FISCAL POLICY AND ASSET PRICE CYCLES: EVIDENCE FROM FOUR EUROPEAN COUNTRIES

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We test for non-linear effects of asset prices on the fiscal policy of four major European economies (France, Italy, Spain and UK). We model government spending and revenue as time-varying transition probability Markovian processes (TVPMS), and find that: (i) in France and Italy, the impact of housing prices on government revenue is conditioned by the phase of the stock price cycle; (ii) a similar asymmetric pattern is found for the UK when considering the effect of stock price fluctuations on government revenue and spending vis-à-vis *the troughs and peaks of aggregate wealth; and (iii) for Spain, a fall in government revenue is typically associated with a negative performance of the housing market, while government spending does not seem to adjust to the dynamics of financial market. In addition, the magnitude of the contribution of housing prices to changes in government revenue appears to have dominated that of stock prices in France and the UK. As for government spending, changes in this policy instrument are correlated with changes in asset prices, but the effect depends on the magnitude of the price variation and the influence of the output cycle. Therefore, the empirical evidence corroborates the idea that accounting for the dynamics of asset markets provides a more accurate assessment of the fiscal stance.*

1 Introduction

Asset-related changes in revenues and spending appear to have been a factor explaining the temporary movements in the fiscal balance (in particular, the so-called "windfall revenue"), but also justifying the lack of confidence of academic and policymakers on the standard measures of the "structural" fiscal balance.

The effects of the asset price cycle on the different components of revenue and spending have been studied in the literature (Jaeger and Schuknecht, 2007; Tujula and Wolswijk, 2007). For instance, Agnello and Sousa (2012) show that fiscal policy is particularly effective during severe housing busts and the government's attempt to mitigate stock price developments may destabilize housing markets. In the same vein, Agnello *et al.* (2012a) find that fiscal policy has an expansionary effect on output, especially, in the context of a rise in financial stress. This, in turns, partially offsets the decline in wealth. Therefore, to target a given structural balance, governments also need to take into account the imbalances of asset markets.

Asset prices can affect the government budget via two major mechanisms: (i) the "direct" channel, whereby an increase in stock prices can have a positive impact on capital gains-losses related taxes, government revenue from households and corporations and turnover taxes; and (ii) the "indirect" channel, in which case higher stock prices can lead to a rise in consumer's confidence and household's wealth, boosting consumption and real economic activity and, thereby, increasing government revenue. In contrast, a sharp correction in stock prices and the design of

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fiscal stimulus packages can raise costs to governments and, therefore, deteriorate the public finances.

Another strand of the literature considers the role of asset prices on revenues and spending in order to better understand the adjustment made by the governments to keep public deficits and government debt on a sustainable path. The policy effort is conditioned by the fiscal space, which depends upon the taxation base. In this context, a bad juncture illustrated by an economic recession may generate a small shortfall in revenue if accompanied by changes in house and share prices that offset the impact on tax receipts. In contrast, a financial turmoil or a bubble burst can put pressure on public spending whenever a government takes actions to support the financial sector.

This paper contributes to the literature on the linkages between fiscal policy and asset markets (Castro, 2010; Sousa, 2010, 2012; Tagkalakis, 2011; Agnello and Nerlich, 2012). In particular, we examine whether changes in stock and housing prices have an impact on tax receipts and primary spending, with a specific focus on four European countries: France, Italy, Spain and UK. While asset market development play an important role in the economic activity of the Spain and UK, the other two countries (France and Italy) are major European countries and are considered for the purpose of comparison.

We propose to measure the influence of the asset prices cycles on government revenue and spending through the estimation of a new type of fiscal policy reaction function. Not only do we consider the asset price variables in addition to the traditional explanatory variables (such as the government debt and the output gap, but also allow the fiscal reaction to booms and busts to be asymmetric. Indeed, the omission of such asymmetry can underestimate the impact of financial imbalances on the state of the fiscal stance.

An interesting issue here is whether financial busts are more detrimental for fiscal deficits than booms are good for fiscal surpluses. And, if yes, why is it so? In order to address this question, we consider a regime-switching non-linear fiscal rule augmented with asset prices. This approach is new in comparison to those considered so far in the literature.

We use a novel econometric model – the Time-varying Transition Probability Markov-Switching (TVPMS) model – and extends the framework that was successfully applied for the case of the US by Agnello *et al.* (2012b) to a set of European countries (France, Italy, Spain and UK). This model allows us to show that: (i) financial wealth changes can help predicting forthcoming changes in fiscal variables; (ii) across the boom and bust phases of the financial wealth, the reaction of both government revenue and government spending to stock and housing prices can be asymmetric; and (iii) taking into account the impact of the financial developments on the fiscal balance yields information about the way in which they contribute to the dynamics in both the cyclical and structural fiscal balance. Therefore, we provide an answer to the problem of the so-called "omitted variables bias" problem, which is particularly sizeable and explains why the standard view about the fiscal stance may be distorted.

Our analysis is retrospective and does not include the recent financial crisis. One reason for limiting our attention to the pre-crisis period is to avoid the bias-selection problem. Indeed, the strength of the housing and stock market crisis that countries have recently experienced was such that one would surely capture an impact of the asset market development on the fiscal position. However, this would not necessarily tell us that there exists a systematic link between government spending, government revenue and asset markets regardless of the state of the economy. In other words, we would not be able to distinguish between the standard fiscal/asset cycle nexus and a rare event ("Great Recession") effect. Furthermore, a great proportion of the variance of our fiscal variables would be explained by the huge changes in the prices of both housing and stock prices that were observed since 2008.

The results suggest that, in order to assess the comovement between the cyclical fiscal balance and the swings in housing and equity prices, we need to take into account the asymmetry of asset price cycles, because governments adjust spending and revenue in different manners depending on whether prices are moving upwards or downwards, as well as whether they are evolving towards a peak or a trough.

In France, stock prices fuel tax increases during downturns and retrench revenue during downturns. Moreover, the phase of the stock price cycle conditions the impact of housing prices on government revenue.

For Italy, equity price changes at peaks reduce the revenues, while they bring higher tax receipts at troughs. Housing price increases raise revenues around a stock market peak, but reduce them when stock prices are near a trough.

In Spain, revenue falls are associated with less favorable developments in the housing markets, but price increases are not reflected into higher revenues. Furthermore, government spending does not react to stock price changes when it is already increasing above a threshold level.

For the UK, we find a similar asymmetric behavior when considering the impact of stock price fluctuations on taxes and spending according to the troughs and peaks of aggregate wealth. However, there are no signs of asymmetry with regard to the influence of house price fluctuations.

The remainder of the paper is organized as follows. Section 2 presents the empirical framework. Section 3 contains a discussion of our main findings. Finally Section 4 concludes.

2 The empirical model

2.1 A time-varying probability Markov-switching model

Following Agnello *et al.* (2012b), we estimate a regime-switching fiscal reaction function:

$$\begin{aligned} \Delta lnF_t = \\ + \sum_{i=1}^{M} \{\alpha_{1i}(s_t)\Delta lnF_{t-i} + \alpha_{2i}\Delta lnY_{t-i} + \alpha_{3i}\Delta lnB_{t-i} + \alpha_{4i}(s_t)\Delta lnHP_{t-i} + \\ \alpha_{5i}(s_t)\Delta lnSP_{t-i} + \alpha_0(s_t) + \varepsilon_t(s_t)\} \end{aligned} \quad (1)$$

where the fiscal policy instrument (F_t), either taxes (T_t) or government expenditure (S_t), is regressed on its lagged values, the lagged values of the GDP growth rate (ΔY_t) and debt to GDP ratio (ΔB_t). W add the housing prices (HP_t) and stock prices (SP_t) to the output and debt variables.

Given the limited number of degrees of freedom, we keep the model as parsimonious as possible by considering only two lags for each independent variable. As our final aim is to investigate whether fiscal policy reacts differently to asset prices (housing and equity) are allowed to switch between two different states, captured by a hidden variable $s_t \in \{1,2\}$. By contrast, we assume the relation between the fiscal policy indicators, output growth and public debt is always linear.

s_t is a first-order Markov-chain with the conditional probability of being in a given state at time t depending only on the state observed at the preceding time $P\{s_t \,/\, s_{t-1}\}$. We further assume that the transition from one regime to the other depends upon the lagged observation of a transition variable z_t described here by the aggregate wealth so that, $P\{s_t \,/\, s_{t-1}\} = P\{s_t / s_{t-1}, z_t\}$. The transition variable reflects the market environment which is assumed to condition the fiscal policy response. Assume for instance that a government is confronted to a burst in asset price and wants to prevent its negative effects on the real sector by activating support policies to the real estate and financial sector. One important concerned is that, while smoothing the asset price cycle, a

government may search to avoid feeding bubbles in asset markets. For ,this reason, the fiscal authorities needs to anticipate the investors' reaction, their behavior towards risk, their decisions on portfolio diversification, etc. It is known that their behavior is strongly related to their wealth (both housing and financial wealth). Therefore, if a government believes that the history of aggregate wealth convey information about the decisions that agents might take following a fiscal decision, it is useful to consider this information as conditioning the impact of the asset price fluctuations on spending and revenues.

The transition probabilities are defined as follows:

$$\begin{cases} p_{11}(z_{t-k}) = \frac{\exp(a_1+b_1 z_{t-k})}{1+\exp(a_1+b_1 z_{t-k})}, \quad p_{22}(z_{t-k}) = \frac{\exp(a_2+b_2 z_{t-k})}{1+\exp(a_2+b_2 z_{t-k})} \\ p_{12}(z_{t-k}) = 1 - p_{11}(z_{t-k}), p_{21}(z_{t-k}) = 1 - p_2(z_{t-k}), \end{cases} \tag{2}$$

where $p_{ij}(z_{t-k})$ is the probability of moving from regime *i* to regime *j* conditional on the dynamics of the transition variable *k* periods before. A key aspect of the empirical equation is modeling the asymmetric nature of the fiscal response to changes in asset prices with transitions between the different phases of the housing and stock price fluctuations being marked by differing sharpness at turning points. The implications is that a regime can be defined as corresponding to a specific correlation between asset prices and the fiscal variables which can vary across time. The regimes are not defined *a priori*, but selected endogenously by the data.

The coefficients b_1 and b_2 are used to compute the maximum marginal impact of one standard deviation in the transition variables on the probability of staying in or leaving respectively regimes 1 and 2. This serves to compare the duration of each regime and to see whether one is more persistent than the other. It can be shown that the derivative of the transition functions (2) with respect to the transition variables et the inflection point of the logistic function equal to $\sigma_z b_j/4$, j=1,2, where σ_z is the standard error or the transition variable.

The model is estimated using maximum likelihood (henceforth ML). We define the following vectors: $\Omega_t = (\mathbf{X}_t, z_{t-k})$ is the vector of observed independent variables and transition variables up to period t. Besides, $\xi_t = (y_t, y_{t-1}, \dots, y_1)$ is the vector of the historical values of an endogenous variable. Denoted θ the vector of parameters to estimate, the conditional likelihood function of the observed data ξ_t is defined as:

$$L(\theta) = \prod_{t=1}^{T} f(y_t/\Omega_t, \xi_{t-1}; \theta) \tag{3}$$

where:
$$f(y_t/\Omega_t, \xi_{t-1}; \theta) = \sum_i \sum_j f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) \times P(s_t = i, s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta). \tag{4}$$

The weighting probability is computed recursively by applying Bayes's rule and finally one gets:

$$P(s_t = i/s_{t-1} = j, z_t) P(s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta) = P_{ij}(z_t) P(s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta) \tag{5}$$

We also have:

$$P(s_t = i / \Omega_{t+1}, \xi_t; \theta) = P(s_t = i / \Omega_t, \xi_t; \theta) \frac{1}{f(y_t/\Omega_t, \xi_{t-1}; \theta)} \sum_j f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) \times P(s_t = i, s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta). \tag{6}$$

To complete the recursion defined by the equations (5) and (6), we need the regime-dependent conditional density functions:

$$f(y_t/\mathrm{s_t}=1,\mathrm{s_{t-1}}=\mathrm{j},\Omega_\mathrm{t},\xi_{\mathrm{t-1}};\theta)=\frac{\phi\left(\frac{y_t-x_t'\beta_1}{\sigma_1}\right)\Phi(a_j+z_t'b_j)}{\sigma_1 P_{1j}(z_t)} \tag{7a}$$

$$f(y_t/\mathrm{s_t}=2,\mathrm{s_{t-1}}=\mathrm{j},\Omega_\mathrm{t},\xi_{\mathrm{t-1}};\theta)=\frac{\phi\left(\frac{y_t-x_t'\beta_2}{\sigma_2}\right)\Phi(a_j+z_t'b_j)}{\sigma_2 P_{2j}(z_t)} \tag{7b}$$

The parameters of the TVPMS model are thus jointly estimated with ML methods for mixtures of Gaussian distributions. As compared with other estimators (for instance, the EM algorithm or the Gibbs sampler used by Diebold *et al.*, 1994, and Filardo and Gordon, 1998), the ML estimator has the advantage of computational ease. As shown by Kiefer (1978), if the errors are distributed as a normal law, then the ML yields consistent and asymptotically efficient estimates. Further, the inverse of the matrix of second partial derivatives of the likelihood function at the true parameter values is a consistent estimate of the asymptotic variance-covariance matrix of the parameter values.

2.2 Computing cyclical and cyclically-adjusted fiscal balance

Using our estimates, we compute cyclical revenues and spending using a gap approach. We also want to identify a structural effort of the government to adopt sustainable fiscal policy within an economic environment reflected by the fluctuations of both the output and the asset price fluctuations. Such an effort is captured by fiscal variables whose dynamics are corrected for the real and financial cycles. Our aim is thus not to discuss the issue as whether a government overestimate or underestimate the structural fiscal balance once the financial environment which conditions their action is taken into account. Since our benchmark equation is a fiscal response function, we only try to capture the induced variations in spending and revenues when government adjust the budget to maintain debts and fiscal balance on a sustainable level, given that they also have to cope with the stabilization of the output fluctuations and that they also try to accommodate the asset price cycles.

We follow Kanda (2010) and Bornhost *et al.* (2011) to adjust fiscal positions for the effects of the business and asset cycles. First, we take exponents of both sides of equation (1) to eliminate natural logs and express all the explanatory variables in levels, say M. Second, we employ an HP filtering technique to extract their corresponding structural part (M^*). Finally, we use the elasticities ($\hat{\alpha}_i$) as obtained from the TVP-MS models to calculate the so-called structural component of taxes and expenditures:

$$F_t^* = F_t\left(\frac{F_{1t-1}^*}{F_{1t-1}}\right)\prod_{i=2}^{5}\left(\frac{M_{it-1}^*}{M_{it-1}}\right)^{\widehat{\alpha}_i(\cdot)}\left(\frac{M_{it-2}^*}{M_{it-2}}\right)^{-\widehat{\alpha}_i(\cdot)} \tag{8}$$

where F_t^* denotes either the structural component of taxes (T_t) or the structural component of government expenditure (S_t) while the index *i* refers to the number of independent variables *M* (excluding the constant) in equation (1).

2.3 Data

We use quarterly data for France, Italy, Spain and the UK, for 1989Q4-2006Q4, 1985Q1-2007Q2, 1991Q1-2008Q2 and 1975Q1-2007Q4. All variables are expressed in difference of natural logarithms, seasonally adjusted and measured at constant prices unless stated otherwise.

Quarterly series of government spending and government revenue are taken from the national accounts in the case of the UK and are based on fiscal cash data for France, Italy, and

Spain. The government debt series are provided by the Office for National Statistics (ONS) in the case of the UK and by the Ministry of Finance for the other countries.

Aggregate wealth is the defined as the sum of net financial wealth and net housing wealth. Data are retrieved from the ONS in the case of UK, and the European Central Bank (ECB) for the remaining countries.

In what concerns asset prices, the housing price index corresponds to the residential property price index, while the stock price index is proxied by the share price index. Housing price data is seasonally adjusted and provided by the Bank for International Settlements (BIS). Stock price data is provided by the International Financial Statistics (IFS) of the International Monetary Fund (IMF).

Finally, data for real GDP is sourced from the IFS of the IMF.

3 Empirical results

3.1 UK

The estimation results are reported in Tables 1a-1e. The linear regressions suggest that revenues and spending do not respond to the output cycle, that debt has a stabilizing effect on the fiscal balance (since an increase in debt raises revenues but does not affect significantly public spending), that taxes are positively influenced by the housing prices, while an increase in the stock prices exerts a positive impact on government spending. However, the linear framework misleads as to the influence of the different variables. Indeed, once the asymmetries of the asset price cycles are taken into account in a TVPMS equation, some of the coefficients that were non-significant become statistically significant. For instance, the influence of lagged output changes is found to impact both tax receipts and primary spending. Specifically, the fiscal rule behaves in a counter-cyclical way on the revenue side (taxes decrease as output increases as shown by the negative sum of the coefficients on lagged output), but in a pro-cyclical manner in the spending side (primary spending decrease as the output increases, with a total impact of –1.29). As in the linear model, we retrieve a stabilizing effect of public debt (statistically significant coefficient of the second lag of public debt).

The statistics of the linearity test suggest that changes in aggregate wealth succeed to give an early warning of changes in both revenues and spending. Indeed, the *p*-values below 5 per cent yield to reject the null hypothesis that the fiscal cycle is independent of asset markets developments. Figures 1a and 1b suggest that the response of the fiscal variables to the asset price cycles (housing and stock prices) are related to two regimes reflecting the turning points of the aggregate wealth cycle. One regime corresponds to the peaks of the wealth cycle (it is identified as regime 1 for taxes and regime 2 for primary spending) and the second regime coincides with the troughs of the wealth cycle (regime 2 for taxes and regime 1 for primary spending). We propose to label revenues and spending that are related to the upturn of the wealth cycle “high-revenue” and “high-spending” regimes. Accordingly, “low-revenue” and “low-spending” regimes refer to tax receipts and spending in the troughs of the wealth cycle.

High revenues and primary spending are both positively correlated with changes in the stock and housing prices. The positive correlation with the stock prices is twice as high for primary spending (with a sum of coefficients equal to 0.08) as for taxes (the significant coefficient equals

Table 1a

UK: Linear Models

	Taxes				Primary Spending			
	(1)		(2)		(3)		(4)	
Constant	0.008*	*(0.67)*	0.02***	*(2.94)*	0.015***	*(3.20)*	0.02***	*(3.56)*
Lagged Output (–1)	0.22	*(0.71)*	0.07	*(0.20)*	–0.122	*(–0.50)*	–0.36	*(–1.34)*
Lagged Output (–2)	–0.08	*(–0.27)*	–0.46	*(–1.38)*	–0.16	*(–0.63)*	–0.17	*(–0.61)*
Lagged Dep. Var.	0.36***	*(3.98)*	0.33***	*(3.62)*	0.69***	*(9.97)*	0.68***	*(9.59)*
Lagged Public Debt (–1)	–0.11	*(–0.71)*	–0.21	*(–1.39)*	–0.13	*(–1.00)*	–0.16	*(–1.23)*
Lagged Public Debt (–2)	0.20	*(1.30)*	0.32**	*(2.12)*	0.05	*(–1.00)*	0.09	*(0.69)*
Lagged Housing Prices (–1)	-	-	–0.03	*(–1.43)*	-	-	0.11	*(1.17)*
Lagged Housing Prices (–2)	-	-	0.065***	*(2.84)*	-	-	–0.03	*(–0.38)*
Lagged Stock Prices (–1)	-	-	0.11	*(1.01)*	-	-	0.04*	*(1.86)*
Lagged Stock Prices (–2)	-	-	0.03	*(0.29)*	-	-	–0.02	*–(1.04)*
R^2	0.45		0.35		0.54		0.56	
Log–Likelihood	260.87		268.76		283.44		287.68	

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets.

Table 1b

UK: TVP-MS Models

	Taxes		Primary Spending	
Non–switching Parameters				
Lagged Output (–1)	0.92***	*(7.45)*	–0.52***	*(–3.35)*
Lagged Output (–2)	–1.08***	*(–5.86)*	–0.77***	*(–5.60)*
Lagged Public Debt (–1)	–0.13	*(–1.18)*	–0.14	*(–1.51)*
Lagged Public Debt (–2)	0.20**	*(1.82)*	–0.05	*(–0.53)*
σ	0.02***	*(14.18)*	0.02***	*(15.40)*
Switching Parameters				
	Regime 1 (*S*=1) Peaks of the wealth cycle		Regime 1 (*S*=1) Troughs of the wealth cycle	
Constant	0.004**	*(1.83)*	0.04***	*(10.90)*
Lagged Dependent Var.	0.58***	*(8.03)*	0.05	*(0.52)*
Lagged Housing Prices (–1)	0.02	*(0.52)*	0.20***	*(4.95)*
Lagged Housing Prices (–2)	0.19***	*(3.41)*	–0.11***	*(–3.04)*
Lagged Stock Prices (–1)	0.04***	*(2.64)*	0.03*	*(1.71)*
Lagged Stock Prices (–2)	–0.02	*(–1.20)*	–0.007	*(–0.43)*
	Regime 2 (S=2) Troughs of the wealth cycle		Regime 2 (S=2) Peaks of the wealth cycle	
Constant	0.014***	*(4.19)*	–0.0	*(–0.02)*
Lagged Dependent Var.	–0.81***	*(–6.95)*	–0.09	*(–0.93)*
Lagged Housing Prices (–1)	–0.08	*(–1.55)*	0.14**	*(2.35)*
Lagged Housing Prices (–2)	0.19***	*(3.41)*	0.02	*(0.38)*
Lagged Stock Prices (–1)	–0.11***	*(–5.93)*	0.03***	*(2.95)*
Lagged Stock Prices (–2)	0.08***	*(3.07)*	0.05***	*(4.65)*
Transition Function				
Transition variable/par	Aggregate Wealth (–4)		Aggregate Wealth (–1)	
a_1	2.91***	*(3.37)*	3.21***	*(4.66)*
a_2	0.65	*(0.67)*	2.47***	*(3.21)*
b_1	38.0**	*(2.22)*	–18.60**	*(–2.21)*
b_2	24.80*	*(1.67)*	–7.95	*(–1.04)*
Linearity Tests				
Statistics and *p*-value	7.14**	*(0.03)*	6.22**	*(0.04)*

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets. *p*-values in parenthesis.

Table 1c

UK: Changes in Cyclical and Cyclically-adjusted Tax Revenues

(annualized quarter-on-quarter changes, percent)

Contributions							
	Cyclical Revenue	**Lagged Revenue**	**GDP**	**Debt**	**Stock Price**	**House Price**	**CAR**
1978-80	4.22	4.31	0.65	1.02	–0.40	–1.35	7.75
1981-85	–3.18	–3.14	–0.21	–0.49	0.23	0.42	1.39
1986-90	–0.36	–1.20	–0.03	0.41	0.09	0.36	–8.27
1991-95	7.35	9.03	–0.39	–0.82	–0.10	–0.33	–2.68
1996-2000	–3.67	–3.92	0.14	0.20	–0.15	0.07	2.93
2001-07	–1.65	–1.99	–0.01	0.23	0.10	0.02	0.47

Note: CAR: cyclically-adjusted revenues (adjustment related to output and asset price fluctuations).

Table 1d

UK: Changes in Cyclical and Cyclically-adjusted Primary Spending

(annualized quarter-on-quarter changes, percent)

Contributions							
	Cyclical Spending	**Lagged Spending**	**GDP**	**Debt**	**Stock Price**	**House Price**	**CAS**
1978-80	–1.19	4.61	–2.82	–1.31	–0.10	–1.58	–3.28
1981-85	–0.05	–1.28	0.67	0.97	–0.75	0.34	2.49
1986-90	2.76	2.36	–0.28	–0.33	0.19	0.82	–1.21
1991-95	–2.34	–3.04	0.85	0.54	0.12	–0.81	6.86
1996-2000	1.42	2.50	0.01	–0.52	–0.31	–0.26	–7.75
2001-07	0.47	0.35	0.78	–0.47	–0.23	0.04	4.84

Note: CAS: cyclically-adjusted revenues (adjustment related to output and asset price fluctuations).

Table 1e

UK: Changes in Cyclically-adjusted Fiscal Balance

(annualized quarter-on-quarter changes, percent)

	Cyclical Spending	**Cyclical Revenues**	**Cyclical Balance**	**Structural Spending**	**Structural Revenues**	**Structural Balance**	**SP**	**HP**	**GDP**
1978-80	–1.19	4.22	5.41	–3.28	7.75	11.03	–	+	+
1981-85	–0.05	–3.18	–3.13	2.49	1.39	–1.1	+	+	–
1986-90	2.76	–0.36	–3.12	–1.21	–8.27	–7.06	–	–	+
1991-95	–2.34	7.35	9.69	6.86	–2.68	–9.54	–	+	–
1996-2000	1.42	–3.67	–5.09	–7.75	2.93	10.68	+	+	+
2001-07	0.47	–1.65	–2.12	4.84	0.47	–4.37	+	–	–

Note: +, – indicate that the contribution of a given variable to changes in cyclical balance is positive, respectively negative.

Figure 1a

UK: Regime 1 for Taxes and Wealth Growth

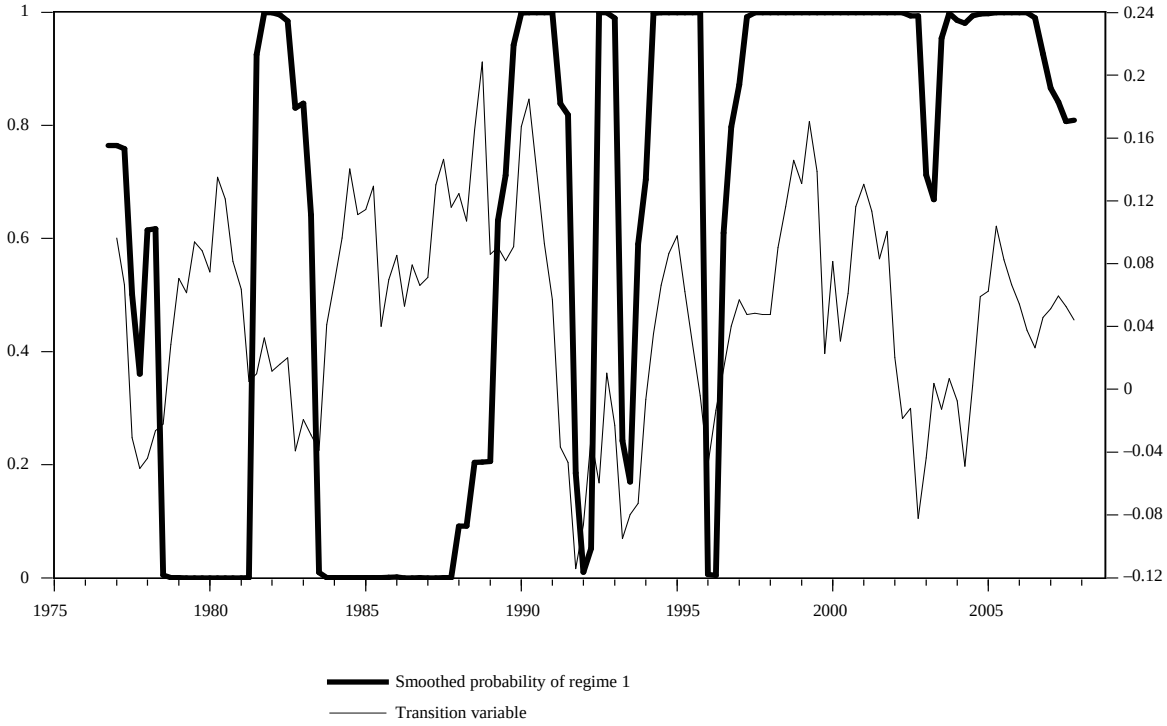
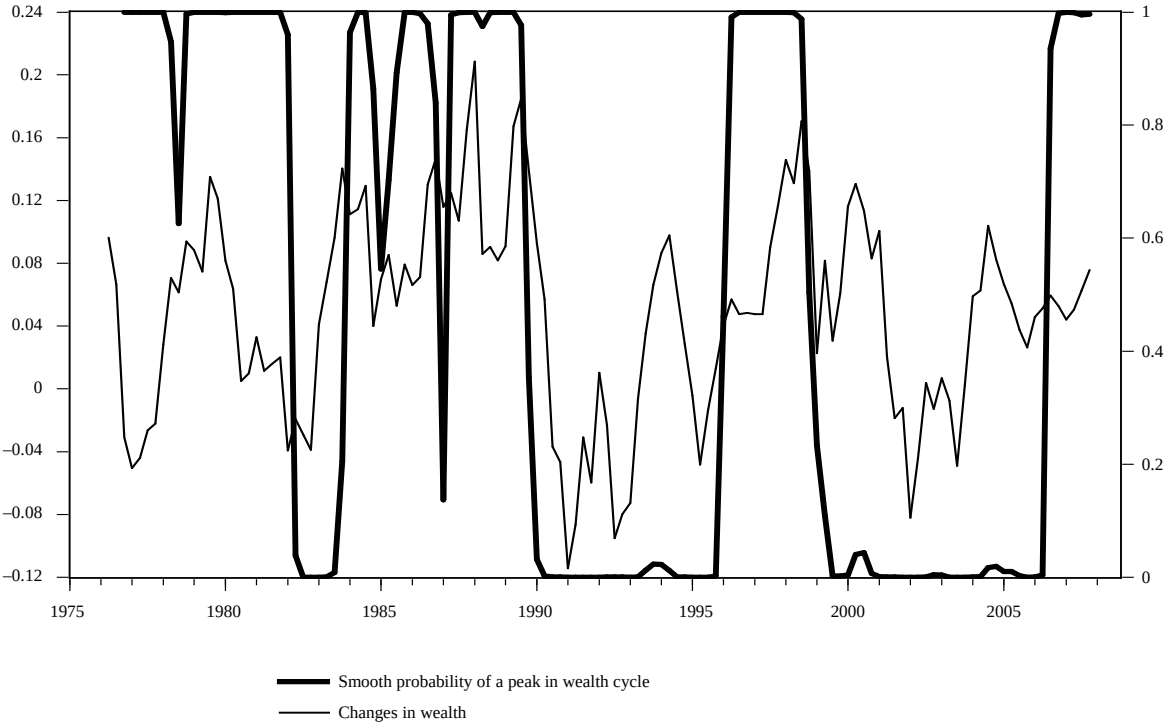


Figure 1b

UK: Regime 2 for Spending and Wealth Growth



0.04). The size of the effects of changes in housing prices is quite the same (0.19 for revenues and 0.14 for primary spending).

Low revenues and spending are positively correlated with the changes in housing prices, but the variations of the former are lower when compared with the latter (the total elasticity is 0.19 for tax receipts, but only 0.09 for primary spending).[1] Turning to the elasticities of revenues with respect to stock prices, we find that a positive immediate effect (0.08) is reversed over time (–0.11). One explanation may be that, during the downturns of the wealth cycle, revenues are very sensitive to the second round effects of changes in the stock market prices. A drop in stock prices reduces fiscal revenues. But since this happens at a trough of the wealth cycle, investors may expect future stock price increases and may thereby increase the size of their portfolio which raises tax revenues. Therefore, the bulk of the responsiveness of tax revenues to changes in stock prices seems to be generated by these second round effects. On the spending side, changes in stock price always involve a positive correlation (0.03).

One implication of the above observations is that relapses in the housing prices are likely to yield a deterioration of the fiscal balance that could be more accentuated in the troughs of the aggregate wealth cycle than at the peaks. A weak responsiveness of fiscal balance to changes in stock prices is expected at the troughs of the wealth cycle (a negative total effect of –0.03 for tax revenues compensates the positive effect of 0.03 on spending). Conversely at the peaks, an improvement of fiscal balance is to be expected following stock price relapses due to the strongest responsiveness of spending (0.08) as compared with that of revenues (0.04).

The elasticities indicate what could happen in terms of reaction of revenues and spending to changes in asset prices in different phases of the aggregate wealth cycle. A further question is: how likely are changes in phases to occur (from troughs to peaks or vice versa)? This question is important because the asset cycles are more volatile than the output cycle, thereby implying a potential more "volatile" fiscal balance. Indeed, the degree of sluggishness of the fiscal balance does not only depend upon the size or magnitude of asset price changes, but also upon the degree of persistence of the different regimes. Frequent changes may yield the fiscal authorities to frequently revise their actions to stabilize the asset market, or may render the revenue more buoyant.

The degree of persistence of the different regimes is obtained by computing the maximum marginal probability of staying in or leaving a regime following a one standard deviation in aggregate wealth. This maximum marginal probability change is given by the quantity $q_j = min\{0.25\sigma_z(b_j), 0.5\}$, where σ_z is the standard error of the transition variable (in our case 0.06) and j=1,2. From q_j, one concludes that, following a change of one standard deviation in the transition variable z, the probability of leaving an initial observed regime j is, at most, $p_{ij} = 0.5 - q_j$, $j \neq i$. For taxes, we obtain $p_{21} = 0$, $p_{12} = 0{,}13$, and, for primary spending, we find $p_{21} = 0{,}78$, $p_{12} = 0{,}5$. This implies a high inertia of revenues with regards to regime changes, while, conversely, the correlation between primary spending and asset prices is very sensitive to the aggregate wealth cycle. This is confirmed by the estimates of the coefficients of the lagged dependent variable in Table 1b. The coefficients are not significant in the case of spending, while they are highly significant and high in magnitude for revenues.

Changes in the cyclical and permanent components of revenues and spending are presented in Tables 1c and 1d. Table 1e shows the corresponding changes in fiscal balance. We apply the estimated elasticities from the TVPMS model to gap measures of the exogenous variables that enter the revenues and spending equations. We consider deviations of the variables from their long-run

[1] 0.09 is computed as the sum of the coefficients of the two lags for housing price changes, that is 0.20-0.11. For revenue, we only consider the coefficients of the lag which is statistically significant.

components captured by a HP filter. Changes are measured as annualized changes of a quarter to quarter point differences. We also report the permanent tax receipts and spending obtained by netting out the observed revenues and primary spending from the influence of the exogenous variables. We consider the average over different sub-periods.

The tables show that adjustments beyond the output gap may be warranted since changes in asset prices exert a significant influence on the cyclical revenues and spending. Comparing the contribution of the GDP and housing/stock prices, we observe that the coefficients are of the same magnitude, and sometimes higher. Therefore, the revenues or spending derived from financial and housing asset are not negligible and have an impact on the fiscal position. Data in the tables are read as follows. For instance, over the years 1978-80, the fiscal balance has increased by 5.41 per cent on average. Housing price changes are estimated to have a contribution of 0.23 per cent (e.g., –1.35 per cent–(–1.58 per cent)), while the contribution of stock prices is negative by –0.30 per cent (e.g. –0.40 per cent–(–10 per cent)). The contribution of the GDP is quite large with a magnitude of 3.57 per cent (0.65 per cent–(–2.82 per cent). In Table 1e we report the sign of the contributions of the housing price, stock prices and GDP to the changes in the cyclical balance over different sub-periods. The run-up or run-down in fiscal balance is either related to changes in the same direction of the asset prices, or works in the opposite direction of the effect of the GDP therefore contributing to dampen the reaction of revenues and spending to output fluctuations.

As far as the effort required to maintain debt on a sustainable level is concerned (captured here by the sign of the "structural" balance), it seems that the fiscal balance would not rapidly revert to an equilibrium level after a degradation (except during the interlude 1996-2000) since the "structural" balance diminishes even when the cyclical balance is negative. We observe that this does not happens over the years 1996-2000 when both the house and asset prices contributes positively to the dynamics of the cyclical fiscal balance. We can therefore presuppose the reaction of the governments to the asset cycles was part of the discretionary policy.

3.2 Spain

The results from the estimation for Spain are reported in Tables 2a and 2b. As for the other countries, we see that the linear model performs poorly, since many non-significant variables become significant once the asymmetry of the asset cycles is taken into account in a TVPMS equation. The statistics of the linearity tests indicates that aggregate wealth is a good predictor of the changing effects of the housing and stock prices on tax receipts and spending. Indeed, the estimated significance level of the tests is below 0.05, which yields to reject the null hypothesis that aggregate wealth is uninformative of the dynamics of revenues and spending. The output highly affects revenues with a total elasticity of 1.56. The fiscal balance remains quite unchanged following an increase in the debt ratio, since the latter results in a decrease in both revenues and spending by the same magnitude (0.12 per cent and 0.15 per cent following a 1 per cent increase in the debt ratio).

There is evidence of two regimes in the dynamics of revenues corresponding respectively to a decrease (regime 1 has a negative intercept) and a regime where they pick up (regime 2 with a positive constant). For spending, the model detects two regimes of increasing expenditure, one in which they raises more rapidly than in the other (the estimated constant is twice as high in regime 2 as in regime 1). This implies that they are two potential regime generating processes for fiscal balance: one related to a huge deterioration of fiscal balance (due to the combination of cuts in revenues and increasing spending) and the other characterized by a moderate degradation with spending increasing on average faster than revenues.

Table 2a

Spain: Linear Models

	Taxes				Primary Spending			
	(1)		(2)		(3)		(4)	
Constant	–0.005	*(–0.22)*	–0.006	*(–0.03)*	0.03	*(0.98)*	0.03	*(1.25)*
Lagged Output (–1)	–0.713	*(–0.72)*	0.198	*(0.19)*	–0.59	*(–0.55)*	0.35	*(0.28)*
Lagged Output (–2)	1.09	*(1.14)*	0.66	*(0.69)*	0.04	*(0.04)*	–0.39	*(–0.35)*
Lagged Dep. Var.	0.287**	*(2.29)*	0.15	*(1.14)*	0.235*	*(1.82)*	0.09	*(0.64)*
Lagged Public Debt (–1)	–0.28	*(–1.02)*	–0.50	*(–1.53)*	0.22	*(0.71)*	0.12	*(0.33)*
Lagged Public Debt (–2)	0.41	*(1.53)*	0.34	*(1.18)*	–0.36	*(–1.12)*	–0.54	*(–1.64)*
Lagged Housing Prices (–1)	-	-	–0.92	*(–1.56)*	-	-	–1.07	*(–1.59)*
Lagged Housing Prices (–2)	-	-	0.48	*(0.77)*	-	-	0.54	*(0.77)*
Lagged Stock Prices (–1)	-	-	0.36**	*(2.45)*	-	-	0.25	*(1.39)*
Lagged Stock Prices (–2)	-	-	–0.26*	*(–1.88)*	-	-	–0.19	*(–1.12)*
R^2	0.05		0.12		0.02		0.04	
Log-likelihood	65.20		69.82		58.74		61.68	

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets.

Table 2b

Spain: TVP-MS Models

	Taxes		Primary Spending	
Non–Switching Parameters				
Lagged Output (–1)	0.32	*(0.46)*	–0.79	*(–1.41)*
Lagged Output (–2)	1.24**	*(2.32)*	–0.35	*(–0.65)*
Lagged Public Debt (–1)	–0.99***	*(–5.69)*	0.29*	*(1.72)*
Lagged Public Debt (–2)	0.67***	*(4.24)*	–0.44**	*(–2.36)*
σ	0.05***	*(9.73)*	0.05***	*(11.86)*
Switching Parameters				
	Regime 1 (*S*=1) Decreases in tax revenues		Regime 1 (*S*=1) Moderate increases in spending	
Constant	–0.04***	*(–3.42)*	0.03***	*(2.62)*
Lagged Dependent Var.	–0.12	*(–1.44)*	–0.26**	*(–1.82)*
Lagged Housing Prices (–1)	–0.52*	*(–1.78)*	–0.70**	*(–2.24)*
Lagged Housing Prices (–2)	0.29	*(1.01)*	0.24	*(0.71)*
Lagged Stock Prices (–1)	0.06	*(0.91)*	0.31***	*(3.63)*
Lagged Stock Prices (–2)	0.24***	*(3.37)*	–0.44***	*(–4.60)*
	Regime 2 (*S*=2) Increases in tax revenues		Regime 2 (*S*=2) Higher increases in spending	
Constant	0.03*	*(1.94)*	0.06***	*(3.93)*
Lagged Dependent Var.	0.07	*(0.35)*	–0.40***	*(–3.24)*
Lagged Housing Prices (–1)	–0.31	*(–0.54)*	–0.68	*(–1.12)*
Lagged Housing Prices (–2)	0.23	*(0.41)*	0.25	*(0.38)*
Lagged Stock Prices (–1)	0.41***	*(4.05)*	–0.04	*(–0.34)*
Lagged Stock Prices (–2)	–0.66***	*(–6.38)*	0.63***	*(5.75)*
Transition Function				
Transition Variable/par	Aggregate Wealth (–3)		Aggregate Wealth (–2)	
a_1	0.23	*(0.41)*	0.23	*(0.43)*
a_2	–0.49	*(–0.69)*	–5.18*	*(–1.75)*
b_1	26.88**	*(2.01)*	8.79	*(1.25)*
b_2	–22.45	*(–1.37)*	54.29*	*(1.87)*
Linearity Tests				
Statistics and *p*-value	6.12**	*(0.04)*	7.36**	*(0.03)*

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets. *p*-values in parenthesis.

Both housing and stock prices explains episodes of decreasing tax receipts, while increasing revenues are related to stock prices only. Indeed, no significant coefficient for housing prices is found in regime 2. In regime 1, a steep drop in revenues can be observed in spite of house price increases, as indicated by the high negative coefficient (high relative to the other estimated coefficients in the same regime) of –0.52. The fact that housing price increases do not initiate a change in revenues is the consequence of significant lags between market values and assessed values of housing. This also reflects the concomitance of ascending price in the real estate sector and the policy makers' actions to reduce taxes related to the housing sector in order to support the building sector. The contractions in tax revenues seem to be driven by the stock market (as we obtained a positive coefficient of 0.24 in regime 1).

The stock price effects in the second regime are globally negative. Revenues are firstly negatively correlated with increases in the stock prices (the elasticity is –0.66) and then turn to be positive during the subsequent quarter (0.41). This dynamic effect can be easily explained because taxes are paid on accrued gains only. In a rising market, investors wait before taking the decision to sell their assets. On the contrary, in a falling market, they wait before deciding whether or to buy new assets. Because of this timing delay, over the asset cycle, increasing prices can result in reduced taxable gains.

Stock prices changes are negatively correlated with "moderate" increases in spending and positively correlated with stronger increases in spending. The total effects are indeed respectively equal to –0.14 and 0.63. Assume a situation of stock price decline yielding to a balance sheet deterioration of financial and corporate sectors. Our estimates suggest that, this burdens the government's budget (for instance through support measures to these sectors). The Government therefore adopts counter-cyclical actions to dampen the negative effects of the asset cycle, provided that this leads a moderate increase in spending. When spending growth too rapidly (regime 2), the policy tends to be pro-cyclical: no measure is undertaken to curb stock price decreases, but primary spending are adjusted downward (which leads to suppose that, if there are options for limiting any drop in stock prices, these operate through the revenue channel). The policy reaction to a drop in housing prices is also counter-cyclical in regime 1 (with an estimated elasticity of –0.70). Conversely, in regime 2 spending are not reactive to any change in the housing price cycle (no statistically significant coefficients are found).

The maximum marginal probabilities of regime shifts are, for revenues, $p_{12} = 0.5$ and $p_{21} = 0.16$ and for spending, $p_{12} = 0$ and $p_{21} = 0.5$. This implies that there is a low likelihood of switching from a regime of decreasing tax revenues, while, if the economy is initially in a regime of increasing revenues, there is no clear evidence that it will continue to evolve in the same regime (the probability is 0.5). We accordingly conclude that the regime in which the revenues fall is likely to appear more frequently. This implies two types of episodes in terms of the dynamics of fiscal balance. At best, a boom in the housing and stock markets will slow the decrease in revenues as well as the raising spending. At worst, a drop or a bubble burst will accentuate the degradation of revenues while rising primary spending, thereby causing a strong deterioration of the fiscal balance.

The estimates in Table 2e show that after improving during the years 1993-96, the cyclical fiscal balance has deteriorated in the course of the subsequent years. The deterioration relies on a progression of taxes below that of spending, or is based on revenues decaying faster than spending. The associate changes in house and stock prices suggest that the cyclical revenue increases during the first three years were positively affected by the dynamics of house and price changes (during the years 1993-96 bull markets were registered), that the lowering revenues were associated with a negative contribution of at least one asset between 1997 and 2004, and that the shortfall in revenues over the years 2005-07 was rather correlated with the negative contribution of the GDP. The positive signs of the contributions suggest that the bullish stock and house market may

Table 2c

Spain: Changes in Cyclical and Cyclically-adjusted Tax Revenues
(annualized quarter-on-quarter changes, percent)

Contributions							
	Cyclical Revenues	**Lagged Revenue**	**GDP**	**Debt**	**Stock Price**	**House Price**	**CAR**
1993-96	7.76	10.96	–4.04	7.36	–8.04	1.6	–5.64
1997-2000	–2.24	–7.16	0.56	0.8	3.68	–0.36	–0.68
2000-04	6.68	7.32	3.24	–0.08	–3.64	–0.24	–29.4
2005-07	–8.76	–9.48	–1.56	0.96	2.88	–1.56	18.72

Note: CAR: cyclically-adjusted revenues (adjustment related to output and asset price fluctuations).

Table 2d

Spain: Changes in Cyclical and Cyclically-adjusted Primary Spending
(annualized quarter-on-quarter changes, percent)

Contributions							
	Cyclical Spending	**Lagged Spending**	**GDP**	**Debt**	**Stock Price**	**House Price**	**CAS**
1993-96	0.88	1.48	0.008	1.64	–2.72	0.44	12.28
1997-2000	–1.48	–6.64	0.08	–1.84	6.2	–1.48	–9.76
2001-04	9.2	4.84	–0.12	0.68	2.96	1.00	–15.92
2005-07	–6.44	2.2	0.08	–0.96	–4.72	–3.00	–4.2

Note: CAS: cyclically-adjusted revenues (adjustment related to output and asset price fluctuations).

Table 2e

Spain: Changes in Cyclical and Cyclically-adjusted Fiscal Balance
(annualized quarter-on-quarter changes, percent)

	Cyclical Spending	**Cyclical Revenues**	**Cyclical Balance**	**Structural Spending**	**Structural Revenues**	**Structural Balance**	**SP**	**HP**	**GDP**
1993-96	0.88	7.76	6.88	12.28	–5.64	–17.92	+	+	–
1997-2000	–1.48	–2.24	–0.76	–9.76	–0.68	9.08	–	+	+
2001-04	9.2	6.68	–2.52	–15.92	–29.4	–13.48	–	–	+
2005-07	–6.44	–8.76	–2.32	–4.2	18.72	22.92	+	+	–

Note: +, – indicate that the contribution of a given variable to changes in cyclical balance is positive, respectively negative.

have contributed to dampen the declining trend of revenues. Compared with the case of UK, it is seen that the adjustment needed to keep debt on a sustainable path is stronger in Spain. Further that real estate and capital gain revenue were probably not used as buffer during the "good" years (for instance between 1993 and 1996) since the "structural balance" is strongly negative.

3.3 Italy and France

Tables 3a and 3b list the estimation for Italy. The statistics of the linearity test suggest that we cannot reject the null hypothesis that the primary spending are better described by a linear model, since the significance level of the test lies above 0.05.We therefore focus our comments on revenues. Figures 3a and 3b show that what the model identifies as regimes 1 and 2 can be related to the turning points of the asset price cycles. There is evidence that regime 1 corresponds to the peaks of the stock price cycle and regime 2 to the troughs. Further, we see that the estimated constants in regimes 1 and 2 are respectively negative and positive. Since the endogenous variable captures quarter-to-quarter changes, the model thus dichotomizes into one regime in which the revenues decrease after achieving a high level and one in which the increase after reaching a bottom. How variations in tax receipts are related to changes in housing prices is less evident (Figure 3b).

Table 3a

Italy: Linear Models

	Taxes				**Primary Spending**			
	(1)		(2)		(3)		(4)	
Constant	–0.006	*(–0.35)*	–0.005	*(–0.29)*	–0.09**	*(1.97)*	–0.09*	*(–1.78)*
Lagged Output (–1)	2.21**	*(2.00)*	2.31**	*(2.04)*	1.53	*(0.53)*	1.56	*(0.50)*
Lagged Output (–2)	–0.72	*(–0.68)*	–0.89	*(–0.83)*	0.75	*(0.26)*	0.65	*(0.22)*
Lagged Dep. Var.	–0.03	*(–0.28)*	–0.09	*(–0.82)*	0.50***	*(5.33)*	0.49***	*(4.94)*
Lagged Public Debt (–1)	1.04	*(1.33)*	0.81	*(1.01)*	1.66	*(0.79)*	1.66	*(0.74)*
Lagged Public Debt (–2)	–1.09	*(–1.40)*	–0.82	*(–1.02)*	–0.77	*(–0.37)*	–0.77	*(–0.35)*
Lagged Housing Prices (–1)	-	-	0.01	*(0.16)*	-	-	–0.06	*(–0.25)*
Lagged Housing Prices (–2)	-	-	–0.07	*(–0.94)*	-	-	0.04	*(0.21)*
Lagged Stock Prices (–1)	-	-	0.80	*(1.56)*	-	-	0.01	*(0.008)*
Lagged Stock Prices (–2)	-	-	–0.73	*(–1.43)*	-	-	–0.008	*(–0.006)*
R^2	0.02		0.03		0.32		0.28	
Log-likelihood	86.06		88.67		4.39		4.43	

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets.

Table 3b

Italy: TVP-MS Models

	Taxes		Primary Spending	
Non-switching Parameters				
Lagged Output (–1)	2.86***	*(4.73)*	–0.34	*(–0.28)*
Lagged Output (–2)	0.01	*(0.03)*	2.10*	*(1.86)*
Lagged Public Debt (–1)	1.17**	*(2.54)*	2.19**	*(2.28)*
Lagged Public Debt (–2)	–1.68***	*(–3.58)*	–0.66	*(–0.71)*
σ	0.05***	*(10.75)*	0.11***	*(17.33)*
Switching Parameters				
Regime 1 (*S*=1) Fall in Revenues at the Peaks of the Stock Price Cycle				
Constant	–0.08***	*(–9.64)*	–0.05***	*(–4.55)*
Lagged Dependent Var.	–0.23**	*(–2.30)*	–0.09	*(–1.20)*
Lagged Housing Prices (–1)	–0.35	*(–1.29)*	0.04	*(0.73)*
Lagged Housing Prices (–2)	0.76***	*(2.73)*	0.60**	*(2.42)*
Lagged Stock Prices (–1)	0.07*	*(1.68)*	–0.05	*(–0.89)*
Lagged Stock Prices (–2)	–0.13**	*(–2.33)*	0.04	*(0.73)*
Regime 2 (*S*=2) Upward-oriented Revenues at the Troughs of the Stock Price Cycle				
Constant	0.07***	*(8.99)*	–0.46	*(–1.10)*
Lagged Dependent Var.	–0.48***	*(–4.99)*	–0.01	*(–0.09)*
Lagged Housing Prices (–1)	0.77***	*(3.25)*	57.39***	*(5.48)*
Lagged Housing Prices (–2)	–0.88***	*(–3.67)*	–47.73***	*(–5.75)*
Lagged Stock Prices (–1)	–0.07	*(–1.40)*	1.77	*(1.26)*
Lagged Stock Prices (–2)	0.16***	*(3.59)*	–7.62***	*(–3.39)*
Transition Function				
Transition variable/par	Aggregate Wealth (–1)		Aggregate Wealth (–1)	
a_1	–1.79***	*(–2.77)*	5.23***	*(2.60)*
a_2	–1.70**	*(–2.47)*	3.43	*(1.03)*
b_1	23.11**	*(1.98)*	–15.20	*(–0.48)*
b_2	29.96**	*(2.53)*	–52.63	*(–0.83)*
Linearity Tests				
Statistics and *p*-value	5.27*	*(0.07)*	0.62	*(0.73)*

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets. *p*-values in parenthesis.

Table 3c

Italy: Changes in Cyclical and Cyclically-adjusted Tax Revenues

(annualized quarter-on-quarter changes, percent)

Contributions							
	Cyclical Revenues	**Lagged Revenue**	**GDP**	**Debt**	**Stock Price**	**House Price**	**CAR**
1989-95	–2.39	2.02	–2.06	0.06	–1.38	–1.03	2.24
1996-99	1.63	–1.68	7.06	–1.00	–2.72	–0.008	18.53
2000-03	3.51	1.07	–0.31	0.95	1.35	0.44	9.49
2004-07	–8.39	–2.83	–3.58	–0.69	–1.43	0.14	6.10

Note: CAR: cyclically-adjusted revenues (adjustment related to output and asset price fluctuations).

Figure 3a

Italy: Regime 2 for Taxes and Stock Price Changes

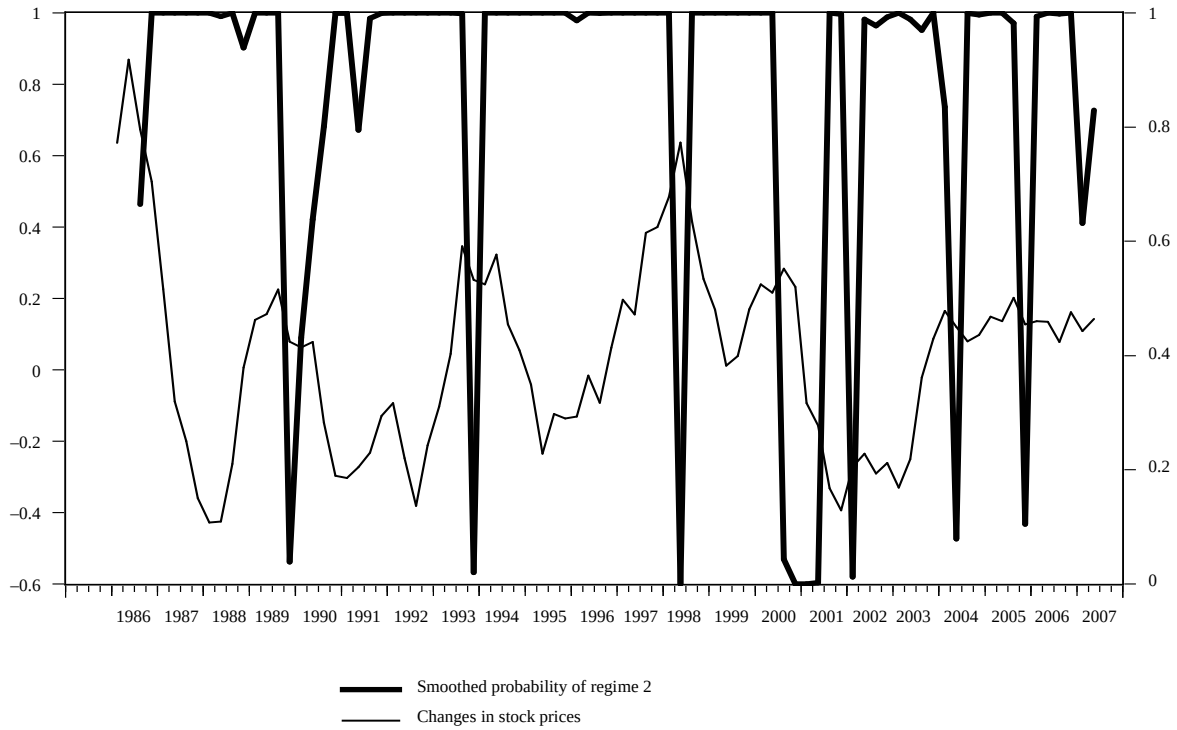
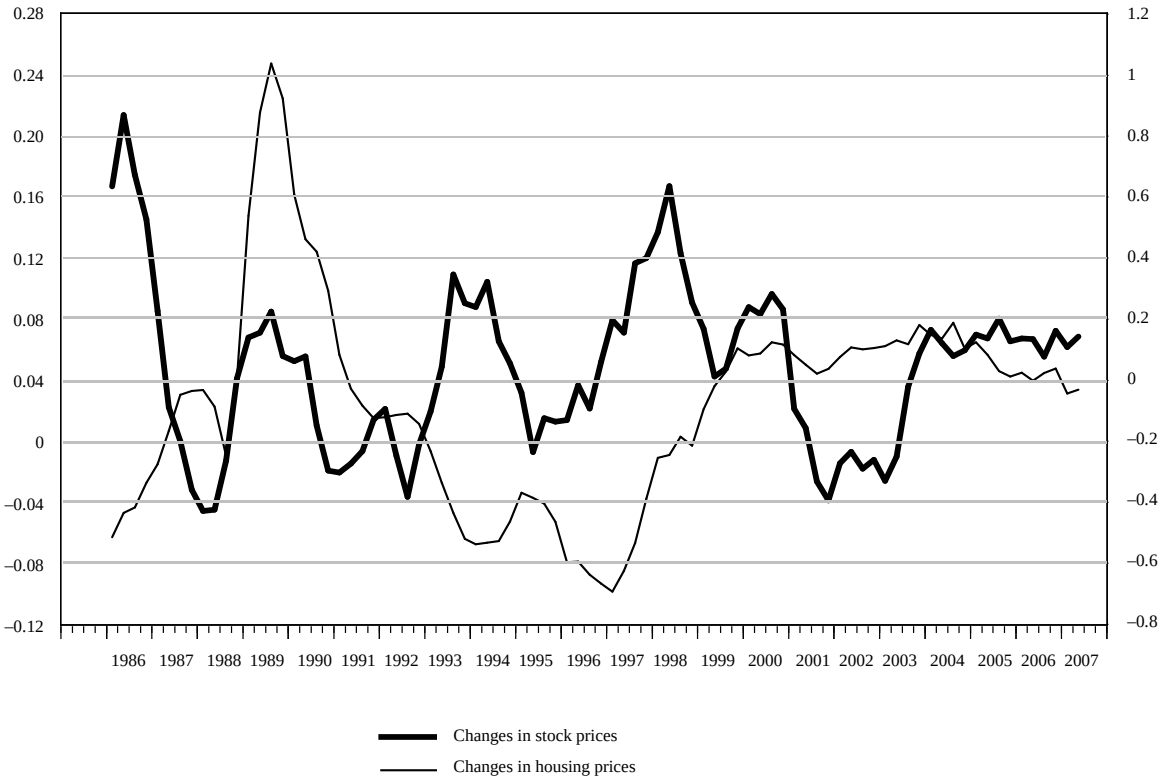


Figure 3b

Italy: Regime 2 for Taxes and Housing Price Changes

Figure 3c

Italy: House and Stock Market Cycles



An important feature is the information conveyed by the aggregate wealth variable when the stock price is evolving near its cyclical peaks (regime 1). This raises the probability of observing an overshoot of prices and therefore increases the probability of a bubble burst with a drop in revenues. The positive sign of b_1 can be viewed as evidence that wealth increases at the peaks of the stock price cycle is informative about the likelihood of the revenues to fall deeply. Similarly, any wealth increase at the troughs of the stock price cycle fuels forthcoming price increases and an upward trend in revenues. This is consistent with the positive sign of the coefficient b_2. It is accordingly found that an increase in the stock price is overall negative in regime 1 with an elasticity of –0.06 (e.g., 0.07 – 0.13), and conversely positive in regime 2 (with the sum of the estimated lagged coefficients equal to 0.09). However, the fall or increase in revenues occurring in either regime or the other may be dampened by the influence of the development in the housing prices. Indeed, it is seen that the sum of the house price coefficient carries an opposite sign to the sum of the coefficients of stock price in each regime. This reveals that, in Italy, the real estate and stock market cycles do not necessarily impact the fiscal revenues in the same direction, which could be explained by the fact that there is no synchronization between their cycles (as suggested by Figure 3c).

As regards the other influences, we find that the GDP strikingly positively affect the revenues, while there seems to be a substitution between revenues and debt (the sum of the lagged coefficients is negative).

Table 3c shows the impact of different changes patterns of the explanatory variables on the cyclical and cyclically-adjusted revenues. It is seen that, in general, the revenues swings is related

to the stock price cycle. Temporary tax buoyancy arises from higher asset prices (and the converse) and its influence overweighs that of the housing prices (the contributions are, in absolute value, of a higher magnitude). Furthermore, it is seen that governments seem to act in such a way that structural fiscal policy maintain the debt ratio on a sustainable path, as reflected by the positive variations in the cyclically-adjusted revenues, whether or not the cyclical component fall or augments.

We finally proceed to comment upon the estimated results for France. Tables 4a and 4b list the estimates. As is suggested by Figure 4a, the estimated probabilities yield to a distinction between two regimes of revenue changes characterized by upturns (regime 1) and downturns (regime 2) of the stock price cycle. The main difference with Italy comes from the fact that the data yield to a distinction between two regimes of decreasing revenues (as reflected by the negative signs of the intercept). Regime 1 refers to huge drops, while regime 2 characterizes more moderate revenue falls. An increase in the stock prices at the upturns of the price cycles results into a reduction of tax receipts (we find a negative coefficient of –0.39), while when the increase happens at a downturn of the cycle, governments can reached higher revenues (as illustrated by the positive coefficient of 0.30. As for the Italian case, the effects of stock prices on revenues are tempered by those of the housing prices, but only in regime 1 where the dynamics of revenues is characterized by high falls the sum of the estimated coefficients for house prices equals 0.96). In regime 2, the influence of the house price works in the same direction from that of the stock price.

It seems that the TVPMS model also helps identify one regime related to high falls in aggregate wealth (with troughs) associated with a positive response of the primary spending (positive intercept in regime 1). This suggests that there is a discretionary spending policy response to aggregate wealth decreases (se also Figure 4b). The signs of the estimated coefficients indicate that governments increase spending when stock price falls (the sum of the elasticities in regime 1 is negative and around –0.23) and reduce them otherwise (the sum of the coefficients equals 0.14 in regime 2). As in the Italian case, the response to the changes in the house price operates in the opposite direction from that of the stock prices

Changes in aggregate wealth provide a signal with regards to predicting a shift in the revenue policy from a state of moderately decreasing tax receipts to highly decreasing taxes. Although this may appear counter-intuitive at first glance (normally, we would expect these changes to fuel raises in stock prices and thus to increase revenues). But this result can be explained as follows. In France, taxes on gains from investments in the real estate has generally been more advantageous, since many years, compared those on gains from equity investments. When a rise in stock prices happens, investors may be hesitant before buying new assets until the increase is really confirmed. In addition, as shown in Figure 4c, the turning points of the asset and housing price cycles are not synchronized. Therefore, the reaction of investors to an increase in wealth is the result of how they react to both cycles. A trough in the price cycle may correspond to a peak the house price cycle, thereby implying a fall in revenue because investors get rid of their assets in the real estate market.

Tables 4c, 4d and 4e report the results of the cyclical and cyclically-adjusted revenues and spending for France. Unlike the other countries, all the variables that influence governments' decision to raise or reduce spending and taxes are found to induce sharper fluctuations in the cyclical revenues and spending. We find that, in general, burst phases in the stock and housing markets coincide with deteriorating cyclical fiscal balances (in Table 4e, the changes in the cyclical balance and stock/housing prices carry the same sign, except over the years 1993-96). Fiscal cyclical balances tend to improve during the boom phases (see Table 4e, where the signs are positive). A procyclical expenditure reduction effort is observed during in times of falling prices. Finally, it is seen that cyclical and structural fiscal balances evolve in opposite directions, thereby indicating that governments have adopted sustainable fiscal policies.

Table 4a

France: Linear Models

	Taxes				Primary Spending			
	(1)		(2)		(3)		(4)	
Constant	–0.24***	*(–3.47)*	–0.28***	*(–3.57)*	–0.16*	*(–1.71)*	–0.19*	*(1.84)*
Lagged Output (–1)	6.46**	*(2.36)*	9.73***	*(3.32)*	3.85	*(1.08)*	9.22**	*(2.35)*
Lagged Output (–2)	–0.75	*(–0.68)*	–0.68	*(–0.26)*	0.76	*(0.21)*	–1.06	*(–0.29)*
Lagged Dep. var	–0.13***	*(–2.83)*	–0.23*	*(–1.81)*	0.15	*(1.12)*	0.002	*(0.013)*
Lagged Public Debt (–1)	–0.92	*(–0.99)*	–1.91*	*(–1.92)*	0.46	*(0.35)*	–0.78	*(–0.58)*
Lagged Public Debt (–2)	2.66***	*(2.83)*	3.68***	*(3.77)*	0.55	*(0.42)*	1.89	*(1.42)*
Lagged Housing Prices (–1)	-	-	0.97	*(0.78)*	-	-	–0.62*	*(2.57)*
Lagged Housing Prices (–2)	-	-	–1.31	*(–1.00)*	-	-	0.23	*(0.95)*
Lagged Stock Prices (–1)	-	-	–0.135	*(–0.77)*	-	-	–0.68	*(–0.40)*
Lagged Stock Prices (–2)	-	-	–0.18	*(–1.05)*	-	-	0.10	*(0.06)*
R^2	0.05		0.12		0.02		0.04	
Log–Likelihood	65.20		69.82		58.74		61.68	

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets.

Table 4b

France: TVP-MS Models

	Taxes		Primary Spending	
Non–switching Parameters				
Lagged Output (–1)	12.00***	*(6.61)*	15.36***	*(6.19)*
Lagged Output (–2)	–3.98***	*(–2.30)*	–5.93***	*(–3.08)*
Lagged Public Debt (–1)	–2.00***	*(–3.59)*	–3.19***	*(–25.18)*
Lagged Public Debt (–2)	3.86***	*(7.66)*	4.32***	*(18.79)*
σ	0.07***	*(9.61)*	0.09***	*(10.96)*
Switching Parameters				
	Regime 1 (*S*=1) Upturns of the Stock Price Cycle		Regime 1 (*S*=1) Troughs of the Wealth Cycle	
Constant	–0.152***	*(–5.46)*	0.21***	*(–13.38)*
Lagged Dependent Var.	–2.00***	*(–2.80)*	–2.25***	*(–2.14)*
Lagged Housing Prices (–1)	1.44**	*(2.04)*	3.49***	*(2.94)*
Lagged Housing Prices (–2)	–0.48***	*(–3.94)*	–1.25***	*(–7.12)*
Lagged Stock Prices (–1)	–0.03	*(–0.24)*	0.20**	*(2.12)*
Lagged Stock Prices (–2)	–0.39***	*(–4.67)*	–0.43***	*(–3.61)*
	Regime 2 (*S*=2) Downturns of the Stock Price Cycle		Regime 2 (*S*=2) Alternative Regime	
Constant	–0.09***	*(–3.63)*	0.008	*(0.74)*
Lagged Dependent Var.	2.21***	*(2.72)*	–1.94*	*(–1.86)*
Lagged Housing Prices (–1)	–1.74*	*(–2.03)*	0.69	*(–0.69)*
Lagged Housing Prices (–2)	–0.05	*(–0.45)*	–0.48***	*(–5.16)*
Lagged Stock Prices (–1)	0.30**	*(2.54)*	0.54***	*(2.62)*
Lagged Stock Prices (–2)	–0.17	*(–1.34)*	–0.43***	*(–4.13)*
Transition Function				
Transition variable/par	Aggregate Wealth (–1)		Aggregate Wealth (–1)	
a_1	–2.15*	*(–1.82)*	2.38***	*(3.14)*
a_2	0.42	*(0.49)*	0.74	*(1.08)*
b_1	17.18	*(1.24)*	–7.36	*(–0.76)*
b_2	–45.34***	*(–2.58)*	34.86*	*(1.85)*
Linearity Tests				
Statistics and *p*-value	6.64**	*(0.036)*	5.02*	*(0.08)*

Note: ***, **, * statistical significance at 1 per cent, 5 per cent and 10 per cent. *t*-values in square brackets. *p*-values in parenthesis.

Table 4c

France: Changes in Cyclical and Cyclically-adjusted Tax Revenues
(annualized quarter-on-quarter changes, percent)

Contributions							
	Cyclical Revenues	**Lagged Revenue**	**GDP**	**Debt**	**Stock Price**	**House Price**	**CAR**
1993–96	0.34	–0.51	15.85	–15.64	3.61	–2.96	14.18
1997–99	–12.00	15.82	–16.30	–1.14	–3.54	–6.83	24.24
2000–03	23.09	–5.12	13.26	3.74	6.38	4.81	–2.85
2004–06	–29.12	12.23	–5.10	–12.80	–2.14	–11.42	–2.51

Note: CAR: cyclically-adjusted revenues (adjustment related to output and asset price fluctuations).

Table 4d

France: Changes in Cyclical and Cyclically-adjusted Primary Spending
(annualized quarter-on-quarter changes, percent)

Contributions							
	Cyclical Spending	**Lagged Spending**	**GDP**	**Debt**	**Stock Price**	**House Price**	**CAS**
1993–96	–18.15	–10.63	29.60	–31.81	–6.87	1.57	21.96
1997–99	–7.37	21.77	–30.91	–3.07	4.46	0.37	16.33
2000–03	20.14	–8.22	25.10	4.86	–3.78	2.18	8.55
2004–06	–17.45	–1.82	–23.96	3.57	10.46	–5.70	–1.69

Note: CAS: cyclically-adjusted revenues (adjustment related to output and asset price fluctuations).

Table 4e

France: Changes in Cyclical and Cyclically-adjusted Fiscal Balance
(annualized quarter-on-quarter changes, percent)

	Cyclical Spending	**Cyclical Revenues**	**Cyclical Balance**	**Structural Spending**	**Structural Revenues**	**Structural Balance**	**SP**	**HP**	**GDP**
1993–96	–18.15	0.34	18.49	21.96	14.18	–7.78	+	–	–
1997–99	–7.37	–12.00	–4.63	16.33	24.24	7.91	–	–	+
2000–03	20.14	23.09	2.95	8.55	–2.85	–11.91	+	+	–
2004–06	–17.45	–29.12	–11.67	–1.69	–2.51	–0.82	–	–	+

Note: +, – indicate that the contribution of a given variable to changes in cyclical balance is positive, respectively negative.

Figure 4a

France: Regime 1 for Taxes and Stock Price Changes

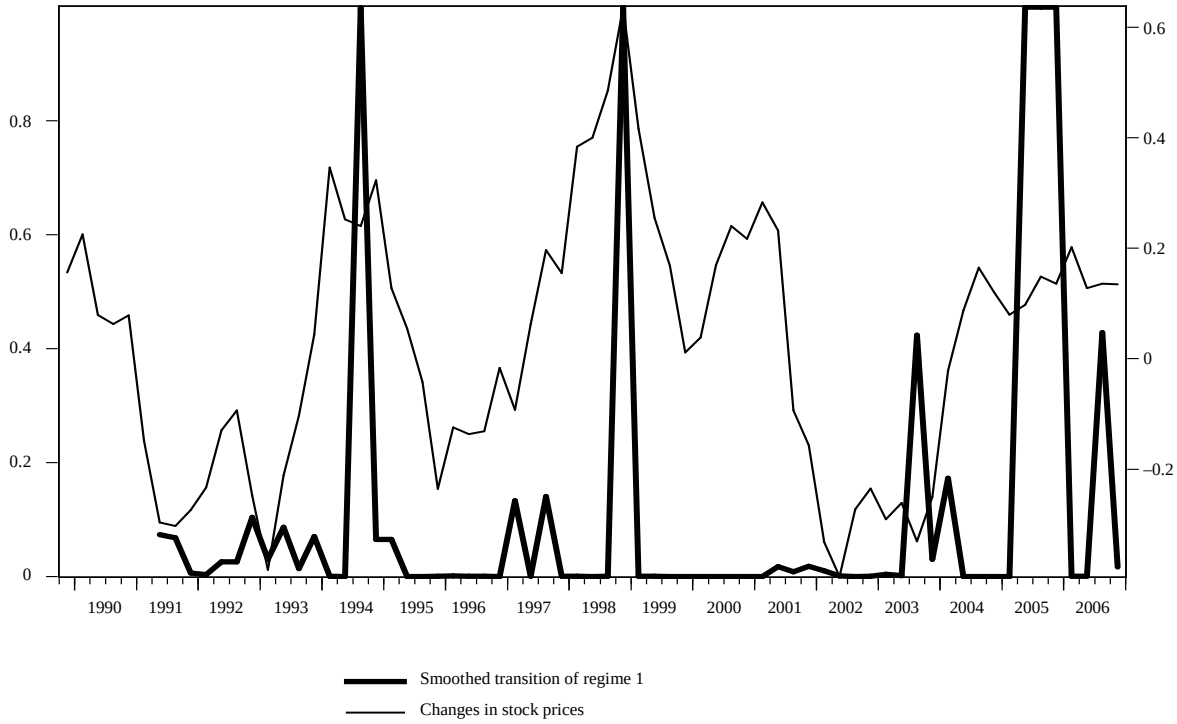


Figure 4b

France: Regime 1 for Spending and Wealth Growth

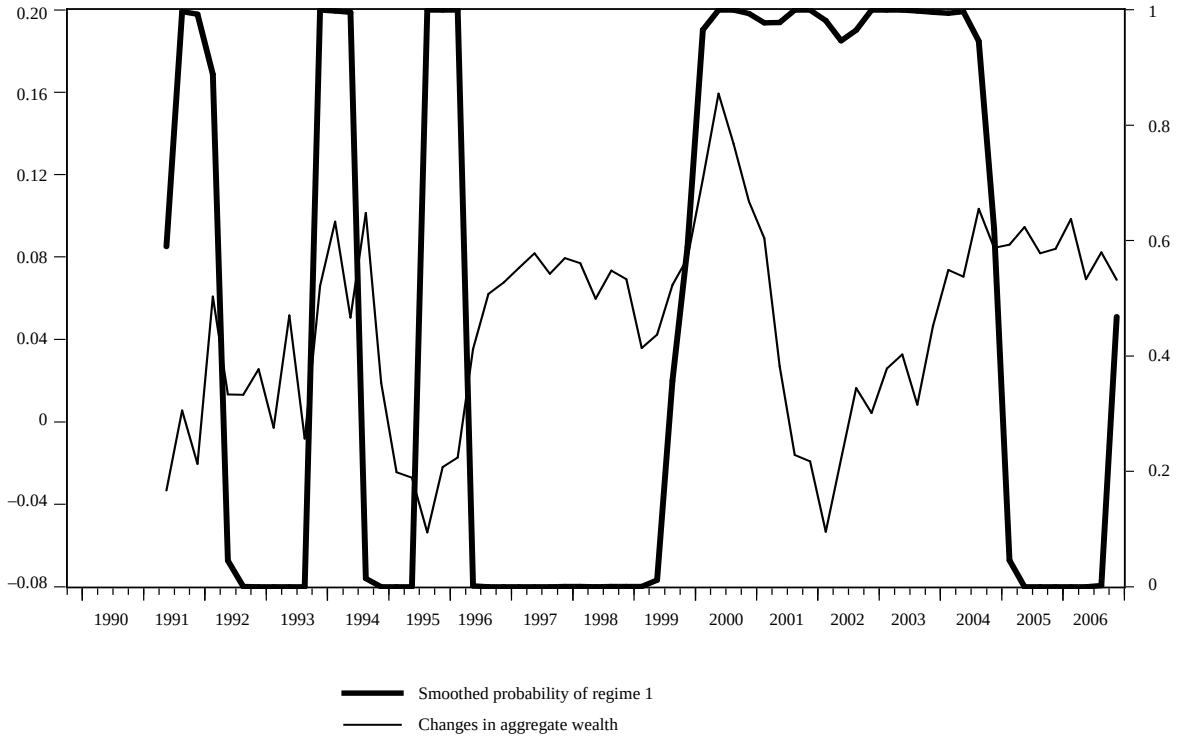
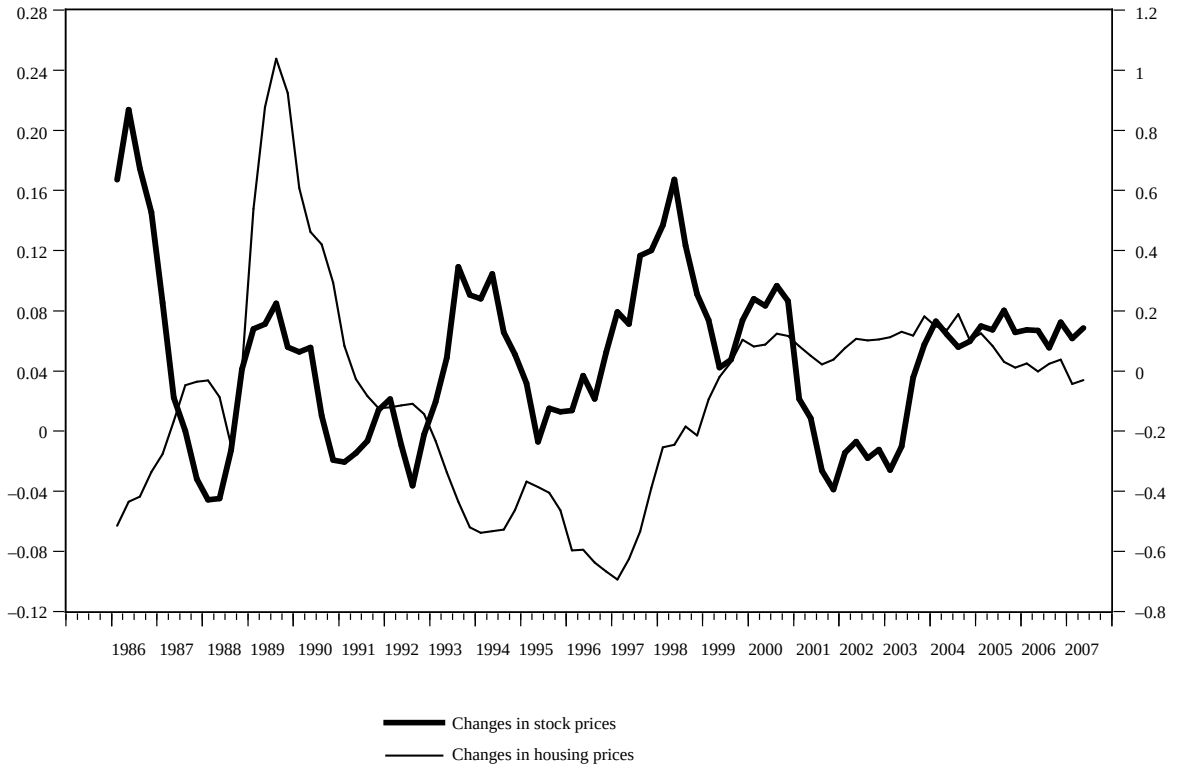


Figure 4c

France: House and Stock Market Cycles



3.4 Summarizing our main findings

We now summarize our main findings by looking at the lessons that can be gleaned from the preceding observations as regards the fiscal policy reactions to the dynamics of the asset price cycles.

A first question is whether we observe co-movements between the cyclical fiscal balance and the swings in housing and equity prices? The paper suggests that, to answer this question, one needs to take into account the asymmetries inherent to the asset price cycles, because governments adjust spending and revenues to the price fluctuations in different manners depending upon whether prices are upward or downward oriented. Furthermore, they also need to anticipate the reactions of the investors when markets are evolving towards a peak or troughs (the regimes identified by the TVPMS equations). The regressions indicate that, the omission of such asymmetries may result into strong biases and yield false interpretations of the magnitude of unexpected revenues or spending. It could also give government false benchmarks as regards the size of the change in financial and real estate that triggers their intervention (for instance to deflate a bubble). Indeed, the linear models do not a good job in explaining the dynamics of the fiscal variables (very often, no significant effects is found at a quarterly frequency, neither for the usual variables that enter the fiscal reaction function, nor for the equity and house prices). It could be more appropriate to work with non-linear reaction functions having the property that is time-varying and regime-switching.

The effects of the asymmetries in the fiscal response to assert market development are well documented within the TVPMS framework.

In Spain, revenue falls are associated with less favorable developments in the housing markets (prices decreases), but price increases are not reflected into higher revenues. Furthermore, spending becomes not reactive to stock price changes when public expenditure is already augmenting above a threshold level.

In Italy, the fiscal effects of changes in stock prices are conditioned by the turning points of the asset price cycles. Equity price changes at peaks reduce the revenues, while they bring higher tax receipts at troughs. Housing price increases raise revenues when a burst phase is developing at the same time in the stock market, but reduce them as a new boom is likely to appear in the stock market (when prices are near a trough).

In France, stock price increases exert an asymmetric effect on revenues at the downturns and upturns of the stock price cycle. In one case, they fuel tax increases, while in the other case, revenues are retrenched. Like in the Italian case, the phases of the stock price cycle condition the impact of housing prices. We find similar asymmetries in the UK, when considering the impact of stock price fluctuations on taxes and spending according to the troughs and peaks of the aggregate wealth itself (negative effects on revenues at the troughs, positive effects near the peaks). However, the influence on spending plays in the same direction, whichever the observed turning points of the wealth cycle. Finally, in the UK, there are no signs of asymmetric effects as regards the influence of house price fluctuations (higher house prices yield an increase in both revenues and spending).

A second issue is the following. Within the framework of such non-linear fiscal reaction functions, what is the behavior of fiscal variables during the boom-bust phases in the asset prices? As regards revenues, there is some evidence that contractions in both the stock and housing prices tend to reduce taxes (and vice versa) in the United Kingdom and France (fiscal and asset variables change in the same direction as shown in Tables 1c and 4c). In Spain, the positive correlation between the asset price cycle and revenues is true for house prices only, while the policy response to stock prices appears to be counter-cyclical (see Table 2c. Stock prices and revenues very often evolve in opposite directions). This could be explained by the fact that, during the stock market booms, governments have accommodate the price cycle by reducing taxes on capital gains. In Italy, revenues move in line with stock prices (in Table 3c, both variables moves in the same direction), while the links with the house price varies across years yielding alternatively a positive and a negative correlation. If we compare the magnitude of the contributions of both the equity and house prices to revenue changes, since the beginning nineties, it seems that the influence of stock prices dominates that of housing prices in Spain and Italy, while in the UK and France, there are periods of more significant contribution of the housing cycles to the changes in tax receipts.

On the spending side, the evidence in favor of the claim that changes in primary spending are correlated with the changes in asset prices and this affects the fiscal position depending on the size of the price changes and the influence of the output cycle on revenues. We consider the examples of the UK and Spain, two countries in which asset market development have a high contribution to the fiscal balances as regards the share of the real estate sector and equity markets in the economy.

A first illustration is what happened in the UK over the years 1986-90 (Table 1d). We observe an increase in cyclical spending – in spite of a declining GDP – with 36 per cent of these higher revenues being attributable to higher house and real estate prices (36 per cent is obtained by dividing 0.89 per cent + 0.19 per cent by 2/76 per cent). But, there is also evidence that in the subsequent years (1991-95), as the revenues from house price experienced a fall – higher in magnitude than the increased revenues from the stock market prices – the fiscal authorities decided to reduce spending. What could be interpreted as a time-consistent behavior in order to maintain the fiscal sustainability over time in the course of the decade 1986-95, turned to a counter-cyclical spending policy with the government increasing public expenditure between 1996 and 2000 in a

context of declining financial and real estate price and very low output growth rate (compare the coefficients in Table 1d). As seen in Table 1e, this left the fiscal balance in a weaker position.

In Spain, the cyclical fiscal balance deteriorates over the years from 1993 to 2007 due to a differential in the respective changes in revenues and spending. For instance, as seen in Table 2c, during the years 2001-04, in times of downward oriented house and stock prices, governments may activate support policies via spending increases, even in a case of a favorable juncture , with the GDP growth augmenting the revenues, the total effect on fiscal balance can be deterioration. A similar deterioration can also occur in the symmetrical situation (see Table 2c, the years from 2005 until 2007). A boom phase in the asset markets brings a decrease in primary spending that, however, translates into a higher deficit or a lower fiscal surplus, if, at the same time, tax revenues reduce as the consequence of a decline in the GDP.

4 Conclusion

This paper tests for non-linear effects of asset prices on the fiscal policy of a set of major European countries: France, Italy, Spain and UK. We model government spending and revenue as time-varying transition probability Markovian processes.

We find that, in France and Italy, the impact of housing prices on government revenue is conditioned by the phase of the stock price cycle. A similar asymmetric pattern is found for the UK when considering the effect of stock price fluctuations on taxes and spending according to the troughs and peaks of aggregate wealth. However, no sign of asymmetry was found with regard to the influence of house price fluctuations. As for Spain, a fall in government revenue is typically associated with a negative performance of the housing market, but the same kind of link does not emerge for positive developments. Moreover, government spending does not seem to adjust to the dynamics of financial markets when it is already increasing above a threshold level.

Additionally, the magnitude of the contribution of housing prices to changes in government revenue appears to have dominated that of stock prices in France and the UK. With regard to government spending, changes in this policy instrument are correlated with changes in asset prices and the effect depends on the size of the price variation and the influence of the output cycle.

From a policy perspective, our work highlights that fiscal policy can play an important stabilizing role at times of financial distress. Castro and Sousa (2012) suggest that the conduct of monetary policy based on a single policy instrument may cause disruptions in asset markets, because of the different nature of the response of housing and financial markets. Agnello *et al.* (2012a) also find that an optimal monetary and fiscal policy mix can help boosting an economy hit by severe housing busts. In addition, Agnello *et al.* (2012b) argue that by correcting the revenue side of the fiscal stance for time-varying effects of asset prices, one obtains a more accurate assessment of the fiscal stance and its sustainability. The current paper shows that governments in major European countries can indeed successfully counteract sharp declines in asset markets.

REFERENCES

Agnello, L., V. Castro and R.M. Sousa (2012a), "How Does Fiscal Policy React to Wealth Composition and Asset Prices?", *Journal of Macroeconomics*, Vol. 34, No. 3, pp. 874-90.

Agnello, L., G. Dufrénot and R.M. Sousa (2012b), "Using Time-varying Transition Probabilities in Markov Switching Processes to Adjust US Fiscal Policy for Asset Prices", *Economic Modelling*, forthcoming.

Agnello, L. and C. Nerlich (2012), "On the Severity of Economic Downturns: Lessons from Cross-country Evidence", *Economics Letters*, Vol. 117, No. 1, pp. 149-55.

Agnello, L. and R.M. Sousa (2012), "Fiscal Policy and Asset Prices", *Bulletin of Economic Research*, forthcoming.

Bornhorst, F., G. Dobrescu, A. Fedelino, J. Gottschalk and T. Nakata (2011), *When and How to Adjust Beyond the Business Cycle? A Guide to Structural Fiscal Balances. Technical Notes and Manuals*, International Monetary Fund, April.

Castro, V. (2010), "The Duration of Economic Expansions and Recessions: More than Duration Dependence", *Journal of Macroeconomics*, No. 32, pp. 347-65.

Castro, V. and R.M. Sousa (2012), "How Do Central Banks React to Wealth Composition and Asset Prices?", *Economic Modelling*, Vol. 29, No. 3, pp. 641-53.

Diebold, F., J.H. Lee and G. Weinbach (1994), "Regime Switching with Time-varying Transition Probabilities", in C. Hargreaves (ed.), *Non-stationary Time Series Analysis and Cointegration*, Oxford University Press, Oxford (UK).

Filardo, A.J. and S.F. Gordon (1998), "Business Cycle Durations", *Journal of Econometrics*, Vol. 85, No. 1, pp. 99-123.

Jaeger, A. and L. Schuknecht (2007), "Boom-bust Phases in Asset Prices and Fiscal Policy Behavior", *Emerging Markets Finance and Trade*, Vol. 43, No. 6, pp. 45-66.

Kanda, D. (2010), "Asset Booms and Structural Fiscal Positions: The Case of Ireland", International Monetary Fund, Working Paper, No. 57.

Kiefer, N.M. (1978), "Discrete Parameter Variation: Efficient Estimation of a Switching Regression Model", *Econometrica*, Vol. 46, No. 2, pp. 427-34.

Sousa, R.M. (2010), "Housing Wealth, Financial Wealth, Money Demand and Policy Rule: Evidence from the Euro Area", *The North American Journal of Economics and Finance*, Vol. 21, No. 1, pp. 88-105.

Sousa, R.M. (2012), "Wealth, Asset Portfolio, Money Demand and Policy Rule", *Bulletin of Economic Research*, forthcoming.

Tagkalakis, A. (2011), "Fiscal Policy and Financial Market Movements", *Journal of Banking and Finance*, No. 35, pp. 231-51.

Tujula, M. and G. Wolswijk (2007), "Budget Balances in OECD Countries: What Makes Them Change", *Empirica*, No. 34, pp. 1-14.