BBVA | Research

Financial and fiscal shocks in the Great Recession and recovery of the Spanish economy

J. E. Boscá, R. Doménech, J. Ferri, R. Méndez and J. Rubio

Annual Meeting of the European Economic Association
Cologne, August, 28, 2018

Introduction

- The recession that began in 2008 has had its own characteristics but has also been similar to other previous financial, real estate and sovereign debt crisis
- Nevertheless, the intensity, duration and combination of different shocks forces us to revise our analysis tools to evaluate the relevance of the different potential drivers behind the crisis
- Here we extend a previous DGE model for Spain (Boscá et al, 2010) with a financial sector
- The estimation of financial, fiscal, external and other macroeconomic shocks is potentially a very useful analytical tool that improves our understanding of the Spanish economy from a macroeconomic perspective

Introduction

- In this paper we develop and estimate a new Bayesian DSGE model for the Spanish economy (EREMS2) that has been designed to evaluate different structural reforms and evaluate the contribution of different shocks
- EREMS2 aims the estimation, simulation and evaluation of macroeconomic policies in Spain as similar models (QUEST, IMF, ECB, Fed, ...) at the research frontier
- EREMS2 complements the macroeconomic analysis of the Spanish economy: REMS (Boscá, Domenech, Ferri and Varela, 2011), Andrés, Hurtado, Ortega and Thomas (2010), MEDEA (Burriel, Fernandez-Villaverde and Rubio, 2007) and Gómez-González and Rees (2018)
- It is a dynamic stochastic general equilibrium model of an open economy intermediate size in a monetary union, which takes into account the interaction between financial and real variables at the aggregate level

Introduction

- Core model
  - general equilibrium model for the eurozone with a banking system (Gerali, Neri, Sessa and Signoretti, 2010)
  - public sector extension (Doménech, García, Méndez and Rubio-Ramírez, 2013)
- This core model has been extended and modified in three major directions:
  - small open economy in a monetary union. Home country is small relative to the rest of the world (see Monacelli, 2004, and Galí and Monacelli, 2005)
  - different nominal, real and financial frictions, and wages and price rigidities in non-competitive labor and product markets
  - the model is estimated using data for the Spanish economy from 1992 to 2017
- More details about the model and its calibration and estimation are available in Boscá, Doménech, Ferrí, Méndez and Rubio (2018)

Introduction: main results

- Our results show that the GDP growth observed during the pre-crisis times was due to the combination of internal and external demand shocks fuelled by favorable credit shocks, whereas supply shocks contributed negatively to the pre-crisis GDP per capita growth (falling labor productivity)
- After 2008 we identify a financial and exports crisis, partly offset by an expansionary monetary and fiscal policy shocks. Additionally, negative supply shocks made the recession worse
- The sovereign debt crisis implied higher financial tensions and a significant fiscal adjustment due to the unsustainability of public finances. Credit shocks made the situation worse. Supply and export shocks positively contribute to GDP growth during this period
- The recovery after 2013 shows a positive contribution of fiscal, banks' and supply shocks, despite some less favorable external trade conditions and the still negative contribution of the intense deleveraging process

The model

- The model represents a small open economy (Spain) that belongs to a trade and monetary union (EMU)
- The economy trades with the rest of the world consumption and investment goods as well as international nominal bonds
- Four types of households: patient, impatient, hand-to-mouth and entrepreneurs:
  - The patient (impatient) households consume, save (borrow), supply labor, and accumulate housing services.
  - The hand-to-mouth households consume, supply labor and have no access to deposits or loans.
  - Households' labour is sold by labor unions to intermediate good producers
  - Entrepreneurs purchase capital and rent it to intermediate good producers, consume and borrow

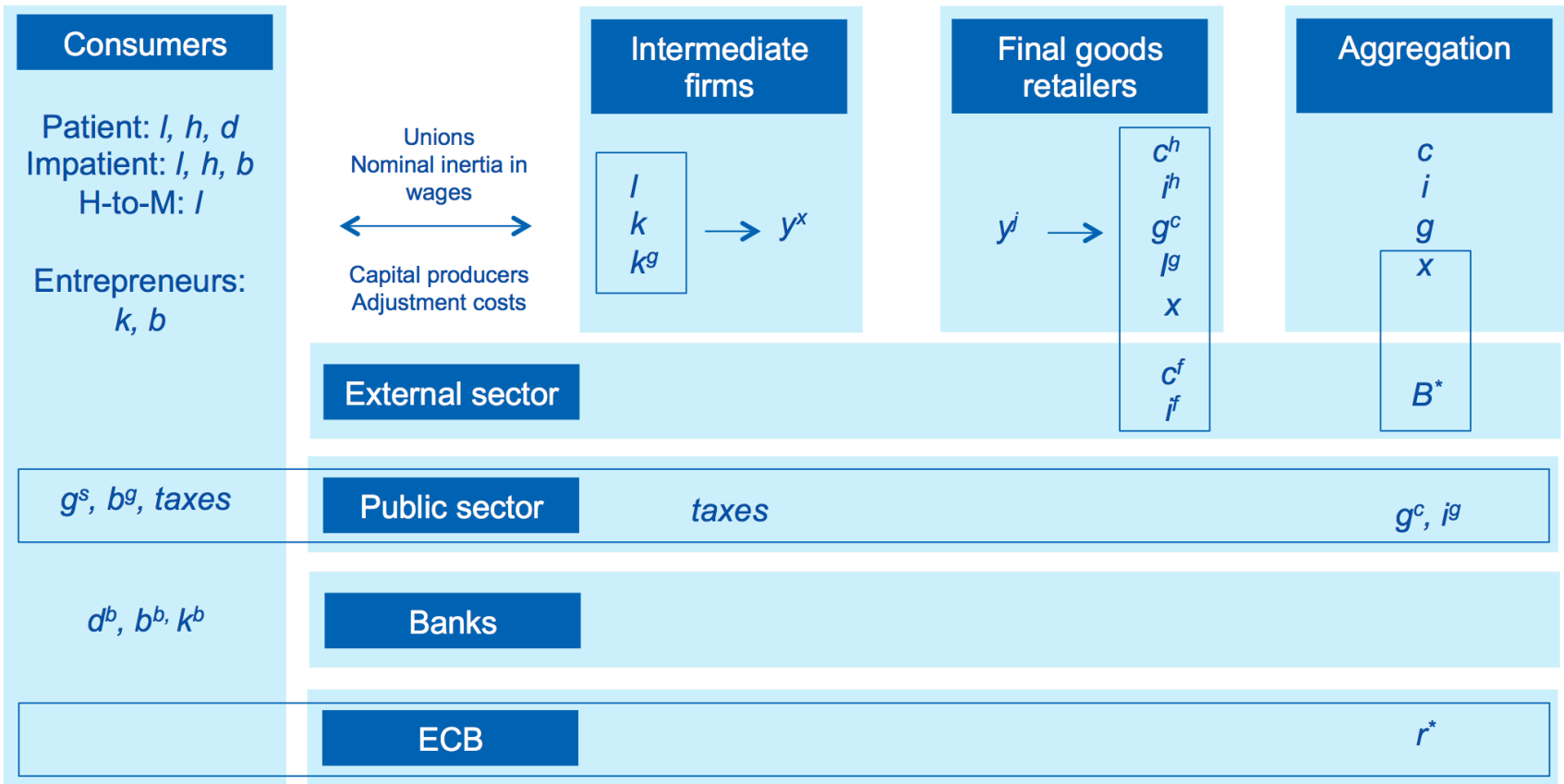
The model

- Intermediate good producers hire labor and rent capital from entrepreneurs to produce intermediate goods that are sold to good retailers in competitive markets
- Retailers buy intermediate goods and sell monopolistically final goods to consumers and capital producers
- Banks form holding units composed by a wholesale bank, a loan-retailing bank, and a deposit-retailing bank
- Patient households deposit their savings on deposit-retailing banks
- Impatient households and entrepreneurs take loans on loan-retailing banks
- Deposit-retailing and loan-retailing banks operates in monopolistically competitive markets

The model

- To ensure stationarity of equilibrium, banks pay a risk-premium that increases with the country's net foreign asset position, as in Schmitt-Grohe and Uribe (2003)
- Fiscal authority provides public consumption goods, invests, borrows, and sets lump-sum transfers and distortionary taxes on consumption, housing services, labor earnings, capital earnings, and financial operations (bond and deposit changes).
- Fiscal authority reacts by rising lump-sum taxes to deviations of the ratio of debt over GDP with respect to its objective.
- A supra-national monetary authority (ECB) sets the interest rate using a Taylor rule.

The model



Model structure

Patient households

- Maximize utility

$$E_0 \sum_{t=0}^{+\infty} \beta_p^t \left[(1 - a_{cp}) \varepsilon_t^z log(c_{j,t}^p - a_{cp} c_{t-1}^p) + a_{hp} \varepsilon_t^h log(h_{j,t}^p) - \frac{a_{\ell p} \ell_{j,t}^{p\,1+\phi}}{1+\phi} \right],$$

subject to the following budget constraint:

$$\begin{aligned}
&(1+\tau_t^c) c_{j,t}^p + (1+\tau_t^h) q_t^h \Delta h_{j,t}^p + (1+\tau_t^d) d_{j,t}^p \\
&+ \frac{\alpha_{RW}(1-\alpha_{Bg}) Bg_t}{\gamma_p} - \frac{(1-\alpha_{ED}) ED_t}{\gamma_p} = \\
&(1-\tau_t^w) w_{j,t}^p \ell_{j,t}^p + \left[\frac{1+(1-\tau_t^d) r_{t-1}^d}{\pi_t} + \tau_t^d \right] d_{j,t-1}^p + \frac{(1-\omega_b) J_{t-1}^b}{\gamma_p} - \frac{T_t^{up}}{\gamma_p} - \frac{T_t^g}{\gamma_p + \gamma_i + \gamma_e + \gamma_m} \\
&+ \frac{\alpha_{RW}(1-\alpha_{Bg})(1+rd_t) Bg_{t-1}}{\gamma_p} - \frac{(1-\alpha_{ED})(1+rd_t) ED_{t-1}}{\gamma_p}
\end{aligned}$$

Impatient households

- They have debts instead of wealth, and maximize utility

$$E_0 \sum_{t=0}^{+\infty} \beta_i^t \left[(1 - a_{ci}) \varepsilon_t^z log(c_{j,t}^i - a_{ci} c_{t-1}^i) + a_{hi} \varepsilon_t^h log(h_{j,t}^i) - \frac{a_{\ell i} \ell_{j,t}^{i\,1+\phi}}{1+\phi} \right]$$

subject to:

$$(1+\tau_t^c) c_{j,t}^i + (1+\tau_t^h) q_t^h \Delta h_{j,t}^i + \left(\frac{1+r_{t-1}^{bi}}{\pi_t} - \tau_t^b \right) b_{j,t-1}^i =$$
$$(1-\tau_t^w) w_{j,t}^i \ell_{j,t}^i + (1-\tau_t^b) b_{j,t}^i - \frac{T_t^{ui}}{\gamma_i} - \frac{T_t^g}{\gamma_p+\gamma_i+\gamma_e+\gamma_m}$$

$$(1+r_t^{bi}) b_{j,t}^i \leq m_t^i E_t \left\{ q_{t+1}^h h_{j,t}^i \pi_{t+1} \right\},$$

Hand-to-mouth households

- They have neither debt nor wealth, and maximize utility

$$E_0 \sum_{t=0}^{+\infty} \beta_m^t \left[(1 - a_{cm}) \varepsilon_t^z log(c_{j,t}^m - a_{cm} c_{t-1}^m) - \frac{a_{\ell m} \ell_{j,t}^{m\,1+\phi}}{1+\phi} \right].$$

subject to

$$(1 + \tau_t^c) c_{j,t}^m = (1 - \tau_t^w) w_{j,t}^m \ell_{j,t}^m - \frac{T_t^{um}}{\gamma_m} - \frac{T_t^g}{\gamma_p + \gamma_i + \gamma_e + \gamma_m}$$

Entrepreneurs

- Maximize the following lifetime utility function

$$E_0 \sum_{t=0}^{+\infty} \beta_e^t (1 - a_e) log(c_{j,t}^e - a_e c_{t-1}^e).$$

subject to

$$(1 + \tau_t^c) c_{j,t}^e + \left(\frac{1 + r_{t-1}^{be}}{\pi_t} - \tau_t^b \right) b_{j,t-1}^e + q_t^k k_{j,t}^e =$$
$$(1 - \tau_t^k) r_t^k k_{j,t}^e + q_t^k (1 - \delta) k_{j,t-1}^e + (1 - \tau_t^b) b_{j,t}^e + \frac{J_t^x}{\gamma_e} + \frac{J_t^k}{\gamma_e} - \frac{T_t^g}{\gamma_p + \gamma_i + \gamma_e + \gamma_m}$$

$$(1 + r_t^{be}) b_{j,t}^e \leq m_t^e E_t \left\{ q_{t+1}^k \pi_{t+1} (1 - \delta) k_{j,t}^e \right\},$$

Unions

- Unions maximize the households' utility perceived from the wage income, net of a quadratic cost for adjusting the nominal wage and the labour supply desutility:

$$E_0 \sum_{t=0}^{+\infty} \beta_s^t \left\{ U_{c,j,t}^s \theta_t^{wc} \left[w_{j,t}^s \ell_{j,t}^s - \frac{\eta_w}{2} \left(\pi_{j,t}^{ws} \theta_t^w - \pi_{t-1}^{\iota_w} \pi^{1-\iota_w} \theta_{t-1}^c \right)^2 w_t^s \right] - \frac{a_{\ell s} {\ell_{j,t}^s}^{1+\phi}}{1+\phi} \right\}$$

subject to

$$\ell_{j,t}^s = \left(\frac{w_{j,t}^s}{w_t^s} \right)^{-\varepsilon_t^\ell} \ell_t^s$$

Intermediate good producers

- Production function

$$y^x_{j,t} = A_t \left(k^{ee}_{j,t-1} u_{j,t} \right)^{\alpha} \left[\left(\ell^{pp}_{j,t} \right)^{\mu_p} \left(\ell^{ii}_{j,t} \right)^{\mu_i} \left(\ell^{mm}_{j,t} \right)^{\mu_m} \right]^{1-\alpha} \left(\frac{K^g_{t-1}}{\gamma_x} \right)^{\alpha_g},$$

  where A_t denotes an aggregate TFP productivity shock.

Capital producers

- Each capital producer chooses $k_{j,t}$ and $i_{j,t}$ to maximize:

$$E_0 \sum_{t=0}^{+\infty} \beta_e^t \lambda_t^e \left\{ q_t^k [k_{j,t} - (1-\delta) k_{j,t-1}] - p_t^I i_{j,t} - \Phi_k \right\}$$

  subject to quadratic adjustment costs in investment (as Bernanke, Gertler and Gilchrist, 1999).

Home goods retailers

- They operate in a monopolistically competitive market and maximize:

$$E_0 \sum_{t=0}^{+\infty} \beta_p^t \lambda_{j,t}^p \left[p_t^H \frac{P_{j,t}^H y_{j,t}}{P_t^H} - \frac{y_{j,t}^{xx}}{x_t} - \frac{\eta_p}{2} \left(\frac{P_{j,t}^H}{P_{j,t-1}^H} - \left(\pi_{t-1}^H\right)^{\iota_p} \left(\pi_{ss}^H\right)^{1-\iota_p} \right)^2 y_t \right]$$

subject to

$$y_{j,t} = y_{j,t}^{xx}$$

$$y_{j,t} = \left(\frac{P_{j,t}^H}{P_t^H} \right)^{-\varepsilon_t^y} Y_t$$

Banks

- Each bank branch is composed of three units: a wholesale unit and two retail branches.
- The two retail branches are assumed to operate in monopolistically competitive markets.
- Each unit of deposits and loan bought by households and entrepreneurs are a CES basket of slightly differentiated products supplied by each retail branch j.
- The wholesale unit manages the capital position of the bank, receives loans from abroad, and raises wholesale domestic loans and deposits. The loan-retailing unit also gives loans to the government in a competitive market.

Whosale banks

- They choose the amount of wholesale loans, $b^b_{j,t}$, wholesale deposits, $d^b_{j,t}$ and foreign borrowing to maximize

$$\max_{b^b_{j,t}, d^b_{j,t}, B^*_t} r^b_t b^b_{j,t} - r_t d^b_{j,t} + r^*_t \frac{B^*_t}{\gamma_b} - \frac{\eta_b}{2}\left(\frac{k^b_{j,t}}{b^b_{j,t}} - \nu_b\right)^2 k^b_{j,t}$$

where

$$k^b_{j,t} = \frac{(1-\delta_b)}{\varepsilon^{kb}_t} k^b_{j,t-1} + \omega_b J^b_{j,t-1},$$

The balance sheet of the wholesale banks is:

$$b^b_{j,t} = d^b_{j,t} - \frac{B^*_{j,t}}{\gamma_b} + k^b_{j,t}.$$

Deposit-retailing branch

- It chooses the path of the nominal gross interest rate paid by deposits, $r^d_{j,t}$, to maximize:

$$E_0 \sum_{t=0}^{+\infty} \beta_p^t \lambda_t^p \left[r_t d^b_{j,t} - r^d_{j,t} d^{pp}_{j,t} - \frac{\eta_p}{2} \left(\frac{r^d_{j,t}}{r^d_{j,t-1}} - 1 \right)^2 r^d_t d^{pp}_t \right]$$

subject to

$$d^b_{j,t} = d^{pp}_{j,t}$$

$$d^{pp}_{j,t} = \left(\frac{r^d_{j,t}}{r^d_t} \right)^{-\varepsilon^d_t} d^{pp}_t,$$

where $\varepsilon^d_t \equiv \left(\frac{\theta^d_t}{\theta^d_t - 1} \right)$

Loan-retailing branch

- The branch chooses $r^{bi}_{j,t}$ and $r^{be}_{j,t}$ to maximize:

$$E_0 \sum_{t=0}^{+\infty} \beta_p^t \lambda_t^p \left[\begin{array}{c} r^{bi}_{j,t} b^{ii}_{j,t} + r^{be}_{j,t} b^{ee}_{j,t} + \theta^g_{ss} r^b_t \left(\frac{B^g_t}{\gamma_b} \right) - r^b_t b^b_{j,t} - \frac{\eta_i}{2} \left(\frac{r^{bi}_{j,t}}{r^{bi}_{j,t-1}} - 1 \right)^2 r^{bi}_t b^{ii}_t \\ - \frac{\eta_e}{2} \left(\frac{r^{be}_{j,t}}{r^{be}_{j,t-1}} - 1 \right)^2 r^{be}_t b^{ee}_t \end{array} \right]$$

subject to

$$b^b_{j,t} = b^{ii}_{j,t} + b^{ee}_{j,t} + \frac{B^g_t}{\gamma_b},$$

$$b^{ii}_{j,t} = \left(\frac{r^{bi}_{j,t}}{r^{bi}_t} \right)^{-\varepsilon^{bi}_t} b^{ii}_t,$$

$$b^{ee}_{j,t} = \left(\frac{r^{be}_{j,t}}{r^{be}_t} \right)^{-\varepsilon^{be}_t} b^{ee}_t.$$

where $\varepsilon^{bs}_t \equiv \left(\frac{\theta^{bs}_t}{\theta^{bs}_t - 1} \right)$

External sector

- Imports:

$$c_t^h = (1-\omega_c)\left(p_t^H\right)^{-\sigma_c} c_t^c$$

$$c_t^f = \omega_c\left(p_t^M\right)^{-\sigma_c} c_t^c$$

$$i_t^h = (1-\omega_i)\left(\frac{p_t^H}{p_t^I}\right)^{-\sigma_i} i_t^z$$

$$i_t^f = \omega_i\left(\frac{p_t^M}{p_t^I}\right)^{-\sigma_i} i_t^z$$

External sector

- Exports demand

$$ex_t = \omega_c^* \left((1 - \tau_t^x) \left(\frac{p_t^H}{er_t} \right)^{(1-ptm)} \right)^{-\sigma_c^*} (c_t^* + i_t^*)$$

With full pricing to market ($ptm = 0$), $p_t^{EX} = (1 - \tau_t^x) p_t^H$ then

$$ex_t = \omega_c^* \left((1 - \tau_t^x) \left(\frac{p_t^H}{er_t} \right) \right)^{-\sigma_c^*} (c_t^* + i_t^*)$$

If the law of one price holds then $ptm = 1$, $p_t^{EX} = (1 - \tau_t^x) er_t$ and

$$ex_t = \omega_c^* (1 - \tau_t^x)^{-\sigma_c^*} (c_t^* + i_t^*)$$

External sector

- Net foreing asset position B_t^*

$$B_t^* = \frac{\left(1 + r_{t-1}^*\right)}{\pi_t} B_{t-1}^* + \left[p_t^{EX} \gamma^* ex_t - p_t^M \left(\gamma_c c_t^f + \gamma_z i_t^f \right) \right]$$

- Trade balance TB_t is defined as

$$TB_t = p_t^{EX} \gamma^* ex_t - p_t^M \left(\gamma_c c_t^f + \gamma_z i_t^f \right)$$

Monetary policy

- Taylor rule for the BCE

$$(1+r_t^*) = (1+r_{ss}^*)^{(1-\phi_r)}(1+r_{t-1}^*)^{\phi_r}\left(\frac{\pi_t^{emu}}{\pi_{ss}^{emu}}\right)^{\phi_\pi(1-\phi_r)}\left(\frac{y_t^{emu}}{y_{t-1}^{emu}}\right)^{\phi_y(1-\phi_r)}(1+e_t^r)$$

- Domestic interest rate

$$r_t = \phi_r r_t^*$$

where

$$\phi_t = \exp\left(-\widetilde{\phi}\left(\frac{B_t^*}{Y_t} - b^*\right)\theta_t^{rp}\right)$$

Fiscal policy rules

- Budget constraint

$$
\begin{aligned}
& C_t^g + I_t^g + \left(\frac{1+\theta_{ss}^b r_{t-1}^b}{\pi_t}\right) B_{t-1}^g = B_t^g + T_t^g + \tau_t^c \left[\gamma_p c_t^p + \gamma_i c_t^i + \gamma_e c_t^e + \gamma_m c_t^m\right] \\
+ \quad & \frac{\tau_t^m}{1+\tau_t^m} p_t^M IM_t - \frac{\tau_t^x}{1-\tau_t^x} p_t^{EX} EX_t \\
+ \quad & \tau_t^h q_t^h \left[\gamma_p \Delta h_t^p + \gamma_i \Delta h_t^i\right] + \tau_t^w \left[w_t^p \gamma_p \ell_t^p + w_t^i \gamma_i \ell_t^i + w_t^m \gamma_m \ell_t^m\right] + \tau_t^k r_t^k K_t \\
+ \quad & \tau_t^{fb} \left[\gamma_i \Delta b_t^i + \gamma_e \Delta b_t^e\right] + \tau_t^{fd} \gamma_p \Delta d_t^p + \tau_t^d \left(\frac{r_{t-1}^d}{\pi_t}\right) \gamma_p d_{t-1}^p.
\end{aligned}
$$

- Tax rates $\tau_t^s = \tau_s$ for $s = c, h, w, d, fd, fb, r, m, x$, and shocks in c^g and i^g
- Fiscal rule in lump-sum transfers

$$
\frac{T_t^g}{\gamma y_{ss}} = \frac{T_{t-1}^g}{\gamma y_{ss}} + \rho_{tgb1}\left(\frac{B_t^g}{\gamma y_t} - \frac{B^{*g}}{\gamma y_t}\right) + \rho_{tgb2}\left(\frac{B_t^g}{\gamma y_t} - \frac{B_{t-1}^g}{\gamma y_t}\right)
$$

- Public capital

$$
K_t^g = (1-\delta_g) K_{t-1}^g + I_t^g.
$$

Calibration

- General strategy: Gerali et.al's calibration structural parameters related to technology and preferences adapted to the Spanish economy
- Consumer shares $\gamma_p = 0.35, \gamma_i = 0.20, \gamma_m = 0.17, \gamma_e = 0.28$.
- Share of private physical capital in the production function: 0.426 (closer to Ratto et.al., 2009, than to Gerali et.al, 2010)
- Output elasticity of public physical capital and its depreciation rate taken from Boscá et al, 2010
- The tax rates on financial transactions (τ_{fb}, τ_{fd}) and on deposits' interest yield (τ_d) are fixed in zero
- Rest of taxes corresponds to the average effective rates, as in Mendoza et al (1994), using information of “Taxation trends in the European Union".
- Other parameters taken from Boscá et al, 2010.

Calibration

Steady state ratios

	Data	Model
$\frac{C}{GDP}$	0.58	0.58
$\frac{I}{GDP}$	0.23	0.20
$\frac{C^g}{GDP}$	0.18	0.18
$\frac{I^g}{GDP}$	0.03	0.04
$\frac{c^h}{GDP}$	0.41	0.42
$\frac{c^f}{GDP}$	0.21	0.16
$\frac{i^h}{GDP}$	0.12	0.10
$\frac{i^f}{GDP}$	0.09	0.11
$\frac{EX}{GDP}$	0.25	0.27
$\frac{IM}{GDP}$	0.27	0.27

Estimation

- We estimate all the parameters related to the 18 structural shocks, plus price and wage adjustment costs and indexation parameters
- Quarterly data from 1992Q4 to 2017Q4
- We estimate a first-order approximation around the steady-state to the solution of the model taking as observables the demeaned interannual change (interest rates) or rate of growth (rest of variables)
- Our priors and posteriors are shown in Table 8 and Table 9, using 500,000 draws from the posterior. We start with a very diffuse set of priors, as in Gerali et al. (2010) and Justiniano et al. (2010)
- The dynamics of the variables and their long-term steady states are well approximated by the model
- The model allows us to analyse many aspects of the Spanish economy as the dynamics of total factor productivity, hours worked, inflation, real wages, financial and fiscal variables, etc.

Shocks and observables

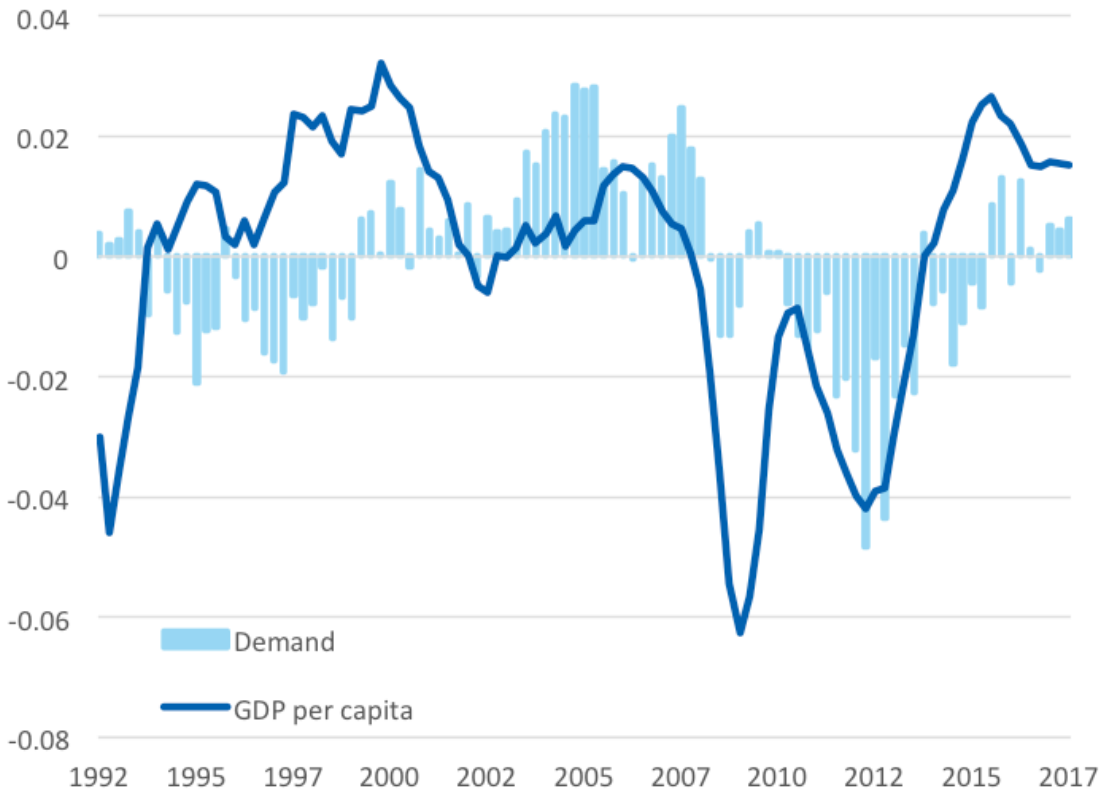
Shocks		Observables	
eA	TFP shock	C	Private consumptiom
eh	Housing preferences	Cg	Public consumption
el	Labour shock	Ig	Public Investment
eme	LTV firms	If	Private Investment
emi	LTV households	D	Deposits
ethetab	Banks' markup loans firms	bi	Loans households
ethetabi	Banks' markup loans households	be	Loans firms
ethetabd	Banks' markup deposits	r	Policy interest rate
er	Monetary policy	rd	Interest rates for deposits
ek	Investment shock	rbe	Interest rates for firms loans
ey	Markup retailers	rbi	Interest rates for households loans
ez	Consumption preferences	pi	Inflation (private consumption)
ewc	Imports	piw	Inflation (wages)
ewfc	Exports	qh	Housing price index (relative to private consumption deflator)
ep	Risk premium	IM	Imports
ecg	Public consumption shock	EX	Exports
eig	Public investment shock	Premium	Risk premium
eb	Banks' capital ratio/efficiency	kb	Banks' capital

Shocks and observables

TABLE 10: Group of Shocks

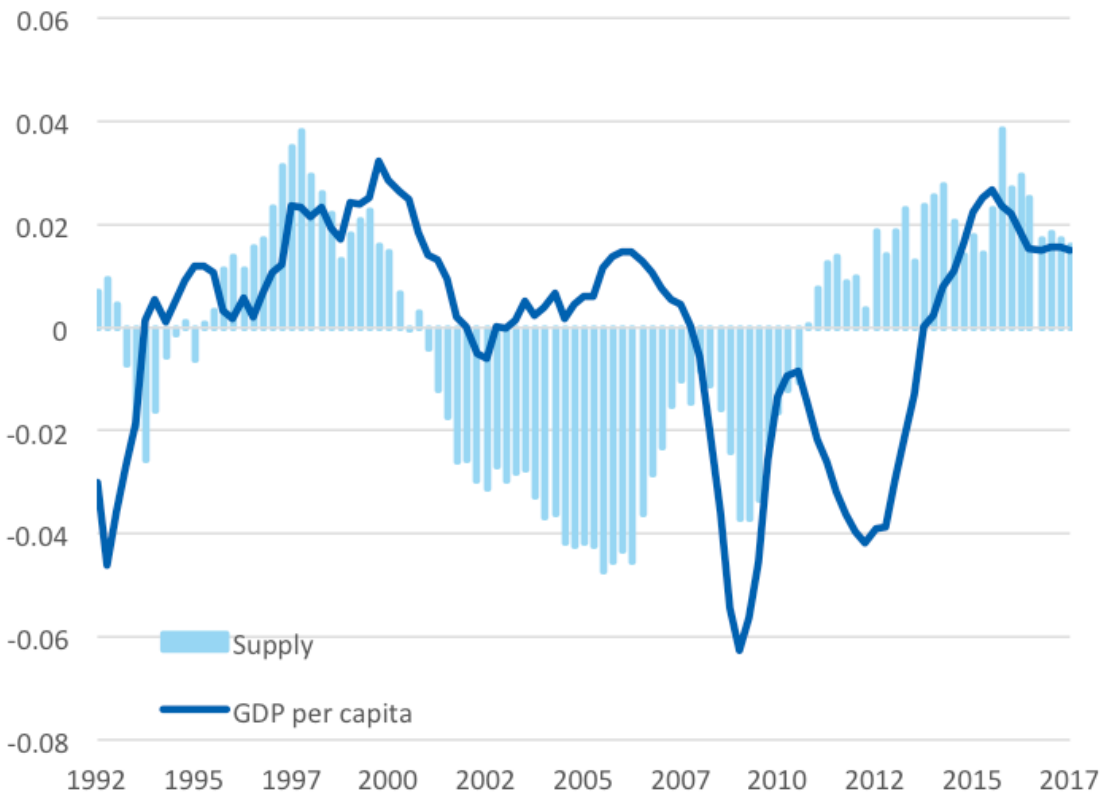
Name of Group	Shocks	Equation Number
Demand Shocks	Consumption + Housing Demand	i+ii
Supply Shocks	Mark up labor + Mark up retailers + TFP + Productive capital	iv+vi+vii+viii
Credit Shocks	Loan to value households + Loan to value entrepreneurs	iii+iv
Bank Shocks	Bank capital + Mark ups deposits + Mark up loans (two types)	ix+xi+xii+xiii
Import Shocks	Imports	xiv
Export Shocks	Exports	xv
Financial Shocks	Risk premium + ECB Interest Rate	x+xvi
Fiscal Shocks	Government Consumption + Government Investment	xvii+xviii

Historical decomposition: demand shocks



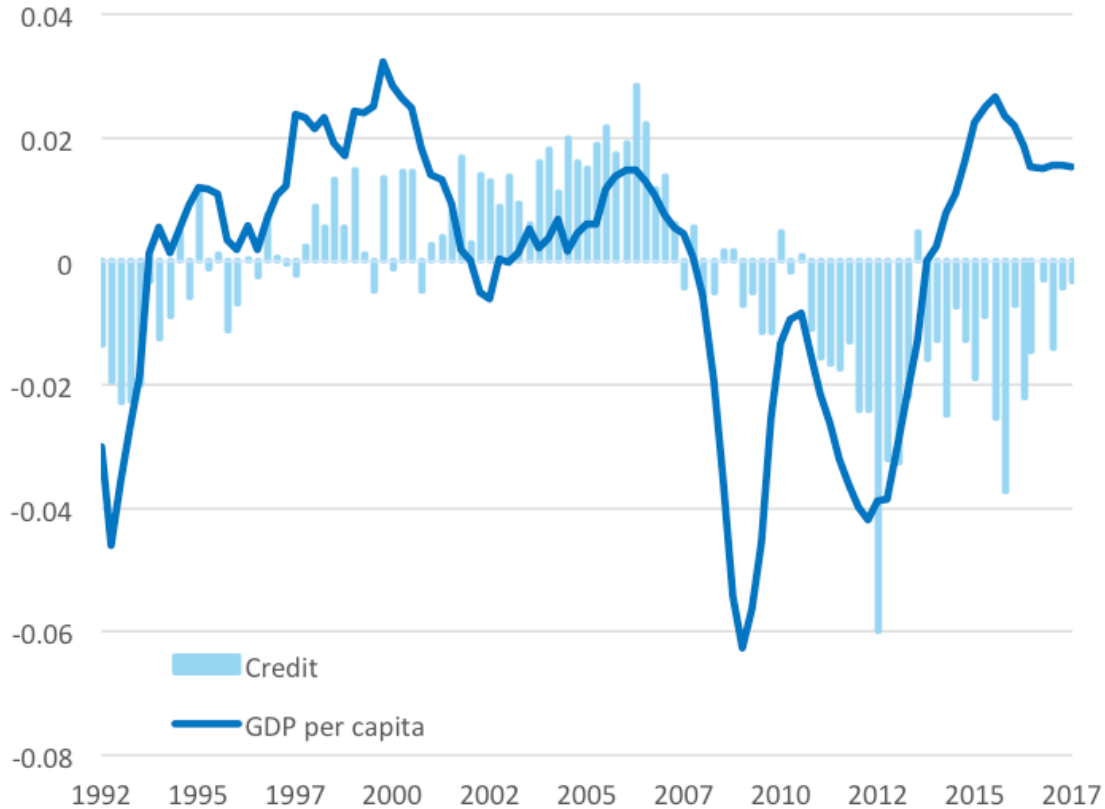
GDP growth and contribution of demand shocks

Historical decomposition: supply shocks



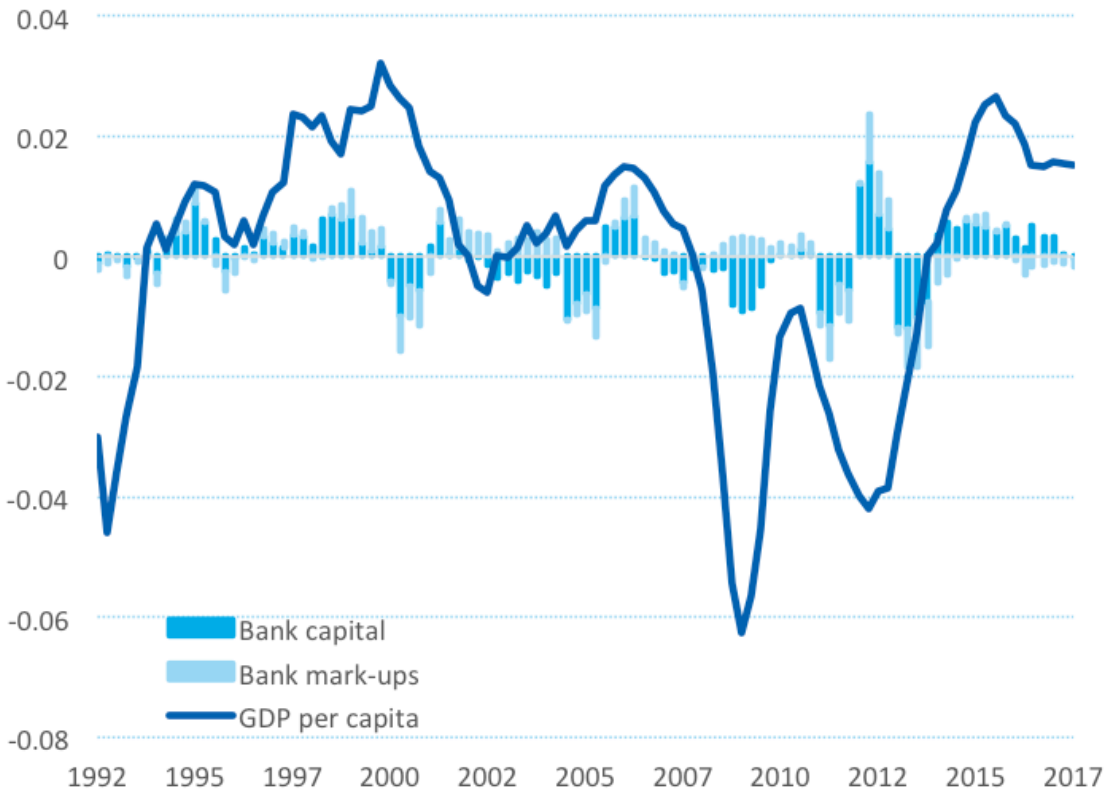
GDP growth and contribution of supply shocks

Historical decomposition: credit shocks



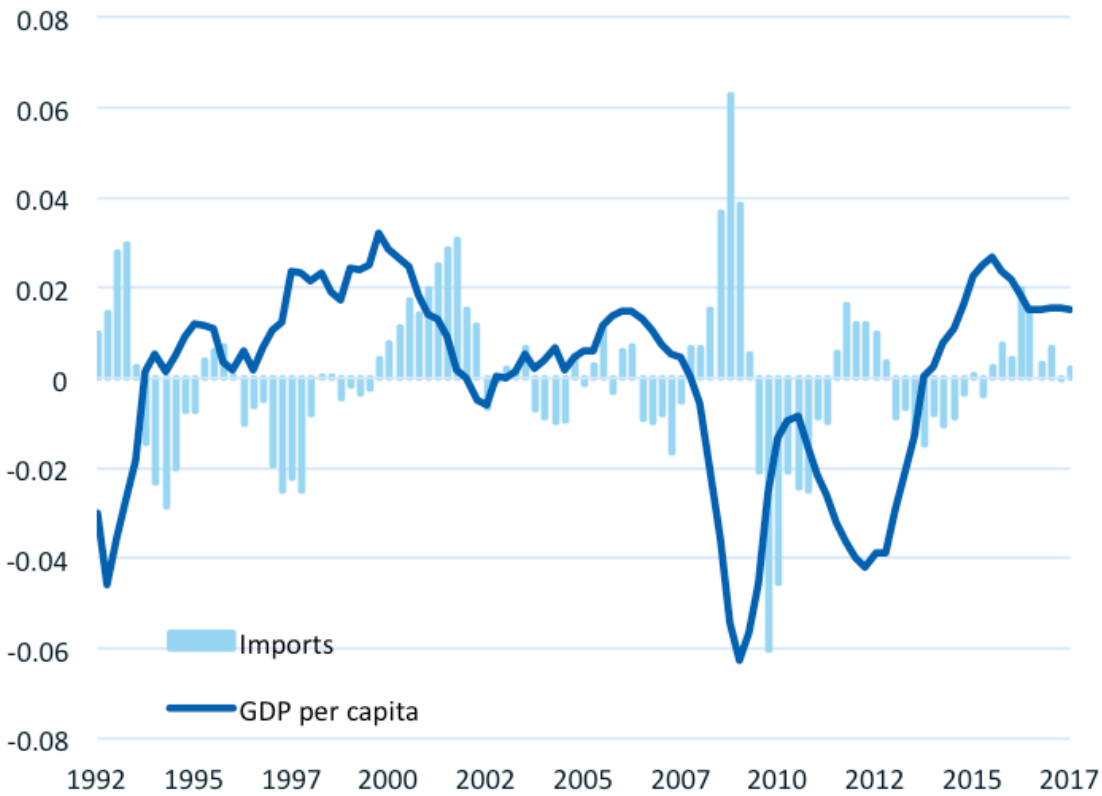
GDP growth and contribution of credit shocks

Historical decomposition: banks' shocks



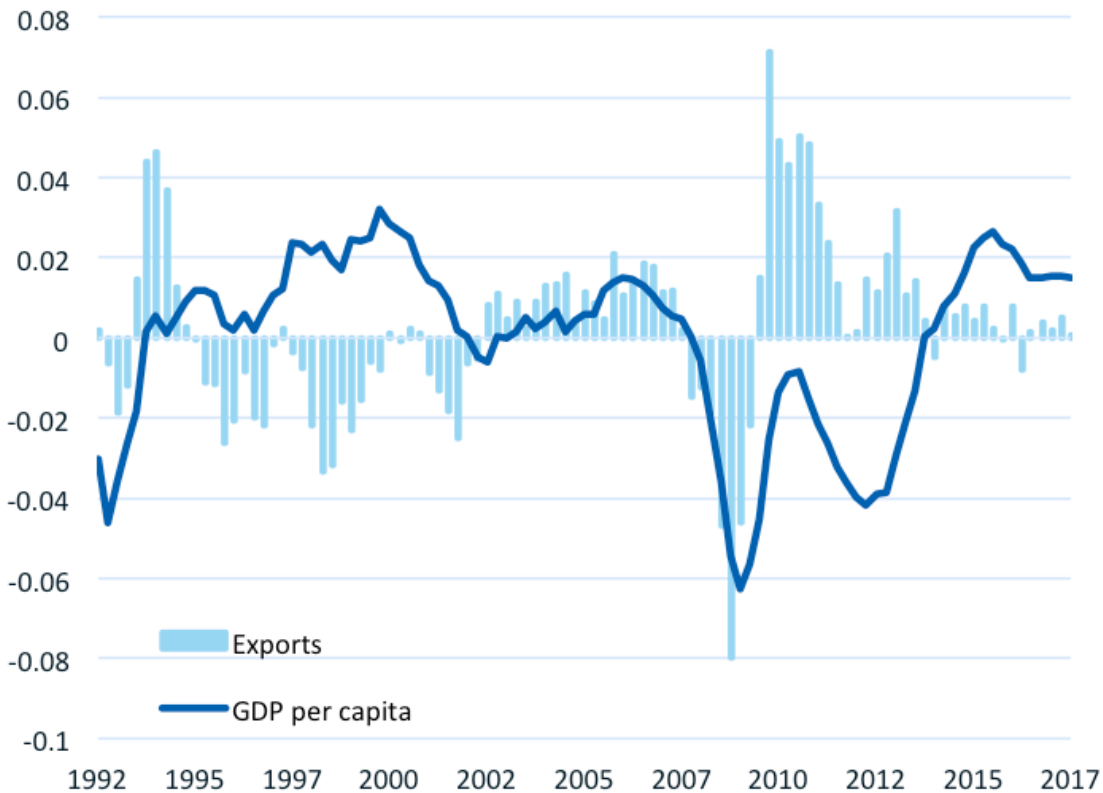
GDP growth and contribution of banks' shocks

Historical decomposition: imports shocks



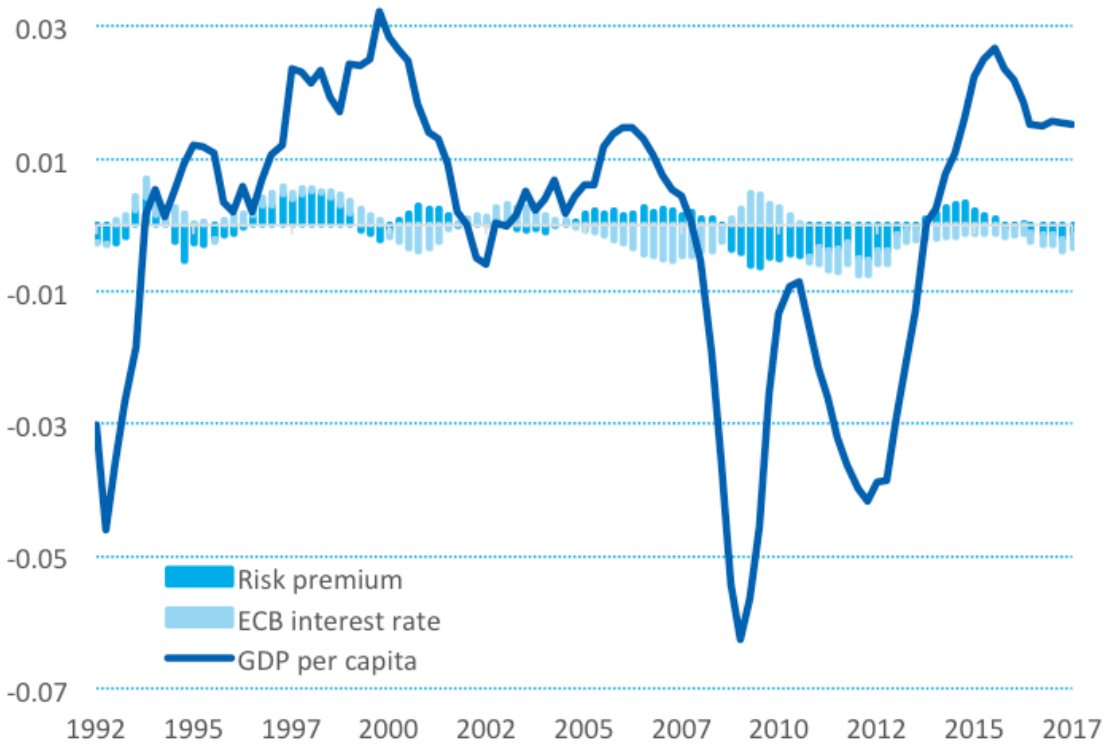
GDP growth and contribution of imports shocks

Historical decomposition: exports shocks



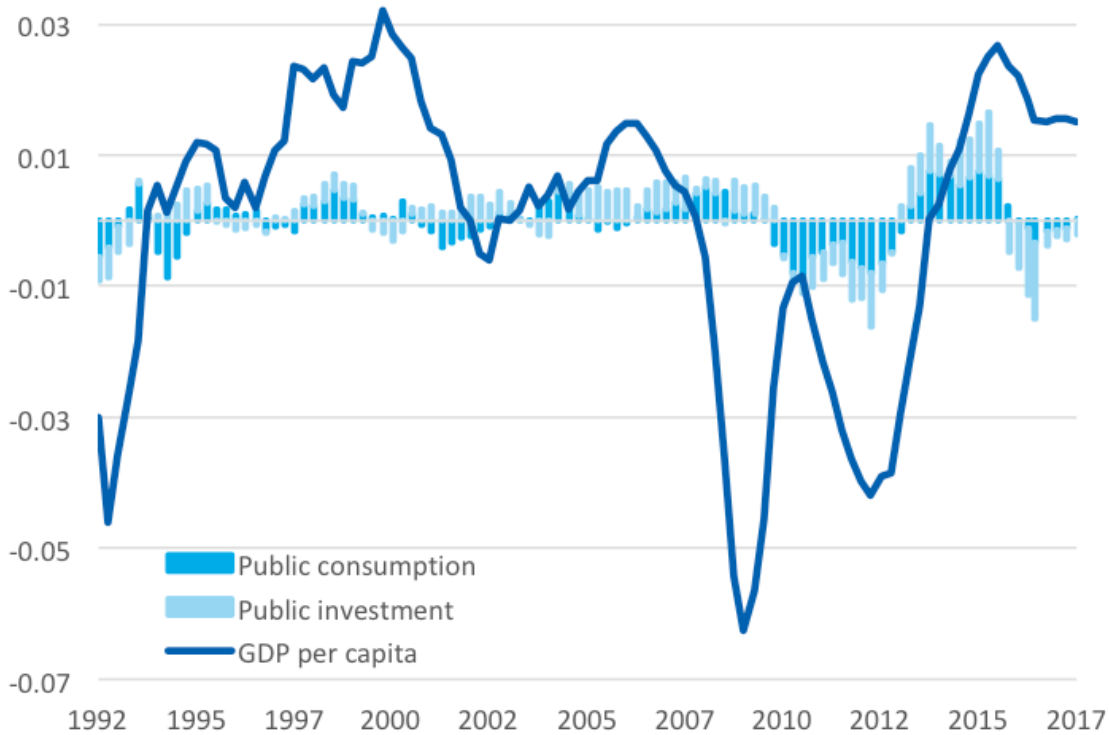
GDP growth and contribution of exports shocks

Historical decomposition: financial shocks



GDP growth and contribution of financial shocks

Historical decomposition: fiscal shocks



GDP growth and contribution of fiscal shocks

Historical decomposition: interpretation (1/3)

- Favorable financial conditions from 2003 to 2007 explain partially GDP growth and excessive debt: intertemporal substitution of growth
- First recession: since 2008 we observe a financial and trade crisis, partly offset by an expansionary fiscal policy. Again, the expansionary demand policy increased activity then at the cost of future lower growth. The negative wage shock made the recession worse
- Second recession (sovereign debt crisis): higher financial tensions and an unavoidable fiscal adjustment due to the unsustainability of public accounts
- Recovery: gradual improvement with a positive contribution of financial, fiscal and wage shocks, despite less favorable external trade conditions

Historical decomposition: interpretation (2/3)

- Demand shocks were important before the crisis and in the sovereign debt crisis. Housing demand shocks subtracted 1.25 percentage points of growth, on average between 2009 and 2015
- Supply shocks have displayed a countercyclical behavior in different periods. The efficiency of investment in capital goods has been quite relevant
- Credit shocks contributed positively in the period previous to the crisis. Since then, its contribution has been negative and much more pronounced during the sovereign crisis.
- After 2014 negative shocks to households' credit virtually disappeared but firms continued to improved their financial position
- Banks' shocks fluctuated from positive to negative during the Great Recession. During the recovery the effect has been always positive

Historical decomposition: interpretation (3/3)

- Export shocks, on the other hand, detracted from the GDP rate of growth in the first part of the financial crisis. They have become an important factor offsetting the crisis
- Risk premium shocks contributed positively before 2007, but explained more than half a percentage point of the reduction in per capita GDP growth at some moments of the crisis
- At the beginning of the crisis, fiscal policy would have counteracted the fall in per capita GDP growth by little more than 0.5 percentage points.
- The fiscal adjustment subtracted an average of almost 1 pp from per capita output growth between the first quarter of 2010 and the last quarter of 2012
- Government consumption and public investment had a positive weight in the recovery, pointing to a fiscal adjustment looser than the one that economic conditions would have allowed.

Conclusions

- In this paper we have developed a DSGE model of a small open economy within a monetary union with a banking sector and a rich representation of fiscal variables
- The model is specially designed to serve as an useful tool for the ex-ante evaluation of macroeconomic policies and to shed light on different shocks affecting the Spanish economy
- Our shock decomposition analysis highlights the fundamental role of financial conditions during the Great Recession and the subsequent recovery of the Spanish economy
- Current extensions: real-time analysis of cyclical conditions, effects of taxes in the banking sector, simulated effects of fiscal policies, and short-term forecasts