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JOSÉ E. BOSCÁ
JAVIER FERRI
MARGARITA RUBIO

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Bonded Together? Welfare and Stability in a Monetary Union with Core–Periphery Preference Convergence*

José E. Boscá[1,3] Javier Ferri[1,3] Margarita Rubio[2]

[1] *University of Valencia* [2] *University of Nottingham* [3] *Fedea*

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Abstract

We study the macroeconomic and welfare consequences of bond preference convergence within a monetary union. Using a two-country DSGE model calibrated to Germany and Spain, we compare two scenarios: convergence toward Spanish bond preferences and convergence toward German bond preferences. The direction of convergence proves decisive. When preferences shift toward those of Spain, union-wide private debt expands, long-run GDP declines, and macro-financial volatility rises, though inflation volatility falls. Welfare increases for the union as a whole in this scenario, with Germany gaining the most and Spain benefiting more modestly. By contrast, convergence toward German bond preferences reduces union-wide private debt and output volatility, but generates only moderate welfare gains for Germany and significant welfare losses for Spain. These results highlight that financial convergence does not yield uniform benefits. Its consequences depend on both the direction of convergence and its distributional effects across countries and households. The findings also point to a trade-off between welfare and stability, underscoring the need for macroprudential tools and fiscal arrangements to manage the risks associated with deeper convergence in bond preferences.

Keywords: Financial Convergence, Monetary Union, Welfare, Financial Stability

JEL Classification: E32, E44, F45

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"Europe's new financial integration has disproportionately benefited the peripheral and lower-income member countries. Both government and private sectors in these countries have experienced much lower interest rates, and their economies have benefited from new inflows of foreign investment capital. However, the process of cross-border financial integration remains quite incomplete". Phillip R. Lane, *Journal of Economic Perspectives*—Volume 20, Number 4—Fall 2006.

1 Introduction

This paper examines the macroeconomic consequences of convergence in financial preferences within a monetary union. A defining feature of such unions is the persistence of differences in investors' portfolio choices. Even under common institutions and similar transaction costs, investors consistently display stable preferences across asset categories, for instance, between domestic and foreign bonds, or between public and private bonds. These patterns often take the form of home bias, where investors disproportionately favor domestic securities, first highlighted by French and Poterba (1991) and later surveyed by Coeurdacier and Rey (2013). They can also appear as foreign bias, where portfolios tilt excessively toward foreign assets, as documented in the global study of mutual fund allocations by Chan et al. (2005). Both types of bias strongly influence cross-country credit allocation and display a high degree of persistence.

A growing body of research shows that these persistent differences in portfolio choices stem from structural and behavioral factors rather than institutional frictions alone. Some investors consistently value the unique services of certain securities, such as the liquidity and safety of U.S. Treasuries (Krishnamurthy & Vissing-Jorgensen, 2012). Others display systematic heterogeneity in international bond allocations driven by fundamentals, liquidity, and visibility (Xiao, 2007), or even by patriotism, which discourages foreign investment and reinforces domestic bias (Pradkhan, 2016). Similar behavioral patterns are observed in equity markets: domestic portfolio managers overweight local equities due to informational advantages and familiarity (Coval & Moskowitz, 1999), while U.S. investors disproportionately invest in their local Regional Bell Operating Company, an example of familiarity-driven bias (Huberman, 2001). Cultural distance, optimism, and peer effects also shape international portfolio allocations (Ardalan, 2019; Beugelsdijk & Frijns, 2010). More recent studies reinforce this perspective, linking home bias to trust and unfamiliarity with foreigners (Kim & Kim, 2022), to investors' past macroeconomic experiences (Malmendier et al., 2020), and to proximity, language, and loyalty (Atrous & Abaoub, 2024;

Wedow et al., 2023). Experimental evidence further confirms that familiarity itself remains a central determinant of portfolio choice (Dlugosch et al., 2023).

These findings suggest that investor preferences are shaped by two complementary components. One is country-specific, reflecting structural and behavioral features (such as familiarity, patriotism, or informational advantages) that persist over time. The other responds to common macroeconomic fundamentals, such as each country's relative debt position, which influences the attractiveness of its bonds. Modeling both dimensions is essential to capture the persistence and heterogeneity of portfolio choices observed in the data. In our framework, households derive utility directly from holding bonds, following earlier theoretical contributions such as Sargent (1986), Krishnamurthy and Vissing-Jorgensen (2012), and Reis (2020). This approach provides a microfounded way to capture home bias, allowing preferences to vary both with macroeconomic fundamentals like relative debt positions and with behavioral factors such as familiarity and attachment to domestic securities, consistent with the mechanisms highlighted in the literature above.

Against this background, the aim of this paper is to examine the macroeconomic consequences of convergence in financial preferences within a monetary union. We analyze the case in which bond preferences in Spain gradually align with those observed in Germany, and vice versa. These two countries offer a natural laboratory, as they are often regarded as representative examples of the core and the periphery in the EMU. Unlike much of the existing literature, which focuses on equities or emphasizes institutional explanations, we study a setting where investors allocate exclusively across bonds, and where preference heterogeneity is modeled explicitly in a two-country DSGE framework with both idiosyncratic (country-specific) and fundamental-driven (debt-dependent) components.

Our contribution is twofold. First, we show that convergence toward Spanish preferences improves welfare in both countries and for the monetary union as a whole, with Germany capturing the largest gains and Spain benefiting to a lesser extent. These improvements are not driven solely by consumption: in this scenario, bonds, leisure, and housing also contribute positively to welfare in both economies. By contrast, convergence toward German preferences reduces welfare in Spain and yields only moderate gains for Germany, with German improvements coming mainly through consumption, while Spain experiences welfare losses from consumption, housing, and leisure. Second, convergence amplifies macro-financial volatility, particularly when it shifts toward Spanish preferences, as private debt and housing markets become more sensitive to aggregate productivity shocks. Together, these results highlight that the distributional and stability effects of convergence in financial preferences depend critically on its direction.

While Lane (2006) emphasized that Europe's financial integration disproportionately benefited peripheral and lower-income member states, our findings suggest that the direction of preference convergence—an important dimension of financial integration—matters for how gains are distributed, with core-to-periphery convergence enhancing union-wide welfare but not necessarily favoring the periphery.

2 The Model

We consider a monetary union comprising two countries, A (domestic) and B (foreign), engaged in trade in both consumption goods and bonds. Agents in each country can choose among different assets, including tradable bonds and non-tradable housing. Heterogeneity in discount rates across households naturally divides them into borrowers and savers in each economy. Both governments and private agents can issue debt, with borrowers obtaining funds from either domestic or foreign lenders. Conversely, lenders may extend credit to either domestic or foreign borrowers, giving rise to four distinct types of bonds within the monetary union. To capture bond-specific demand, we incorporate country-specific preferences for bonds.

Borrowing entails an external effect in the form of a risk premium, which varies with the relative total debt-to-GDP ratio. Households in both countries consume domestic and foreign goods, without home bias for simplicity. Labor is employed in a competitive market and is the sole factor of production. Final goods prices are sticky.

Fiscal policy is conducted through a progressive tax scheme consisting of a flat rate and exempt labor income, designed to stabilize the government debt-to-GDP ratio. Monetary policy is conducted by the central bank, which sets the policy interest rate in response to union-wide inflation.

The economic equations that characterize both countries are symmetric. The relative population weights between countries are represented by ω and $(1-\omega)$ for country A and B, respectively. Within each country, the share of borrowers is represented by τ and τ^*, respectively. Specifically, if we designate by N the total population in the monetary union, then $N = N_A + N_B$, where N_A and N_B denote the population in economy A and B, respectively. Consequently, we define $\omega = \frac{N_A}{N}$ and $(1-\omega) = \frac{N_B}{N}$. Assuming the populations of patient and impatient individuals in economy A are represented by N_l and N_r, respectively, we define $\tau = \frac{N_r}{N_A}$ and $(1-\tau) = \frac{N_l}{N_A}$. Similarly, for country B,$\tau^* = \frac{N_r^*}{N_B}$ and $(1-\tau^*) = \frac{N_l^*}{N_B}$.

Next, we outline the model, presenting the most relevant equations and deferring the remaining

details to *Appendix 1.* The equivalent equations for country B are omitted for brevity.

2.1 Households

2.1.1 Patient Households

Patient households discount the future at a lower rate $\left(\frac{1}{\beta^l}\right)$ than impatient households.This fact drives them to be the lenders in the economy as they assign relatively greater value to future consumption compared to the borrower population.

In our notation, in general, lower-case letters represent real variables, while capital letters denote nominal variables. Patient households optimize their utility function by solving the following maximization problem:

$$U_0^l = E_0 \sum_{i=0}^{\infty} \beta^{li} \begin{pmatrix} \ln c_{t+i}^l + \gamma_h \ln h_{t+i}^l + \\ +\gamma_{b_{At}}(\bullet) \ln(b_{At}^l) + \chi_B \ln(b_{Bt}^l) + \\ \gamma_{b_{At}}^g(\bullet) \ln(b_{At}^g) + \chi_B^g \ln(b_{Bt}^g) - \frac{\left(n_{t+i}^l\right)^{1+\eta}}{1+\eta} \end{pmatrix}.$$

The variables are written relative to the population of lenders N_l, that is, c_t^l can be interpreted as the total consumption of lenders divided by the total amount of lenders in the economy A. In the same vein, n^l stands for per capita working hours and h^l represents the per capita stock of houses owned by lenders. The parameters η, γ_h, relate to the elasticity of labor supply with respect to wages and preferences for housing, respectively. The utility function distinguishes between four types of bonds that capture different financial alternatives for lenders. Bonds issued by national borrowers in hands of national lenders are denoted by b_{At}^l, where $b_{At}^l = \frac{B_{At}^l}{P_{At}}$ and B_{At}^l stands for the nominal value of bonds, which pay a gross nominal interest rate R_{At}. Similarly, bonds bought by national lenders from the home government are called b_{At}^g, whereas b_{Bt}^l and b_{Bt}^g stand for bonds issued by foreign households and the government.

In our framework, households derive utility directly from holding bonds, following earlier theoretical contributions such as Sargent (1986), Krishnamurthy and Vissing-Jorgensen (2012), and Reis (2020). This formulation provides a microfounded way to capture home bias, allowing preferences to vary with macroeconomic fundamentals—such as relative debt positions—and with behavioral factors—such as familiarity and attachment to domestic securities. To operationalize this idea, we allow bond preferences to adjust endogenously to macroeconomic conditions, evolving with relative debt positions across

countries.

Specifically, as the total debt-to-output ratio in economy A rises relative to that in economy B, bonds issued in economy B become more attractive. Preferences for bonds therefore evolve over time in response to cross-country differences in debt-to-output ratios.

$$\begin{aligned}\gamma_{b_{At}}(\bullet) &= \chi_A + \vartheta\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right),\\ \gamma^g_{b_{At}}(\bullet) &= \chi^g_A + \vartheta\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right).\end{aligned} \tag{1}$$

where b_t and b_t^* represent aggregate debt (to be defined more precisely below) in country A and B, respectively, and ϑ is a positive parameter. Notice that the difference $\gamma^g_A - \gamma_A$ and $\chi^g_B - \chi_B$ captures the existence of a public-private bond bias, whilst the presence of a country bias would be reflected by $\gamma^g_A - \chi^g_B$ and $\gamma_A - \chi_B$.

We assume that patient households do not internalize the impact of their lending decisions on the ratios $\frac{b_t}{y_t}$ and $\frac{b_t^*}{y_t^*}$, meaning they do not take into account how their lending choices may influence the aggregates b_t and b_t^*.

The budget constraint, in real terms, is

$$\begin{aligned}&c^l_{At} + \frac{P_{Bt}}{P_{At}}c^l_{Bt} + q_t\left(h^l_t - h^l_{t-1}\right) + b^l_{At} + \frac{P_{Bt}}{P_{At}}b^l_{Bt} + b^g_{At} + \frac{P_{Bt}}{P_{At}}b^g_{Bt}\\ &\leq \left(1 - x^l_t\right)w_t n^l_t + \frac{R_{At-1}}{\pi_{At}}b^l_{At-1} + \frac{P_{Bt}}{P_{At}}\frac{R_{Bt-1}}{\pi_{Bt}}b^l_{Bt-1}\\ &+ \frac{R^g_{At-1}}{\pi_{At}}b^g_{At-1} + \frac{P_{Bt}}{P_{At}}\frac{R_{t-1}}{\pi_{Bt}}b^g_{Bt-1} + d_t.\end{aligned} \tag{2}$$

c^l_{At} and c^l_{Bt} represent the per capita consumption of domestically and foreign-produced goods, respectively. P_{At} and P_{Bt} denote the producer price indexes in countries A and B. The numeraire is P_{At}, which is used to deflate all nominal variables, including loans, wages, and profits. $\frac{P_{Bt}}{P_{At}}$ represents the inverse of the terms of trade and q_t denotes the relative price of houses, h^l_t. A positive value for b^l_{At} and b^l_{Bt} signifies to a lending amount, while a negative value indicates a borrowing amount. For patient households both are positive. Bonds yield an interest rate, which varies depending on the type, with government bonds in country B yielding an interest rate R_t equivalent to the policy rate. d_t represents profits derived from the monopolistically competitive firms owned by lenders. We assume that labor income ($w_t n^l_t$, i.e. wages multiplied by per capita working hours,) is subject to taxation. The average

tax rate on labor income for lenders, x_t^l is defined as $\frac{t_{At}^l}{w_t n_t^l}$, where t_{At}^l represents the per capita amount of taxes paid by these households,

$$t_{At}^l = m_{At}(w_t n_t^l - \overline{t_A}). \tag{3}$$

The preceding equation presupposes a progressive tax scheme, accomplished by introducing a per capita tax-exempt income, denoted as $\overline{t_A}$, and a flat tax rate on labor income, m_{At}. Consequently, the average tax rate rises with income, bolstering the automatic stabilizer aspect of the tax system. As elucidated below, m_{At} will serve as the tool employed by the fiscal authority to maintain a constant ratio of public debt to GDP over the long term. A higher m_{At} implies a more progressive tax structure.

The inflation rate on the domestically produced goods, π_{At}, and foreign goods, π_{Bt}, are defined as

$$\pi_{At} = \frac{P_{At}}{P_{At-1}}, \tag{4}$$

$$\pi_{Bt} = \frac{P_{Bt}}{P_{Bt-1}}. \tag{5}$$

The consumption basket for lenders is defined as

$$c_t^l = (c_{At}^l)^{\omega}(c_{Bt}^l)^{1-\omega} \tag{6}$$

Patient households maximize with respect to c_{At}^l, c_{Bt}^l, h_t^l and n_t^l (leading to standard first order conditions, as can be seen the Appendix 1 , and also over the four financial assets (b_{At}^l, b_{Bt}^l, b_{At}^g, and b_{Bt}^g). Optimal decisions regarding bonds should satisfy the following conditions:

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_{At}}{\pi_{At+1}}\right] + \frac{\chi_A}{b_{At}^l} + \frac{\vartheta}{b_{At}^l}\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right), \tag{7}$$

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_{Bt}}{\pi_{At+1}}\right] + \frac{P_{At}}{P_{Bt}}\frac{\chi_B}{b_{Bt}^l}, \tag{8}$$

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_{At}^g}{\pi_{At+1}}\right] + \frac{\chi_A^g}{b_{At}^g} + \frac{\vartheta}{b_{At}^g}\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right), \tag{9}$$

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_t}{\pi_{At+1}}\right] + \frac{P_{At}}{P_{Bt}}\frac{\chi_B^g}{b_{Bt}^g}, \tag{10}$$

where λ_t^l is the Lagrangian multiplier associated with the restriction (2). From these conditions,

we can obtain non-arbitrage conditions among the four assets. Differences in interest rates between different bonds depend on three factors. First, the amount of bonds held by households, as captured by the second term on the right-hand side of the above expressions. Other things being equal, a decrease in the price of a particular type of bond (an increase in its interest rate) increases the desired amount of that bond type held by households vis-à-vis other bonds. Thus, there is a downward-sloping demand for bonds. Second, the term related to the endogenous risk premium. As the debt-to-GDP ratio increases in the domestic economy with respect to the foreign one, the domestic interest rate increases relative to the foreign one. Third, a factor capturing the terms of trade, $\frac{P_{At}}{P_{Bt}}$, that indicates that nominal interest rate differentials between the two countries are related to price differentials. From equations (9) and (10) let us define this risk premium term as

$$\phi_t \equiv -\frac{\pi_A \vartheta}{b_A^g \beta^l \lambda^l} \left(\frac{b_t^*}{b_t} \frac{y_t}{y_t^*} - 1 \right), \tag{11}$$

which represents the increase in $R_{At}^g - R_t$ to a given change in $\left(\frac{b_t^*}{b_t} \frac{y_t}{y_t^*} - 1 \right)$. Notice that, *caeteris paribus*, it increases with the ratio of total debt-over-output in country A.

Together with the demand for bonds from foreign households, the above expressions produce induced effects of economic policies on the desired composition of bonds in the portfolio of lenders households. These effects translate into changes in the decisions of private/public and national/foreign borrowers.

2.1.2 Impatient Households

Impatient households have a higher discount rate than patient households $\left(\frac{1}{\beta^r} > \frac{1}{\beta^l} \right)$, which drives them to be the borrowers of the economy. These agents sell bonds to the lenders of both economies, paying the corresponding interest rates. Impatient households solve the following optimization problem, maximizing the utility function

$$U_0^r = E_0 \sum_{i=0}^{\infty} \beta^{ri} \left(\ln c_{t+i}^r + \gamma_h \ln h_{t+i}^r - \frac{\left(n_{t+i}^r\right)^{1+\eta}}{1+\eta} \right),$$

subject to

$$c_{At}^r + \frac{P_{Bt}}{P_{At}} c_{Bt}^r + q_t \left(h_t^r - h_{t-1}^r\right) + \frac{R_{At-1}}{\pi_{At}} b_{t-1}^r \tag{12}$$
$$\leq \left(1 - x_t^r\right) w_t n_t^r + b_t^r.$$

c_t^r can be interpreted as total consumption of borrowers divided by the total amount of borrowers in economy A. $b_t^r = \frac{B_t^r}{P_{At}}$ expresses the total real private borrowing in country A from domestic and foreign lenders, and is defined as a positive variable. Similarly to impatient households, x_t^r is defined as $\frac{t_{At}^r}{w_t n_t^r}$, where

$$t_{At}^r = m_{At}(w_t n_t^r - \overline{t_A}). \tag{13}$$

Hence, the average tax rate will differ between borrowers and lenders given that, although wages will be common across households, working hours may be different.

Additionally, these consumers face a borrowing constraint of the form

$$E_t \left[\frac{R_{At}}{\pi_{At+1}} b_t^r\right] \leq E_t \left[k_A q_{t+1} h_t^r\right], \tag{14}$$

where k_A can be interpreted as a loan-to-value ratio (LTV). Keeping constant the rest of variables, an increase in the price of b_t^r (a fall in R_{At}) will increase the supply of private bonds.

The consumption basket for borrowers is defined as

$$c_t^r = (c_{At}^r)^{\omega} (c_{Bt}^r)^{1-\omega}. \tag{15}$$

The impatient household maximizes with respect to c_{At}^r, c_{Bt}^r, h_t^r, n_t^r, and b_t^r. The derivative with respect to b_t^r yields

$$\lambda_t^r = \beta^r E_t \left[\lambda_{t+1}^r \frac{R_{At}}{\pi_{At+1}}\right] + \xi_t R_{At}, \tag{16}$$

where λ_t^r and ξ_t are the Lagrangian multiplier associated with the restrictions (12) and 14. Borrowers in country A will pay the interest rate R_{At}, regardless who provides the funds (domestic or foreign lenders). According to this equation, a tighter macroprudential policy (an increase in ξ_t driven by a reduction in the LTV) would reduce the interest rate borne by borrowers, as borrowers would demand

a higher price for the bond in order to maintain their consumption.

2.2 Firms

We have J firms of mass 1. Each firm j produces a differentiated good and takes decisions subject to three constraints: a constant returns production technology; a downward sloping demand curve, and a perfect competition labor market. In all that follows all variables are represented in per capita terms of total population in the economy. The optimization problem can be written as:

$$\min \ W_t n_t(j),$$

subject to:

$$y_t(j) = z_t n_t(j), \tag{17}$$

$$y_t\left(j\right) = \left(\frac{P_{At}\left(j\right)}{P_{At}}\right)^{-\varepsilon} y_t, \tag{18}$$

where W_t is the nominal wage and z_t is the technical level, both common to all firms.

Optimization with respect to employment yields the following standard labor demand in real terms:

$$w_t = mc_t \frac{y_t}{n_t}. \tag{19}$$

Optimal prices are obtained assuming a Calvo scheme:

$$\max_{p_{At}(j)} \Pi_0 = E_t \sum_{i=0}^{\infty} \lambda_{t+i}^{l} (\beta^l \theta)^i \left[\left(\prod_{r=1}^{i} \frac{(\pi_{At+r-1})^{\zeta}}{\pi_{At+r}} p_{At}(j) - mc_{t+i} \right) y_{t+i}\left(j\right) \right],$$

subject to the variety demand function,

$$y_{t+i}(j) = \left(\prod_{r=1}^{i} \frac{(\pi_{At+r-1})^{\zeta}}{\pi_{At+r}} p_{At}(j) \right)^{-\varepsilon} y_{t+i}. \tag{20}$$

A proportion θ of firms do not reset prices optimally at t and adjust them according to a simple indexation rule to catch up with lagged inflation: $P_{jt} = (\pi_{t-1})^{\zeta} P_{jt-1}$. We are assuming that firms that are not allowed to change prices optimally reset prices each period according to inflation. $p_{At}(j)$ stands for the relative price $\frac{P_{At}(j)}{P_{At}}$. Taking into account that all firms will set the same optimal price, the solution to the above problem renders the following New Keynesian Phillips curve,

$$\left(\frac{1-\theta(\pi_{At})^{\varepsilon-1}}{1-\theta}\right)^{\frac{1}{1-\varepsilon}} = \frac{\varepsilon}{\varepsilon-1}\frac{E_t\sum_{i=0}^{\infty}\lambda_{t+i}^{l}(\beta^{l}\theta)^{i}mc_{t+i}y_{t+i}\left(\prod_{r=1}^{i}\frac{(\pi_{At+r-1})^{\zeta}}{(\pi_{At+r})}\right)^{-\varepsilon}}{E_t\sum_{i=0}^{\infty}\lambda_{t+i}^{l}(\beta^{l}\theta)^{i}y_{t+i}\left(\prod_{r=1}^{i}\frac{(\pi_{At+r-1})^{\zeta}}{(\pi_{At+r})}\right)^{1-\varepsilon}}. \tag{21}$$

2.3 Aggregation

There are some restrictions linking debt. In the domestic economy, bonds issued by domestic borrowers (total private debt) may be in hands of either domestic or foreign lenders:

$$b_t^r = \frac{(1-\tau)}{\tau}b_{At}^{l} + \frac{(1-\omega)}{\omega}\frac{(1-\tau^*)}{\tau}b_{At}^{*l}, \tag{22}$$

where b_{At}^{*l} is economy B's lenders holdings of bonds issued by economy A's borrowers.

With respect to public debt,

$$b_t^g = (1-\tau)\, b_{At}^{g} + (1-\tau^*)\,\frac{(1-\omega)}{\omega}b_{At}^{*g}. \tag{23}$$

where b_{At}^{*g} is economy B's holdings of bonds issued by economy A's government.

Total debt, i.e. the sum of public and private debt, in economy A can be defined as:

$$b_{_t} = b_t^g + \tau b_t^r \tag{24}$$

Aggregation over housing results in:

$$\tau h_t^r + (1-\tau)\, h_t^l = h, \tag{25}$$

where h is an exogenous variable representing the per capita stock of housing in economy A.

Consumption can also be aggregated using the shares of lenders and borrowers in each economy. Consumption in country A of goods produced in country A:

$$c_{At} = \tau c_{At}^{r} + (1-\tau)\, c_{At}^{l}. \tag{26}$$

Consumption in country A of goods produced in country B (imports -exports- by country A -B-):

$$c_{Bt} = \tau c_{Bt}^{r} + (1-\tau)\, c_{Bt}^{l}. \tag{27}$$

Total consumption in country A can be defined as

$$c_t = \tau c_t^r + (1-\tau)\, c_t^l = c_{At} + \frac{P_{Bt}}{P_{At}} c_{Bt}, \tag{28}$$

where

$$c_t^l = c_{At}^l + \frac{P_{Bt}}{P_{At}} c_{Bt}^l, \tag{29}$$

and

$$c_t^r = c_{At}^r + \frac{P_{Bt}}{P_{At}} c_{Bt}^r. \tag{30}$$

Employment is aggregated as

$$n_t = \tau n_t^r + (1-\tau)\, n_t^l. \tag{31}$$

Total government revenues are characterized by,

$$t_t = (1-\tau) t_{At}^l + \tau t_{At}^r = m_A(w_t n_t - \overline{t_A}). \tag{32}$$

The aggregate production function for the domestic economy is,

$$y_t = z_t n_t. \tag{33}$$

2.4 Fiscal and Monetary Rules

We assume an exogenous amount of non-productive government consumption g_t for the domestic economy and g_t^* for economy B. Public debt evolves according to

$$b_t^g = \frac{R_{At-1}^g}{\pi_{At}} b_{t-1}^g + (g_t - t_t). \tag{34}$$

$$b_t^{*g} = \frac{R_{t-1}}{\pi_{Bt}} b_{t-1}^{*g} + (g_t^* - t_t^*). \tag{35}$$

Common monetary policy is characterized by a simple Taylor rule. The central bank takes into

account the weighted average of the monetary union countries' inflation:

$$R_t = R_{t-1}^{\rho} \left[\left(\pi_{At}^{\omega} \pi_{Bt}^{1-\omega} \right)^{\Phi} \overline{R} \right]^{1-\rho}. \tag{36}$$

Each country uses the flat tax as the instrument to stabilize the ratio of total public debt-over-GDP in the long run. Then, the fiscal policy rule can be represented as:

$$m_{At} = m_{At-1} + \psi_1 f_t \left(\frac{b_t^g}{y_t} - \overline{\left(\frac{b^g}{y} \right)} \right) + \psi_2 f_t \left(\frac{b_t^g}{y_t} - \frac{b_{t-1}^g}{y_{t-1}} \right), \tag{37}$$

where the parameter ψ_1 captures the speed of adjustment from the current ratio to the desired ratio, and f_t is a dummy variable that controls for the time period in which the fiscal rule is initially inactive. Similarly, for country B,

$$m_{Bt} = m_{Bt-1} + \psi_1^* f_t^* \left(\frac{b_t^{*g}}{y_t^*} - \overline{\left(\frac{b^{*g}}{y^*} \right)} \right) + \psi_1^* f_t^* \left(\frac{b_t^{*g}}{y_t^*} - \frac{b_{t-1}^{*g}}{y_{t-1}^*} \right). \tag{38}$$

2.5 GDP and Balance of Payments

The total resource constraint should satisfy the condition that total production y_t should be equal to the sum of factor incomes or total final demand in the economy. That is,

$$y_t = w_t n_t + (1-\tau)\, d_t, \tag{39}$$

or

$$y_t = c_{At} + \frac{(1-\omega)}{\omega} c_{At}^* + g_t. \tag{40}$$

To find an expression for aggregate firm's profits in economy A, we can combine expressions (39) and (19) to obtain:

$$(1-\tau)\, d_t = \left(\frac{1}{mc_t} - 1 \right) w_t n_t. \tag{41}$$

To derive an expression for the balance of payments, first, we multiply the household budget constraints (2) and (12) by their respective shares in population $(1-\tau)$ and τ and aggregate them. Then, substituting $g_t = y_t - c_{At} - \frac{(1-\omega)}{\omega} c_{At}^*$ into the previous expression results in:

$$
\begin{aligned}
(1-\tau)\frac{P_{Bt}}{P_{At}}\left(b^{l}_{Bt}+b^{g}_{Bt}\right)+(1-\tau)\,b^{g}_{At}-(1-\tau^{*})\,\frac{(1-\omega)}{\omega}b^{*l}_{At}= \\
\left(\frac{(1-\omega)}{\omega}c^{*}_{At}-\frac{P_{Bt}}{P_{At}}c_{Bt}\right)+(g_t-t_t)+ \\
+(1-\tau)\frac{P_{Bt}}{P_{At}}\left(\frac{R_{Bt-1}}{\pi_{Bt}}b^{l}_{Bt-1}+\frac{R_{t-1}}{\pi_{Bt}}b^{g}_{Bt-1}\right)+(1-\tau)\,\frac{R^{g}_{At-1}}{\pi_{At}}b^{g}_{At-1} \\
-(1-\tau^{*})\,\frac{(1-\omega)}{\omega}\frac{R_{At-1}}{\pi_{At}}b^{*l}_{At-1},
\end{aligned}
\tag{42}
$$

with $x_t=\frac{t_t}{w_t n_t}$. Notice that all the previous variables are in terms of total population in the economy A (they are divided by N_A).

An alternative understanding of the balance of payments condition can be grasped if we obtain the steady-state version of (42)

$$
\begin{aligned}
(1-\tau^{*})\,\frac{(1-\omega)}{\omega}b^{*l}_{A}\left(\frac{R_A}{\pi_A}-1\right)-(1-\tau)\,\frac{P_B}{P_A}b^{l}_{B}\left(\frac{R_B}{\pi_B}-1\right) \\
+(1-\tau^{*})\,\frac{(1-\omega)}{\omega}b^{*g}_{A}\left(\frac{R^{g}_{A}}{\pi_A}+1\right)-(1-\tau)\,\frac{P_B}{P_A}b^{g}_{B}\left(\frac{R}{\pi_B}+1\right)= \\
\left(\frac{(1-\omega)}{\omega}c^{*}_{A}-\frac{P_B}{P_{At}}c_B\right),
\end{aligned}
\tag{43}
$$

In expression (43), the left-hand side represents the difference in the rates of return of the net foreign asset position, which reflects the disparity between the real interest rates of bonds owned abroad (both private and public) and those of domestic bonds (both private and public) held by foreigners. The right-hand side denotes the current account balance. Consequently, the difference in the rates of return of foreign and domestic assets of a negative net asset position should be compensated by a current account surplus in the steady state.

2.6 Calibration

The values assigned to the parameters of the model use information for Spain (country A) and Germany (country B). We impose some parameters and use the equations of the steady state of the model to calibrate the rest. In this way, we are able to reproduce relevant observable economic facts of the two countries. Table 1 reflects the parameters that have been initially set and the sources used, while Table 2 reproduces the calibrated parameters and the targets obtained with the model.

The weight of Spain ω, has been established according to the population statistics of Eurostat. We set the reaction of the risk premium to changes in the ratio of debt-to-GDP, $\vartheta = 0.09$, to reflect a rise in risk premium of roughly 4.5 basis points for each 1 pp increase in debt-to-GDP, consistent with estimates in the literature (see IMF (2017)),

To obtain the value of 0.09 we use equation (11). The Taylor rule parameters Φ and ρ fall within the standard range. The first value is consistent with the original parameters proposed by Taylor in 1993. The latter value reflects a realistic degree of interest-rate smoothing (see McCallum, 2001). They are also consistent with recent estimations of Taylor rules (see, for example, Sauer and Sturm, 2007). The inverse of Frisch elasticities, the Calvo price probabilities, and the inflation indexation are those estimated for Spain and Germany by Casares and Vázquez (2018). As regards the share of credit constrained consumers, we guess a value of $\tau = 0.5$ for Spain.[1] To set τ^* we correct τ using the relationship between the ratio of household debt-over-GDP in Germany and the same ratio in Spain. The value of the elasticity of substitution among different goods in the German monopolistic sector has been calculated for a price-cost margin of 39%, according to Bundesbank (2017). We assume that the price-cost margin in Spain is halfway between the estimates for Germany and Italy in this study. We use information from the European Mortgage Federation (Westig and Bertalot (2017)) to set the LTV value. Also, we assume the same intensity of reaction between Spain and Germany in the fiscal rule.

Table 2 shows the values of some parameters related to the targeting of different empirical facts. In our model, steady-state interest rates depend on the discount rate and preference parameters for different types of bonds. We chose β^{*l} so that, given the value of the preference parameters for the bond, the annual interest rate of the German government bond is 1.9%.

Then, we set the impatient discount rate for Spanish lenders at the same figure. Notice that this does not imply that the interest rate of the Spanish public debt is the same as that of Germany, due to the different country preferences for bonds and the existence of a risk premium. We consider that the borrower's discount rate is 2 percentage points lower, in the range of values observed in the literature (see Iacoviello, 2005 for a discussion on the calibration of this parameter). There are four preference parameters that affect the demand for bonds in Spain (χ_A, χ_A^g, χ_B, χ_B^g) and the respective ones for Germany (χ_A^*, χ_A^{*g}, χ_B^*, χ_B^{*g}). We calibrate these values so that the steady-state model solution reproduces two sets of facts: *(a)* a set of interest rates (the 1 to 2 year Spanish government bond, R_A^g, and the

[1] Gali et al. (2004), in a model with Ricardian and rule-of-thumb consumers, consider that the best guess for the share of non Ricardian consumers is in the neighbourhood of 1/2.

mortgage interest rates in Spain and Germany, R_A and R_b); *(b)* a set of debt ratios (the ratio of Spanish public debt in the hands of Spanish households, the ratio of German public debt in German households' hands, the ratio of German private debt in German households' hands, total Spanish debt-over-GDP, and total German debt-over-GDP). The housing preference parameter for Spain has been chosen to obtain the residential stock-over-GDP according to Bank of Spain (BdE). Following Deloitte (2016), the number of dwellings per citizen in Spain is roughly the same as in Germany. Thus, we set the value of this parameter for Germany to replicate the same ratio as in Spain. The values for tax-exempt income $\overline{t_A}$ and $\overline{t_b}$ guarantee that the flat rates for Spain and Germany are 0.31 and 0.37, respectively.[2]

As shown in Table 3, we normalize the steady-state per capita aggregate income in Spain to 1, and the German per capita income to 1.3, according to Eurostat. Government consumption represents 18.5% of GDP in Spain and 18.8% in Germany. The targeted long-run public debt-over-GDP is set to an annual 60 and 85 per cent in Germany and Spain, respectively. The German figure is in accordance with the the EU's Stability and Growth Pact, while the Spanish one is close to the average of the decade before the Covid crisis. Table 4 shows the model steady-state values for aggregate demand and bonds.

[2]These tax rates are approximated using data on taxation from the European Commission.

Table 1. Parameters imposed in the model

Parameter	Value	Description	Source
ω	0.35	Weight domestic country	Eurostat
ϑ	0.09	Risk premium reaction to the debt/GDP	IMF (2017)
Φ	1.5	Inflation parameter Taylor rule	Sauer and Sturm (2007)
ρ	0.8	Persistence interest rate Taylor rule	Sauer and Sturm (2007)
η	1.74	Inverse Frisch elasticity A	Casares and Vázquez (2018)
η^*	1.59	Inverse Frisch elasticity B	Casares and Vázquez (2018)
τ	0.5	Share of borrowers A	Gali et al. (2004)
τ^*	0.36	Share of borrowers B	FRED
θ	0.86	Price Calvo probability A	Casares and Vázquez (2018)
θ^*	0.56	Price Calvo probability B	Casares and Vázquez (2018))
ε	3.17	Monopolistic competition elasticity A	Bundesbank (2017)
ε^*	3.56	Monopolistic competition elasticity B	Bundesbank (2017)
k_{SSA}	0.80	LTV A	Westig and Bertalot (2017)
k_{SSB}	0.76	LTV B	Westig and Bertalot (2017)
$\psi_1 = \psi_1^*$	$\frac{1}{6}$	Fiscal reaction to SS deviation	
$\psi_2 = \psi_2^*$	1.1	Fiscal adjustment speed	
ζ	0.44	Inflation indexation A	Casares and Vázquez (2018)
ζ^*	0.21	Inflation indexation B	Casares and Vázquez (2018)

Table 2. Parameters calibrated from model equations

Parameter	Value	Target	Source
β^{*l}	0.985	$(R-1)*4*100 = 1.9\%$	Bundesbank (2017)
β^{l}	0.985		Assumed
β^{*r}	0.965		Iacoviello (2005)
β^{r}	0.965		Iacoviello (2005)
χ_A	0.0901	$(R_A-1)*4*100 = 3.2\%$	ECB
χ_A^g	0.0606	$(R_A^g-1)*4*100 = 2.2\%$	BdE
χ_B	0.0375	$\frac{b_B^{*l}}{b^{*r}} = 0.71$	Bundesbank (2017)
χ_B^g	0.0413	$\frac{b^*}{y^*} = 8.8$	OECD
χ_A^*	0.0532	$\frac{b}{y} = 12.7$	OECD
χ_A^{*g}	0.0399	$\frac{b_A^g}{b_t^g} = 0.58$	BdE
χ_B^*	0.0454	$(R_b-1)*4*100 = 3.5\%$	ECB
χ_B^{*g}	0.0189	$\frac{b_B^{*g}}{b_t^{*g}} = 0.48$	Bundesbank (2017)
$\overline{t_A}$	0.04	$m_A = 0.31$	European Commission
$\overline{t_B}$	0.24	$m_B = 0.37$	European Commission
γ_h	0.6785	$\frac{h}{4y} = 0.65$	BdE
γ_h^*	0.7156	$\frac{h}{4y} = 0.65$	Deloitte

Table 3. Normalizations and exogenous variables

Variable	Value	Source
y	1	Normalization
y^*	1.3	Eurostat
$\frac{g}{y}$	0.185	World Bank
$\frac{g^*}{y^*}$	0.188	World Bank
$\frac{b^g}{4y}$	0.85	EU's Stability and Growth Pact corrected
$\frac{b^{*g}}{4y^*}$	0.6	EU's Stability and Growth Pact

Table 4. Steady state (in country per capita values on a quarterly basis)

Spain		
y	1.00	GDP in country A
c_A	0.29	Consumption in A of goods produced in A
c_A^*	0.53	Exports of A
b^g	3.40	Government bonds issued in A
τb^r	9.22	Private bonds issued in A
$(1-\tau)b_A^l$	5.09	Private bonds issued in A held by A's lenders
$(1-\tau)b_B^l$	4.46	Private bonds issued in B held by A's lenders
$(1-\tau)b_A^g$	1.97	Public bonds issued in A held by A's lenders
$(1-\tau)b_B^g$	3.01	Public bonds issued in B held by A's lenders
Germany		
y^*	1.30	GDP in country B
c_B^*	0.69	Consumption in country B of goods produced in country B
c_B	0.37	Exports of country B
b^{*g}	3.12	Government bonds issued in B
$\tau^* b^{*r}$	8.28	Public bonds issued in B
$(1-\tau^*)b_A^{*l}$	2.23	Private bonds issued in A held by B's lenders
$(1-\tau^*)b_B^{*l}$	5.88	Private bonds issued in B held by B's lenders
$(1-\tau^*)b_A^{*g}$	0.77	Public bonds issued in A held by B's lenders
$(1-\tau^*)b_B^{*g}$	1.50	Public bonds issued in B held by B's lenders

3 Financial convergence: results

The degree of bond preference convergence is measured by an index, I^C, which starts at the benchmark economy and increases to 1, where Spanish and German lenders share the same preferences.

We consider two scenarios. In the first, preferences converge toward those of Spanish lenders for Spanish bonds; in the second, they converge toward the preferences of German lenders for German bonds. For private bonds, this implies that all lenders adopt the preferences of Spanish (German) households in the first (second) scenario. For public bonds, convergence takes place toward the respective domestic

households' preferences for government securities.

Formally, let χ^p denote the 4×1 vector of benchmark cross-country preference parameters for private bonds,

$$\chi^p = \begin{pmatrix} \chi_A \\ \chi_B \\ \chi_A^* \\ \chi_B^* \end{pmatrix}.$$

Similarly, let χ^g denote the 4×1 vector of benchmark cross-country preference parameters for public bonds

$$\chi^g = \begin{pmatrix} \chi_A^g \\ \chi_B^g \\ \chi_A^{*g} \\ \chi_B^{*g} \end{pmatrix}.$$

Define χ as the 8×1 vector collecting both private and public bond preferences,

$$\chi = \begin{pmatrix} \chi^p \\ \chi^g \end{pmatrix}.$$

Let $\bar{\chi}$ be the 8×1 vector of common preference parameters under full convergence. For scenario 1 (convergence to Spanish preferences),

$$\bar{\chi} = \begin{pmatrix} \chi_A \\ \chi_A \\ \chi_A \\ \chi_A \\ \chi_A^g \\ \chi_A^g \\ \chi_A^g \\ \chi_A^g \end{pmatrix},$$

and for scenario 2 (convergence to German preferences),

$$\bar{\chi} = \begin{pmatrix} \chi_B^* \\ \chi_B^* \\ \chi_B^* \\ \chi_B^* \\ \chi_B^{*g} \\ \chi_B^{*g} \\ \chi_B^{*g} \\ \chi_B^{*g} \end{pmatrix}.$$

Let ι be a parameter that varies monotonically between 0 and 1, where $\iota = 0$ represents full convergence and $\iota = 1$ corresponds to the benchmark economy. The vector of preference parameters in a bond preference convergence environment ι is then given by

$$\chi(\iota) = \bar{\chi} - \iota(\bar{\chi} - \chi).$$

When $\iota = 0$, preferences are fully converged across countries; when $\iota = 1$, they remain at the benchmark values.

The financial convergence index is defined as

$$I^C = e^{-\iota},$$

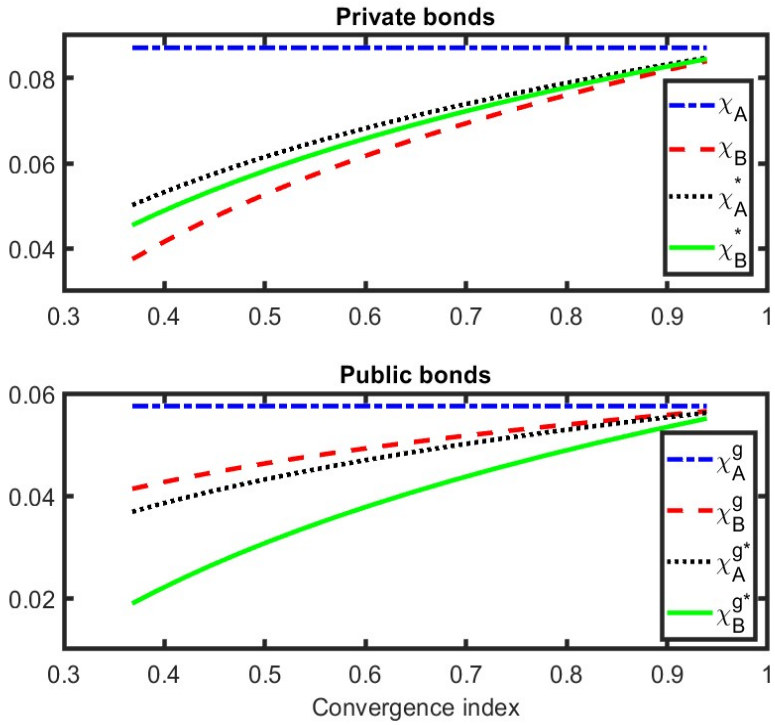
which ranges from $I^C = 0.36$ at the benchmark economy[3] to $I^C = 1$ under full convergence.

Figure 1 illustrates how financial convergence increases as the preference parameters of both Spanish and German lenders approach either the Spanish benchmark preferences for Spanish bonds (subfigure 1a) or the German benchmark preferences for German bonds (subfigure 1b).

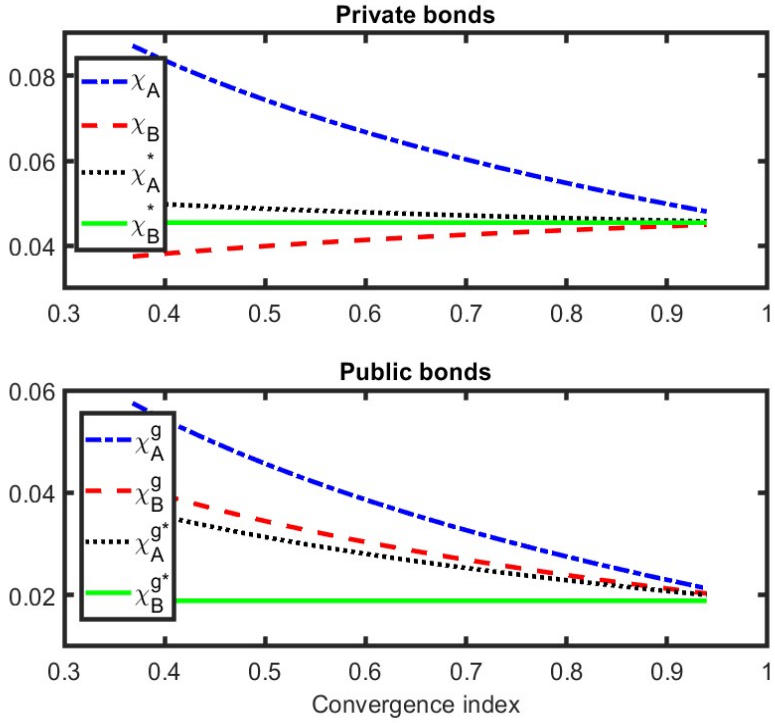
It is important to highlight that, in parallel with this behavioral convergence exercise, our framework retains the mechanism by which bond preferences adjust endogenously to relative debt-to-output ratios, as expressed in (1). This channel captures the fundamental, macroeconomic dimension of convergence emphasized in the Introduction, thereby complementing the more behaviorally driven dynamics.

[3]This value is close to the average index of financial integration reported by Hoffmann et al. (2020) for the period 1999–2021.

In what follows, we analyze the implications of bond preference convergence (referred to as *financial convergence* for short) along three dimensions: (i) the steady-state levels of macroeconomic and financial variables, (ii) the volatilities of these variables, and (iii) the welfare consequences for both countries in the monetary union.



(a) Spanish preferences for Spanish bonds



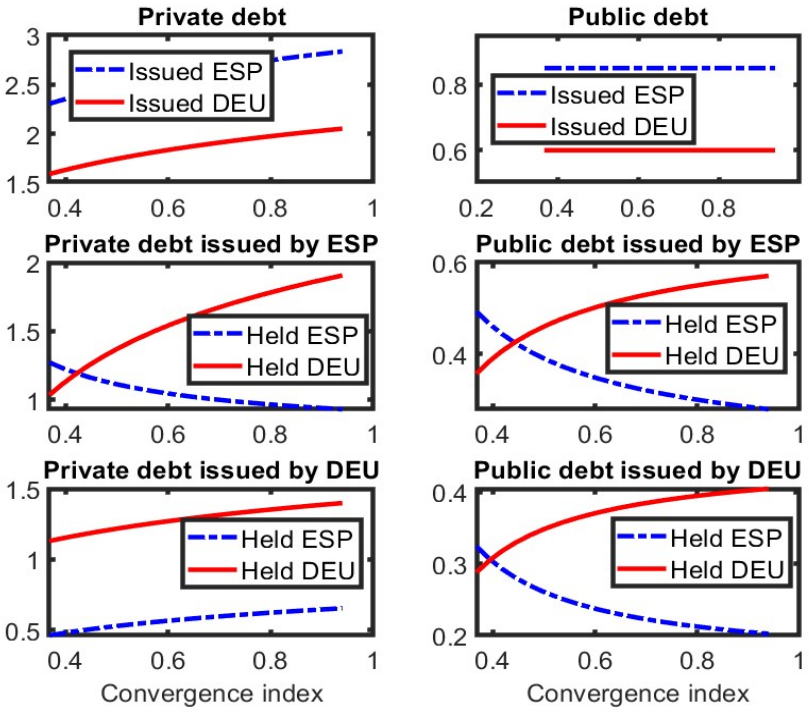
(b) German preferences for German bonds

Figure 1: Convergence in preferences for bonds

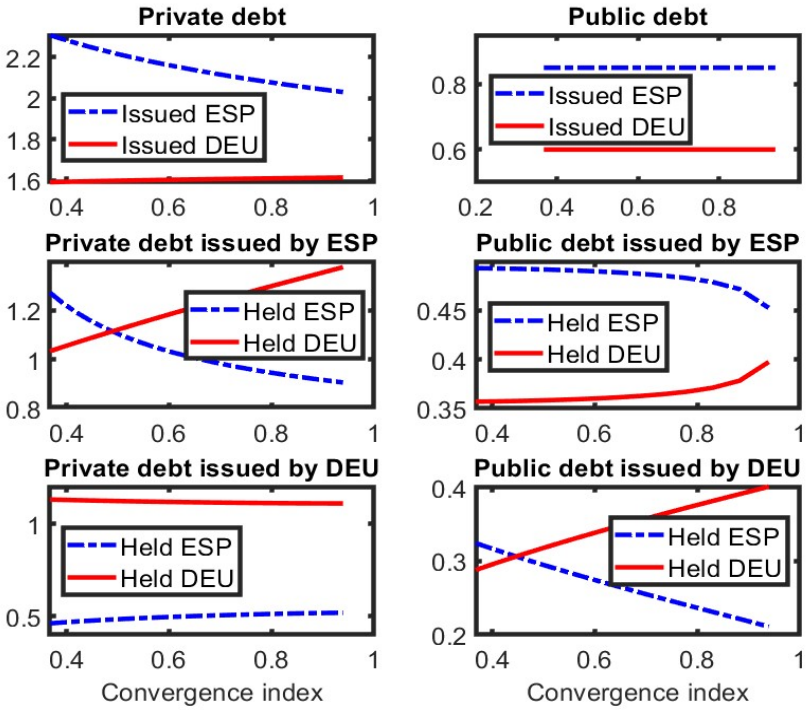
3.1 Financial convergence: Steady-state analysis

Figure 2 reports the effects of convergence on bond issuance and bond holdings once the economy has stabilized. The implications for private debt differ markedly between the two countries, depending on whether preferences converge toward the Spanish benchmark (subfigure 2a) or the German benchmark (subfigure 2b). In the first case, convergence leads to a long-run increase in private debt issued in both Spain and Germany. In the second case, however, union-wide private debt declines, driven mainly by a reduction in Spain.

By construction, the ratio of public debt to GDP does not change in the long run. Nevertheless, the distribution of both private and public debt between Spanish and German lenders shifts considerably with convergence. Interestingly, as preferences converge, the direction of change in the volume of bonds held by Spanish and German lenders is the same across nearly all bond categories, regardless of whether convergence is toward Spanish or German preferences. In most bond categories, Spanish lenders reduce their holdings, which are taken up instead by German investors. The only exception is private bonds issued in Germany: their holdings increase when convergence is toward Spanish preferences but remain broadly stable when convergence is toward German preferences.



(a) Spanish preferences for Spanish bonds



(b) German preferences for German bonds

Figure 2: Steady state effects on bond holdings (bonds-to-annual-GDP ratio)

Figures 3 and 4 illustrate how financial convergence affects long-run macroeconomic outcomes and

their distribution across households. Note that in the benchmark, GDP is normalized to 1 in Spain and to 1.3 in Germany.

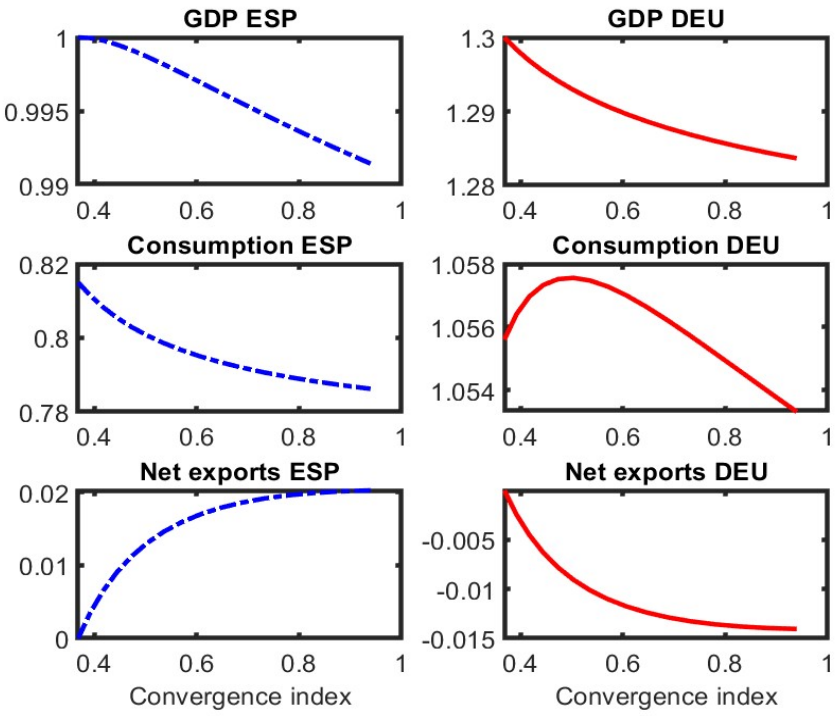
When preferences converge toward the Spanish benchmark, as in Figure 1a, Spanish aggregate consumption declines steadily, falling by up to 3 percent under full convergence (see Figure 3a). German aggregate consumption also decreases, though in a non-monotonic and quantitatively negligible way. In this scenario, international demand for both Spanish and German private bonds rises, lowering their interest rates. The associated decline in debt-service costs boosts borrowers' consumption and housing demand. Lenders, by contrast, are adversely affected by the fall in real interest rates, reducing both consumption and housing as financial convergence proceeds. Convergence toward Spanish preferences thus generates pronounced distributional effects.

In Germany, the opposing shifts in borrowers' and lenders' consumption largely offset one another, leaving aggregate consumption broadly unchanged. In Spain, however, the contraction in lenders' consumption dominates, leading to a net decline in aggregate consumption. The weaker absorption capacity of the Spanish economy reduces imports and raises net exports. Overall, convergence toward Spanish preferences lowers GDP in both countries, with output falling by about 1 percent in Spain—mainly due to weaker consumption—and by 1.5 percent in Germany, driven primarily by a deterioration in net exports.

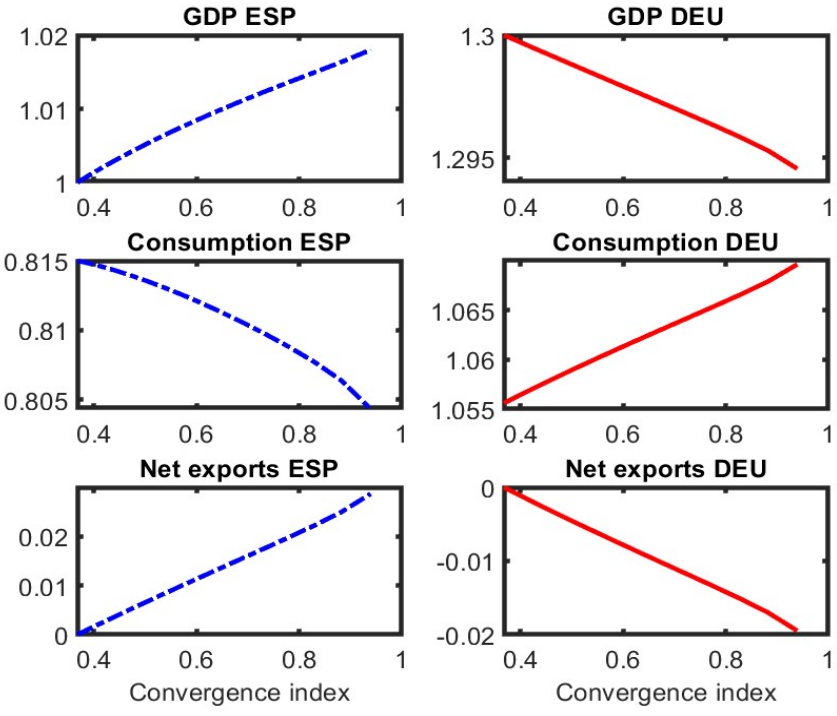
When preferences converge toward the German benchmark, as shown in Figure 1b the picture changes (Figure 3b). In this case, investors are generally less willing to hold bonds of any type, with the exception of Spanish preferences for German private bonds, which increase. Preferences for Spanish bonds among domestic lenders are particularly weakened. As a result, the price of Spanish private bonds declines, encouraging German investors to hold more Spanish private debt.

In the steady state, higher interest rates reduce borrowers' consumption in Spain but raise lenders' consumption in Germany, leading to an increase in Germany's aggregate consumption. In Spain, aggregate consumption again falls, though in this case the decline is driven by borrowers rather than lenders. Convergence toward German preferences therefore worsens the distribution of consumption and housing by widening the gap between the two household types.

At the aggregate level, GDP moves in the opposite direction of consumption. In Spain, the positive contribution of net exports more than offsets the drag from weaker consumption, resulting in a GDP increase of about 2 percent under full convergence. In Germany, by contrast, the deterioration in net exports outweighs the boost from stronger consumption, producing a GDP decline of around 0.5 percent.

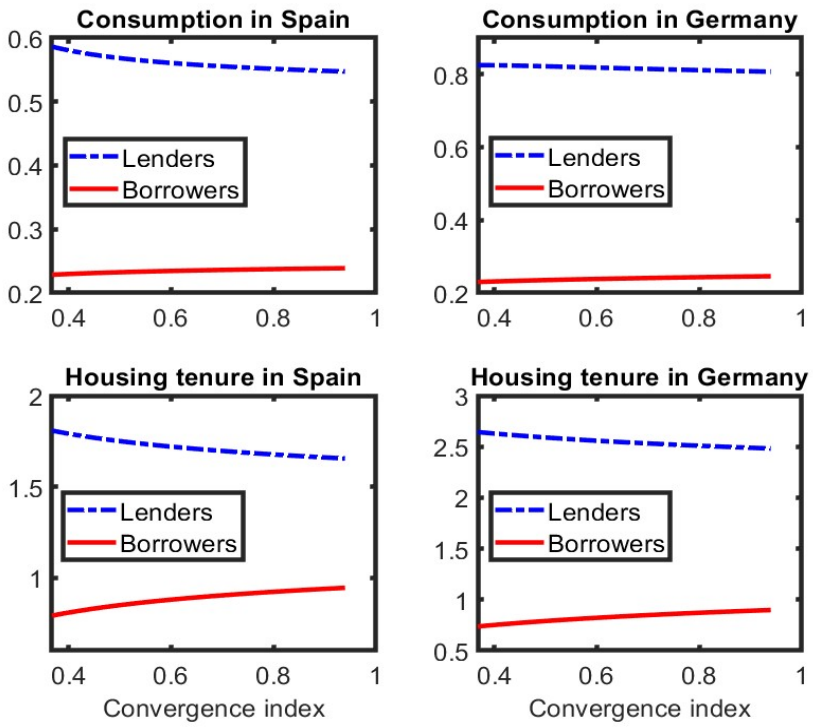


(a) Spanish preferences for Spanish bonds

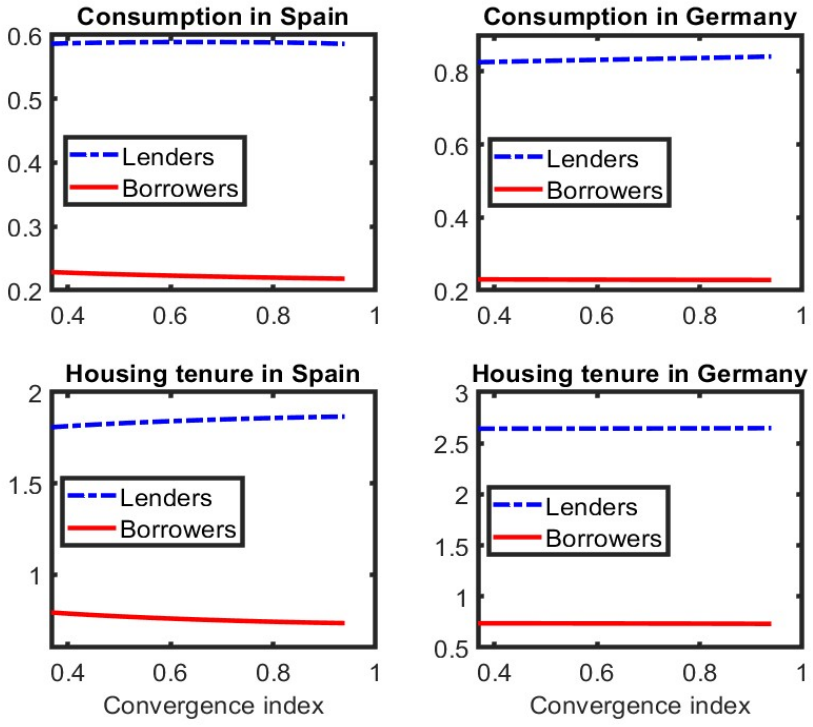


(b) German preferences for German bonds

Figure 3: Steady state effects on GDP and consumption



(a) Spanish preferences for Spanish bonds



(b) German preferences for German bonds

Figure 4: Steady state effects on consumption and housing distribution

Figure 5 displays how welfare changes as bond preferences converge. Values on the y-axis represent

the consumption equivalent variation with respect to the benchmark preferences.

Following the logic of Andrés et al. (2016), we define:

$$V^s = \sum_{t=0}^{\infty} (\beta^s)^t \, U^s(\cdot)$$

where $U^s(\cdot)$ denotes the steady-state instantaneous utility of agents $s = l, r$ (lenders and borrowers) in the benchmark Spanish economy, and V^s is their infinite-horizon discounted utility.

We compute benchmark social welfare in Spain by aggregating the two household types as:

$$V = (1 - \beta^l)(1 - \tau) \, U^l(\cdot) + (1 - \beta^r)\tau \, U^r(\cdot)$$

and define social welfare in the monetary union as:

$$V^{EU} = \omega V + (1 - \omega) V^*$$

where V^* denotes the benchmark social welfare in Germany.

Welfare gains, measured in consumption-equivalent terms, are given by:

$$\Delta^c = \left(\exp\left(V^c(\iota) - V^c\right) - 1\right) \cdot 100$$

where c denotes Spain, Germany, or the monetary union, and $V^c(\iota)$ represents welfare under the convergence regime ι. Δ^c is interpreted as the percentage of additional steady-state consumption that would make agents in the benchmark economy as well off as under the convergence regime ι.

Starting from the most general specification of the utility function, which includes bonds in the lenders' utility (first subfigure), we sequentially exclude different components for the sole purpose of welfare calculations.[4] The second subfigure excludes bonds, the third removes both debt and hours worked, and the fourth further excludes housing so that welfare depends solely on consumption.

Several findings emerge from Figure 5. First, convergence toward Spanish bond preferences yields systematically better welfare outcomes than convergence toward German preferences. In the former case, welfare improves across the entire monetary union; in the latter, it deteriorates.

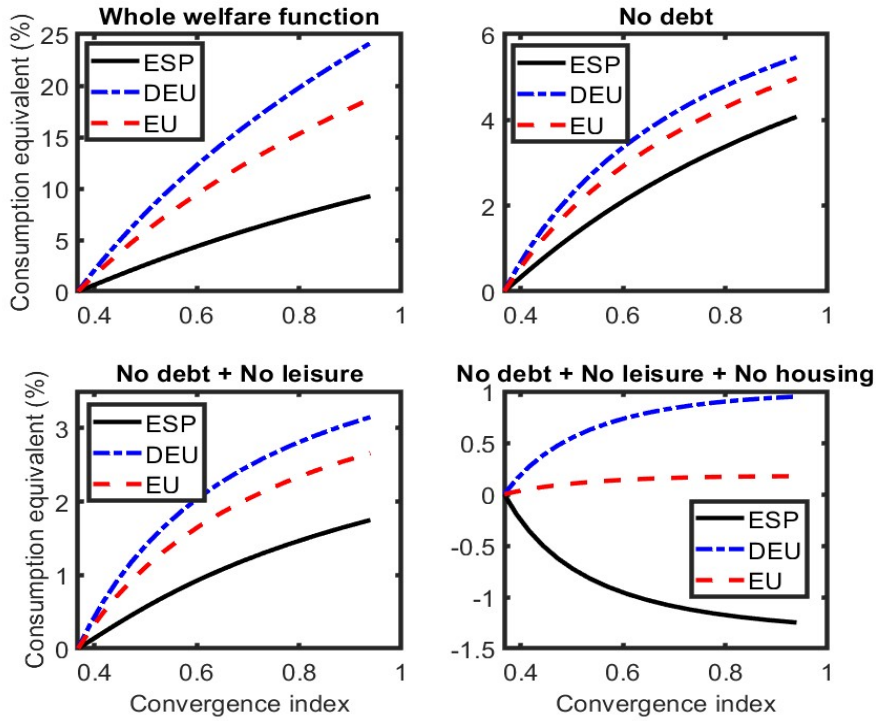
Second, Germany consistently gains from preference convergence, regardless of its direction, though the gains are larger when preferences move toward those of Spain. Third, Spain also benefits from

[4]The structure of the economy is unchanged; only the utility specification used to compute welfare varies.

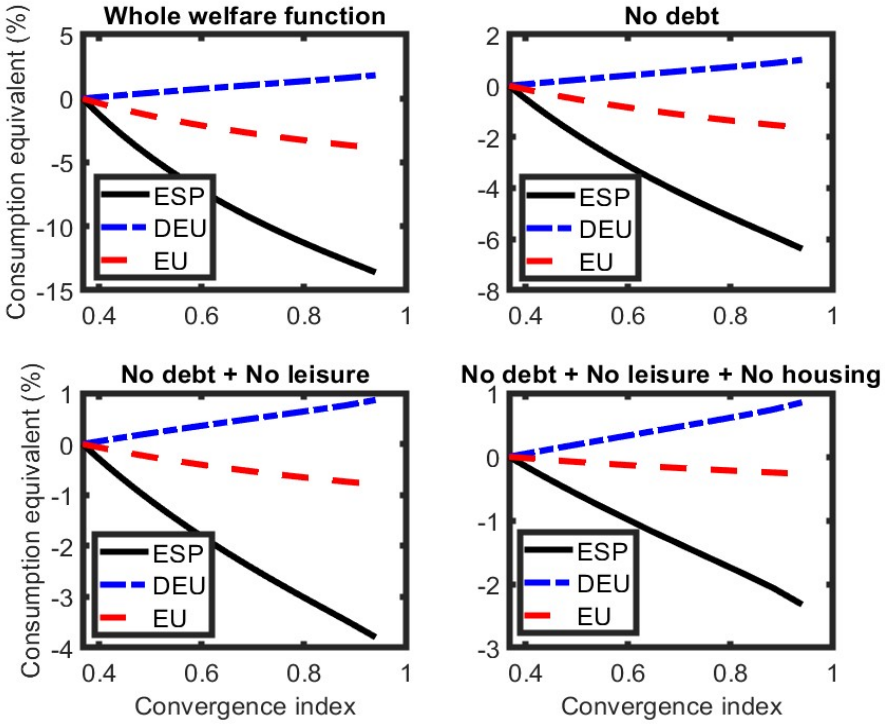
convergence toward its own preferences, but to a lesser extent than Germany. By contrast, convergence toward German preferences substantially reduces welfare in Spain.

Fourth, decomposing welfare across utility components highlights the importance of non-consumption channels. Under convergence toward Spanish preferences, bonds, leisure, and housing all contribute positively to welfare in both Spain and Germany. This is no longer true under convergence toward German preferences: in that case, German welfare gains are driven primarily by consumption, while in Spain, consumption, housing, and leisure all exert downward pressure on welfare.[5]

[5]Because social welfare aggregates lenders' and borrowers' utility using different discount factors, overall welfare does not necessarily move monotonically with aggregate consumption, even when consumption is the sole determinant of utility.



(a) Spanish preferences for Spanish bonds



(b) German preferences for German bonds

Figure 5: Steady-state welfare effects.
Consumption equivalent (% change vs. benchmark)

3.2 Financial Convergence: Volatility Analysis

We now turn to the effects of financial preference convergence on volatility. Throughout, both economies are assumed to be symmetrically affected by technology shocks to total factor productivity (TFP).

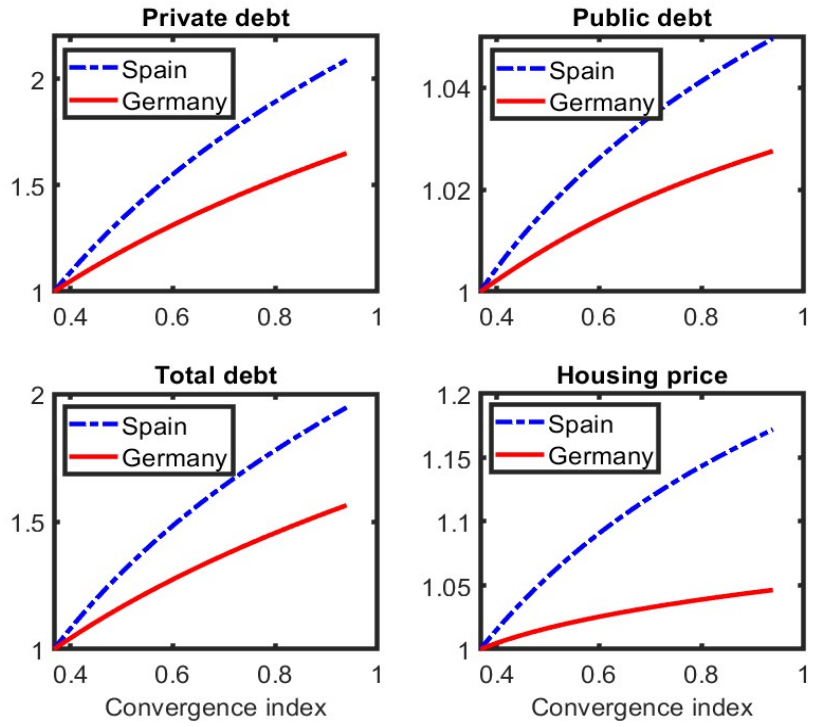
Figure 6 shows the impact of bond preference convergence on financial stability, measured by the volatility of bond issuance and housing prices. Convergence toward Spanish preferences substantially amplifies financial volatility, with private debt and housing prices becoming more sensitive to productivity shocks. The effect is stronger in Spain than in Germany.

By contrast, convergence toward German preferences produces more moderate effects. Bond market volatility generally declines—especially in Spain—while the impact on Germany is negligible. Housing price volatility still rises in this scenario, but by an order of magnitude smaller than under convergence toward Spanish preferences.

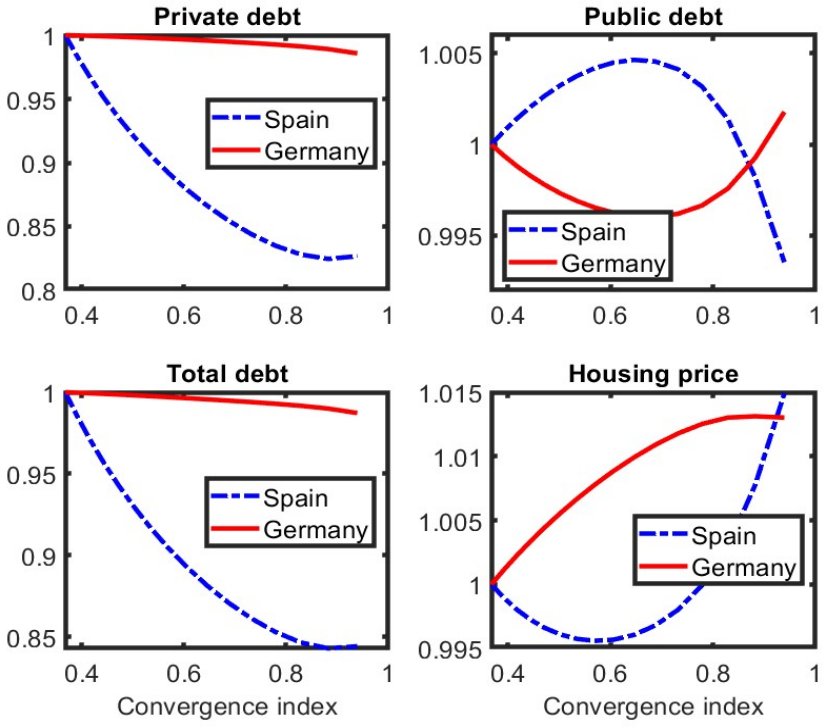
Figure 7 highlights the macroeconomic implications of these dynamics. The stronger debt response to productivity shocks under Spanish-like preferences fuels borrower consumption in Spain, boosting aggregate demand. This amplifies GDP's responsiveness to TFP shocks and attenuates the deflationary (inflationary) pressure that would otherwise follow positive (negative) shocks. Accordingly, panel (a) of Figure 7 shows larger GDP volatility and a sharper decline in inflation volatility in Spain relative to Germany.

When preferences converge toward German ones (panel (b)), the macroeconomic volatility effects are much more muted, consistent with the behavior of debt in Subfigure 6b. For example, Spain's aggregate consumption volatility increases only in a non-monotonic fashion, reflecting offsetting movements in borrower and lender consumption under a common shock.

Finally, the last subplot in each panel of Figure 7 plots the variance of the consumption gap between lenders and borrowers, $\text{var}(c_t^l - c_t^r)$. This measure is an order of magnitude larger when preferences converge toward Spanish ones than when they converge toward German ones. In other words, Spanish-like convergence produces a much stronger post-shock compression in the lender–borrower consumption gap than the widening observed under German-like convergence.

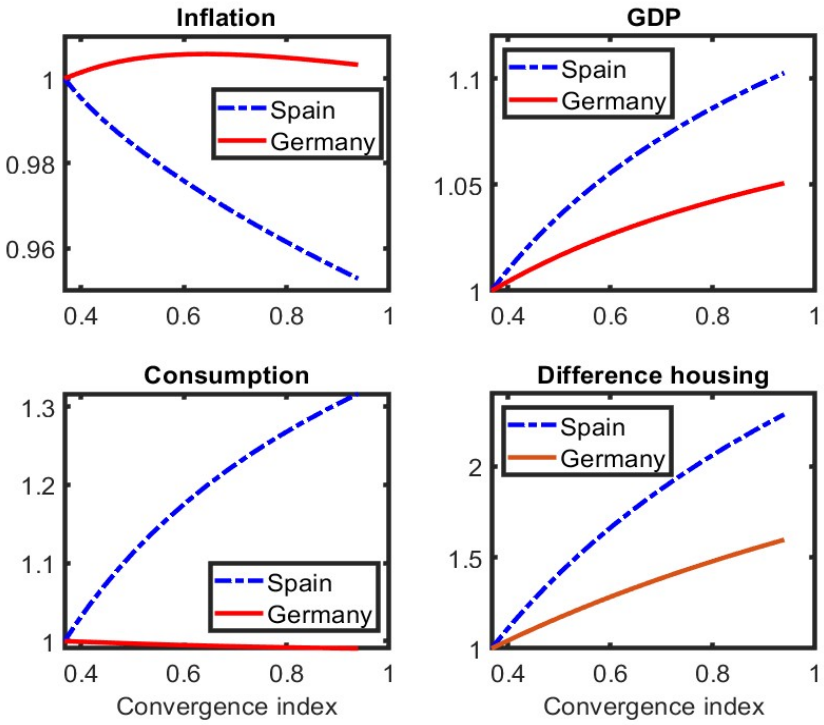


(a) Spanish preferences for Spanish bonds

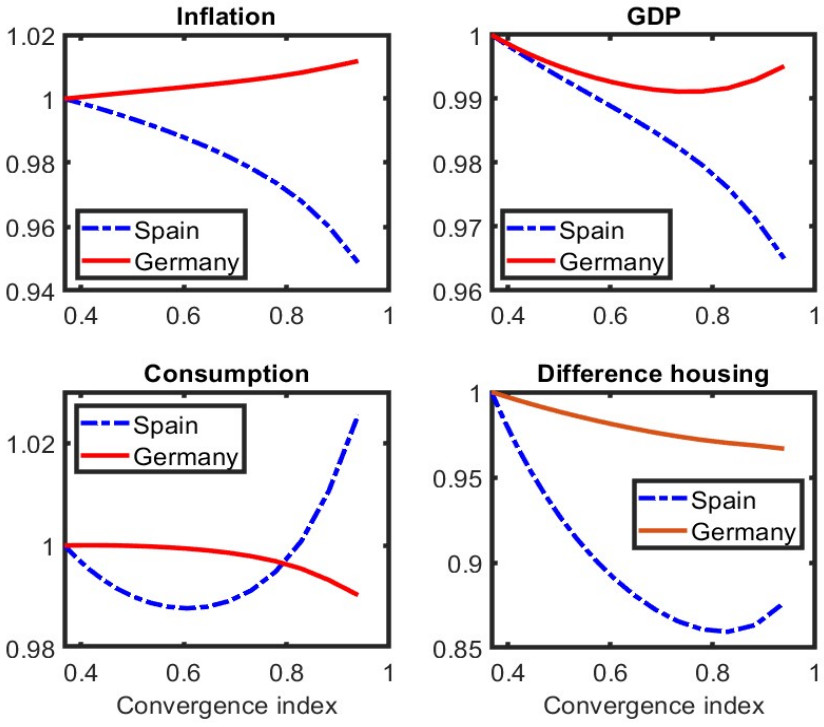


(b) German preferences for German bonds

Figure 6: Effects on financial stability.
Relative variance over benchmark variance



(a) Spanish preferences for Spanish bonds



(b) German preferences for German bonds

Figure 7: Volatility effects: inflation, GDP, consumption, and housing inequality (benchmark variance = 1)

4 Policy Implications

Our findings highlight that financial preference convergence (an integral but often overlooked dimension of financial integration) has distributional and stability effects that are highly asymmetric across member states. This suggests that euro area policymakers cannot evaluate convergence solely in terms of aggregate efficiency or long-run welfare gains; they must also consider how its direction affects both cross-country and within-country distributional outcomes.

Convergence toward periphery-like preferences, while beneficial in terms of union-wide welfare, comes at the cost of heightened financial and output volatility. This underscores the importance of reinforcing macroprudential frameworks, particularly those targeting housing and credit markets, to dampen excessive fluctuations. Tools such as countercyclical loan-to-value (LTV) ratios, debt-service-to-income (DSTI) caps, or borrower-based capital buffers could mitigate the destabilizing effects of stronger debt responses to shocks.

Convergence toward core-country preferences appears more stabilizing in macro-financial terms but imposes significant welfare losses on the periphery. In this scenario, the case for risk-sharing mechanisms becomes stronger. Enhanced fiscal transfers, common budgetary instruments, or joint debt issuance could serve as compensating devices to ensure that the benefits of stability are not concentrated disproportionately in core countries while costs fall on the periphery.

Taken together, these results imply that deeper financial convergence must be accompanied by institutional safeguards. A balanced policy agenda would combine macroprudential instruments to address volatility with fiscal mechanisms to offset unequal welfare effects. Recognizing financial preference convergence as a structural force in the euro area provides a richer perspective on the design of macro-financial governance.

5 Conclusions

This paper has analyzed the macroeconomic and welfare consequences of convergence in financial preferences within a monetary union. We developed a two-country DSGE model in which households differ in their preferences for private versus public, and domestic versus foreign bonds. These preferences are shaped by both structural–behavioral factors and macroeconomic fundamentals. Within this framework, we compared two convergence scenarios: one in which preferences gradually align with those of Spanish lenders, and another in which they align with those of German lenders.

Three main conclusions emerge. First, the *direction* of convergence is critical. Convergence toward Spanish (periphery) preferences expands private debt, lowers long-run GDP, and increases macro-financial volatility, while reducing inflation volatility. Welfare rises across the monetary union under this scenario, with Germany gaining the most and Spain benefiting more modestly. These gains are not driven by consumption alone: in both countries, bonds, leisure, and housing also contribute positively to welfare when convergence takes a Spanish direction. By contrast, convergence toward German (core) preferences reduces private debt and output volatility but delivers only moderate welfare gains for Germany and sizeable welfare losses for Spain. In this case, German welfare improvements come mainly through higher consumption, while in Spain, consumption, housing, and leisure all exert downward pressure on welfare. Financial convergence therefore does not yield uniform benefits: distributional consequences across countries, and across utility components, are decisive.

Second, aggregate outcomes mask important redistributional effects within countries. In Spain, convergence toward Spanish preferences shifts resources from lenders to borrowers but reduces aggregate consumption and output. In Germany, borrower–lender effects offset one another in the aggregate. Convergence toward German preferences, by contrast, widens the consumption gap between lenders and borrowers, especially in Spain, even though German aggregate consumption rises. Welfare thus depends not only on output and consumption levels but also on how debt and housing dynamics redistribute resources across households.

Third, convergence has strong implications for macro-financial stability. Spanish-style convergence amplifies debt and housing price volatility and makes GDP more responsive to shocks, though it stabilizes inflation. German-style convergence contains volatility in debt and output but at the cost of worsening welfare in Spain.

These findings carry important policy implications. Financial convergence is a key dimension of euro area integration, yet its impact cannot be assessed solely through aggregate indicators. The distribution of gains and losses across countries and households, together with the trade-off between welfare and stability, should be taken into account. Convergence toward periphery preferences may significantly raise overall welfare but requires stronger macroprudential frameworks to contain volatility. Convergence toward core-country preferences is more stabilizing but less equitable, imposing welfare costs on the periphery. A forward-looking policy agenda should therefore combine deeper financial convergence with compensating instruments—such as macroprudential tools and fiscal arrangements—to manage these trade-offs. Designing such mechanisms, especially in the context of euro area policy coordination,

constitutes a natural avenue for future research.

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Appendix

National economy households equations

The Patient Households

$$\gamma_{b_{At}}(\bullet) = \chi_A + \vartheta\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right) \tag{44}$$

$$\gamma_{b_{At}}^g(\bullet) = \chi_A^g + \vartheta\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right) \tag{45}$$

$$\begin{aligned} &c_{At}^l + \frac{P_{Bt}}{P_{At}}c_{Bt}^l + q_t\left(h_t^l - h_{t-1}^l\right) + b_{At}^l + \frac{P_{Bt}}{P_{At}}b_{Bt}^l + b_{At}^g + \frac{P_{Bt}}{P_{At}}b_{Bt}^g \\ &\leq \left(1 - x_t^l\right)w_t n_t^l + \frac{R_{At-1}}{\pi_{At}}b_{At-1}^l + \frac{P_{Bt}}{P_{At}}\frac{R_{Bt-1}}{\pi_{Bt}}b_{Bt-1}^l \\ &+ \frac{R_{At-1}^g}{\pi_{At}}b_{At-1}^g + \frac{P_{Bt}}{P_{At}}\frac{R_{t-1}}{\pi_{Bt}}b_{Bt-1}^g + d_t, \end{aligned} \tag{46}$$

$$t_{At}^l = m_{At}(w_t n_t^l - \overline{t_A}) \tag{47}$$

$$x_t^l = \frac{t_{At}^l}{w_t n_t^l} \tag{48}$$

$$\pi_{At} = \frac{P_{At}}{P_{At-1}} \tag{49}$$

$$c_t^l = c_{At}^l + \frac{P_{Bt}}{P_{At}}c_{Bt}^l \tag{50}$$

$$\lambda_t^l = \frac{\omega}{c_{At}^l} \tag{51}$$

$$\frac{c_{At}^l}{c_{Bt}^l} = \frac{\omega P_{Bt}}{(1-\omega)P_{At}} \tag{52}$$

$$\frac{\gamma_h}{h_t^l} = \lambda_t^l q_t - \beta E_t \left[\lambda_{t+1}^l q_{t+1}\right] \tag{53}$$

$$w_t = \frac{c_{At}^l}{\omega}\left(n_t^l\right)^\eta \tag{54}$$

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_{At}}{\pi_{At+1}}\right] + \frac{\chi_A}{b_{At}^l} + \frac{\vartheta}{b_{At}^l}\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right) \tag{55}$$

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_{Bt}}{\pi_{At+1}}\right] + \frac{P_{At}}{P_{Bt}}\frac{\chi_B}{b_{Bt}^l} \tag{56}$$

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_{At}^g}{\pi_{At+1}}\right] + \frac{\chi_A^g}{b_{At}^g} + \frac{\vartheta}{b_{At}^g}\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right) \tag{57}$$

$$\lambda_t^l = \beta^l E_t\left[\lambda_{t+1}^l \frac{R_t}{\pi_{At+1}}\right] + \frac{P_{At}}{P_{Bt}}\frac{\chi_B^g}{b_{Bt}^g} \tag{58}$$

$$\phi_t \equiv -\vartheta\left(\frac{b_t^*}{b_t}\frac{y_t}{y_t^*} - 1\right) \tag{59}$$

The Impatient Households

$$\begin{aligned} &c_{At}^r + \frac{P_{Bt}}{P_{At}}c_{Bt}^r + q_t\left(h_t^r - h_{t-1}^r\right) + \frac{R_{At-1}}{\pi_{At}}b_{t-1}^r \\ &\leq \left(1 - x_t^r\right) w_t n_t^r + b_t^r. \end{aligned} \tag{60}$$

$$t_{At}^r = m_{At}(w_t n_t^r - \overline{t_A}) \tag{61}$$

$$x_t^r = \frac{t_{At}^r}{w_t n_t^r} \tag{62}$$

$$E_t\left[\frac{R_{At}}{\pi_{At+1}}b_t^r\right] \leq E_t\left[k_{At} q_{t+1} h_t^r\right], \tag{63}$$

$$c_t^r = c_{At}^r + \frac{P_{Bt}}{P_{At}}c_{Bt}^r \tag{64}$$

$$\lambda_t^r = \frac{\omega}{c_{At}^r} \tag{65}$$

$$\frac{c_{At}^r}{c_{Bt}^r} = \frac{\omega P_{Bt}}{(1-\omega) P_{At}} \tag{66}$$

$$\frac{\gamma_h}{h_t^r} = q_t \lambda_t^r - E_t \left[\beta^r q_{t+1} \lambda_{t+1}^r + \xi_t k_{At} q_{t+1} \pi_{At+1} \right] \tag{67}$$

$$w_t = \frac{c_{At}^r}{\omega} (n_t^r)^\eta \tag{68}$$

$$\lambda_t^r = \beta^r E_t \left[\lambda_{t+1}^r \frac{R_{At}}{\pi_{At+1}} \right] + \xi_t R_{At} \tag{69}$$

The foreign country's households

The Patient Households

$$\gamma_{b_{At}}^*(\bullet) = \chi_A^* + \vartheta \left(\frac{b_t^*}{b_t} \frac{y_t}{y_t^*} - 1 \right) \tag{70}$$

$$\gamma_{b_{At}}^{*g}(\bullet) = \chi_A^{*g} + \vartheta \left(\frac{b_t^*}{b_t} \frac{y_t}{y_t^*} - 1 \right) \tag{71}$$

$$\begin{aligned} &\frac{P_{At}}{P_{Bt}} c_{At}^{*l} + c_{Bt}^{*l} + q_t^* \left(h_t^{*l} - h_{t-1}^{*l} \right) + \frac{P_{At}}{P_{Bt}} b_{At}^{*l} + b_{Bt}^{*l} + \frac{P_{At}}{P_{Bt}} b_{At}^{*g} + b_{Bt}^{*g} \\ &\leq \left(1 - x_t^{*l} \right) w_t^* n_t^{*l} + \frac{P_{At}}{P_{Bt}} \frac{R_{At-1}}{\pi_{At}} b_{At-1}^{*l} + \frac{R_{Bt-1}}{\pi_{Bt}} b_{Bt-1}^{*l} \\ &+ \frac{P_{At}}{P_{Bt}} \frac{R_{At-1}^g}{\pi_{At}} b_{At-1}^{*g} + \frac{R_{t-1}}{\pi_{Bt}} b_{Bt-1}^{*g} + d_t^* \end{aligned} \tag{72}$$

$$t_{Bt}^l = m_{Bt}(w_t^* n_t^{*l} - \overline{t_B}) \tag{73}$$

$$x_t^{*l} = \frac{t_{Bt}^l}{w_t^* n_t^{*l}} \tag{74}$$

$$c_t^{*l} = \frac{P_{At}}{P_{Bt}} c_{At}^{*l} + c_{Bt}^{*l} \tag{75}$$

$$\pi_{Bt} = \frac{P_{Bt}}{P_{Bt-1}} \tag{76}$$

$$\lambda_t^{*l} = \frac{1-\omega}{c_{Bt}^{*l}} \tag{77}$$

$$\frac{c_{At}^{*l}}{c_{Bt}^{*l}} = \frac{\omega}{(1-\omega)} \frac{P_{Bt}}{P_{At}} \tag{78}$$

$$\frac{\gamma_h^*}{h_t^{*l}} = \lambda_t^{*l} q_t^* - \beta^{*l} E_t \left[\lambda_{t+1}^{*l} q_{t+1}^* \right] \tag{79}$$

$$w_t^* = \frac{c_{Bt}^{*l}}{1-\omega} \left(n_t^{*l} \right)^{\eta^*} \tag{80}$$

$$\lambda_t^{*l} = \beta^{*l} E_t \left[\lambda_{t+1}^{*l} \frac{R_{At}}{\pi_{Bt+1}} \right] + \frac{P_{Bt}}{P_{At}} \frac{\chi_A^*}{b_{At}^{*l}} + \frac{\vartheta}{b_{At}^{*l}} \frac{P_{Bt}}{P_{At}} \left(\frac{b_t^*}{b_t} \frac{y_t}{y_t^*} - 1 \right) \tag{81}$$

$$\lambda_t^{*l} = \beta^{*l} E_t \left[\lambda_{t+1}^{*l} \frac{R_{Bt}}{\pi_{Bt+1}} \right] + \frac{\chi_B^*}{b_{Bt}^{*l}} \tag{82}$$

$$\lambda_t^{*l} = \beta^{*l} E_t \left[\lambda_{t+1}^{*l} \frac{R_{At}^g}{\pi_{Bt+1}} \right] + \frac{P_{Bt}}{P_{At}} \frac{\chi_A^{*g}}{b_{At}^{*g}} + \frac{P_{Bt}}{P_{At}} \frac{\vartheta}{b_{At}^{*g}} \left(\frac{b_t^*}{b_t} \frac{y_t}{y_t^*} - 1 \right) \tag{83}$$

$$\lambda_t^{*l} = \beta^{*l} E_t \left[\lambda_{t+1}^{*l} \frac{R_t}{\pi_{Bt+1}} \right] + \frac{\chi_B^{*g}}{b_{Bt}^{*g}} \tag{84}$$

Impatient Households

$$\begin{aligned} &\frac{P_{At}}{P_{Bt}} c_{At}^{*r} + c_{Bt}^{*r} + q_t^* \left(h_t^{*r} - h_{t-1}^{*r} \right) + \frac{R_{Bt-1}}{\pi_{Bt}} b_{t-1}^{*r} \\ &= \left(1 - x_t^{*r} \right) w_t^* n_t^{*r} + b_t^{*r} \end{aligned} \tag{85}$$

$$t_{Bt}^{r} = m_{Bt}(w_t^* n_t^{*r} - \overline{t_B}) \tag{86}$$

$$x_t^{*r} = \frac{t_{Bt}^{r}}{w_t^* n_t^{*r}} \tag{87}$$

$$E_t\left[\frac{R_{Bt}}{\pi_{Bt+1}} b_t^{*r}\right] \leq E_t\left[k_{Bt} q_{t+1}^* h_t^{*r}\right] \tag{88}$$

$$c_t^{*r} = \frac{P_{At}}{P_{Bt}} c_{At}^{*r} + c_{Bt}^{*r} \tag{89}$$

$$\lambda_t^{*r} = \frac{1-\omega}{c_{Bt}^{*r}} \tag{90}$$

$$\frac{c_{At}^{*r}}{c_{Bt}^{*r}} = \frac{\omega P_{Bt}}{(1-\omega) P_{At}} \tag{91}$$

$$\frac{\gamma_h^*}{h_t^{*r}} = q_t^* \lambda_t^{*r} - E_t\left[\beta^{*r} q_{t+1}^* \lambda_{t+1}^{*r} + \xi_t^* k_{Bt} q_{t+1}^* \pi_{Bt+1}\right] \tag{92}$$

$$w_t^* = \frac{c_{Bt}^{*r}}{(1-\omega)} (n_t^{*r})^{\eta^*} \tag{93}$$

$$\lambda_t^{*r} = \beta^{*r} E_t\left[\lambda_{t+1}^{*r} \frac{R_{Bt}}{\pi_{Bt+1}}\right] + \xi_t^* R_{Bt} \tag{94}$$

The National Firms

$$w_t = mc_t \frac{y_t}{n_t} \tag{95}$$

$$\left(\frac{1-\theta\left(\frac{\pi_{At}}{\pi_{At-1}^{\zeta}}\right)^{\varepsilon-1}}{1-\theta}\right)^{\frac{1}{1-\varepsilon}} = \frac{\varepsilon}{\varepsilon-1}\frac{V_t}{F_t} \tag{96}$$

$$V_t = \lambda_t^l mc_t y_t + E_t(\beta^l \theta)\left(\frac{\pi_{At}^{\zeta}}{\pi_{At+1}}\right)^{-\varepsilon} V_{t+1} \tag{97}$$

$$F_t = \lambda_t^l y_t + E_t(\beta^l \theta) \left(\frac{\pi_{At}^{\zeta}}{\pi_{At+1}} \right)^{1-\varepsilon} F_{t+1} \tag{98}$$

The Foreign Firms

$$w_t^* = mc_t^* \frac{y_t^*}{n_t^*} \tag{99}$$

$$\left(\frac{1 - \theta \left(\frac{\pi_{Bt}}{\pi_{Bt-1}^{\zeta}} \right)^{\varepsilon^* - 1}}{1 - \theta} \right)^{\frac{1}{1-\varepsilon^*}} = \frac{\varepsilon^*}{\varepsilon^* - 1} \frac{V_t^*}{F_t^*} \tag{100}$$

$$V_t^* = \lambda_t^{*l} mc_t^* y_t^* + E_t(\beta^{*l} \theta^*) \left(\frac{\pi_{Bt}^{\zeta}}{\pi_{Bt+1}} \right)^{-\varepsilon} V_{t+1}^* \tag{101}$$

$$F_t^* = \lambda_t^{*l} y_t^* + E_t(\beta^{*l} \theta^*) \left(\frac{\pi_{Bt}^{\zeta}}{\pi_{Bt+1}} \right)^{1-\varepsilon} F_{t+1}^* \tag{102}$$

Aggregation

$$b_t^r = \frac{(1-\tau)}{\tau} b_{At}^l + \frac{(1-\omega)}{\omega} \frac{(1-\tau^*)}{\tau} b_{At}^{*l}, \tag{103}$$

$$b_t^{*r} = \frac{\omega}{(1-\omega)} \frac{(1-\tau)}{\tau^*} b_{Bt}^l + \frac{(1-\tau^*)}{\tau^*} b_{Bt}^{*l}, \tag{104}$$

$$b_t^g = (1-\tau)\, b_{At}^g + (1-\tau^*)\, \frac{(1-\omega)}{\omega} b_{At}^{*g}. \tag{105}$$

$$b_t^{*g} = (1-\tau)\, \frac{\omega}{(1-\omega)} b_{Bt}^g + (1-\tau^*)\, b_{Bt}^{*g}, \tag{106}$$

$$b_{_t} = b_t^g + \tau b_t^r \tag{107}$$

$$b_t^* = b_t^{*g} + \tau^* b_t^{*r} \tag{108}$$

$$\tau h_t^r + (1-\tau)\, h_t^l = h \tag{109}$$

$$\tau^* h_t^{*r} + (1-\tau^*)\, h_t^{*l} = h^* \tag{110}$$

$$c_{At} = \tau c_{At}^{r} + (1-\tau)\, c_{At}^{l} \tag{111}$$

$$c_{Bt}^{*} = \tau^{*} c_{Bt}^{*r} + (1-\tau^{*})\, c_{Bt}^{*l} \tag{112}$$

$$c_{Bt} = \tau c_{Bt}^{r} + (1-\tau)\, c_{Bt}^{l} \tag{113}$$

$$c_{At}^{*} = \tau^{*} c_{At}^{*r} + (1-\tau^{*})\, c_{At}^{*l} \tag{114}$$

$$c_{t} = \tau c_{t}^{r} + (1-\tau)\, c_{t}^{l} = c_{At} + \frac{P_{Bt}}{P_{At}} c_{Bt} \tag{115}$$

$$c_{t}^{*} = \tau c_{t}^{*r} + (1-\tau)\, c_{t}^{*l} = c_{Bt}^{*} + \frac{P_{At}}{P_{Bt}} c_{At}^{*} \tag{116}$$

$$n_{t} = \tau n_{t}^{r} + (1-\tau)\, n_{t}^{l} \tag{117}$$

$$n_{t}^{*} = \tau^{*} n_{t}^{*r} + (1-\tau^{*})\, n_{t}^{*l} \tag{118}$$

$$t_{t} = (1-\tau) t_{At}^{l} + \tau t_{At}^{r} \tag{119}$$

$$t_{t}^{*} = (1-\tau^{*}) t_{Bt}^{l} + \tau^{*} t_{Bt}^{r} \tag{120}$$

$$y_{t} = z_{t} n_{t} \tag{121}$$

$$y_{t}^{*} = z_{t}^{*} n_{t}^{*} \tag{122}$$

Fiscal and monetary policies

$$b_t^g = \frac{R_{At-1}^g}{\pi_{At}} b_{t-1}^g + (g_t - t_t) \tag{123}$$

$$b_t^{*g} = \frac{R_{t-1}}{\pi_{Bt}} b_{t-1}^{*g} + (g_t^* - t_t^*) \tag{124}$$

$$R_t = R_{t-1}^{\rho} \left[\left(\pi_{At}^{\omega} \pi_{Bt}^{1-\omega} \right)^{\Phi} \overline{R} \right]^{1-\rho} \tag{125}$$

$$m_{At} = m_{At-1} + \psi f_t \left(\frac{b_t^g}{y_t} - \overline{\left(\frac{b^g}{y} \right)} \right) \tag{126}$$

$$m_{Bt} = m_{Bt-1} + \psi^* f_t^* \left(\frac{b_t^{*g}}{y_t^*} - \overline{\left(\frac{b^{*g}}{y^*} \right)} \right) \tag{127}$$

GDP and balance of payments restriction

$$\begin{aligned} (1-\tau) \frac{P_{Bt}}{P_{At}} \left(b_{Bt}^l + b_{Bt}^g \right) + (1-\tau) b_{At}^g - (1-\tau^*) \frac{(1-\omega)}{\omega} b_{At}^{*l} = \\ \left(\frac{(1-\omega)}{\omega} c_{At}^* - \frac{P_{Bt}}{P_{At}} c_{Bt} \right) + (g_t - t_t) + \\ + (1-\tau) \frac{P_{Bt}}{P_{At}} \left(\frac{R_{Bt-1}}{\pi_{Bt}} b_{Bt-1}^l + \frac{R_{t-1}}{\pi_{Bt}} b_{Bt-1}^g \right) + (1-\tau) \frac{R_{At-1}^g}{\pi_{At}} b_{At-1}^g \\ - (1-\tau^*) \frac{(1-\omega)}{\omega} \frac{R_{At-1}}{\pi_{At}} b_{At-1}^{*l}. \end{aligned} \tag{128}$$

$$y_t = c_{At} + \frac{(1-\omega)}{\omega} c_{At}^* + g_t \tag{129}$$

$$(1-\tau) d_t = \left(\frac{1}{mc_t} - 1 \right) w_t n_t \tag{130}$$

$$y_t^* = c_{Bt}^* + \frac{\omega}{(1-\omega)} c_{Bt} + g_t^* \tag{131}$$

$$(1-\tau^*) d_t^* = \left(\frac{1}{mc_t^*} - 1 \right) w_t^* n_t^* \tag{132}$$