How does Fiscal Policy react to Wealth Composition and Asset Prices?

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Outline

1. Motivation
2. Literature
3. Methodology
4. Empirical Results
5. Conclusions
Recent developments in the asset markets have renewed the interest of academics, central bankers and governments on the role that fiscal and/or monetary policy can play to prevent or minimize the (negative) consequences of financial turmoils.
Motivation

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Therefore, understanding the dynamics of financial and housing markets and how economic policies can affect them is of crucial importance.
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- Therefore, understanding the dynamics of financial and housing markets and how economic policies can affect them is of crucial importance.

- Some studies have contributed to the understanding of the relationship between monetary policy, macroeconomic variables and wealth.
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Therefore, **understanding the dynamics of financial and housing markets and how economic policies can affect them** is of crucial importance.

Some studies have contributed to the understanding of the relationship between **monetary policy**, macroeconomic variables and wealth.

However, the **impact** that **fiscal policy** decisions may have on financial and housing wealth has been **neglected**.
Asset markets react to economic developments and policy decisions, and consumers will, therefore, respond to changes in their wealth composition.

Changes in policy measures influence asset values, which, in turn, will affect economic activity ("wealth" channel).
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Some arguments to study the role of the asset markets on the fiscal policy rule:

- increase in housing prices $\Rightarrow$ rise in housing wealth $\Rightarrow$ boost consumption $\Rightarrow$ overheating of the economy $\Rightarrow$ tight fiscal policy (e.g. $\downarrow$ expenditures, $\uparrow$ taxes).
- increase in stock prices $\Rightarrow$ potential bubble $\Rightarrow$ rise in housing wealth $\Rightarrow$ overheating of the economy $\Rightarrow$ fiscal policy measures (e.g. taxation on capital gains).
In this paper we assess the **response of fiscal policy** to developments in asset markets in the US.
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We estimate fiscal policy rules augmented with aggregate wealth, wealth composition (i.e. financial and housing wealth) and asset prices (i.e. stock and housing prices) using:
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- a linear framework based on a fully simultaneous system approach in a Bayesian framework;
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We estimate fiscal policy rules augmented with aggregate wealth, wealth composition (i.e. financial and housing wealth) and asset prices (i.e. stock and housing prices) using:

- a linear framework based on a fully simultaneous system approach in a Bayesian framework;

- and two nonlinear specifications that rely on a smooth transition regression (STR) and on a Markov-switching (MS) model.
Relationship between monetary policy and asset markets

Borio & Lowe (2002); Bordo & Jeanne (2002); Aoki et al. (2004); Blenman (2004); Iacoviello (2005); Driffield et al. (2006); Mallick & Mohsin (2007, 2010); Rafiq & Mallick (2008); Granville & Mallick (2009); Issing (2009); Sousa (2009); Castro & Sousa (2010); Sousa (2010a,b,c); Castro (2011).
Literature

- **Relationship between monetary policy and asset markets**
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- **Relationship between fiscal policy and stock prices**
  - government revenue should be adjusted for the asset price cycle (in addition to the business cycle):
  - fiscal policy may influence stock market returns:
    - Darrat (1988); Tavares & Valkanov (2001); Arin et al. (2009).
Relationship between fiscal policy and housing prices

- changes in fiscal policy increases housing prices variability: Afonso & Sousa (2011a,b); Agnello & Sousa (2010).
- the effect of housing prices on fiscal balances: Tagkalakis (2011).
- do not assess the response of fiscal authorities to developments in housing markets.

Relationship between fiscal policy and wealth

- fiscal policy may accommodate wealth expansion (e.g. by cutting taxes on wealth): Blake et al. (1998); Lossani & Tirelli (1994).
- the existing studies have not focused on the reaction of governments to wealth (only on the reaction of central banks): see Sousa (2010a,b) and Castro & Sousa (2010).
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I. Linear Approach: The Fully Simultaneous System

Structural VAR (S-VAR):

\[ \Gamma(L) X_t = \Gamma_0 X_t + \Gamma_1 X_{t-1} + \ldots = c + \varepsilon_t \tag{1} \]

where the fundamental economic shocks \( \varepsilon_t \sim N(0, \Lambda) \).

The “reduced form”:

\[ \Gamma_0^{-1} \Gamma(L) X_t = B(L) X_t = a + v_t \sim N(0, \Sigma) \tag{2} \]

where \( v_t \sim N(0, \Sigma) \); \( \Sigma = \Gamma_0^{-1} \Lambda (\Gamma_0^{-1})' \); and \( v_t = \Gamma_0^{-1} \varepsilon_t \).
The economy is divided into three sectors:

1. **Financial sector** – reacts contemporaneously to all new information; proxied by the stock price index \( (sp_t) \) and financial wealth \( (fw_t) \).

2. **Public sector** – allows for simultaneous effects and comprises: equations for primary government spending, \( (g_t) \), government revenue, \( (t_t) \), or primary government surplus, \( (gs_t) \), and links them with real GDP, \( (y_t) \), and government debt, \( (b_t) \).

3. **Production sector** – includes real GDP \( (y_t) \), government debt \( (b_t) \), and the housing wealth measure \( (hw_t) \) or the housing price index \( (hp_t) \).

- The variables are not predetermined relative to the fiscal policy shocks but it is assumed that they can influence them contemporaneously.
To estimate the fiscal policy rule, we consider several specifications, by linking the policy instrument:

- primary government spending, $g_t$;
- or the government revenue, $t_t$;
- or the primary government surplus, $gs_t$;

With:

- real GDP ($y_t$),
- government debt ($b_t$),
- aggregate wealth ($w_t$),
- financial wealth ($fw_t$),
- housing wealth ($hw_t$),
- stock prices ($sp_t$),
- housing prices ($hp_t$).

These different policy reactions allow us to understand how the fiscal authority reacts to wealth composition.
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- primary government spending, $g_t$;
- or the government revenue, $t_t$;
- or the primary government surplus, $gs_t$;

With:

- real GDP ($y_t$), government debt ($b_t$), aggregate wealth ($w_t$), financial wealth ($fw_t$), housing wealth ($hw_t$), stock prices ($sp_t$), and housing prices ($hp_t$).
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- primary government spending, $g_t$;
- or the government revenue, $t_t$;
- or the primary government surplus, $g_{st}$;

With:

- real GDP ($y_t$), government debt ($b_t$), aggregate wealth ($w_t$), financial wealth ($fw_t$), housing wealth ($hw_t$), stock prices ($sp_t$), and housing prices ($hp_t$).

These different policy reactions allow us to understand how the fiscal authority reacts to wealth composition.
II. Nonlinear Approach: Smooth Transition Regression

- Consider the possibility that fiscal authorities may respond differently to deviations of wealth variables or output from their targets.

Vitor Castro (Univ. Minho and NIPE)  Fiscal Policy reaction to Wealth and Assets
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- Already applied to study the behaviour of some monetary authorities (Castro & Sousa, 2010; Castro, 2011).
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- Already applied to study the behaviour of some monetary authorities (Castro & Sousa, 2010; Castro, 2011).

- First attempt to control for the presence of nonlinearities in the reaction of fiscal authorities to wealth composition and asset prices.
Standard STR model for a nonlinear monetary rule:

\[ FL_t = \psi' z_t + \omega' z_t G(\eta, c, s_t) + \varepsilon_t, \quad t = 1, \ldots, T \]  

\( FL_t \): fiscal policy instrument \((g_t, t_t, gs_t)\); \( z_t \): vector of \( k \) explanatory variables; \( \psi \) (linear) and \( \omega \) (nonlinear) parameter vectors; \( \eta \) smoothness of regime transition.
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Monotonic transition function (LSTR1):

\[ G(\eta, c, s_t) = \left[ 1 + \exp \left\{ -\eta (s_t - c) \right\} \right]^{-1} \]  

(4)

Point-target? Different reaction when the transition variable \((s_t)\) is above or below the target \((c)\)?
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(4)

Point-target? Different reaction when the transition variable \((s_t)\) is above or below the target \((c)\)?

Non-monotonic transition function (LSTR2):

\[ G(\eta, c, s_t) = \left[ 1 + \exp \left\{ -\eta (s_t - c_1) (s_t - c_2) \right\} \right]^{-1} \]  

(5)

Target-range? Different reaction when \( s_t \) is inside or outside \([c_1, c_2]\)?
III. Nonlinear Approach: Markov-switching

- Alternative approach to capture nonlinear aspects of fiscal policy reaction function:
  - Incorporates less prior information than the STR approach (the choice of a transition variable is sometimes a difficult task).
  - Identifies the timing of significant changes in the behavior of the dependent variable.

\[
\begin{align*}
\psi_t &= \psi_0 z_1 t + \omega(s_t) z_2 t + \sigma(s_t) \varepsilon_t, \\
   &\quad t = 1, \ldots, T.
\end{align*}
\]
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  - Incorporates less prior information than the STR approach (the choice of a transition variable is sometimes a difficult task).
  - Identifies the timing of significant changes in the behavior of the dependent variable.

The Markov-Switching model:

\[ Fl_t = \psi' z_{1t} + \omega(s_t)' z_{2t} + \sigma(s_t) \varepsilon_t, \quad t = 1, \ldots, T. \]  

- \( \psi \) – vector of non-switching parameters;
- \( \omega \) – vector of parameters that varies across different regimes \( s_t \);
- \( \varepsilon_t | s_t \sim N(0, \sigma^2(s_t)) \) – variance of \( \varepsilon_t \) is regime-dependent;
- \( p_{ij} = P \{ s_t = i | s_{t-1} = j \} \) – transition probability from state \( j \) to \( i \).
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Fiscal Policy reaction to Wealth and Assets
Variables in natural logarithms, measured at constant prices; Time-period: 1967:Q2-2008:Q4

Fiscal policy instruments:
- primary government spending, $g_t$;
- government revenue, $t_t$;
- primary government surplus, $g_s t$.

Macroeconomic aggregates:
- real GDP, $y_t$; and government debt, $b_t$.

Variables of interest in the fiscal policy rule:
- aggregate wealth, $w_t$;
- financial wealth, $fw_t$, or the stock price index, $sp_t$;
- housing wealth, $hw_t$, or the housing price index, $hp_t$. 
### Table 1: Linear fiscal rule estimated using a fully simultaneous system of equations.

<table>
<thead>
<tr>
<th>Fiscal instrument</th>
<th>Primary Spending ($g$)</th>
<th>Taxes ($t$)</th>
<th>Primary Surplus ($gs$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>[3.151]</td>
<td>[3.172]</td>
<td>[28.270]</td>
</tr>
<tr>
<td>$y_t$</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td></td>
<td>[7.871]</td>
<td>[8.094]</td>
<td>[25.013]</td>
</tr>
<tr>
<td>$w_t$</td>
<td>-7.618</td>
<td>-27.659</td>
<td>-22.994</td>
</tr>
<tr>
<td></td>
<td>[5.468]</td>
<td>[7.463]</td>
<td>[8.467]</td>
</tr>
<tr>
<td>$fw_t$</td>
<td>-3.900</td>
<td>-33.115</td>
<td>-32.172</td>
</tr>
<tr>
<td></td>
<td>[4.173]</td>
<td>[6.488]</td>
<td>[6.717]</td>
</tr>
<tr>
<td>$hw_t$</td>
<td>-5.911</td>
<td>9.707</td>
<td>11.786</td>
</tr>
<tr>
<td></td>
<td>[3.902]</td>
<td>[4.127]</td>
<td>[3.794]</td>
</tr>
<tr>
<td>$sp_t$</td>
<td>7.931</td>
<td>0.615</td>
<td>-10.577</td>
</tr>
<tr>
<td></td>
<td>[6.306]</td>
<td>[2.418]</td>
<td>[2.107]</td>
</tr>
<tr>
<td>$hp_t$</td>
<td>-4.578</td>
<td>-9.187</td>
<td>3.514</td>
</tr>
<tr>
<td></td>
<td>[7.059]</td>
<td>[5.616]</td>
<td>[6.071]</td>
</tr>
</tbody>
</table>

Note: Coefficient estimates computed using a Monte Carlo Importance Sampling algorithm. Asymptotic standard errors are in square brackets.
Linear Evidence (SVAR model):

- When the **output** rises, taxes and primary surplus increase; primary spending does not react to the economic activity.
- When government **debt** grows, primary spending increases and primary surplus (and taxes) decrease.
- **Aggregate wealth** cause a negative reaction on taxes and primary surplus (the reaction of primary spending is small).
- **Wealth composition and Asset prices:**
  - **financial wealth** is the variable that exerts the strongest negative impact on taxes and primary surplus, however
  - a rise in **housing wealth** has a positive impact on them.
  - an increase in **stock prices** induces a fall in the primary surplus and a rise in government spending (small response of taxes);
  - a rise in **housing prices** generates a negative response of primary spending and taxes (primary surplus: small response).
Table 2: Nonlinear fiscal rule estimated using a smooth transition regression model.

<table>
<thead>
<tr>
<th>Part</th>
<th>Primary Spending ($g$)</th>
<th>Primary Surplus ($gs$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear ($\psi$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$y_t$</td>
<td>$-0.088$</td>
<td>$-0.004$</td>
</tr>
<tr>
<td></td>
<td>[0.203]</td>
<td>[0.197]</td>
</tr>
<tr>
<td>$b_t$</td>
<td>$0.257^{***}$</td>
<td>$0.211^{**}$</td>
</tr>
<tr>
<td></td>
<td>[0.089]</td>
<td>[0.092]</td>
</tr>
<tr>
<td>Nonlinear ($\omega$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$w_t$</td>
<td>$-0.412^{****}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.127]</td>
<td></td>
</tr>
<tr>
<td>$fw_t$</td>
<td></td>
<td>$-0.063$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.637]</td>
</tr>
<tr>
<td>$hw_t$</td>
<td></td>
<td>$-0.422^{***}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.161]</td>
</tr>
<tr>
<td>$sp_t$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$hp_t$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\eta$</td>
<td>6.82</td>
<td>7.93</td>
</tr>
<tr>
<td>$c$</td>
<td>$0.014^{***}$</td>
<td>$0.032$</td>
</tr>
<tr>
<td></td>
<td>[0.003]</td>
<td>[0.053]</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.153</td>
<td>0.165</td>
</tr>
<tr>
<td>$H_01$</td>
<td>0.007</td>
<td>0.013</td>
</tr>
<tr>
<td>$H_02$</td>
<td>0.048</td>
<td>0.006</td>
</tr>
<tr>
<td>$H_03$</td>
<td>0.774</td>
<td>0.085</td>
</tr>
<tr>
<td>$H_04$</td>
<td>0.371</td>
<td>0.598</td>
</tr>
<tr>
<td>Model</td>
<td>LSTR1</td>
<td>LSTR1</td>
</tr>
<tr>
<td>$z_t = w_t$</td>
<td>$fw_t$</td>
<td>$sp_t$</td>
</tr>
</tbody>
</table>

Notes: * statistically significant at 10% level; ** at 5% level; *** at 1% level. All variables are in log differences. Standard errors are in square brackets. Adj. $R^2$ is the adjusted $R^2$ and SBIC is the Schwarz Bayesian Information Criterion. $H_{01}$ reports the $p$-value of the linearity test. $H_{02}$ to $H_{04}$ report the $p$-value of the tests used to choose the preferred model.
Nonlinear Evidence (STR model)

- Presence of nonlinearities when the fiscal policy instruments are the primary spending and the primary surplus.

- LSTR1 model fits better: fiscal authority is more concerned in pursuing a point target than a target range for the respective transition variable.

- Fiscal policy tends to react differently when the transition variable is above or below a certain threshold.

- Results confirm that **output** has no significant effect on primary spending, but primary surplus is still reacting positively.

- An increase in **debt** leads to a rise in primary spending and to a decrease in government surplus.
Nonlinear Evidence (STR model)

- **Aggregate wealth:**
  - primary spending starts to react negatively to aggregate wealth only when it grows substantially above 1.4%;
  - primary surplus reacts positively to wealth only when the growth rate of wealth is above 1.5%.

- **Wealth composition:**
  - primary spending decreases when housing wealth rises but it does not respond to financial wealth;
  - primary surplus rises when housing wealth increases (financial wealth grows above 3.2%).

- **Asset prices:**
  - primary spending decreases when stock prices grow above 9.8% but do not respond to housing prices;
  - primary surplus rises when stock prices grow above 9.7% but do not respond to housing prices.
Nonlinear Evidence (MS model)

Table 3. Nonlinear fiscal rule estimated using a Markov-switching approach.

<table>
<thead>
<tr>
<th>Part</th>
<th>Linear ($\psi$)</th>
<th>Nonlinear ($\omega$)</th>
<th>Regime 1</th>
<th>Regime 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Spending ($g$)</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>$g_t$</td>
<td>$-0.390^{***}$</td>
<td>$-0.233^{***}$</td>
<td>$-0.262^{***}$</td>
<td>$1.157^{***}$</td>
</tr>
<tr>
<td></td>
<td>$[-2.506]$</td>
<td>$[-2.158]$</td>
<td>$[-2.391]$</td>
<td>$[7.953]$</td>
</tr>
<tr>
<td>$b_t$</td>
<td>$0.231^{***}$</td>
<td>$0.253^{***}$</td>
<td>$0.265^{***}$</td>
<td>$-0.083^{***}$</td>
</tr>
<tr>
<td>$\sigma_1$</td>
<td>$0.508^{***}$</td>
<td>$0.508^{***}$</td>
<td>$0.508^{***}$</td>
<td>$0.508^{***}$</td>
</tr>
<tr>
<td>$\sigma_2$</td>
<td>$0.342^{***}$</td>
<td>$0.342^{***}$</td>
<td>$0.342^{***}$</td>
<td>$0.342^{***}$</td>
</tr>
<tr>
<td>$\pi_t$</td>
<td>$0.095^{***}$</td>
<td>$0.095^{***}$</td>
<td>$0.095^{***}$</td>
<td>$0.095^{***}$</td>
</tr>
<tr>
<td>$\Pi_t$</td>
<td>$0.105^{**}$</td>
<td>$0.105^{**}$</td>
<td>$0.105^{**}$</td>
<td>$0.105^{**}$</td>
</tr>
<tr>
<td>LR-Stat.</td>
<td>$33.981$</td>
<td>$37.813$</td>
<td>$35.252$</td>
<td>$37.522$</td>
</tr>
</tbody>
</table>

Notes: * = statistically significant at 10% level; ** = at 5% level; *** = at 1% level. t-values are in square brackets. LR statistics test the null hypothesis of linear versus a non-linear model and are constructed as $2(ln L^* - ln L)$, where $L^*$ and $L$ represent the unrestricted and the constrained maximum likelihood respectively. These tests are distributed as $\chi^2(r)$, where $r$ is the number of restrictions imposed.

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Nonlinear Evidence (MS model)

- Primary spending, taxes and primary surplus react to output and debt as in the linear and STR models.
- The response of both primary spending, taxes and primary surplus to aggregate wealth, wealth composition and asset prices is strongly nonlinear.
  - the three fiscal indicators react positively to aggregate wealth in reg.1, but the impact is mitigated in reg.2;
  - taxes and primary surplus (primary spending) rises when financial wealth (housing wealth) increases (in reg.1), while primary spending reacts negatively to financial wealth in reg.2;
  - only primary spending reacts positively to asset prices in reg.1, while it starts to react negatively to stock prices in reg.2;
  - taxes and primary surplus only start to react (positively) to asset prices in reg.2.
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The linear framework suggests that:

- primary spending does not react to wealth composition or asset prices;
- taxes and primary surplus are cut when financial wealth or stock prices rise, and raised when housing wealth or housing prices increase;
- the negative relationship between taxation and wealth is consistent with the literature supporting the view that fiscal policy rules can be designed to steer national wealth to its target value (Blake et al., 1998; Lossani & Tirelli, 1994).
The **smooth transition regression** model shows that:

- primary spending and fiscal balance are adjusted in a nonlinear fashion to both wealth and price effects;

- fiscal policy is tightened when:
  - the growth rate of aggregate wealth is above the threshold of 1.4%;
  - stock prices rise well above 9.8%;
  - and when there is accumulation of financial wealth, in which case, fiscal policy counterbalances the dynamics of housing wealth.
The *Markov-switching* model highlights:

- the evidence of nonlinearities in the fiscal reaction to wealth and asset prices;
- the importance of tax cuts to offset the decline in wealth during major recessions and financial crises;
- that, in a context of economic distress, fiscal policy becomes expansionary, hence, offsetting the decline in wealth.
Overall, our results provide evidence of a non-stabilizing effect of government debt, a countercyclical policy and a vigilant track of wealth developments by fiscal authorities.
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By tracking the dynamics of wealth and asset prices, governments can counteract any potential mispricing or deviation from fundamentals in financial and housing markets.
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By tracking the dynamics of wealth and asset prices, governments can counteract any potential mispricing or deviation from fundamentals in financial and housing markets.

Fiscal policy can complement the task of central banks during periods of severe financial turmoils: a selective choice of monetary and fiscal policy instruments can be successful at boosting the economy and stabilizing financial and housing markets.
THE END
Comments are Welcome
Thank you!