An Iberian Disease?

On current account imbalances within a monetary union

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Abstract

During the process of accession to the Eurozone, some member countries experienced a rapid increase in credit availability fueled by the fast convergence of interest rates. This was accompanied by large current account deficits and booms in the housing sector. This paper argues that these features are intimately related to the fast expansion of the household credit market, namely the financing of housing purchases. A model is presented of a small open economy where the fall of interest rates is associated with an increase in the collateral value of housing, which in turn shifts production towards the housing sector. This also impacts on competitiveness, leading to a deterioration of the trade balance. Similar effects may also imply an asymmetry across member countries in the transmission of monetary policy, depending on how important collateral constraints are in each country.

Keywords: DSGE Models, Monetary Union, Current Account, Collateral Constraints, Housing

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1 Introduction

Before the introduction of the Euro on January 1999, most of the discussion regarding accession to the monetary union focused on the degree of economic integration. The question whether business cycles were comoving sufficiently for a common monetary policy to be effective was dominant. However, another important question is that the difference between financial development among Eurozone members can also have a significant impact on the transmission of monetary policy. Changes in interest rates may lead to different effects on GDP, consumption and even on the current account. Moreover, entering a monetary union may also lead to important adjustments when it implies a fast convergence of interest rates, as observed in some countries. This paper attempts to address this issue, by focusing on the mortgage credit channel.

In this channel, housing can play an important role in the dynamics of the economy, as the model presented will try to illustrate later. The main mechanism is that access to cheaper credit in a collaterally constrained economy increases the collateral value of housing. This may increase the relative price of housing, thus also increasing the share of residential investment. In an effect not unlike the classic Dutch Disease, the increase in demand for labour in the non-tradable housing sector may lead to wage increases and a loss of competitiveness in the tradable sector. If this channel is important, then this could lead to increased household indebtedness levels, accompanied by a housing boom and a deterioration of the trade balance.

Although the deterioration of the current account is not necessarily problematic in itself, it might lead to external fragility. In a globally adverse financial climate, such countries might find it harder to convince foreign investors that the country is financially sound. Moreover, the decrease in competitiveness, accompanied by housing sector growth, may lead to a crowding out of other sectors where real productivity growth is higher. This could imply that the initial growth, spurred by an expansion of credit, is followed by a slowdown as the economy adjusts its sectoral composition. Such potential negative consequences of joining a financially developed monetary union form what is alluded to in the title as an Iberian Disease. However, the paper presented here will stop short of affirming the presence of such a disease, but it will open the door by simply illustrating the expected dynamics of a small open economy featuring collateral constraints within a monetary union.

It is then crucial that collateral constraints on housing are important for household behaviour. On the relationship between consumption and housing wealth there
is some mixed evidence but there are a number of papers documenting that housing wealth effects are larger than equity wealth ones. For example, Case et al. (2005), using both a panel of developed countries and a panel of states within the US, find a highly statistically significant marginal propensity to consume out of housing wealth (around 3.5% for the US) and a non-significant one for out of stock wealth. Using aggregate US data, Carroll et al. (2006) also estimate that the marginal propensity to consume out of housing wealth is more than double (9.1%) that out of stock wealth (4.1%) in the long-run. A caveat would be that if the level of wealth is on average lower for households which have most of their wealth in the form of housing, then one would also expect them to have a higher marginal propensity simply because of their lower level of wealth. Interestingly, Disney et al. (2002) estimate that the marginal propensity to consume out of housing wealth is 4 times higher for home-owners with negative equity (and can be as high as 40%), relative to those with a positive one. Campbell and Cocco (2007) also document that predictable house price changes have an important effect on consumption (with an estimated elasticity of roughly 1.6). This effect also seems to be weaker for households with unused borrowing capacity. Although the empirical debate is not yet settled, there seems to be enough evidence to warrant investigating the macroeconomic effects of the presence of collaterally constrained households.

In line with previous work like Erceg and Levin (2006) the model studied here features a durable and non-durable good. In their paper, the authors study monetary policy in a closed economy sticky-price model without a borrowing constraint. In this model the transmission of monetary policy shocks is affected largely by the asymmetry of price stickiness in each sector, as shown by Barsky et al. (2007). This helps in replicating the fact that sensitivity of durable spending to monetary shocks is larger than non-durable spending. However, Monacelli (2009) shows that the presence of collateral constraints on borrowing by households can provide the same type of effects on durable spending even without any stickiness in the sector. Moreover, the model in Monacelli (2009) also has the advantage of generating positive comovement of durable and non-durable spending, something which the other models could not replicate. The paper by Pariès and Notarpietro (2008) describes an open economy two-country model which again highlights the importance of the collateral effects but monetary policy has virtually no impact on current accounts as most of the borrowing occurs between domestic agents. The model of the present paper then aims to extend this analysis to a small open economy environment, where international borrowing features more prominently. This extension seems particularly relevant in the context of a monetary union, as accession has been typically associated with
important inflows of credit in small converging countries.

The presence of collateral constraints can generate interesting movements in the sectoral composition of the economy associated with such credit inflows. Since the housing good can be used as collateral, changes in interest rates also affect the collateral value of housing. This affects the agent’s intratemporal choice between housing and consumption and so a fall in interest rates can tilt demand proportionally more towards the housing good. By increasing available collateral, domestic agents can borrow more and so demand more of both goods. This leads to pressure on wages and a deterioration of competitiveness and the trade balance.

So why focus on small open economies? Since small open economies are interest rate takers, it then is possible that current account imbalances are more common and persistent. This also seems particularly adequate for the typical non-core countries, such as Greece, Portugal, or even Spain\footnote{Despite being a less clear cut case, it is still arguably an interest rate taker within the EU.}, as all featured large interest rate falls and worsening current accounts in the run-up to the Euro. Moreover, idiosyncratic shocks in these countries are unlikely to have any significant impact on the decisions of the European Central Bank. Regarding the newer entrants, a similar pattern can be seen with Slovenia, Slovakia and Cyprus with current accounts deteriorating progressively in recent years, up until the current crisis.

Of course, accession to a monetary union is a complex process, so one should not overstate the importance of this particular channel. The impact of joining a Monetary Union is likely to impact the economy in different ways than the one discussed here. Still, this paper will argue that the observed regularity makes intuitive and theoretical sense and will try to identify factors that determine its importance.

2 Empirical Evidence

The process of convergence that began a few years before the Eurozone features some interesting dynamics across Eurozone member countries. In some of these countries the process of convergence led to a fast drop in market interest rates on housing loans to households, which can be seen in Figure 1.

The convergence process for Portugal and Spain is quite stark, as its market interest rates were cut in half in a period of roughly 4 years and then remained at
levels prevalent in financially more advanced European economies. Figure 1 highlights the comparison with Austria, as it is an example of a richer small open economy within the monetary union. In these countries, including Austria, market rates track Euribor\(^2\) movements quite closely. Although this is a by-product of mortgage contracts being mostly variable in these countries, it is nevertheless interesting to note how close they seem to track each other during the whole period after the introduction of the Euro, particularly in the case of Portugal and Spain. This could be an indication of an important degree of exogeneity in interest rate movements for these economies.

![Figure 1: Market interest rates on housing loans to households](image)

This fast fall in interest rates was accompanied by interesting current account dynamics. As can be seen in Figure 2, Portugal, Ireland and Spain all featured widening current account deficits during this period, while other small open economies like Finland, the Netherlands and Austria did not. This difference in behaviour might be partially explained by the collateral channel described above. If collateral constraints play an important role in countries like Portugal, Ireland and Spain, then one might expect that such a fall in interest rates could be accompanied by an expansion of the

\(^2\)For Euribor data before 1999, the European Central Bank provides synthetic Euro Area rates calculated on the basis of national rates weighted by GDP.
housing sector and increased international borrowing.

![Figure 2: Current account balances as a percentage of GDP](image)

Moving to more formal approaches, there are already several papers regarding the empirical evidence on the links between housing and business cycles. Using a purely empirical approach, Leamer (2007) suggests that housing consistently leads the business cycle and that weakness in housing is an important part of US recessions. On the side of the spectrum of empirical strategies that is closer to economic theory, Iacoviello and Neri (2008) estimate the parameters in a two-sector dynamic stochastic general equilibrium model of the US, which includes collaterally constrained households. These authors find evidence of significant spillovers from the housing market to the rest of the economy and document a tighter link with consumption than investment. Moreover, the importance of this channel seems to have grown over time and in the model is related to increased availability of credit to constrained agents.

The paper by Jarocinski and Smets (2008) finds similar evidence, in the sense
that low interest rates contribute to housing booms. However, it also provides evidence that the collateral channel may only explain partially the developments in the housing market. This seems compatible with the dynamics of the collateral channel turning into a potential housing bubble when interest rates are kept low for extended periods. Nevertheless, it is not an objective of the present paper to deal with such bubbles. The theoretical model will then abstract from them and focus on understanding the mechanism of the collateral channel. Interestingly, Jarocinski and Smets (2008) also find that when housing is included in the empirical specification, monetary policy shocks seem to have muted effects on output and CPI inflation. A possible explanation comes from Calza et al. (2009), who report that the transmission of monetary policy may depend crucially on the characteristics of housing finance. They provide evidence that countries where interest rates in mortgage contracts are predominantly fixed, like the United States, tend to have muted responses to monetary policy. They also report that countries with typically lower loan-to-value ratios tend to have sharper responses on impact, albeit less persistent ones.

2.1 Data and Methodology

The data used in this section was collected from OECD and Eurostat. The main macro variables used were real GDP, construction value added (from the real GDP decomposition by NACE branch), net exports (external balance of goods and services), real consumption, the average interest rate of housing loans to households, consumer price inflation index (HICP) and a housing price index (HICP-04). In the figures of this section these variables were labeled as (resp.): Output, Housing, Trade balance, Consumption, Interest Rate, CPI and House Prices. Aside from these main variables of interest, unit labour indices, consumer price inflation index excluding housing (HICP-XHOUSING), the EONIA money markets rate and a commodity price index were included as additional controls. Data was collected for Portugal, Spain and the Euro-Area for a period ranging from 1996Q01 to 2008Q04.

The estimation technique follows the work of Banbura, Giannone and Reichlin (2008) and uses Bayesian shrinkage. This allows for using a relatively large set of information while still using shrinkage to control for over-fitting. As De Mol, Giannone and Reichlin (2008) have shown, this technique can control for over-fitting without jettisoning relevant sample information, by exploiting the strong collinearity of typical macroeconomic time series at business cycle frequencies. Each country’s

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3They consider mortgage contracts where interest rates are fixed for more than five years and report that in the US these contracts are roughly 85% of all mortgage contracts.
impulse response functions can then be analyzed using a larger range of controls
within the Bayesian VAR framework, overcoming the curse of dimensionality. Im-
pulse response functions for individual countries are then estimated in a model that
includes the same variables of interest for the Euro-Area, a Eurozone average of in-
terbank overnight rates (EONIA) and a commodity price index, which is also added
as a control to capture forward-looking effects on prices, as described in Christiano,

The reduced form model estimated is then a simple VAR(1):

$$Y_t = c + A Y_{t-1} + u$$

where $u$ is a vector of Gaussian white noise with covariance matrix $E(u_t u'_t) = \Sigma$. $c$
is a vector of constants and $A$ the autoregressive matrix. An inverted Wishart prior
is used as it can be set to retain the properties of the Litterman prior, but avoids
the issue of having a fixed and diagonal covariance matrix. To avoid overfitting, the
shrinkage hyperparameter is set such that the fit is equal to that of an autoregressive
model using only real GDP, real interest rates and the Consumer Price Index.

Dummy observations are used for implementation as in the papers described
above. In order to match the Minnesota moments, these are of the following form:

$$Y_d = \begin{pmatrix}
\text{diag}(\delta_1 \sigma_1, \ldots, \delta_n \sigma_n)/\lambda \\
\text{diag}(\sigma_1, \ldots, \sigma_n) \\
\hdots \\
0_{1 \times n}
\end{pmatrix}$$

$$X_d = \begin{pmatrix}
\text{diag}(\sigma_1, \ldots, \sigma_n)/\lambda & 0_{n \times 1} \\
\hdots & \hdots \\
0_{n \times n} & 0_{n \times 1} \\
\hdots & \hdots \\
0_{1 \times n} & \epsilon
\end{pmatrix}$$

where each scale parameter $\sigma_i$ equals the variance of a residual from a univariate
autoregressive model for each variable $i$. $\lambda$ is the hyperparameter discussed above
and $\epsilon$ is a very small number to reflect an uninformative prior for the intercepts. The
indicator variables $\delta_i$ take the value 1 if variable $i$ is non-stationary (random walk
prior) or 0 if it is stationary (white noise prior).

For the impulse response functions, a recursive scheme for identification is used
and real variables are considered to be slow-moving variables and financial variables
fast-moving, in the sense that the latter respond contemporaneously to an interest
rate innovation but the former do not.
2.2 Estimation results

The estimated impulse response functions for Portugal and the Euro-Area can be seen in figures 3 and 4, with the bands showing the confidence intervals for one standard error deviation. As can be seen in Figure 3, in Portugal the housing sector seems to respond relatively more than the consumption one and thus increases its relative weight in GDP. Interestingly, as in Jarocinski and Smets (2008), the impact on output is relatively small and the one on prices is negligible. There also seems to be a positive effect on the trade balance, which will be discussed later.

![Figure 3: Empirical IRF for an interest rate innovation - Portugal](image)

Figure 4 tells a different story. Unlike the impulse response functions for Portugal, the Euro Area does not seem to feature the composition effects seen in the case of Portugal. This is what would be expected from an economy in which collateral constraints do not play an important role. Without the presence of collateral constraints, monetary policy would not necessarily impact relative prices because

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4See annex for Spain
the collateral value of housing would not be present. Such an interpretation is compatible with the view that collateral matters because in an unconstrained economy one should expect proportional comovement between sectors, unless there are differences in sectoral rigidities as Monacelli (2009) points out. The asymmetry between the provided impulse response functions can then be seen to favour the collateral hypothesis.

The effects on the trade balance also provide interesting evidence. As will be seen later, in the presence of collateral constraints an expansionary monetary policy may lead to a transfer of resources from the tradable sector to the non-tradable housing sector. On the other hand, cheaper access to interest rates also increases investment and domestic production. If the composition effects are large and the first effect dominates then the trade balance may deteriorate. So again the asymmetry in the impulse response functions seems to be also consistent with the presence of collateral constraints.

![Figure 4: Empirical IRF for an interest rate innovation - Euro Area](image)

These important differences in responses to interest rate innovations seem then to fit reasonably the intuitive economic arguments described above. In the following
section, a model of a small open economy will be outlined to describe the above dynamics of the collateral channel in a general equilibrium setting.

## 3 A small open economy model

Consider a model of a small open economy in a monetary union, with two final good sectors: housing and a consumption good. The consumption good is an aggregate of domestic and foreign goods produced by a representative firm in each country. In the following sections, the basic setup of the model will be described and then the associated dynamics will be characterized.

### 3.1 Consumers

The representative consumer derives utility from 2 types of goods: the consumption good (C) and the housing good (H). The first good (C) is a tradable, non-durable composite of foreign (C\(_F\)) and domestic (C\(_D\)) goods and the agent derives utility from its direct consumption. The domestic and foreign goods are aggregated according to the following expression:

\[
C_t \equiv \left[ \alpha \eta C_{D,t}^{\eta - 1} + (1 - \alpha) \eta^{\frac{\eta - 1}{\eta - 1}} \right]^{\frac{\eta}{\eta - 1}}
\]

where \(\eta\) is the elasticity of substitution between foreign and domestic goods and \(\alpha > 0.5\) a measure of home bias.

The second type of good (H) is a durable good and individuals derive utility from services associated with the owned stock of the housing good. It is also non-tradable in the sense that to enjoy its services the owner must be domestic. The agent also values leisure and is able to borrow but faces a collateral constraint. Note that since a small open economy within a monetary union is being considered, there is no nominal exchange rate and foreign prices are exogenously given. However, they are still subject to shocks (e.g. shocks to the core countries of the monetary union) and the law of one price holds for the tradable goods.

The agent then chooses between spending his budget on housing and consumption goods, while supplying labour as a source of income. Additionally, he owns domestic equity and may stand to receive dividends. The housing good is durable, but its stock depreciates at the constant rate \(\delta\). The agent also has the choice to save or
contract debt, but for the latter he is obliged to provide sufficient collateral, in the form of housing goods. The program of the agent then as follows:

$$\max_{C_\tau, H_\tau, B_\tau, N_\tau} V_t = E_t \left[ \sum_{\tau=t}^{\infty} \beta^{\tau-t} U(C_\tau, H_\tau, N_\tau) \right] \text{ s.t.}$$

$$B_\tau = R_{\tau-1} B_{\tau-1} + W_\tau N_\tau + d_\tau - P_{H,\tau}(H_\tau - (1 - \delta)H_{\tau-1}) - P_{C,\tau}C_\tau, \forall \tau$$

$$B_\tau \geq -(1 - \Lambda)P_{H,\tau}H_\tau, \forall \tau$$

In this program, $C_\tau$ represents the amount of the composite consumption good and $H_\tau$ represents the stock of housing goods owned at the end of period $\tau$. Note that utility is derived of services from the stock of housing and not from consumption of the housing good. $N_\tau$ is total labour supplied, which is remunerated at the wage rate $W_\tau$. The agent also receives distributed profits from both sectors: $d_\tau = d_{H,\tau} + d_{C,\tau}$, where $d_{i,\tau}$ are dividends from the sector producing good $i$. $\beta$ is the subjective discount factor, $P$ is the consumption price index and $P_{H}$ the price of housing.

The objective function is also subject to the sequence of budget and collateral constraints, to which the respective Lagrange multipliers $\theta_\tau$ and $\gamma_\tau \theta_\tau$ are associated. The budget constraints are expressed in units of the foreign good, which will be chosen as the numeraire\(^5\). The choice variable $B_\tau$ is the end-of-period real bond holdings, with $R_\tau$ being the return at $\tau + 1$ on contracts stipulated at time $\tau$. The parameter $\Lambda \in ]0, 1[$ can be seen either as the down-payment rate or $1 - \Lambda$ as the loan-to-value ratio (LTV), that is, the amount of debt that agents are able to contract per unit of housing wealth.

For simplicity reasons, uncollateralized debt is excluded from the program. This simplification is only possible since, historically, collateralized debt is by far the main vehicle of long-term household debt and very short-term unsecured debt can be seen as a vehicle to respond to liquidity shocks and not long-term consumption smoothing. Also, a starting assumption is that the representative household is constrained at the balanced growth path and the collateral constraint holds with equality. This means that the representative household is assumed to be relatively impatient (compared to the rest of the world) and the calibration of the subjective discount factor will have to reflect this.

The choice for the functional form of the collateral constraint is motivated by the standard procedure during mortgage approvals. When lender and borrower agree on

\(^5\)In the context of the theoretical model presented, real should then be interpreted as in units of the foreign consumption good.
a loan-to-value ratio and an interest rate, the value considered for collateral purposes is the present market value of the dwelling. This is usually determined by third-party appraisal but this is abstracted from in the model as it features perfectly competitive markets, which implies all sales are at the market price. Given the program described, the following first-order-conditions are satisfied:

\[ -\frac{U_{N,t}}{U_{c,t}} = \frac{W_t}{P_t} \tag{1} \]

\[ \frac{P_{H,t}}{P_t} U_{C,t} = U_{H,t} + \beta(1-\delta)E_t \left( \frac{P_{H,t+1}U_{C,t+1}}{P_{t+1}} \right) + \gamma_t(1-\Lambda)\frac{P_{H,t}}{P_t} U_{C,t} \tag{2} \]

\[ \gamma_t = E_t \left[ 1 - \frac{P_t}{P_{t+1}} \frac{U_{C,t+1}}{U_{C,t}} \beta R_t \right] \tag{3} \]

Equation (1) is the typical condition equating the marginal rate of substitution between consumption and leisure to the real wage. As expected, if the marginal rate of substitution was higher (resp. lower) than the real wage, then the agent would simply decrease (resp. increase) the number of working hours and substitute consumption goods for leisure. Equation (2) equates the marginal cost of housing (in terms of utility forfeited in consumption goods) to the marginal gain of an additional unit of housing. This benefit has three components: (i) the direct utility gain \( U_{H,t} \); (ii) the stock value of an additional unit \( \beta(1-\delta)E_t \left( \frac{P_{H,t+1}U_{C,t+1}}{P_{t+1}} \right) \) in terms of marginal utility of future consumption and (iii) the marginal utility of relaxing the collateral constraint \( \gamma_t(1-\Lambda)\frac{P_{H,t}}{P_t} U_{C,t} \). Equation (3) is the modified Euler equation. The collateral value of housing then inserts a wedge in the standard intertemporal condition if the constraint is tight.

In equation (2), the stock value mentioned in (ii) can be interpreted as the expected value of increasing future consumption by selling in \( t+1 \) the value, net of depreciation, of one additional unit of the housing good purchased in the current period. The last term (iii) is simply the shadow value of the collateral constraint multiplied by the collateralizable proportion of an additional unit of housing, which represents a measure of relief that an additional unit of housing provides to the collateral constraint. From equation (2) we can also see that the loan-to-value ratio will impact the strength of this effect. The larger the loan-to-value ratio is, the stronger will be the impact of changes to the collateral value of housing. Of course, the collateral value of housing is itself dependent on the loan-to-value ratio because if agents are allowed to borrow more then the constraint would not be as tight.
3.2 Producers

There are two production sectors in the economy: housing and the domestic good. Both sectors are perfectly competitive and the representative firm in each sector \( j \) has the following production function:

\[
Y_{j,t} = A_{j,t} K_{j,t-1}^{\omega} N_{j,t}^{1-\omega} \quad j = D, H
\]

\( Y_j \) is the amount produced in sector \( j \), \( K_j \) the amount of installed capital and \( N_j \) the amount labour used in the sector. As usual in this class of models, investments in capital are assumed to require time to be installed and so become productive only in the following period. \( \omega \) is the capital share at the balanced growth path and \( A_j \) is a productivity parameter that follows:

\[
\log A_{j,t} = G + \rho_a j \log A_{j,t-1} + \varepsilon^j_t + \varepsilon^{TFP}_t \quad j = D, H
\]

There is then an exogenous growth rate \( G \) and two types of productivity shocks. \( \varepsilon^j_t \) a sector-\( j \) specific shock and \( \varepsilon^{TFP}_t \) an aggregate productivity shock.

Firms set prices taking into account total demand for each good. In the case of the tradable good, foreign demand is modeled following Galí and Monacelli (2005) which allows foreign demand for domestic goods to be micro-founded, yet not perfectly elastic. This approach models the economy as one among a continuum of infinitesimally small economies, which aggregate as the world economy under a typical Dixit-Stiglitz aggregator. Assuming symmetry of the foreign economies and the same home bias as the home economy, then one can show that total demand of the domestic good can be expressed as:

\[
Y_{D,t} = \alpha \left( \frac{P_{D,t}}{P_t} \right)^{-\eta} C_t + C^W \int_0^1 (1 - \alpha) \left( \frac{P_{D,t}}{P_{F,t}} \right)^{-\mu} d_i
\]

where \( \mu \) here measures the substitutability between foreign goods produced in each country \( i \). Foreign demand is then a function of the total consumption of the world economy \( C^W \) and the terms of trade. Taking then demand into account, firms then set prices to maximize the expected discounted sequence of profits:

\[
\max E_0 \sum_{t=1}^{\infty} M_t \left\{ P_{j,t} A_{j,t} K_{j,t-1}^{\omega} N_{j,t}^{1-\omega} - W_{j,t} N_{j,t} - P_{H,t} I_{j,t} \right\}
\]

s.t. \( K_{j,t} = (1 - \delta) K_{j,t-1} + \Phi(I_{j,t}/K_{j,t-1}) K_{j,t-1} \)
where $I$ is investment and $M$ is the stochastic discount factor of the representative household, which owns the firm. Note that the investment good is housing. This was chosen because housing is already a durable good and this will also generate some competition between firms and households for the housing good. The model also features fixed costs and considers the possibility of the firm incurring in capital adjustment costs. For the numerical simulations, the following functional form from Jermann (1998) was used:

$$
\Phi(I_{j,t}/K_{j,t-1}) = \frac{b}{1-a} \left( \frac{I_{j,t}}{K_{j,t}} \right)^{1-a} + c
$$

Again following Jermann (1998), parameters $b$ and $c$ are calibrated such that adjustment costs do not affect the deterministic balanced growth path and $a$ controls the elasticity of the investment function.

## 4 Main Results

In this section, the most interesting numerical results will be presented and discussed.

For the numerical analysis, the following functional form was specified:

$$
U(C_t, H_t, N_t) = \log C_t + \log H_t - \nu N_t^x
$$

This particular form is assumed because growth is a necessary condition for borrowing to be feasible at equilibrium. A functional form that admits a balanced growth path is then required to stationarize the model. Alternatively, non-separable utility in labour and both the consumption and housing goods would be required. This is not yet explored in this paper. Note that given the calibration choice for the discount factor, the presence of the collateral constraint is also required for stationarity. Given this choice and the program described above, perturbation methods were used around the steady-state of the stationary model in order to approximate its dynamics. Of particular interest will be the analysis of the expected effects of a fall in the long-run level of interest rates, as this can provide interesting insights with respect to the consequences of a convergence of interest rates during monetary accession.
4.1 Calibration

Most of the calibration is standard and taken directly from the literature. There are, however, a few differences. First, labour disutility is calibrated such that labour supply is relatively inelastic, reflecting the stylized fact that nominal wages have risen significantly in these countries relative to productivity gains. Secondly, a shock to the long-run interest rates is considered which is assumed to converge progressively to a permanently lower one. To simulate a progressive convergence to the new long run level of interest rates, interest rates in logs are assumed to follow the following mean-reverting process:

\[ r_t = (1 - \rho_r) \bar{r} + \rho_r r_{t-1} + \varepsilon_t \] where \( \varepsilon_t \sim N(0, \sigma^2_r) \)

Interest rates then converge in logs towards the long-run level \( \bar{r} \) at the speed \( (1 - \rho_r) \). To calibrate this the example of Portugal is considered. Portugal is a small open economy that joined the European Monetary Union, so it’s a good example for this type of convergence. In Portugal, interest rates on average market housing loans to households\(^6\) fell systematically from 20.1% in 1992:Q1 to 5.37% in 1999:Q1 when the Euro was finally introduced. If we interpret this as implying a half-life of 14 quarters, then this in turn implies a calibration of \( (1 - \rho) \approx 0.05 \). The long-run shock will then be modeled as a one-time fall in \( \bar{r} \).

Also, the assumption that the borrowing constraint is strictly binding at steady-state requires that \( \gamma^* > 0 \) which in turn implies that \( G > \beta R^* \), where \( G \) is the growth rate of the economy and \( R^* \) the long-run level of interest rates. Since interest rates are assumed to be exogenously determined, the choice lies between relatively high growth rates of the economy or very high preference for the present. Although one would expect growth effects from catching-up phenomena, the dynamics studied are based on shocks to an economy at the balanced growth path. A permanently higher rate of growth would be inadequate. The calibration is then done by assuming a stronger preference for the present and therefore a smaller discount factor \( (\beta = 0.97) \). Moreover, since the interest rate prior to the shock is assumed to be at a higher level than the prevalent in the core countries, a calibration of \( \bar{r} = 0.025 \) implies that a

\(^6\) The one that affects households more directly and thus the most appropriate to study such housing collateral effects. Nominal rates were used, as for these countries a good measure of long-run inflation is not available. Since the maturity of these loans is typically 20 years or more, current inflation would not be a good deflator. Moreover, if long-run inflation is not very volatile, then to a first order it would be similar to deflating by a constant factor, which would not change the calibration as the decay considered is exponential.
typical shock to interest rates would bring the long-run level of interest rates on par with the standard level calibrated in this class of models.

Another free parameter is the size of the world economy, which can be calibrated by choosing a value for world consumption $C^W$ that leads to a realistic degree of openness. The value chosen implies that the trade-to-GDP ratio is about 70%, which is close to Portugal’s average trade-to-GDP ratio in the last decade. For the remaining parameters, typical values from the literature were chosen. The proportion of uncollateralizable housing $\Lambda$ was chosen to be 29% which reflects again typical LTV ratios from Portugal\textsuperscript{7}. This value is also very similar in both Spain and Greece (28% and 27%, respectively).

It is then possible to study the business cycle dynamics of this model and check the effects of a permanent fall in interest rates. It is worthy to note that the presence of the collateral constraint introduces an additional source for persistence. Since the constraint is not truly forward-looking (as it depends on current and not expectations of future prices) then a shock that generates an increase in the amount of collateral allows borrowers to increase their borrowing level. This increase would then feedback in self-reinforcing fashion. Agents are able to borrow more and, in doing so, increase housing prices (and quantities) that again enable them to borrow more. Note that this amplification mechanism does not imply non-stationarity, since not only is the LTV ratio less than 1, but this increase in housing demand is also proportional to the shadow value of the collateral constraint $\gamma_t$ \textsuperscript{8}.

### 4.2 Real interest rate shocks

The effect of a temporary shock to interest rates is then presented in figure 5. As expected, both consumption and housing investment rise. This is due to the income effect of a fall in interest rates. Since the representative consumer is a constrained borrower, the income effect dominates and therefore a fall in the cost of debt will necessarily imply an increase in demand for both goods. Moreover, the fall in interest rates also increases the collateral value of housing as the agent now wants to borrow more. Demand increases then proportionally more in this sector, leading to a higher increase in housing expenditure relative to consumption. Due to the presence of adjustment costs, this is mostly reflected on prices.


\textsuperscript{8}Which is necessarily smaller than 1 at the steady-state, but should also be decreasing with this process, as the borrowing limit expansion relaxes the tightness of the constraint.
To be met, this increased demand for both goods will require additional labour, which pushes wages up and leads to a loss in competitiveness. This loss in competitiveness leads to a deterioration of the trade balance, which is also the mirror image of additional borrowing. In fact, as the relative price of housing increases, labour moves from the domestic good sector into the housing sector and production of the domestic good actually falls initially. Imports are then the main outlet by which aggregate consumption increases.

![Graphs of Residential Investment, GDP, Consumption, Trade Balance, House Prices, Price Level, Wages, Interest Rates](image)

**Figure 5: Temporary shock to real interest rates**

Furthermore, we can examine the effects of a fall in long-run interest rates. The impulse response functions for a permanent fall in long-run interest rates can be seen in figure 6. The initial impact of a change in long-run interest rates has similar effects. As the interest rate falls, the collateral value of housing goes up and demand for housing increases proportionally more. As borrowing becomes cheaper, agents would like to borrow more (at the unconstrained optimum) leading to an increase in the collateral value of housing. Demand increases for both goods but proportionally more towards the housing good. There is a larger increase in the price of housing
relative to the consumption good and labour moves to the housing sector. As before, wages increase and the trade balance deteriorates.

![Graphs showing various economic indicators over time](image)

**Figure 6: Shock to long-run real interest rates**

There is then a composition effect, shifting production from the consumption sector to housing. The model then predicts that small countries with less mature household credit markets are expected to experience a deterioration of the trade balance and a housing sector boom. This boom leads to increased pressure on wages and thus deteriorates competitiveness in the domestic good sector. The increase in both price and holdings of the housing good also leads to increased borrowing, which in turn deteriorates the net foreign asset position of the country.

Interestingly, demand for housing seems to be front-loaded. This can be seen in the response of prices here. The presence of overshooting in the response of prices comes from the fact that the collateral value of housing (in terms of utility) is larger, the more constrained is the household. Since collateral is a durable good, then there is an incentive to front-load the adjustment. Demand for housing is then higher initially, when the stock of housing is at its lowest and consumption is still
below its new long-run level. This is reflected on most clearly on prices due to the presence of adjustment costs. As the stock of housing increases, the collateral value of additional falls so residential investment and house prices stabilize at a level that is still higher than the initial one, but lower than the peak occurred during the adjustment periods. Note that such front-loading is still apparent, despite the fall in interest rates considered here being slow and permanent.

There is also a muted impact on the price index, which is also compatible with the empirical evidence presented. In the model, this is probably due to the relatively high degree of openness, which reduces the importance of domestic demand for the tradable sector. Moreover, the price index also includes the price of foreign goods, which do not change.

4.3 Productivity shock

It is also interesting to study the impact of a productivity shock in such an economy. The studied shock affects both sectors, but is specific to the country. The impulse response functions can be seen in figure 7.

This figure again highlights the compositional shifts of such an economy. As expected, a positive technological shock increases demand for labour and pushes wages up. Production increases in both sectors, but more so in the housing sector. This is due to the front-loading effect mentioned earlier. Agents want to consume more of both goods, but front-load expenditure on the housing good because it allows them to use it as collateral. This is also why the price response of housing is more muted here and also hump shaped.

The increased supply also depresses the price of the domestic good. This improves competitiveness, which reflects in a trade balance improvement. Again, the hump shape is due to the aforementioned front-loading effect. Front-loading housing expenditure allows the agent to import more by borrowing more. This slows down the trade balance improvements due to increased competitiveness.

4.4 Terms of trade shock

Since this is a model of an open economy, it’s also relevant to analyze what would happen if foreign goods prices would increase relative to the domestic good. Since the small open economy considered here does not affect world prices of foreign goods, this is simply modeled as a temporary increase in world prices. This by definition
Figure 7: Productivity shock

decreases terms of trade and improves competitiveness of the domestic economy. The effects of such a shock can be seen in figure 8.

The shock increases competitiveness and this leads to an improvement of the trade balance. On the other hand, increased production requires shifting resources from the housing to the consumption sector. Residential investment then falls and this is aggravated by the increase in labour demand which pushes wages up. Since this fall in residential investment is due to a fall in supply and not demand, we then see that the price of housing goes up. This partially mitigates the fall in the quantity of housing available for collateral. Still, agents are able to borrow less and this again mirrors the effect on the trade balance.

5 Conclusion

The theoretical model here described then seems to point out important compositional shifts in collaterally-constrained economies that join a monetary union.
Considering the nominal convergence of interest rates in Euro area countries was particularly strong, then such effects are potentially crucial to understand their macroeconomic dynamics during this period. The simple model presented here illustrates the adjustment effects of joining a monetary union and analyzes how the transmission of real interest rate innovations in these countries is affected.

The results presented suggest that the demand shift from a fall in interest rates originates a compositional shift in the production of the economy. This transfers labour and capital towards the housing sector and away from the production of the consumption good. The fact that the economy is open and the consumption good is tradable, leads to a deterioration of the trade balance which along with the increased borrowing implies that we should expect such countries to also feature current account deficits.

Such demand distortions generated by the presence of collateral constraints could potentially also have consequences in terms of medium or long-term growth. There are several channels through which these distortions can dampen growth and lead to
a potential Iberian Disease. First there is the possibility that the construction sector crowds-out other sectors where real productivity growth is higher. Credit market imperfections generate an increase in demand for housing goods, which can direct investment towards the construction sector. Although the use of collateral serves to compensate asymmetric information, its nominal value is also clearly pro-cyclical. If house prices are inflated through credit demand, then one would expect house prices to decrease even more in the case of credit crises. This effect can then generate excess volatility in credit markets. Secondly, if the rate of innovation and real productivity growth is lower in the construction sector (as it has been historically) then this effect can be dynamically inefficient, especially so in the presence of adjustment or other sunk costs of investment. Boom periods led by demand-driven growth in the construction sector could then be followed by slowdown periods as the economy adjusts back to the steady-state sectoral composition.

This paper then highlights a potential problem for policy makers in a monetary union. If a common monetary policy has significantly different effects on countries which are net borrowers, then there is an element of additional volatility within a monetary union. Small open economies which join a financially more developed monetary union, may be expected to experience a worsening of their net foreign asset position and their trade balance. Moreover, even when real shocks are perfectly synchronized, monetary policy shocks will impact currency union members differently depending on whether they are borrowers or lenders within that monetary union. The problem of asymmetric shocks may then be compounded by an inherent inability of monetary policy to be equally effective across a monetary union which features net lenders and borrowers.
References


## Annexes

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Table 1: Calibration of parameters in the model
Figure 9: Empirical IRF for Spain

Figure 10: Shock to long-run interest rates with no adjustment costs
Figure 11: Productivity shock with no adjustment costs

Figure 12: Monetary policy shock with no adjustment costs
Figure 13: Terms of trade shock with no adjustment costs