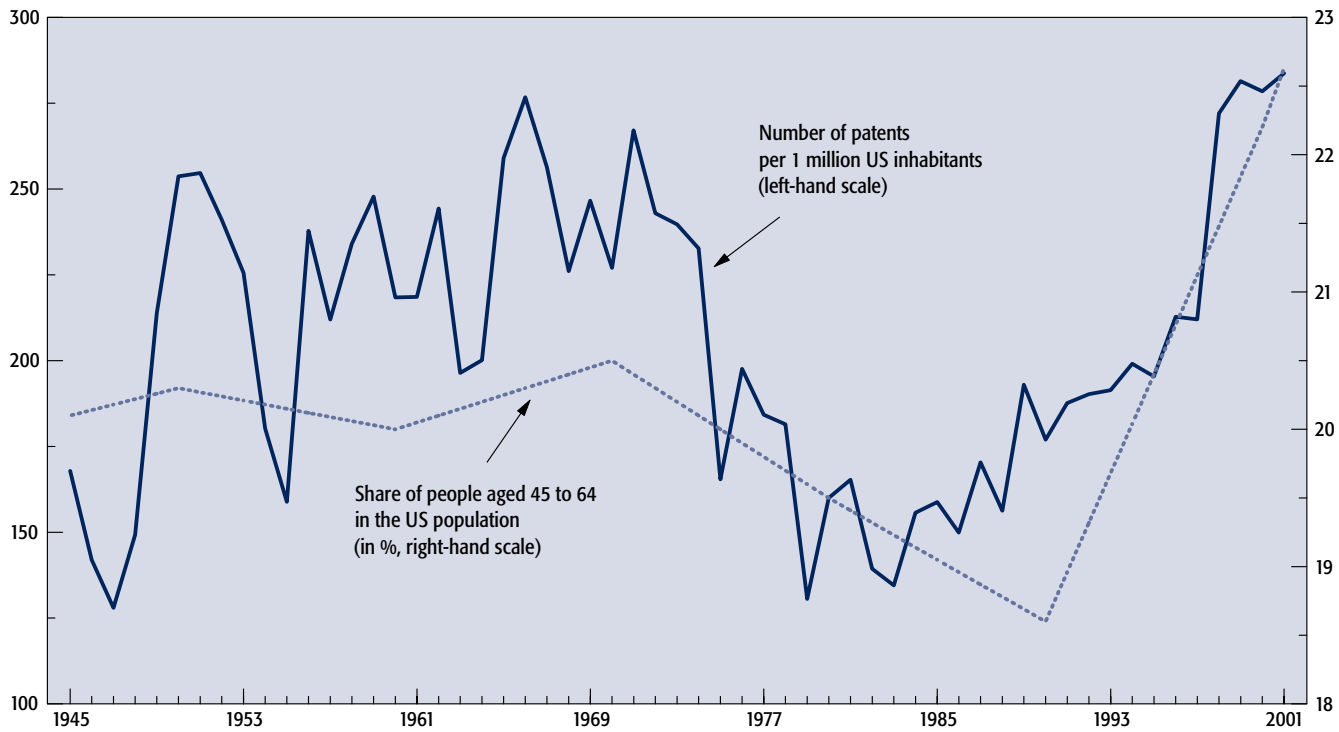
[19] The authors would like to thank Kenneth Sokoloff, University of Los Angeles, for his help in procuring the figures.

These findings substantiate our view that no credible relationship, which could be used as a reference for forecasting purposes, exists between population growth – or the size of the workforce – and technical advancement.

In addition to developments in population size, influences of the demographic structure on the innovative potential of a national economy must also be taken into account. Younger employees are considered to be more innovative than older ones. A distinction should, however, be made between basic research and the development of marketable patents. Based on the idea that the number of publications in leading journals is a suitable means for gauging the innovativeness of basic research, there are the following pointers to changes in innovative potential over the life cycle. According to research carried out by Oster and Hamermesh, the number of annual scientific publications rises significantly until researchers reach 36 years of age, but declines substantially after they reach 50.

By contrast, the picture on the patents front is somewhat different. The trend in this example points more toward a positive correlation between the 45- to 64-year-old section of the population – i.e. those drawing comparatively high incomes – and the number of patents developed.

## POPULATION STRUCTURE AND PATENTS




Sources: US Census Bureau, United Nations: Population Division.

All in all, demographic structure and population growth can be seen to have the effect of both holding back and driving forward technological advancement.

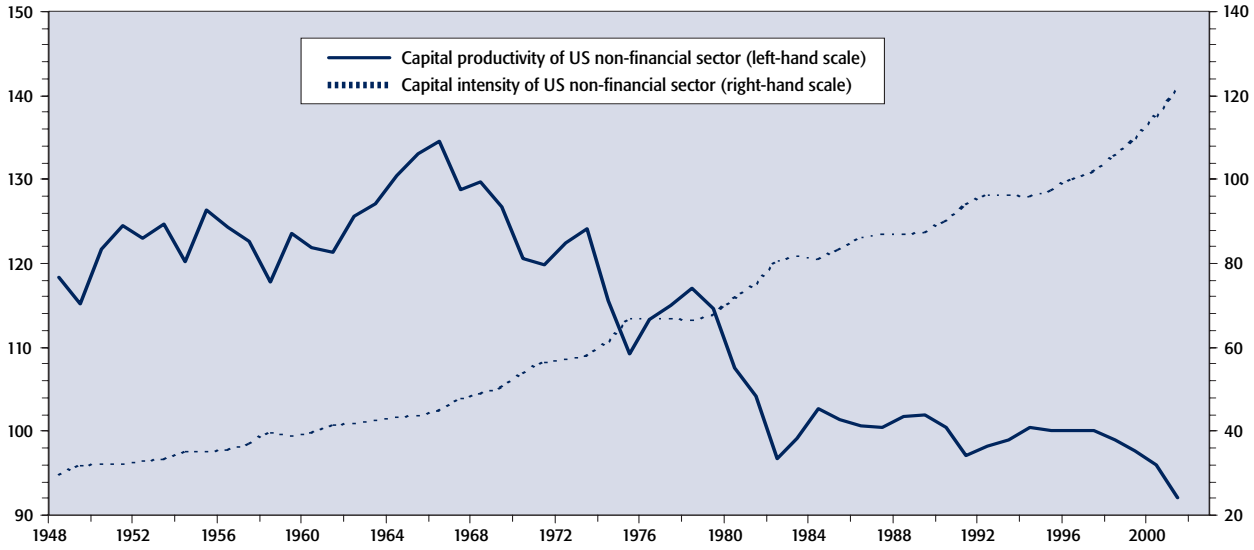
Projections outlining a marked drop in productivity due to impending demographic trends cannot be substantiated.

## THE EMPIRICAL FINDINGS FOR THE USA

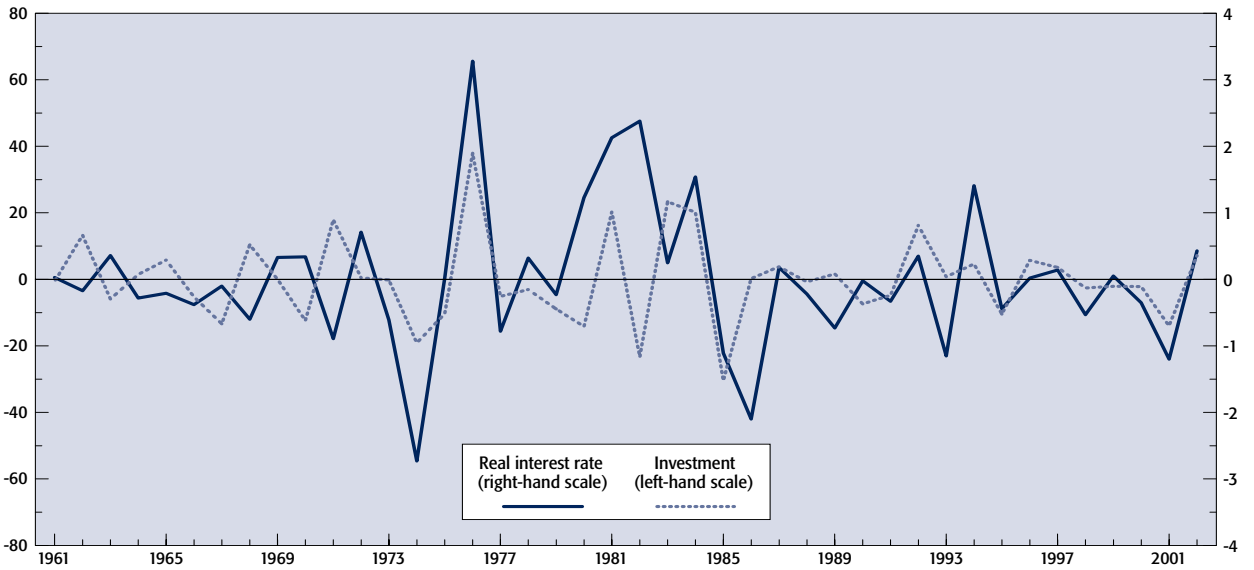
In the USA, capital intensity has risen constantly in recent decades. The fact that average capital productivity has fallen does not contradict this finding. The decisive factors are the ratio of labor to capital costs and the development of the marginal productivity of capital.

### US CAPITAL PRODUCTIVITY AND INTENSITY

INDICES (1996 = 100)




### US INVESTMENT DYNAMICS* AND REAL INTEREST RATE**




*Private domestic gross investment in chained (2000) dollars; differences between rates of change of two subsequent years, in %.
**Yield of 10-year US Treasuries minus change of the implicit GDP deflator, differences between two subsequent years, in %.
Source: Economic Report of the President and own calculations.

In the USA, the total unit costs of capital (write-offs + net interest costs) rose more than sixfold in the period 1959-2003, while unit wage costs only increased just under fourfold. In absolute terms, however, labor costs will probably exceed capital costs per output unit and/or the marginal productivity of capital will trend constant or upwards. Otherwise, the increasing substitution of labor by capital would be difficult to explain. Labor intensity has fallen in line with the rise in capital intensity, pushing up the output per employee and disposable income per head of the population.

## THE OUTLOOK FOR THE COMING DECADES

- In most industrialized countries the population will stagnate or shrink, and the proportion of young people decline. In the developing countries the population will continue to grow in the short term, although the rate of growth will slow. However, the societies are ageing there, too.

- Initially, the savings propensity in the industrialized countries will rise in line the ageing of the population, but it is likely to stagnate – or even fall – from a certain "critical" threshold onwards. Demand for personal loans and mortgages will decline.

- Technological progress and globalization will continue, while the international division of labor and the use of global information and communication networks will increase further. Similarly, the structural phase shift from the agricultural society through the industrial society to the service and information society will continue.

- The economies that gain most from these trends will be the developed and emerging economies with a high degree of openness to foreign trade, low bureaucratic and regulatory density, and societies that are prepared to invest in education and innovation. They will attract higher levels of human capital – complementing new technologies – and will actively exploit the external effects of that capital.

  In such countries, low and moderately qualified labor will increasingly be replaced by more highly qualified and better paid knowledge application, and the range of variation in wages and salaries will widen. Even if certain parts of the costs previously borne by society are internalized (e.g. via university tuition fees), the prospect of rising returns on human capital will act as an incentive to new investment in education. Since the combination of real and human capital input promises increasing economies of scale in some cases, overall investment activity will rise.

  There is much to suggest that demand for capital will rise over the next few decades as a result of impending demographic changes. Alongside further growth in investment in human capital, the sustained substitution of labor by capital will make a decisive contribution to this trend. Technological efforts driven by labor shortages will be implemented via new investment in the production process and accompanied by rising demand for capital.

- Economies at a medium or low level of development also stand to gain, provided they pursue stability-oriented policies, gradually open up to the world outside, and invest their savings above all in the development of human capital.

  In terms of the international division of labor and the development of human capital, these countries – whose populations will continue to grow beyond the middle of the current century – will move into areas in which the wage cost advantage of today's advanced economies is gradually receding. In the first instance these will be traditional, labor-intensive sectors of the economy.

  In a further stage, however, multinational industrial companies with capital-intensive production will turn to these locations. Via direct investment they will contribute to the development and expansion of the capital stock in developing countries.

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# 7 Capital for the emerging markets?

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According to popular theory, economies that are still in the development process have a huge army of labor at their disposal, but very little capital. For this reason, investments provide a major boost to production. In the industrialized countries, the opposite is the case: with capital intensity high, the deployment of additional capital as a rule sparks only small production gains. In such a situation either the people migrate to the capital or vice versa. Given the frequently considerable political and social problems associated with migration waves, transferring capital to the less developed regions would certainly be the obvious solution. This would give the people in the emerging markets[1] work and the investors from the industrialized countries higher returns.

The increasing aging of the population in the industrialized countries will underpin this process further. For in view of the dwindling supply of manpower here, there is much to recommend integrating the workforce of the emerging markets, especially from central and eastern Europe as well as Asia, by way of capital transfer. One of the advantages of funded pension provision over the pay-as-you-go system also consists in the possibility of investing in young market economies and being able to participate in high capital returns there. It comes as no surprise, therefore, to learn that in surveys most institutional investors who offer retirement provision products express a desire to step up their long-term financial commitments in the emerging markets[2].

What magnitude might the flow of capital assume in the coming three decades? Do any obstacles exist that could curb this transfer or even disrupt it?

DIFFICULTY DEFINING EMERGING MARKETS GROUP

Needless to say, very long-term projections are notoriously uncertain and this applies all the more to the emerging markets, given that the structural transformation is taking place very rapidly as a result of the economic momentum. Merely defining which countries belong to the emerging markets group over such a long period is difficult enough. While today classic emerging market countries – such as South Korea and Taiwan – already display the typical features of an industrialized country, India until a few years ago still belonged to the group of poorer developing countries that was only moderately integrated into the international economy. In the next 10 to 15 years a number of countries will put their emerging market status behind them and join the ranks of the industrialized countries. Others that maybe no one had thought about at this juncture will shed their current status as third world country and file in with the emerging markets and possibly open up lucrative markets for private international capital.

[1] By "emerging markets", we mean economies at an advanced stage in the development process which offer international investors investment opportunities and which have an industrial base that can be drawn on, e.g. Brazil, Mexico, India, China, Russia, Poland, South Africa and Turkey.

[2] e.g. Schröder, Michael and Schüler, Martin: Capital markets and demography. A survey of financial experts. ZEW, Zentrum für Europäische Wirtschaftsforschung, July 2004, here especially pp. 17-21.

On top of this come political and economic uncertainties which affect the global economy in general but the emerging markets in particular. Will globalization continue to advance or are setbacks on the cards, such as strong protectionism in the industrialized nations? Risks also lurk in the emerging markets themselves, risks it is hard to imagine at present but which, over a long projection period, could indeed become reality. Will, for example, China and Russia remain on the road to a market economy or will they revert to their old systems?

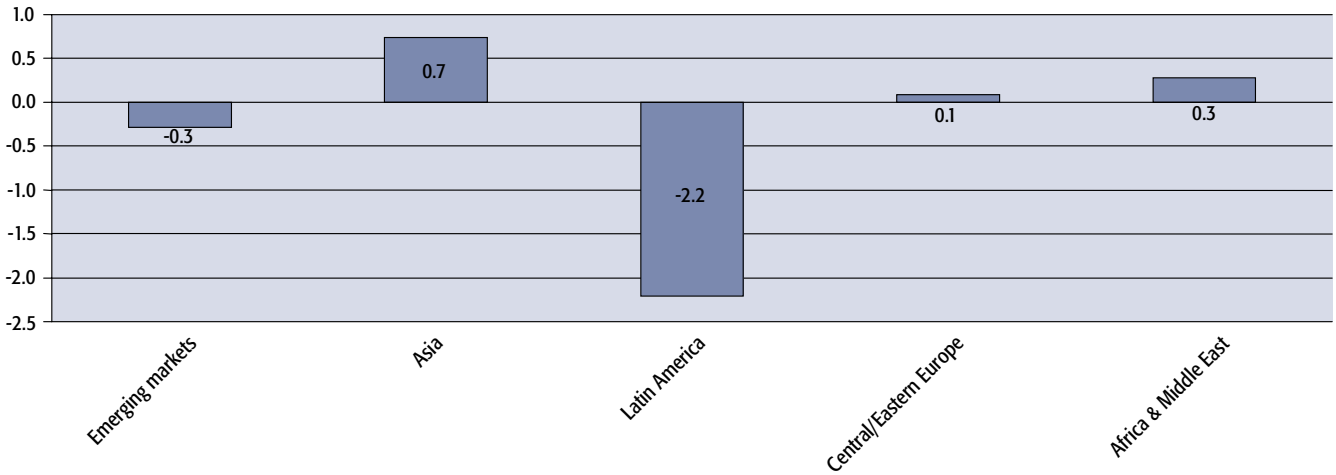
But let's first cast our minds back: for the emerging markets as a whole the only period worth considering in detail is the period after 1990. Prior to this, central and eastern Europe was still mired in socialism, as was China which, although it had opened up to some extent earlier, still primarily displayed the typical characteristics of a planned economy. Nor was Latin America in a particularly representative phase in the eighties, either; this decade is generally viewed as the "lost decade" due to the persistent debt crisis.

CURRENT ACCOUNT BALANCE
KEY INDICATOR

The most important indicator for an economy's net capital inflow is the current account balance. A surplus signals net capital outflows, a deficit corresponding inflows. The net capital inflow is so to speak the quintessence of a multitude of financial decisions which can lead to an inflow or outflow of foreign currency. For example, China: the People's Republic is globally one of the most attractive markets for foreign direct investment. In 2003, foreign investment capital to the tune of USD 50bn flowed into the country. At the same time, though, this import of capital was offset by even higher capital exports. Currency reserves alone increased by more than USD 100bn. On balance, the People's Republic provided foreign countries with funds totaling USD 10bn, in other words the extent of its current account surplus.

## CURRENT ACCOUNT BALANCE AS % OF GDP

(1990 – 2003, AVERAGES)



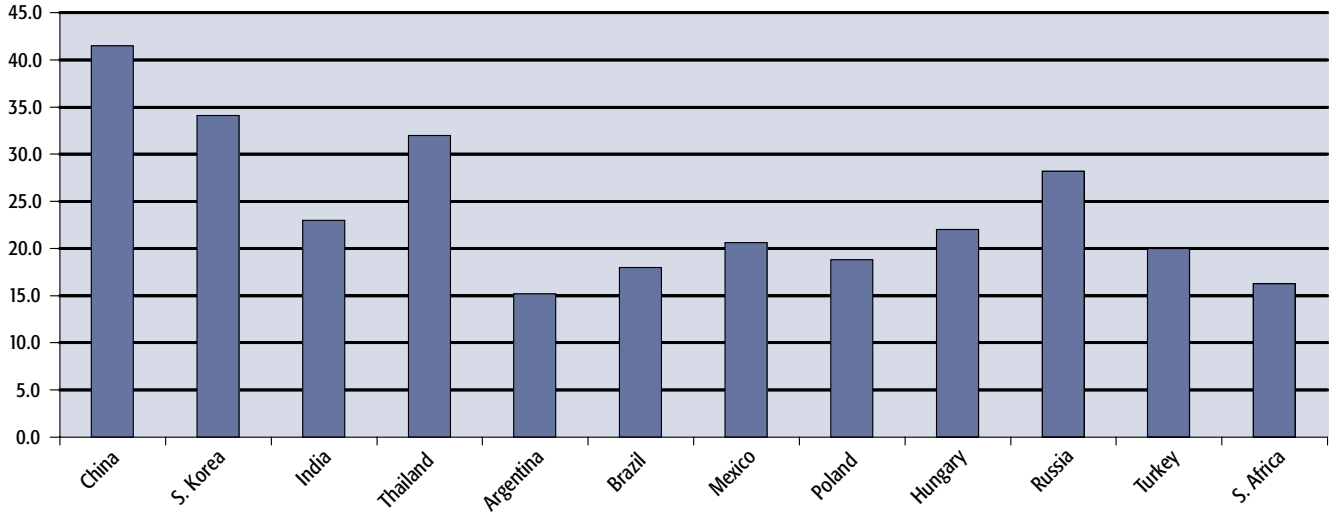

The graph[3] shows that in the period 1990-2003 the emerging markets recorded a current account deficit totaling 0.3 % of gross domestic product, which in itself is already an unexpectedly low rate. Qualifying this fact even further is the consideration that in the same period the emerging markets only accounted on average

[3] The statistical data used in the text and in the graphs are our own calculations based on figures published by the IMF, IIF and the respective national statistical sources.

for roughly one fifth of the world's GDP. The conclusion that can be drawn from these two aspects is that the current account deficit of the emerging markets, i.e. the influx of net capital into this country group in quantitative terms was of hardly any significance compared to total global savings formation. Asia, which accounts for more than half the total value added generated in the emerging markets, actually recorded a surplus, in other words it exported capital. Only Latin America, with a current account deficit of a good 2 % of its GDP, recorded a substantial inflow of capital from abroad.

## AGGREGATE SAVINGS IN RELATION TO GDP

1990 – 2003

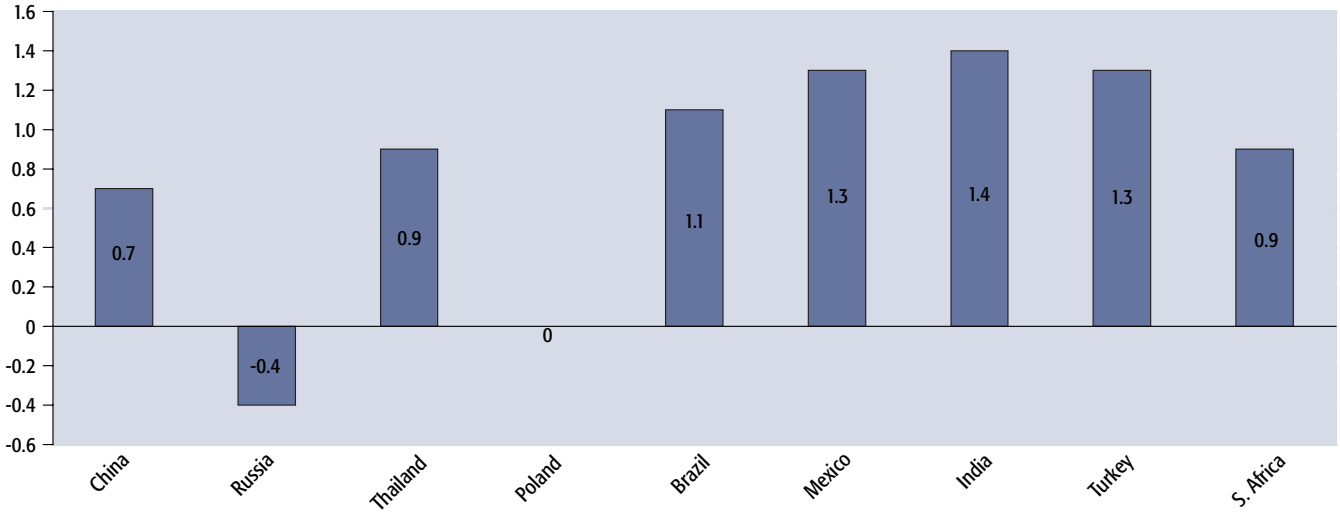



Three aspects primarily contribute towards the unexpectedly weak flow of capital into the emerging markets:

- The development strategy of the Asian emerging markets followed the example set by Japan: a low exchange rate stimulates exports and curbs imports, which leads to high foreign trade surpluses. The financial pendant to this is the export of net capital. Together with other factors, the low exchange rate is a key factor behind the high level of savings in the far eastern economies. It makes imported consumer goods more expensive and encourages saving. The aggregate savings rate in Asia is very high, with China holding the record of more than 40 %. Thus more than enough domestic funds are available to finance the economic momentum.

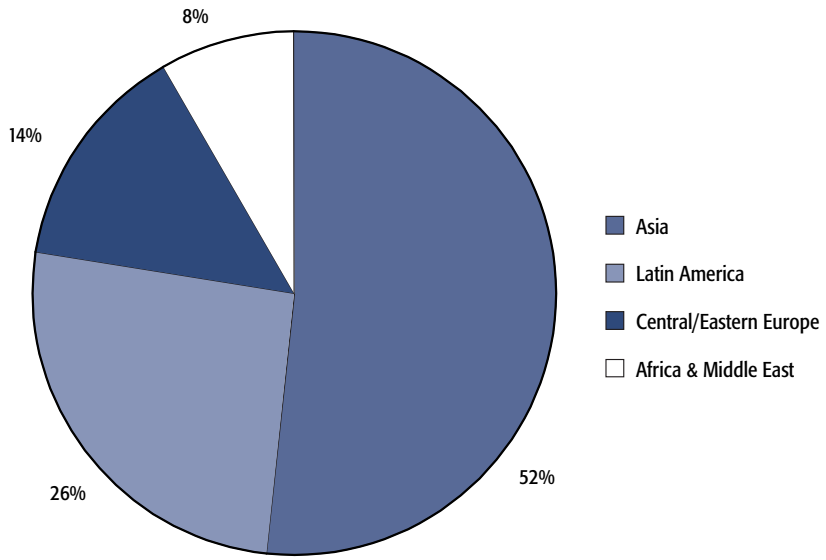
- Obviously, the capital flowing into the emerging markets should be put to profitable use, a precondition that has frequently not been fulfilled. Investor losses have resulted in a lower tolerance of capital flows towards current account deficits: in boom years, international capital pours into the emerging markets, which then record high current account deficits. If foreign investors subsequently lose confidence, the capital is abruptly withdrawn. The consequence is a financial crisis which, with the access to international capital being cut off, culminates in a decline in imports and recession. The numerous crises of the nineties which followed this fateful pattern hit Latin America in particular.

## ANNUAL AVERAGE POPULATION GROWTH 1998-2002 IN %




There are also signs of an aging population in a number of the emerging markets. As a rule, the division of labor increases the more a country's economy develops. At the same time, savings rise and economic growth gathers steam. The population increases more slowly as incomes develop positively and social security systems are established. Thus, demographic problems are starting to rear their heads in many emerging markets, at least viewed over a very long-term horizon. Most central and eastern European countries are in any case already registering a marked decline in birth rates, certainly also attributable to the system transformation which created considerable uncertainty among private households over their own economic future[4]. The "one-child policy" pursued in China for years will also take its toll. But: in the most densely populated countries, such as the People's Republic and India, the strong migration of labor from rural areas to the big cities, as is expected at least for the next 15 to 20 years, will counter this trend. The migration waves in these regions ensure a constant increase in employment, at least among persons working in industry.

## PERCENTAGE BREAKDOWN GDP EMERGING MARKETS 2003



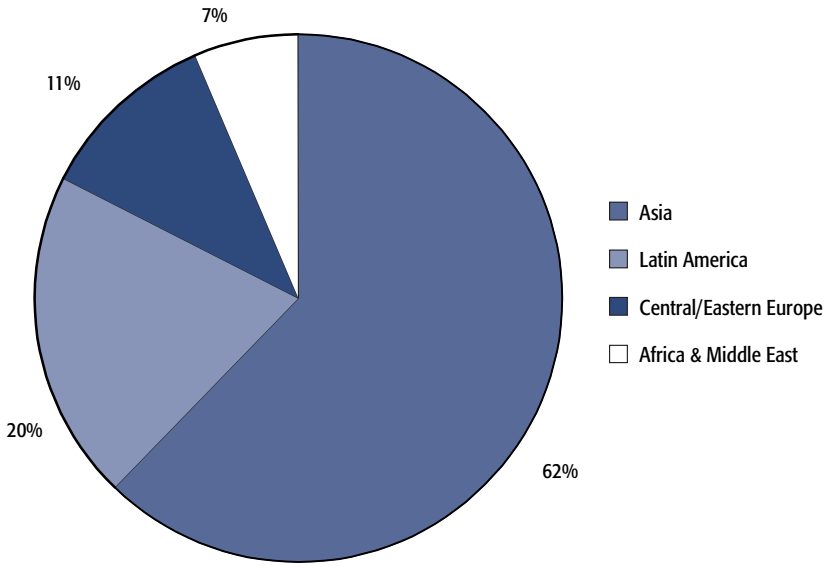

[4] Allianz-Dresdner Asset Management: Central and Eastern European pensions: Reform trends and growth opportunities, Munich, 2004, p. 9/10

What will be the situation regarding the current account development in the emerging markets and, by extension, the movement of capital with them in the next three decades? Will the emerging markets absorb more savings from the industrialized countries than has been the case until now and thus help to disentangle the unbalanced relationship between capital/labor there? The answers to these questions depend on the one hand on the future economic growth of the individual country groups, on the other hand on their respective need for capital and their ability to successfully absorb the funds flowing in from abroad.

### ASIAN ECONOMIES LEAD THE WAY

Here, too, let's start by glancing back: the Asian economies recorded the most impressive economic momentum, with average annual growth of more than 6.5% from 1990 to 2003. This compares to Africa and the Middle East in the same period with 3%, Latin America with 2.5% and central/eastern Europe which essentially stagnated as a result of the contraction process at the beginning of the nineties. Asia's marked growth differential in relation to the other regions has bolstered the economic dominance of the far eastern countries. Indeed, this country group already accounted for more than half of GDP generated in the emerging markets in 2003.

## PROJECTION: PERCENTAGE BREAKDOWN GDP – EMERGING MARKETS 2034




We expect Asia's lead on the growth front to remain intact in the coming decades. The persistently high capital formation not to mention the enormous army of manpower that has yet to be incorporated into industrial production argue for this. An annual average growth rate of 5.5% (1990-2003: 6.5%) over the next 30 years is likely to be at the lower end of what can be realistically achieved. For the other country groups, we are assuming growth of 4% p.a., well above the rate achieved in the period 1990-2003. But even based on this relatively conservative growth assumption for Asia, the economic strength of the Far East increases disproportionately. Asia's share in emerging market GDP is thus set to top 60% at the end of the projection period.

Furthermore, there is more to suggest that the Asian emerging markets will for the most part record current account surpluses in the projection period, as has been the case so far. For one thing, capital formation should remain high. This conclusion

is suggested by countries already at a more advanced stage of the development process, such as South Korea and Taiwan, which even today are recording aggregate savings rates way in excess of the international average. In Japan, too, capital formation is very high compared with the European industrialized countries and the USA, although the rate has fallen sharply in the last ten years. China and the other Asian emerging markets will probably follow these examples. The same applies to their strong orientation towards exports which is set to remain in place and ensure healthy trade and current account surpluses. This is not altered by the fact that these could be somewhat lower in the future given the likely modest increase in exchange rate flexibility. As economically by far the most important group of emerging markets, Asia will therefore provide the international capital market with savings but not on balance tap it.

Latin America, by contrast, is likely to continue registering an influx of international capital, albeit on a manageable scale. Periods of extremely high and stubborn current account deficits are not very likely, even if growing transparency within the national economies is likely to moderately raise the ability to absorb international capital. The situation regarding Africa and the Middle East is similar. Central/eastern Europe, on the other hand, could cope with more substantial current account deficits as they become increasingly anchored into the EU and owing to their high need for capital. But the demographic structure here is moving swiftly towards that of western Europe. Here, too, capital will not represent the main bottleneck factor for production, but labor.

The current account deficits of Latin America, Africa and the Middle East as well as of central/eastern Europe will hardly suffice to compensate Asia's corresponding surplus. At best, only a very moderate deficit can be expected overall in the emerging markets in the longer term. The developing countries will therefore absorb capital from the demographically weakened industrialized countries only to a limited extent[5]. All in all, therefore, the repercussions of this capital flow for international interest rates will be extremely limited. This will not prevent their capital links with the industrialized countries and with each other from increasing rapidly as the emerging markets open up further for foreign investments. Together with world trade, the movement of capital remains an important source of prosperity. And this means that pension funds will increasingly invest funds in the emerging markets and generate impressive returns there.

[5] A high current account deficit in the USA and corresponding surpluses of the developing countries still in the development process. This constellation currently evident may on the one hand contradict the popular development theory and count in the longer term as untenable. On the other hand, the past shows that the capital accumulation in development regions must be primarily self-generated, in other words via domestic savings. Sooner or later, high current account deficits lead to financial crises with considerable sudden outflow of capital. In addition, a strong export orientation as a rule promotes the development process and economic growth. For the most part it goes hand in hand with the corresponding trade and current account surpluses.

# 8 Real yield in the long run: a projection

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When projecting interest rates on a long time line, many aspects come into play. A quantitative prediction along the lines of a short-term economic forecast is awkward. However, as far as possible we have sought to structure the subject with sections on inflation, capital demand and capital supply, deducing economically plausible chain effects from this. Our analysis produces the following interest rate scenario.

- In terms of price trends, which determine the inflation component in interest rates, up to 2010 the signs point more to upside than downside risks, given the surplus liquidity available. However, we do not expect a return to really inflationary developments. The decade from 2010 to 2020 could turn out to be a period with a high degree of price stability. First, the process of globalization will continue to have an impact through internationalization of the labor markets; and second, governments will arguably respond to the budgetary challenges of demographic development with sounder fiscal policies. For the period post-2020, though, there are risks on the inflation front. For all the attempts at austerity, demographic trends look set to swell public deficits. The international division of labor will possibly also reach limits, taking some of the bite out of its cost-curbing effects.

- Demographic change shapes the industrial countries' demand for capital in various ways. Received economic wisdom says that the increasing scarcity of labor leads to more capital-intensive production, tending to reduce capital productivity and exerting downward pressure on long-term yields through a declining return on capital.

  But as a result of demographic change we can also expect to see a further technological drive; implemented through new investment in production processes, it will boost both capital demand and capital productivity, with the effect of pushing up interest rates. Furthermore, in the long range the trend towards a service and information society and the increasing use of global information and communications networks could cause the factor input ratio to swing towards human capital. The heavy investment in education that this necessitates will raise economies of scale and marginal returns on real capital input. This could exert upward pressure on interest rates.

  Generally speaking, the processes relating to capital demand described here have either already been ongoing for some time (such as the growing use of global information and communications networks) or will not occur before 2015/2020 at the earliest (such as the shortage of the factor labor given

comparatively low participation rates and high unemployment in Europe). In so far, the long-range determinants of capital demand are not likely to have any notable effect on interest rates until 2015/2020; thereafter, rate-increasing and rate-reducing effects could balance each other out.

- The supply of capital in the industrial nations hinges on households' savings behavior. This will alter in the wake of conversion of the public pension systems from pay-as-you-go (PAYG) to funded schemes. The need for additional pension provision and the relatively large proportion of the population in age groups with high accumulation of savings will lift the savings rate of households in the industrial countries until about 2015, tending to push down yields. After 2015, however, the proportion of older people with low savings formation will become increasingly dominant, leading to a decline in the savings rate. Nonetheless, aggregate savings up to 2050 in the industrial countries will presumably remain constant, or even tick up slightly, as population growth in the US will probably make up for the decline in Europe. On balance, though, only marginal expansion, if any, in the supply of capital will tend to push up yields as from 2015/2020.

- The catch-up process in the emerging markets has so far been funded mainly through domestic savings and investment in physical and human capital. Traditionally high current account surpluses (high capital exports) in the Asian emerging markets stem primarily from high domestic saving and an exchange rate policy geared to the promotion of exports through undervaluation.

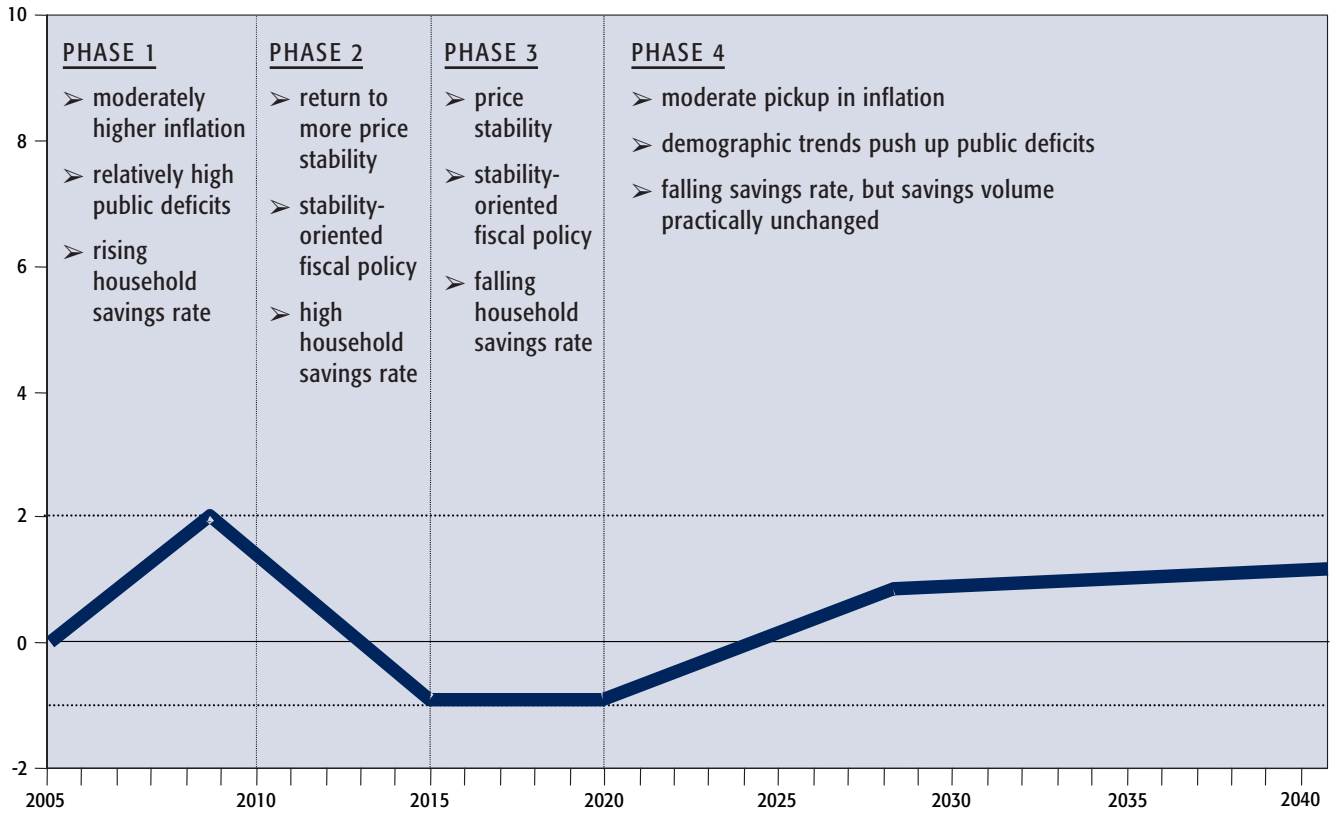
  A high US current account deficit and corresponding surpluses in the newly developing economies may contradict conventional development theory and be deemed unsustainable in the longer term. On the other hand, we know from past experience that, notwithstanding all the regional differences in detail, the great bulk of capital accumulation in developing regions has been generated internally, that is to say by domestic savings. Sooner or later, high current account deficits lead to financial crises and the sudden withdrawal of large amounts of capital.

  In the longer run, temporary current account deficits cannot be ruled out in the Asian states either, particularly since most of them peg their currencies to the dollar, a practice that cannot be maintained permanently. On the whole, though, we do not expect the emerging markets to run sustained, substantial current account deficits and correspondingly high capital inflows. The rate-boosting effects of this transfer of capital – if, indeed, it takes place at all – will be very limited.

- Taking all potential effects together, the outlook on yields is as follows: In terms of both the industrial countries' demand for capital and capital supply and demand in the emerging markets, for the coming decade there are no distinct signals pointing to either rising or falling capital market yields. The picture is clearer with regard to the supply of capital in the industrial nations. The increase in savings up to 2015 and the downward trend in the savings rate thereafter point to a gradual drop in real interest rates in the first decade and a subsequent increase. We expect the inflation component in the interest rate to rise appreciably up to 2010, to revert to a low level in the following decade and then to trend upward again as from 2020.

Consequently, up to about 2010 nominal yields are likely to edge up a little despite the tendency toward softening real interest rates. Then between 2010 and 2015 an easing in both real and nominal yields represents a plausible scenario. As from 2015, demographic trends will serve to gradually push up real yields and, as from 2020, the tendency to mounting upward price pressures will push up both nominal and real yields. However, this development will begin from a low interest rate level and, given the absence of massive changes in the volume of savings, will not precipitate drastic market adjustments.

## PROJECTED LONG-TERM CHANGES IN CAPITAL MARKET YIELDS
– IN PERCENTAGE POINTS –




We make a point of stressing again at this juncture that, for such long time frames, only rough scenarios can be drawn up. The actual timing of the turning points is subject to major assessment uncertainty. The economic cycle and its short-term impact on rates will, anyway, superimpose themselves on long-range interest rate trends.

One of the questions we asked at the beginning of this study was whether the implications of demographic change would unhinge the capital market. The answer is a clear no! Certainly, the greater supply of capital that is to be expected will check yields a little, bringing lower returns for savers. But these losses will be very limited because, as in the past, other factors will impress themselves far more distinctly on the interest rate level. The most prominent of these is, of course, monetary policy, both short and long-term. The biggest enemy for savers is inflation and its root cause: monetary policy with a weak stability bias. But in this respect we have reason to hope. Of course we will still see periods of monetary restriction which follow on from policies with a more expansive slant. But in all probability

these fluctuations will not lead to permanently higher rates of inflation with correspondingly negative fallout on the capital markets. So it is worth saving for retirement, particularly when we consider the adverse demographics. The lower yield to which this accumulation of capital gives rise will be more than compensated by the fact that the state pension system is increasingly creaking at the seams and therefore needs to be supplemented by personal provision.