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A STRUCTURAL VAR APPROACH

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CONTENTS

Abstract

Since the late-1990s, the global economy is characterised by historically low risk premia and an unprecedented widening of external imbalances. This paper explores to what extent these two global trends can be understood as a reaction to three structural shocks in different regions of the global economy: (i) monetary shocks ("excess liquidity" hypothesis), (ii) preference shocks ("savings glut" hypothesis), and (iii) investment shocks ("investment drought" hypothesis). In order to uniquely identify these shocks in an integrated framework, we estimate structural VARs for the two main regions with widening imbalances, the United States and emerging Asia, using sign restrictions that are compatible with standard New Keynesian and Real Business Cycle models. Our results show that monetary shocks potentially explain the largest part of the variation in imbalances and financial market prices. We find that savings shocks and investment shocks explain less of the variation. Hence, a "liquidity glut" may have been a more important driver of real and financial imbalances in the US and emerging Asia than a "savings glut".

JEL No.: E2, F32, F41, G15.

Keywords: Global imbalances; global liquidity; savings glut; investment drought; current account; structural VARs.

Non-technical summary

Since the late-1990s, the global economy is characterised by two largely unprecedented phenomena. The first is the benign financial market environment, low long-term interest rates, low risk aversion, the hunt for yield, and the perceived abundance of global liquidity, all of which prevailed at least until the turmoil episode that hit global financial markets during the summer of 2007. The second is the widening of external imbalances, in particular the increasing current account deficit in the United States and the corresponding pick-up in current account surpluses of emerging Asian economies. While widening external imbalances have been extensively studied in the literature, global liquidity has been more loosely defined, for example as the total stock of foreign exchange reserves or monetary aggregates in the major economies, and has received relatively limited coverage.

One challenge in assessing trends in global liquidity and widening imbalances is the identification of underlying structural drivers. Are global liquidity and imbalances policy-driven phenomena, and are they in particular related to the path of monetary policy in major economies? Are they driven by real economy shocks, such as increased savings in oil exporting and Asian economies? What is the role of financial market structures, in particular the incomplete nature of those markets in emerging economies?

This paper has a closer look at three alternative explanations for the observed fall in risk aversion in financial markets and the widening of external imbalances since the mid-1990s. A first hypothesis is that monetary shocks to the global economy have contributed to the widening of external imbalances and driven up global asset prices. A second hypothesis corresponds to the view that a drop in saving propensities in the US relative to the rest of the world has triggered a surge in capital flows to the US and an attendant compression of US bond yields. The third hypothesis reflects the view that more dynamic behaviour of investment in the US relative to the rest of the world, helps explain the benign global financial conditions and the observed pattern of imbalances.

In order to differentiate these three structural shocks in the data, this paper applies an empirical strategy, based on structural vector autoregression using sign-restrictions to identify the structural shocks, that allows for the unique and simultaneous identification of underlying structural shocks that takes into account the general equilibrium conditions relating investment decisions, saving behaviour, and financial market conditions.

Our findings show that, among our three potential candidates, monetary shocks appear to have the largest impact. In particular, they seem to be an important driver for current account balances in the US but also emerging Asia, thus rendering support to the view that ample liquidity has contributed to the build-up of large external imbalances. Further, monetary shocks account for a substantial fraction of the worsening of the US current account in the mid-1980s and the early 2000s. Preference shocks particularly in Asia but also in the US (of an opposite sign) seem to be a somewhat less important factor, while our results find no evidence in favour of the "investment drought" hypothesis.

1 Introduction

Since the late-1990s, the global economy is characterised by two largely unprecedented phenomena. The first is the benign financial market environment, low long-term interest rates, low risk aversion, the hunt for yield, and the perceived abundance of global liquidity, all of which prevailed at least until the turmoil episode that hit global financial markets during the summer of 2007. The second is the widening of external imbalances, in particular the increasing current account deficit in the United States and the corresponding pick-up in current account surpluses of emerging Asian economies.

While widening external imbalances have been extensively studied in the literature, global liquidity is more loosely defined and has received relatively limited coverage. It has been used to refer to the total stock of foreign exchange reserves (Clark and Polak, 2004; King, 2005), the sum of those reserves and the US money base (Economist, 2005 and 2007), monetary aggregates in the major economies, (Delozier and Hissler, 2005; Rüffer and Stracca, 2006), or monetary aggregates summed into a global index (Anderson, 2007; Baks and Cramer, 1999; International Monetary Fund, 1999). To clarify terminology, a number of authors propose a distinction between financial market liquidity and macroeconomic liquidity or between price-based and quantity-based indicators of global liquidity (International Monetary Fund, 1999 and 2007).

Adding to the complexity of any study of global liquidity, the phenomena of perceived ample global liquidity and widening external imbalances are clearly related. By way of example, Bernanke's (2005) savings glut hypothesis, postulating that the global economy has experienced a positive savings shock, has implications for both global financial markets, as it may induce a reduction in risk premia, and external imbalances, as it may lead to widening surpluses in those regions exhibiting a shock. Similarly, the view that parts of the world have limited capacity in generating financial assets (Caballero, Farhi and Gourinchas, 2006) may help explain the search for yield and the increasing external imbalances.

One challenge in assessing trends in global liquidity and widening imbalances is the identification of underlying structural drivers. Are global liquidity and imbalances policy-driven phenomena, and are they in particular related to the path of monetary policy in major economies? Are they driven by real economy shocks, such as increased savings in oil exporting and Asian economies? What is the role of financial market structures, in particular the incomplete nature of those markets in emerging economies?

Disentangling these underlying drivers is an important, but difficult task. This paper has a closer look at three alternative explanations for the observed fall in risk aversion in financial markets and the widening of external imbalances since the mid-1990s:

1. **Monetary shocks**. This class of shocks encompasses the view that the widening US current account deficit partly reflects monetary policy shocks (see e.g. Bems, Dedola and Smets, 2007) and the view that globally loose monetary policy has driven up global asset prices.

2. **Preference shocks**. These shocks correspond to the view that a drop in saving propensities in

the US relative to the rest of the world has triggered a surge in capital flows to the US (savings glut hypothesis of Bernanke, 2005) and an attendant compression of US bond yields (Warnock and Warnock, 2007).

3. **Investment shocks**. This comprises the idea that more dynamic behaviour of investment in the US relative to the rest of the world (investment strike hypothesis, see e.g. International Monetary Fund, 2005), helps explain the benign global financial conditions and the observed pattern of imbalances.

Clearly, these three shocks may not be sufficient to explain the full dynamics of global imbalances or global financial markets. Fiscal policy shocks, productivity shocks, asset price shocks, and oil price shocks, may all have played a role in the build-up of imbalances. Still, this article chooses to keep a focus on the three shocks mentioned above, as these three shocks have received relatively limited attention, while some alternative shocks have already been covered extensively in the literature.[1]

How can one differentiate these three structural shocks in the data? The challenge with our empirical exercise is the unique and simultaneous identification of underlying structural shocks that takes into account the general equilibrium conditions relating investment decisions, saving behaviour, and financial market conditions. Our approach is to estimate a structural vector autoregression (sVAR) model, where the structural shocks are identified through sign restrictions. This approach follows the methodology developed inter alia by Canova and de Nicoló (2002), Uhlig (2005) and Mountford and Uhlig (2005). Structural shocks are identified by verifying whether the signs of the corresponding impulse responses, for some periods following the shock, are in line with broadly accepted theoretical priors.

The sign restrictions approach is particularly well suited for the problem at hand, as it allows to be agnostic on the impact of structural shocks on a number of variables of interest, namely the current account as a measure of external imbalances and long-term interest rates and equity prices as a measure of financial conditions. We restrict other variables in the model, using priors that are based on conventional results from standard open economy dynamic stochastic equilibrium (DSGE) models. This allows to identify the structural shocks on the basis of a minimal set of economically meaningful restrictions, and to test for the significance, sign, and persistence of the impact of these structural shocks on the unrestricted variables.

In implementing our estimation strategy, we focus on two major country blocks, the United States and emerging Asia, using quarterly data between 1975 and 2006. These two country blocks are selected as they correspond to those areas where imbalances have widened particularly strongly over the past years. We provide estimates for each region individually as well as in relative terms, comparing the US relative to emerging Asia.

[1] See, for instance, Bems, Dedola and Smets (2007), on fiscal policy and technology shocks, Erceg, Guerrieri and Gust (2005) on fiscal policy shocks, and Fratzscher, Juvenal and Sarno (2007) on asset price shocks.

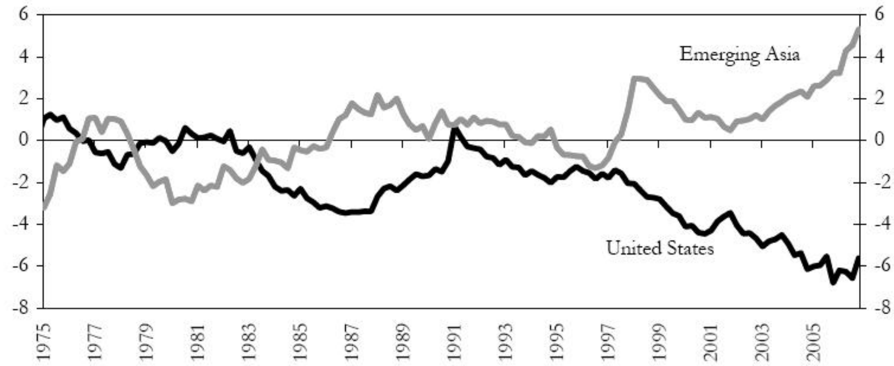
Our results suggest that, among the three drivers examined in this paper, the strongest driver of widening external imbalances are positive monetary shocks in the United States. For emerging Asia, preference shocks appear to play an important role in explaining the widening current account surpluses.

The paper first recalls some trends in global liquidity and global imbalances and puts in context some findings of related literature (Section 2). It then outlines the econometric approach to identify the three shocks and briefly presents the dataset used for the estimations (Section 3). Impulse response analysis is carried out in Section 4 and Section 5 provides a counterfactual analysis of our results against historical developments. Finally, Section 6 concludes.

2 Excess liquidity, the savings glut, and global imbalances

Global imbalances have widened considerably over the past decade. As one measure of these imbalances, Figure 1 plots the current account positions of the United States and emerging Asia, expressed in percent of domestic GDP (data are described in more detail in Section 3). Over the past ten years, current account trends in these two regions have strongly diverged, with a marked build-up in the US deficit and a strong expansion of emerging Asia's surplus. The two phenomena are clearly related: in 2006, bilateral trade with emerging Asia accounted for around 48 percent of the US trade deficit.

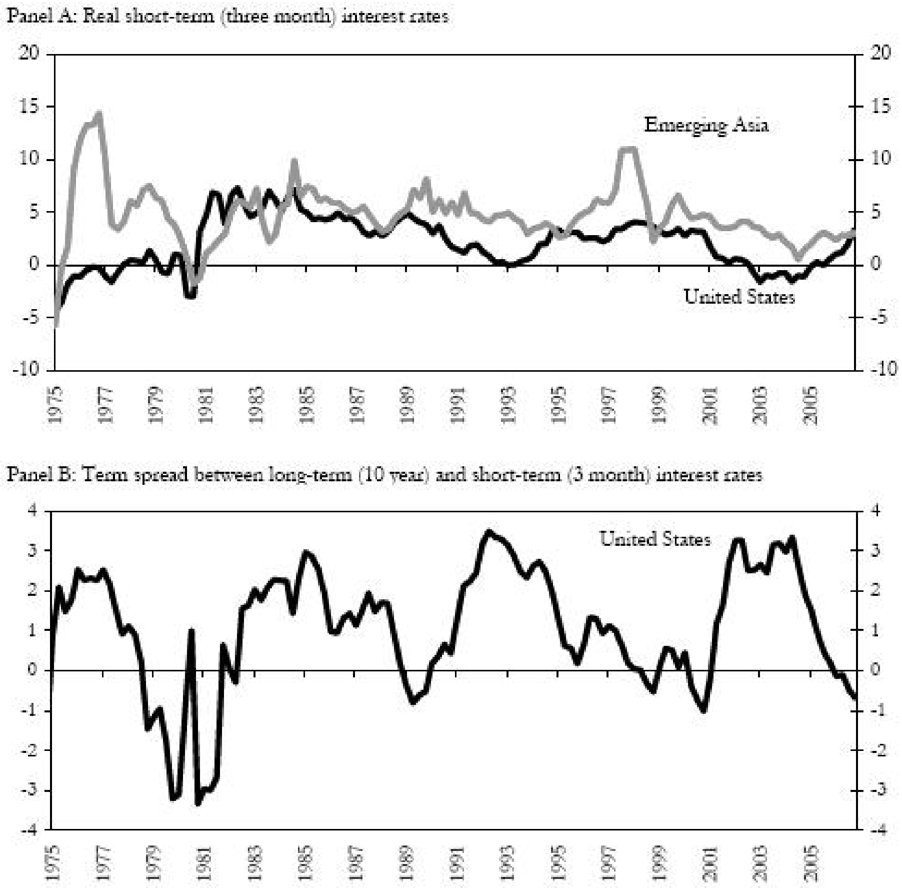
Figure 1: Current account imbalances
(In percent of GDP, 1975Q1–2006Q4)



Sources: Dataset as described in Section 3.3.
Note: Emerging Asia comprises China (P.R. and Hong Kong), India, South Korea, Singapore, Thailand, and Indonesia.

The past decade was also characterised by partly unprecedented financial developments. Real interest rates were markedly low, with negative real short-term rates in the United States during a number of years (2003–2005), a phenomenon last observed in the mid-1970s. Also in emerging Asia, real interest rates were relatively low after a peak during the 1997-98 Asian crisis (Figure 2, panel A). The yield-curve was inverted in the United States during parts of 2000–2001 and 2006 (Figure 2, panel B). The real growth rate of monetary aggregates has been relatively sustained in the United States from the mid-1990s onwards, following a period of slow money growth in the early-1990s (Figure 3). Finally, real share prices recorded buoyant increases over part of the period, although their increase was curbed by the 2001 IT-related stock market collapse in the United States (Figure 4).

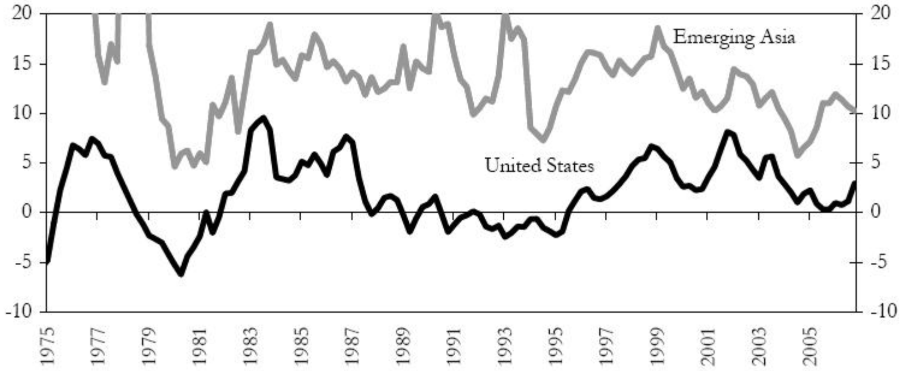
Figure 2: Interest rates and term spread
(In percent, 1975Q1–2006Q4)



Sources: Dataset as described in Section 3.3.
Note: Emerging Asia comprises China (P.R. and Hong Kong), India, South Korea, Singapore, Thailand, and Indonesia.

There is no unifying theoretical framework explaining these trends in external imbalances and financial market developments, but it is useful to classify the literature according to a monetary and

Figure 3: Real growth rate of broad monetary aggregates
(Annual percent change, 1975Q1–2006Q4)



Sources: Dataset as described in Section 3.3.
Note: Emerging Asia comprises China (P.R. and Hong Kong), India, South Korea, Singapore, Thailand, and Indonesia.

a non-monetary approach.

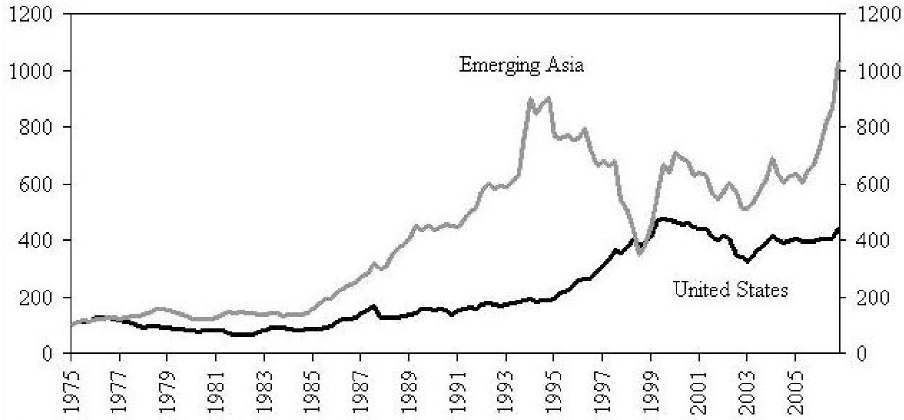
The monetary approach focuses on global liquidity as an explanation for global phenomena such as low interest rates, the "hunt for yield", and decreasing risk aversion. Within this approach, there is a large dispersion of views on the definition and measurement and the drivers of global liquidity. The most widely used measure of global liquidity are monetary aggregates in the major economies.[2] Comparisons of monetary aggregates to some benchmark (e.g. GDP) are sometimes used to assess whether liquidity is "excessive". Some authors (International Monetary Fund, 1999) advocate the use of both quantity and price indicators, as an easing of liquidity conditions tends to show up not only in an expanding stock of money, but also lower interest rates.

There is a debate whether rapidly expanding global liquidity reflects supply or demand factors. On the supply side, loose monetary policy in the major economies is sometimes seen as a driver of (excessively) growing liquidity (e.g. Economist, 2007). Rüffer and Stracca (2006) point to endogenous money creation as a more important source of money supply than high-powered money. On the demand side, growing liquidity needs of households and firms are sometimes seen as a driver of expanding liquidity. In fact, Anderson (2007) argues that the global economy has recorded a decrease in money demand, rather than an increase, especially in Asia where credit growth has been more subdued than often perceived.

Non-monetary approaches argue that widening imbalances and low risk aversion are mainly driven by real phenomena, in particular saving and investment decisions, or by intrinsic characteristics of global financial markets. One main driver identified in the literature is an increase in desired savings,

[2]See, e.g., Baks and Cramer (1999), Delozier and Hissler (2005) and Rüffer and Stracca (2006).

Figure 4: Real shares price index
(Deflated by consumer price index, 1975Q1=100, 1975Q1–2006Q4)



Sources : Dataset as described in Section 3.3.
Note : Emerging Asia comprises China (P.R. and Hong Kong), India, South Korea, Singapore, Thailand, and Indonesia.

especially in the emerging world (Bernanke, 2005). Another driver has been a fall in savings in the United States, including government savings—due to the widening government deficits in the early-2000s—and private savings. The fall in US private savings is, in turn, seen as the result of various possible factors, including a lesser need for precautionary savings due to a less volatile macroeconomic environment (great moderation, see e.g. Fogli and Perri, 2006). Bems, Dedola and Smets (2007) have pointed to the role of monetary policy as part of the drivers of low US savings. The International Monetary Fund (2005) has argued that a fall in ex ante investment plans, rather than a change in ex ante savings behaviour, may be a more powerful explanation of widening saving-investment balances in the emerging world. Productivity differentials between the United States and the rest of the world have been cited as another factor that could explain observed current account trends (Glick and Rogoff, 1995). Some authors have offered a financial interpretation of these observed trends. Examples are Greenspan's (2004) home bias hypothesis, postulating that a decline in foreign investors' home bias has facilitated the financing of the US current account deficit, and Caballero's (2006) argument that on the lack of supply of financial assets in some parts of the world as drivers of the low level of global interest rate and the large financial inflows to the United States.[3]

This paper focuses on some of these interpretations and provides and empirical assessment of their potential explanatory power in terms of the observed widening of external imbalances, the drop in global long-term interest rates, and the fall in overall risk sentiment, proxied here by rapidly rising

[3]A formalisation of the impact of cross-country differences in the degrees of financial asset creation is developed in Caballero, Farhi and Gourinchas (2006).

global equity prices. Our study will not be exhaustive and will not reveal all potential shocks that the global economy may have experienced over the past decade. Instead, it will focus on a number of shocks that have received relatively limited attention in the empirical literature, in particular monetary shocks, savings shocks, and investment shocks. An attractive feature of these three shocks is that they are compatible with both the observed widening of global imbalances and the observed benign financial environment prevailing through much of the late-1990s and early-2000s. We thereby exclude other potential shocks that may have been important over the past decade, such as productivity shocks or fiscal policy shocks. The omission of these shocks is not an indication of our views on their potential importance, but is rather driven by the wish to focus on more novel explanations that have been less examined in the literature.

3 Econometric model and data

3.1 Structural VARs with identifying sign restrictions

We estimate a VAR of order p with the following reduced form representation:

$$y_t = B(L)y_{t-1} + u_t \tag{1}$$

where y_t is an $n \times 1$ vector of endogenous variables, $B(L)$ is a lag polynomial of order p, and u_t is an $n \times 1$ vector of reduced-form residuals with covariance matrix Σ. Constants, time trends, and exogenous variables can be added to this representation but are omitted here for clarity of exposition. While this reduced-form representation can be consistently estimated with ordinary least squares, the challenge is to identify the structural representation of the VAR, which can be written as follows:

$$A^{-1}y_t = A^{-1}B(L)y_{t-1} + A^{-1}u_t = A^{-1}B(L)y_{t-1} + v_t \tag{2}$$

where the residuals $v_t = A^{-1}u_t$ represent uncorrelated, orthogonal structural shocks with the identity matrix as covariance matrix, i.e. $E[v_t v_t^T] = I$. The identifying matrix A defines a mapping between the structural and the reduced-form representations. It also allows to compute the contemporaneous impact of structural shocks on the n variables. Specifically, the ith column of this matrix, a_i, is an impulse vector and corresponds to the contemporaneous impact of the ith structural shock on each of the variables of interest.

To retrieve the identifying matrix, one may use the property that $\Sigma = AA^T$. This property, in itself, is however insufficient to compute a unique solution for the matrix A. At least $\frac{n(n-1)}{2}$ identifying restrictions need to be imposed to achieve unique identification. Common identification approaches include a recursive ordering of variables (Cholesky decomposition), contemporaneous restrictions on the error terms, restrictions on the long-run dynamics of the model, or a decomposition in temporary and permanent components (Blanchard and Quah, 1989).

This paper follows an alternative identification approach developed inter alia by Faust (1998), Canova and Pina (1999), Canova and de Nicoló (2002), Uhlig (2005) and Mountford and Uhlig (2005), which consists of imposing sign restrictions on the impulse response functions. The basic intuition is that structural shocks can be identified by checking whether the signs of the corresponding impulse responses are in line with theoretical priors.

The method uses a number of properties, outlined by Uhlig (2005) and Uhlig and Mountford (2005). In particular they show that the impulse vectors a_i can be retrieved even if the true identifying matrix A is unknown. Using any arbitrary decomposition $\widetilde{A}$ of Σ, such that $\Sigma = \widetilde{A}\widetilde{A}^T$ (for instance, the Cholesky decomposition), a_i is an impulse vector if and only if there exists an n-dimensional vector of unit length q such that:

$$a_i = \widetilde{A}q \tag{3}$$

On the basis of this property, Monte Carlo simulations are conducted, drawing random vectors of unit length q, computing the corresponding candidate impulse vectors a_i, and verifying whether the corresponding impulse responses have the correct sign over a number of horizons k. If the sign restrictions are met, the draw is kept.

As argued by Uhlig and Mountford (2005), this method can be applied to identify a subset of structural shocks. Suppose one wishes to identify s shocks, where $s \leq n$. Then, rather than drawing a single vector q, draw a matrix Q of dimension $n \times s$, containing s orthonormal vectors, i.e. orthogonal vectors of unit length ($QQ^T = I$). This allows to compute the corresponding matrix $\widetilde{A}Q$, also of dimension $n \times s$, which contains s candidate impulse vectors. As before, impulse responses can be computed and sign restrictions verified, and the draw is kept in case all sign restrictions are met for each of s shocks.

In implementing such estimation, we concretely adopt the following steps:[4]

1. Estimate the reduced-form VAR of equation (1) and obtain parameter estimates $\widehat{B}$ and $\widehat{\Sigma}$.

2. Draw the prior for B and Σ from the Normal Wishart family as described in detail in Uhlig (2005).

3. Draw a $n \times s$ matrix Q containing n-element orthonormal vectors. Operationally, this is done by using the first s columns of the Q-matrix that is obtained by a QR-decomposition of a $n \times n$ random matrix of independent and normally distributed elements. Rubio-Ramírez, Waggoner and Zha (2006) show that this Q-matrix has the required uniform distribution.[5]

[4] We have implemented this procedure in RATS. Our procedure can be used to identify s shocks in any structural VAR of dimension n on the basis of sign restrictions. The code is available from the authors upon request.

[5] One technical complexity is that the Q-matrices obtained in this way do not span the full space of possible orthonormal matrices, given that the QR decomposition delivers matrices with positive values on the diagonal. To overcome this problem, we switch signs of the Q-matrices in function of the originally drawn random matrices.

4. Compute the candidate impulse matrix AQ, where A is obtained from a Cholesky decomposition of Σ, and obtain the impulse response function corresponding to the s shocks.

5. Keep the draw if the impulse response functions of all s shocks satisfy the sign restrictions.

This procedure is repeated, taking as many draws of B, Σ and Q as needed to obtain enough successful impulse response functions to conduct inference.

3.2 Identification

Our aim is to uniquely identify and estimate the impact of (i) monetary shocks, (ii) preference shocks, and (iii) investment shocks on (i) the current account, (ii) long-term interest rates and (iii) asset prices. We adopt an integrated approach that takes into account the general equilibrium conditions relating monetary conditions, investment decisions, savings decisions and financial markets. In detail, we estimate a VAR in the following endogenous variables:

$$y_t = [P_t \quad M_t \quad C_t \quad I_t \quad i_t^s \quad i_t^l \quad s_t \quad CA_t] \tag{4}$$

where P are consumer prices in log levels, M, C, and I represent real money, consumption, and investment, in log levels, i^s and i^l correspond to short and long-term real interest rates, s denotes real share prices in log levels, and CA is the current account balance as a ratio to GDP.

This specification includes a set of variables that allows us to simultaneously and uniquely identify monetary, preference and investment shocks. We adopt the scheme of sign restrictions shown in Table 1. We assume an expansionary monetary policy shock to result in an increase in the supply of broad money, consumption, investment and the price level, and a decrease in short-term real interest rates. A shock to the rate of time preference, i.e. a negative shock to savings, is assumed to result in an increase in the price level and consumption, while crowding out investment and raising short-term real interest rates. A positive shock to investment, as e.g. induced by a (temporary) reduction in the capital utilisation adjustment cost, similarly increases the price level and short-term real interest rate, but has a positive effect on investment while not increasing consumption.

Table 1: Identifying sign restrictions

	P	M	C	I	i^s	i^l	s	CA
Monetary shock	+	+	+	+	−			
Preference shock	+		+	−	+			
Investment shock	+		−	+	+			

Our identification scheme meets three purposes:

First, the restrictions are in line with standard macroeconomic theory and share widespread support among the different literatures and schools of thought. In particular, the restrictions on the dynamic responses to the different shocks are compatible with a wide range of DSGE models of both a New Keynesian and a Real Business Cycle model type and have also been used in the empirical literature employing VARs with sign restrictions to identify these shocks for individual countries (see e.g. Smets and Wouters, 2003, Peersman and Straub, 2006).

Second, the restrictions uniquely identify monetary, preference and investment shocks. The restrictions discriminate the three different shocks, in the sense that the set of restrictions is mutually exclusive. The restrictions also aim to discriminate these three shocks from other potential shocks to the economy, as the sign restrictions imposed are sufficient to control for a wide range of potential shocks by being incompatible with e.g. labour supply shocks, technology shocks, or fiscal policy shocks.

Third, we leave the impact on long-term interest rates, share prices and the current account unrestricted. This allows to meet the key purpose of our analysis, namely to assess the impact of structural shocks on these variables.

3.3 The data

Our database contains quarterly data for the United States and emerging Asia between 1975Q1 and 2006Q4. The country series come from a variety of sources, including the IMF International Financial Statistics, the OECD Main Economic Indicators and Economic Outlook, BIS statistics, and national sources. Where original data were not available at quarterly frequency, an interpolation filter was used to transform data into quarterly frequency.[6]

The database comprises national account series (GDP, fixed private investment, private consumption, all in real terms), the current account balance, consumer price indices, broad monetary aggregates,[7], share prices, and short- and long-term interest rates.[8] The monetary aggregates, share prices, and interest rates are converted from nominal to real data, using the consumer price indices as a deflator.

Data for emerging Asia are aggregated across a group of countries. The composition of the group widens over time, in line with data availability and reflecting the emergence of these respective economies as new important players in the global economy. The initial group consists of India, Singapore, Korea, and Thailand, and is broadened to Indonesia in 1981, to Hong Kong in 1985, and to China in 1990. Data are aggregated as a weighted average of log-levels.[9] The weights are current GDP

[6]The data are seasonally adjusted, with the exception of share prices and interest rates. For the United States, the original series in the database were seasonally adjusted. For emerging Asia, the original series were seasonally adjusted at the level of individual countries, i.e. before aggregation, using the Census X11 method.

[7]For the United States, M2 is used. For emerging Asian countries, we use “money” plus “quasi-money” as defined in lines 34 and 35 of the IMF International Financial Statistics. This corresponds to M2 in most country cases.

[8]We use three-month interbank interest rates and ten-year interest rates on government bonds. For long-term rates, data are available for the United States only.

[9]This methodology is also followed in the construction of the Euro Area Wide Model database in Fagan, Henry and

at market prices converted into a common currency on the basis of market exchange rates. In very few cases where data is missing for some countries, the weights are rescaled without the missing countries.

4 Identification of the three structural shocks and impulse response functions

The estimation is computationally intensive, in particular to achieve a simultaneous identification of the three shocks. The results presented below are based on 1,000 draws from the posterior of B and Σ and 1,000 draws of orthonormal matrices Q, resulting in a total of one million draws to identify the three shocks simultaneously.

We estimate a VAR including a constant and 4 lags and impose restrictions as outlined in the previous Section over a horizon of $k = 5$, i.e. we require the impulse responses to have the anticipated sign both contemporaneously and over the next 5 quarters, corresponding to a one and a half year horizon. Using alternative horizons for the sign restrictions and selecting other lag lengths or deterministics turns out to have no qualitative impact on the results.

4.1 Results for the United States

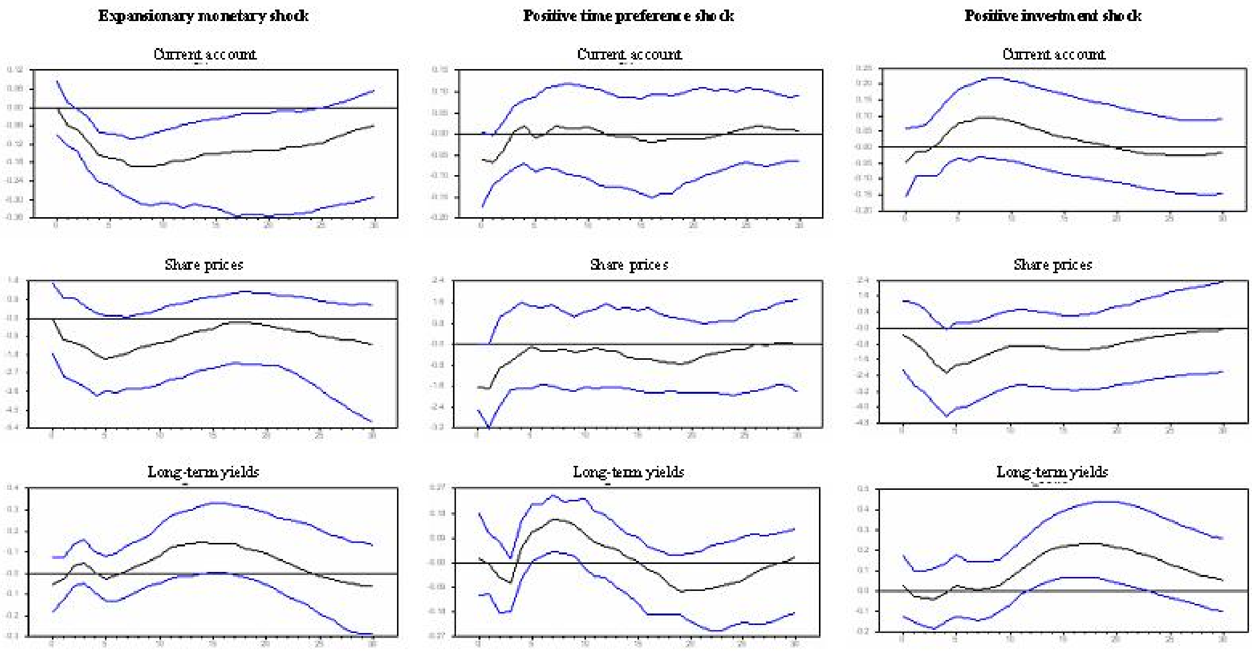
Figure 5 reports the impulse responses of the US current account, real share prices and real long-term yields to an expansionary monetary shock, an increase in time preference, and a positive shock to investment in the US, normalised to the magnitude of one standard error. As in Uhlig (2005) we also report 16% and 84% quantiles of the posterior distribution of impulse responses, corresponding to one standard deviation under the assumption of normality.

First, a one standard deviation expansionary monetary shock—roughly equal to a 25 basis points decrease in short term interest rates, identified through a rise in real money supply and inflation and decreasing short term interest rates—results in a worsening of the current account that is statistically significant after 2 quarters following the shock and strongly persistent. The effect on financial variables is far less pronounced and only has a marginally significant impact over the short run. Still, the results are indicative that expansionary monetary shocks tend to result in an rise in real long-term interest rates and at the same time have a negative effect on the stock market.

Second, an increase in time preference in the United States results in a deterioration in the current account, but the impact is very short-lived and significant only in the 2 quarters immediately following the shock. At the same time, real share prices tend to fall on impact, but also here, the impact is short-lived.

Mestre (2005). A different method is used for some series, in particular for interest rates and the current account to GDP ratio, which are aggregated without expressing in logarithms.

Figure 5: United States – Impulse responses to three structural shocks



Third, a positive shock to investment initially worsens the current account and then produces some improvement after a horizon of around two years, but these findings do not prove to be statistically significant. The delayed improvement in the current account reflects the rather short-lived increase in investment while the corresponding crowding out of consumption is more persistent (not reported here). Real share prices tend to fall while real long-term yields would rise after several quarters, possibly again related to the delayed impact of consumption behaviour.

How important are these shocks for explaining the dynamics of the current account and asset prices? Table 2 reports the fraction of the variance of the current account, real share prices and real long-term interest rates explained by each of the 3 shocks. The three shocks considered have the largest explanatory power in explaining the dynamics of the US current account. Taken together, they explain around 45% of the variance of the current account. Moreover, the variance decomposition suggests that monetary shocks are the most important driver of the current account, explaining 29% of the variation. Monetary shocks also appear to explain the largest part of the variation in real share prices (15%). For real long-term yields, however, we find the preference shock to be the potentially most important driver, as it accounts for around 17% of the variation.

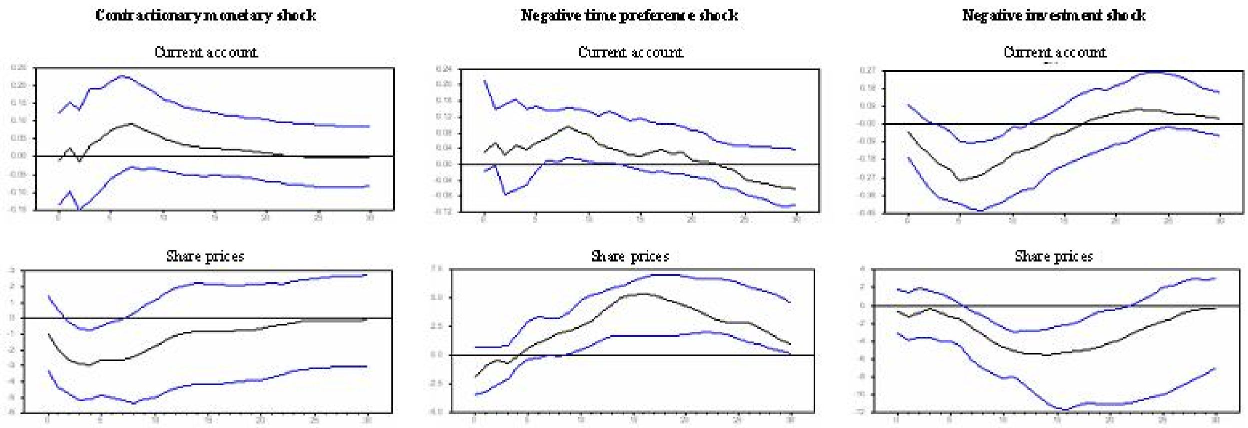
Table 2: United States – Share of variation in variables explained by structural shocks (reported at peak during 12 quarters following the shock)

	Monetary shock	Preference shock	Investment shock
Current account	29% *(4 quarters)*	8% *(8 quarters)*	9% *(7 quarters)*
Real share prices	15% *(9 quarters)*	8% *(1 quarter)*	12% *(4 quarters)*
Real long-term yields	8% *(8 quarters)*	17% *(7 quarters)*	5% *(7 quarters)*

4.2 Results for emerging Asia

Impulse responses to the same shocks as in the previous subsection, though with inverse signs, are presented in Figure 6. Overall, the impulse responses are less significant than in the US case:[10]

Figure 6: Emerging Asia – Impulse responses to three structural shocks



First, a contractionary monetary shock in emerging Asia leads to a slight but insignificant improvement in the current account while reducing real share prices on impact.

Second, negative shocks to time preference ("savings glut") seem to be a good candidate for current account surpluses and buoyant stock markets in emerging Asia, as the impulse response function points to an improvement in the current account that is statistically significant around two years after impact and a significant pick-up in real share prices in the region. Negative shocks to investment, by contrast, do not seem compatible with the observed widening of emerging Asia's current account surpluses and

[10] Due to data availability constraints, long-term interest rates are not included in the model for emerging Asia.

benign financial market conditions, as the impulse response functions predict a significant worsening of current account positions and weak stock market performance.

The variance decomposition in (Table 3) again confirms the findings from the impulse response analysis. For the current account, preference shocks turn out to explain the largest fraction of the variation (18%), confirming that trends in savings in emerging Asia have historically been the most important drivers of swings in its current account position. Shocks to investment, seem to be more a important driver of stock markets, accounting for 42% of the variation in share prices.

Table 3: Emerging Asia – Share of variation in variables explained by structural shocks (reported at peak during 12 quarters following the shock)

	Monetary shock	Preference shock	Investment shock
Current account	5% *(1 quarter)*	18% *(1 quarter)*	15% *(9 quarters)*
Real share prices	14% *(4 quarters)*	5% *(6 quarters)*	42% *(7 quarters)*

4.3 Results for the United States relative to emerging Asia

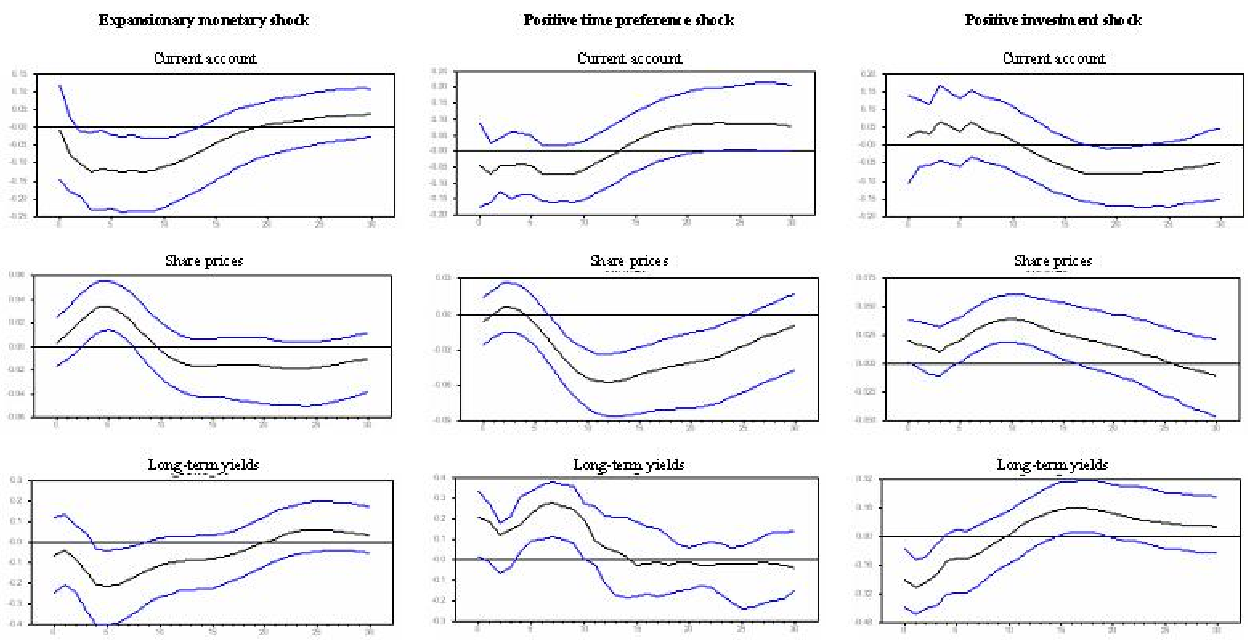
We now turn to the results of VAR specifications where we express variables in relative terms, comparing developments in the United States with emerging Asia. This allows to analyse whether the three structural shocks help to account for relative developments between the two regions. The three variables that are of key interest are the US current account, relative share prices (i.e. share prices in the US relative to emerging Asia) and US long-term yields. Figure 7 reports the impulse responses of these variables to our three candidate shocks.

First, a positive monetary shock in the US relative to emerging Asia has a significant impact on both the US current account and on relative share prices. The signs of the impact are in line with expectations, as expansionary monetary policy in the US relative to emerging Asia generates a current account deficit in the US and an increase in US shares prices relative to emerging Asia.

Second, a positive preference shock in the US relative to emerging Asia, capturing the notion of a change in relative saving propensities, would also produce a worsening in the US current account, although of smaller magnitude and only marginally statistically significant. Share prices in the US fall relative to emerging Asian.

Third, turning to the investment shock, a positive shock in the US relative to emerging Asia, corresponding to the investment drought view, proves unable to explain the widening US current account deficit according to our model. Quite on the contrary, the estimations suggest that a positive shock to US investment should produce an increase in the US current account position, although the impact is insignificant. The impact on real share prices is more in line with expectations, as they tend

Figure 7: United States relative to Emerging Asia – Impulse responses to three structural shocks



to increase US share prices relative to those in emerging Asia.

Overall the findings from the impulse responses analysis support the results obtained in the individual region models. This is also confirmed by the variance decomposition shown in Table 4. As in the previous models, the monetary shock turns out to be the most potent driver of the variation in the US current account. In addition, preference shocks contribute to the variation of the current account, although to a lesser extent, while they are a more important source of fluctuations in share prices. Investment shocks, while resulting in an implausible sign on the current account, are an important driver of financial market prices.

5 Counterfactual analysis: historical contributions

This section provides a counterfactual analysis that assesses to which extent the identified structural shocks have contributed to movements in the current account and asset prices.

In order to do so, we adopt a case-study approach and compute historical contributions of the structural shock over selected periods. Starting from a given point in time T, one can represent each

Table 4: United States vs Asia – Share of variation in variables explained by structural shocks (reported at peak during 12 quarters following the shock)

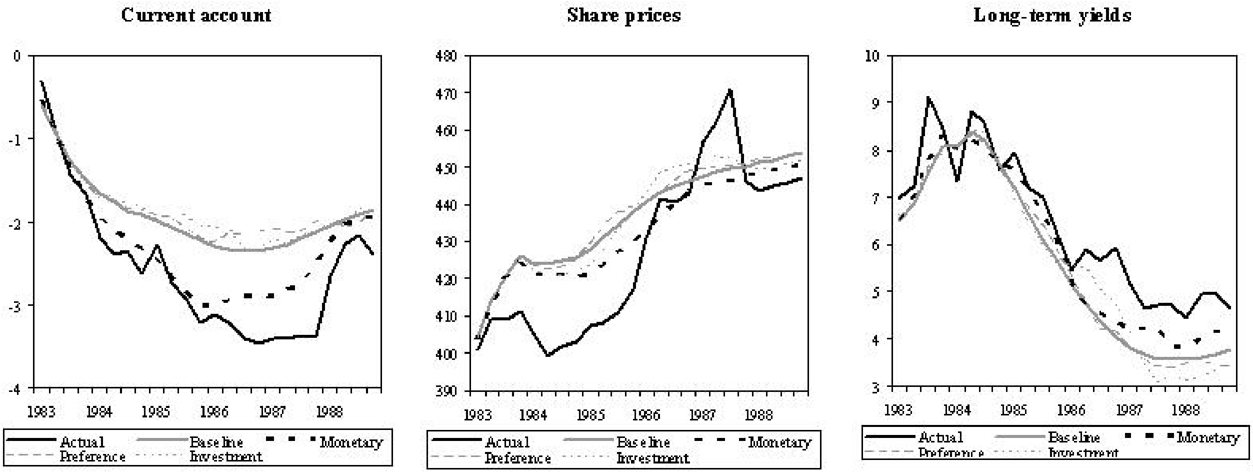
	Monetary shock	Preference shock	Investment shock
US current account	15% *(7 quarters)*	9% *(1 quarter)*	9% *(1 quarter)*
Difference in real share prices	16% *(7 quarters)*	43% *(9 quarters)*	25% *(8 quarters)*
US real long-term yields	10% *(5 quarters)*	20% *(1 quarter)*	20% *(2 quarters)*

of the variables in the VAR as the sum of a baseline projection, which draws on all information available up to time T, and a combination of the structural shocks that occurred after T. This analysis usefully complements the inspection of impulse responses and variance decompositions, as it provides a "reality check" whether the shocks modelled in the system have actually occurred in reality and whether they can help explain actual developments of the variables of interest.

We perform the analysis of historical contributions on our US model for two starting points T, 1983Q1 and 2001Q1. These two reference points are chosen because the main variables of interest have recorded very strong movements in the subsequent quarters. Real long-term interest rates in the United States fell strongly over these periods, from around 9% in 1983 to below 5% in 1987, and from around 2% in 2001 to close to 0% in 2004. Likewise, these were periods of significant worsening of the US current account balance, from close to balance in 1983 to well over 3% of GDP in 1987 and from 4% in 2001 to 6% at the end of 2004. In other words, these two periods present interesting case studies that witness both improving financial conditions and a significant widening of imbalances. They are therefore good candidates for the purpose of our analysis, which is to disentangle liquidity, saving and investment shocks as simultaneous drivers of financial conditions and external positions. An additional consideration for the selection of these two episodes is that there are relatively large deviations between the baseline projections and the actual series, especially for the current account. Running the exercise for other points in time, deviations between the baseline projections and the actual series are typically smaller. Hence, for other starting points T, there is a lesser need to explain these deviations as a result of a combination of structural shocks.

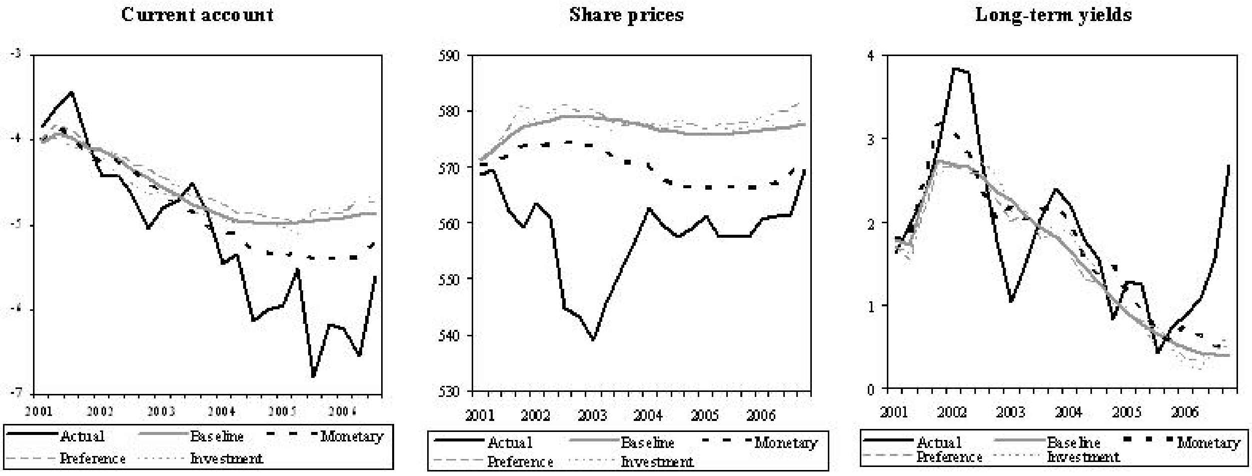
Results are presented in Figure 8 for $T = 1983Q1$ and Figure 9 for $T = 2001Q1$. The actual series, in dark solid lines, show in both episodes, a significant worsening of the US current account position and a sustained fall in real long-term interest rates. Share prices, however, behaved very differently in the two episodes, as they rose strongly in the aftermath of 1983 while they fell considerably after 2001 in the context of the collapse of the IT bubble. The baseline projections, in solid full grey lines, are relatively poor in tracking actual developments. This holds in particular for the US current account, as in both episodes the model was would have failed to predict the bulk of the deterioration. In 1983, the model would have predicted the current account to fall to 2% of GDP by 1987, while in reality it deteriorated to 3.5%. In 2001, the model would have predicted a worsening to 5% of GDP by late-2004, whereas the actual current account deficit ended above 6%. Also for share prices, the prediction errors are relatively large, as the model would in both episodes have predicted somewhat more buoyant share price developments. For long-term interest rates, by contrast, the errors around the baseline prediction would typically have been somewhat smaller.

Figure 8: United States – contribution of structural shocks after 1983



The contribution of historical shocks is shown in the dotted lines. For the current account developments, the monetary shock appears to have the largest contribution in explaining the deviation between the baseline and the actual series. For the 1983 episode, the monetary shock explains close to 1 percentage point of the worsening in the current account to GDP ratio in the subsequent years. In the 2001 episode, the monetary shock captures around 0.5 percentage point of the deterioration in the current account by 2005. Preference shocks and investment shocks seem to have a very limited role in explaining deviations of the current account from the baseline projection, and sometimes even turn out to have the wrong sign in explaining actual developments. For share prices, results are more mixed, as none of the three shocks appears as a strong candidate to explain actual share price developments. The result suggests that equity markets have been driven by other developments, which is in line also with the observation that share prices moved in opposite directions in the two episodes. For long-term interest rates, the results suggest that the three shocks help explain the deviation between the baseline projection and the actual series at given points in time. However, there is no clear pattern on the medium-term contribution of these shocks to long-term interest rate developments.

Figure 9: United States – contribution of structural shocks after 2001



All in all, the analysis of historical contributions confirms that these three shocks may help explain some of the observed developments during the two episodes starting in 1983 and 2001. The strongest results are found for the US current account, as monetary shocks turn out to explain a significant part of the current account worsening over the two episodes.

6 Concluding remarks

Today's global economy is marked by largely unprecedented phenomena, such as exceptionally benign financial market conditions in an environment of historically large external imbalances. The theoretical literature has brought forward a number of explanations for some of these phenomena, including a "savings glut", an "investment drought", and "global liquidity".

Empirical work on these hypotheses, however, has been relatively limited, not the least since the identification of the underlying structural shocks is a difficult task. This paper tries to fill the gap by applying an empirical strategy that allows to isolate the effect of monetary shocks, preference shocks and investment shocks on the current account, stock markets, and long-term interest rates,

Our findings show that, among our three potential candidates, monetary shocks appear to have the largest impact. In particular, they seem to be an important driver for current account balances in the US but also emerging Asia, thus rendering support to the view that ample liquidity has contributed to the build-up of large external imbalances. Further, monetary shocks account for a substantial fraction of the worsening of the US current account in the mid-1980s and the early 2000s. Preference shocks particularly in Asia but also in the US (of an opposite sign) seem to be a somewhat less important factor, while our results find no evidence in favour of the "investment drought" hypothesis.

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