Fiscal Policy and Asset Prices[*]

Luca Agnello[†]   Ricardo M. Sousa[‡]

Abstract

We assess the role played by fiscal policy in explaining the dynamics of asset markets. Using a panel of ten industrialized countries, we show that a positive fiscal shock has a negative impact in both stock and housing prices. However, while stock prices immediately adjust to the shock and the effect of fiscal policy is temporary, housing prices gradually and persistently fall. As a result, the attempts of fiscal policy to mitigate stock price developments may severely de-stabilize housing markets. The empirical findings also point to: (*i*) a contractionary effect of fiscal policy on output in line with the existence of crowding-out effects; (*ii*) a weakening of the effectiveness of fiscal policy in recent times; (*iii*) significant fiscal multiplier effects in the context of severe housing busts; and (*iv*) an increase of the sensitivity of asset prices to fiscal policy shocks following the process of financial deregulation and mortgage liberalization. Finally, the evidence suggests that changes in equity prices may help governments towards consolidation of public finances.

Keywords: *fiscal policy, asset prices, panel VAR.*

JEL Classification: *E62, H30.*

[†]Banque de France, Service d'Etude des Politiques de Finances Publiques (FIPU), 31 Rue Croix des Petits Champs, 75001 Paris, France; University of Palermo, Department of Economics, Italy. Email: luca.agnello@banque-france.fr; luca.agnello@economia.unipa.it.

[‡]Corresponding author. London School of Economics, Financial Markets Group (FMG), Houghton Street, London WC2 2AE, United Kingdom; University of Minho, Department of Economics and Economic Policies Research Unit (NIPE), Campus of Gualtar, 4710-057 - Braga, Portugal. Email: rjsousa@alumni.lse.ac.uk, rjsousa@eeg.uminho.pt. Phone: +44(0)2079557542; +351253601936. Fax: +44(0)2079556592; +351253676375.

1

1 Introduction

Over the last decades, important historical events have captured the attention of academics, governments and policy makers towards fiscal policy. The tax cuts during Reagan's presidency in the U.S. and the fiscal consolidations in Europe linked to the Maastricht convergence criteria, the Economic Growth and Stability Pact are just a few examples of the renewed interest on the role of fiscal policy as a tool for stabilizing the economy and its potential effects on asset markets.

More recently, the sudden occurrence of the global financial turmoil, its severity and potentially long-lasting impact, became key elements for assessing the role that external influences, oil prices, private investment, stock and credit markets or even duration dependence play on the likelihood of an expansion and contraction ending (Castro, 2009; Agnello and Nerlich, 2010). As a result, a prompt answer from monetary policy and large fiscal stimulus have become important ingredients of the attempt to recover economic activity. Notably, these interventions pose major challenges because they represent an valuable test to the long-term (un)sustainability of public accounts as the evidence on current developments in government bond markets shows (Hallett, 2008; Hallett and Lewis, 2008; Hallett et al., 2008; Schuknecht et al., 2009). Moreover, they may lead to business cycle de-synchronization (Rafiq and Mallick, 2008; Mallick and Mohsin, 2007, 2010) or negatively affect the nexus between monetary stability and financial stability (Castro, 2008; Granville and Mallick, 2009; Sousa, 2010a).

The behaviour of asset markets is indeed of major importance for financial institutions, homeowners, monetary authorities and policy makers. In addition, the linkages between the financial markets and the banking system, the housing sector, the credit market, and the monetary framework have emerged very strongly and powerfully in the course of the financial turmoil. Not surprisingly, the relationship between macroeconomic variables, wealth, and asset returns has revived the interest on the topic by academics (Schuknecht et al., 2009; Sousa, 2010b).

Yet, our understanding of the transmission of fiscal policy innovations to asset markets is far from complete. More importantly, despite the analysis of the macroeconomic effects of fiscal policy and the importance of asset markets over the business cycle, there is still an important gap in the literature, in particular, regarding the empirical relationship between fiscal policy actions and developments in asset prices.

This work aims at filling that gap. Specifically, its main goals is to answer the following questions: What is the impact of fiscal policy on asset prices? How are stock and housing prices affected by fiscal policy shocks? What is the magnitude and the persistence of the effects? Can fiscal policy be a powerful tool towards putting the economy in the track of recovery from a deep crisis?

Our approach is empirically used to these issues in an innovative manner. First, we analyze the

effects of fiscal poly on asset prices using a panel of ten industrialized countries, namely, Belgium, Finland, France, Germany, Italy, the Netherlands, Portugal, Spain, the U.K. and the U.S.. Second, we use quarterly data, which allows us to identify more precisely the impact of fiscal policy measures. To the best of our knowledge, such fiscal data set has not yet been used in the strand of economic modelling embodied in the paper. This is also a novelty with respect to the related literature which, generally, focuses on annual data to analyze a broad set of countries. Third, we estimate a Panel Vector Auto-Regression (PVAR) and, therefore, allow for unobserved individual heterogeneity, while treating all variables in the system as endogenous. Similarly, the PVAR approach allows us to increase the efficiency of the statistical inference, which would otherwise suffer from a small number of degrees of freedom of the country-level Vector Auto-Regression (VAR).

Our work suggests that fiscal policy plays a major role in asset markets. In fact, the results show that a positive fiscal shock has a negative impact in both stock and housing prices. However, the dynamics of the reaction is quite different. In fact, stock prices immediately adjust to the shock, but the effect of fiscal policy is temporary and quickly erodes. Stock prices start recovering after eight quarters, in anticipation of the positive effects on output. On the contrary, the impact of fiscal policy on housing prices exhibits strong persistence: housing prices gradually fall after the change in the fiscal stance, the trough is reached after eight quarters, and then slowly return to their initial level. In consequence, housing prices remain depressed even thirty quarters-ahead.

This piece of evidence has a dramatic policy implication. In the attempt of stabilizing financial markets and mitigating movements in stock prices, governments may negatively and persistently impact on housing markets. Consequently, the lack of synchronization in the timing of the response of stock and housing prices suggests that one can not use fiscal policy to simultaneously stabilize the two asset markets.

The empirical findings also point to a contractionary effect of fiscal policy on output and the key mechanism seems to be explained by the existence of crowding-out effects: a positive fiscal shock leads to an increase in the interest rate, that is, the cost of debt refinancing. Nevertheless, as the shock erodes and interest rate goes back to its initial level, output starts recovering and the response becomes positive at longer horizons. In consequence, the use of fiscal policy as a tool to recover the economy may be undermined by its contractionary effects in the short-run.

While our paper focuses on the role of fiscal policy as a driver of asset price dynamics, one may also question on whether asset prices influence fiscal policy. We find that the effects of stock market shocks on fiscal policy are greater in magnitude than the ones associated to housing prices. This, therefore, suggests that, rather than housing market movements, changes in equity prices may decisively contribute

to the goal of fiscal consolidation.

The robustness of the results is assessed in several directions. First, we show that fiscal policy actions can have significant multiplier effects when undertaken in the outcome of severe housing busts, which gives rise to the importance of the implementation of fiscal stimulus packages. Second, we find that the expansionary effect of fiscal policy has somewhat weakened in recent times and, as a result, asset markets have become more sensitive to a deterioration in fiscal stance. Third, the process of financial deregulation and mortgage liberalization might have contributed to the change in the degree of effectiveness of fiscal policy, as the competitiveness of national banking sector became strongly related to the commitment of government to credible and sound policies.

The rest of the paper is organized as follows. Section 2 reviews the existing literature on the relationship between fiscal policy and asset prices. Section 3 presents the estimation methodology. Section 4 describes the data. Section 5 discusses the results, while Section 6 assesses the robustness of the findings. Finally, Section 7 concludes and summarizes the main policy implications.

2 A Brief Review of the Literature

Despite the major fiscal developments of the last decades, the attention of academics, central banks and governments has been typically directed towards monetary policy and its linkage with asset markets.[1,2] For instance, Granville and Mallick (2009) investigate the nexus between monetary stability and financial stability. The authors show that the interest rate instrument used for inflation targeting (monetary stability) is conducive to financial stability (proxied by the term structure of interest rates, share prices, exchange rates, property price inflation and the deposit–loan ratio of the banking sector). Rafiq and Mallick (2008) examine the effects of monetary policy shocks on output in the three largest euro area economies – Germany, France and Italy (EMU3) – and show that there is a lack of homogeneity in the responses. Sousa (2010a, 2010c) shows that, for the Euro Area as whole and the U.S., housing wealth effects associated to a monetary policy contraction are very persistent, while financial wealth effects are of short duration. Additionally, the monetary authority pays a special attention to developments in monetary aggregates, but the monetary policy rule also suggests the adoption of a vigilant posture regarding financial markets. Similarly, Castro (2008) finds evidence of nonlinearity in the monetary policy rule, in particular, vis-a-vis financial conditions. This, in turn, makes economies less vulnerable to a credit crunch.

---

[1] For a summary of the empirical evidence on the impact of monetary policy on housing prices, see Aoki et al. (2004) and Iacoviello (2005).

[2] For the effects of monetary policy on stock prices and/or stock returns, see, for instance, Rigobon and Sack (2003), Bernanke and Kuttner (2005), Bordo and Wheelock (2007), and Wongswan (2009).

The role of fiscal policy in explaining both housing market developments and stock market dynamics should not, however, be neglected. In fact, fiscal policy can affect housing prices via subsidies, tax measures and its (wealth) effects on household's disposable income: capital taxes on housing gains, tax deductibility of interest payments, taxation of the imputed rental value of the house, and VAT on new houses are just a few examples of how fiscal policy can dramatically impact on housing markets. In fact, given that housing supply is typically inelastic in the short-run, fiscal subsidies targeted to the acquisition of a house may end up pushing up its demand and prices. Similarly, tax deductibility of interest rates may influence the demand for mortgage debt. In addition, sounder fiscal positions and lower sovereign financing needs allow for lower interest and better financing conditions for mortgage-loans, while higher government indebtedness can crowd-out resources away from home-owners (Maclennan et al., 1999).

As for the link between fiscal policy and stock prices, fiscal consolidations that lead to a permanent and substantial fall in government debt or signal sounder fiscal behaviour are typically related with increases in stock market prices (Ardagna, 2009). Similarly, fiscal policy measures may impact on sovereign risk spreads and financial markets may also be influenced by the interaction between fiscal variables and political institutions (Akitoby and Stratmann, 2008).

From the empirical point of view, the evidence on the linkages between fiscal policy, housing prices and stock prices is roughly inexistent. Using Canadian data, Darrat (1990) shows that fiscal policy plays an important role in determining stock market returns. Van Aarle et al. (2003) provide evidence supporting the relationship between fiscal policy and stock prices. Jappelli and Pistaferri (2007) highlight the role of fiscal policy measures in explaining the developments in housing markets. Ardagna (2009) reports that fiscal adjustments based on expenditure reduction are related with increases in stock market prices. Additionally, long-term government bond rates fall in periods of budget consolidation and rise when the fiscal position deteriorates. For emerging markets, Akitoby and Stratmann (2008) find that revenue-based adjustment lowers sovereign risk spreads more than spending-based adjustment. Financial markets also react to more to cuts in current spending than cuts in investment. Moreover, debt-financed spending increases sovereign risk, while tax-financed spending lowers spreads. Arin et al. (2009) investigate the effects of various tax policy innovations on stock market returns and show that indirect taxes have a larger effect on market returns than labor taxes.

3 Empirical Methodology

We use a Panel-data Vector Auto-Regression (PVAR) methodology to assess the effects of fiscal policy on asset prices. This framework combines the panel-data approach (that allows for unobserved individual heterogeneity) with the traditional Vector Auto-Regression (VAR) approach (that treats all variables in the system as endogenous). The first-order VAR model is specified as follows:

$$Y_{it} = \Gamma_0 + \Gamma(L)Y_{it} + f_i + d_{c,t} + \varepsilon_{it} \tag{1}$$

where Y_{it} is a vector of endogenous variables, Γ_0 is a vector of constants, $\Gamma(L)$ is a matrix polynomial in the lag operator, and ε_{it} is a vector of error terms.[3] The vector of endogenous variables includes the property price index ($HOUSE_{it}$), the Gross Domestic Product (GDP_{it}), the price level (P_{it}), the primary government deficit (DEF_{it}), the interest rate (IR_{it}), and the equity price index (EQ_{it}). In practice, it can be expressed as $Y_{it} = [HOUSE_{it}, GDP_{it}, P_{it}, DEF_{it}, IR_{it}, EQ_{it}]'$. Our model also allows for country-specific fixed effects, f_i, and country-specific time dummies, $d_{c,t}$, in order to capture aggregate and country-specific macroeconomic shocks. These dummies are eliminated by subtracting the means of each variable calculated for each country-year.

The advantage of using the PVAR approach is that it increases the efficiency of the statistical inference. In fact, the estimation of country-level VARs would suffer from a small number of degrees of freedom due to the lack of available data. Moreover, despite the fact that cross-country differences are disregarded in the model (as it imposes the same underlying structure for each cross-section unit), Gavin and Theodorou (2005) note that the PVAR approach also allows one to uncover common dynamic relationships. In addition, this problem can be overcome by introducing fixed effects. However, given the correlation between the fixed effects and the regressors (due to the lags of the dependent variables), the commonly used mean-differencing procedure produces biased estimates (Holtz-Eakin et al., 1988), in particular, when the time dimension is small (Nickell, 1981).

We avoid the drawback of the fixed effects estimator by following a two-stage procedure in which: (i) we use a forward mean-differencing approach (the 'Helmert procedure') that removes only the mean of all future observations available for each country-year (Arellano and Bover, 1995); and (ii) we estimate the system by GMM, using the lags of the regressors as instruments, therefore, keeping the orthogonality between lagged regressors and transformed variables unchanged (Blundell and Bond, 1998). Given that the number of regressors is equal to the number of instruments, the model is "just identified" and the system GMM is equivalent to a two-stage least squares estimator applied equation by equation (Love

---

[3] The vector of error terms, ε_{it}, has zero mean and a country-specific variance, σ_i.

and Zicchino, 2006).

In what concerns the impulse-response functions, we transform the system in a "recursive" VAR and impose a triangular identification structure (Hamilton, 1994).[4] We follow the usual Choleski decomposition of variance-covariance matrix of residuals, and assume that the interest rate and the equity price adjust simultaneously to shocks to fiscal policy, while the housing price, the GDP, and the price level only react with a lag.

The ordering of the variables in the system and, specifically, for the GDP, the price level, the primary fiscal deficit and the interest rate, is common in the literature on fiscal policy.[5] Regarding asset prices, one needs to distinguish between the ordering of equity price and housing price. The equity price was ordered last as it refers to assets that are traded in markets where auctions take place instantaneously. By its turn, the housing price was ordered first in the system for the following reasons. First, housing markets are inherently sticky and housing prices do not immediately reach the equilibrium after the fiscal policy shock. Second, there is a "time-to-build" argument showing that it takes time for developers to bring new houses to the market or to work off inventories when demand increases. Third, the matching between the needs of buyers and sellers requires time. Fourth, there are important transaction costs inherent to trading housing up or down.

4   Data and Summary Statistics

We use quarterly data for ten industrialized countries. The data are available in the following samples: 1980:1-2007:3, for Belgium; 1970:1-2007:4, for Finland; 1970:2-2007:2, for France; 1979:1-2007:2, for Germany; 1980:1-2007:3, for Italy; 1977:1-2007:1, for the Netherlands; 1985:1-2006:4, for Spain; 1988:1-2007:4, for Portugal; 1955:2-2007:4, for the U.K.; and 1967:2-2007:4, for the U.S.. The main sources are as follows:

- *Property Price Index* ($HOUSE_{it}$). Obtained from the Bank for International Settlements (BIS).

- *GDP* (GDP_t). Used as a proxy for economic activity and business cycle and provided by the Bureau of Economic Analysis (in the case of the U.S..), the Office for National Statistics (for the U.K.), the Bank of Portugal (for Portugal) and the International Financial Statistics of the IMF (for the remaining countries).

---

[4] The orthogonalized shocks can be interpreted as reduced-form but not as structural shocks. This could be achieved by imposing some sort of sign restrictions (Mountford and Uhlig, 2008), long-run restrictions (Blanchard and Quah, 1989) or short-run restrictions (Sims and Zha, 2006) and estimating the VAR at the country level. Unfortunately, the sample sizes at the country-level are relatively short and do not allow one to be confident on the statistical inference based on these approaches. Consequently, the PVAR approach appears to be the most appropriate framework.

[5] See, for instance, Fatás and Mihov (2001). Note, however, that changing the ordering of the variables does not have a significant impact on the results.

- Price (P_{it}). Proxied by the GDP deflator and provided by the International Financial Statistics of the IMF.

- *Primary Fiscal Deficit* (DEF_{it}). Used as the fiscal policy instrument and provided by the Bureau of Economic Analysis (U.S.), the Office for National Statistics (U.K.), the Bank of Portugal (Portugal) or typically disseminated through the monthly publications of the General Accounting Offices, Ministries of Finance, National Central Banks and National Statistical Institutes. For the U.S., we consider the Federal Government spending and revenue, whilst, for the U.K., figures correspond to the Public Sector. In the case of the euro area countries, we use budgetary data on a cash basis. It normally refers to the Central Government, therefore, with the exclusion of the Local and/or the Regional Authorities. The latest figures are also published in the Special Data Dissemination Standard (SDDS) section of the International Monetary Fund (IMF) website, to which euro area Member States contribute.

- *Interest Rate* (IR_{it}). Proxied by the 3-month Treasury Bill rate (Belgium, France, Germany, Italy, Spain, U.K. and U.S.), the central bank rate (Finland) and the government bond yield (Netherlands and Portugal) and provided by the International Financial Statistics of the IMF.

- *Equity Price Index* (EQ_{it}). Obtained from the BIS (all countries except Portugal) and the International Financial Statistics of the IMF (Portugal).

All variables are seasonally adjusted and expressed in natural logarithms of real terms with the obvious exception of the interest rate. National currency data for all years prior to the switch of the euro area countries to the euro have been converted using the fixed euro conversion rate in order to provide comparable series across time for each country.

A summary of the descriptive statistics of the variables is reported in Table 1, while a detailed description of the data sources and data construction is provided in Appendix A. Table 1 shows that, in general, stock prices exhibit more dispersion that housing prices, therefore, reflecting the typically larger volatility that one observes in those markets. The sample average of the government deficit is about 6.6%, that is, almost double of the threshold defined by the Maastricht criteria. Note, however, that the sample includes countries such as the U.S. and the U.K. which are not euro area members. Moreover, the time coverage (1970-2007) also includes observations from periods that are prior to that set of rules that impose fiscal discipline.

Table 1: Descriptive statistics.

Variable (name)	# Observ.	Mean	St. Dev.	Minimum	Maximum
Housing prices	1327	0.7074	0.4380	-0.1646	2.1659
GDP	1483	11.3303	1.3098	8.1502	13.2703
Price level	1484	3.9652	0.7436	1.7025	4.7920
Government Deficit	1344	0.0661	0.1889	-0.8200	0.5999
Real interest rate	1359	2.5113	4.2617	-30.1844	34.2559
Equity prices	1332	0.9199	0.8108	-1.0211	3.4290

5 Empirical Results

5.1 Baseline Model

Given that the major goal of the paper is to assess the impact of unexpected variation in fiscal policy on asset prices, we estimate the PVAR represented by system (1) after the fixed effects have been removed.

Table 2 summarizes the parameter estimates. It is interesting to note that the majority of the variables included in the system (with the exception of the interest rate) exhibits a relatively strong persistence. This may, therefore, lead to the existence of substantial differences between the short-run and the long-run responses of the variables to different shocks. In particular, in the case of fiscal deficit, it can also be explained by some inertia of the budgetary process.

The dynamics of housing prices is negatively correlated with real interest rates, suggesting the negative relationship between monetary policy and this set of asset prices. The same negative linkages can be found for stock prices, although the coefficient is not statistically significant. This probably reflects the existence of a small or temporary effect of monetary policy on stock prices.

In what concerns fiscal policy, one can see that it positively impinges on real interest rates in a very significant way. This is in line with the studies that find a positive link between deficits and the long-term interest rates (Hoelscher, 1986; Cebula and Rhodd, 1993).[6] In addition, fiscal policy seems to be negatively related with housing prices and positively linked with stock prices.

---

[6] In contrast, other authors did not find evidence of a significant relationship between government deficits and interest rates (Barro, 1976; Evans, 1985).

Table 2: Main results of a six-variable VAR model.

Response of	Response to					
	$HOUSE_{t-1}$	GDP_{t-1}	P_{t-1}	$DEFICIT_{t-1}$	IR_{t-1}	EQ_{t-1}
$HOUSE_t$	0.9375	0.0263	0.0026	-0.0083	-0.0011	0.0073
	[0.0134]***	[0.0335]	[0.0085]	[0.0141]	[0.0003]***	[0.0065]
GDP_t	-0.0084	0.9574	0.0096	0.0003	-0.0004	0.0085
	[0.0051]*	[0.0127]***	[0.0030]***	[0.0052]	[0.0001]***	[0.0024]***
P_t	-0.0202	0.0587	0.9732	0.0140	0.0001	-0.0149
	[0.0057]***	[0.0142]***	[0.0033]***	[0.0053]***	[0.0001]	[0.0027]***
$DEFICIT_t$	-0.0694	0.1178	0.0115	0.7027	0.0007	-0.0611
	[0.0494]	[0.1218]	[0.0272]	[0.0481]***	[0.0006]	[0.0223]***
IR_t	-2.6612	-2.1828	3.8117	4.2657	0.1606	-0.9313
	[1.9457]	[4.6532]	[1.1617]***	[1.9480]***	[0.0606]***	[0.8790]
EQ_t	0.0242	-0.1838	0.0510	0.0331	-0.0013	1.0299
	[0.0505]	[0.1388]	[0.0324]	[0.0442]	[0.0009]	[0.0265]***

Note: Six-variable VAR model is estimated by GMM. Country-time and fixed effects are removed prior to estimation.
Reported numbers show the coefficients of regressing the row variables on lags of the column variables.
Heteroscedasticity and serial correlation robust standard errors appear in brackets.
* statistically significant at 10% level; ** at 5% level; *** at 1% level.

Figure 1 plots the impulse-responses to an orthogonalized fiscal policy shock together with 68% bootstrapped confidence bands based on 10000 draws. It shows that asset prices react in a very different manner to the shock in fiscal policy: while the effect on housing prices is significant and negative, in the case of stock prices, the findings do not reveal a statistically significant effect. Moreover, the response of housing prices is highly persistent and the trough is reached after about seven quarters, but housing prices are below their initial level for almost twenty-five quarters. In contrast, the adjustment of stock prices is quick and temporary.

Figure 1: Impulse-responses to a fiscal policy shock (Model with six variables: $HOUSE_{it}, GDP_{it}, P_{it}, DEF_{it}, IR_{it}, EQ_{it}$).
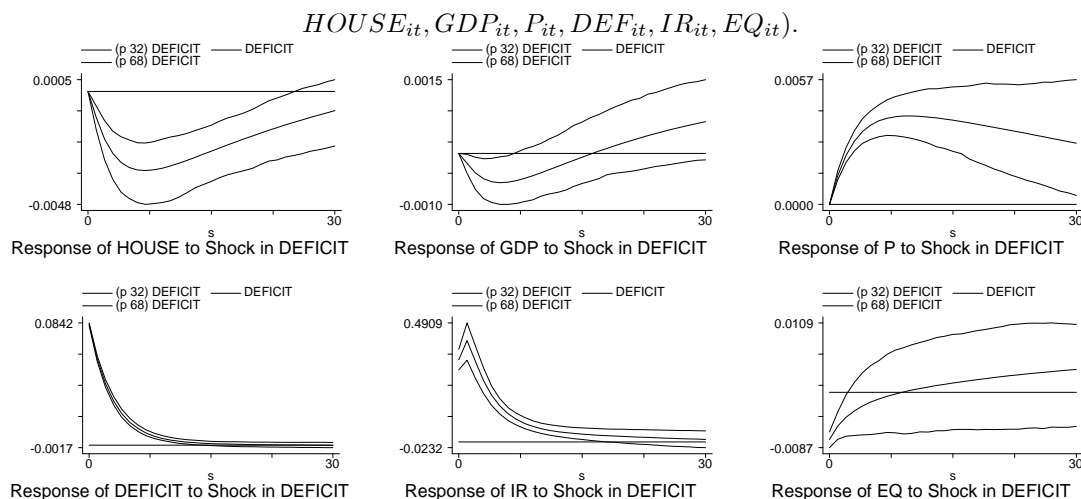
Interestingly, real interest rates increase temporarily and fall gradually after one quarter. This is in line with the work of Gale and Orszag (2003) who argue that there are two important reasons for

why budget deficits may raise interest rates: (i) public deficits reduce aggregate savings when private savings do not increase by the same amount and there are no compensating foreign capital inflows; and (ii) deficits increase the stock of government debt. Similarly, Kiani (2009) examines the effect of federal budget deficits on long-term interest rates and emphasizes the "crowding-out" hypothesis, whereby fiscal policy can negatively influence investment expenditures on plant, equipment, research and development and, ultimately, the long-term growth of living standards. Schuknecht et al. (2009) also highlight the importance of the government risk premium in bond markets.

This evidence suggests that the credit channel from fiscal policy shocks mainly operates via the housing market. Consistently, the temporary and immediate increase in the interest rates seems to lead to a fall in the private sector's housing demand and, therefore, induce a downward adjustment in housing prices. In the case of stock prices, the credit channel matters only for a short period (of about two quarters). Notably, after the fiscal shock occurs, the rise in the interest rates makes the stock market a less attractive place for the allocation of savings. As a consequence, share prices immediately fall. However, as the shock erodes, stock prices start recovering in anticipation of the expansionary effects of fiscal policy on output.

Actually, GDP starts to significantly fall for about six quarters before it gradually recovers. This is in accordance with the work of Perotti (2004), who uses a Structural Vector Auto-Regression (SVAR) approach to study the effects of fiscal policy on a set of five OECD countries. The author shows that while, in general, tax multipliers are negative and small, one can also find empirical support for positive tax multipliers. Similarly, Baldacci et al. (2001) argue that, although research generally suggests small and positive spending multipliers and small and negative tax multipliers, there is some evidence for both negative spending multipliers and positive tax multipliers. Giavazzi and Pagano (1990) and Bradley and Whelan (1997) also find an expansionary effect associated to contractionary fiscal policy, in particular, when undertaken in a situation of public accounts distress and coordinated with an adequate exchange rate policy. Non-Keynesian effects may indeed emerge when the fiscal consolidation programme appears to the public as a serious attempt to reduce the public sector borrowing requirements. In that case, an induced wealth effect may emerge, leading to an increase in private consumption (Sutherland, 1997). However, if the fiscal consolidation is not seen as credible, then the negative Keynesian effect on consumption will prevail.

The response of the price level shows that is significantly rises after the shock with the peak effect being reached after twelve quarters. This corroborates the fiscal theory of the price level that takes into account monetary and fiscal policy interactions and assumes that fiscal policy may determine the price level even if monetary authorities pursue an inflation targeting strategy (Woodford, 1995).

11

These findings deserve some further comments. First, from a theoretical perspective, the structural relationship between fiscal deficit, interest rates and GDP can be interpreted as referring to the so-called "crowding-out" effect. Indeed, when governments run a budget deficit and fund it by borrowing on the domestic capital market (for instance, by selling Treasury Bills), they place an upward pressure on real interest rates. This, in turn, stimulates savings in the private sector and discourages or "crowds-out" private consumption and investment. Consequently, aggregate demand may fall. Second, fiscal policy shocks may also affect domestic interest rates through their impact on households' and firms' expectations. For example, if agents believe that the increase in debt that is used to finance the budget deficit will be funded by a raise in future taxation - that is, if they act in a Ricardian manner -, then one might observe an increase in current savings.[7] Third, to the extent that agents' expectations are consistent with the existence of inflationary effects due to large budget deficits, the increase in inflation (risk) premium will be embedded into interest rates and rise them. Once again, the final effect of the upward adjustment in the interest rates will be a fall in the level of real GDP.

Table 3: Forecast-error variance decomposition.

| Response of | Response to | | | | | |
	$HOUSE_{t-1}$	GDP_{t-1}	P_{t-1}	$DEFICIT_{t-1}$	IR_{t-1}	EQ_{t-1}
$HOUSE_t$	0.4579	0.0032	0.0076	0.0142	0.0610	0.4562
GDP_t	0.0041	0.2879	0.0026	0.0012	0.0578	0.6464
P_t	0.0487	0.0425	0.1887	0.0179	0.0390	0.6631
$DEFICIT_t$	0.0193	0.0119	0.0166	0.4885	0.0270	0.4367
IR_t	0.0629	0.0072	0.1913	0.0304	0.5033	0.2050
EQ_t	0.0050	0.0097	0.0243	0.0006	0.0471	0.9132

Note: Percent of variation in the row variable (thirty quarters-ahead) explained by the column variable.

In Table 3, we report the variance decomposition of the variables included in the PVAR at the horizon of thirty quarters. Similarly, Figure 2 plots the forecast-error variance decomposition to a fiscal policy shock over different time horizons. The evidence corroborates the previous findings: unexpected variation in the fiscal stance explains just a small fraction of the forecast-error variance decomposition of stock prices (thin solid line), but it plays an important role in generating the dynamics of housing prices.(thin and dotted line) even thirty quarters-ahead. In addition, fiscal shocks substantially and persistently impact on prices and interest rates, which gives echo to the current developments in bond markets, especially, given the difficulties faced by some highly-indebted governments in trying to raise

---

[7]Barro (1976) and Seater (1993) show that forward-looking consumers save the proceeds from a debt-financed fiscal stimulus in anticipation of the future tax increase needed to repay the additional government debt. Such Ricardian behaviour implies that consumers' net wealth is invariant to a debt-financed government expenditure increase.

the necessary funds. Finally, the evolution of the forecast-error variance decomposition of GDP suggests that fiscal policy plays a negligible role, which casts some doubts about the effectiveness of the current fiscal stimulus packages. Note, however, that these results have not been conditioned on the state of the economy, a feature that may be crucial indeed.

Figure 2: Forecast-error variance decomposition: shock to fiscal policy.
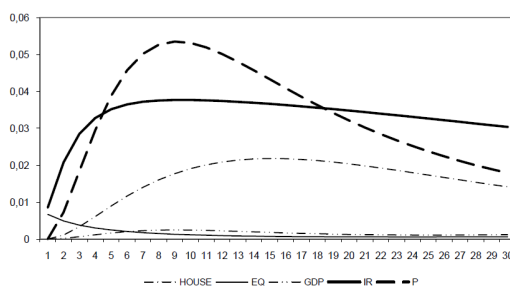
An important question remains: do asset prices influence the dynamics of fiscal policy? As discussed in Section 1, there is very limited evidence on whether fiscal policy responds and/or is affected by asset price movements. From a theoretical perspective, Schuknecht and Eschenbach (2002) show that asset prices can influence government budget balances through a series of channels: (*i*) directly, via related taxes on capital gains/losses; and (*ii*) indirectly, via a feedback effect from asset prices to the economy. A positive shock in asset prices may, therefore, have a counter-cyclical effect on the budget balance, as the additional government revenue would translate into a lower deficit (or a higher surplus). Alternatively (i.e. in the case of indirect effects), higher asset prices can boost consumer confidence, via the wealth effect, and lead to a rise in consumption. This, in turn, induces an increase in taxes, thereby, reducing government deficit.

In order to investigate the potential multidirectional linkage between fiscal policy and asset prices, Figure 3 displays the impulse-response functions of fiscal policy to, respectively, a shock in housing prices and a shock in stock prices. The evidence suggests that the effects of asset price shocks on fiscal policy are significant and highly persistent. Interestingly, the negative response of fiscal deficit indicates that unexpected variation in asset prices contribute to fiscal consolidation. In particular, the reduction of government deficit seems larger in magnitude in the case of stock price shocks (a 2.4% fall *versus* a 0.5% fall in the case of housing prices). This suggests that changes in stock prices (rather than housing market movements) can play a prominent role towards the achievement of a sounder and more sustainable fiscal stance.

13

Figure 3: Impulse-response of $DEFICIT_{i,t}$ to, respectively, a housing price ($HOUSE_{i,t}$) and a equity price ($EQ_{i,t}$) shock.
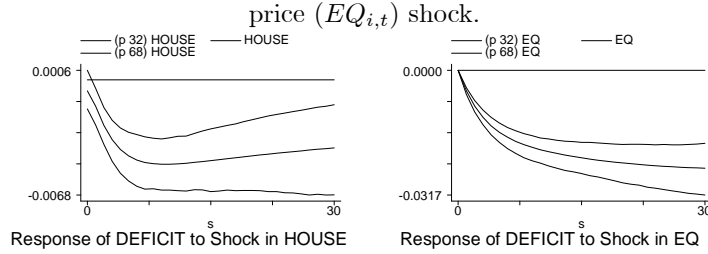
6   Sensitivity Analysis

We now assess the robustness of the previous results in several directions. First, we investigate if the effectiveness of fiscal policy has changed over time. Second, we evaluate the role of fiscal deregulation and the importance of the process of mortgage liberalization. Finally, we ask whether the fiscal stimulus packages help boosting the recovery.

6.1   Have asset markets become more sensitive to fiscal policy?

This section examines whether the impact of fiscal policy on asset prices (and economic activity) has changed over time. To that end, we estimate the PVAR model specified in (1) over two sub-periods: 1970:1-1984:4 and 1985:1-2007:4.

Figure 4 plots the impulse-response functions of asset prices and output to a shock in the fiscal stance. In the first sub-sample period (1970:1-1984-4), fiscal policy seems to have a positive impact on economic activity. After a fall in the first few quarters, GDP starts rising in a significant manner. In anticipation of the expansionary effect on output, the demand for financial assets increases and stock prices quickly rise. In what concerns housing prices, our analysis suggests that the effect of fiscal policy tends to be significantly negative only in the first few quarters, and as a result of the "crowding-out" effect generated by the increase in interest rates. From the fifth quarter onwards, housing prices gradually recover and the impact of fiscal policy remains significant even thirty quarters-ahead.

As for the second sub-sample period (1985:1-2007:4), the results displayed in Figure 5 show that fiscal policy effects are dramatically different. The pattern of the response of GDP suggests that, after the mid eighties, the fiscal multiplier has become negative, therefore, providing evidence of a "Non-Keynesian" effect of fiscal policy. This result is consistent with the common wisdom that fiscal policy effects has substantially weakened over the last twenty years (Perotti, 2004). In the case of asset prices and in contrast with the previous results, we find that fiscal shocks impact negatively and persistently on both housing and equity prices.

A possible explanation for such asymmetric response of output and asset prices over the two sub-samples may lay on the fact that financial deregulation has progressively changed the degree of effectiveness of fiscal policy, as well as the way it is perceived by markets' participants. We investigate this issue in the next sub-Section.

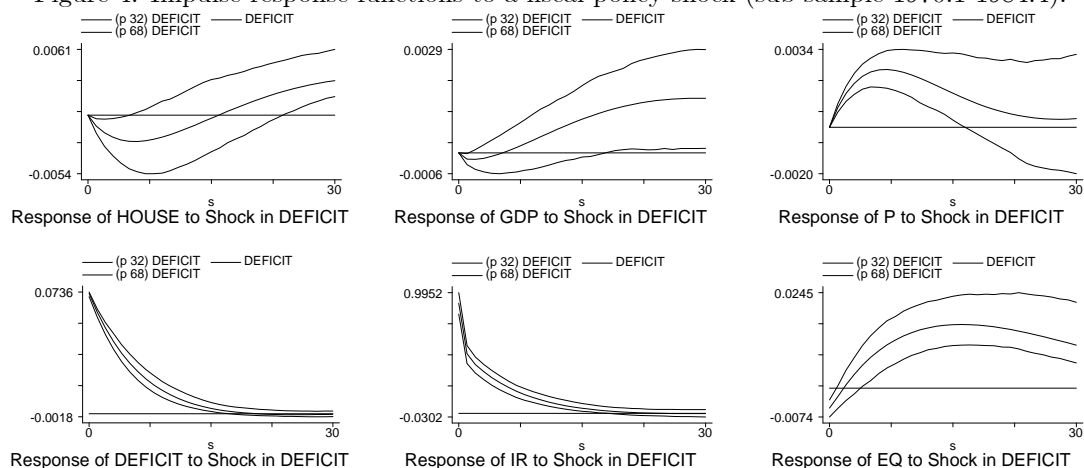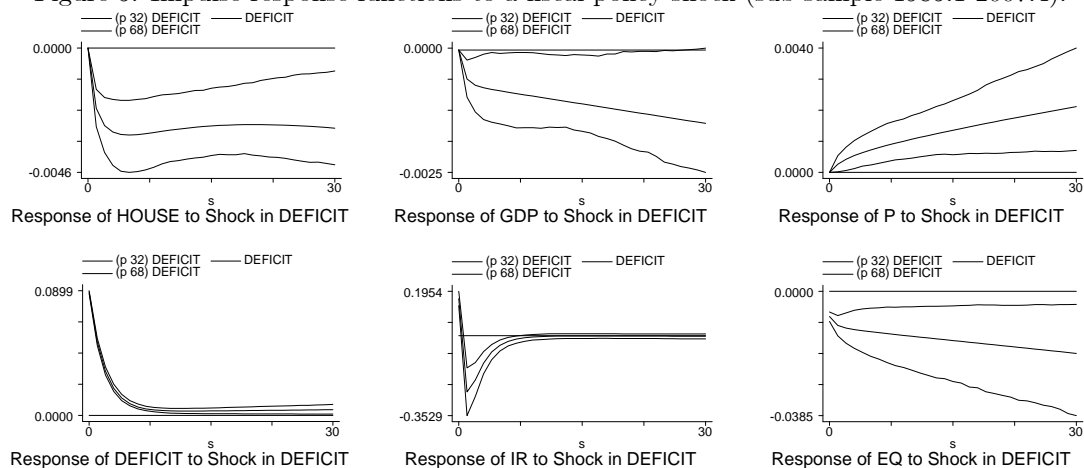Figure 4: Impulse-response functions to a fiscal policy shock (sub-sample 1970:1-1984:4).

Figure 5: Impulse-response functions to a fiscal policy shock (sub-sample 1985:1-2007:4).

6.2 Does financial deregulation matter?

Until the early eighties, mortgage markets were, in general, highly regulated. Interest rate ceilings and quantitative limits on credit and repayment periods often led to chronic or temporary credit rationing. This made it difficult for households to access credit and increased the sensitivity of demand to shocks in disposable income (Girouard and Blondal, 2001). In this context, one would expect that the positive

15

effect on private income due to an expansionary fiscal policy also generates a rise in the demand of asset markets and, consequently, asset prices.

In contrast, when the deregulation process started, credit constraints on households and firms become more relaxed and access to mortgage credit broadened (Diamond and Lea, 1992). Because of the enhanced opportunities to smooth consumption vis-a-vis temporary fluctuations in income and to hedge against unfavorable labour income shocks, households' demand may have become less dependent on current income. Similarly, the incidence of mortgage market deregulation may significantly affect the probability of extreme variations in asset prices (Agnello and Schuknecht, 2009). These features could partially explain the high degree of uncertainty regarding the size of the effect of fiscal shocks on GDP in the post-1984 sub-sample.

In addition, the asymmetric response of asset prices that one observes for the two sub-samples may be linked to the increase of competition in the banking sector. In fact, in a context of high degree of liberalization and market integration, the competitiveness of the banking sector becomes strongly dependent on the quality of national policy's formulation and implementation, and on the credibility of government's commitment to such policies. As a result, an expansionary fiscal policy might be interpreted by markets as signalling a deterioration of public finances (Ardagna, 2009) or a lack of fiscal discipline (Hallett et al., 2008). This, in turn, may induce the private sector to dramatically increase savings and persistently reduce investment in housing and stock markets.

In order to uncover the dynamics behind the patterns of the impulse-response functions across different sub-samples and support our predictions regarding the role played by the financial deregulation, we re-estimate the model specified by (1), namely, by accounting for the liberalization process of the mortgage market in each country. Specifically, we estimate a dummy-augmented PVAR model of the form:

$$Y_{it} = \Gamma_0 + \Gamma_{BL}(L)Y_{it} \times D_{it}^{BL} + \Gamma_{AL}(L)Y_{it} \times D_{it}^{AL} + f_i + d_{c,t} + \varepsilon_{it}, \tag{2}$$

where Y_{it} is the same vector of endogenous variables defined above, and D_{it}^{BL} and D_{it}^{AL} are dummy variables that capture the process of deregulation in the mortgage markets. In particular, for each country i, D_{it}^{BL} takes the value of one before the deregulation process started, and zero once it is in place. Similarly, D_{it}^{AL} takes the value of one after the deregulation process has taken place, and zero otherwise.

Table 4 summarizes the starting dates of the most relevant financial deregulation measures affecting the housing markets in the countries included in the sample. In the majority of countries, the process of liberalization consisted of a deregulation of interest rates (Germany, Netherlands, Portugal and Spain) or a lifting of credit controls (Finland, France and Italy).

16

Table 4: Selected financial deregulation measures affecting the housing market.

Country	Date	Type of measurement
Belgium	1992	Introduction of variable interest rate loans and reduction of the maximum early repayment fee
Germany	1967	Deregulation of interest rates
Finland	1986	Lifting of quantitative credit controls Funding quotas from the Central Bank to commercial banks eliminated
France	1987	Lifting of credit controls Bank specialization requirement reduced
Italy	1988	Permanent lifting of quantitative credit controls (credit ceilings eliminated)*
Netherlands	1980	Deregulation of interest rates
Portugal	1992	Deregulation of interest rates
Spain	1987	Deregulation of interest rates
United Kingdom	1986	Authorization granted to building societies to extend their activity to mortgage loans
United States	1984	Removal of Regulation Q and elimination of portfolio restrictions for thrifts

Note: Data are provided by Mehrez and Kaufmann (1999), Girouard and Blondal (2001), ECB (2003) and Debelle (2004).
* Although credit ceilings were officially eliminated in Italy in 1983, they were temporary reimposed in the period 1986-1987.

Figures 6 and 7 plot the impulse-response functions to a shock to fiscal policy, respectively, before and after the deregulation process. The results corroborate our previous findings and conjectures. In particular, one can see that in a context of highly deregulated markets, fiscal policy may be particularly ineffective. Most importantly, an expansionary fiscal policy may increase the vulnerability of real estate and financial markets. In fact, markets will immediately interpret the measure as a deterioration of the fiscal stance and a threat to long-term sustainability of public finances (Hallett and Lewis, 2008). As a result, both stock prices and housing prices significantly and persistently fall in the "after deregulation" period.

Figure 6: Impulse-responses to a fiscal policy shock (before deregulation).
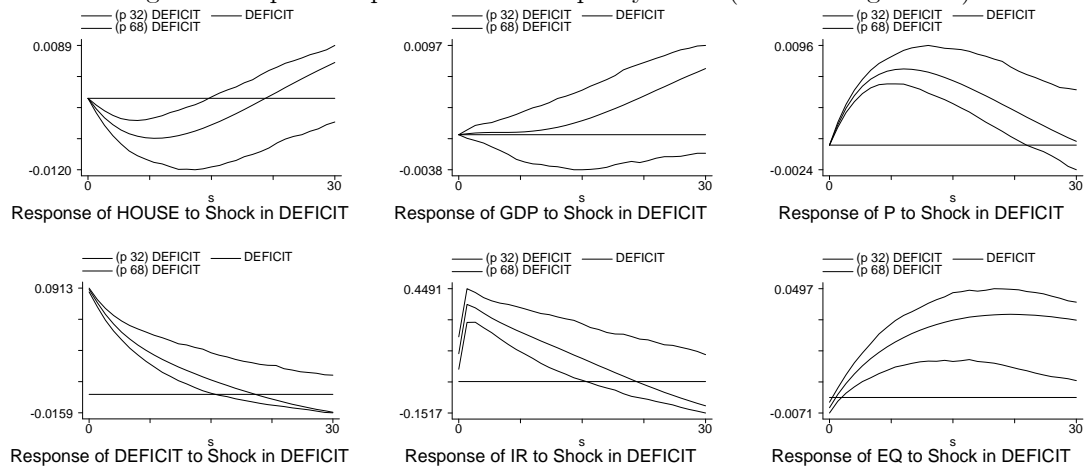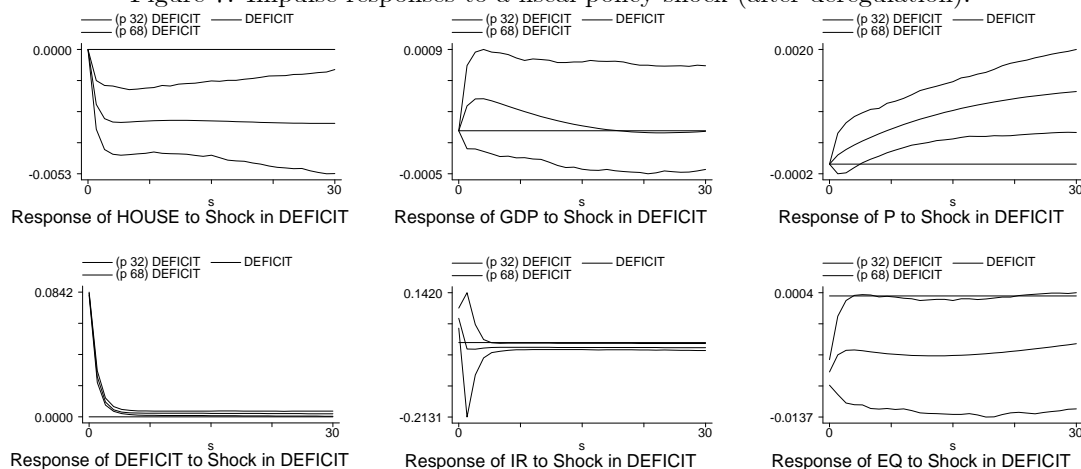
Figure 7: Impulse-responses to a fiscal policy shock (after deregulation).

Response of HOUSE to Shock in DEFICIT

Response of GDP to Shock in DEFICIT

Response of P to Shock in DEFICIT

Response of DEFICIT to Shock in DEFICIT

Response of IR to Shock in DEFICIT

Response of EQ to Shock in DEFICIT

6.3   Can the fiscal stimulus packages help boosting recovery?

Financial crises can be contagious and damaging, and typically lead economies into recessions. Among the many causes of financial crises, one can refer: (i) credit booms; (ii) currency and maturity mismatches; (iii) large capital inflows; and (iv) unsustainable macroeconomic policies (i.e., large current account deficits and rising public debt).

Asset prices constitute a critical link between macroeconomic, monetary and financial stability (Rafiq and Mallick, 2008; Sousa, 2010a, 2010c). History shows that significant corrections in asset prices, from their long-run equilibrium levels, may lead to financial instability (in particular, in the banking system) and, ultimately, to macroeconomic instability (Granville and Mallick, 2009). Moreover, situations of busts in asset prices have important economic costs, in particular, in terms of GDP losses during the post-boom phase (Jaeger and Schuknecht, 2007; Agnello and Schuknecht, 2009). The developments of the most severe financial crises (i.e., the Great Depression and the banking crisis of Japan in 1997) also generated a global downturn, therefore, suggesting that monetary policy may have a limited scope for further stimulus. Not surprisingly, in the context of the current global downturn characterized by a sharp correction of both housing and stock prices, central banks and governments have called for prompt and very expansionary fiscal policy measures. These have generally reallocated wealth toward banks and debtors and away from taxpayers.

Table 5 summarizes, for the set of countries included in the sample, the fiscal stimulus packages announced for 2009-2010. It shows the dramatic magnitude (in percentage of the GDP) of such policies, in particular, in countries such as Spain (6.7%) and the U.S. (5.5%), but also in Finland (1.7%), Germany (1.6%), France and Portugal (1.3%) and the Netherlands (1%).

18

Table 5: Fiscal stimulus packages.

Country	Amount ($ billions)	%GDP
Belgium	2.5	0.6
Germany	103.3	1.6
Finland	2.6	1.7
France	33.0	1.3
Italy	6.3	0.3
Netherlands	7.5	1.0
Portugal	2.7	1.3
Spain	113.3	6.7
United Kingdom	36.3	0.9
United States	787.0	5.5

Note: Data come from Gallagher (2009).

Against this background, we assess the extent to which a fiscal stimulus contributes to the strength of the economic recovery. Specifically, we investigate whether fiscal policy shocks undertaken during housing bust phases can have an important multiplier effect on the economy. For instance, Ahearne et al. (2005) examine periods of pronounced rises and falls of real housing prices since 1970 in eighteen major industrial countries. The authors find that housing price booms are typically preceded by a period of easing monetary policy, but then diminishing slack and rising inflation lead monetary authorities to tighten policy before housing prices peak. Similarly, Agnello and Schuknecht (2009) analyze episodes of booms and busts in real estate price in eighteen industrialized countries. The authors show that recent housing booms have been very persistent and a number of policy variables (such as credit developments, global and local monetary conditions and short-term interest rates) are particularly important in explaining the probability of a boom or bust.

To shed some light on this question, we estimate a dummy-augmented version of the PVAR specified in (1). More specifically, we consider the following model:

$$Y_{it} = \Gamma_0 + \Gamma_B(L)Y_{it} \times D_{it}^B + \Gamma_{NB}(L)Y_{it} \times D_{it}^{NB} + f_i + d_{c,t} + \varepsilon_{it} \tag{3}$$

where Y_{it} is the same vector of endogenous variables as defined above, D_{it}^B is a dummy variable that is set equal to one in case of an episode of bust in the housing prices in period t in country i, and zero, otherwise. Similarly, D_{it}^{NB} defines a dummy variable that takes the value of one in the absence of housing price busts in period t in country i, and zero otherwise.

In order to detect the bust episodes, we use a non-parametric approach and, following Agnello and Schuknecht (2009), we define a bust in housing prices as a major and persistent downward deviation from their trend computed by a one-sided Hodrick-Prescott (HP) filter with a smoothing parameter of 100,000. Therefore, a bust corresponds to a negative deviation (more than 5%) and persistent (at least

twelve quarters) of housing prices from the trend.[8]. Using this definition, we are able to identify the bust episodes reported in Table 6.

Table 6: Episodes of busts in housing market.

Country	Busts
Belgium	1983Q1-1989Q1
Germany	1975Q2-1979Q1; 1982Q21989Q4; 1996Q2-2007Q2
Finland	1970Q1-1972Q4; 1977Q2-1980Q4; 1990Q3-1997Q2
France	1971Q1-1973Q4; 1982Q1-1999Q2
Italy	1984Q3-1989Q1; 1993Q3-2001Q3
Netherlands	1980Q4-1986Q2; 2003Q3-2007Q3
Portugal	1995Q3-2000Q2; 2001Q3-2007Q4
Spain	1971Q2-1974Q1; 1980Q4-1986Q3; 1992Q2-2001Q4
United Kingdom	1975Q4-1979Q1; 1981Q4-1986Q2; 1990Q3-1998Q2
United States	1974Q4-1978Q1; 1981Q3-1988Q1; 1989Q4-1998Q2

Note: A bust is defined as a negative (more than 5%) and persistent (at least twelve quarters) deviation of housing prices from their trend.

Figure 8 displays the impulse-response functions to a fiscal shock during busts in housing prices. We can see that unexpected variation in the fiscal stance persistently drives up both housing and stock prices. Consistent with the previous findings, while the reaction of housing prices is gradual, stock prices immediately adjust to the shock. Fiscal policy also has a positive and persistent effect on GDP in a Keynesian manner. This, therefore, suggests that a stimulus package implemented during a bust in housing prices is likely to have the largest multiplier impact.

The effectiveness of fiscal policy seems to be the result of both the "direct" effects of policy measures and the "indirect" effects arising from movements in real interest rates. In a context where the private sector is unwilling to spend and invest on asset prices, an expansionary fiscal policy stimulates aggregate demand *per se*, namely, via public investment and public consumption (the "direct" effect). In addition, it may lead to a flip in expectations of market participants which can move from being deflationary to being inflationary. In fact, as time goes by and fiscal policy exerts its expansionary effects on output, consumer and firm's confidence levels may be restored, inducing an upward revision in price level expectations. This, in turn, leads to a reduction in real interest rates, thereby, amplifying the overall size of the fiscal multiplier (the "indirect" effect).
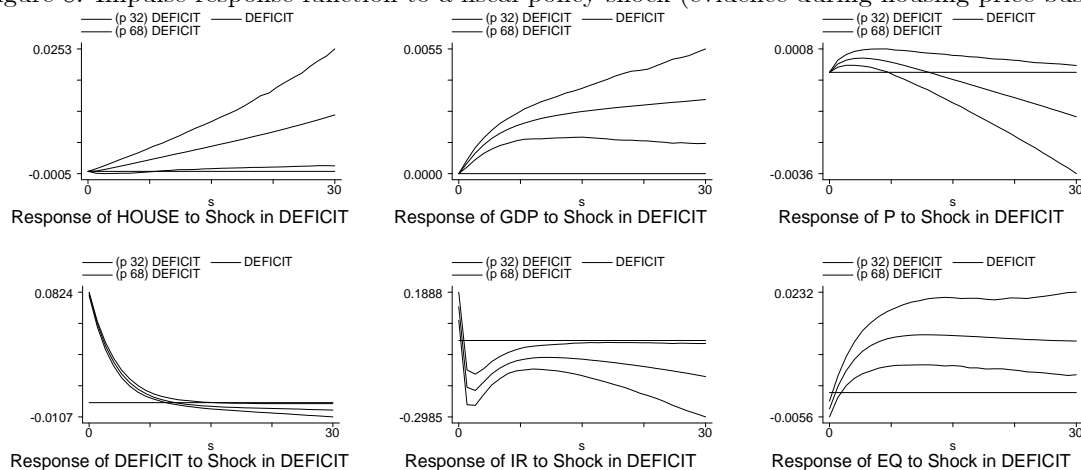
Summing up, in comparison with the results of the baseline model, one concludes that, conditioning the effects of fiscal policy on the occurrence of a bust in housing prices, there is a great scope for short-term fiscal policy stimulus. In fact, our findings suggest that in the presence of a strong fall in aggregate demand and sharp corrections in real estate and financial wealth, there is little room for adverse interest rate adjustments. As a result, fiscal stimulus appears to be particularly helpful in

---

[8] The set of bust periods identified in this manner does not change when we consider an alternative definition, say a negative (more than 10%) and persistent (at least twelve quarters) deviation of housing prices from their trend.

boosting the economic recovery and less prone in crowding-out private spending.

Figure 8: Impulse-response function to a fiscal policy shock (evidence during housing price busts).

Response of HOUSE to Shock in DEFICIT   Response of GDP to Shock in DEFICIT   Response of P to Shock in DEFICIT

Response of DEFICIT to Shock in DEFICIT   Response of IR to Shock in DEFICIT   Response of EQ to Shock in DEFICIT

7 Conclusion

The current financial crisis has demonstrated that the financial system, the housing sector, and the banking sector are strongly connected and may affect the nexus between monetary stability and financial stability (Castro, 2008; Granville and Mallick, 2009; Sousa, 2010a) and/or impinge on business cycle (de)synchronization (Mallick and Mohsin, 2007, 2010). Moreover, its severity and persistent effects became key features of the assessment about the impact of macroeconomic variables on the likelihood of an expansion and contraction ending (Castro, 2009; Agnello and Nerlich, 2010) or a boom-bust phase in asset prices (Jaeger and Schuknecht, 2007). As a result, a quick response from monetary authorities and the implementation of large fiscal stimulus packages by governments have become the most visible features of the attempts to stimulate the economy and promote the recovery.

Despite this, the empirical linkages between fiscal policy innovations and asset markets have not been explored and a good understanding of the transmission mechanism of fiscal policy measures to asset prices has not been provided yet.

In the present work, we try to fill those gaps. Using a panel VAR and quarterly data for ten industrialized countries, we show that a positive fiscal policy shock has a negative impact in both stock prices and housing prices. However, while stock prices immediately adjust to the shock and the effect is merely temporary, housing prices exhibit strong persistence and remain depressed even thirty quarters-ahead. As a result, governments may find it quite difficult to mitigate movements in stock prices without disrupting the behaviour of housing markets.

The robustness of the results is assessed in several directions. First, we find that the expansionary effect of fiscal policy has somewhat weakened in the recent times and, as a result, asset markets became more sensitive to a deterioration in the fiscal stance. Second, the process of financial deregulation and mortgage liberalization might have contributed to the change in the degree of effectiveness of fiscal policy, as the competitiveness of national banking sector becomes strongly related to the commitment of government to credible sound policies. This, in turn, gives rise to the importance of fiscal discipline (Hallett, 2008; Hallett et al., 2008). Third, we show that fiscal policy actions can have significant multiplier effects when undertaken in the outcome of severe housing busts, therefore, suggesting the importance of the implementation of fiscal stimulus packages.

While our paper focuses on the role that fiscal policy plays in leading asset price dynamics, one may also question on whether asset prices influence fiscal policy. We find that stock price shocks impact more on fiscal policy than housing price shocks. As a result, they may contribute more decisively to the goal of fiscal consolidation.

References

[1] Agnello, L., and C. Nerlich (2010). On the severity of economic downturns: lessons from cross-country evidence. European Central Bank, mimeo.

[2] Agnello L., and L. Schuknecht (2009). Booms and busts in housing markets: determinants and implications. European Central Bank, ECB Working Paper No. 1071.

[3] Ahearne, A. G., Ammer, J., Doyle, B. M., Kole, L. S., and R. F. Martin (2005). Housing prices and monetary policy: a cross-country study. Board of Governors of the Federal Reserve System, International Finance Discussion Paper No. 841.

[4] Akitoby, B., and T. Stratmann (2008). Fiscal policy and financial markets. *The Economic Journal*, 118, 1971-1985.

[5] Aoki, K., Proudman, J., and G. Vlieghe (2004). House prices, consumption, and monetary policy: a financial accelerator approach. *Journal of Financial Intermediation*, 13, 414-435.

[6] Ardagna, S. (2009). Financial markets' behavior around episodes of large changes in the fiscal stance. *European Economic Review*, 53(1), 37-55.

[7] Arellano, M., and O. Bover (1995). Another look at the instrumental variables estimation error component models. *Journal of Econometrics*, 68, 29-51.

[8] Arin, K. P., Mamun, A., and N. Purushothman (2009). The effects of tax policy on financial markets: G3 evidence. *Review of Financial Economics*, 18, 33-46.

[9] Baldacci, E., Cangiano, M., Mahfouz, S, and A. Schimmelpfennig (2001). The effectiveness of fiscal policy in stimulating economic activity: an empirical investigation. Paper presented at the IMF Annual Research Conference, International Monetary Fund.

[10] Barro, R. J. (1976). Are government bonds net wealth? *Journal of Political Economy*, 82(6), 1095-1117.

[11] Bernanke, B., and K. Kuttner (2005). What explains the stock market's reaction to Federal Reserve policy? *Journal of Finance*, 60(3), 1221-1257.

[12] Blanchard, O., and D. Quah (1989). The dynamic effects of aggregate demand and supply disturbances. *American Economic Review*, 79(4), 655-673.

[13] Blundell R., and S. Bond (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.

[14] Bordo, M. D., and D. C. Wheelock (2007). Stock market booms and monetary policy in the twentieth century. *Federal Reserve Bank of St. Louis Review*, 89(2), 91-122.

[15] Bradley, J., and K. Whelan (1997). The Irish expansionary fiscal contraction: a tale from one small European economy. *Economic Modelling*, 14(2), 175-201.

[16] Castro, V. (2008). Are central banks following a linear or nonlinear (augmented) Taylor rule? Warwick University, Economic Research Paper No. 872.

[17] Castro, V. (2009). The duration of economic expansions and recessions: More than duration dependence. *Journal of Macroeconomics*, 32, 347-365.

[18] Cebula, J., and R. Rhodd (1993). A note on budget deficits, debt service payments and interest rates. *The Quarterly Journal of Economics and Finance*, 4, 439-445.

[19] Darrat, A. F. (1990). Stock returns, money, and fiscal deficits. *Journal of Financial and Quantitative Analysis*, 25, 387-398.

[20] Debelle, G. (2004). Macroeconomic implications of rising household debt. Bank for International Settlements, BIS Working Paper No. 153.

[21] Diamond Jr., D. B., and M. J. Lea (1992). The decline of special circuits in developed country housing finance. *Housing Policy Debate*, 3(3), 747-777.

[22] ECB (2003). Structural factors in the EU housing markets. Report.

[23] Evans, P. (1985). Do large deficits produce high interest rates? *American Economic Review*, 7, 68-87.

[24] Fatás, A., and I. Mihov (2001). The effects of fiscal policy on consumption and employment: theory and evidence. CEPR Discussion Paper No. 2760.

[25] Gale, W. G., and P. R. Orszag (2003). Economic effects of sustained budget deficits. *National Tax Journal*, 56, 463-485.

[26] Gallagher, K. P. (2009). A global survey of stimulus plans. Available at: http://rodrik.typepad.com/dani_rodriks_webog/2009/02/a-global-survey-of-stimulus-plans.html.

[27] Gavin, W., and A. Theodorou (2005). A common model approach to macroeconomics: using panel data to reduce sampling error. *Journal of Forecasting*, 24, 203-219.

[28] Giavazzi, F., and M. Pagano (1990). Can severe fiscal contractions be expansionary? Tales of two small European countries. In Blanchard, O., and S. Fischer (eds.), *NBER Macroeconomics Annual*, MIT Press.

[29] Girouard, N., and S. Blöndal (2001). House prices and economic activity. Organization for Economic Development and Co-Operation, OECD Working Paper No. 279.

[30] Granville, B., and S. K. Mallick (2009). Monetary and financial stability in the euro area: Pro-cyclicality versus trade-off. *Journal of International Financial Markets, Institutions and Money*, 19, 662-674.

[31] Hallett, A. H. (2008). Sustainable fiscal policies and budgetary risk under alternative monetary policy arrangements. *Economic Change and Restructuring*, 41(1), 1-28.

[32] Hallett, A. H., and J. Lewis (2008). European fiscal discipline before and after EMU: crash diet or permanent weight loss? *Macroeconomic Dynamics*, 12(3), 404-424.

[33] Hallett, A. H., Neck, R., and C. Richter (2008). Policy issues in the Eurozone: cyclic convergence and fiscal sustainability. *International Economics and Economic Policy*, 5(1), 1-4.

[34] Hamilton, J. (1994). *Time series analysis.* Princeton: Princeton University Press.

[35] Hoelscher, G. (1986). New evidence on deficits and interest rates. *Journal of Money Credit and Banking*, 18, 1-17.

[36] Holtz-Eakin, D., Newey, W., and S. R. Harvey (1988). Estimating vector autoregressions with panel data. *Econometrica*, 56, 1371-1395.

[37] Iacoviello, M. (2005). House prices, borrowing constraints, and monetary policy in the business cycle. *American Economic Review*, 95(3), 739-764.

[38] Jaeger, A., and L. Schuknecht (2007). Boom-bust phases in asset prices and fiscal policy behavior. *Emerging Markets Finance and Trade*, 43(6), 45-66.

[39] Jappelli, T., and L. Pistaferri (2007). Do people respond to tax incentives? An analysis of the Italian reform of the deductibility of home mortgage interests. *European Economic Review*, 51(2), 247-271.

[40] Kiani, K. M. (2009). Federal budget deficits and long-term interest rates in USA. *The Quarterly Review of Economics and Finance*, 49, 74-84.

[41] Love, I., and L. Zicchino (2006). Financial development and dynamic investment behavior: evidence from panel VAR. *The Quarterly Review of Economics and Finance*, 46(2), 190-210.

[42] Maclennan, D., Muellbauer, J., and M. Stephens (1999), Asymmetries in housing and financial market institutions and EMU. CEPR Discussion Paper No. 2062.

[43] Mallick, S. K., and M. Mohsin (2007). Monetary policy in high inflation open economies: Evidence from Israel and Turkey. *International Journal of Finance and Economics*, 12(4), 405-415.

[44] Mallick, S. K., and M. Mohsin (2010). On the real effects of inflation in open economies: theory and empirics. *Empirical Economics*, forthcoming.

[45] Mehrez, G., and D. Kaufmann (1999). Transparency, liberalization and financial crises. World Bank, Working Paper.

[46] Mountford, A., and H. Uhlig (2008). What are the effects of fiscal policy shocks? National Bureau of Economic Research, NBER Working Paper No. 14551.

[47] Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49, 1417-1426.

[48] Perotti, R. (2004). Estimating the effects of fiscal policy in OECD countries. University of Bocconi, IGIER Working Paper No. 276.

[49] Rafiq, M. S., and S. K. Mallick (2008). The effect of monetary policy on output in EMU3: a sign restriction approach. *Journal of Macroeconomics*, 30, 1756-1791.

[50] Rigobon, R., and B. Sack (2003). Measuring the reaction of monetary policy to the stock market. *Quarterly Journal of Economics*, 118(2), 639-670.

[51] Schuknecht, L., and F. Eschenbach (2002). Asset prices and fiscal balances. European Central Bank, ECB Working Paper No. 141.

[52] Schuknecht, L., von Hagen, J., and G. Wolswijk (2009). Government risk premiums in the bond market: EMU and Canada. *European Journal of Political Economy*, 25(3), 371-384.

[53] Seater, J. (1993). Ricardian Equivalence. *Journal of Economic Literature*, 31, 142-190.

[54] Sims, C. A., and T. Zha (2006). Were there regime switches in U.S. monetary policy? *American Economic Review*, 96(1), 54-81.

[55] Sousa, R. M. (2010a). Housing wealth, financial wealth, money demand and policy rule: evidence from the euro area. *The North American Journal of Economics and Finance*, 21(1), 88-105.

[56] Sousa, R. M. (2010b). The consumption-wealth ratio and asset returns: the euro area, the UK and the US. *Journal of Money, Investment and Banking*, forthcoming.

[57] Sousa, R. M. (2010c). Consumption, (dis)aggregate wealth, and asset returns. *Journal of Empirical Finance*, forthcoming.

[58] Sutherland, A. (1997). Fiscal crises and aggregate demand: can high public debt reverse the effects of fiscal policy? *Journal of Public Economics*, 65(2), 147-162.

[59] Van Aarle, B., Garretsen, H., and N. Gobbin (2003). Monetary and fiscal policy transmission in the Euro-Area: Evidence from a structural VAR analysis. *Journal of Economics and Business*, 55(5-6), 609-638.

[60] Wongswan, J. (2009). The response of global equity indexes to U.S. monetary policy announcements. *Journal of International Money and Finance*, 28, 344-365.

[61] Woodford, M. (1995). Price-level determinacy without control of a monetary aggregate. *Carnegie-Rochester Conference Series on Public Policy*, 43, 1-46.

A Data Description

A.1 Belgium Data

GDP

The source is the IMF, International Financial Statistics (series " IFS.Q.124.9.9B.B$$.Z.W.$$$"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1980:1-2007:3.

Price Deflator

All variables were deflated by the GDP deflator (2000=100). The source is the IMF, International Financial Statistics (series IFS.Q.124.9.9B.BIP.Z.F.$$$"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1980:1-2007:3.

Government Spending

The source is the Belgium Ministry of Finance. Government Spending is defined as State Government expenditure on a cash basis (series "BISM.M.FJHC.BE.91"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1967:1-2008:1.

Government Revenue

The source is the Belgium Ministry of Finance. Government Revenue is defined as State Government revenue on a cash basis (series "BISM.M.FJBC.BE.91"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1967:1-2008:1.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNBE"). The series comprise the period 1970:1-2007:2.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNBE"). The series comprise the period 1970:1-2007:4.

Interest Rate

Proxied by the Treasury Bill rate. The source is the IMF, International Financial Statistics (series "12460C..ZF..."). The series comprise the period 1960:1-2008:3.

A.2 Finland Data

GDP

The source is the IMF, International Financial Statistics (series " IFS.Q.172.9.9B.B$$.Z.W.$$$"). We
seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period
1970:1-2007:4

Price Deflator

All variables were deflated by the GDP deflator (2000=100). The source is the IMF, International
Financial Statistics (series "IFS.Q.172.9.9B.BIP.Z.F.$$"). We seasonally adjust quarterly data
using Census X12 ARIMA, and the series comprise the period 1970:1-2007:4.

Government Spending

The source is the IMF via Finnish Ministry of Finance. Government Spending is defined as State
Government expenditure on a cash basis (series "IFS.M.17282...ZF..."). We seasonally adjust
quarterly data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:4.

Government Revenue

The source is the IMF via Finnish Ministry of Finance. Government Revenue is defined as State
Government revenue on a cash basis (series "IFS.M.17281...ZF..."). We seasonally adjust quarterly
data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:4.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNFI"). The series comprise
the period 1970:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNFI"). The series comprise
the period 1970:1-2007:4.

Interest Rate

Proxied by the Central Bank rate. The source is the IMF, International Financial Statistics (series
"17260...ZF..."). The series comprise the period 1960:1-2008:3.

A.3 France Data

GDP

Data for GDP are quarterly, seasonally adjusted, and comprise the period 1970:1-2007:2. The source is the IMF, International Financial Statistics (series " IFS.Q.132.9.9B.B$C.Z.F.$$$").

Price Deflator

All variables were deflated by the GDP deflator (2000=100). Data are quarterly, seasonally adjusted, and comprise the period 1970:1-2007:2. The source is the IMF, International Financial Statistics (series "IFS.Q.132.9.9B.BIR.Z.F.$$$").

Government Spending

The source is the IMF via French Ministry of Finance. Government Spending is defined as State Government expenditure on a cash basis (series "IFS.M.13282z..ZF..."). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:2.

Government Revenue

The source is the IMF via French Ministry of Finance. Government Revenue is defined as State Government revenue on a cash basis (series "IFS.M.13281...ZF..."). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:2.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNFR"). The series comprise the period 1970:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNFR"). The series comprise the period 1970:1-2007:4.

Interest Rate

Proxied by the Treasury Bill rate. The source is the IMF, International Financial Statistics (series "13260C..ZF..."). The series comprise the period 1970:1-2008:3.

A.4 Germany Data

GDP

Data for GDP are quarterly, seasonally adjusted, and comprise the period 1960:1-2007:4. The source is the IMF, International Financial Statistics (series "IFS.Q.134.9.9B.B$C.Z.F.$$$").

Price Deflator

All variables were deflated by the GDP deflator (2000=100). Data are quarterly, seasonally adjusted, and comprise the period 1960:1-2007:2. The source is the IMF, International Financial Statistics (series "IFS.Q.134.9.9B.BIR.Z.F.$$$").

Government Spending

The source is the Bundesbank and the Monthly Reports released by the German Ministry of Finance. Government Spending is defined as General Government total expenditure on a cash basis. We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1979:1-2007:3.

Government Revenue

The source is the Bundesbank and the Monthly Reports released by the German Ministry of Finance. Government Revenue is defined as General Government total revenue on a cash basis. We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1979:1-2007:3.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNDE"). The series comprise the period 1970:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNDE"). The series comprise the period 1970:1-2007:4.

Interest Rate

Proxied by the Treasury Bill rate. The source is the IMF, International Financial Statistics (series "13460C..ZF..."). The series comprise the period 1975:3-2007:2.

A.5 Italy Data

GDP

Data for GDP are quarterly, seasonally adjusted, and comprise the period 1960:1-2007:3. The source
is the IMF, International Financial Statistics (series "IFS.Q.136.9.9B.B$C.Z.F.$$$").

Price Deflator

All variables were deflated by the GDP deflator (2000=100). Data are quarterly, seasonally adjusted,
and comprise the period 1980:1-2007:2. The source is the IMF, International Financial Statistics
(series "IFS.Q.136.9.9B.BIR.Z.F.$$$").

Government Spending

The source is the Bank of Italy and the Italian Ministry of Finance. Government Spending is defined
as Central Government primary expenditure on a cash basis. We seasonally adjust quarterly data
using Census X12 ARIMA, and the series comprise the period 1960:1-2007:4.

Government Revenue

The source is the Bank of Italy and the Italian Ministry of Finance. Government Revenue is defined
as Central Government total revenue on a cash basis. We seasonally adjust quarterly data using
Census X12 ARIMA, and the series comprise the period 1960:1-2007:4.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNIT"). The series comprise
the period 1970:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNIT"). The series comprise
the period 1970:1-2007:4.

Interest Rate

Proxied by the Treasury Bill rate. The source is the IMF, International Financial Statistics (series
"13660C..ZF..."). The series comprise the period 1977:1-2008:3.

A.6 Netherlands Data

GDP

The source is the IMF, International Financial Statistics (series " IFS.Q.138.9.9B.B$C.Z.W.$$$"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:4.

Price Deflator

All variables were deflated by the GDP deflator (2000=100). The source is the IMF, International Financial Statistics (series "IFS.Q.138.9.9B.BIR.Z.F.$$$"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:2.

Government Spending

The source is the IMF via Dutch Ministry of Finance. Government Spending is defined as State Government expenditure on a cash basis (series "IFS.M.138.C.C2.$$$.C.G.$$$"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:1.

Government Revenue

The source is the IMF via Dutch Ministry of Finance. Government Revenue is defined as State Government revenue on a cash basis (series "IFS.M.138.C.C1.$$$.C.G.$$$"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1970:1-2007:1.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNNL"). The series comprise the period 1970:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNNL"). The series comprise the period 1970:1-2007:4.

Interest Rate

Proxied by the Government Bond Yield. The source is the IMF, International Financial Statistics (series "13861...ZF..."). The series comprise the period 1960:1-2008:3.

A.7 Portugal Data

GDP

The source is the Bank of Portugal. We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1978:1-2007:4.

Price Deflator

All variables were deflated by the GDP deflator (2000=100). Data are quarterly, seasonally adjusted, and comprise the period 1978:1-2007:4. The source is the Bank of Portugal.

Government Spending

The source is the Bank of Portugal, collected from the Monthly Bulletin of the Directorate-General of Public Accounting. Government Spending is defined as Central Government primary spending (on a cash basis), that is, the difference between authorized expenditure and debt interest payments. We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1978:1-2007:4.

Government Revenue

The source is the Bank of Portugal, collected from the Monthly Bulletin of the Directorate-General of Public Accounting. Government Revenue is defined as Central Government total revenue (on a cash basis). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1978:1-2007:4.

Housing Price

The source is the European Central Bank (ECB). The series comprise the period 1988:1-2007:4.

Equity Price

The source is the IMF, International Financial Statistics (series "IFS.Q.18262...ZF..."). The series comprise the period 1988:1-2007:4.

Interest Rate

Proxied by the Government Bond Yield. The source is the IMF, International Financial Statistics (series "IFS.Q.18261...ZF..."). The series comprise the period 1960:1-2008:3.

A.8 Spain Data

GDP

Data for GDP are quarterly, seasonally adjusted, and comprise the period 1970:1-2007:2. The source is the IMF, International Financial Statistics (series " IFS.Q.184.9.9B.B$C.Z.F.$$$").

Price Deflator

All variables were deflated by the GDP deflator (2000=100). Data are quarterly, seasonally adjusted, and comprise the period 1970:1-2007:2. The source is the IMF, International Financial Statistics (series "IFS.Q.184.9.9B.BIR.Z.F.$$$").

Government Spending

The source is the IMF via Spanish Ministry of Finance. Government Spending is defined as State Government expenditure on a cash basis (series "IFS.M.18482...Zf..."). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1985:1-2006:4.

Government Revenue

The source is the IMF via Spanish Ministry of Finance. Government Revenue is defined as State Government revenue on a cash basis (series "IFS.M.18481...Zf..."). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1986:1-2006:4.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNES"). The series comprise the period 1971:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNES"). The series comprise the period 1970:1-2007:4.

Interest Rate

Proxied by the Treasury Bill rate. The source is the IMF, International Financial Statistics (series "18460C..ZF..."). The series comprise the period 1979:1-2008:3.

A.9 U.K. Data

GDP

Data for GDP are quarterly, seasonally adjusted, and comprise the period 1955:1-2007:4. The source is the Office for National Statistics, Release UKEA, Table A1 (series "YBHA").

Price Deflator

All variables were deflated by the GDP deflator. Data are quarterly, seasonally adjusted, and comprise the period 1955:1-2007:4. The source is the Office for National Statistics, Release MDS, Table 1.1 (series "YBGB").

Government Spending

The source is the Office for National Statistics (ONS), Release Public Sector Accounts. Government Spending is defined as total current expenditures of the Public Sector ESA 95 (series "ANLT") less net investment (series "ANNW"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1947:1-2007:4.

Government Revenue

The source is the Office for National Statistics (ONS), Release Public Sector Accounts. Government Revenue is defined as total current receipts of the Public Sector ESA 95 (series "ANBT"). We seasonally adjust quarterly data using Census X12 ARIMA, and the series comprise the period 1947:1-2007:4.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNGB"). The series comprise the period 1970:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNGB"). The series comprise the period 1970:1-2007:4.

Interest Rate

Proxied by the Treasury Bill rate. The source is the IMF, International Financial Statistics (series "11260C..ZF..."). The series comprise the period 1960:1-2008:2.

A.10 U.S. Data

GDP

The source is Bureau of Economic Analysis, NIPA Table 1.1.5, line 1. Data for GDP are quarterly, seasonally adjusted, and comprise the period 1947:1-2007:4.

Price Deflator

All variables were deflated by the GDP deflator. Data are quarterly, seasonally adjusted, and comprise the period 1967:1-2007:4. The source is the Bureau of Economic Analysis, NIPA Tables 1.1.5 and 1.1.6, line 1.

Government Spending

The source is Bureau of Economic Analysis, NIPA Table 3.2. Government Spending is defined as total Federal Government Current Expenditure (line 39). Data are quarterly, seasonally adjusted, and comprise the period 1960:1-2007:4.

Government Revenue

The source is Bureau of Economic Analysis, NIPA Table 3.2. Government Revenue is defined as government receipts at annual rates (line 36). Data are quarterly, seasonally adjusted, and comprise the period 1947:1-2007:4.

Housing Price

The source is the Bank for International Settlements (BIS) (series "QRPNUS"). The series comprise the period 1970:1-2007:4.

Equity Price

The source is the Bank for International Settlements (BIS) (series "QEPNUS"). The series comprise the period 1970:1-2007:4.

Interest Rate

Proxied by the Treasury Bill rate. The source is the IMF, International Financial Statistics (series "11160C..ZF..."). The series comprise the period 1960:1-2008:3.