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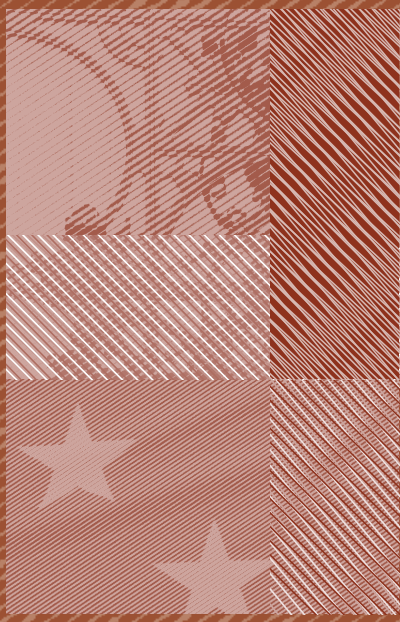

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# HOUSE PURCHASE VERSUS RENTAL IN SPAIN [*]

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BANCO DE ESPAÑA

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**Abstract**

One of the most salient feature of the Spanish housing market, compared to other European economies, is its relatively low rental share. This may be partly attributed to the existence of fiscal distortions in Spain favoring ownership. In this paper, we simulate the potential efects of different policy measures aimed at homogenizing the fiscal treatment of ownership and renting and improving the efficiency of the rental market. We do so in the context of a DSGE model featuring a market for owner-occupied and rented housing, as well as collateral constraints in loan markets. We find that eliminating the existing subsidy to house purchases, introducing a comparable subsidy to rental payments or increasing the efficiency in the production of housing rental services raise the rental share by a similar amount. However, their implications in terms of the construction sector differ.

**Keywords:** Rental market share, subsidy to house purchases, subsidy to rents, rental market efficiency.

**JEL classification:** E21, E3, E51, E6.

**Resumen**

Una de las características más particulares del mercado de la vivienda en España, en relación con otras economías europeas, es la proporción relativamente baja de viviendas en alquiler. Esto puede deberse en parte a la existencia de distorsiones fiscales que favorezcan la vivienda en propiedad. En este artículo, simulamos los efectos potenciales de distintas políticas encaminadas a homogeneizar el tratamiento fiscal de alquiler y compra de vivienda, y a mejorar la eficiencia del mercado de alquiler. Lo hacemos en el marco de un modelo de equilibrio general que incluye un mercado de vivienda tanto en propiedad como de alquiler, así como restricciones de colateral en el mercado de crédito. Encontramos que eliminar la desgravación existente a la compra de vivienda, introducir una desgravación equivalente al pago de alquileres o incrementar la eficiencia en la producción de servicios de alquiler elevan todas ellas la proporción de vivienda en alquiler en una cuantía similar. Sin embargo, difieren en sus implicaciones para el sector de la construcción.

**Palabras claves:** Proporción de vivienda en alquiler, desgravación a la compra de vivienda, desgravación al alquiler, eficiencia del mercado de alquiler.

**Códigos JEL:** E21, E3, E51, E6.

# 1 Introduction

Recent economic developments have taught us that housing is a key ingredient to understand the scope of the crisis and to shape the recovery. This statement is true all throughout Europe (and beyond), but especially so in Spain, where the housing market experimented a very strong boom as compared to many of its EMU partners.[1]

There are important idiosyncrasies of the Spanish housing market in relation to its main EMU partners, some of which have already been analyzed by the literature in the context of general equilibrium models. An important difference is that in Spain the vast majority of borrowers have variable-rate mortgages. As argued by Rubio (2009ab), this makes them worse off in terms of welfare because they have to bear the interest-rate variability risk. Also, real house prices and construction activity have experienced faster increases and more volatile fluctuations in Spain during the euro regime. Aspachs and Rabanal (2009) estimate a two-country monetary union model, and assess the role played by the economic structure and the structural shocks in Spain and the rest of EMU in producing such divergences.

One salient feature of the Spanish housing market which has not been analyzed in a general equilibrium context is its strikingly low rental share. In 2007 the rental share was 11% in Spain, versus 29% in the EU as a whole. In Germany, the rental share reached 60% in 2009. What leads to such big differences in rental markets is open to debate. One could think that they are due to exogenous cultural or preference factors, that is, Spaniards simply like to own houses whereas Germans prefer to rent them. However, a more plausible explanation could be that the different tax systems across countries favor either the rental or the owner-occupied market. According to Rodríguez (2009), the historical housing policy in Spain could be responsible for the lack of rentals in Spain and could have contributed to create a "property culture". Tax incentives in Spain seem to have favored house purchases whereas in countries such as Germany, the incentives were aiming at rental markets.[2] For example, according to the ECB (2003), as of 2001, neither Germany nor France had any tax deduction for mortgage payments, while Italy did but only for low-income households. Recently, some measures have been taken or announced which are aimed at enhancing the house rental market in Spain, in particular fiscal deductions and incentives. Among these measures, the government has removed (for houses bought after January 1st, 2011) the existing deduction of 15% of mortgage payments for first homes from the personal income tax.[3]

[1] See Marqués et al (2010)

[2] Gervais (2002) also shows in a dynamic general equilibrium life-cycle model that housing tax provisions provide an incentive for individuals to own rather than rent.

[3] The legislation establishes upper bounds on the effective tax deduction. Also, the elimination of the tax break will not

Furthermore, tax deductions for rental payments have recently been increased, aiming at homogenizing their fiscal treatment to that of first home purchases.

There can also be institutional factors that affect the house purchase versus rental decision, and hence the rental market share. For instance, the ability of the legal framework to enforce rental contracts can also be a crucial issue.[4] Some steps in order to improve the protection of landlords in Spain have also been taken. Specifically, in November 2009, a new law was implemented to facilitate the ejection of tenants if the house recovery is needed ("*Ley 19/2009 de Medidas de Fomento y agilización procesal del alquiler*"). Another example along these lines is the "home rental with guarantee" ("*Sociedad pública de alquiler*"), created by the Spanish government to promote home rental with maximum guarantee for home owners and better conditions and quality for tenants. All these measures are part of a law project in which the Spanish government, among other policy objectives, would aim at increasing the rental share to levels closer to the rest of the EMU countries by 2020 ("*Proyecto de ley de economía sostenible*").

In this paper, we build a DSGE model for Spain with a housing market and financial restrictions. It is a small open economy model within a monetary union.[5] In the model there are heterogeneous households. Some households are more impatient and need housing collateral to borrow. This divides the economy into borrowers and savers. There are two sectors in the economy: consumption and housing. Consumption goods are tradable while housing is a non-tradable good. The novelty of this model with respect to others of a similar kind is that we introduce a rental market for housing services and analyze the effects of changes in taxation and rental market efficiency on macroeconomic variables and welfare.

Our aim is to evaluate the effects on the Spanish housing markets of some of the measures proposed by the government to homogenize the fiscal treatment of ownership and renting and improve rental market efficiency. In particular, we consider (i) the removal of the subsidy to house purchases and (ii) the introduction of a comparable subsidy to rental payments; in addition, we simulate (iii) an increase in the efficiency of the rental market.[6] We do these exercises both from a positive perspective

affect owners with personal income below a certain, relatively low threshold. Furthermore, this measure affects the central government part of the income tax for all citizens, which in this case would mean two thirds of the house purchase deduction, while it applies to the local part of the tax only in some regions for the moment (the other third of the deduction). In this paper we consider the hypothetical case in which all regions would supress the fiscal incentive to house purchases and, hence, can be consider an upper bound for the current case in Spain.

[4] See Casas-Arce and Saiz (2008) and Mora (2009)

[5] See Rubio (2009b) and Aspachs and Rabanal (2008) for two-country models that take into account differences in housing markets across EMU countries.

[6] We use the efficiency parameter in the production function of rental services as a proxy for the ability of the legal framework to enforce and hence promote rental contracts. We then check the effects of a change in the efficiency of the rental market that raises the rental share to 20%.

(by analyzing their effects on rental shares, house prices, construction activity, etc.) and a normative perspective (by studying their implications for social welfare). We are aware that these measures could affect specific population groups in a different manner; for instance, the rental subsidy could benefit more the younger cohort, whereas the house purchase subsidy could be especially beneficial for the middle age group. However, this paper does not take into account these aspects, since households in our model are representative agents within their type. An overlapping generations version of the model could account for these differences, although this would require a very different theoretical framework. Another dimension that is potentially important but is beyond the scope of this study is the fact that increasing the rental share by itself could be beneficial because it enhances labor mobility and the overall efficiency of the economy.

Our results show that, although the three measures manage to increase the rental share, they have different implications for the rest of the macroeconomic variables and for welfare. In particular, we find that the proposed removal of the subsidy to house purchases in Spain downsizes the construction sector; the existence of collateral constraints plays an important role in amplifying such effects. With respect to the introduction of a subsidy to rents, we show that the construction activity slightly increases. Finally, increasing the efficiency in the rental market is essentially neutral with respect to real house prices and construction activity. The impact on public finances are also very different, since removing a subsidy has opposite effects to introducing one in terms of the taxes which can be reduced or need to be levied in order to finance each policy. The latter is an important mechanism, which ends up making aggregate activity fall by less when removing the house purchases rebate than when introducing a rental subsidy. However, in terms of the model-based measure of welfare, we find that while introducing a subsidy to rentals and improving the rental market efficiency are welfare improving, removing the subsidy to house purchases may actually be detrimental for welfare, because collateral constraints amplify the reduction in demand for housing services by constrained households.

The paper relates to different strands of the literature. On the one hand, it takes as a baseline housing models with collateral constraints such as Iacoviello and Neri (2010) and it adds to it a rental market. It also relates to papers which study particularities of European housing markets in the context of the EMU such as Rubio (2009b) and Aspachs and Rabanal (2009). Finally, it relates to papers which analyze welfare in a context of collateral constraints such as Monacelli (2006), Mendicino and Pescatori (2007), Andrés et al (2010), Campbell and Hercowitz (2009) and Rubio (2009ab).

The paper is organized as follows. Section 2 presents the model. Section 3 calibrates it for Spain and

analyzes some of its dynamic properties. Section 4 studies the long run effects and transitional dynamics following each of the policy measures. Section 5 presents welfare results and Section 6 concludes.

# 2 Model setup

We consider a small-open economy inside a monetary union. We denote the home country by A and the rest of the union by B. In the home country, there are savers and borrowers which differ in their discount factors. Savers consume goods produced domestically and abroad, derive utility from housing, and work. They can also trade financial assets both domestically and internationally. Countries are in a monetary union in which the euro is the common currency, therefore assets are denominated in euros. Borrowers are more impatient than savers and need collateral to obtain loans. There are two production sectors: the construction sector and the consumption goods sector. For simplicity, housing is a non-tradable good. Consumption goods prices are sticky. Houses can be bought or rented. There are fiscal incentives to house purchases and to rentals, in the form of subsidies. In order to perform a meaningful welfare analysis, we assume that subsidies are financed by distortionary taxes; in particular, we consider a tax on wage income. Monetary policy is conducted by a single central bank and fiscal policy is implemented at the country level.

## 2.1 Savers

Savers in Country A choose consumption, housing and labor in order to maximize

$$W_0^s = E_0 \sum_{t=0}^{\infty} (\beta^s)^t \left( \log C_t^s + \vartheta \log H_t^s - \frac{(L_t^s)^{1+\eta}}{1+\eta} \right),$$

where $\beta^s$ is the savers' discount factor, $\vartheta$ is the weight of utility from housing services, $H_t^s$ is savers' stock of owner-occupied housing, and $L_t^s$ is a composite of labor supply to the consumption sector ($L_{ct}^s$) and the housing sector ($L_{ht}^s$),

$$L_t^s = \left[ \omega_l^{1/\varepsilon_l} \left(L_{ct}^s\right)^{(1+\varepsilon_l)/\varepsilon_l} + (1-\omega_l)^{1/\varepsilon_l} \left(L_{ht}^s\right)^{(1+\varepsilon_l)/\varepsilon_l} \right]^{\varepsilon_l/(1+\varepsilon_l)}.$$

where $\omega_l$ is a weight parameter and $\varepsilon_l$ is the elasticity of substitution between labor types. Savers consume a basket of domestically and foreign produced goods, given by

$$C_t^s = \left(C_{At}^s\right)^{\xi} \left(C_{Bt}^s\right)^{1-\xi},$$

where $C_{jt}^s$ are Dixit-Stiglitz aggregators of consumption goods varieties produced in country $j = A, B$, and $\xi > 0$ measures the degree of home bias in consumption. The household's nominal budget constraint is given by

$$P_{At}C_{At}^s + P_{Bt}C_{Bt}^s + Q_t^h\left[\left(1-\tau_h\right)\left(H_t^s - \left(1-\delta\right)H_{t-1}^s\right) + \left(H_t^z - \left(1-\delta\right)H_{t-1}^z\right)\right] + B_t + D_t =$$
$$\left(1-\tau_{wt}\right)\left(W_{ct}L_{ct}^s + W_{ht}L_{ht}^s\right) + Q_t^z Z_t + R_{At-1}B_{t-1} + R_{t-1}\Gamma\left(\frac{-D_{t-1}}{P_{At-1}Y_{t-1}}\right)D_{t-1} + P_{At}F_t,$$

where $P_{At}$ is the nominal price index of final consumption goods produced in Country A, $P_{Bt}$ is the corresponding index for goods produced in Country B, $Q_t^h$ is the nominal price of houses, $\tau_h$ is the subsidy rate on purchases of owner-occupied houses, $B_t$ and $D_t$ are domestic and foreign nominal debt held by savers, respectively, $\tau_{wt}$ is the time-varying tax rate on wage income, $W_{ct}$ and $W_{ht}$ are nominal wages in the consumption goods and the housing sector, respectively, $R_{At}$ is the nominal interest rate on domestic bonds, and $R_t$ is the nominal ECB rate. In order to ensure stationarity of equilibrium, we follow Schmitt-Grohe & Uribe (2001) and assume that domestic agents pay a risk premium $\Gamma$ which is strictly increasing in the country's net foreign debt to output ratio, $\left(-D_t\right)/\left(P_{At}Y_t\right)$. We assume that the risk-premium takes the form $\Gamma\left(x\right) = e^{\psi x}$, with $\psi > 0$. $F_t$ are firms' real profits rebated to savers every period. Savers use a certain part of their housing stock, which we denote by $H_t^z$, to produce rental services $Z_t$ according to the production function $Z_t = A_z H_t^z$. The parameter $A_z$ measures the efficiency of the rental market and will serve as a proxy of the efficiency of institutions to enforce rental contracts. Rental services are sold competitively to borrowers at a unit nominal price $Q_t^z$. The parameter $\delta$ is the depreciation rate of houses. We can rewrite the budget constraint in terms of producer prices in Country A,

$$C_{At}^s + p_{Bt}C_{Bt}^s + q_t^h\left[\left(1-\tau_h\right)\left(H_t^s - \left(1-\delta\right)H_{t-1}^s\right) + \left(H_t^z - \left(1-\delta\right)H_{t-1}^z\right)\right] + b_t + d_t$$
$$= \left(1-\tau_{wt}\right)\left(w_{ct}L_{ct}^s + w_{ht}L_{ht}^s\right) + q_t^z A_z H_t^z + \frac{R_{At-1}b_{t-1}}{\Pi_{At}} + \frac{R_{t-1}e^{\psi(-d_{t-1})/Y_{t-1}}d_{t-1}}{\Pi_{At}} + F_t,$$

where $\Pi_{At} \equiv P_{At}/P_{At-1}$ denotes domestic PPI inflation, $p_{Bt} \equiv P_{Bt}/P_{At}$ is the price of foreign goods in terms of home goods (that is, the terms of trade), $q_t^h \equiv Q_t^h/P_{At}$ and $q_t^z \equiv Q_t^z/P_{At}$ denote real house prices and real rental rates, respectively, $w_{ct}$ and $w_{ht}$ are real wages in each sector, and we have defined $b_t \equiv B_t/P_{At}$ and $d_t \equiv D_t/P_{At}$. The first order conditions of the maximization problem are the following,

$$\frac{C_{At}^s}{C_{Bt}^s} = \left(\frac{\xi}{1-\xi}\right) p_{Bt}, \tag{1}$$

$$\frac{\vartheta}{H_t^s} = (1-\tau_h)\left(\frac{q_t^h}{C_{At}^s/\xi} - \beta^s E_t \frac{q_{t+1}^h (1-\delta)}{C_{At+1}^s/\xi}\right), \tag{2}$$

$$\frac{1}{C_{At}^s} = \beta^s E_t \frac{1}{C_{At+1}^s} \frac{R_{At}}{\Pi_{At+1}}, \tag{3}$$

$$R_{At} = R_t e^{\psi(-d_t)/Y_t}, \tag{4}$$

$$(1-\tau_{wt})\frac{w_{ct}}{C_{At}^s/\xi} = (L_t^s)^{\eta}\, \omega_l^{1/\varepsilon_l} \left(\frac{L_{ct}^s}{L_t^s}\right)^{1/\varepsilon_l}, \tag{5}$$

$$(1-\tau_{wt})\frac{w_{ht}}{C_{At}^s/\xi} = (L_t^s)^{\eta}\, (1-\omega_l)^{1/\varepsilon_l} \left(\frac{L_{ht}^s}{L_t^s}\right)^{1/\varepsilon_l}, \tag{6}$$

$$\frac{q_t^h}{C_{At}^s} = \frac{q_t^z A_z}{C_{At}^s} + \beta^s E_t \frac{(1-\delta)\, q_{t+1}^h}{C_{At+1}^s}. \tag{7}$$

Equation (1) equates relative prices to the marginal rate of substitution between the goods produced in Countries A and B. Equation (2) is the first order condition for owner-occupied housing, which equates the marginal utility of housing services to the *effective* (i.e. subsidy-adjusted) user cost of housing. Equation (3) is the Euler Equation for domestic bonds. Equation (4) follows from no arbitrage between domestic and foreign bonds. Equations (5) and (6) are the first order conditions for labor supply in the consumption and housing sector, respectively. Equation (7) is the first order condition for house purchases for production of rental services.

## 2.2 Borrowers

Borrowers have a discount factor $\beta^b < \beta^s$ and maximize

$$W_0^b = E_0 \sum_{t=0}^{\infty} \left(\beta^b\right)^t \left(\log C_t^b + \vartheta \log \tilde{H}_t^b - \frac{\left(L_t^b\right)^{1+\eta}}{1+\eta}\right),$$

where $C_t^b = \left(C_{At}^b\right)^{\xi} \left(C_{Bt}^b\right)^{1-\xi}$ is a consumption basket,

$$L_t^b = \left[\omega_l^{1/\varepsilon_l} \left(L_{ct}^b\right)^{(1+\varepsilon_l)/\varepsilon_l} + (1-\omega_l)^{1/\varepsilon_l} \left(L_{ht}^b\right)^{(1+\varepsilon_l)/\varepsilon_l}\right]^{\varepsilon_l/(1+\varepsilon_l)} \tag{8}$$

is a composite of labor services in both sectors analogous to that of savers and

$$\tilde{H}_t^b = \left[\omega_h^{1/\varepsilon_h} \left(H_t^b\right)^{(\varepsilon_h-1)/\varepsilon_h} + (1-\omega_h)^{1/\varepsilon_h} \left(Z_t\right)^{(\varepsilon_h-1)/\varepsilon_h}\right]^{\varepsilon_h/(\varepsilon_h-1)} \tag{9}$$

is a composite of housing services provided by owner-occupied and rented houses, where $H_t^b$ is borrowers' stock of owned houses and $Z_t$ are rental services. Therefore, borrowers derive utility both from living in owner-occupied houses and in rented houses.[7] Maximization is subject to the following budget constraint, written in terms of domestic producer prices,

$$\begin{aligned} C_{At}^b + p_{Bt} C_{Bt}^b + q_t^h \left(1-\tau_h\right) \left[H_t^b - (1-\delta) H_{t-1}^b\right] + \left(1-\tau_z\right) q_t^z Z_t + \frac{R_{At-1} b_{t-1}}{\Pi_{At}} \\ = \left(1-\tau_{wt}\right) \left(w_{ct} L_{ct}^b + w_{ht} L_{ht}^b\right) + b_t, \end{aligned} \tag{10}$$

where $\tau_z$ is the subsidy rate on rental payments. Borrowers are also subject to a collateral constraint which limits the amount of borrowing (gross of interest payments) to a fraction $m$ of the expected resale value of their houses,[8]

$$b_t \leq \frac{m}{R_{At}} E_t \Pi_{At+1} q_{t+1}^h H_t^b. \tag{11}$$

The first order conditions of this problem are the following,

$$\frac{C_{At}^b}{C_{Bt}^b} = \frac{\xi}{1-\xi} p_{Bt}, \tag{12}$$

$$\frac{\xi}{C_{At}^b} = \beta^b E_t \frac{\xi}{C_{At+1}^b} \frac{R_{At}}{\Pi_{At+1}} + \lambda_t \tag{13}$$

[7] This does not literally mean that each borrower lives simultaneously in an owned house and in a rented house. Instead, our interpretation is that there exists a large representative borrower-type household with a continuum of members, some of which live in owner-occupied houses and the rest of which live in rented houses. Our composite index in equation (9) thus represents the aggregate preferences of all household members with respect to each kind of housing services. As an alternative modelling approach, Gervais (2002) considers a framework where agents decide endogenously whether to buy a house or rent.

On the other hand, notice that savers do not demand rental housing services, unlike the case of borrowers. We do this for simplicity. However, results not reported here but available upon request show that, under the assumption of homogeneous preferences across savers and borrowers, our quantitative results are only marginally affected.

[8] The fact that borrowers are more impatient than savers guarantees that the collateral constraint is binding in the steady state. Provided the shocks to the economy are small enough, the constraint also binds over the business cycle.

$$(1-\tau_{wt})\frac{w_{ct}}{C^b_{At}/\xi}=\left(L^b_t\right)^{\eta}\left(\frac{\omega_l L^b_{ct}}{L^b_t}\right)^{1/\varepsilon_l}, \tag{14}$$

$$(1-\tau_{wt})\frac{w_{ht}}{C^b_{At}/\xi}=\left(L^b_t\right)^{\eta}\left(\frac{(1-\omega_l)\,L^b_{ht}}{L^b_t}\right)^{1/\varepsilon_l}, \tag{15}$$

$$\frac{\vartheta}{\tilde{H}^b_t}\left(\frac{\omega_h\tilde{H}^b_t}{H^b_t}\right)^{1/\varepsilon_h}=(1-\tau_h)\left(\frac{q^h_t}{C^b_{At}/\xi}-\beta^b E_t\frac{q^h_{t+1}(1-\delta)}{C^b_{At+1}/\xi}\right)-\lambda_t m E_t q^h_{t+1}\frac{\Pi_{At+1}}{R_{At}}, \tag{16}$$

$$\frac{\vartheta}{\tilde{H}^b_t}\left(\frac{(1-\omega_h)\,\tilde{H}^b_t}{Z_t}\right)^{1/\varepsilon_h}=(1-\tau_z)\frac{q^z_t}{C^b_{At}/\xi}. \tag{17}$$

where $\lambda_t$ is the Lagrange multiplier on the collateral constraint. These first order conditions are interpreted analogously to the ones of savers. An important difference is the demand for owner-occupied housing, equation (16). The latter equates the marginal utility of owner-occupied housing to the effective user cost of housing minus the marginal collateral value of housing. Therefore, *ceteris paribus*, an increase in the collateral value of housing (due for instance to an expected increase in house prices) has a positive effect on borrowers' demand for owner-occupied housing.

## 2.3 Firms

### 2.3.1 Construction firms

New homes are produced using the following technology,

$$IH_t=L^s_{ht}+L^b_{ht}, \tag{18}$$

where $IH_t$ is residential investment, $L^s_{ht}$ and $L^b_{ht}$ are savers' and borrowers' supply of labor in the housing sector, respectively. Free entry in the construction sector implies the following zero profit condition,

$$w_{ht}=q^h_t. \tag{19}$$

### 2.3.2 Intermediate good producers

The intermediate good market is perfectly competitive. The homogenous intermediate good is produced according to the following technology,

$$Y_t=L^s_{ct}+L^b_{ct}, \tag{20}$$

where $L^s_{ct}$ and $L^b_{ct}$ are savers' and borrowers' supply of labor in the consumption goods sector, respectively. Free entry in this sector implies the following zero profit condition,

$$w_{ct} = p^I_t, \tag{21}$$

where $p^I_t$ is the real price of the intermediate good, that is, the real marginal cost for final consumption goods producers.

### 2.3.3 Final consumption goods producers

Final consumption goods are produced by a continuum of monopolistically competitive firms. Prices in the final goods sector are set in a staggered fashion according to the Calvo (1983) mechanism. This implies the following (log-linear approximation of the) New Keynesian Phillips Curve for domestic PPI inflation,

$$\log \Pi_{At} = \beta^s \log \Pi_{At+1} + \frac{(1-\theta)(1-\theta\beta^s)}{\theta} \log\left(p^I_t \frac{\varepsilon_p}{\varepsilon_p - 1}\right), \tag{22}$$

where $\theta$ is the probability of firms not changing prices, $\varepsilon_p$ is the elasticity of substitution across final goods, and $\varepsilon_p/(\varepsilon_p - 1)$ is the steady-state markup.

## 2.4 Fiscal policy

For simplicity, we assume that the government balances its budget period by period. That is,

$$\tau_{wt}\left[w_{ct}\left(L^s_{ct} + L^b_{ct}\right) + w_{ht}\left(L^s_{ht} + L^b_{ht}\right)\right] = \tau_z q^z_t Z_t + \tau_h q^h_t \left[H^s_t - (1-\delta) H^s_{t-1} + H^b_t - (1-\delta) H^b_{t-1}\right]. \tag{23}$$

Therefore, the government levies taxes on wage income in order to finance its subsidies to rental payments and to house purchases.

## 2.5 Market clearing and international linkages

Housing market clearing implies $H_t = H^s_t + H^z_t + H^b_t$, where the total supply of houses evolves according to $H_t = IH_t + (1-\delta) H_{t-1}$. Combining the latter two conditions, we have that

$$IH_t = H^s_t - (1-\delta) H^s_{t-1} + H^z_t - (1-\delta) H^z_{t-1} + H^b_t - (1-\delta) H^b_{t-1}. \tag{24}$$

The aggregate resource constraint for domestically-produced consumption goods can be expressed as

$$Y_t = C^s_{At} + C^b_{At} + \xi^* p_{Bt} c^*_t,$$

where $c^*_t$ is aggregate consumption in the rest of the monetary union and $\xi^*$ is a foreign preference parameter. For future reference, we define real gross domestic product as $GDP_t \equiv Y_t + q^h_t IH_t$. Terms of trade evolve according to

$$p_{Bt} = \frac{\Pi_{Bt}}{\Pi_{At}} p_{B,t-1},$$

where $\Pi_{Bt}$ is both PPI and CPI inflation in the rest of the union.[9] The ECB nominal interest rate follows a Taylor rule that responds smoothly to deviations of EMU-wide inflation from its long-run target (which we normalize to 1),

$$R_t = (1/\beta)^{1-\phi_R} R^{\phi_R}_{t-1} \Pi^{(1+\phi_\Pi)(1-\phi_R)}_{Bt} \exp(e_{R,t}),$$

where $\phi_R$ is a smoothing parameter, $\phi_\Pi$ captures the policy response to inflation, and $e_{R,t}$ is an iid shock.

The home country's net foreign asset position (per capita) follows

$$d_t = \frac{R_{t-1} e^{\psi(-d_{t-1})/Y_{t-1}}}{\Pi_{At}} d_{t-1} + Y_t - C^s_{At} - C^b_{At} - p_{Bt}\left(C^s_{Bt} + C^b_{Bt}\right). \tag{25}$$

The model can be closed by means of two equations that determine foreign consumption demand ($c^*_t$) and foreign inflation ($\Pi_{Bt}$). We assume for simplicity that both variables (in logs) follow AR(1) processes, with means normalized to zero.

## 3 Calibration

We calibrate a subset of parameters in order for the model to match a number of key average ratios of the Spanish economy, mostly for the period 1997-2008.[10] The home bias parameter, $\xi$, is set to match the share of Spanish goods in private consumption, which in the model is exactly equal to $[C^s_A + C^b_A/(C^s_A + C^b_A + p_B(C^s_B + C^b_B))] = \xi$.[11] The efficiency in the production of rental services, $A_z$, is chosen to replicate the rent-to-house-price ratio, given by $q^z/q^h = (1 - \beta^s(1-\delta))/A_z$ in the model's steady state. Notice

[9] Remember that the home country is assumed to be small relative to the rest of the monetary union.

[10] Notice that, even though the EMU regime started in 1999, by 1997 EMU membership was anticipated by most agents, and in practice Spain had fixed exchange rate with respect to the rest of the EMU in that period.

[11] The foreign preference parameter is set such that terms of trade in the steady state are normalized to one, producing $\xi^* = 1.256$.

that the latter two steady-state ratios are invariant to changes in housing subsidies ($\tau_h$, $\tau_z$). The relative weight on utility from housing services, $\vartheta$, and the weight parameters in the CES baskets of labor supply and housing services, $\omega_l$ and $\omega_h$ respectively, are jointly chosen by minimizing the sum of square distances between four steady-state ratios in the model and their corresponding data counterparts. These ratios are the shares of rented houses and mortgaged houses in the aggregate housing stock, $H^z/H$ and $H^b/H$ respectively, the share of residential investment in GDP, $q^h IH/GDP$, and the share of construction in total employment, $L_h/(L_c + L_h)$, where $L_i \equiv L_i^s + L_i^b$ is total labor in sector $i = c, h$. The values for these parameters, together with all other parameters, are reported in Table 1, whereas the resulting model steady-state ratios are compared to their data counterparts in Table 2.

**Table 1: Parameter Values**

| | | |
|---|---|---|
| $\xi$ | 0.663 | Home bias in consumption |
| $A_z$ | 1.621 | Efficiency in production of rental housing services |
| $\vartheta$ | 0.143 | Relative weight on utility from housing services |
| $\omega_l$ | 0.214 | Weight parameter in labor services aggregator |
| $\omega_h$ | 0.787 | Weight parameter in housing services aggregator |
| $\beta^s/\beta^b$ | 0.99/0.97 | Discount factor of savers / borrowers |
| $\varepsilon_l$ | 1 | Elasticity of substitution between labor types |
| $\varepsilon_h$ | 2 | Elasticity of subst btw. home ownership and rent |
| $\eta$ | 0.01 | Inverse elasticity of labor supply |
| $\varepsilon_p$ | 6 | Elasticity of substitution among final goods |
| $\delta$ | 0.01 | Depreciation rate of the housing stock |
| $m$ | 0.70 | Loan-to-value ratio |
| $\theta$ | 0.75 | Calvo parameter |
| $\phi_R$ | 0.8 | Coefficient on lagged nominal interest rate in Taylor rule |
| $\phi_\Pi$ | 1.5 | Coefficient on area-wide inflation in the Taylor rule |
| $\psi$ | 0.01 | Elasticity of risk premium wrt net foreign asset position |
| $\tau_h$ | 0.15 | Subsidy rate house purchases for owner occupation |
| $\tau_z$ | 0 | Subsidy rate on rent payments |

**Table 2: Steady State Ratios of the Spanish Economy**

| | Data | Model | Data Sources |
|---|---|---|---|
| Share home goods in consumption | 0.663 | 0.663 | Spanish National Accounts, 1997-2008 |
| Rent over housing price, $q^z/q^h$ | 0.012 | 0.012 | Ministerio de Vivienda, 1997-2008 |
| Housing rental share, $H^z/H$ | 0.122 | 0.139 | INE, Censo de Población y Vivienda 2001 |
| Share of housing w/ mortgage, $H^b/H$ | 0.305 | 0.322 | Asociación Española de Banca, 2003-2008 |
| Residential investment / GDP, $q^h IH/GDP$ | 0.073 | 0.073 | Spanish National Accounts, 1997-2008 |
| Construction labor share, $L_h/(L_c + L_h)$ | 0.138 | 0.138 | INE, Encuesta de Población Activa, 1997-2008 |

The remaining parameters are set to standard values in the literature. For savers, we use a discount factor that corresponds to an annual interest rate of 4%. For borrowers, we use a slightly lower discount factor, in line with the literature on DSGE models with housing and financial frictions. Following Horvath (2000), we set the elasticity of substitution between labor types, $\varepsilon_l$, to one. For the elasticity of substitution between services from home ownership and rent, $\varepsilon_h$, unfortunately there are no reliable estimates in the literature. We take the value of 2 as our baseline in order to make households more sensitive to the relative price of houses and rents than would be the case under, e.g. a Cobb-Douglas specification for equation (9). We have performed however a sensitivity analysis and find that the qualitative results are largely unaffected by this parameter.[12] We choose the inverse elasticity of labor supply, $\eta$, following Iacoviello (2005).[13] The value for the elasticity of substitution among final goods, $\varepsilon_p$, implies a markup of 20% in the steady state, a value commonly found in the literature.[14] We set the housing depreciation rate to 0.01, as in Iacoviello and Neri (2010). We use 0.70 for the loan-to-value ratio, consistently with data from the European Mortgage Federation (Spain Factsheet 2009).[15] We perform however a robustness check on this parameter (See Table 6 in the Appendix) and see that the main steady state ratios and welfare results are not significantly affected by the value of this parameter. The probability of not changing prices, $\theta$, is set to 0.75, implying that prices change every four quarters on average. The coefficients in the Taylor Rule are set to 0.8 for the lagged interest rate and 1.5 for inflation, as proposed by Taylor (1993). The elasticity of the international risk-premium, $\psi$, is set to a

[12] See Table 5 in the Appendix for the robustness results. Welfare results are practically unaffected when using different values of this parameter. Steady state ratios are very similar in qualitative terms although more sensitive to the implementation of the different measures the larger $\varepsilon_h$ is.

[13] This value implies a virtually flat labor supply curve, higher than microeconomic estimates but rationalizing the weak observed response of real wages to macroeconomic disturbances.

[14] See for instance Blanchard and Galí (2008).

[15] The actual value published by the European Mortgage Federation is 67.5%.

standard value of 0.01. The subsidy for house purchases in Spain is set to $\tau_h = 0.15$, consistently with the 15% income tax deduction for house purchases applied until 2011. As a baseline, we set the subsidy to rentals $\tau_z$ to zero, and will later explore the effects of raising it to 15%.[16]

### 3.1 Impulse-responses to monetary shocks

Before moving to the analysis of housing market policies, it is interesting to assess some of the dynamic properties of the model. Figure 1 shows impulse responses to a 25 basis points shock to the nominal interest rate.[17] Following the monetary policy tightening, GDP, residential investment, PPI inflation and real house prices all go down, as expected. The implied reduction in the total housing stock is unequally shared between agents and alternative uses. On the one hand, the increase in the cost of mortgages leads borrowers to substitute away from house purchases and increase their demand for rented houses. This is reinforced by two effects. First, the drop in rental rates due to the fact that landlords expect a quick recovery in real house prices following the shock.[18] Second, the fall in real house prices which reduces the collateral value of housing, thus limiting borrowers' access to credit and further reducing their demand for mortgaged housing. In the case of savers, the fall in real house prices leads them to increase their housing stock on impact, but from then onwards this effect is dominated by the fact that they now discount future utility flows more heavily.

## 4 Policy analysis

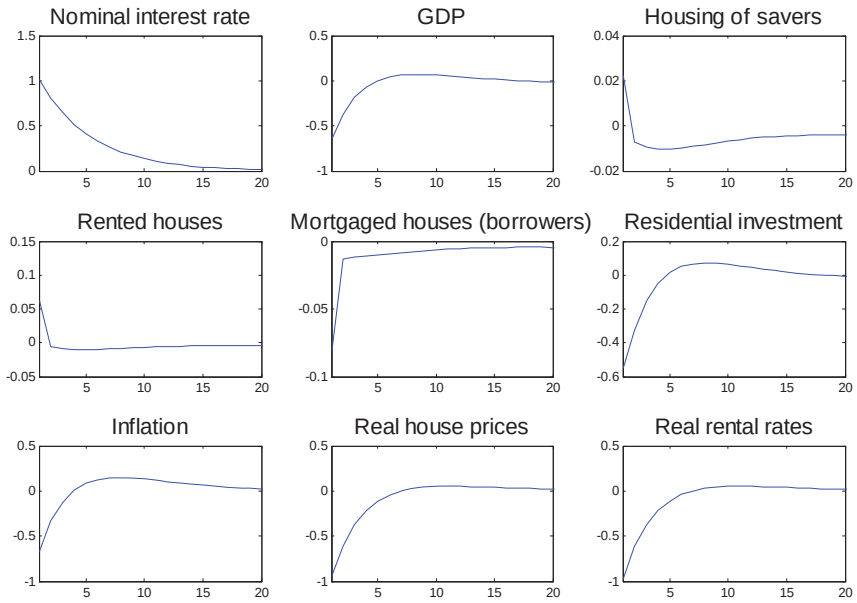
In this section we evaluate the effects that the different proposed measures, which are assumed to be permanent, have on the steady state of the model. We also analyze the transitional dynamics from the initial to the new steady state, so as to assess the economy's short- and medium-run response. All measures aim at increasing the rental share and they manage to do so, but the impact they have on other variables may be different. The three measures that we consider are: removing the subsidy to house purchases, introducing a comparable subsidy to rentals, and improving the rental market efficiency.

[16] In Spain, there are subsidies to rentals but they are for specific groups (young people, low income...), rather than being generally applicable as in the case of the subsidy to house purchases.

[17] In figure 1, the nominal interest rate and inflation are shown in absolute deviations from steady state and in annualized terms; all other variables are shown in percentage deviation from steady state.

[18] This can be seen by writing equation (7) as $q_t^z A_z = q_t^h - \beta^s E_t \left(C_{At}^s / C_{At+1}^s\right)(1-\delta)\, q_{t+1}^h$.

Figure 1: Impulse responses to a nominal interest rate shock




## 4.1 Removing the subsidy to house purchases

The first exercise we perform is to evaluate the possible effects of removing a subsidy to house purchases in Spain. As we mentioned in the introduction, the Spanish government has removed the 15% income tax deduction for house purchases starting on January 1st, 2011[19]. In order to assess the long-run impact of this measure, we compute the steady state effects of setting $\tau_h$ to 0. The results for a number of key variables and ratios are displayed in the second column of Table 3.

[19] For the time being, this measure affects the central government part of the income tax for all citizens, while it applies to the local part of the tax only in some regions. Here we consider the hypothetical case in which all regions would supress the fiscal incentive to house purchases.

**Table 3. Steady state effects of alternative housing market measures**

| | $\tau_h = 0$ | $\tau_z = 0.15$ | $A_z = 2.9$ |
|---|---|---|---|
| GDP (%) | -0.1 | -0.2 | 0.1 |
| Employment (%) | -0.6 | -0.1 | 0.1 |
| Residential investment / GDP (pp) | -1.0 | 0.2 | -0.0 |
| Construction labor share (pp) | -0.9 | 0.2 | -0.0 |
| Real house prices (%) | -7.8 | 1.4 | -0.0 |
| Rental Share (pp) | 5.6 | 3.9 | 6.1 |
| Share of housing w/ mortgage (pp) | -5.5 | -2.4 | -6.1 |

This measure has relatively small effects on the overall economic activity, as measured by GDP (which falls by 0.1%) and employment (-0.6%). However, it implies a substantial reallocation of resources from the construction sector to the consumption goods sector, because now purchasing a house for own use is less attractive both for savers and borrowers. This can be seen in the share of residential investment in GDP, which goes down by 1 percentage point from its baseline of 7.3%. Similarly, the share of construction in total employment goes down by almost 1 percentage point. The fiscal loss reduces the asset value of houses as well. More importantly, this measure implies a sizeable reallocation of the available housing stock from the ownership to the rental segment of the market. In particular, the rental share in the housing market increases by 5.6 percentage points, from its baseline of 13.9% (see Table 2) to 19.5%. The flip-side of the coin is that borrowers reduce drastically their holdings of (mortgaged) houses, such that the share of mortgaged houses in the total housing stock falls by 5.5 percentage points. The effects of this measure on housing market quantities and prices is reinforced by the existence of collateral constraints on borrowers' access to credit. Indeed, the fall in real house prices reduces the collateral value of their real estate holdings, which tightens their borrowing constraint. This reduces further their house purchases, which feeds back into house prices, and so on.

It is important to take into account the other side of the fiscal subsidy removal: in terms of the government budget, the reduction in fiscal expenditures amounts to 0.9% of GDP. This sizeable improvement of public accounts allows the fiscal authority to reduce the wage income tax, $\tau_w$, by 1.1 percentage points, which softens the negative effects of the measure on economic activity.

Figure 2: Transitional dynamics, removal of subsidy to housing purchases.

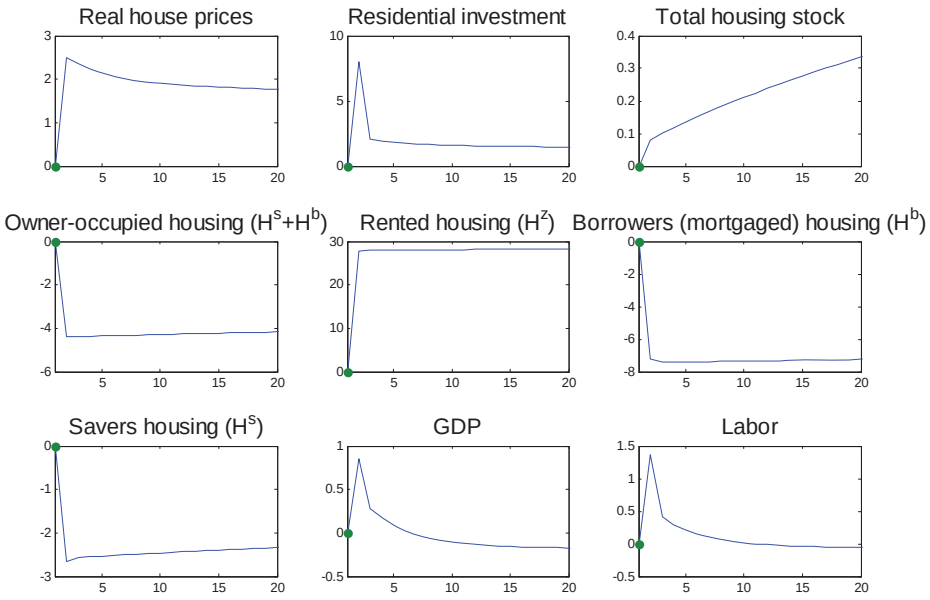

Figure 2 shows the transitional dynamics of going from the baseline steady state to the new one in which the subsidy has been removed.[20] The main message from the figure is that all variables tend to react sharply on impact, which reflects the forward-looking nature of most of them. The only exceptions are the total housing stock, which moves slowly with residential investment, and savers' stock of housing, which adjusts gradually. The latter contrasts with the sharp changes in borrowers' demand for housing of both types (rented and owner-occupied), which, as explained above, is directly related to the amplifying effect of collateral constraints. From the impact period onwards, all variables converge smoothly to their new steady state.

## 4.2 Introducing a subsidy to rentals

In this subsection we consider subsidizing rental payments. In particular, we introduce a subsidy to rentals of $\tau_z = 0.15$. The steady-state results are reported in the third column of Table 3. As it was the case with the elimination of the subsidy to house purchases, introducing a comparable subsidy to rentals has small negative effects on the overall economic activity (GDP and total employment). This is because of the opposite effects this measure has on public finances relative to the removal of the subsidy to house purchases. In this case, in order to finance the new subsidy (which amounts to 0.4% of

[20] All variables in figures 2, 3, and 4 are expressed in percentage deviations from the baseline steady state.

Figure 3: Transitional dynamics, introduction of subsidy to rentals




GDP in the terminal steady state), the government must raise the wage income tax rate by about 0.5 percentage points, with the resulting negative effects on labor supply. Contrary to the previous case, too, the rental subsidy actually increases the size of the construction sector, although the effects are rather small: the share of construction in GDP and employment both increase by 0.2 percentage points. Similarly, real house prices increase slightly, by 1.4%. The main effect, by far, is the reallocation of the housing stock from the ownership to the rental segment of the market, as borrowers now see renting as a more attractive option relative to buying a house. Indeed, the rental share increases by almost 4 percentage points, whereas the share of mortgaged houses falls by 2.4 percentage points.

Figure 3 shows the transitional dynamics to the new steady state. Once again, we mostly observe sharp reactions on impact, and gradual adjustments afterwards. As in the case of removing the subsidy to house purchases, the largest effects take place on borrowers' demand for rented and owner-occupied (mortgaged) houses. However, whereas in the previous case this was mainly due to the amplifying effect of collateral constraints, now it is mainly due to the fact that only borrowers benefit from the introduction of the rental subsidy. As renting becomes relatively cheaper, they substitute away from home ownership and into the rental segment.

### 4.3 Improving the efficiency of the rental market

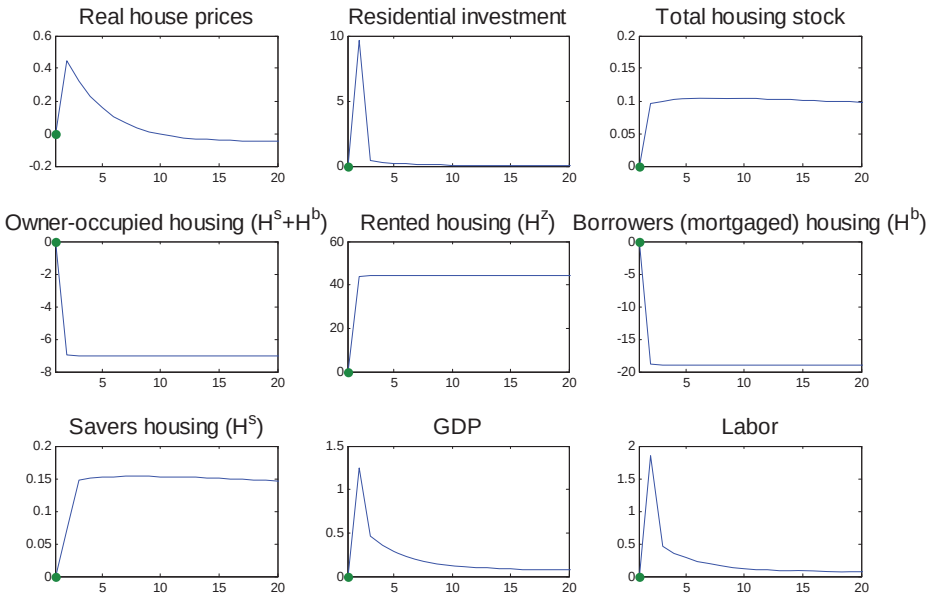
As stated in the introduction, it is a goal of the Spanish government to increase the rental share to levels closer to the rest of the EMU countries. One of the measures that have been taken in order to achieve this aim is to improve the ability of the legal framework to enforce rental contracts. Another one is to promote rental contracts by providing public guarantees through public rental agencies. In our model, we proxy such measures as an increase in the efficiency in the production of rental services, captured by the parameter $A_z$. We then find the value of $A_z$ that delivers a rental share of 20% (as a reasonable target) in the new steady state. The required value of $A_z$ rises from its baseline value of 1.621 to 2.885.

The last column of Table 3 reports the steady state effects of this measure. As it can be seen, the effects are quite similar to those of introducing a rental subsidy, in the sense that the overall economic activity is not affected much and the largest effect is in the reallocation of the housing stock from the ownership to the rental segment.

Contrary to introducing a rental subsidy, the effects of this policy on GDP and employment are actually positive (albeit small). The reason is that this measure does not have a direct impact on public finances; it does not require raising distortionary taxes to finance a subsidy, as it was the case for the previous exercise. Instead, the fall in rental rates allows borrowers to consume more goods, with the resulting positive effects on the overall economic activity. In any case, the reallocation from ownership to rental is the only noticeable effect, because the weight of construction in the economy and real house prices are virtually unaffected. The increase in the rental share is larger (6.1 pp) than for the other measures, although this is by construction, given that we are targeting a rental share of 20%. The fall in the share of mortgaged housing is also larger. As the supply of rental services expands, the housing rent-to-price ratio falls, from its baseline value of 1.2% to 0.7%. Renting becomes relatively cheaper for borrowers, who thus substitute away from house purchases and into renting.

Figure 4 displays the transitional dynamics following the increase in $A_z$. Overall, the short run effects are similar to those of introducing a rental subsidy (see Figure 3). However, the effects tend to be more transitory, especially in the case of real house prices and residential investment. Once again, the sharper changes take place in borrowers' demand for housing of either type, with the fall in the rent-to-price ratio producing a drastic substitution effect from home ownership to renting.

Figure 4: Transitional dynamics, increase in efficiency in production of rental services




# 5 Welfare analysis

We have seen in the previous section that the three measures considered have similar implications in terms of increasing the rental share in the economy. However, they could have different implications for consumer's welfare. In this section, we numerically evaluate the effects of the three policy measures both on aggregate welfare and on the welfare of each household type. It is important to note that there are other relevant dimensions that are not being considered in this analysis. The welfare approximation is only taking into account changes in consumption, housing and labor derived from the policy measure, given the utility function of the model. We are not considering, for example, the fact that increasing the rental share would *per se* have implications on labor mobility and that would be welfare enhancing.[21] Redistributive or composition effects would be another issue which is missing in the model. For instance, while the subsidy is financed by the government, and hence by the taxes paid by all households, the owners of land benefit from it because a first-order effect of this deduction is a parallel rise in housing prices. Similarly, our framework ignores positive long-run effects coming from the reallocation of resources from construction towards other activities with a stronger potential for productivity growth. Finally, one may think that removing the subsidy would make housing bubbles less likely, and this, in turn, would be

[21] See Barceló (2006) for an empirical paper on this issue.

welfare improving. However, bubbles are not considered in the model.

With these caveats, the welfare analysis performed here will be based on the individual welfare for savers and borrowers, respectively, which is defined as follows,

$$W_t^s \equiv E_t \sum_{k=0}^{\infty} (\beta^s)^k \left( \log C_{t+k}^s + \vartheta \log H_{t+k}^s - \frac{\left(L_{t+k}^s\right)^{1+\eta}}{1+\eta} \right), \tag{26}$$

$$W_t^b \equiv E_t \sum_{k=0}^{\infty} \left(\beta^b\right)^k \left( \log C_{t+k}^b + \vartheta \log \tilde{H}_{t+k}^b - \frac{\left(L_{t+k}^b\right)^{1+\eta}}{1+\eta} \right), \tag{27}$$

Following Mendicino and Pescatori (2007), we define social welfare as a weighted sum of the individual welfare for the different types of households,

$$W_t = (1-\beta^s) W_t^s + \left(1-\beta^b\right) W_t^b. \tag{28}$$

Borrowers and savers' welfare are weighted by $\left(1-\beta^b\right)$ and $(1-\beta^s)$ respectively, so that the two groups receive the same level of utility from a constant consumption stream. We will focus on the steady state effects of each policy measure.[22] Denoting by $dW = (1-\beta^s)\, dW^s + \left(1-\beta^b\right) dW^b$ the change in aggregate welfare from the baseline to the new steady state, the latter can be expressed in terms of aggregate steady-state consumption as

$$\frac{dW}{C^s + C^b} = \frac{C^s}{C^s + C^b} \frac{(1-\beta^s)\, dW^s}{C^s} + \frac{C^b}{C^s + C^b} \frac{\left(1-\beta^b\right) dW^b}{C^b}.$$

Therefore, aggregate welfare gains/losses equal the weighted average of welfare gains/losses across household types (normalized by their own steady-state consumption), with weights given by each type's share of aggregate consumption in the baseline steady state, $C^i / \left(C^s + C^b\right)$ for $i = s, b$.[23] Table 4 displays the steady state effects of each policy measure on (normalized) aggregate welfare, $dW / \left(C^s + C^b\right)$, on each household type's (normalized) welfare, $\{\left(1-\beta^i\right) dW^i / C^i\}_{i=s,b}$, and on the three components of each type's utility function: consumption, housing services and labor.

[22] We focus on steady state values, as opposed to unconditional means, in order to make the results independent from the calibration of shock parameters. Results for mean welfare values are very similar however, and they are available upon request.

[23] Under our baseline calibration, steady-state consumption shares are given by $C^s / \left(C^s + C^b\right) = 0.5 = 1 - C^b / \left(C^s + C^b\right)$.

### 5.1 Eliminating the subsidy to house purchases

The second column of Table 4 shows the long-run welfare effects of removing the subsidy to house purchases. This measure decreases welfare for both groups and, consequently, for the entire household sector. This is mainly due to the reduction in the flow of housing services enjoyed by both groups, a direct consequence of the subsidy removal. Notice that both household types are actually able to consume more. The elimination of the subsidy makes agents substitute from housing to consumption because now, in relative terms, housing is more expensive. For borrowers, the decrease in housing demand and the increase in consumption are both reinforced by collateral constraints. First, the fall in real house prices due to this measure reduces the collateral value of their houses, hence further reducing their demand for owner-occupied houses. Second, the same tightening in the collateral constraint also reduces borrowers' indebtedness and hence their interest rate payments every period, which allows them to devote more resources to consumption demand. This result relates to Campbell and Hercowitz (2009) and Rubio (2009b), who find that increasing loan to value ratios, although they relax the collateral constraint, can have a negative effect on welfare. Borrowers increase their debt up to a point in which their high flow of repayments end up depressing their consumption. The argument here is analogous, removing the subsidy lowers the burden of repayments. Finally, the welfare loss is greater for savers because their labor effort increases whereas that of borrowers falls. There are two opposing effects on labor supply following the subsidy removal. On the one hand, the fall in construction wages and the increase in consumption both push towards reducing labor supply (i.e. we have negative substitution and wealth effects, respectively).[24] On the other hand, the reduction in wage income taxes stimulates labor supply. The change in after-tax wages is the same for both household types. However, the consumption increase (and hence the negative wealth effect) is slightly smaller for savers; this, together with the high elasticity of labor supply assumed in our baseline calibration, is enough to make the tax effect dominate in the case of savers and viceversa for borrowers.

[24] Steady state wages in the consumption goods sector are equal to the inverse price mark-up, $(\varepsilon_p - 1)/\varepsilon_p$ (see equations 21 and 22), and are therefore unaffected by fiscal changes.

**Table 4. Steady state effects on welfare and its components**

| | $\tau_h = 0$ | $\tau_z = 0.15$ | $A_z = 2.9$ |
|---|---|---|---|
| Aggregate welfare | -0.74 | 0.11 | 1.55 |
| Savers' welfare | -1.45 | 0.04 | 0.35 |
| $C^s$ | 0.312 | -0.22 | 0.05 |
| $H^s$ | -7.40 | -1.66 | 0.10 |
| $L^s$ | 0.93 | -0.73 | -0.40 |
| Borrowers' welfare | -0.03 | 0.18 | 2.75 |
| $C^b$ | 0.314 | -0.22 | 0.05 |
| $\tilde{H}^b$ | -8.65 | 3.60 | 23.75 |
| $L^b$ | -0.85 | 0.10 | 0.37 |

Note: welfare gains/losses are expressed as a % of steady state consumption; all other variables as % deviations from steady state.

### 5.2 Introducing a subsidy to rent payments

The third column of Table 4 shows the steady state welfare effects of introducing a subsidy to rentals. We see that in this case, welfare for both agents increases, especially for borrowers, and thus total welfare goes up. Borrowers increase their total demand for housing services, which indicates that their increased demand for rental services dominates their reduced demand for owner-occupied housing. In order to meet this demand, savers increase the number of houses they devote to renting. This is made at the expense of lower owner-occupied housing for savers, which is the type of housing that affects their welfare. Consumption falls for both agents because now more resources are devoted to housing demand. Again, we have that the fiscal measure has opposite effects on each household type's labor effort, due to the fact that the consumption fall (i.e. the positive wealth effect on labor supply) is again weaker for savers. As a result, the negative effect on labor supply stemming from the increase in wage income taxes (required in order to finance the new subsidy) dominates in the case of savers, and viceversa for borrowers. In the aggregate, this measure is welfare increasing, contrary to the removal of the subsidy to house purchases.

### 5.3 Improving rental market efficiency

Finally, the last column of Table 4 reports the welfare effects of increasing the efficiency in the rental market. In this case, this measure expands the supply of rental services without the need of any distortionary subsidies, and as a result welfare unambiguously increases for both groups. The housing component for borrowers increases very much, mainly due to the increase in rentals. Savers also benefit from that because they are the owners of rented houses. In this case, since it is more efficient to produce housing services, savers do not need to sacrifice owner-occupied housing in order to meet the increase in rental demand and their housing component in utility also increases, as opposed to the previous measure. As a consequence, total welfare increases.

## 6 Concluding remarks

In this paper, we have built a small open economy DSGE model with housing and collateral constraints, focusing on the differences and the interactions between the ownership and the rental segments of the housing market. We have calibrated the model for Spain and have explored the effects of different policy measures aimed at homogenizing the fiscal treatment of both segments of the housing market and improving the efficiency of the rental market.

In particular we analyze the removal of the existing subsidy to house purchases in Spain, the introduction of a comparable subsidy to rent payments, and an increase in the efficiency in the production of housing rental services. All three measures produce noticeable increases in the rental share, but have different implications for the other macroeconomic variables and for a model-based measure of welfare. Results show that removing the subsidy to house purchases downsizes the housing sector. On the contrary, subsidizing rentals increases slightly the share of construction in the economy, whereas the efficiency improvement in the rental market has virtually no macroeconomic effects. The impact on public finances are also very different, since removing a subsidy has opposite effects to introducing one in terms of the taxes which can be reduced or need to be levied in order to finance each policy. The latter is an important mechanism, which ends up making aggregate activity fall by less when removing the house purchases rebate than when introducing a rental subsidy. However, in terms of the utility-based measure of welfare, we find, on the one hand, that introducing a subsidy to rentals and improving the rental market efficiency are welfare enhancing. On the other hand, removing the subsidy to house purchases decreases welfare, due to a large extent to the presence of collateral constraints.

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# Appendix

## Tables

**Table 5. Steady state effects of policy measures for different values of $\varepsilon_h$**

| | $\varepsilon_h = 1.5$ | | | $\varepsilon_h = 2$ | | | $\varepsilon_h = 2.5$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | $\tau_h = 0$ | $\tau_z = .15$ | $A_z = 2.9$ | $\tau_h = 0$ | $\tau_z = .15$ | $A_z = 2.9$ | $\tau_h = 0$ | $\tau_z = .15$ | $A_z = 2.9$ |
| $H_z/H$ (pp) | 3.6 | 2.6 | 2.7 | 5.6 | 3.9 | 6.1 | 7.7 | 5.2 | 9.7 |
| $H_b/H$ (pp) | -4.1 | -1.4 | -2.7 | -5.5 | -2.4 | -6.1 | -7.0 | -3.5 | -9.7 |
| $q^h$ (%) | -8.2 | 1.1 | -0.0 | -7.8 | 1.4 | -0.0 | -7.2 | 1.6 | -0.0 |
| $q^h IH/GDP$ (pp) | -1.0 | 0.1 | -0.0 | -1.0 | 0.2 | -0.0 | -0.9 | 0.2 | -0.0 |
| $W$ (%) | -0.75 | 0.09 | 1.19 | -0.74 | 0.11 | 1.55 | -0.72 | 0.12 | 1.93 |

**Table 6. Steady state effects of policy measures for different values of $m$**

| | $m = 0.60$ | | | $m = 0.70$ | | | $m = 0.80$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | $\tau_h = 0$ | $\tau_z = .15$ | $A_z = 2.9$ | $\tau_h = 0$ | $\tau_z = .15$ | $A_z = 2.9$ | $\tau_h = 0$ | $\tau_z = .15$ | $A_z = 2.9$ |
| $H_z/H$ (pp) | 5.4 | 4.1 | 6.3 | 5.6 | 3.9 | 6.1 | 5.6 | 3.6 | 5.8 |
| $H_b/H$ (pp) | -4.7 | -2.4 | -6.0 | -5.5 | -2.4 | -6.1 | -6.4 | -2.4 | -6.1 |
| $q^h$ (%) | -7.1 | 1.5 | 0.2 | -7.8 | 1.4 | -0.0 | -8.5 | 1.1 | -0.3 |
| $q^h IH/GDP$ (pp) | -0.9 | 0.2 | 0.0 | -1.0 | 0.2 | -0.0 | -1.1 | 0.1 | -0.0 |
| $W$ (%) | -0.75 | 0.09 | 1.57 | -0.74 | 0.11 | 1.55 | -0.71 | 0.12 | 1.51 |

## Model Summary

$$L_t^s = \left[\omega_l^{1/\varepsilon_l} \left(L_{ct}^s\right)^{(1+\varepsilon_l)/\varepsilon_l} + (1-\omega_l)^{1/\varepsilon_l} \left(L_{ht}^s\right)^{(1+\varepsilon_l)/\varepsilon_l}\right]^{\varepsilon_l/(1+\varepsilon_l)}. \tag{29}$$

$$\frac{C_{At}^s}{C_{Bt}^s} = \frac{\xi}{1-\xi} p_{Bt}, \tag{30}$$

$$\frac{\vartheta}{H_t^s} = (1-\tau_h)\left(\frac{q_t^h}{C_{At}^s/\xi} - \beta^s E_t \frac{q_{t+1}^h (1-\delta)}{C_{At+1}^s/\xi}\right), \tag{31}$$

$$\frac{1}{C_{At}^s} = \beta^s E_t \frac{1}{C_{At+1}^s} \frac{R_{At}}{\Pi_{At+1}}, \tag{32}$$

$$R_{At} = R_t e^{\psi(-d_t)/Y_t}, \tag{33}$$

$$(1-\tau_{wt})\frac{w_{ct}}{C^s_{At}/\xi} = (L^s_t)^{\eta}\,\omega_l^{1/\varepsilon_l}\left(\frac{L^s_{ct}}{L^s_t}\right)^{1/\varepsilon_l}, \tag{34}$$

$$(1-\tau_{wt})\frac{w_{ht}}{C^s_{At}/\xi} = (L^s_t)^{\eta}\,(1-\omega_l)^{1/\varepsilon_l}\left(\frac{L^s_{ht}}{L^s_t}\right)^{1/\varepsilon_l}, \tag{35}$$

$$\frac{q^h_t}{C^s_{At}} = \frac{q^z_t A_z}{C^s_{At}} + \beta^s E_t \frac{(1-\delta)\,q^h_{t+1}}{C^s_{At+1}}, \tag{36}$$

$$L^b_t = \left[\omega_l^{1/\varepsilon_l}\left(L^b_{ct}\right)^{(1+\varepsilon_l)/\varepsilon_l} + (1-\omega_l)^{1/\varepsilon_l}\left(L^b_{ht}\right)^{(1+\varepsilon_l)/\varepsilon_l}\right]^{\varepsilon_l/(1+\varepsilon_l)}, \tag{37}$$

$$\tilde{H}^b_t = \left[\omega_h^{1/\varepsilon_h}\left(H^b_t\right)^{(\varepsilon_h-1)/\varepsilon_h} + (1-\omega_h)^{1/\varepsilon_h}\left(A_z H^z_t\right)^{(\varepsilon_h-1)/\varepsilon_h}\right]^{\varepsilon_h/(\varepsilon_h-1)}, \tag{38}$$

$$\begin{aligned} &C^b_{At} + p_{Bt}C^b_{Bt} + q^h_t(1-\tau_h)\left[H^b_t - (1-\delta)\,H^b_{t-1}\right] + (1-\tau_z)\,q^z_t A_z H^z_t + \frac{R_{At-1}b_{t-1}}{\Pi_{At}} \\ &\quad = (1-\tau_{wt})\left(w_{ct}L^b_{ct} + w_{ht}L^b_{ht}\right) + b_t. \end{aligned} \tag{39}$$

$$b_t = \frac{m}{R_{At}} E_t \Pi_{At+1} q^h_{t+1} H^b_t. \tag{40}$$

$$\frac{C^b_{At}}{C^b_{Bt}} = \frac{\xi}{1-\xi} p_{Bt}, \tag{41}$$

$$\frac{\xi}{C^b_{At}} = \beta^b E_t \frac{\xi}{C^b_{At+1}} \frac{R_{At}}{\Pi_{At+1}} + \lambda_t \tag{42}$$

$$(1-\tau_{wt})\frac{w_{ct}}{C^b_{At}/\xi} = \left(L^b_t\right)^{\eta}\left(\frac{\omega_l L^b_{ct}}{L^b_t}\right)^{1/\varepsilon_l}, \tag{43}$$

$$(1-\tau_{wt})\frac{w_{ht}}{C^b_{At}/\xi} = \left(L^b_t\right)^{\eta}\left(\frac{(1-\omega_l)\,L^b_{ht}}{L^b_t}\right)^{1/\varepsilon_l}, \tag{44}$$

$$\frac{\vartheta}{\tilde{H}^b_t}\left(\frac{\omega_h \tilde{H}^b_t}{H^b_t}\right)^{1/\varepsilon_h} = (1-\tau_h)\left(\frac{q^h_t}{C^b_{At}/\xi} - \beta^b E_t \frac{q^h_{t+1}(1-\delta)}{C^b_{At+1}/\xi}\right) - \lambda_t m E_t q^h_{t+1}\frac{\Pi_{At+1}}{R_{At}}, \tag{45}$$

$$\frac{\vartheta}{\tilde{H}^b_t}\left(\frac{(1-\omega_h)\,\tilde{H}^b_t}{A_z H^z_t}\right)^{1/\varepsilon_h} = (1-\tau_z)\frac{q^z_t}{C^b_{At}/\xi}, \tag{46}$$

$$Y_t = L^s_{ct} + L^b_{ct}, \tag{47}$$

$$IH_t = L^s_{ht} + L^b_{ht}, \tag{48}$$

$$w_{ct} = p^I_t, \tag{49}$$

$$w_{ht} = q_t^h, \tag{50}$$

$$\log \Pi_{At} = \beta^s \log \Pi_{At+1} + \frac{(1-\theta)(1-\theta\beta^s)}{\theta} \log\left(p_t^I \frac{\varepsilon_p}{\varepsilon_p - 1}\right) + \log u_t, \tag{51}$$

$$IH_t = H_t^s - (1-\delta) H_{t-1}^s + H_t^z - (1-\delta) H_{t-1}^z + H_t^b - (1-\delta) H_{t-1}^b. \tag{52}$$

$$\tau_{wt}\left[w_{ct}\left(L_{ct}^s + L_{ct}^b\right) + w_{ht}\left(L_{ht}^s + L_{ht}^b\right)\right] = \tau_z q_t^z \left(A_z H_t^z\right) + \tau_h q_t^h \left[H_t^s - (1-\delta) H_{t-1}^s + H_t^b - (1-\delta) H_{t-1}^b\right], \tag{53}$$

$$Y_t = C_{At}^s + C_{At}^b + \xi^* p_{Bt} c_t^*, \tag{54}$$

$$d_t = \frac{R_{t-1} e^{\psi(-d_{t-1})/Y_{t-1}}}{\Pi_{At}} d_{t-1} + Y_t - C_{At}^s - C_{At}^b - p_{Bt}\left(C_{Bt}^s + C_{Bt}^b\right). \tag{55}$$

$$p_{Bt} = \frac{\Pi_{Bt}}{\Pi_{At}} p_{B,t-1}, \tag{56}$$

$$R_t = (1/\beta)^{1-\phi_R} R_{t-1}^{\phi_R} \Pi_{Bt}^{(1+\phi_\Pi)(1-\phi_R)} \exp\left(e_{R,t}\right), \tag{57}$$

$$\Pi_{Bt} = \left(\Pi_{B,t-1}\right)^{\rho_\Pi} \exp\left(e_{\Pi,t}\right), \tag{58}$$

$$c_t^* = \left(c_{t-1}^*\right)^{\rho_*} \exp\left(e_{*,t}\right). \tag{59}$$

We thus have 31 equations for 31 variables: $\left\{L_t^j, L_{ct}^j, L_{ht}^j, C_{At}^j, C_{Bt}^j, H_t^j\right\}_{j=s,b}$, $H_t^z$, $\tilde{H}_t^b$, $b_t$, $Y_t$, $IH_t$, $w_{ct}$, $w_{ht}$, $q_t^h$, $q_t^z$, $p_t^I$, $p_{Bt}$, $R_{At}, R_t, \Pi_{At}$, $\lambda_t$, $d_t$, $\tau_{w,t}$, $\Pi_{Bt}$, $c_t^*$.

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