ROBECO

Research paper

# Inflation vs Deflation

## It won't be NICE

Robeco Financial Markets Research

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# Contents

# 1. Introduction

**The macroeconomic climate in the period from the mid-1980s to the early part of this century was very friendly. So much so that it is now known as the Great Moderation. This moniker implied steady growth, low volatility and low inflation. Indeed, it was tempting to believe that a new era had started. But this illusion was shattered by the mounting shortages of natural resources and by the credit crisis that induced a severe recession. Future developments are highly uncertain.**

In this paper, we describe the factors that contributed to the Great Moderation and the reasons why it came to an end. We then look at impact of scarcity, as well as the risks posed by the rapid deterioration of budget deficits and government debt. The perceived threat of scarcity has been with us since the Club of Rome, but the impact on inflation has not. As for government debt, we come to the conclusion that inflation might not be as effective in bringing down the debt problem as is popularly believed. Finally, we perform an empirical analysis in which we examine the sensitivity of asset classes to inflation and to changes in inflation.

> Some say the world will end in fire,
> Some say in ice. But whichever it is
> It won't be NICE.
>
> **Mervyn King,** 18 June 2008, adapting Robert Frost's poem 'Fire and Ice'. NICE is an acronym for non-inflationary consistently expansionary.

# 2. Summary and conclusions

Four factors that contributed to the Great Moderation can be distinguished:

- central banks' successful fight against inflation in the early 1980s;
- the reduction of restrictions on the movement of capital and labor, although we feel this effect might very well be overestimated;
- technological innovation, in which IT raised productivity and the internet boosted price competition as it increased market transparency; and
- luck.

Mounting shortages of natural resources and the financial crisis have resulted in the ending of the Great Moderation. The scarcity of natural resources may well return as an investment theme as soon as the economy revives. Furthermore, ageing in both developed and emerging economies is set to bring scarcity of labor to the fore, as the dependency of elderly people on the labor force rises significantly over the next decades. Both factors could contribute to inflationary pressures.

The current financial crisis follows a powerful recovery from the post-internet-bubble recession, which resulted in an inflation spike. Now, inflation has collapsed, just like economic growth. Even economic trend growth seems far away, never mind stable growth. In addition, there is high uncertainty regarding future prices, as both deflation and high inflation are possible scenarios. Whichever it is, however, it won't be NICE, Mervyn King's acronym for non-inflationary consistently expansionary, his description of the UK economy during the 1990s.

Whether it is going to be inflation or deflation is very much the outcome of policy choices by the budgetary and monetary authorities. Whereas the initial response to the outbreak of the credit crunch of these authorities has been to opt for stimulative measures, increasing the odds for inflation moving forward, at the time of writing austerity seems to have become the buzz word, though, which raises the odds for (short-term) deflation. Deflation prior to inflation may therefore be the outcome, with the UK the clear exception to the rule.

At the same time, leading economists are clearly not as worried about the costs of higher inflation as central banks, which typically have restrictive inflation targets of around 2%. Here's Joseph Stiglitz: "Moderate inflation, under 8% to 10%, does not have any significant effect on growth." Meanwhile, IMF Chief Economist Blanchard suggested that inflation targets should be raised to 4%, while Alan Greenspan expects inflation to trend higher: "inflation rates by 2030 will be some 4½% or higher." And Kenneth Rogoff has remarked: "I'm advocating 6% inflation for at least a couple of years. It would ameliorate the debt bomb and help us work through the deleveraging process."

We acknowledge that there is high uncertainty about whether it will be inflation or deflation that will dominate in the future. But, in the end, the return of inflation is more likely, though not before 2012 at the earliest, as the recession is still working through. First, the scarcity of natural resources and labor can contribute to inflation. Second, monetary policy is loose and debt-to-GDP ratios are rising strongly. Both induce inflation. It could be tempting for policymakers to monetize at least some of their nations' debt rather than cut back expenditures or raise taxes. Empirical evidence suggests higher debt ratios will lead to higher inflation. Institutional guarantees such as independent central banks will not prevent it.

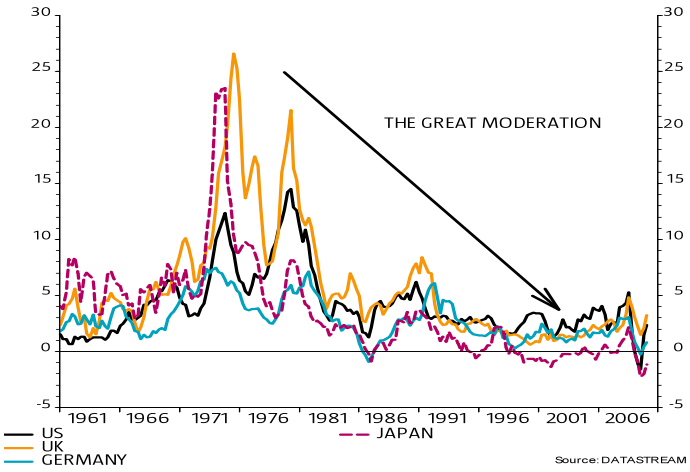
Our empirical results suggest commodities and commodity related stocks to offer the best inflation protection, next to what we ex-ante believe for inflation linked bonds/swaps. A rough guess for the inflation multiplier of commodities and commodity related stocks would be around 4. This suggests that an investor who is seeking full protection against inflation with commodities and commodity related stocks should invest 25% of his portfolio in commodities and commodity related stocks.

Stocks, cash and bonds tend to generate flattish real returns during periods of rising inflation. Our results suggest real estate to deliver negative real returns during periods of quickly rising inflation.

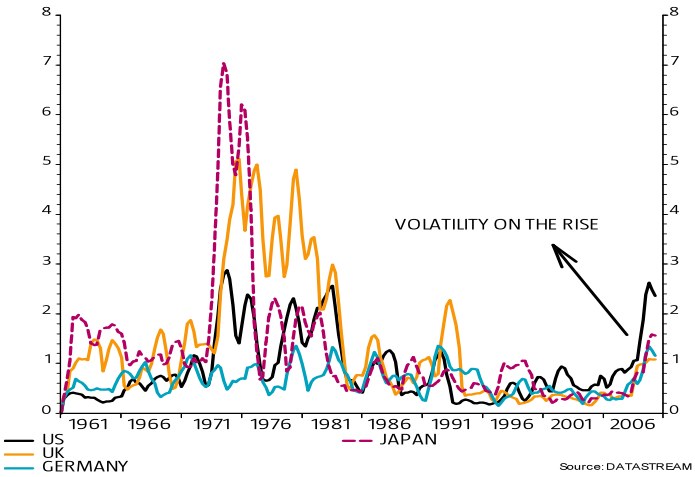
# 3. The Great Moderation

## 3.1 The causes of the Great Moderation

**Annual inflation**

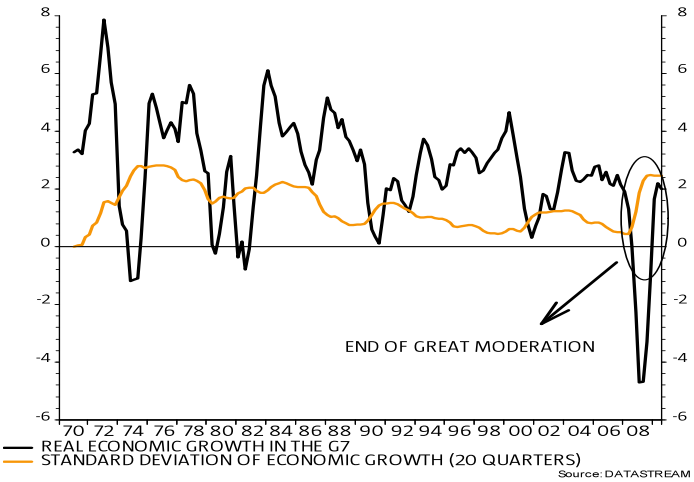



**Inflation volatility**

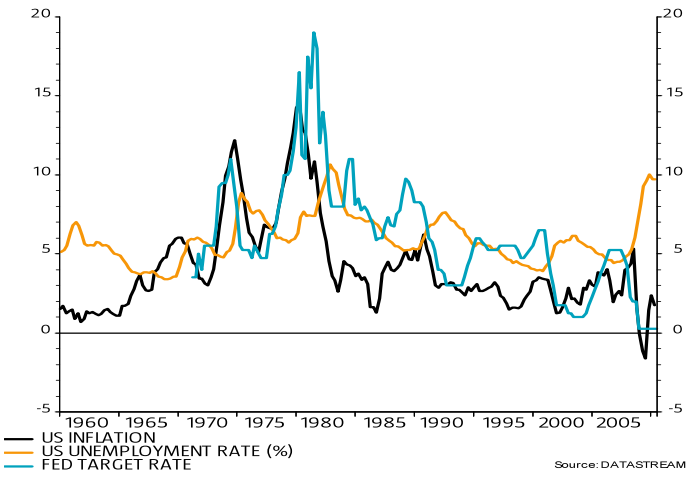



The Great Moderation was the period of stable economic growth and declining inflation that started in the early 1980s. This marked a turnaround from the 1970s, a decade characterized by the high inflation that resulted from the oil crises and spiraling wage demands. Several factors contributed to declining and less-volatile inflation.

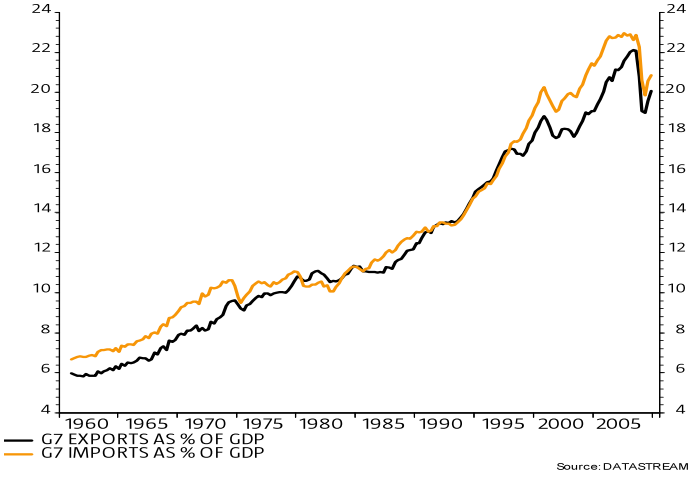
**Growth and volatility of growth (G7)**



**US economy: inflation, unemployment and Fed target rate**




**Trade as a percentage of BBP**




First, the lessons learned from the stagflation in the 70s allowed central banks to combat inflation. Milton Friedman's view (1968) that "inflation is always and everywhere a monetary phenomenon" was adopted by the world's major central banks, with Paul Volcker, chairman of the US Federal Reserve, in the lead. The Fed raised the federal funds rate to a peak of 20% in June 1981, after averaging 11% in 1979.

Second, restrictions on the movement of capital and labor were reduced as globalization took hold. Capital now flies around the world at the push of a button, while developed countries have outsourced labor to emerging markets. Formerly planned economies joined the global trade system, boosting outsourcing. China, for instance, entered the World Trade Organization in 2001. Rogoff (2003) highlighted the increased level of competition—in both product and labor markets—that resulted from the interplay of increased globalization, deregulation and a decreased role for government in many economies. However, the effect of globalization on inflation may well have been overestimated, as Laurence Ball (2006) has pointed out. For example, the increase in world trade has been a gradual trend that started before the 1980s, as illustrated in the chart above.

Third, technological innovation has depressed inflation. Innovation clearly boosts labor productivity and thereby affects unit labor costs. However, we also think that the internet has played a significant role in keeping inflation under control, as the increased transparency it has brought has boosted price competition. Price comparison websites make it easier for consumers and businesses alike to find the cheapest options in the market.

Fourth, given the absence of major shocks, luck played a role in the Great Moderation. Shaghil Ahmed, Andrew Levin and Beth Anne Wilson (2002) concluded that "our results support the "good-luck" hypothesis as the leading explanation for the decline in aggregate output volatility, although "good-practices" and "good-policy" are also contributing factors. Applying the same methods to consumer price inflation, we find that the post-1984 decline in inflation volatility can be attributed largely to improvements in monetary policy."

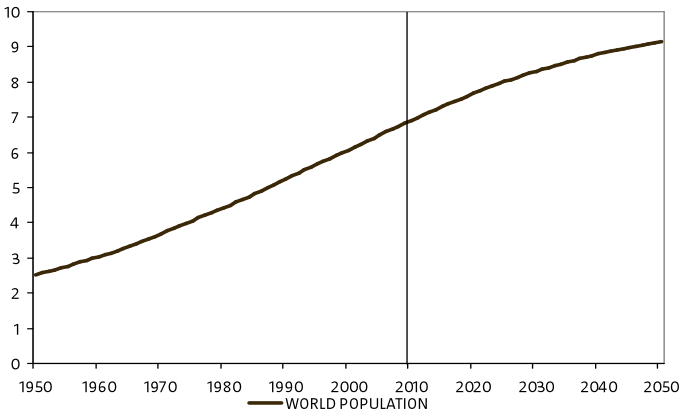
The Great Moderation has ended due to a changing macro-economic environment. First, scarcity plays a role. Due to a commodities intensive growth phase in emerging markets, shortages of natural resources pose

a real risk of another spike in commodity prices. Moreover, ageing of the population might induce some labor cost inflation. Second, the financial crisis and the reduced independence of central banks also lessen the likelihood of a return to a low-inflation, stable-growth environment. In the next section we discuss scarcity. Afterwards, the implications of the rise of government debt will be addressed.

# 4. Scarcity

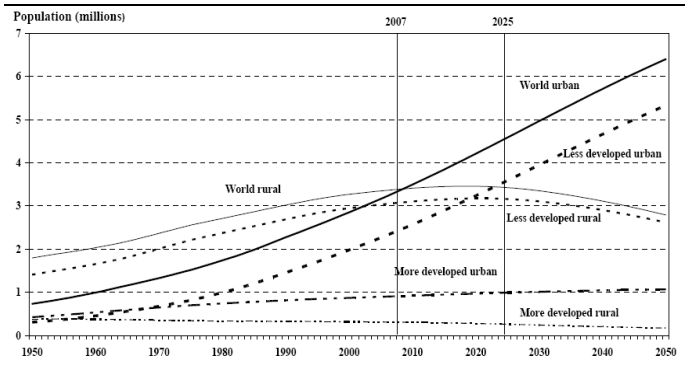
## 4.1 Fast growing middle class drives demand for commodities

### World population




Source: OECD, United Nations, Robeco

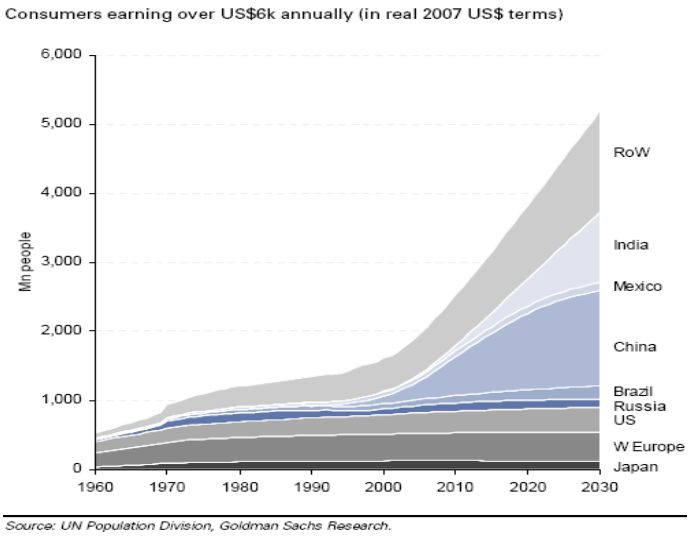
### Urban and rural population growth for the world, the more devoloped and the less developed regions




Source: United Nations (2008)

The growing world population and urbanization are both frequently mentioned as driving forces for rising commodity prices. World population has ballooned from 2.5 billion people in 1950 to 6.8 billion currently, and is expected to swell to close to 10 billion in 2050. More people means more demand, especially when they move to cities as building them requires a lot of commodities. Basically, both are true, but both of these two trends have been around for decades, as illustrated in the graphs. Therefore, they do not help to explain why they would drive quickly accelerating commodity prices right now[1].

### Quickly arising world middle class



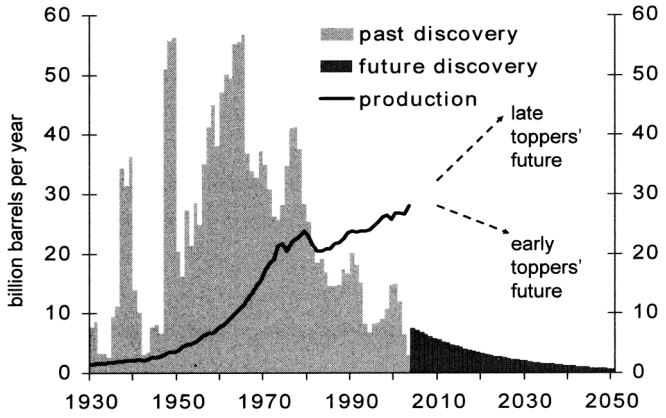

[1] One only could use this argument when one is willing to accept the view that we are currently consuming the last commodities available on planet earth. However, as the word 'commodities' already suggest, this is a rather extreme view. In general we believe that the supply of commodities is variable. Adding capacity, offering alternatives and improving efficiency all can add to supply, although not over night.

However, according to Bussolo, De Hoyos and Medvedev (2008) from the World Bank, there is something changing right now, i.e. the emergence of a global middle class: "... a group of consumers who demand access to, and have the means to purchase, international goods and services. The results [from their simulation model for Global Income Distribution Dynamics] show that the share of these consumers in the global population is likely to more than double in the next 20 years". Such estimates are obviously based on a certain definition of middle class as well as a set of assumptions, but as the accompanying chart illustrates it could very well be the case that we just entered a period of a quickly rising world middle class.

The emergence of a global middle class that drives a car and consumes more proteins can actually put upward pressure on commodity prices if supply does not immediately catch up with increasingly accelerating demand. As transport accounts for roughly 30% of energy usage, it will be clear that when income rises to the level at which a car comes within reach, this boosts energy demand. Likewise, increased consumption of milk and meat brings a huge demand for grains. To grow a kilogram of chicken meat it takes two kilograms of grain, for pigs and cows it takes three and eight kilograms of grains respectively. Not to mention the amounts of water it takes. The accelerating demand for commodities comes at a time when key commodities like oil and copper run at capacity utilization rates of 96-97%. We are getting closer and closer to a scenario where we are touching 100% capacity utilization, same as in 1974 or 2008.

Even if supply would immediately catch up with demand, it still can induce higher prices as the marginal costs of production rise and commodities are increasingly coming from risky countries. For example, the less fertile the agriculture land, the higher the costs of production will be. This is exacerbated by building cities close to the (fertile) coasts and deltas and moving agriculture inland. A comparable example applies to oil. As scarcity of resources is primarily connected to energy in general and more specifically oil, we discuss oil in more detail below.

**Global oil discovery and production**

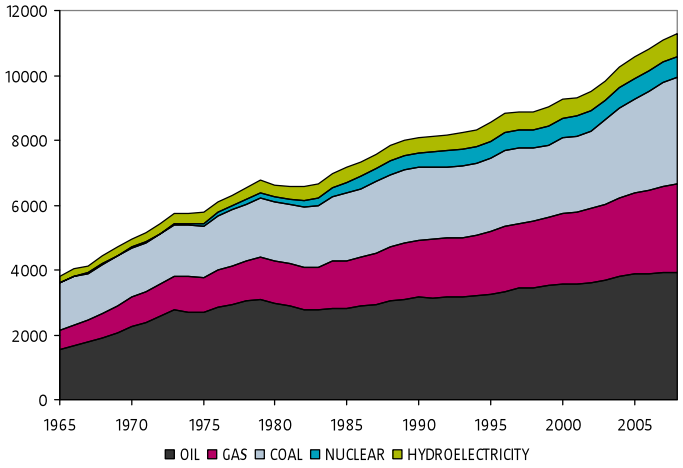



Source: LEGGETT (2006)

As shown in the graph above, oil discoveries have seriously lagged oil production in recent decades. Oil production is currently in decline in the North Sea, the Gulf of Mexico and – perhaps temporarily – Russia. This is not a cyclical decline in output but a structural one, as the oil fields concerned are depleting. The so-called "early toppers" argue that there will be a structural decline in global oil production in a few years, while "late toppers" expect this scenario to be several decades away.

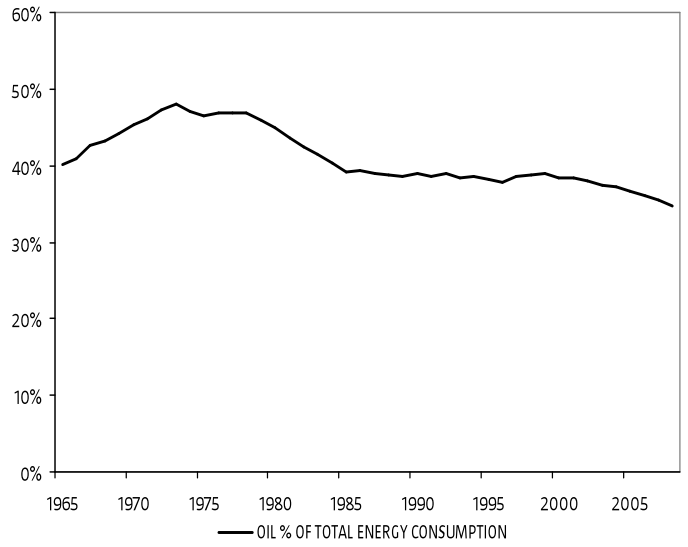
Oil consumption rose until a few years ago, when it more or less stabilized. But the importance of oil in total energy consumption has been in a gradual decline since 1973. Since that time, the consumption of oil has dropped from 48% of total energy consumption to just 35%. Oil's decline in total energy consumption has accelerated since 2002.

**Total world energy consumption (million tonnes oil equivalent)**




Source: BP

**Oil as percentage of total energy consumption**

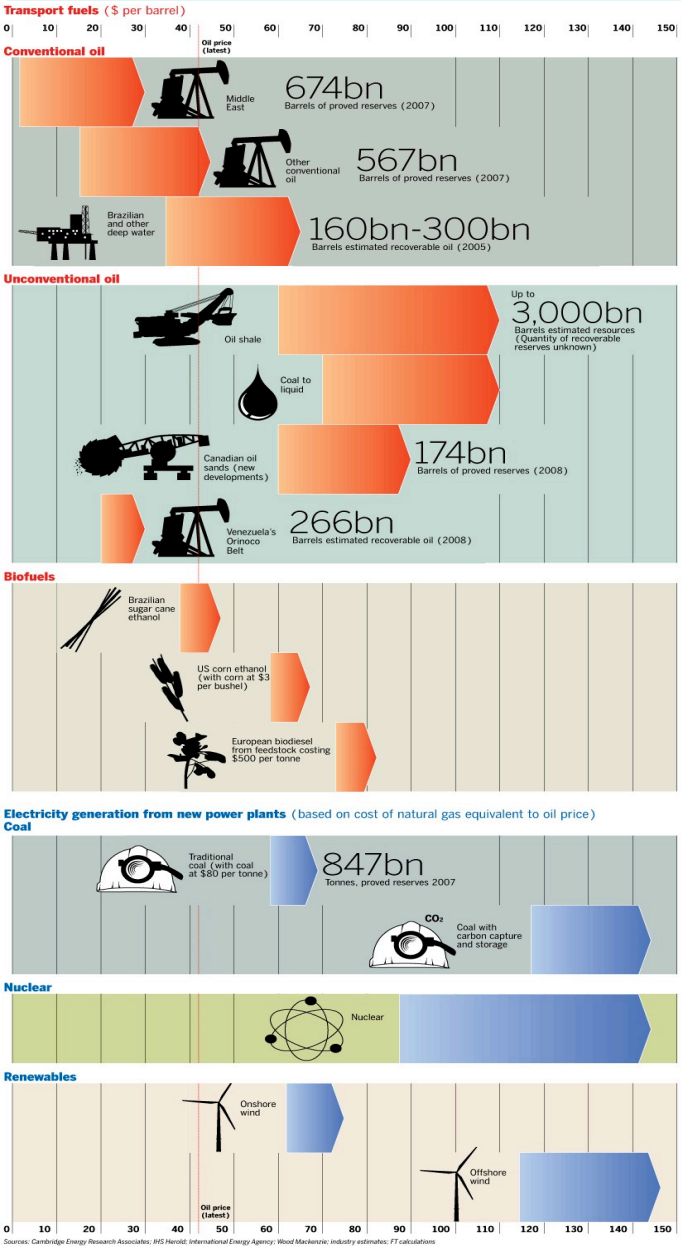



Source: BP

Whether the early toppers or the late toppers are right, the energy mix will shift. As the graphic on the following page shows, oil is a relatively cheap source of energy and its continued decline in total energy consumption will mean that the average cost of the energy mix will rise. If the late toppers are right, only a gradual and easy-to-handle rise in the price of energy may occur. But if the early toppers are right, or even if the outcome is somewhere in the middle, energy costs will be a burden on the economy as soon as the sector hits full capacity. Indeed, they may well be a serious threat to the low-inflation environment with which we are familiar.

In a scenario in which energy costs undermine price stability, the ability of central banks to hold back inflation will be limited, as the prices of natural resources could be mostly outside their control. In case of a severe jump in commodity prices, economic costs of controlling the average price level will be considered too high.

**Oil price at which fuel sources become economically viable**

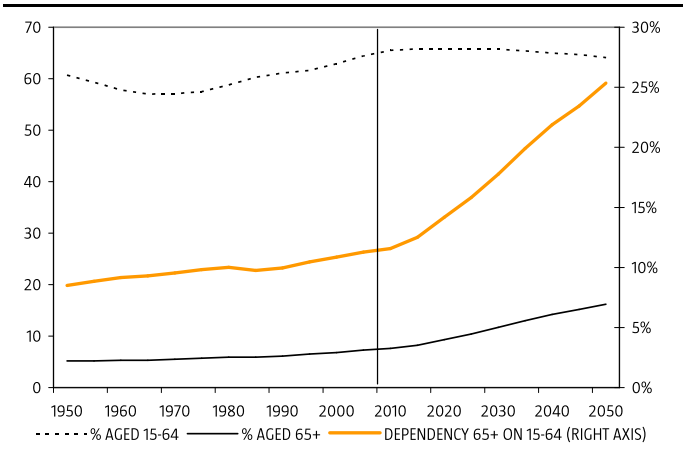



Source: Financial Times, 22 december 2008

## 4.2 Aging might spur labor cost inflation

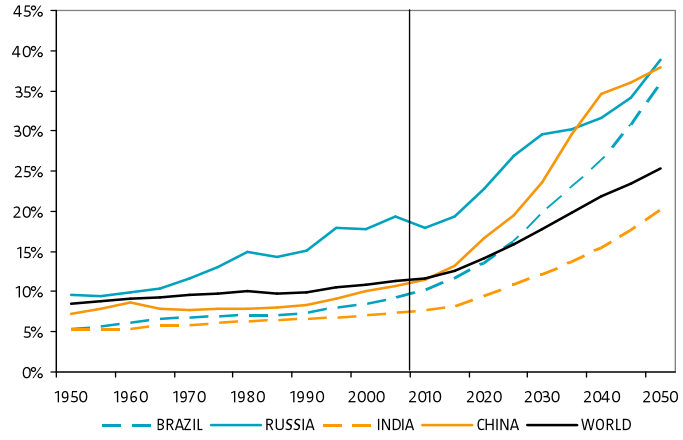
The world population is increasing and growing older. A growing world population is not a new phenomenon. But the aging of the population is new. The number of people older than 65 is forecast to increase from 7.6% in 2010 to 16.2% in 2050. Over the same period, the number of people aged 15 to 64, the potential labor force, is set to decline slightly in a number of countries. This decrease represents a reversal, as we are used to a growing labor force. The global labor force has grown by 1.8% a year since 1950. The United Nations expects the global labor force to increase by a moderate 0.7% over the 2010-2050 period. Looking at the forecasts more closely, however, growth rates differ significantly. For example, Africa is expected to experience a growth rate of 2.1%, at the same time as the labor force shrinks in countries such as Germany, France, Japan and China.

**Dependency ratio world**




Source: United Nations, Robeco

**Dependency ratios bric countries and world**




Source: United Nations, Robeco

The combination of the declining growth of the labor force and the rapidly accelerating increase in the elderly is set to result in a huge increase in the dependency ratio, which expresses the number of people older than 65 as a percentage of the 15-to-64 age group. This ratio is set to rise from 10% to 25% over the next 40 years. Aging will change the economy. This applies to the developed world as well as emerging economies. Aging will reduce economic growth potential, as economic growth is the product of the size of the labor force and its productivity, excluding cyclical swings in the unemployment rate.

Aging results in labor getting scarce. It could be that aging results in a struggle between the old and young generation, the young not willing to pay an increasing part of their income for the elderly. Then, the young would ask their employers to compensate for the rising pension costs they pay which could result in cost push inflation. But in the end, it depends on the monetary authorities whether labor costs push inflation or whether

**Labor force**

| Region | Country | Labor Force 1950 | Labor Force 2010 | Labor Force 2050 | Growth Rate 1950-2010 | Growth Rate 2010-2050 |
|---|---|---|---|---|---|---|
| World | | 1535985 | 4523706 | 5865828 | 1.8% | 0.7% |
| North America | | 110819 | 235923 | 274146 | 1.3% | 0.4% |
| Europe | | 359131 | 500832 | 398215 | 0.6% | -0.6% |
| | Germany | 45877 | 54302 | 38739 | 0.3% | -0.8% |
| | UK | 33881 | 40883 | 43930 | 0.3% | 0.2% |
| | Italy | 30237 | 39297 | 30399 | 0.4% | -0.6% |
| | France | 27570 | 40493 | 38468 | 0.6% | -0.1% |
| Asia | | 838789 | 2796827 | 3387981 | 2.0% | 0.5% |
| | Japan | 49424 | 81572 | 51790 | 0.8% | -1.1% |
| | China | 337781 | 973303 | 870115 | 1.8% | -0.3% |
| | India | 220804 | 780571 | 1097969 | 2.1% | 0.9% |
| | Russia | 66660 | 101236 | 70086 | 0.7% | -0.9% |
| Oceania | | 8045 | 23298 | 31960 | 1.8% | 0.8% |
| Latin America | | 94139 | 385130 | 462833 | 2.4% | 0.5% |
| | Brasil | 29937 | 132174 | 137166 | 2.5% | 0.1% |
| Africa | | 125063 | 581696 | 1310693 | 2.6% | 2.1% |

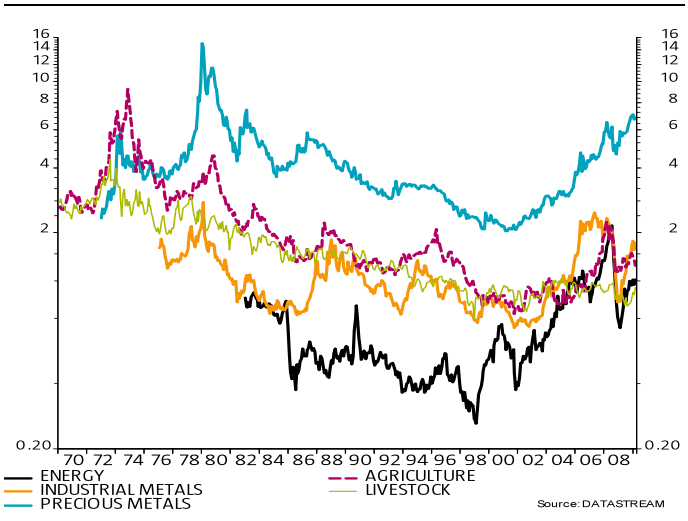
Source: United Nations, Robeco

only the relative price of labor increases. In other words, aging brings the risk of inflation, but does not induce inflation by definition. As a final remark we note that another way of solving the aging issue would be a significant rise in the retiring age, a significant increase in labor immigration[2] or a cut in social security. In such scenarios the inflationary pressures from aging will be limited.

## 4.3 Fear of scarcity tends to be cyclical

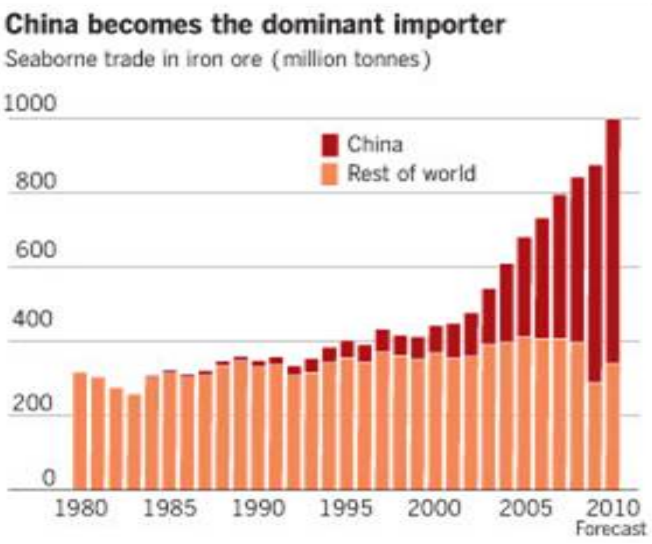
We finalize the scarcity issue with a qualification as it seems us that the fear for scarcity is of a cyclical nature. Actually, back in the early seventies the Club of Rome already warned that economic growth would be hindered by the limited availability of natural resources, particularly oil. Although shortly after their report 'Limits to Growth' we went through two oil crises, it is hard to maintain the view that the global economy was hindered by shortages of natural resources in the eighties or nineties when there was an economic boom. Even worse, commodity prices have fallen in real terms during these two decades, as shown in the graph below.

**Real spot prices for the five main groups of commodities (GSCI; deflated with us CPI)**




Source: United Nations, Robeco

**Iron ore seaborne trade**




From the beginning of this century, we have seen an upturn in the commodity prices. Four out of the five main GSCI commodity indices have risen in real terms over the last decade. This price pattern supports the view that we actually have a quickly rising middle class which brings a strong appetite for commodities. Just as an illustration, we point to China's role in the iron ore market where they have grown from a marginal player to a dominant buyer in a period of ten year. Now, China accounts for more than 60% of seaborne trade. With its central lead economy it has significantly invested in infrastructure. This unprecedented rise has been possible due to the absence of bureaucratic delays of investments. Therefore, other emerging markets are likely to show a slower development (or better: less quick) as infrastructure projects have to overcome more bureaucratic barriers, but the trend should be the same.

The emergence of a global middle class could very well cause another round of accelerating price increases in lots of commodities due to scarcity, resulting in a new spike in the next few years. The financial crisis actually has increased the risk of such a scenario, as it has undermined

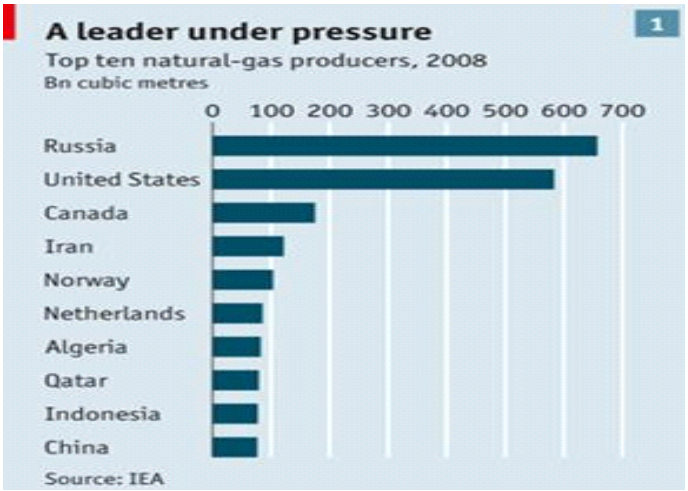
[2] This would help to decrease labor scarcity in one country but would worsen the aging problem in another country.

investments in the energy and mining sectors. But, on the positive side, we note that scarcity is likely to be a temporary phenomenon again.

If a renewed period of seemingly continuous rising commodity prices occurs, prices will affect both supply and demand significantly. On the supply side producers will add capacity and put money into alternatives. Just as an illustration of alternatives, we refer to the huge reserves of shale gasses that have been in the center of attention over the last few months, as shown in the charts below[3]. At current US natural gas production rates, there are reserves of shale gasses in the US of almost 200 years. Next, innovation can improve production efficiency in a way of lowering costs as well as increasing yields. On the demand side, higher prices will dampen demand. Higher prices make consumers more aware of their needs while improved efficiency or alternatives can result in a lower usage per capita. On a horizon of three to five years both supply and demand are flexible. Therefore, we do not believe in a lengthy period of quickly rising commodity prices. We see the risk of a new spike in the years ahead, but in that case the subsequent drop is inevitable.

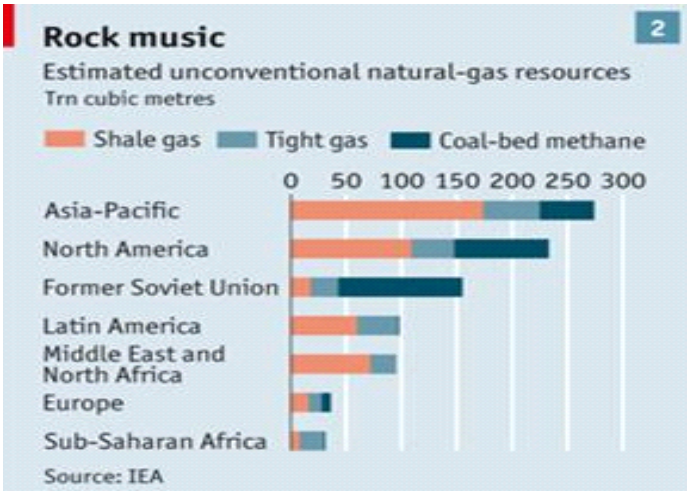
[3] Please, note that the scale of reserves is x1000 compared to the current annual production of natural gas.

**Natural gas production**




Source: Economist

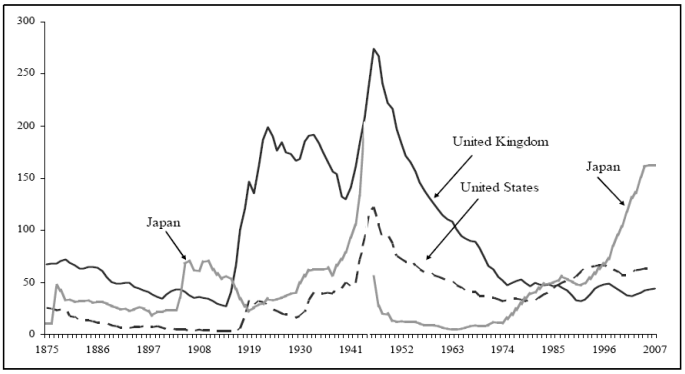
**Unconventional gas reserves**




Source: Economist

# 5. The threat of government debt

**Public debt-to-GDP ratios 1875-2007 as estimated by IMF (2009)**



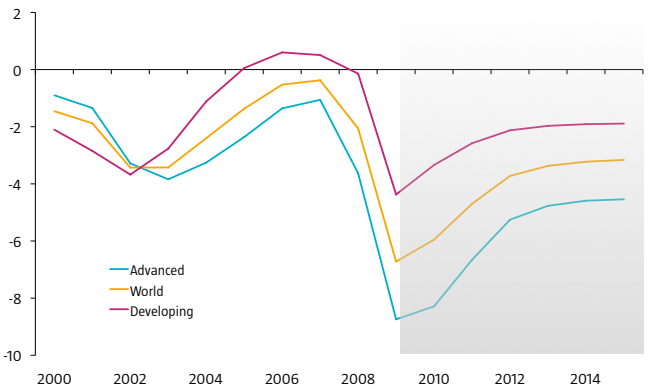

Sources and notes: United Kingdom: Goodhart (1999) and WEO database. United States: *Historical Statistics of the United States*, Millennial Edition Online; Office of Management and Budget; and U.S. Census Bureau. Japan: *Hundred-Year Statistics of the Japanese Economy*, Bank of Japan; and *Estimates of Long-Term Economic Statistics of Japan since 1868*, Toyo Keizai Shinposha. Data for Japan refer to the central government.

## 5.1 The explosion of government debt

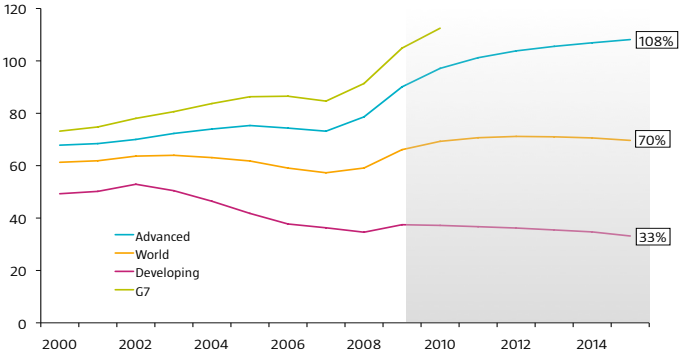
One of the arguments that has been put forward why inflation is set to rise in the years ahead, is linked to the rapid increase seen in public debt. When demand of the private sector collapsed in 2008-2009 as a result of the credit crisis, governments stepped as a lender of last resort. Economies were propped up by numerous stimulus packages, not only to save the financial sector, but oftentimes the economy as a whole. Although this has been a successful strategy in preventing a worldwide depression, it has come at the cost of a rapid deterioration of the government finances (see charts below). Countries like the US (-12.5%) and the UK (-10.9%) recorded double digit deficits as percentage of GDP in 2009, with no meaningful improvement in sight for 2010.

According to the IMF the gross debt to GDP ratio for the world is set to climb to 70% in 2015, from the 60% level on average seen during the last decade. Although this seems to be a relatively small deterioration from an acceptable level, it masks a strong divergence within the world. Especially the so-called Advanced Economies will be faced with a rapid rise in debt to GDP. The IMF estimates debt of Advanced Economies to rise to close to 110% of GDP by 2015, while the Developing Economies are forecasted to show a steady decline of debt levels to 33% of GDP (see chart below). If we keep in mind that within the Advanced Economies the G7 debt was already 15% above the average in 2009 (mostly as a result of Japan though), it is clear that the biggest debt problem will arise in the G7 countries. Addressing this debt is one of the bigger challenges for the years to come.

**Governments deficits**




**Governments debt**



## 5.2 High debt, four ways out

A high level of debt to GDP ratio can theoretically be brought down in four ways:

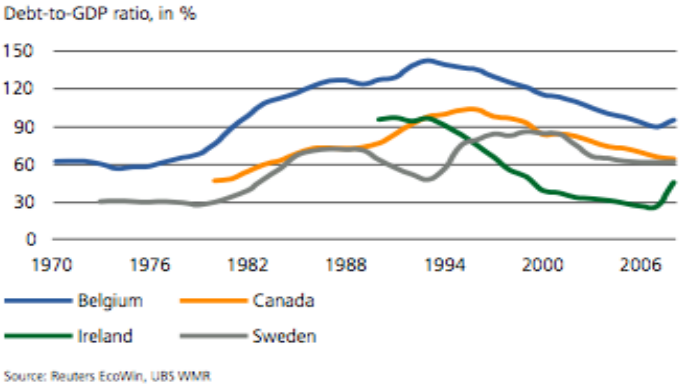
1. Reducing the nominal amount of debt. This can be considered the hard way of tackling the problem: actually reducing the absolute level of debt outstanding. History shows that a reduction of the nominal level of debt is rare. The first chart (taken from a UBS-research paper), shows four developed countries that have successfully reduced debt as a percentage of GDP in the recent past, reducing debt by more than 30% points in a 10 year time span. As the second chart shows, these reductions have mostly been in relative terms though, with the absolute level of debt remaining stable or in fact increasing. The same is true with respect to the US debt at the end of World War II: debt as percentage of GDP declined from above 120% in 1945 to 35% in 1974, while the level of nominal debt – except for the first years – steadily increased. This seems to suggest that the regular way to reduce debt is by boosting the denominator (nominal GDP), not by decreasing the numerator (the actual debt level).

2. Higher real growth. This is by all means the preferred way out of the debt problem. The charts are a clear example of how the debt problem can be tackled, without actually lowering debt itself: as long as GDP growth outstrips the expansion of debt, debt to GDP is set to decline. Theoretically this could happen this time around as well. There is an important point to make though: the debt reduction that took place in the examples above took place in a relatively favourable growth environment (1993-2007). What's more, the debt problem was not a widespread phenomenon at the time, which means that the countries benefited from the stability in the world around them. With most of the advanced economies currently facing the same challenges (private sector deleveraging, budgetary austerity and aging) at the same time, it is clear that the situation right now is far less favourable this time around. In other words, the scope for solving the debt problem by producing high growth –although not absent- seems to be limited at this stage in time.

3. Higher inflation. Whereas higher growth aims to boost the size of an economy in real terms, inflation does the same, but on a nominal level. Given that higher inflation is the central theme of this paper, we take a closer look at the inflation option in the next paragraph.

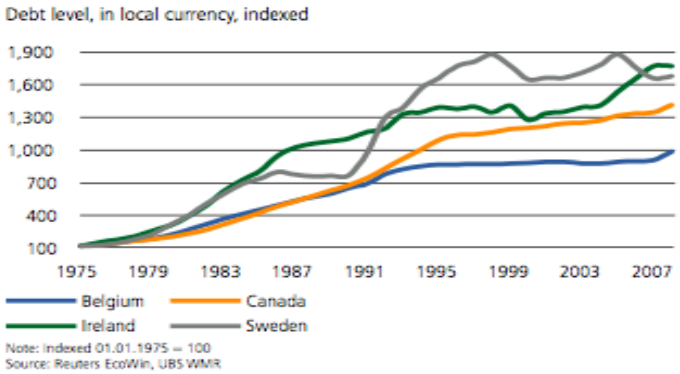
4. Restructuring or defaulting on debt. Given the almost unprecedented level of deterioration of debt seen in the developed world, it is clear

**Four instances of falling debt ratios**




Source: Reuters EcoWin, UBS WMR

**The total debt levels did not fall**




Note: Indexed 01.01.1975 = 100
Source: Reuters EcoWin, UBS WMR

that the dreaded option number 4 cannot be ruled out. As a general rule however, as long as a country 1) is able to finance its debt in its own currency and 2) has a central bank willing (or coerced) to print money, monetising debt is a more likely outcome than a default. In that case, the central bank of a country will (partially) buy the newly issued government debt, boosting the money supply in the process. In extreme cases monetising debt can result in a scenario of hyperinflation, such as we have seen in Germany in the 30s and more recently in Zimbabwe. In those cases, bond holders will hardly be better off compared to a downright default. In less extreme circumstances (partial monetising), the increase in money supply carries the risk of higher inflation.

Based on the two criteria mentioned above, there is one group of countries that is different from the rest: the members of the euro area. As a unit, they are not much unlike the US and the UK, in that sense that the only hurdle to take towards monetisation is to curb the independence of the central bank. On an individual basis however, they do not have the power to turn on the money printing machine. Theoretically this seems to imply that the odds of a default of an individual government are higher within the euro area than outside it. However, as the recent developments with respect to Greece show, the risk of contagion can still force the euro members to act as one to save an individual country. Although the rescue package announced does so far not include the monetising of debt (extra liquidity related to the acquisition of peripheral bonds is being drained by the ECB), it is a clear signal that at this point, the euro members are not willing to let a single euro member default on its outstanding debt.

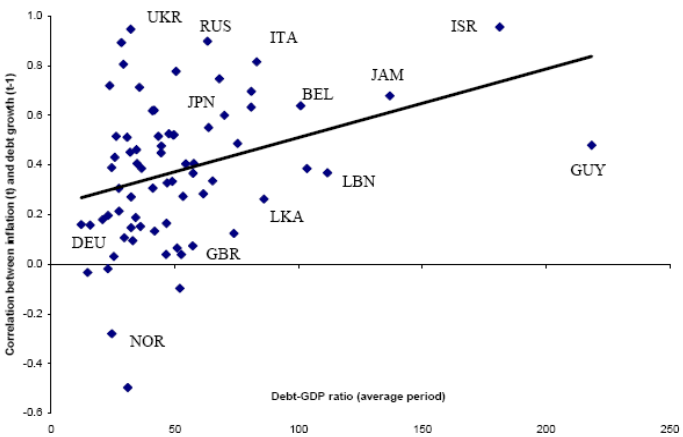
## 5.3 Effectiveness of inflation to bring the debt ratio down

If – as a government – you lack the ability to stimulate your economy, do not have the guts to make necessary budget cuts and prefer to stay away from default, there is only one option left to make debt more manageable: inflation. In this paragraph we address the question how effective inflation really is in reducing the debt burden. In the next paragraph we take a look how easy it is to actually get inflation going.

In a recent NBER study, Aizenman and Marion (2009) take a more specific look at the relation between debt and inflation for the US. Inflation played an important role in bringing down the debt/GDP ration in the US, following World War II. In fact, inflation reduced the 1946 debt/GDP ratio by almost 40 percent points within a decade, according to the authors. More in general, they point out that a government has the incentive to inflate its debt if the rewards are big and the reputation damage is small. They also raise the question of effectiveness of inflation as a tool to reduce the debt ratio, identifying four variables. We take a look at these variables, to which we add two of our own.

**1.** The level of debt. This argument is straightforward: with a higher level of debt, the incentive to reduce it by boosting inflation is bigger. There is some empirical evidence on this subject. Drawing on an extensive panel dataset, Kwon, MacFarlane and Robinson (2006) find that the relationship holds strongly in indebted developing countries, weakly in other developing countries, but generally not in developed economies. Given that in the past debt problems have been more concentrated in the developing countries, this outcome is not too surprising. Due to the unprecedented increase in debt ratios we are experiencing right now, we expected that the strength of the relationship for the last category is likely to increase.

**Public debt growth more inflationary in high debt countries; kwon et al. (2006)**



The table below shows the level of gross debt for a number of Advanced Economies, ranked according to the level of debt. Most of the high level debt countries can be considered the usual suspects, such as Japan, Greece, Italy and Belgium. Japan is an extreme outlier, given that it is the only financially stable country with a gross debt above the 200%. Due to the sizeable interest payments on the existing level of debt, simply stabilising the debt at this level requires a big primary surplus: reducing debt to acceptable levels by fiscal austerity seems to be out of the question. Apart from the usual suspects, one of the newcomers is the US, with a projected debt to GDP of close to 110% in 2015. The UK, according to these estimates, is forecasted to stay below the 100% level, but will also show a strong deterioration from the current level.

As we have pointed out before, the individual euro countries hold a somewhat special position. As long as we look at the euro as a block, the euro area can be seen much like the UK or the US, but this is not true for individual countries. Looking at Spain as an example, increasing VAT might trigger an inflation-wage spiral, which will push the debt to GDP ratio down. However, this would have serious repercussions for the economic performance of Spain within the euro area, as the wage-inflation spiral will make Spain uncompetitive compared to the other euro members. Spain would price itself out of the market, resulting in lower future growth and consequently a higher debt problem.

**2.** The maturity of outstanding debt. The maturity of debt, or more specifically the duration, determines how successful a country can be in inflating its way out of the debt problem. Basically, the maturity is a measure of how long existing bond holders are 'locked up' under the old conditions, unable to renegotiate debt specifics. In the extreme case of perpetual debt, the cost of higher interest payments is limited to the amount of newly issued debt (new deficits), while roll-over of old debt does not exist. In this scenario, the incentive to resort to inflation is high. In the other extreme of a very short duration, the turnover in maturing debt is a lot higher, which means that a government is much quicker penalised for the higher inflation (expectations). As Aizenman and Marion point out: in the theoretical case of zero maturity the government is unable to reduce its debt ratio at all.

The table below showing IMF data, gives a good indication of the inflation sensitivity of the current debt structure. Two countries stand out: the UK and the US. With an average maturity of almost 13 years, the UK has by far the longest maturity, roughly twice the level seen in the other Advanced Economies, and nearly 3 times that of the US. It is clear that the penalty of higher inflation will only gradually feed through, as on average

**Gross debt ration**

| | Gross Debt | |
|---|---|---|
| | **2010** | **2015** |
| Canada | 83.3 | 71.2 |
| Netherlands | 64.2 | 77.4 |
| Germany | 76.7 | 81.5 |
| UK | 78.2 | 90.6 |
| Spain | 66.9 | 94.4 |
| France | 84.2 | 94.8 |
| Belgium | 100.1 | 99.9 |
| US | 92.6 | 109.7 |
| Italy | 118.6 | 124.7 |
| Greece | 133.2 | 140.4 |
| Japan | 227.1 | 250.0 |

Source: IMF, Fiscal Monitor

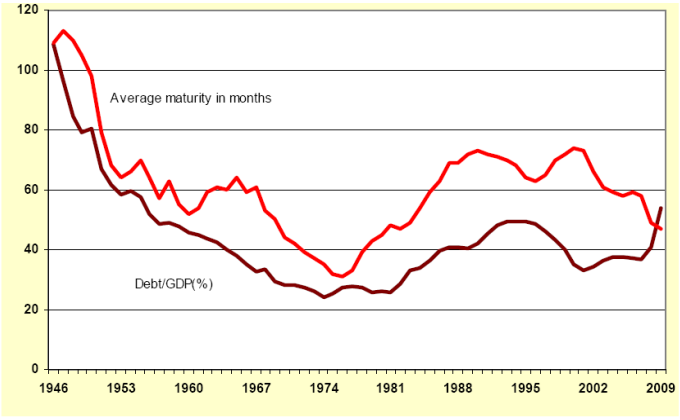
**Average maturity**

| | Average Maturity |
|---|---|
| US | 4.4 |
| Australia | 4.8 |
| Japan | 5.2 |
| Belgium | 5.4 |
| Canada | 5.6 |
| Germany | 6.5 |
| France | 6.5 |
| Spain | 6.7 |
| Italy | 6.7 |
| Greece | 7.4 |
| UK | 12.8 |

Source: IMF, Fiscal Monitor

only 8% of debt needs to be refinanced on a yearly basis. The US on the other hand has by far the shortest average maturity of only 4.4 years. According to Aizenman and Marion, the US is one of only countries that show a significant correlation between the level of the debt ratio and the maturity of debt: for most other countries there is no correlation. As can be seen in the chart, the relationship seems to have broken down recently. As for Japan, according to the IMF data the average maturity is on the low end of the spectrum, but it should be pointed out that the government is pursuing an active policy to increase the maturity of its outstanding debt. In the period of 2004-2009 the duration of JGB debt was increased by a year. This may not sound like a steep increase, but based on the issuance calendar, the government is aiming to increase the duration of outstanding debt by another full year, by the end of 2010. This means that Japan is rapidly moving up the ladder of countries with a favourable debt structure to inflate on debt.

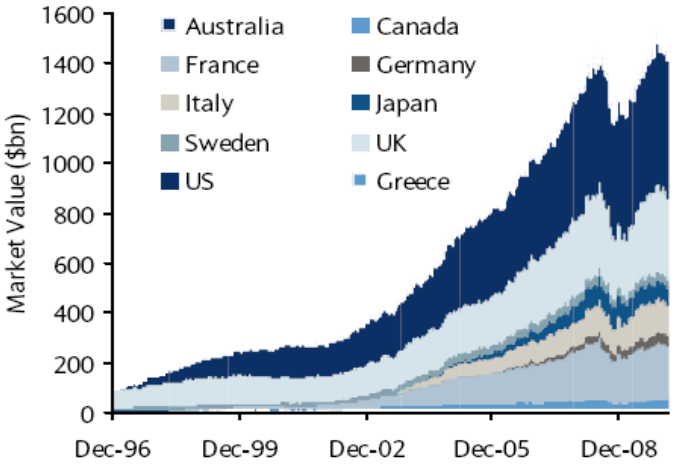
**Debt/GDP Ratio and Average Maturity of Debt**




Source:US Treasury Bulletin

Based on the current numbers, it is clear that the UK stands to gain more from boosting inflation, while the US has the least incentive to inflate its way out of debt.

**Index market value by country**




Source: Barclays Capital

**3.** The percentage of inflation linked bonds. Although inflation linked bonds have been around since 1790, regular government issuance has only recently been introduced. For example, UK Gilts were issued from 1981 onward, US TIPS from 1997 and French OATi's from 1998. The chart below, taken from the Barclays Global Inflation-linked Products guide, shows the absolute growth of the inflation linked market worldwide. For the world as a total, the inflation-linked bonds represent around 6% of all outstanding sovereign debt.

Although not all of the outstanding inflation-linked bonds offer 100% protection against inflation, it is clear that the higher the percentage of inflation linked to the total portfolio, the less effective inflation will be in lowering the debt burden. However, given that for the major financial markets like US, UK and France inflation linked bonds are normally below 10% of the total government debt outstanding, it is clear that this does not seriously reduce the risk of inflation as a way to solve the debt problem.

**4.** Amount of debt held by foreigners. Aizenman and Marion state that a higher percentage of foreign ownership increases the incentive to

resort to inflation, without specifying why though. Given that inflation leads to a redistribution of wealth from lenders to borrowers, or – to put it differently – given that inflation can be seen as a tax on the holders of debt, increased inflation redistributes part of the debt-burden away from domestic economy.

**Foreign share of public debt**

| | Foreign share of public debt |
|---|---|
| Japan | 5% |
| EMU | 27% - 36% |
| UK | 35% |
| Spain | 45% |
| Italy | 45% |
| US | 47% |
| Belgium | 55% |
| France | 65% |
| Netherlands | 65% |
| Greece | 65% |
| Germany | 75% |

Source: IMF, Fiscal Monitor

This may sound as a clear positive from the debtor country, but is not without cost though. The drawback is that reputation risk is probably bigger with a high level of foreign ownership: bond holders are more likely to stay loyal to a domestic government than to a foreign entity. A complicating factor is that the 'cost' for a foreign bondholder is not so much domestic inflation of the debtor country, but rather the relative change in its currency (assuming no hedge was in place to begin with). Given the volatile and sometimes unpredictable nature of currencies, it is possible that the higher inflation is accompanied by a stable currency, in which case the foreign bond holder does not feel any pain.

Based on the assumption that currencies on the longer run are driven by inflation differences, the foreign cost element can still be assumed. Even if currencies move against the inflation difference for a longer period of time, this can lead to an increased uncertainty over future exchange rates. Additionally, raising short term interest rates to fight inflation by the debtor country leads to higher hedging costs which may also have an adverse effect on the willingness by foreigners to continue to invest money abroad.

All in all, even though the direct costs of inflating debt for the economy as a whole may be smaller the higher the level of foreign ownership, the longer term impact on refinancing (higher real rates) might be more negative. Indeed, alienating your foreign stakeholders can have a profound impact on the economy as a whole. Replacing foreign debt holders by domestic debt holders means that the domestic savings rate needs to rise. In the case of the US for example, this would mean a radical change in the economic growth model, as it has always been based on consumption rather than savings.

Looking at the league table, the highest level of foreign ownership is found in the individual euro countries. On average, 60% of outstanding debt is held by foreigners. This picture changes radically if we look at the holdings of the euro countries as a block: an estimated 27% to 36% is held by non-euro members, indicating that the biggest foreign holdings are cross euro. Treating the euro area as a single block, the US has the highest level of foreign holdings, reaching close to 50%. Japan is at the other end of the spectrum, with only 5% of total debt in the hands of foreigners. Inflation will therefore mostly hit Japanese debt holders.

**5.** Amount of debt issued in foreign currencies. Given that a government does not control the inflation abroad, the amount of debt issued in foreign currencies reduces the incentive to opt for inflation. Indeed, given that higher domestic inflation (compared to abroad) is expected to result in a depreciation of the currency, inflation will only lead to a worsening of the debt crisis. Given that most of the Advanced Economies almost exclusively have domestic denominated debt, this variable does not play an important role at present.

**6.** The timing of inflation compared to inflation expectations. The pattern how inflation evolves is of crucial importance in reducing the debt burden. A sharp rise in inflation, which is perceived to be temporary, is more effective than steadily accelerating inflation. The key factor is the

way expectations about future inflation are impacted: higher inflation expectations will result in less favourable refinancing conditions, limiting the scope of inflation as a debt-reduction tool. The credibility of the central bank is a good proxy to assess whether inflation will be successful or not: as long as the central bank has a credible track record and a clear target, a rise in inflation is likely to be perceived as temporary.

Demertzis, Marcellino and Viegi (2009) recently conducted a study to assess the credibility of various central banks in Advanced Economies (excluding the US). Credible monetary policy was defined as a disconnect between inflation and inflation expectations on the one hand and the amount of anchoring of inflation expectations towards inflation targets on the other. For those countries that had a specific inflation target, correlation between actual inflation and inflation expectations was always below 0.5, indicating a relatively high level of credibility. Canada (0.48) and UK (0.42) were the only two countries that had a correlation that was statistically different from zero. With respect to the only country that had no specific inflation target (Japan), the researchers found that inflation expectations were clearly higher correlated with actual inflation (0.69). Also, the level of expected inflations on average turned out to be systematically higher than actual inflation.

According to this research, central bank policy is generally viewed to be credible at this point in time. Another way of putting it would be to say that following the Great Moderation, financial markets appear to be less aware of inflation risks, as disinflation has been with us for almost 20 years now. A clear signal is the fact that the 10 year Gilt is currently trading at a yield of 3.4%, while UK inflation runs above 3%. As such, with financial markets currently underscoring the risk factor of inflation, the environment is ideal for inflating away the debt burden.

Two points should be kept in mind though. First, being a prime mover helps. Once bond investors get burned, it is likely to lead to a risk premium in the other markets. In fact, even a credible central bank cannot stop some sort of a risk premium emerging in that scenario. Second, credibility is not set in stone, meaning that continued high inflation will ultimately result in a deterioration of the lending environment. What's more, creditors get the feeling that the independence of a central bank is being reduced, this can have a direct impact on the risk premium, even before inflation kicks in.

## 5.4 Raising inflation: hurdles to overcome part I

The last observation of the previous paragraph raises an interesting question: how can a credible and independent central bank be combined with a rise in inflation? Although there is no one-golden level of inflation that represents price stability, a consensus amongst central banks has evolved that inflation should ideally be around 2.0%. The target in New Zealand –the first independent central bank to adopt a target- is 1-3%, in the United Kingdom 2%, in Euroland below but close to 2.0% and in the United States 1.5%-2.0% as can be implicitly derived from the longer term economic projections of FOMC-members[4]. It is clear that 2% is not exactly the level that is needed to reduce the debt problem: a (temporary) spike of 5% is the least to go for.

The target of price stability and/or independent central banks appears to stand in the way of an increase in inflation. How is it possible to work around this problem?

One possible way is to change the idea of price stability. Although it was not with the debt problem in mind, but rather the effectiveness of monetary policy in times of crisis, this is exactly what the Chief Economist of the IMF Olivier Blanchard suggested in a recent IMF Paper "Rethinking Macroeconomic Policy" (2010). His surprising argument (IMF members normally shy away from this kind of statements) was that given the zero bound on the nominal rate, low inflation resulted in less room for expansionary monetary policy in case of an adverse shock:

"When the crisis started in earnest in 2008, and aggregate demand collapsed, most central banks quickly decreased their policy rate to close to zero. Had they been able to, they would have decreased the rate further: estimates, based on a simple Taylor rule, suggest another 3 to 5 percent for the United States. But the zero nominal interest rate bound prevented them from doing so."

[4] FOMC Minutes, April 28-29, 2009.

This example seems suggests that a pre-crisis level of inflation of between 5% to 7% would have been needed for the Fed to get rates to their desirable level. Apparently that was too harsh a message even for Blanchard and the credibility of the IMF: 4% was as far as he dared to go. Not surprisingly, Blanchards suggestion was met with hostility of the most outspoken of independent central banks, the ECB. In an interview ECB president Trichet called the plans "plain wrong", adding that this was the sentiment of "all the central banks he knew".

More support along the way of a higher inflation rate as an optimal has come from various sources in the recent past. Former Chief Economist of the World Bank and Nobel prize winning economist Joseph Stiglitz remarked for instance in the Sunday Times of June 15, 2008: "Moderate inflation, under 8% to 10%, does not have any significant effect on growth". Earlier he criticized the exclusive focus on curbing inflation of the Reserve Bank of New Zealand. In his memoirs of 2007 "The Age of Turbulance" former Fed Chief Alan Greenspan uttered his expectation that inflation will be trending higher. "(...)[I]nflation rates by 2030 will be some 4½% or higher." Kenneth Rogoff, a former chief economist at the International Monetary Fund and currently professor at Harvard University remarked: "I'm advocating 6% inflation for at least a couple of years. It would ameliorate the debt bomb and help us work through the deleveraging process."

We do not think any of these economists expected a sudden change of heart of the current ruling central bankers. What they did accomplish however, was opening up the discussion on the optimum level of inflation, lending more credibility to central banks that –covertly or not- decide to aim for a higher inflation rate.

## 5.5 Raising inflation: hurdles to overcome part II

Given the statements of Trichet above, it is clear that a more direct approach will be needed for inflation to play an important role in Europe and –if Trichet is right about "all the central banks" he knows- other central banks. If keeping inflation around the 2% is the real aim, the independence of central banks is probably a luxury that needs to be suspended. Rather than doing that out in the open, by changing laws and regulations, the covert way to do so is probably the best way to proceed, as this does not trigger a risk premium by financial markets.

It will be interesting to watch whether political leaders will formally change the mandate of their banks as is easily to arrange in New Zealand and the UK where the government can adjust their targets upwards. For the US there is no formal mandate and due to its dual mandate (price stability and full employment) it can be easily pressured to accept higher inflation. The words of Fed Chief Ben Bernanke before the National Economists Club, Washington D.C., at November 21, 2002, although uttered in the context of the prevention of deflation, do suggest a bias towards monetizing: "I am confident that the Fed would take whatever means necessary to prevent significant deflation in the United States and, moreover, that the U.S. central bank, in cooperation with other parts of the government as needed, has sufficient policy instruments to ensure that any deflation that might occur would be both mild and brief. (...) [T] he U.S. government has a technology, called a printing press (or, today, its electronic equivalent) that allows it to produce as many U.S. dollars as it wishes at essentially no cost."

A more interesting case is the uniquely privileged European Central Bank which has the luxury to be able to give its own definition what price stability in practice mean. They can of course tacitly accept a higher inflation than their professed target of slightly below 2.0%. Half of the time, the famous Bundesbank missed its targets before EMU. In the first ten years of EMU inflation on average amounted 2.1%, slightly above the target and probably mainly thanks to a mostly struggling Germany, which had entered the euro on an overvalued exchange rate. Of course, it could also accept higher inflation as inevitable given the unwillingness of the European electorate to accept the economic costs of keeping inflation in line with their self-proclaimed target. A strict monetary policy in Euroland endangers in our opinion the continuity of the euro-project as it will threaten several euro countries to default. A higher average inflation rate in Euroland could be a price that has to be paid to keep the euro-area intact because it will offer a way to decrease real debt burdens and readjust relative prices in the euro area more smoothly.

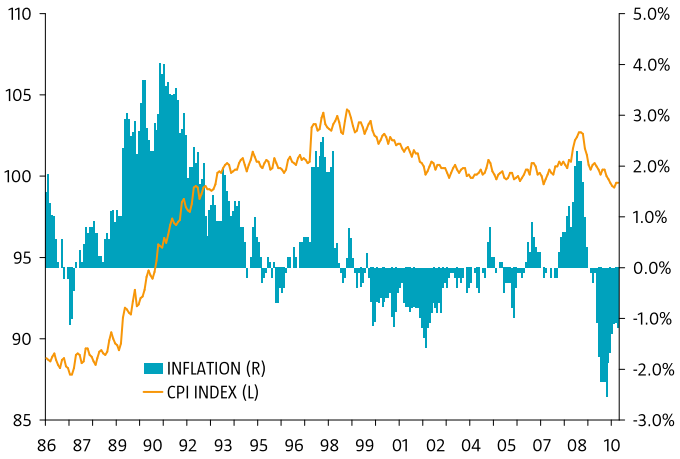
The developments surrounding the Greek crisis shed some interesting light on the dependence of the ECB. In January of 2010 Trichet was quite outspoken on the possibility of the ECB accepting Greek bonds as collateral if the would be downgraded to junk status. He stated that the ECB would not bend the rules "for the sake of any particular country," As the crisis progressed, it was clear that the rule would have destabilising effects on the banking sector, prompting the ECB to issue a press release on May 3rd suspending the rule for –any particular country- Greece. Additionally, on Wednesday May 6th Trichet indicated that the ECB was not contemplating outright purchases of European sovereign debt, as the matter "wasn't even discussed" in the council meeting. On Monday May 10th, as part of a combined rescue package of the EU members, the ECB announced the plan to start market supportive operations in European sovereign bonds. The measure was only one step shy of downright monetising of debt, as the ECB announced that it would sterilize any liquidity created by the operation.

All in all, although there is much talk about the independence of central banks, the recent developments clearly show that there is no clear line in the sand, no black and white. Under pressure even the most independent central bank understands that not cooperating may result in much higher costs, like the collapse of the euro, or an official restriction of independence. In that sense, monetising of debt can be presented as an independent choice. As such we should not forget the words of Rogoff (2003): "Since the invention of money, pressure to finance government debt and deficits, directly or indirectly, has been the single most important driver of inflation."

## 5.6 Some additional thoughts: Japan

Now that we have motive (debt) and opportunity (central banks willing to comply) all we need is a body, to make the story complete. As simple as that sounds, it is probably worth mentioning that trying to get inflation going, is not always as easy as such. We only have to think of Japan to see that having the motive and the means does not always lead to the desired outcome. As we have seen in paragraph 5.3, Japan has a gross debt of 227%, a debt that has been steadily building over the years. This has not led to an increase of inflation, although certainly not for lack of trying.

Inflation over the past 15 years has on average reached -0.1%, with the CPI index currently at the level of 1993. The VAT increase of 1997 clearly shows up as a temporary spike in inflation, but lasted exactly 12 months and pushed the Japanese economy in a recession, worsening the situation. Also the quantitive easing (QE, the modern-day version of monetizing debt) the Bank of Japan undertook in the period 2001-2006 did not have a visible effect on inflation. In a Bank of Japan Working Paper, Ugai (2006) concludes from the survey of the empirical analyses on the effectiveness of the policy that "many of the macroeconomic analyses concluded that the QEP's effects in raising aggregate demand and prices were limited".




The absence of a clear impact from QE on inflation has left many puzzled. In a Lecture for the London School of Economics held in May of this year, Adam Posen, external member to the monetary policy committee of the Bank of England remarked on the findings:

"The other lesson for me, as a central banker, is to have much more humility about what we are capable of doing with monetary policy, especially with unconventional measures. Monetary policy has been unable in Japan to remove deflation quickly in any easy way. (..) As a

result, we should stay away from very mechanistic monetarism that, "Oh, boy, they've printed a lot of money so at some point that has to turn into inflation." or, "If we do this specific amount of quantitative easing, so it will lead to this result." Looking at Japan, it is clear that their quantitative easing measures had the right sign, in the sense of removing fears of tightening, but did not have a predictable or even large short-term result, let alone cause high inflation."

This also same seems to apply to the US experience, where sizeable QE operations were conducted during 2008-2010 period[5]. Although the Fed has successfully boosted liquidity by buying up debt securities, the spillover to the real economy was limited, as banks just boosted their reserves. Excess liquidity was not passed on to the private sector, thereby limiting any risk of inflation hitting off. If the banking sector is too weak because of non-performing loans, it is clear that even QE can be unsuccessful in getting inflation starting.

## 5.7 Outlook

First, we acknowledge that there is high uncertainty whether inflation or in fact deflation will dominate in the future. Second, in the end we think it is more likely to see inflation returning for several reasons, at earliest in 2011 as we are still working through the recession. Scarcities of natural resources and labour can contribute to inflation. Next, monetary policy is loose and debt-to-GDP ratios are rising strongly. Both induce inflation. It is tempting for policy makers to, at least partly, monetize debt. This is preferable to cut back expenditures or raise taxes. Empirical evidence suggests higher debt ratios will lead to higher inflation. Institutional guarantees such as independent central banks will not prevent it. The view that there is a strong consensus among economists that inflation should be low is clearly an overstatement. Therefore, an inflation scenario is more likely than a deflation scenario.

[5] As an aside, Fed Chairman Bernanke tried to introduce the term 'credit easing', as the term Quantative Easing would raise doubts about its effectiveness, following the Bank of Japan experience.

# 6. Empirical findings on inflation hedging

**In this section, we discuss our empirical findings about the relationship between inflation and the performance of asset classes. We will focus on the relationship between the change in inflation and the performance of asset classes. For investors, the last relationship is of major importance. First, we provide a short overview of our data and methodology; afterwards, we present our results.**

## 6.1 Data and methodology

We divide the asset classes involved in this study into nominal and real ones. Nominal asset classes are cash and bonds; real asset classes are equities, real estate, commodities and inflation-linked bonds. We will also distinguish commodity stocks by incorporating a global basket of energy stocks and a global basket of mining stocks into out analysis. For commodities we take the oil price and the gold price. For all countries use the same data series for commodities and the baskets of commodity stocks, albeit in their own local currency. For all other asset classes we use local total return data series. The table below shows the data series used for each country. Inflation series are taken from the OECD. We derive all data from Thomson Financial DataStream.

**Overview Data Series**

| Cash | Bonds | Il-Bonds | Equities | Real Estate |
|---|---|---|---|---|
| US Treasury Bill 2nd Market 3 Month | Barclays US Treasury | Barclays GLB Infl US 5+Y | MSCI USA | FTSE/Nareit All Reits |
| CGBI WMMI UK £ 3 Mth Euro Dep. | UK Citigroup WBGI UK All Mats. | Bcy.Sterling Il Gilt All Maturities | MSCI UK | FTSE EPRA/ Nareit UK |
| JPM Germany Cash 3M | BD Citigroup WGBI Germany All Mats. | n.a. | MSCI Germany | FTSE EPRA/ Nareit Germany |
| JPM Japan Cash 3M | JP Citigroup WGBI Japan All Mats. | n.a. | MSCI Japan | FTSE EPRA/ Nareit Japan |

To estimate the relationship between inflation and changes in inflation and the performance of an asset class, we calculate correlation coefficients by using overlapping annual data. Next, we zoom in on the four periods with inflation hick ups that we have witnessed since 1970. This exercise is especially worthy as it neglects all the periods with stable inflation and stresses the impact of increasing inflation.

## 6.2 Sensitivity to inflation and to changes in inflation

To judge an asset's inflation hedging properties one can take a look at the sensitivity to inflation. This analysis suggests that, in general, the performance of assets is hardly related to the level of inflation. Correlation coefficients are low with the exception of cash.

**Correlation coefficients between inflation and the performance of asset classes**

| | 1970-2009 | | | | 1986-2009 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | US | UK | Germany | Japan | US | UK | Germany | Japan | Avg. 1986-2009 |
| **Nominal assets** | | | | | | | | | |
| Government bonds | -0.18 | n.a. | n.a. | n.a. | -0.06 | 0.24 | 0.10 | 0.16 | 0.11 |
| Cash* | 0.66 | 0.80 | 0.80 | 0.77 | 0.55 | 0.84 | 0.72 | 0.65 | 0.69 |
| **Real assets** | | | | | | | | | |
| Equities | -0.12 | 0.20 | -0.12 | -0.02 | 0.10 | 0.12 | 0.02 | -0.16 | 0.02 |
| Real estate** | -0.06 | 0.07 | n.a. | n.a. | 0.02 | -0.19 | -0.05 | -0.15 | -0.09 |
| Energy stocks | 0.12 | 0.15 | -0.02 | -0.05 | 0.34 | -0.02 | 0.08 | 0.08 | 0.12 |
| Mining stocks | 0.16 | 0.04 | 0.02 | 0.01 | 0.23 | -0.11 | 0.01 | -0.20 | -0.02 |
| Oil | 0.51 | 0.34 | 0.28 | 0.47 | 0.46 | -0.08 | 0.08 | -0.05 | 0.10 |
| Gold | 0.44 | 0.32 | 0.35 | 0.39 | -0.02 | -0.16 | -0.01 | -0.27 | -0.11 |
| Inflation linked bonds*** | n.a. | n.a. | n.a. | n.a. | 0.30 | 0.02 | n.a. | n.a. | 0.16 |

* From 1979 on for the UK, Germany and Japan

** From 1973 on for the US, for Germany and Japan from 1990

*** From 1983 on for the UK, from 1998 on for the US

For investors it is much more important to know the sensitivity of assets to changes in inflation. Therefore, we examine the correlation between the change in annual inflation rates and the performance, shown in the table below. Then, not surprisingly, bonds show up as the asset class with a negative correlation coefficient. Commodity stocks and commodities have the highest correlation coefficients. Stocks and real estate are hardly related to changes in inflation. Surprisingly, this also applies to inflation linked bonds. We believe this is due to the limited dataset and return biases, as inflation-linked bonds have not been liquid. The inflation-linked market has been affected by market imbalances, as there has been huge interest from investors and limited supply from governments.

## 6.3 Inflation protection during inflation spikes on a three year horizon

From an inflation hedging perspective, a correlation analysis with annual inflation data over a period in which inflation mostly behaved in line with expectations is of limited interest. Investors want to know which assets provide the best inflation protection against significant unexpected inflation. Basically, this question is rather hard to answer with only four decades of US data availability for a range of asset classes. On a three year horizon, the US (illustrated in the graph below, other graphs in the appendix), the UK and Germany have experienced only a few periods in which headline inflation has risen. Inflation peaked midway in the seventies, in the early eighties, in the early nineties and in 2008. Japan shows a somewhat different picture. In all countries, head line and core inflation tend to top at the same time.

**Correlation coefficients between changes in inflation and the performance of asset classes**

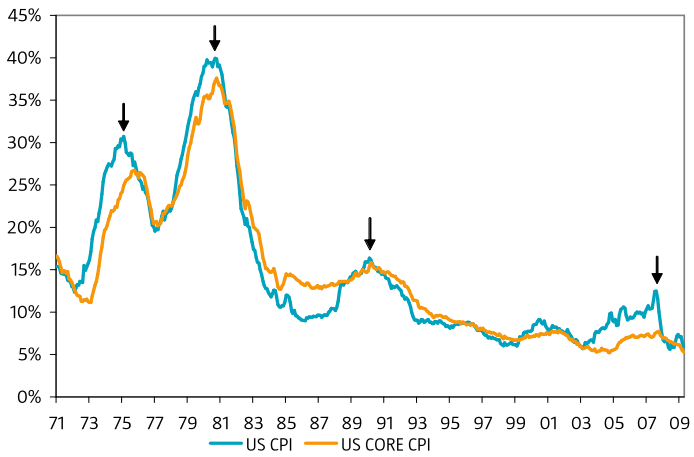
| | 1970-2009 | | | | 1986-2009 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | US | UK | Germany | Japan | US | UK | Germany | Japan | Avg. 1986-2009 |
| **Nominal assets** | | | | | | | | | |
| Government bonds | -0.42 | n.a. | n.a. | n.a. | -0.29 | -0.30 | -0.33 | -0.26 | -0.29 |
| Cash* | -0.01 | -0.03 | 0.02 | -0.07 | 0.19 | 0.04 | 0.04 | -0.06 | 0.05 |
| **Real assets** | | | | | | | | | |
| Equities | -0.21 | -0.08 | -0.09 | -0.11 | 0.13 | -0.11 | 0.08 | -0.06 | 0.01 |
| Real estate** | -0.24 | 0.05 | n.a. | n.a. | 0.05 | 0.05 | 0.07 | 0.20 | 0.09 |
| Energy stocks | 0.25 | 0.04 | 0.24 | 0.07 | 0.46 | 0.10 | 0.37 | 0.32 | 0.31 |
| Mining stocks | 0.31 | -0.03 | 0.23 | 0.21 | 0.39 | 0.07 | 0.36 | 0.19 | 0.25 |
| Oil | 0.65 | 0.35 | 0.34 | 0.49 | 0.67 | 0.24 | 0.43 | 0.32 | 0.42 |
| Gold | 0.54 | 0.30 | 0.29 | 0.46 | 0.17 | 0.00 | 0.07 | 0.15 | 0.10 |
| Inflation linked bonds*** | n.a. | n.a. | n.a. | n.a. | 0.37 | -0.13 | n.a. | n.a. | 0.12 |

* From 1979 on for the UK, Germany and Japan

** From 1973 on for the US, for Germany and Japan from 1990

*** From 1983 on for the UK, from 1998 on for the US

**Cumulative inflation over three years**




To get an idea which investments offer the best returns in an environment of rising inflation, we examined the cumulative real returns of several assets in the three year towards a peak in inflation. We focus on the four peaks in inflation that we mentioned above. We leave Japan out of our sample as it has shown an atypical inflation picture over the last two decades. We include Germany from the nineties onwards as we lack data on government bonds, real estate and inflation linked bonds before 1990.

We stress one should interpret these results with care. Over the last four decades we only have had four periods with a more or less pronounced spike in inflation. In other words, due to severe data limitations it is hard to derive strong conclusions.

As becomes clear from the graph, commodities and commodity related stocks have offered the best inflation protection. Stocks were roughly flat

in real terms, as were bonds and cash while real estate has been hurt the most during this sample. Surprisingly, real estate has offered the worst inflation hedge of the assets involved in this analysis.

As two inflation spikes can be attributed to oil crises, we also examine the inflation hick ups in the early nineties and 2008 in a separate sample. Here, we average the real cumulative returns for the US, UK and Germany towards their peak in inflation. The performance of inflation linked bonds is based on the UK only.

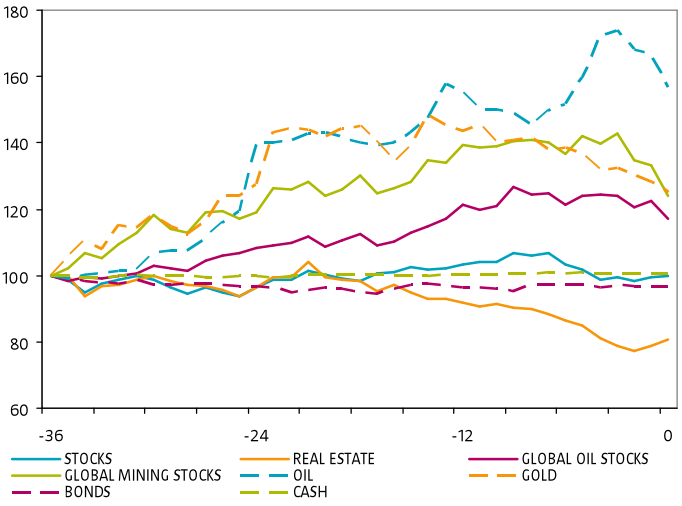
Once again, commodities and commodity related stocks generate the best performance during periods of rising inflation. Stocks, bonds and cash offer small positive real returns while real estate also lags all other assets in this sub sample. Inflation linked bonds generate flat real returns. As noted earlier at the correlation analysis, we believe the results for inflation linked bonds to be biased. When we use the median in stead of the average, the numbers change but the conclusions remain the same.

## 6.4 Inflation multiplier

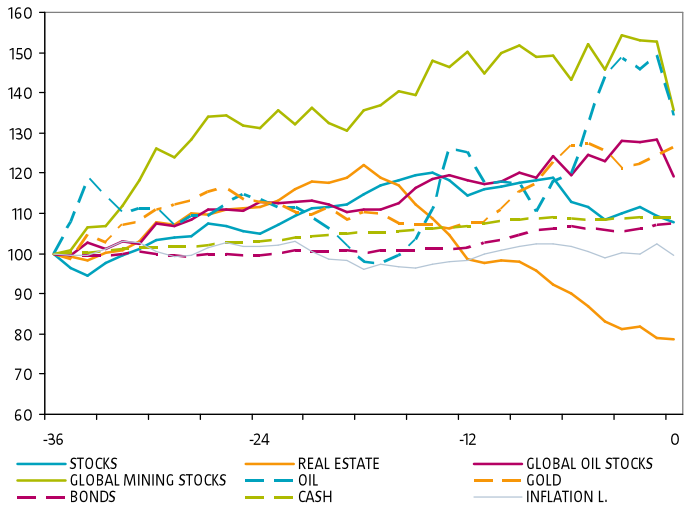
Our results suggest commodities and commodity related stocks to offer the best inflation protection. The next question that is of importance for investors is how much protection they offer. Therefore, we examine the inflation multipliers. The table below shows the results.

When one averages the inflation multiplier for commodity related stocks and commodities (i.e. oil and gold) it is 3.6 for 1970-2009 period with for inflation spikes and 4.2 for the 1986-2009 period with two inflation spikes. When we spilt these numbers between commodity related stocks and commodities these numbers are 3.6 and 4.0 for commodity related stocks and 4.2 and 4.4 for commodities. As appears from the table these numbers differ significantly by country. A rough guess for the inflation multiplier would therefore be around 4. This suggests that an investor who is seeking full protection against inflation should invest 25% of his portfolio in commodities and commodity related stocks.

**Real cumulative return indices three year prior to a top in inflation (four inflation spikes, US and UK, 1970-2010)**




**Real cumulative return indices three year prior to a top in inflation (two inflation spikes, US, UK and Germany 1970-2010)**



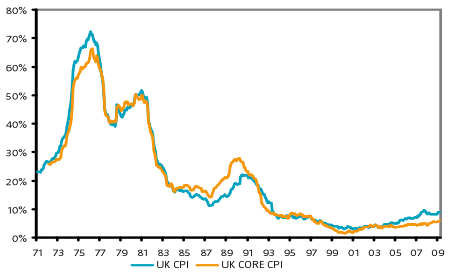
Once again we stress that the inflation multiplier for commodity investments of around 4 is based on a very small sample (only four inflation spikes in four decades, of which two oil crises related spikes). Therefore, the results should be treated with utmost caution.

**Inflation multipliers**

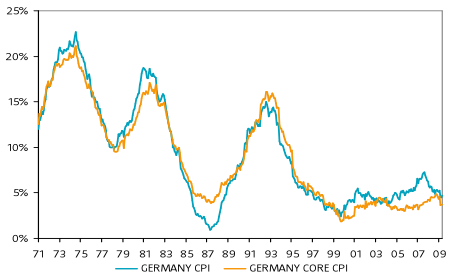
| | Stocks | R.E. | Oil stocks | mining stocks | oil | gold | bonds | cash |
|---|---|---|---|---|---|---|---|---|
| **1970-2009, Four inflation spikes, ten events (US: 4, UK: 4, Germany: 2)** | | | | | | | | |
| US | 1.12 | 0.03 | 2.41 | 4.56 | 5.16 | 3.31 | 1.03 | 1.09 |
| UK | 1.03 | -0.33 | 1.67 | 1.32 | 3.16 | 2.70 | 1.36 | 1.69 |
| Germany | 2.02 | -1.91 | 2.15 | 7.35 | 3.92 | 5.19 | 1.55 | 1.83 |
| **1986-2009, Two inflation spikes, six events (US: 2, UK: 2, Germany: 2)** | | | | | | | | |
| US | 1.91 | -0.13 | 3.66 | 7.19 | 5.07 | 3.94 | 1.57 | 1.28 |
| UK | 1.15 | -1.37 | 1.95 | 1.44 | 4.39 | 4.14 | 1.36 | 2.01 |
| Germany | 2.02 | -1.91 | 2.15 | 7.35 | 3.92 | 5.19 | 1.55 | 1.83 |

# Appendix

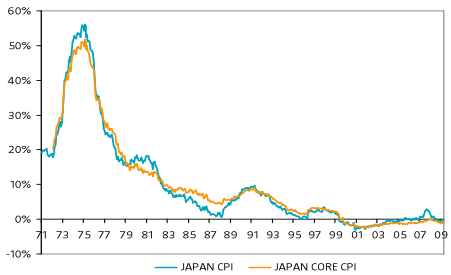
**Cumulative inflation over three years**




**Cumulative inflation over three years**




**Cumulative inflation over three years**



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