Global "excess" liquidity: does it matter for house and stock prices on a global scale[1]?

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Abstract

This paper investigates the relationship between global liquidity and asset prices on a global scale: how important is global liquidity? How are asset (especially house) prices and other important macro variables affected by global monetary conditions? This paper analyzes the international transmission of monetary shocks with a special focus on the effects of a global monetary aggregate (global liquidity) on different asset prices, namely houses and share prices. We estimate a variety of VAR models for the global economy using aggregated data that represent the major OECD countries. The impulse responses obtained show that a positive shock to global liquidity leads to permanent increases in the global GDP deflator and in the global house price index, with the latter reaction being even more distinctive. Moreover, we find that there are subsequent spill-over effects from house prices to consumer prices. In contrast, we are not able to find empirical evidence in favor of the hypothesis that stock prices significantly react to changes in global liquidity.

1 We would like to thank Mark Weth and Sebastian Schich from the Deutsche Bundesbank who provided us with valuable data on house prices. The paper does not necessarily reflect the views of the Bundesbank.

The expansionary monetary policies of the G3 countries (Euro area, U.S. and Japan) and the huge and steady foreign exchange interventions by many Asian countries have contributed to a significant increase in global money balances during the more recent years. With the exception of the most recent quarters, the strong monetary impetus has not been accompanied by a parallel increase in consumer prices. At the same time, however, the majority of OECD countries have undergone sharp increases in asset prices, such as real estate or share prices[2]. We suggest that this pattern is related with the abundant liquidity that prevails on a global scale. Some observers even argue that the growth in asset prices is the result of liquidity spillovers to certain asset markets [Adalid and Detken (2007), Greiber and Setzer (2007)].

Up to now, empirical evidence concerning the relationship between money growth and asset prices from an international context has been quite scarce. However, in this paper we investigate the extent and some specific macroeconomic impacts of global liquidity with an eye on identifying its interactions with global inflation and asset prices, as suggested by a number of authors such as Baks and Kramer (1999), Sousa and Zaghini (2006) and Rüffer and Stracca (2006). We feel legitimized to focus on a global model and, hence, do not explicitly deal with any spillovers to national variables. According to recent research, global models are increasingly relevant. For instance, Ciccarelli and Mojon (2005) suggest that deviations from the global inflation trend are not sustainable in the long run. In the same vein, Borio and Filardo (2007) convincingly argue that a more globe-centric approach to inflation is far more suitable since global factors have become more dominant in explaining national inflation rates.

Theory

Why a global perspective?

The concept of 'global liquidity' has attracted considerable attention in recent years. One of the first studies is Baks and Kramer (1999), who apply different indices of liquidity in seven industrial countries to investigate the direction of the relationship between liquidity and asset returns more deeply. They find evidence in favor of important common components in G7 money growth. Moreover, an increase in G7 money growth is consistent with higher G7 real stock returns. More recently, a couple of studies have applied VAR models with data aggregated on a global level. For instance, Rüffer and Stracca (2006) estimate a VAR model based on a sample of aggregated G5 data using the same array of macroeconomic variables as used in our study in their benchmark specification. They identify the so-called 'price puzzle,' i.e., the initial increase in consumer prices in reaction to a more restrictive monetary policy, and cannot solve it even when they explicitly account for the impact of commodity prices. Moreover, they extend their model with a real asset price index that incorporates property and equity prices. According to their study, the response of the (consumer) price level to a global liquidity shock is even more distinctive than in our paper, while the real asset price index, as in our study, does not display any significant reaction to global liquidity. Another relevant study is Sousa and Zaghini (2006) who estimate a VAR model for the G5 with aggregated data. Moreover, they include a commodity price index and deviate from the standard Cholesky identification scheme in restricting the structural equations. Once again, the price puzzle is not solved by the commodity price index. Sousa and Zaghini also find a significant and long-lasting response of the price level to a global liquidity shock. Their sample period only ranges to the year 2001. However, our prior is that in the post-2001 period the relationship between money and consumer prices was less stable than before. This might, in our view, challenge the stability of their results.

A prominent role for house prices among other specific kinds of asset prices in the same context is also found on a global scale by Giese and Tuxen (2007). They cannot empirically reject significant cointegration relationships which, by successful tests of exogeneity, support the proposition that global liquidity has a positive impact on house prices and on more general categories of inflation. A more recent country-level study is Roffia and Zaghini (2007). Using probit regressions for 15 countries, they come up with evidence in favor of the hypothesis that periods of strong monetary growth are likely to turn into periods of high inflation, especially if they are accompanied by asset price inflation.

To what extent can global factors be made responsible for the development of global liquidity over time? Rüffer and Stracca (2006) try to answer this question for the G7 countries by applying a factor analysis. They conclude that around fifty percent of the variance of a narrow monetary aggregate can be traced back to one common global factor. For instance, the extremely expansionary monetary policy stance of the Bank of Japan (BoJ) over the last years is a prominent example of such a global factor. It has been characterized by a significant accumulation of foreign reserves and by extremely low interest rates. By means of carry trades, financial investors took out loans in Japan which they invested in currencies with higher interest rates. Such kind of capital transactions should of course have an impact on the development of monetary aggregates beyond Japan.

An additional argument in favor of focusing on global instead of national liquidity is that national monetary aggregates have become more difficult to interpret due to the huge increase in international capital flows [Papademos (2007)]. Sousa and Zaghini (2006) argue that global aggregates are likely to internalize cross-country movements in monetary aggregates — due to capital flows between the different regions — that may make the link between money and inflation and output more difficult to disentangle in the single country case. Giese and Tuxen (2007) further argue that in today's linked financial markets shifts in the money supply in one country may be absorbed

2 Between 2001 and 2006, for example, house prices have risen sharply in the U.S. (55%), the Euro area (41%), Australia (59%), Canada (61%), and a number of further OECD countries. Notable exceptions are Japan, where house prices stopped their 15-year fall not earlier than in 2007, and Germany.

by demand elsewhere, but simultaneous shifts in major economies may have significant effects on worldwide goods' price inflation.

Not only with respect to global liquidity but also with an eye on global inflation performance, available evidence becomes increasingly stronger that the global instead of the national perspective is more important when monetary transmission mechanisms have to be identified and interpreted. For instance, Ciccarelli und Mojon (2005) apply a factor analysis to macroeconomic data of 22 OECD countries and establish that seventy percent of the variance of the inflation rates of these countries can be traced back to a common factor. The same authors find some pieces of empirical evidence in favor of a robust error-correction mechanism, meaning that deviations of national inflation from global inflation are corrected over time. They finally conclude that inflation is to a large degree a global phenomenon. The study by Borio und Filardo (2007) delivers a similar result. Referring to their empirical results, they argue that the traditional way of modeling inflation is too country-centered, a global approach is more adequate, and that the importance of global factors has increased significantly in recent years. One important global factor, for instance, is certainly the increasing level of competition in international goods and labor markets – a phenomenon which has to be mainly ascribed to globalization. It appears fair to say that it is exactly the globalization process that has contributed to the decrease in inflation rates since the eighties (and that this puts the contribution of central banks on the agenda again).

Money growth and asset prices

Notwithstanding the fact that the focus of this paper is clearly on the empirical aspects of the subject, we will address some theoretical issues regarding the linkages between money growth (and thus, liquidity) and asset prices. Mishkin (2007) stresses the user cost of capital as an important determinant of the demand for residential capital. In this context, lower interest rates in the wage of higher money growth should influence mortgage rates and thus by decreasing the user cost of capital should raise the demand for housing capital. A similar effect should work on the supply side where easier financing conditions tend to stimulate housing construction. However, Mishkin focuses on the effects of interest changes on house price changes and does not explicitly refer to monetary aggregates. He is able to provide empirical evidence in support of a stable relationship between an interest rate shock and house price developments via the FRB/U.S. model.

A more general strand of literature investigates the impact of monetary policy on more generally defined asset price developments. One example is Congdon (2005) who investigates the relationship between money supply (specified as broad money) and asset price booms and finds empirical evidence in many cases. For instance, he analyzes the portfolio management of (other) financial institutions like pension funds. There, he finds evidence in favor of a long-run stability of the money/asset ratio (percentage of money in their portfolios) and argues – similar to Meltzer (1995) – that increases in the money supply lead to "too much money chasing too few assets," suggesting that asset prices rise in order to restore the money/asset ratio.

Several studies investigating the impact of monetary policy and liquidity on asset prices find a special role for housing in the monetary transmission process [Giese and Tuxen (2007), Adalid and Detken (2007), Cecchetti et al., (2000)]. From a theoretical point of view, one can argue that it is one characteristic feature of housing markets that the supply of real estate cannot be easily expanded [Belke and Gros (2007), OECD (2005) and Shiller (2005)]. Therefore, housing markets should exhibit a lower price elasticity of supply than, for instance, stock markets, which means that additional demand (caused by global excess liquidity) will be reflected to a higher degree in house price increases than on stock markets. Similarly, consumer goods are – not least due to low-cost producers from the emerging markets – nowadays supposed to be largely price-elastic on the supply side, so that additional demand has mainly materialized as additional quantity and not in price increases in recent years. In the following, we will present a simple model of price adjustment for illustration purposes.

Some insights into the relationship between money, house prices, and consumer prices can be derived from the dynamic price adjustment to a liquidity shock across the housing sector and the goods market. In the short term, an expansionary monetary policy providing the markets with ample liquidity may trigger an immediate price reaction in the housing sector, but a more subdued price reaction in the consumer goods market. Over time, however, consumer prices also adjust to the new equilibrium by proportional changes of the consumer price level. In other words, it is plausible to argue that in the long term changes in money supply do not lead to any real effects in money or output. As will become clear below, the possibility of different dynamic adjustments of house prices and consumer prices to a monetary shock may also provide an explanation for the recent shift in relative prices between housing and consumer goods. In order to formalize these considerations, the quantity theory of money might serve as a starting point: $m_t v_t = p_t y_t$ (1), where m denotes the money stock, v represents the velocity of money, and p and y stand for the price level and real output, respectively. Equation (1) is simply an identity and is valid for all time periods t. Money can be spend either for housing (y^H) or on consumption goods (y^C) with prices p^H and p^c, respectively. The distinguishing features of y^H and y^C are different price elasticities of supply. On the one hand, housing is generally assumed to be restricted in supply and cannot be expanded (Japan), with high transaction costs (continental Europe), and each piece of real estate being different from even its adjacent plot. Hence, the elasticity of housing supply vis-à-vis house price changes should be quite limited. On the other hand, consumption

has infinite price elasticity so that additional demand can be satisfied without any price increase. This assumption is based on the recent developments in international trade. The emergence of low-cost producers in emerging markets and developing countries may have prevented firms from increasing consumer prices in response to a liquidity shock while supply in housing markets was subject to natural constraints. The general price level is then a weighted combination of the prices of both goods: $p_t = \lambda p_t^H + (1-\lambda)p_t^c$ (2), with $0<\lambda<1$. Similarly, output consists of the production of both housing and consumer goods: $y_t = \lambda y_t^H + (1-\lambda)y_t^c$ (3).

In the following, the effects of a one-off increase (of μ percent) in money supply in period t+1 are analyzed against this background. Assuming that v is constant and has a value of one, the relationship between money and the general price level in period t+1 can be written as follows: $(1+\mu)m_t = p_{t+1}y_{t+1} = (1+\mu)\, p_t y_t$ (4). Due to high competition in international goods markets and the vast supply of cheap labor in many emerging regions of the world, which weighs heavily on the prices of manufactured goods, consumer price inflation remains unaffected by the increase in aggregate demand: $P_{t+1}^C = P_t^C$ (5). Rather, the liquidity shock fully translates into an increase in output: $y_{t+1}^C = (1+\mu)y_t^C$ (6). By contrast, housing is in short supply, which drives prices upwards as a result of the liquidity shock, but keeps output in the housing sector constant: $p_{t+1}^H = (1+\mu)p_t^H$ (7), $y_{t+1}^H = y_t^H$ (8).

Combining equations (4) to (9), the money-price relationship in period t can be described as follows:
$(1+\mu)m_t = [(1+\mu)\lambda p_t^H + (1-\lambda)p_t^C][\lambda y_t^H + (1+\mu)(1-\lambda)y_t^C] = (1+\mu)p_t y_t$ (9). In the long term, however, the theoretical proposition of long-run neutrality must hold, i.e., the increase in money supply affects prices without changing long-run equilibrium real values: $p_{t+2}^C = (1+\mu)p_t^C$ (10), $y_{t+2}^C = y_t^C$ (11), $p_{t+2}^H = (1+\mu)p_t^H$ (12), $y_{t+2}^H = y_t^H$ (13), $(1+\mu)m_t = p_{t+2}y_{t+2} = (1+\mu)p_t y_t$ (14)

Equations (1) to (14) illustrate the price-quantity changes in the housing and consumer goods markets when aggregate demand changes. On the goods market, one would expect an increase in the production of consumer goods if the demand for consumer goods increases as a result of a positive liquidity shock. By contrast, housing supply is insensitive to price changes and thus the additional demand for housing is fully reflected in a rise in house prices. In the long term, the neutrality of money holds, such that any change in the money supply is met with a proportional change in the price level that keeps real money and real output in both sectors unchanged.

Empirical analysis

Data and variables

In our VAR analysis, we make use of quarterly time series ranging from Q1-1984 to Q4-2006 for the U.S., the Euro Area, Japan, the U.K., Korea, Australia, Switzerland, Sweden, Norway, and Denmark. Hence, in our analysis 72.2 % of the world GDP in 2006 and presumably a considerably larger share of the global financial markets are represented[3]. For the aforementioned countries, we have collected data for real GDP (Y), the GDP deflator (P), a short-term money market rate (IS), a broad monetary aggregate (M), and, as asset prices, a house price index (HPI) and the MSCI World price index (MSW). The selected monetary aggregate is M2 for the U.S., M3 for the Euro Area, M2 plus cash deposits for Japan, M4 for the U.K., and mostly M3 for the other countries. The data are taken from the IMF, the BIS, and the ECB databases and are seasonally adjusted where available or treated with the X12-ARIMA procedure[4].

We start with aggregating the country-specific time series to produce a global series, strictly following the guidelines provided by Beyer et al. (2000) and applied by Giese and Tuxen (2007) in the same context. First, we calculate variable weights for each country by using PPP exchange rates to convert nominal GDP into a single currency[5]. Hence, the weight of country i in period t is given by: $w_{i,t} = [GDP_{i,t}e_{i,t}^{PPP}] \div [GDP_{agg,t}]$ (15). Secondly, we start with the growth rates of the variable in the domestic currency and amalgamate them to global growth rates by applying the weights calculated above: $= g_{agg,t} = \Sigma_{i=1\rightarrow 11}\, w_{i,t}g_{i,t}$ (16). We obtain aggregate levels by selecting an initial value (i.e., 100) and multiplying it with the above global growth rates. Hence, the level of the variable v is: $index_{v,t} = \prod_{t=2\rightarrow T}(1+ g_{agg,t})$ (17). This method is applied to all variables except the MSCI World, which already represents share price developments at a global level. Interest rate aggregation is performed directly without calculating growth rates.

With respect to the monetary aggregate which plays a central role in our analysis, this method lowers the bias resulting from different national definitions of broad money which obviously exist. Forming a simple sum of national monetary aggregates — as often conducted in the related literature — would underrepresent countries with narrower definitions of the monetary aggregate and vice versa. Using this methodology we also avoid the so-called 'dollar bias,' which results from converting national monetary aggregates with actual exchange rates into U.S. dollar and constructing a simple unweighted sum to obtain global money. The recent fall of the dollar would result in an overestimation of global monetary growth[6].

In order to provide a first impression of the development of global liquidity since 1984, Figure 1 displays global monetary time series in absolute and relative terms. For nominal and real money, a simple regression on an intercept and a linear time trend is performed. Both series move clearly above their time trend from around 2001, when the rapid downturn in stock markets was a strong incentive for households and investors to increase the share of safe assets like money in their portfolios. Monetary growth remained strong afterwards, as indicated by the persistent growth of the ratio of nominal money to nominal GDP, a measure commonly used as an indicator of

3 Own calculations based on IMF data.
4 House price date was compiled by Sebastian Schich and Mark Weth, who obtained this information from several national institutions for their project "demographic changes and real house prices."
5 1999 is our base year for the PPP exchange rates.
6 See Commerzbank Economic & Commodity Research (2007), p. 3.

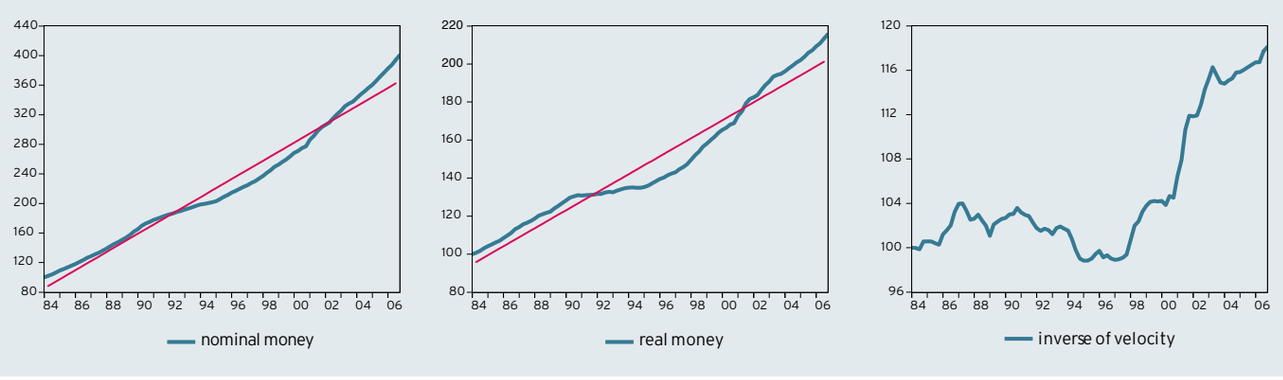

Figure 1 – Development of global liquidity since 1984

Figure 2 – Global series, four-quarter moving average of growth rates (except interest rate series)

excess liquidity [Belke et al. (2004), Rüffer and Stracca (2006)]. As this series is equal to the inverse of the income velocity of money, it seems obvious that global velocity is not trend-stationary, a phenomenon which has appeared on a country level as well and has contributed to the instability of national money demand equations. Seen on the whole, thus, the series seem to confirm our proposition that global liquidity is indeed already at a high level and that the liquidity ought to be classified as 'excessive' for the most recent period.

Figure 2 shows the whole array of global time series investigated. The pattern of the growth of the GDP deflator series clearly reveals the moderate inflation which started to emerge around the mid-90s and has persisted up to recent years, which was characterized by global excess liquidity. The growth rate of house prices has steadily become greater in the 2000 to 2006 period. This lends support, to some extent, to the popular asset price inflation hypothesis in the real estate sector. Finally, global short-term interest rates were at historically low levels between 2002 and 2005, as monetary policy was extremely loose during this period[7].

Econometrics

The econometric framework employed is a vectorautoregressive model (VAR) which allows us to model for the impact of monetary shocks on the economy while taking care of the feedback between the variables since all of them are treated as endogenous [Krätzig and Lütkepohl (2004)]. To identify the structural equations we use

7 One might regard the deviation from a Taylor rate as a more accurate measure in this respect. However, these numbers create a similar picture. See International Monetary Fund (2007), Chapter 1, Box 1.4.

the Cholesky decomposition which implies a recursive identification scheme and involves restrictions about the contemporaneous relationships between the variables. These are given by the Cholesky ordering of the variables and might significantly influence the results of our analysis. Consequently, different orderings are used to prove the robustness of the results.

In our VAR analysis we mainly focus on the impulse response functions, which can be obtained from the estimated VAR equations, and show how an unanticipated shock to one variable influences another variable over time. To compute standard errors for the impulse response functions which are not relying on any specific assumptions, in particular concerning the distribution of the coefficients, Monte Carlo techniques are an appropriate way to construct the desired confidence intervals [Enders (2003)]. Hence, we are using this approach in the following section.

Since the macroeconomic variables included in the analysis are likely to be non-stationary, the question arises about whether one should take differences of the variables in order to eliminate the stochastic trend. Here, we follow Sims et al. (1990) and estimate the VAR model in levels, which, due to its simplicity, might be the more appropriate technique too.

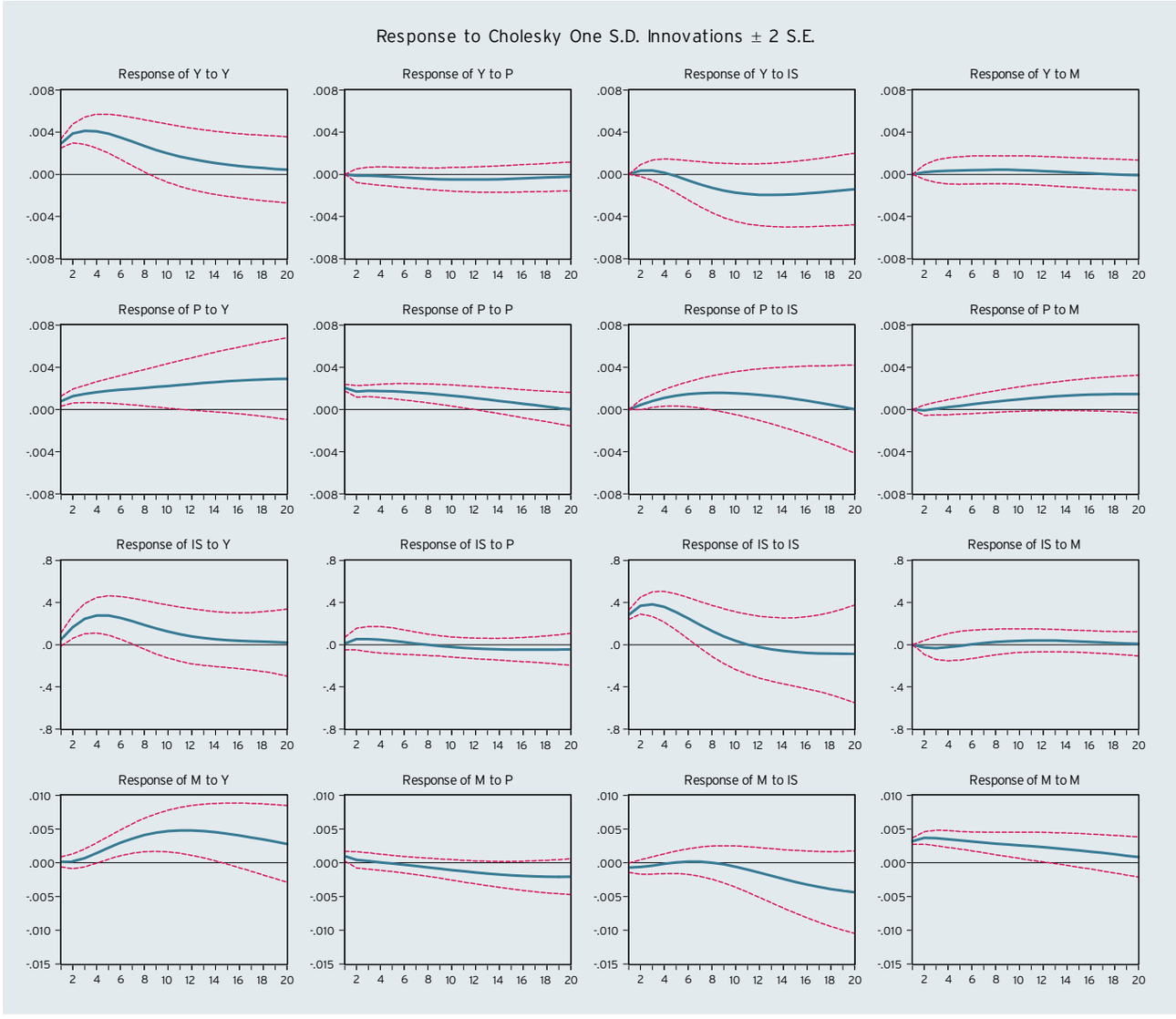

Figure 3 – Impulse response analysis; basic model

Empirical results

The baseline model without asset prices

The conceptual approach of our VAR analysis is as follows. Firstly, a benchmark model for the macroeconomic variables Y, P, IS, and M is estimated. Secondly, if the dynamics of the system is found to be plausible at the global level, this is considered by us as a confirmation of our global approach, and the asset price variables HPI and MSW will be added one by one to the VAR system. The basic specification to start with is given by the following vector of endogenous variables (with the corresponding Cholesky ordering)[8]: x_t = (y, p, IS, m)$_t$ (18). The Cholesky ordering of the basic specification strictly follows the usual guideline that monetary variables should be ordered last, since they are assumed to react faster to the real economy than vice versa [Favero (2001)]. Variables are taken in log-levels except for the short-term interest rate, and a constant and a linear time trend are added to the model. The usual criteria are applied to determine the lag length[9]. The empirical realizations of the criteria point to a lag length of 2, which also proves to be sufficient to avoid serial correlation among the residuals and, in addition, appears to be appropriate to guarantee a parsimoniously specified model[10]. Since this is true for the following models as well, we will continue with two lags for the whole analysis.

Figure 3 shows the impulse responses obtained from the basic specification. Output declines with an interest rate shock and increases with a liquidity shock, which is in line with our expectations, but both effects are not significant at the 5% level. The GDP deflator P moves upwards in the wake of an innovation to the output variable, which might give support to the consideration of the output gap in assessing inflationary pressures. The particularly interesting reaction of the GDP deflator to a global liquidity shock is only slightly significant at a 5% level after a few periods, but the significance (and the level of the impact) increases over time. We interpret this result to be in support of the hypothesis that the influence of money on inflation has a long-term characteristic. In the case of the interest rate shock, the reaction of the price level yields the 'price puzzle,' which often occurs in the VAR analysis and was also experienced by Rüffer and Stracca (2006) as well as Sousa and Zaghini (2006) in the same context. The appearance of the price puzzle is sometimes thought to be caused by the lack of a variable which captures inflationary expectations. Monetary policymakers are supposed to raise interest rates when inflation expectations rise. When their policy cannot stop inflation from rising the system may interpret the rise in interest rates as a trigger of the increase in the price level. Therefore, it is recommended by Favero (2001) to use a commodity price index that might capture inflationary expectations to some degree and solve this problem. However, considering this alternative and adding a commodity price index (or, alternatively, the price of oil) into our model did not solve the price puzzle [Rüffer and Stracca (2006), Sousa and Zaghini (2006)]. There will be further discussion of the implausible reaction of inflation to interest rate changes in the context of the following models, where the house price index helps us to solve the price puzzle.

The short-term interest rate moves up in the wake of an output shock, but does not display any significant reaction to a price or a money shock. This does not come as a surprise if either the system captures only the monetary policy stance in the short run, which could be dominated by the business cycle, or if the monetary policy instrument might be difficult to model from a global perspective, according to which different central banks with different strategies exist. The empirical pattern of the estimated responses of money reveals, in line with standard money demand considerations, a positive response to an output innovation and a decline in liquidity in the wake of an increase in interest rates. A standard interpretation would be that the latter effect might be due to rising opportunity costs of money holdings and/or due to central bank-driven shifts in the money supply.

Augmenting the VAR with asset prices

After having derived the benchmark model, the next step in our VAR analysis is to allow for the first asset price variable to enter the model. We start with the house price index (HPI), since house prices may play a crucial role in this context for several reasons. In the Cholesky ordering we put house prices just behind the GDP deflator, so that we are working with the following vector of endogenous variables: x_t = (y, p, hpi, IS, m)$_t$ (19).

The first row of Figure 4 shows the effects emanating from a positive shock to the short-term interest rate. Like in the benchmark model, this kind of shock causes output and money to decline, with the latter becoming significant at the 5% level here. Moreover, the price puzzle disappears. This supports the view that house prices are essential for our model and if they are excluded from the empirical model an omitted variable bias might occur. Alternatively, one could argue that house prices and inflationary expectations might be correlated, since a lack of the latter is often supposed to be the reason for the existence of the price puzzle. The liquidity shock impact on the price level is slightly lower than in the basic model. However, by adding up both effects that may represent (recent) expansionary monetary policy (money and interest rate shock) we find substantial upward pressure on inflation, although, once again, the long time lags of these effects have to be taken into account.

The responses of the house price index to interest rate and liquidity are significant over quite a long period. Both graphs support our view that loose monetary policy and ample global liquidity have contributed to the bull market in the real estate sector, which is in line with our theoretical considerations. Analyzing a house price shock, which may be especially relevant in the present situation,

8 Lower case variables are taken in logarithms.

9 To be more explicit here, the Likelihood Ratio test, the Final Prediction Error, the Akaike information criterion, the Schwarz criterion, and the Hannan-Quinn criterion are used.

10 To test for autocorrelation of the residuals, we performed the Lagrange Multiplier test.

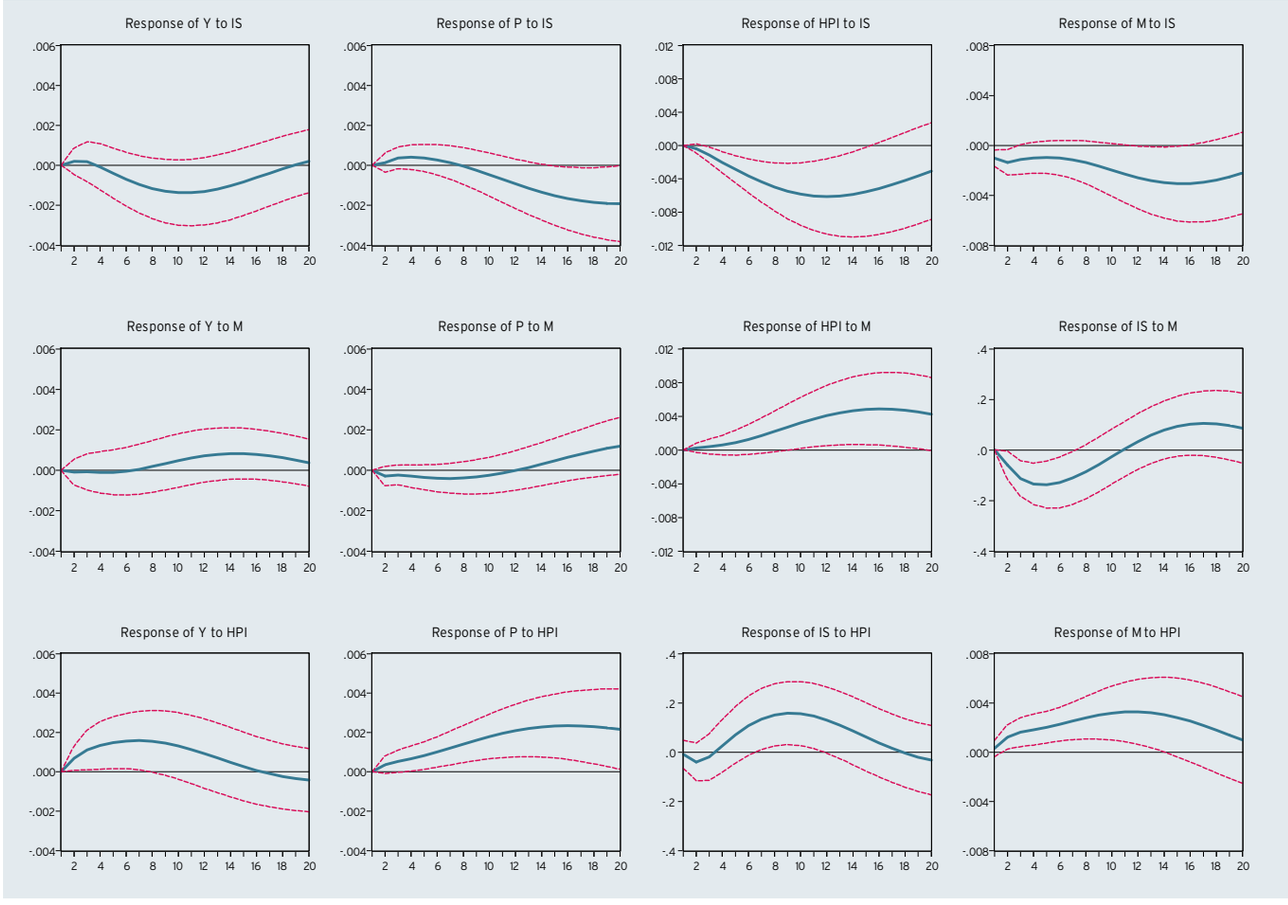

Figure 4: Impulse response analysis; basic model augmented with house prices

gives some additional insights. A house price shock raises liquidity, which may be at the very least due to rising credit demand. This evidence is not surprising, given the cointegration relationship between money and house prices found by Greiber and Setzer (2007) for the Euro Area and the U.S., and provides further support that housing should be considered in money demand models. More surprisingly, a house price shock causes a rise in interest rates (row 3, column 3). Since it has not been commonly known until now that monetary policymakers are reacting directly to house price developments[11] this again raises questions about the degree to which house prices are linked with inflationary expectations or forecasts.

The house price index in our model does not only solve the price puzzle, it is also involved in many significant impulse responses. Consequently, the house price variable is too crucial to be omitted in the following analyses. For this reason, we will augment our model with stock prices while still including the house price index. We now add the log of the MSCI World Index to our model to represent global stock markets. The vector of variables under consideration is therefore (in a Cholesky ordering): x_t = (y, p, hpi, IS, m, msw)$_t$ (20).

Figure 5 shows a selection of impulse responses representing the relationships that are of primary interest. No evidence can be found that either interest rate shocks or liquidity shocks fuel stock markets. Furthermore, no significant spill-overs from share prices to inflation occur in our model. However, there is a significant response from money to a stock market impulse. This may be due to wealth effects of money demand. As rising share prices contribute to wealth, and with money demand depending on wealth, perhaps even more than on income, this effect makes sense from a portfolio-theoretical perspective [European Central Bank (2007)]. These results are robust to an estimation of the model in which the house price index is excluded.

There may be different reasons for the insignificant reaction of stock prices to monetary conditions. Firstly, stock prices may be mainly determined by fundamental criteria like future cash flow expectations or price earnings ratios, assuming that the latter

11 For now, the sub-prime crisis ought to contribute to a changing behavior in this respect.

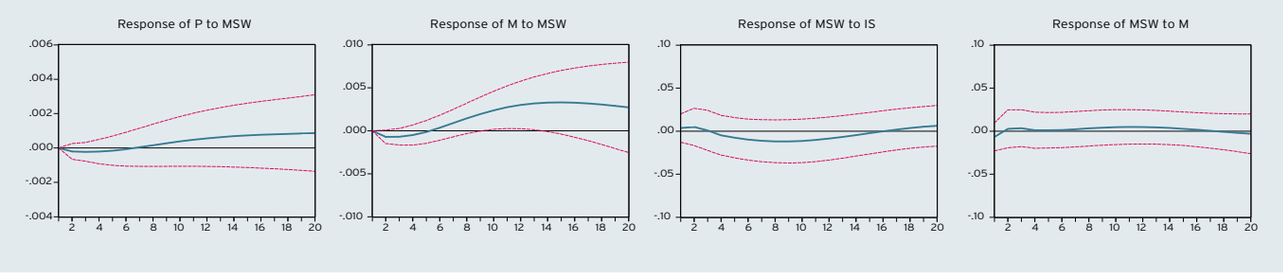

Figure 5: Impulse response analysis; model augmented with house prices and stocks

are independent of monetary policy. Secondly, the relationship between money and stock prices is theoretically not determined, since, with the exception of the aforementioned wealth effect, there is also an opposing substitution effect which postulates that a (expected) rise in stock prices, ceteris paribus, renders this type of investment more attractive than holding money balances and causes a portfolio shift into equities and away from money. Thus, the special role we found for house prices among asset prices in our theoretical considerations is clearly confirmed in our empirical investigation. The data tell us that additional demand (caused by a positive liquidity shock) is fully reflected in a rise in house prices. On the goods market, the same shock leads in the short run to an increase in the production of consumer goods. In the long term, the neutrality of money holds, i.e., the positive liquidity shock is met with a change in the GDP deflator.

Robustness checks

To check the robustness of our results, we estimated several alternative versions of our model. First, we changed the Cholesky ordering of the variables and, additionally, used generalized impulse responses [Pesaran and Shin (1998)]. For example, interest rate is often ordered behind the money variable in similar VAR models. When we incorporated such modifications we found that they have no impact on our results. The same is true for generalized impulse response analysis. Second, additional variables were added to the model, namely a commodity price index (as mentioned above), the oil price (as an alternative to the commodity price index), and a long-term interest rate (specified by 10-year government bond yields). Belke and Orth (2007) find that the results do not change significantly as a result. As a third methodological innovation, different lag lengths were used. Particularly, the use of four lags in the VAR was tried, but the results did not change significantly in this case either. All the results are available on request.

Conclusion

This paper has analyzed the relationship between money and asset prices at a global level. The main empirical results are the following. We find further support to the conjecture that monetary aggregates may convey some useful information on the future development of house prices, which matter for aggregate demand and hence consumer price inflation. Thus, we conclude that liquidity is a useful indicator of house price inflation. In our view, one important reason for these quite unbalanced findings are the different price elasticities of supply. In contrast, our VAR analysis does not provide any empirical evidence that stock prices are influenced by global liquidity.

Against this background, the still high levels of global liquidity can be seen as a threat to future inflation and financial stability. Since global excess liquidity is found to be an important determinant of house prices there might be at least two implications. Firstly, monetary authorities have to be aware of likely spill-overs from housing to consumer prices. Secondly, when house prices reach an unsustainable level and a potential bubble is created, the implications are risks to not only price stability but also to the economy at large – as seen in the current sub-prime crisis which apparently has partly spread from the U.S. to other parts of the world. We also see some implications for policy makers. In the first place, our VAR analysis indicates that house prices might well serve as indicators of future inflationary pressures. Moreover, strong monetary growth might be a good indicator of emerging bubbles in the real estate sector.

This conclusion would be totally in line with the findings of some other recent studies [Jarociński and Smets (2008)]. For instance, reviewing the role of housing investment in post-WWII business cycles in the U.S., Leamer (2007) maintains that "problems in residential investment have contributed 26% of the weakness in the economy in the year before the eight recessions" and claims that during the recent boom and bust period highly stimulating monetary policy by the Fed in the first place contributed to a booming housing market and subsequently led to an abrupt contraction as the yield curve inverted. Similarly, applying counterfactual simulations, Taylor (2007) demonstrates that the period of unusually low short-term interest rates in 2003 and 2004 (compared to a Taylor rule) may have significantly contributed to the boom in housing starts and may have led to an upward spiral of higher house prices, falling delinquency and foreclosure rates, more favorable credit ratings and financing conditions, and a higher demand for housing.

As the short-term interest rates returned to normal levels, housing demand rapidly fell, which, in turn, brought down both construction and house price inflation. Note that Germany, which is included in our investigated country sample, is no contradiction in our context because German reunification has led to huge overcapacities in some categories of real estate and, hence, real estate prices have not been blown up to the same extent as in other Euro Area countries facing the same liquidity expansion.

However, some important questions are left open to debate. If there is a build-up in global excess liquidity, why is that so and what are the consequences? How to deal with the so-called Greenspan and Bernanke puts, i.e., central banks which are creating too much liquidity in order to avoid crashes in financial markets? With the benefit of hindsight, one might be tempted to argue that central bankers might still not be used to globalization and lower inflation rates. Hence, they are flooding their economies with liquidity to avoid deflation, thereby accommodating global imbalances [Borio and Filardo (2007)]. Another open question is whether there really is a growing importance of uncertainty for national monetary policy makers which can be traced back to factors determined at the global level? For instance, the Brainard (1967) conservatism principle elaborates on the idea that multiplier uncertainty should make the central bank more conservative, in the sense of using its policy instrument less vigorously. A final question is related to assessment of the consequences of a slowing down or smooth reversal in global excess liquidity, especially with an eye on the risks and options in the light of Bretton Woods II? We leave these questions to further research.

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