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(Occasional Papers)

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# THE ROLE OF MACROECONOMIC POLICIES IN THE GLOBAL CRISIS

by Pietro Catte, Pietro Cova, Patrizio Pagano and Ignazio Visco\*

## Abstract

This paper argues that the lack of timely and decisive policy action to correct domestic and external imbalances contributed crucially to the build-up of financial excesses that led to the financial crisis and the Great Recession. We focus on 2002-07 and perform a number of counterfactual simulations to investigate two central elements of the story, namely: (a) an over-expansionary US monetary policy and the absence of effective macro-prudential supervision, which permitted a prolonged expansion of debt-financed consumer spending; (b) the decision of China and other emerging countries to pursue an export-led growth strategy supported by pegging their currencies to the US dollar, resulting in a huge build-up of their official reserves, in conjunction with sluggish domestic demand in surplus advanced economies characterized by low potential output growth. The results of the simulations lend support to the view that if substantial, globally coordinated demand rebalancing had been undertaken in a timely manner, the macroeconomic and financial imbalances would not have accumulated to the extent that they did and the financial turmoil might have had less drastic global consequences.

**JEL Classification:** E52, F42, F43, F47, G15

**Keywords:** Global imbalances, financial crisis, monetary policy, macroprudential regulation, structural reforms.

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# 1 Introduction

While the trigger and the proximate causes of the crisis that has rocked the global economy since the summer of 2007 were essentially financial, it has become increasingly clear that macroeconomic imbalances were a central part of the complex set of circumstances that lay at its root. In particular, the financial excesses that led to the piling up and underestimation of risks could not have become so widespread if the macroeconomic environment had not been characterized by large saving-investment imbalances, very low interest rates and substantial asset price misalignments. In the general climate of hype that those macroeconomic conditions permitted, supervisory and regulatory failures allowed financial innovations to generate serious dysfunctions in the US and global financial systems. Moreover, the lopsided composition of global final demand in the years preceding the crisis, with most of the world ultimately relying on US consumer spending, essentially financed by growing mortgage debt, made the world economy extremely vulnerable to a shock – the downturn in the US housing market – that called this central factor of the global expansion into question. If this key source of fragility is not borne in mind, it is difficult to explain fully the sharp and highly synchronized contraction of world trade and the collapse of global confidence that characterized the propagation of the global recession.

In this paper we argue that the lack of sufficiently decisive policy reactions to the domestic and external imbalances was crucial: if those imbalances had been eliminated, the financial turmoil would have had lesser far-reaching consequences. Over the 10-15 years that preceded the crisis it was indeed already possible to identify a number of signals of macroeconomic stress, which interacted with flaws in the financial system to create very significant, though at the time partly hidden, financial fragilities.<sup>1</sup>

These signals consisted in: the dramatic fall in the US household saving rate, from around 7 per cent in the early 1990s to close to zero in 2005-07; a sharp increase in US and global liquidity, which largely reflected the generally accommodating monetary conditions in the United States; the continuous widening of global imbalances, already recognized as hard to sustain in the late 1990s; an enormous increase in official reserves, mainly in emerging Asia and the oil-exporting countries, which mostly pegged their currencies to the US dollar; very low levels of long-term interest rates and asset price volatility after 2003; and a sequence of asset price bubbles in the United States and globally, starting with the dot-com bubble of the late 1990s, followed by an unusually synchronized global housing price boom.

Essentially, these disequilibria reflected rapid and sustained growth in final demand, especially consumption demand, in the United States, financed by over-borrowing, primarily from abroad. This occurred in a global context of excess saving that compressed real interest rates to abnormally low levels compared with average GDP growth. If the United States served as a sort of “consumer of last resort”, other large advanced and emerging economies implicitly or explicitly followed an

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<sup>1</sup>See Visco (2009, 2010).

export-led growth strategy, which is difficult to maintain indefinitely but also difficult to abandon.

In order to reduce the risk that macroeconomic imbalances and distortions in the financial system might again combine to produce large-scale, devastating financial crises in the future, it is essential to address both elements. Important changes in financial market regulation and banking supervision are already being introduced. In the macroeconomic field, an effort is being made to strengthen economic policy coordination in the context of the G-20. However, it is also necessary to review how macroeconomic policies are conducted in light of the experience of the crisis. Two areas where a rethinking is already under way are monetary policy frameworks – and, in particular, how and to what extent they should take into account asset market developments and associated financial fragilities – and exchange rate arrangements.

In this paper we focus on the period 2002-07, before the start of the financial turmoil that evolved into the global crisis, and perform several counterfactual simulations to investigate two central elements of the story, namely: (a) an overly expansionary monetary policy and lax supervisory policy in the United States, which may have permitted a prolonged expansion of debt-financed consumer spending; (b) the decision of China and other emerging countries to pursue an export-led growth strategy supported by pegging their currencies to the US dollar, resulting in a huge build-up of their official reserves, in conjunction with other advanced economies characterized by low rates of growth in potential output.

To investigate whether different policy choices could have prevented, or at least moderated, the build-up of disequilibria, we use the National Institute of Economic and Social Research’s large-scale global macroeconomic model (NiGEM). NiGEM is an estimated model, whose framework is “neo-Keynesian” in the sense that agents’ choices may be assumed to be forward-looking, but with nominal rigidities that slow the process of adjustment to shocks. Financial asset prices are normally assumed to be forward-looking, and affect consumer demand via wealth effects. Monetary policy can be set according to alternative interest rate feedback rules.<sup>2</sup>

Model simulations were conducted to provide a quantitative assessment of the effects of the different policy choices mentioned above. We report the results as answers to the following questions:

1. Was US monetary policy too expansionary for too long in the wake of the 2001 recession? Would a tighter monetary stance have prevented (or at least contained) the housing bubble?
2. Would stricter financial supervision or the use of a macro-prudential policy instrument, acting via the cost of credit, have helped to prevent or contain the bubble?
3. Would the combination of monetary policy tightening and a macro-prudential tool have been effective in dampening house prices? Would it have also helped in reducing the US external

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<sup>2</sup>The main model properties of NiGEM are discussed in Barrell et al. (2004). The structure of the main equations of the model can be found on the Niesr website ([www.niesr.ac.uk](http://www.niesr.ac.uk)).



imbalance?

4. What would have been the effect on US housing prices and America's current account imbalance of an increase in potential output in Japan and Europe and a major rebalancing towards domestic demand (with an appreciation of the currencies that were being pegged to the dollar) in emerging Asia?
5. Would the combination of tighter US policies and a major demand rebalancing (and currency appreciation) in surplus economies have been able simultaneously to address both the US domestic imbalance (housing bubble) and global imbalances?

Overall, our results highlight the complementarity of policy actions in the United States and in surplus countries with respect to the correction of both internal US and global imbalances. In this sense, they support the fundamental assumption underlying the current efforts to rebalance global demand in the context of the G-20 Framework for strong, sustainable and balanced growth (G-20, 2009). The results lend support to the view that if substantial and globally coordinated demand rebalancing had been undertaken in a timely manner, the imbalances would not have accumulated to the extent that they did. Although it is hard to say whether in that scenario the financial crisis might have been avoided, its propagation would probably have been less destructive because both the US financial system and the global economy would have been less vulnerable to it.

In the remainder of the paper, we first review the debate in the literature (Section 2) and the sequence of events that led to the global crisis (Section 3). We then provide an overview of the model and of the simulation design (Section 4). Section 5 reports the results of the simulations and Section 6 concludes.

## 2 The literature

Whether US monetary policy has been too expansionary for too long is at the centre of a heated debate. In his paper at 2007 Jackson Hole Conference, John Taylor considered two alternative paths for the federal funds rate: the one actually observed and a counterfactual path that he considered to be closer to an optimal response (Taylor, 2007). On the basis of a simple model of housing starts as a function of lagged interest rates, Taylor accounted for the boom and subsequent bust in housing, although less pronounced than the one actually observed in the data. With a counterfactual simulation he then showed that, had the Fed simply adhered from 2002 to 2005 to the standard "Taylor rule", the federal funds rate would have been raised more quickly and the boom and bust in housing starts would have been considerably mitigated. In other words, Taylor's counterfactual simulations suggest that the excessively low interest rates set by the Fed were a key cause of the unsustainable housing boom. Similarly, Papell (2010) suggests that the target federal

funds interest rate was too low in 2003-05 even if one uses the real-time GDP deflator in the Taylor rule.

On the other hand, in his speech at the annual meeting of the American Economic Association, Bernanke (2010) claims that if one considers the information available at the time (and especially current estimates of the output gap) monetary policy played at most a modest role in the US housing bubble; consequently, financial regulatory policy should be the appropriate tool for preventing harmful asset price bubbles in the future. In a similar vein, Svensson (2010) argues that, given the information available, there was a genuine and well-motivated fear of the US economy falling into a Japanese-style deflationary liquidity trap, so that a highly expansionary monetary policy would have likely been optimal in such a situation. It may be that the risk of deflation was exaggerated, but there was no way to know this *ex ante*.

At bottom, this is the old controversy on whether monetary policy should react to asset price misalignments.<sup>3</sup> The arguments asserting that short-term interest rates may be ill-suited for this task point out that the impact of a rise in short-term interest rates on the risk-taking propensity of financial market agents cannot be predicted with certainty. When risk premia are adjusting rapidly, whether upwards or downwards, risk-free rates may be an ineffective instrument for influencing risk-taking behaviour (Kohn, 2008). Furthermore, to rein in the growth in banks' balance sheets, monetary policy would probably have needed to throttle economic activity to a pace below that consistent with price stability. This would have resulted in lower output relative to trend and higher unemployment over the period in question. Finally, using interest rates to lean against asset bubbles can de-anchor the private sector's inflation expectations. Persistent deviations of inflation from target can make the central bank's commitment to return inflation to target in the medium term more arduous.

It has been suggested that in order to take the effects of asset price movements into account in a flexible inflation-targeting framework, central banks may need to look further into the future than is normally the case.<sup>4</sup> But since forecasts can only become less precise as the time horizon extends, it is debatable whether trade-offs that depend on forecasts of the distant future and are inherently rather uncertain can be stable enough to provide reliable guidance for current policy decisions. Furthermore, this may be too general a framework to provide actual guidance to monetary policy. If allowed to develop, asset price bubbles and the financial instability that usually accompanies them can eventually destabilize expectations about future monetary policy and inflation, especially if authorities invariably "clean up" once a bubble has burst by easing policy as much as necessary to offset the effects on the economy. Here the crucial point is that the models we use to interpret economic data and to set policy are largely linear, do not pay sufficient attention to leverage, probabilities of default and banks' balance sheets, and are particularly deficient in their treatment of asset prices.

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<sup>3</sup>See, for example, Borio and Lowe (2002).

<sup>4</sup>See, for example, Bean (2003).

Recent IMF research (IMF, 2009; Kannan, Rabanal and Scott, 2009) shows that in some countries there was some correlation between loose monetary policy and house price rises in the years leading up to the crisis, but loose monetary policy was not the main, systematic cause of the boom and consequent bust. However, simulation results suggest that a stronger emphasis on macrofinancial risk could provide stabilization benefits. Strong monetary reactions to accelerator mechanisms that push up credit growth and asset prices could help macroeconomic stability, but a macro-prudential instrument designed specifically to dampen credit market cycles would also be useful. Nevertheless, invariant and rigid policy responses that do not consider the source of the shock (e.g. financial vs. real) raise the risk of policy errors that could destabilize the economy instead of stabilizing it. Hence, discretion would be required.

Other interpretations of the build-up of the crisis emphasize the role of excess saving outside the United States and the channeling of these resources into Treasuries, which put downward pressure on interest rates (e.g. Bernanke, 2009). Low interest rates triggered a search for yield, and the attendant squeezing of risk premia tended to make financial conditions even more favourable for a broad range of borrowers, feeding the house price bubble.

Several explanations have been put forward to rationalize the impact of global savings on long-term interest rates. One strand of this literature, originated by Bernanke (2005), starts out from the reaction of emerging Asian countries to the 1997-98 crisis. The sudden stop in capital inflows and the sharp recession forced Asian countries hit by the crisis to reduce their external deficits. Further, the crisis induced these countries to assign a high priority to accumulating official reserves as a buffer against possible capital outflows. The rapid improvement in their current account positions was assisted by substantial currency depreciation. In several countries the counterpart was a sharp drop in investment (IMF, 2005). In China, however, which had escaped a currency crisis, there was an exceptional increase in saving after 2002. The formation outside the United States of what came to be alternatively called a “saving glut” or an “investment drought” is seen as consistent with the observation that, roughly in the same years, real long-term interest rates worldwide declined to historically low levels and current account imbalances widened dramatically.

Overall, the “excess saving” approach does not explain why emerging countries would channel their additional savings into portfolios biased towards a few assets (mainly US Treasury paper). This is made explicit in the “Bretton Woods II” analysis (Dooley, Folkerts-Landau and Garber, 2003), which emphasizes the deliberate maintenance of undervalued exchange rates pegged to the dollar as part of an export-led growth strategy. This second strand of literature also starts out from the behaviour of a number of emerging countries (not only in Asia) in the aftermath of the Asian crisis, but it focuses primarily on the excessive build-up of foreign exchange reserves. In addition to the emerging economies’ need to guard against the risk of capital account crises, other possible explanations of the rapid reserve accumulation that have been given include the need to provide investors from advanced economies with some kind of “collateral” against major direct investment projects or, alternatively, deliberate “mercantilist” strategies of promoting export-led growth based on price competitiveness.

An alternative interpretation of emerging countries' accumulation of reserve assets is found in a more recent strand of the literature (Caballero, Fahri and Gourinchas, 2008), which focuses on financial globalization, viewed as an ongoing endogenous process of integration between countries at different stages of financial development. According to this view, the United States' unrivalled comparative advantage in terms of financial market deepness, liquidity and legal infrastructure and its position at the financial core of a rapidly integrating world enable it to attract financial investments from fast-growing industrializing economies, which are unable themselves to produce the financial assets needed to store wealth safely. Excess demand for high-quality assets in the periphery thus translates into a global shortage of assets that forces the core country, the United States, into a structural equilibrium characterized by persistent current account deficits and low long-term real interest rates.

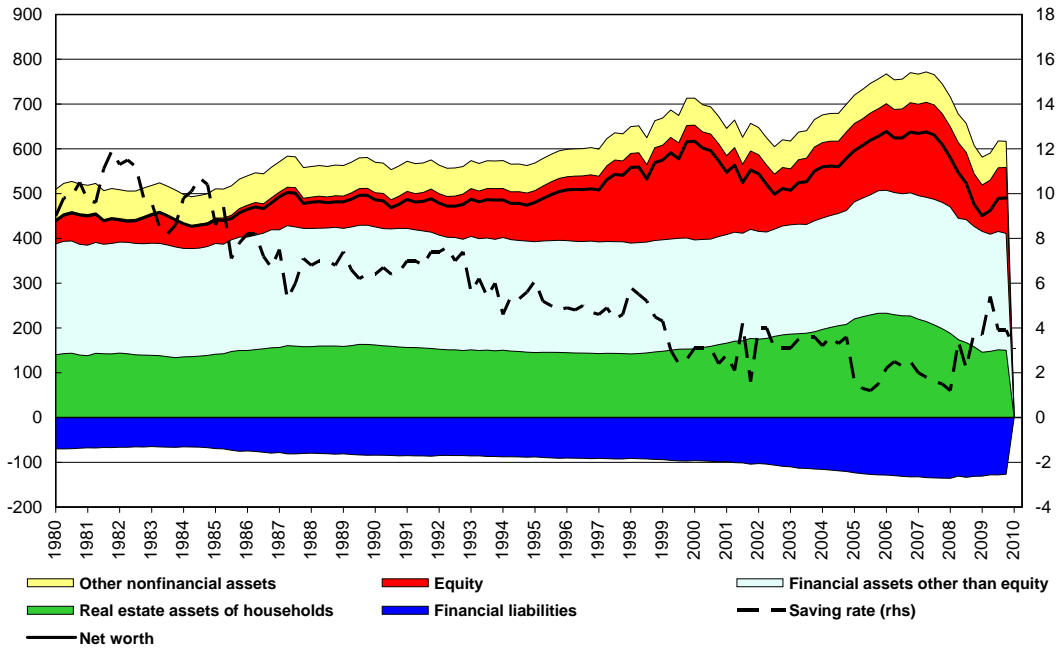
More recently, it has been suggested that only a much broader set of interrelated factors – macroeconomic as well as financial – could have generated a crisis of such magnitude (Visco, 2009). Along similar lines, Bean (2009) concludes that “it would be a mistake to look for a single guilty culprit. Underestimation of risk born of the Great Moderation, loose monetary policy in the United States and a perverse pattern of international capital flows together provided fertile territory for the emergence of a credit/asset-price bubble”. Similarly, Obstfeld and Rogoff (2009) argue that the global imbalances of the 2000s and the global crisis are intimately connected. Both have their origins in the economic policies followed in a number of countries in the 2000s and in distortions that influenced the transmission of these policies through the United States and ultimately global financial markets. The interaction among the Fed's monetary stance, global real interest rates, credit market distortions, and financial innovation created the toxic mix of conditions that made the United States the epicentre of the global financial crisis. Outside the United States, exchange rate and other economic policies followed by emerging markets such as China contributed to the United States' ability to borrow cheaply abroad and thereby finance its unsustainable housing bubble.

### **3 Narrative: the build-up of external and internal imbalances and the role of policies**

The postulate of this paper is that policies played a significant role in sustaining this pattern of unbalanced growth. To be sure, the pattern dates back to the early-1990s, when geopolitical shocks such as the end of the Cold War and technological shocks like the advent of new information and communications technologies hit the global economy. But its economic consequences were magnified a decade later, with the integration of China in the world trading system and the acceleration of financial globalization. To illustrate the role of policies in creating the conditions that eventually led to the global recession, it will be useful to review the sequence of events that marked the last decade.

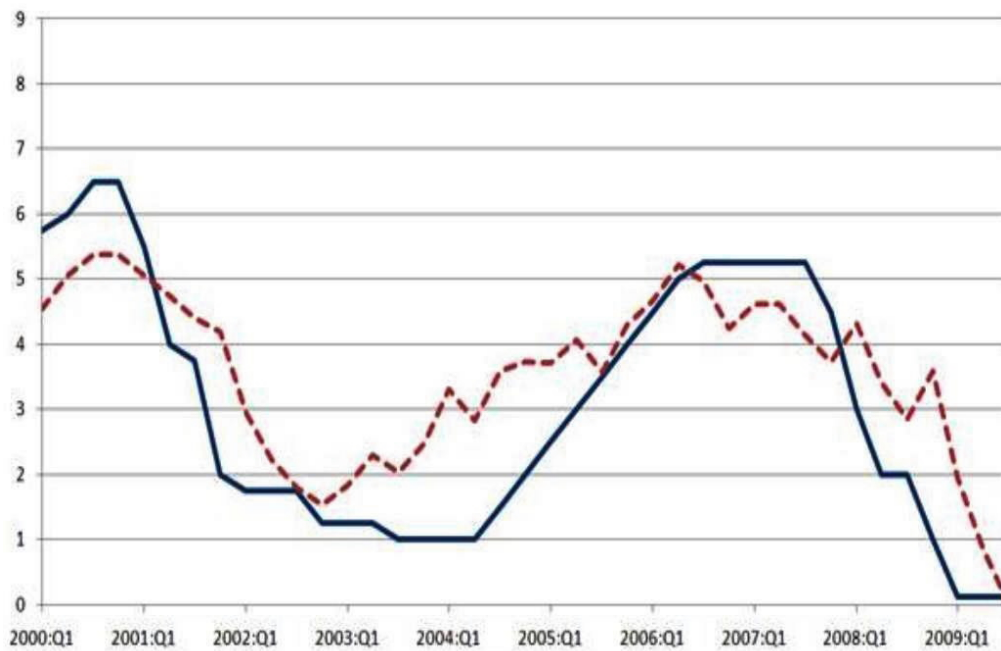
1. The recessionary effects of the bursting of the dot-com bubble in 2000-01 were compounded by the severe shock of the 11 September 2001 terrorist attacks. The Federal Reserve's response was very rapid and accommodating. The drastic reduction in interest rates was accompanied by a strongly expansionary budgetary policy. Monetary policy remained expansionary for a protracted period, facilitating a return to sustained growth in household consumption. The associated decline in the saving rate to close to zero in mid-2000s corresponded to the rise in household sector net worth (Figure 1). A crucial element motivating this policy was the "deflation scare" of 2002-03, when the Fed became highly concerned that monetary policy risked becoming ineffective in a low-inflation environment (Ahearne et al., 2002). With the benefit of hindsight, it has been argued that in that period, thanks to the credit and housing channel, US monetary policy had become more powerful than before (e.g. Muellbauer, 2007) and that, therefore, the federal funds rate was kept too low for too long (Figure 2). This conclusion would apply a fortiori insofar as policy should have reacted to risks to financial stability, which were not being adequately countered by regulatory policies and prudential supervision.
2. By supporting domestic demand, the expansionary US monetary (and fiscal) stance contributed to an unsustainable widening of the US external deficit, matched by growing surpluses in major emerging economies. The current account deficit deteriorated from around 2 per cent of GDP in mid-1996 – close to the average over the previous twenty years – to almost 6 per cent in 2006. Fiscal policy, which turned very expansionary after 2000, largely offset the sharp increase in corporate net saving as the investment boom ended. Households, already net borrowers in the late 1990s, ran increasingly larger saving deficits as the housing boom got under way (Mian and Sufi, 2010). The powerful expansion in US final demand and imports supported the increasingly rapid growth of exports and output in the major emerging economies. The growing US current account deficit was accompanied by ever larger surpluses in emerging economies and in Japan. A significant build-up of official reserves occurred in a context of relatively sluggish growth in domestic demand and, especially in China, of saving rates even higher than the elevated rates of fixed investment. Oil-producing countries also recorded surging trade surpluses, as oil prices were driven up by the expansion of global demand. The unsustainability of these growing current account imbalances was already an issue in the late 1990s; afterwards, only a succession of favourable valuation effects (after 2001, mostly due to the dollar's depreciation) contained the otherwise explosive deterioration in the US net debtor position (Figure 3).
3. A number of Asian and oil-exporting countries that pegged their currencies to the dollar accumulated very substantial official reserves (Figure 4). Their investment in US Treasury paper contributed to lower long-term interest rates. It also facilitated the financing of the growing US current account deficit, whose composition shifted, after the dot-com bubble burst, from mostly private flows (FDI and portfolio equity) to official capital flows coming from countries with limited exchange rate flexibility. The accumulation of official reserves accelerated as China and other emerging countries continued to peg their currencies to the

Figure 1: United States: household sector net worth and saving rate



Source: Federal Reserve (Flow of Funds) and Bureau of Economic Analysis.  
 Notes: quarterly; per cent of disposable income. Other nonfinancial assets include tangible assets owned by non-profit organizations and consumer durables.

Figure 2: The target rate and the Taylor rule prescriptions using real-time GDP deflator inflation



Source: Papell (2010).

Notes: solid line: target rate; dashed line: implied federal funds rate

dollar, which started to depreciate in 2002. Almost 70 per cent of the total increase in foreign exchange reserves registered between 1998 and 2007 is ascribable to emerging Asian and oil-exporting economies. The consensus opinion is that capital inflows lowered long-term US rates by less than one percentage point (Craine and Martin, 2009; Warnock and Warnock, 2006).

4. Low interest rates triggered a search for yield, which squeezed risk premia as long-term rates declined significantly more than the expected future profile of short-term rates (Figure 5). This tended to make financial conditions even more favourable for a broad range of borrowers. Low perceived risk, abundant liquidity and credit expansion, as well as regulatory failures in some markets, helped feed the house price bubble. Ex-ante real interest rates on 10-year US government bonds fell below 2 per cent in 2002 and remained there for several years. One consequence was an increasing search by investors – including international banks, non-US banks and financial vehicles they controlled – for investments with higher risk-return profiles. This stimulated the supply of structured financial instruments backed mainly, though not exclusively, by home mortgages often granted with loan-to-value ratios exceeding 100 per cent, based on the illusion that house prices could only rise. Generally lax financial regulation, whose framework did not even encompass some market segments, played a crucial role. In this environment, housing finance became cheap and attractive, especially variable rate mortgages, and even more so those with teaser rates. Rates on 30-year fixed-rate conventional mortgages declined to just above 5 per cent in June 2003, with almost 3 per cent annual inflation. Housing starts jumped by the end of 2003 and the surge in demand propelled housing prices. The increased ability of households to borrow against their growing home equity was crucial in boosting consumer spending on goods and services as well as housing.
5. Eventually, supply bottlenecks formed in world commodity markets, US monetary policy was gradually tightened, and house prices peaked (Figure 6), whereupon the large risk exposures that had accumulated in the financial system suddenly became apparent and financial turmoil ensued. In fact, the strong expansion of global demand had been accompanied by a rapid increase in the demand for energy and other commodities, particularly in fast-growing emerging economies. Over time, this added to inflationary pressures, and monetary policy in the advanced economies had to be tightened. By late 2006 the rise in US interest rates had induced first a loss of momentum and then a turnaround in house prices. This triggered a domino effect, starting with the structured products based on subprime mortgages. In the summer of 2007 the world economy entered a period of acute financial turmoil, which, despite central banks' prompt and massive response, gradually turned into a global crisis affecting whole industries and economies. The earlier increase in leverage and the various kinds of pro-cyclicality that characterize the behaviour of financial systems amplified the race to deleverage and exacerbated the resulting credit crunch. With the collapse of Lehman Brothers in September 2008, the worst global crisis since the Great Depression became a stark reality.

Figure 3: Cumulated current account balances

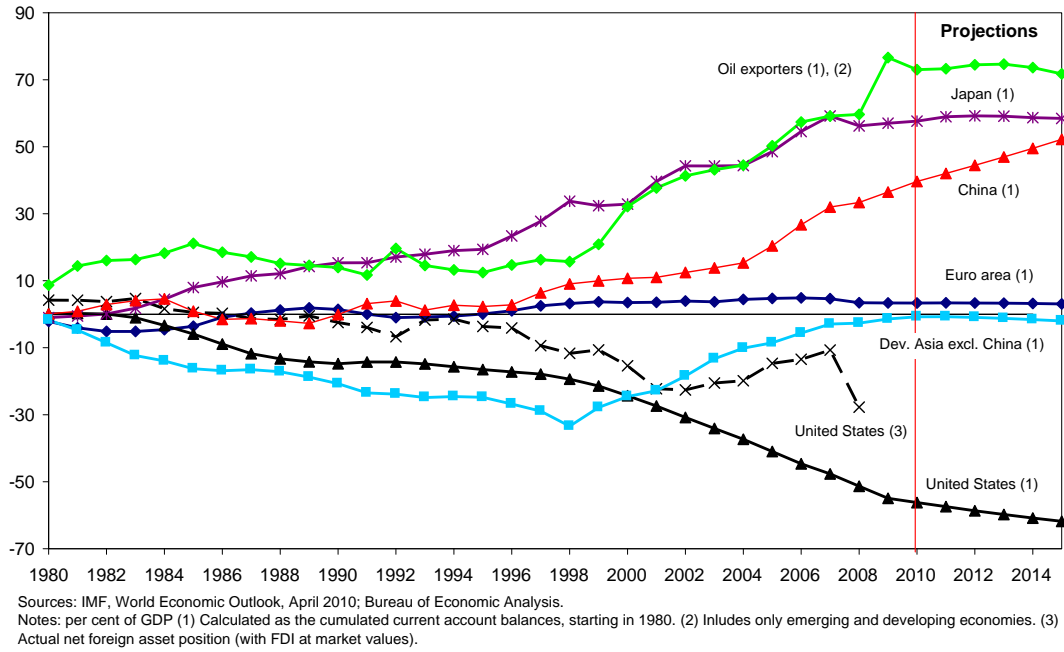


Figure 4: Total reserves minus gold

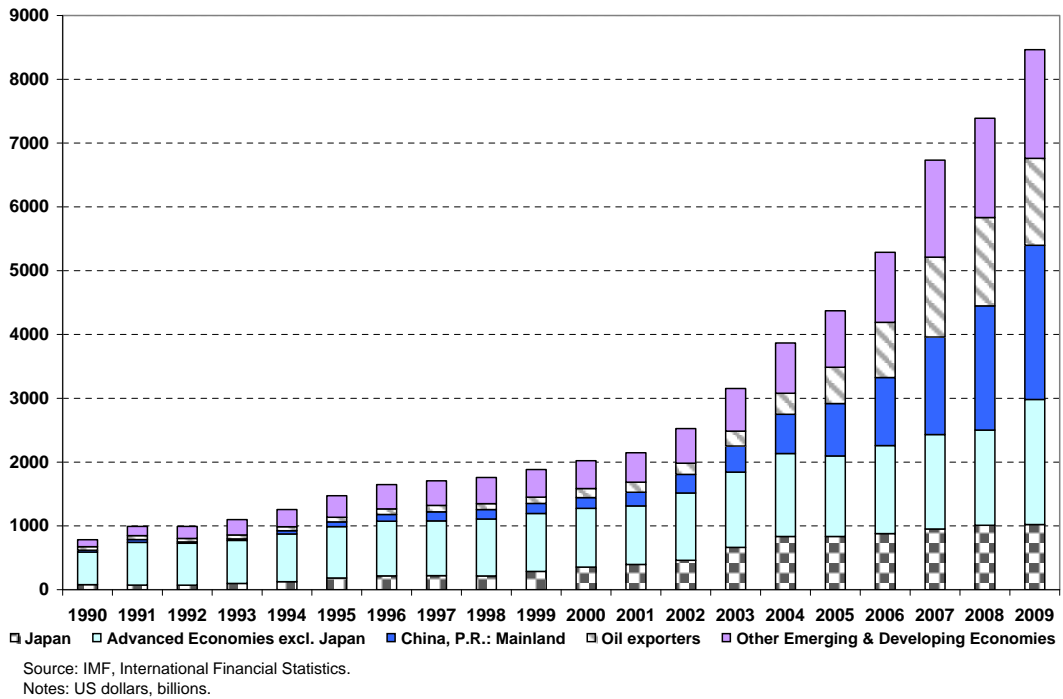




Figure 5: Long- term US Treasury bond yields and expected short-term rates

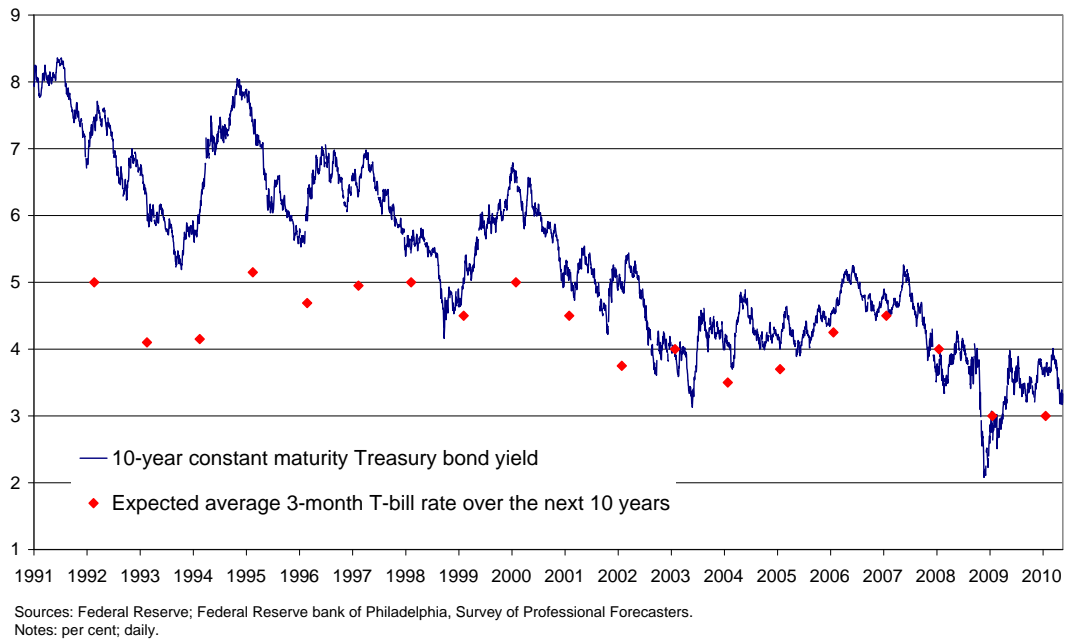
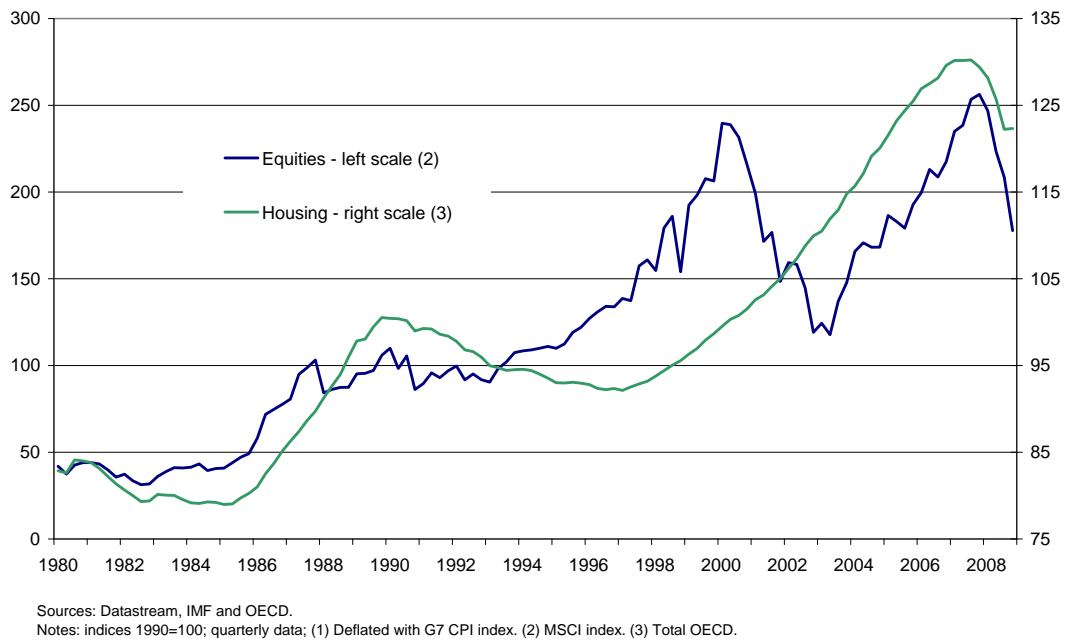


Figure 6: Global asset prices in real terms (1)



As is clear from this simplified overview, two central elements of the story are: (a) an over-expansionary monetary and regulatory stance in the United States, which permitted a protracted, debt-finance consumer spending boom; and (b) the decision of China and other emerging countries to pursue an export-led growth strategy supported by pegging their currencies to the US dollar, resulting in a huge build-up of their official reserves, in conjunction with sluggish domestic demand in surplus advanced economies characterized by low potential output growth.

Both policies were attractive in the short run but ultimately unsustainable. In order to assess their respective contributions, in what follows we perform a series of counterfactual exercises using NiGEM, a large-scale world macroeconometric model, whose characteristics are described in the following section.

## 4 Overview of the model and simulation design

In NiGEM, for most OECD countries there is a specific model containing the determinants of domestic demand, export and import volumes, prices, current accounts and net assets. The rest of the world is modelled through regional blocks: Latin America, Africa, East Asia, Developing Europe, OPEC and a Miscellaneous group comprising mainly countries in West Asia. The non-OECD models are less detailed than the OECD ones.

The core of each of these country models consists of a production function determining output in the long term; a wage-price block; a description of the government sector; consumption, personal income and wealth; international trade; and financial markets. A dynamic error-correction structure is used for the estimated equations, which allows the model to adjust gradually towards equilibrium in response to a shock. In some cases the speed of adjustment depends on expectations as well as the distance from equilibrium. In the steady-state equilibrium, output depends on the production function underlying the model, and the output gap is the deviation of actual from equilibrium output.

Cross-country linkages in NiGEM take place through trade and competitiveness, financial market interactions and international stocks of assets. The model is homogeneous in exchange rates, and demand for exports equals imports across the world. Price competitiveness acts as an important stabilizing feedback on the model, as shifts in domestic price levels or the exchange rate feed into relative trade prices, allowing net trade to offset shifts in domestic demand.

Countries are also linked via their financial markets, as the model describes the structure and composition of financial net worth, emphasizing the role and origin of foreign assets and liabilities as well as the distinction between equity, bond and bank-based assets.

The value of wealth depends on expectations, since bond prices reflect long-term interest rates, which are the forward convolution of short-term interest rates, and equity prices depend

on expected future profits. A method is therefore needed to solve for their current and future values. The extended path method of Fair and Taylor (1983) is used to obtain values for future and current expectations and iterate along solution paths. Expectations are repeatedly recalculated until convergence is achieved.

In what follows several shocks are applied to the model. We assume that agents have full knowledge of the vector of model parameter estimates, future values of the exogenous values are available and all lagged values are known. Agents know the set of shocks and when solving for the dynamic path of the endogenous variables they set all future shocks equal to their expected value of zero (the certainty equivalence assumption is assumed to hold). The model is solved far enough into the future so that the results are not affected by the terminal date. Terminal conditions are standard, and embed steady-state properties where appropriate.

Where NiGEM allows us to choose among alternative simulation options, we have adopted the following ones throughout:

1. Flexible exchange rates are forward looking (and determined according to a UIP condition).
2. Equity prices are forward looking.
3. House prices are backward looking. In the US they are determined according to the following, estimated, equation, which states that in the long run real house prices are cointegrated with a measure of the cost of borrowing:

$$\log(P_t^H) = \log(P_{t-1}^H) - 0.125 \cdot [\log(P_{t-1}^H) - \log(P_{t-1}^C) + \sigma \cdot \log(r_{t-1}^{LR} + \mu_{t-1} + 0.05)]$$

where  $P^H$  is the house price index,  $P^C$  is the consumption deflator,  $\sigma$  is the elasticity of substitution between capital and labour in the production function (set at 0.5),  $r^{LR}$  is the forward real long-term interest rate, and  $\mu$  is the wedge between lending and borrowing rates for households.

4. Long-term real rates are forward looking. Nominal long-term rates are modelled as a convolution of expected short-term rates plus a term spread.

5. Consumption is backward looking in all countries; we experimented with forward-looking consumption without obtaining significantly different results.<sup>5</sup> In both forward and backward-looking consumption equations there is a share of liquidity-constrained consumers, which varies across countries. For example, in the United States it is calibrated to around 15 per cent; it is higher in most other industrialized countries.

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<sup>5</sup>As expected, results are slightly more frontloaded with forward-looking consumption, even if the speed of convergence of simulations is much faster with backward-looking consumption.

6. The inflation rate included as an argument of the monetary policy targeting rules is forward looking.

7. Interest rates are determined endogenously and follow different monetary policy targeting rules. In particular, the United States follows a standard Taylor rule. Monetary policies in the other countries follow a 2-pillar – inflation and nominal GDP – rule (the euro area, United Kingdom, Russia, Canada, Australia, India, Korea, New Zealand, Taiwan and South Africa) or shadow the policies adopted by some other countries (e.g. China’s policy shadows the policy adopted by the US so as to peg its currency to the United States; most non-euro-area European countries shadow the ECB’s 2-pillar strategy). The notable exception is Japan, which follows a price-level targeting rule in order to prevent deflation from leading to real interest rates that are lower than growth rates and hence to explosive paths for the Japanese economy.

8. A fiscal solvency condition is imposed, which stabilizes the budget deficit (as a percentage of GDP) with respect to some target deficit.

9. All individual country models are allowed to respond endogenously to the various shocks that are imposed in the different simulation exercises.

## 5 Counterfactuals

Following the narrative described in Section 3, we concentrate on the period 2002-07.<sup>6</sup> One crucial element concerns how to deal with the “conundrum” of the apparent lack of sensitivity of US long-term interest rates to the gradual rise in short rates, which surprised many observers as it was in sharp contrast with interest rate behaviour during past policy tightening cycles (Greenspan, 2005). Many interpretations (see Rudebusch, Sack and Swanson, 2007, for a survey) have traced it to a decline in the term premium. For instance, Kim and Wright (2005) estimated a three-factor affine model of the yield curve and found that the risk premium on ten-year bonds fell by 0.8 percentage points between 2004 and 2005.<sup>7</sup> As noted by Kohn (2005), the decline in term premia in the Treasury market may have contributed to keeping long-term interest rates relatively low and, consequently, may have supported the housing sector and consumer spending more generally.

In the counterfactuals we follow Craine and Martin (2009) and attribute half of the decline in the term premium to the increase in foreign holdings of Treasury debt. This may be viewed as a conservative assumption with respect to the findings of Warnock and Warnock (2006), who estimate that increased foreign demand in 2004-05 kept the ten-year Treasury yield 0.9 percentage points

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<sup>6</sup>By contrast, Barrell et al. (2008), who also use the NiGEM to simulate a scenario of global imbalances correction via demand rebalancing, take 2007 as the starting point. Their scenario is centred on a large US dollar depreciation driven by a rise in risk premia on US assets, with no exogenous change in US monetary policy.

<sup>7</sup>This estimate is remarkably similar to that obtained by Bernanke, Reinhart and Sack (2004). It is slightly higher than the estimate by Rudebusch and Wu (2007) and lower than that by Cochrane and Piazzesi (2005).

lower than it would otherwise have been. But other studies find that foreign official purchases of Treasury securities play little or no role in explaining the decline in long-term Treasury yields (e.g. Wu, 2008). As suggested by Rudebusch (2010), with the benefit of hindsight, it now appears that the “conundrum” was part of a broader global credit boom characterized by an underpricing of many types of risk, especially for fixed-income securities. Indeed, monetary policy actions may have affected the risk-taking capacity of banks, leading to shifts in the supply of credit (Adrian and Shin, 2008, 2009). Therefore, when we assume a more restrictive monetary policy, we also assume that tighter liquidity conditions would have reduced the appetite for risk (or the search for yield), resulting in higher term premia.

### **5.1 Was US monetary policy too expansionary for too long in the wake of the 2001 recession? Would a tighter monetary stance have prevented (or at least contained) the housing bubble?**

The counterfactual simulation (scenario A) carried out to answer this question is closely modelled on that proposed by Taylor (2007), which assumes that the federal funds rate followed a Taylor rule, smoothed to have the 25-basis-point increments used by the Fed in those years. So the policy rate is assumed to be raised by 25 basis points per quarter, from 1.75 per cent in 2002Q1 to 5.25 per cent in 2005Q3; it then follows the baseline until 2007Q4, after which it is allowed to be endogenously determined. In reality, the federal funds rate was initially lowered to 1 per cent and did not start to be raised until 2004Q2, reaching 5.25 per cent only in mid-2006. We further assume that the term premium on long-term US interest rates increases by 40 basis points by 2005; we assume that the risk premium also increases in the rest of the world.<sup>8</sup> This second assumption can be justified as reflecting the indirect effect of tighter US policy on global liquidity conditions and, by that channel, on risk premia in general (thus removing one possible source of the “conundrum”).

**Results:** Tighter monetary policy leads to lower output (by about one and half percentage points after two years) and lower price level (5 percentage points by the fourth year). Nominal house prices are dampened by more than 4 per cent with respect to the baseline, but because the general price level falls by more than that, the effect on real house prices is expansionary.<sup>9</sup> The tighter monetary policy leads, on impact, to a strengthening of the dollar’s effective exchange rate. The US current account balance (as a percentage of GDP) initially deteriorates before improving modestly with respect to the baseline by end-2007.

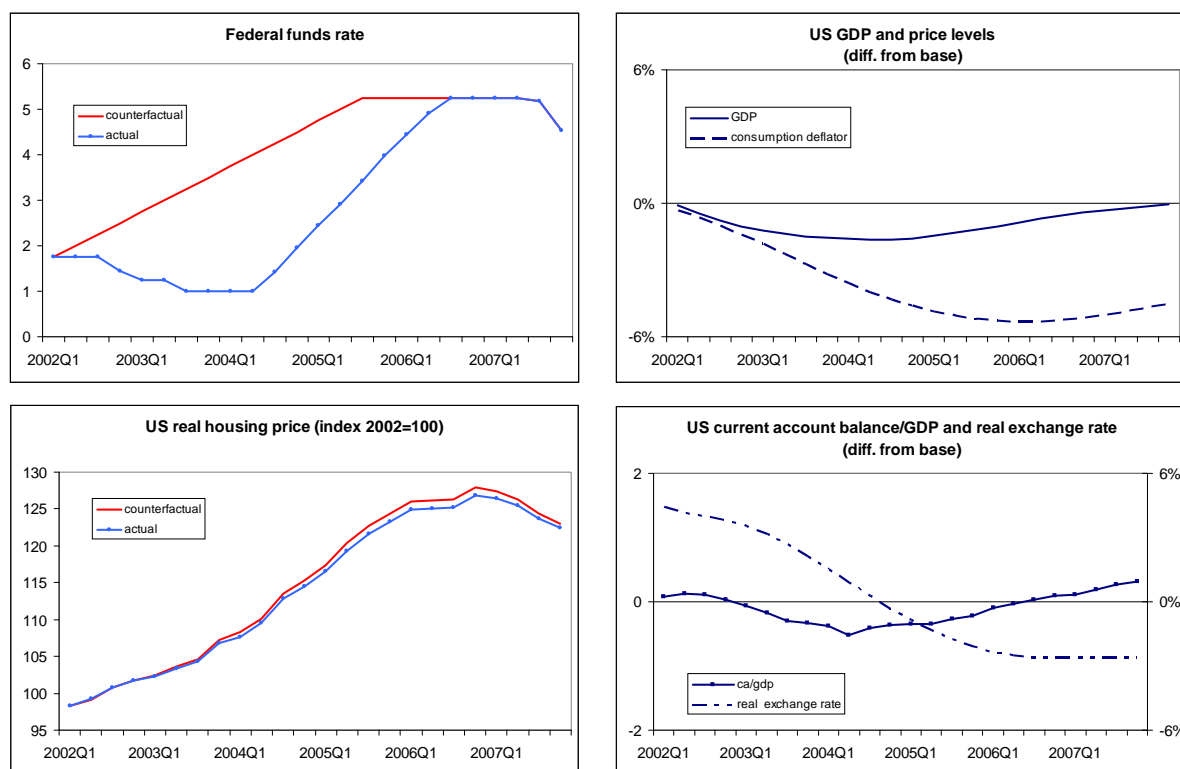
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<sup>8</sup>For example, the increase is equal to 40 basis points in the euro area and somewhat lower (25 basis points) in Japan.

<sup>9</sup>Del Negro and Otrok (2007) calculate that expansionary monetary policy accounts for less than one percentage point of the average growth rate in real housing prices in 2001-05 (6 percent per year). Iacoviello and Neri (2010) estimate that between 1998 and 2005 monetary policy can account for 2.1 percentage points of the increase in real house prices in excess of a deterministic trend (cumulatively equal to 13.9 percentage points).

Overall, it appears that the tighter US monetary policy suggested by Taylor (2007), coupled with an increase in the term premium on long bonds, would have not avoided the house price bubble and would have produced at most a small dent in the US external deficit. However, it can be argued that a large component of the appreciation of housing prices came through self-fulfilling expectations of price increases, in which case the effect of monetary policy on housing prices reported above would just represent a lower bound, since the equation that describes the evolution of housing prices does not incorporate such a mechanism. In fact, in a model that allows for self-fulfilling expectations, a front-loading of the monetary restriction could have significantly dampened the prospect of future price growth.

Figure 7: Scenario A (Taylor, 2007)



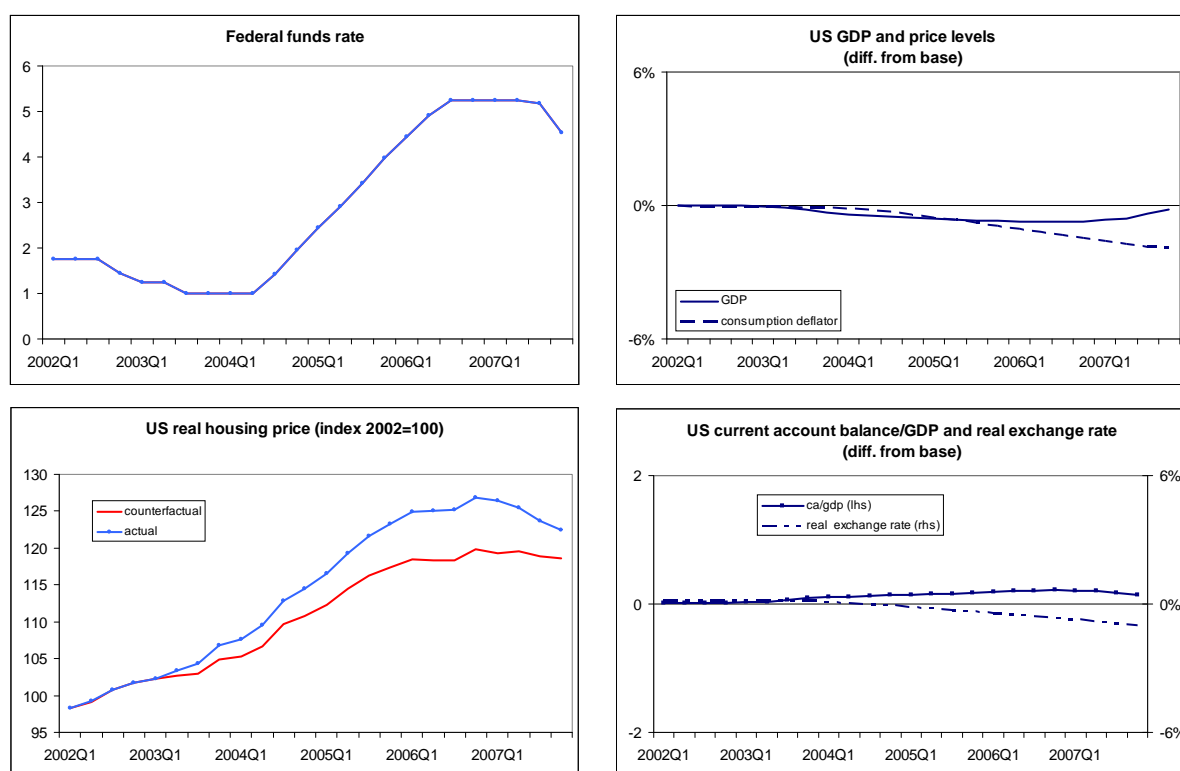
## 5.2 Would stricter financial supervision or the use of a macro-prudential policy instrument, acting via the cost of credit, have helped prevent or contain the housing bubble?

As in the analysis conducted by the IMF (2009), the model is insufficiently rich to specify the nature of banking supervisory or macro-prudential tools explicitly (banks are not explicitly modelled, for example). So we assume that the policymaker had access to an instrument that affects mortgage credit spreads directly. This is a simple shortcut intended to mimic the effects of, say, regulations that require banks to set aside more capital as asset prices rise, thus raising the margin that banks have to charge over funding costs. We maintain that it is equivalent, for instance, to regulatory

limits on loan-to-value ratios.

In counterfactual scenario B the credit spread incorporated in mortgage rates is raised progressively by 1.5 percentage points in 2003Q1-2004Q2, and by an additional 0.5 percentage point until 2006Q1; it is then assumed to return to the baseline by early-2007.<sup>10</sup> The cost of capital for the business sector is not directly affected. This policy shock is calibrated so as to keep the cost of mortgages in 2002-07 close to the average recorded in the 1990s. Monetary policy is allowed to follow the baseline.

Figure 8: Scenario B (macro-prudential)



**Results:** Because this macro-prudential tool is specifically targeted to the mortgage market, it affects real house prices but has a limited (and only indirect) impact on other macroeconomic variables. The effect on real house prices is significant: by 2007 they are more than 5 per cent lower with respect to the baseline. The effect on nominal prices is slightly greater (-7 per cent), but is partly offset by lower inflation, which is the result of this policy’s dampening effect, via a negative wealth effect, on consumption demand and output. The improvement in the current account balance is minimal – about 0.2 percentage points of GDP by 2007.

<sup>10</sup>Such a path for the lending wedge was designed to increase the cost of mortgages when housing prices were increasing particularly fast.

### 5.3 Would the combination of monetary policy tightening (perhaps somewhat less aggressive than in the first exercise) and a macro-prudential tool have been effective in dampening house prices?

Counterfactual scenario C combines the main features of the previous two scenarios, with some modifications designed to avoid the deflationary impact of scenario A while enhancing the effect on housing markets. The policy tightening is assumed to begin one year later (2003Q1), with the federal funds target starting from a lower initial level (1.5 per cent) and reaching 3.75 per cent in 2005Q2; the policy rate is then allowed to remain constant for other two quarters, when it crosses the baseline, and to be determined afterwards by a Taylor rule. Until 2005Q4, this path for the federal funds rate is very similar to the path that would have been obtained had the Fed followed a Taylor rule using real-time data on changes in the GDP deflator as the inflation measure (as in the original Taylor rule specification), as suggested by Papell (2010). The term premium also increases, as in scenario A. In addition, the credit premium on mortgage rates is increased starting in 2003Q1, as in scenario B.

**Results:** The dampening effect on house prices is stronger: at their peak in 2007 real house prices are about 6 per cent lower than in the baseline. The cumulative adverse effect on output is slightly more than 1 per cent by the third year of the simulation. On the other hand, the disinflationary effect obtained in the first scenario is now much more muted. The current account balance improves by almost half a percentage point of GDP, reflecting both the increase in domestic saving and the depreciation of the dollar.

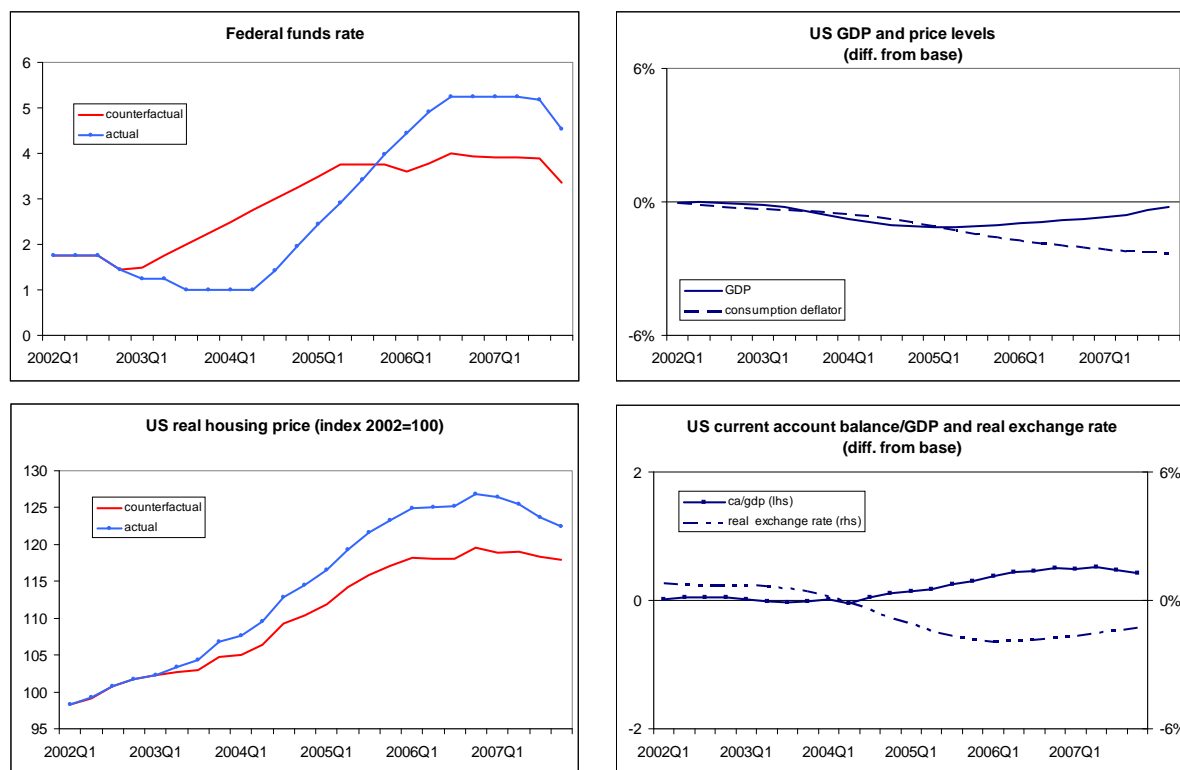
This scenario suggests that an appropriate combination of tighter US monetary policy and additional credit restraint resulting from an aggressive use of macro-prudential policy tools could have dampened the housing boom (cutting the total rise in real house prices between 2002 and 2006 by one-third) and would have made a dent in the US external imbalance. However, this would have been achieved at the cost of somewhat lower output. Moreover, the improvement in the current account deficit, though not trivial, would have presumably been too small to eliminate the risk of a disorderly correction. The decline of activity in the United States would have spilled over to the other main areas, where GDP falls permanently below the baseline. To avoid such an outcome, these economies would have had to implement policies to cope with the adverse effect of the shortfall in their external demand.<sup>11</sup> Therefore, we turn next to exercises that include a rebalancing of demand outside the United States.

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<sup>11</sup>In the simulation, the only offsetting endogenous policy changes allowed are to monetary policy. After three years it becomes more expansionary in Europe and Japan, where it soon hits the zero lower bound.



Figure 9: Scenario C (tighter US monetary and supervision policies)



#### 5.4 What would have been the effect on US housing prices and America's current account imbalance of an increase in potential output in Japan and Europe and a major rebalancing toward domestic demand (with an appreciation of the currencies that were being pegged to the dollar) in emerging Asia?

In counterfactual scenario D we assume that major advanced economies suffering from particularly sluggish growth enact supply-side reforms that enhance their potential output; this would also endogenously boost their domestic demand. Specifically, in Japan and the three major euro-area countries (Germany, France and Italy) we would ideally want to assume a productivity enhancement in nontradables (e.g. Koske and Wörgötter, 2010). This, in turn, would augment domestic demand via wealth effects. However, since NiGEM is a one-good model, we take a short-cut and increase potential output directly. The size of the shock is calibrated so as to raise potential output growth to 2.5 per cent in 2002-07, which is roughly equal to potential output growth in the United States in the same period.<sup>12</sup> Thereafter, counterfactual potential growth is assumed to stabilize gradually at an average between the United States' and the country's baseline potential growth. Ultimately, over the entire period, potential output growth exceeds the baseline by 0.7 percentage points in Japan, 0.5 points in Germany and 0.3 points in France and Italy.

<sup>12</sup>Country risk premia are assumed to remain at average levels recorded in 1991-2001.

In emerging countries, instead, we assume a broad range of economic reforms – macro-fiscal management, governance – that directly rebalance growth towards domestic demand. In particular, in China and other surplus emerging Asian economies, domestic demand is assumed to shift upwards between 2002Q1 and 2007Q4 by an amount equal to net exports; after that, it is allowed to revert very gradually to the baseline. These assumptions are meant to capture a genuine rebalancing towards domestic demand, carried out through enhanced welfare state reforms aimed at reducing precautionary saving (Blanchard and Giavazzi, 2006, Baldacci et al., 2010) or corporate governance reforms able to reduce firms’ retained earnings.

At the same time, in China and other surplus emerging Asian economies the path of the exchange rate is calibrated so as to ensure that the counterfactual path of output and inflation remains as close as possible to the baseline.<sup>13</sup> In other words, a real appreciation is engineered to ensure that the excess domestic demand is directed towards imports and domestic macroeconomic balance is maintained. In Japan and the euro area, which like all advanced economies have a fully modelled monetary policy reaction function in NiGEM, the reaction of the exchange rate occurs endogenously, though with some lags, via the induced changes in monetary policy rates.

Finally, we also assume an increase in the term premium on US bonds of 0.4 percentage points starting from 2004. Given the other assumed policy changes, this should reflect the lower demand for US Treasuries coming from official authorities, consistent with the estimates of Craine and Martin (2009). As in scenarios A and C, we assume that the term premium also increases in the rest of the world.

This scenario is designed to assess the “global savings glut” hypothesis, which asserts that if the surplus countries had saved less, US monetary policy could have been tighter, US consumers would not have needed to act as “consumers of last resort” and global interest rates would have been higher. Thus, according to this view, both the large global imbalances and asset price bubbles could have been significantly reduced.

**Results:** In the United States, the global shock forces monetary policy to be more restrictive than in the baseline, by about three-quarters of a percentage point in the first 3 years. The dampening effect on real house prices reaches 3 per cent by end-2007. The shocks drive real interest rates permanently higher. US consumers react to the negative wealth effect on asset prices (due to higher real rates) and also to the fall in their incomes, and immediately reduce their spending. As a result, US output falls, and although growth rates later return close to the baseline, the decline in the output level is permanent. In addition, the US price level increases permanently, although inflation returns to the baseline after 3 years. Higher demand for US exports and the fall in domestic demand, together with the depreciation of the dollar (by about 2 per cent on impact and almost 4 per cent by end-2007), cause the US current account balance to improve by more than 1 percentage point of GDP by end-2007.

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<sup>13</sup>This allows, among other things, for an appreciation of the renminbi vis-à-vis the U.S. dollar by an amount cumulatively slightly larger than 20 per cent.

Figure 10: Scenario D (US)

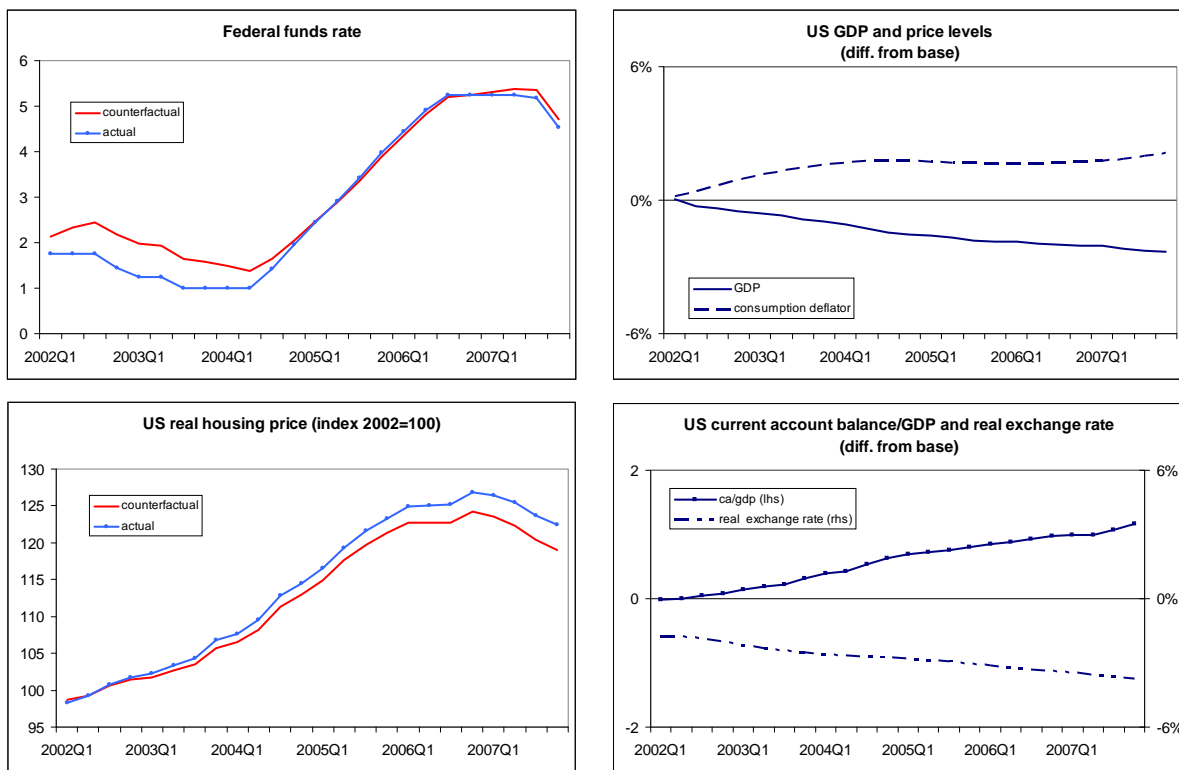
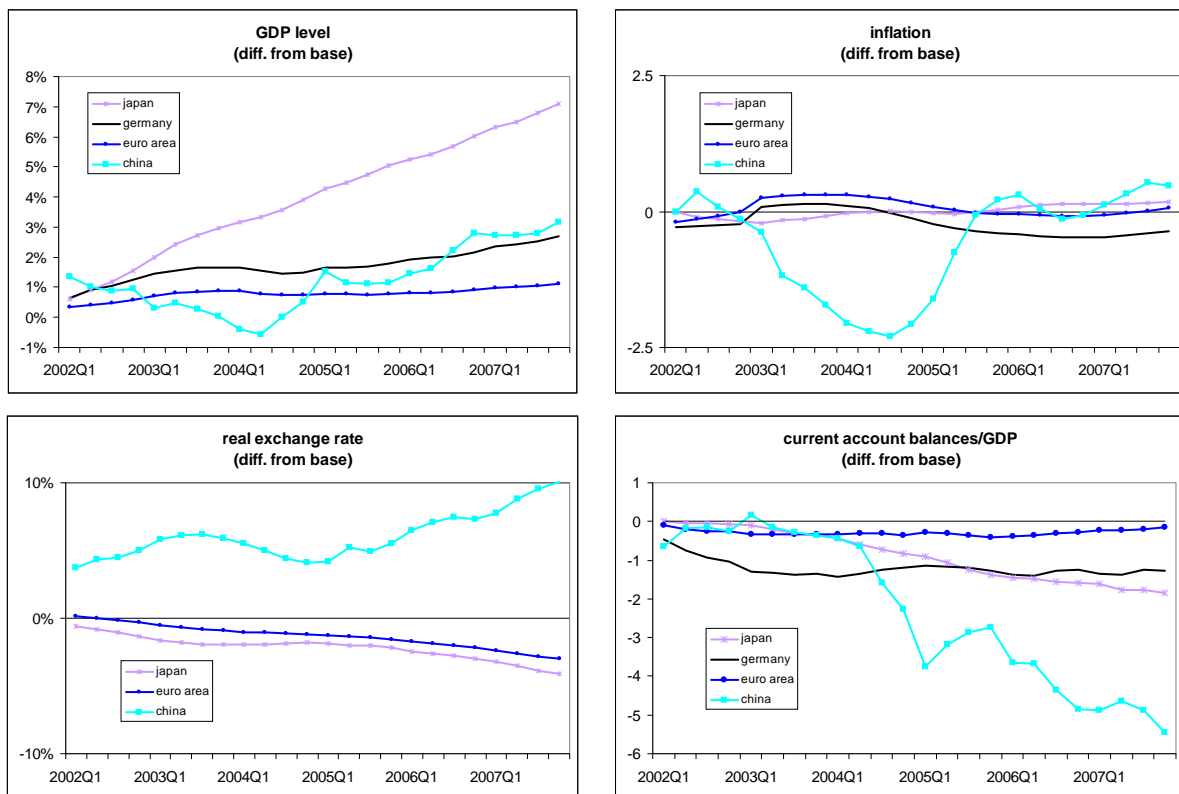


Figure 11: Scenario D (other major economies)



These stagflationary effects are also due to the increase in the oil price induced by the rebalancing of global demand towards oil-consumption-intensive countries (especially China). In fact the oil price increases by 3 per cent in US dollars relative to the baseline in the first year and then progressively rises (following the evolution of world demand) to 9 per cent above the baseline after 10 years.

In Japan, the higher potential output deepens deflation on impact, but just slightly. The expansionary effect of the increase in domestic demand is only partially offset by the fall in equity prices, due to expectations of a long-lasting monetary tightening (even though the actual policy tightening occurs only several years later, since policy rates were initially above the desired level owing to the zero lower bound). Thus, the deviation of output from the baseline is substantial. The large increase in domestic absorption causes the current account surplus to shrink relative to the baseline by almost 2 percentage points of GDP by 2007.

In Germany too, the shock to potential output pushes inflation slightly below the baseline. Output growth jumps above the baseline on impact and then slows down, but remains persistently above the base. For the euro area as a whole, the net effects are more limited (output rises permanently above the baseline, by 1 percentage point by end-2007). Germany's external surplus shrinks by 1.3 percentage points of GDP by 2007. The euro area's external balance changes very little.

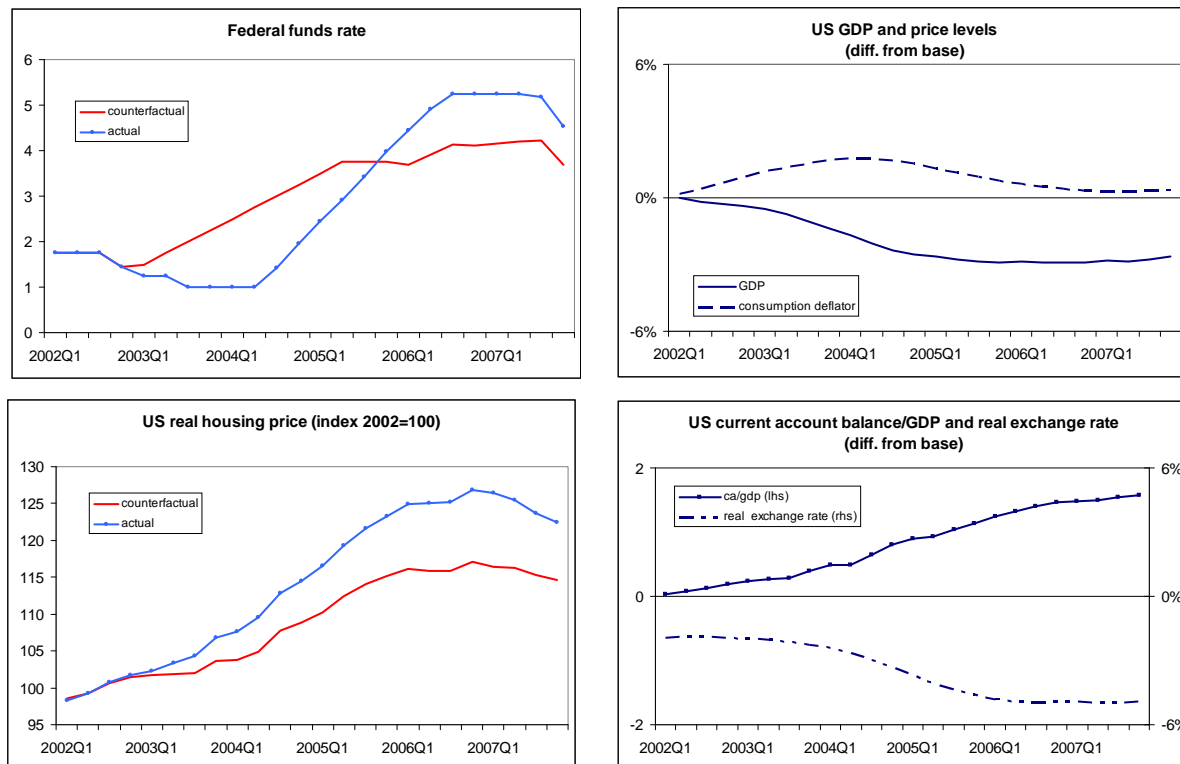
In China, output remains close to the baseline, as the domestic demand shock is offset by the exchange rate appreciation; the (calibrated) renminbi appreciation required to do that is on impact, relative to the baseline, of the order of 6 per cent with respect to the US dollar and a little more than 20 per cent by end-2007 (but just 10 per cent in real effective terms). The reduction in China's current account surplus is small initially, but increases progressively after 2004 and exceeds 5 percentage points of GDP by 2007.

### **5.5 Would the combination of tighter US monetary and supervisory policies and a major demand rebalancing (and currency appreciation) in surplus economies have addressed both the US domestic imbalance and global imbalances simultaneously?**

Scenario E combines the changes introduced in scenarios C and D: in addition to a monetary tightening and a credit tightening via macro-prudential policy tools in the United States, there is a large increase in potential output in Japan and the larger-euro area countries and a rebalancing towards domestic demand, accompanied by an exogenous currency appreciation, in China and other Asian surplus economies that peg to the dollar. Furthermore, due to the tighter policy stance in the United States and the reduced demand for US Treasuries coming from official authorities, from 2004 onwards the term premium on long-term bonds increases everywhere by 0.8 percentage

points.<sup>14</sup>

Figure 12: Scenario E



**Results:** In the United States, the contractionary effect of tighter monetary policy is compounded by the increase in real interest rates due to the global demand shock and the higher term premium. Accordingly, output falls by more than in both scenarios C and D (about 3 percentage points relative to the baseline by 2005). The increase in the price level is transitory and disappears after the third year of the simulation.

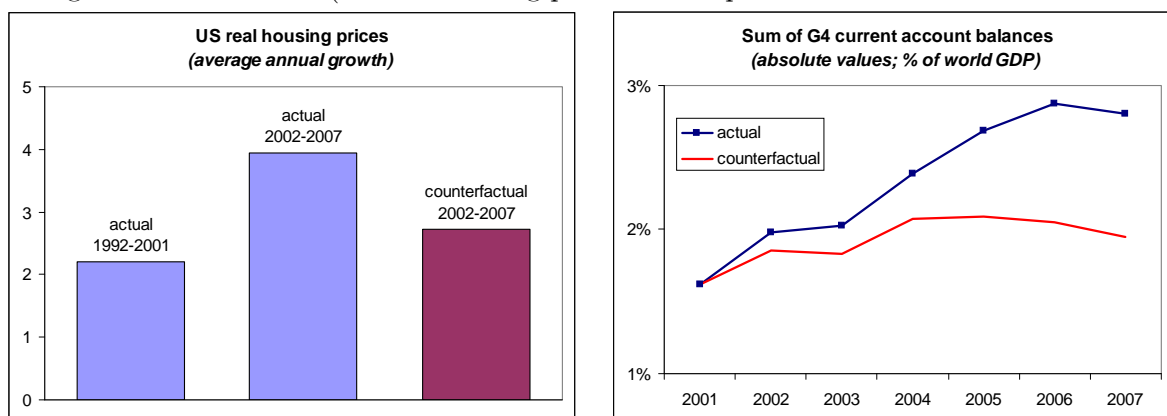
The effect on real house prices is substantial: by end-2006 they are 8 percentage points lower than the baseline. Their cumulative increase between end-2001 and the peak (2006Q4) is cut by 11 percentage points relative to the baseline (from 31 to 20 per cent). This means that while real house prices actually increased by almost 4 per cent per year in the six years between 2002 and 2007, according to the counterfactual in the same period they would have increased by 2.7 per cent per year, which is much closer to the average annual growth in the previous decade (2.2 per cent, Figure 13, left-hand panel).

The improvement in the US current account deficit comes to 1.6 percentage points relative to GDP by end-2007. The implied real depreciation of the dollar amounts to less than 5 percentage points by end-2007. The improvement in the current account also continues in the remaining years of the simulation exercise, when it exceeds 2 percentage points.

<sup>14</sup>Except in Japan, where the increase in the term premium is assumed to be somewhat smaller (50 basis points).

In the rest of the world, the effects on output and on current account imbalances are not substantially different from those described under scenario D, with a somewhat larger current account adjustment in Japan. As a consequence, in 2001-07 the dispersion of current account balances – measured as the sum of the absolute values of the current account balances of the US, Japan, Germany and China (G4) scaled by world GDP – would have remained almost flat, whereas it actually doubled (Figure 13, right-hand panel). As in the previous scenario, monetary policies and real exchange rates are little changed both in Europe and Japan.

Figure 13: Scenario E (US real housing prices and dispersion in current account balances)



## 6 Concluding remarks

Was the Great Recession avoidable? It is probably impossible to tell, but this paper shows that with a different set of economic policies in various areas of the world the global environment could have been substantially different. In particular, had monetary and supervision policies been less expansionary in the United States, had policies enhancing potential output growth been implemented in Japan and Europe, and had policies conducive to rebalancing towards domestic demand been pursued in emerging Asian economies, in combination with enough exchange rate flexibility to maintain domestic balance, the pattern of current accounts would have been considerably more balanced and US housing prices would have grown at a much slower pace. For the United States, the cost of these policies would have been lower output and temporarily higher inflation, but the loss in output (less than 3 percentage points below the baseline in 2006) is half as big as the output loss at the trough of the recession (6 percentage points relative to the pre-crisis trend in 2009Q2). All in all, the slower US GDP growth could be viewed as an insurance premium for avoiding the costs of the recession and the subsequent large increase in public debt in order to offset the weakness in private demand and the effects of financial sector deleveraging. For the other major economies the rebalancing of global demand, through a shift towards greater reliance on domestic demand in China and an increase in potential output growth in Europe and Japan, would have compensated the slowdown induced by tighter US monetary and supervision policies, helping markedly to mitigate the international distortions that facilitated the build-up of the crisis.

The fundamental macroeconomic imbalances that lay at the root of the financial turmoil have not been righted by the consequent global recession. After a temporary narrowing induced by the rise in US private sector saving and the sharp fall in investment, partly offset by a larger public sector deficit, the US current account deficit is again on the rise according to IMF projections. Exchange rate movements have not generally supported the correction of imbalances. In effective terms the dollar is stronger than it was in July 2007. This scenario is complicated by the huge accumulation of public debt, which could lead to higher borrowing costs if markets became concerned about its sustainability, and the protracted period of very low policy interest rates and abundant liquidity, which could end up fuelling new asset price bubbles, thus creating the conditions for the next crisis.

The importance of achieving a major rebalancing of global demand through policies aimed at a more sustainable pattern of growth has not been reduced with the crisis.

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