Structural Reforms in a Debt Overhang*

Javier Andrés† Óscar Arce‡ Carlos Thomas§
University of Valencia Banco de España Banco de España¶

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Abstract

We assess the effects of reforms in product and labor markets in an economy where credit restrictions and long-term debt combine to produce a persistent recession with slow deleveraging following a negative financial shock. We show that reforms that reduce markups in product markets stimulate output and employment even in the short run, despite their deflationary effects. By favouring a faster recovery of investment and collateral values, product market reforms bring forward the end of the deleveraging phase. This last effect is missing in the case of labor market reforms, the short-run effects of which are sensitive to the response of trade flows and to debt maturity.

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†javier.andres@uv.es

‡o.arce@bde.es

§Corresponding author: carlos.thomas@bde.es

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1 Introduction

More than six years after the beginning of the recent crisis, economic growth in the periphery of the Euro area remains fragile and weighed down by weak domestic demand, in a context of high levels of private debt and widespread credit restrictions. Therein, the lack of room for manoeuvre to apply expansionary fiscal and (conventional) monetary policies is drawing a scenario of protracted private sector deleveraging amid low growth, with few policy alternatives to bring some relief. Among the available options, structural reforms in product and labor markets have attracted much attention by governments, multilateral bodies and commentators.[1]

Common wisdom suggests that reforms leading to lower and/or more flexible prices and wages should help the external sector lead the recovery in the short term. Growth potential should also benefit from more competitive markets, with the resulting permanent income effects stimulating current expenditure of forward-looking households and firms (expectations channel). However, absent the margin for expansionary monetary and fiscal policies, more competitive markets are likely to unchain contractionary forces in the short term arising from higher real interest rates and debt-deflation effects due to lower prices and/or wages (deflationary channel). Which of the two previous groups of forces -international competitiveness and expectations versus deflationary channels- dominates remains an open question and, in principle, well-intended reforms could end-up worsening the recession and postponing the recovery, as emphasized e.g. by Eggertsson, Ferrero and Raffo (2014).

To assess the relative strength of these alternative channels, we construct a model upon some core elements that characterize the current macrofinancial environment of the European periphery countries: (i) a widespread tightening of the financing conditions faced by households and firms, (ii) a slow and protracted process of deleverag-

[1] See e.g. OECD (2012), European Commission (2013) and International Monetary Fund (2013).

ing, (iii) a lack of monetary accommodation, and (iv) an external sector that buffers the contraction of domestic demand. The main contribution of the paper is to shed light on how the previous elements shape the way product and labor market reforms affect the macroeconomy, with a special attention to how both types of reform differ in terms of transmission channels and their short-run effects.

In particular, we consider a small open economy inside a monetary union. Households and entrepreneurs obtain new credit subject to collateral constraints that link their credit capacity to the value of real estate holdings, following Kiyotaki and Moore (1997) and Iacoviello (2005). A key point of departure from most recent papers in the macrofinance area, aimed at producing an empirically plausible slow deleveraging path, is that we consider long term debt contracts. Following Woodford (2001), we assume that nominal debt outstanding is amortized at a constant contractual rate. This creates an asymmetry in the dynamics of the debt stock, similar to the one in Justiniano, Primiceri and Tambalotti (2014). In 'normal times', when collateral values are high enough so as to sustain new credit flows, the value of available collateral restricts the size of the debt stock. By contrast, following an adverse shock that reduces debtors' collateral values sufficiently, new credit is frozen and outstanding loans are amortized at the contractual rate. In this way, the model features two debt regimes with asymmetric speeds of debt accumulation and deleveraging, among which the economy switches endogenously as collateral values fall below or rise above some critical thresholds.

In order to construct a baseline deleveraging scenario motivated by the financial origin of the recent crisis, we introduce a 'credit crunch' shock that reduces loan-to-value ratios for households and firms. Falling collateral values send the economy into a slow deleveraging process and a prolonged recession. At some (endogenous) date, collateral values recover sufficiently to justify new credit flows, putting an end to the deleveraging process and giving rise to an expansionary phase. We show that our model with long-term debt replicates well the duration and intensity of historical and ongoing deleveraging processes.

Against the backdrop of this baseline scenario, we simulate the effects of structural reforms. We model the latter as reductions in desired price and wage mark-ups,

following much of the theoretical literature on the macroeconomic effects of product market reforms (e.g. Blanchard and Giavazzi, 2003; Eggertsson et al. 2014; Fernández-Villaverde, Guerrón-Quintana and Rubio-Ramírez, 2014) and labor market reforms (e.g. Eggertsson et al. 2014; Forni, Gerali and Pisani, 2010). As expected, such reforms produce long run gains in GDP. In the short run, though, important differences arise between the two reforms, in terms of their impact on output and employment, the length of the deleveraging process, and the mechanisms through which they operate.

In the case of the product market reform, lower markups and the ensuing long-run gains in output and consumption lead to an increase in investment already in the short run, vis-à-vis the baseline (no-reform) scenario. Stronger investment demand (including demand for real estate) in turn alleviates the fall in assets prices produced by the deleveraging shock. This reinforces the short-run positive reaction of investment in two related ways. First, borrowers anticipate higher collateral values during the recovery phase. Second, a faster recovery in collateral allows borrowers to regain access to fresh credit at an earlier date, i.e. the reform *brings forward* the end of the deleveraging process and hence of the recession. Both effects, in turn, lead borrowers to further increase their investment demand today, with the resulting boost to asset prices, collateral values, and so on.

By contrast, the labor market reform, which yields long-run GDP gains similar to those from the product market reform, produces a much more modest impact in the short-run, with its expansionary effects materializing only gradually over time. Two factors explain this difference. First, this reform makes labor cheaper relative to capital goods and hence does not produce a significant rise in the demand for capital (including commercial real estate). As a consequence, neither investment, nor collateral values, nor the end of deleveraging are much affected. Second, unlike a reduction in price markups, a fall in wage markups needs to overcome a double layer of nominal rigidities (wages and prices) before affecting actual production prices. Motivated by this observation, we also consider a broader labor market reform that includes an increase in nominal wage flexibility and find that it generates sizable short-run output and employment gains.

We finally analyze the robustness of these results to alternative model parametrizations. We find that the expansionary short-run effects of the product market reform are extremely difficult to overturn, due to the powerful investment and collateral channels discussed above. By contrast, the absence of such a channel in the case of the labor market reform implies that its short-run effects are far more fragile. Two factors are especially relevant in this regard. First, we find that if debt maturities are sufficiently short, reductions in wage markups may actually produce a (small) negative impact. The reason is that higher amortization rates strengthen the Fisherian debt deflation channel through which the reform impacts negatively on the economy. Second, if the terms-of-trade elasticity of gross trade flows is not high enough, then labor market reforms may again become contractionary. Indeed, if the reform-induced improvement in international competitiveness does not carry over sufficiently to trade flows, such effect may be dominated by opposing forces such as lower household incomes and consumption. Our analysis thus suggests that, unlike product market reforms, labor market reforms may under certain conditions become counterproductive in the short term.

The rest of the paper is organized as follows. We briefly describe the related literature in Section 2. The model and the baseline calibration are presented in Section 3. The baseline deleveraging scenario is analyzed in Section 4. Section 5 is devoted to analyzing the impact of several reforms in product and labor markets, followed by robustness analysis and further inspection of the relevant channels in Section 6. Section 7 concludes.

2 Related literature

Our paper is related to several strands of literature. First, a number of recent contributions analyze the macroeconomic impact of structural reforms in situations in which monetary policy cannot accommodate the deflationary effects of such reforms.[2] In the context of a standard New Keynesian (NK) framework, Eggertsson

[2]In our framework, the lack of monetary accommodation stems from the assumption of a small open economy inside a monetary union.

et al. (2014) show that structural reforms may be contractionary if monetary policy is constrained by the zero lower bound (ZLB), due to their deflationary impact and the resulting increase in real interest rates. In a stylized two-period NK model, Fernández-Villaverde et al. (2012) show that credible announcements of future supply side reforms (such as an increase in product market competition) unchain positive wealth effects that may raise consumption and output today even if monetary policy is at the ZLB. Galí and Monacelli (2014) analyze the employment effects of a reduction in payroll taxes (which has similar effects to those of a contraction in desired wage markups) in a standard NK small open economy model in which the monetary authority is constrained by its concern for nominal exchange rate stabilization. They find that the (positive) impact of wage adjustments on employment is smaller the more the central bank seeks to stabilize the exchange rate.

None of the above contributions considers the existence of credit-constrained agents and long-term debt. In this regard, we propose a novel mechanism through which structural reforms may impact on activity, in the context of an economy undergoing a prolonged deleveraging process. In particular, our approach helps understand the role that reforms may play in mitigating the fall in investment demand, asset prices and collateral values caused by a deleveraging shock, and in shortening the duration of the ensuing deleveraging phase.

Likewise, the above papers do not consider the separate effects of product and labor market reforms, either because one of such reforms is not considered (Fernández-Villaverde et al. 2014; Galí and Monacelli, 2014) or because they are jointly implemented (Eggertsson et al. 2014). Our analysis reveals important differences in the short-term impact of both types of reforms: whereas product market reforms create sizable gains in GDP and employment, thanks to a powerful boost to investment that is further amplified by the collateral channel, the impact of a labor market reform is much more modest and its sign may depend on factors like the maturity of debt or the price elasticity of trade flows.

In considering separately the effects of product and labor market reforms, our paper is also related to seminal research by Blanchard and Giavazzi (2003), who consider the effects of reductions in firms' price markups and workers' bargaining

power in a two-period economy characterized by monopolistic competition in product markets and bargaining in the labor market. Similarly, Forni et al. (2010) simulate separately the effects of reductions in price and wage markups in a fully dynamic two-country monetary union model without financial frictions.

Most of the above papers model structural reforms as reductions in desired price and wage markups. An alternative line of research considers the effects of structural reforms in the context of frameworks with different product and labor market structures. In a model featuring endogenous product creation and labor market frictions, Cacciatore and Fiori (2013) discuss the effects of deregulation in the form of reductions in producer entry costs, firing restrictions and unemployment benefits.[3]

More generally, our paper also contributes to the growing literature on the macroeconomic effects of deleveraging processes. Guerreri and Iacoviello (2014) find that recessions driven by asset price deflations have a significant negative impact on spending and output. Eggertsson and Krugman (2012), and Calvo, Coricelli, and Ottonello (2012) find similar effects of deleveraging on output and employment. Fornaro (2012) and Benigno and Romei (2014) analyze the international transmission mechanisms of debt deleveraging processes. Benigno, Eggertsson and Romei (2014) study the effects of monetary and fiscal policy in a model of dynamic deleveraging with ZLB. Our paper also sheds light on some of these issues although it differs with respect both to its motivation, which here is on the impact of structural reforms, and to some modeling assumptions, especially the one concerning long-term debt, which is a centerpiece in our analysis. Regarding this last issue, our modeling strategy is closer to the one followed by Justiniano et al. (2014), who consider the existence of long-term debt to study the connection between financial frictions and the credit cycle during the last housing boom-bust in the United States.

[3]In a related environment, Cacciatore, Fiori and Ghironi (2013) analyze the design of optimal monetary policy.

3 Model

We now present a general equilibrium model of a small open economy that belongs to a monetary union. The real side of the economy is fairly standard. Households obtain utility from consumption goods and from housing units. Consumption goods are produced using a combination of household labor, commercial real estate and equipment capital goods. Construction firms build real estate (both for residential and commercial purposes) using labor and consumption goods; the latter are also used as inputs by equipment capital goods producers. Consumption-goods and labor markets are both characterized by monopolistic competition and nominal rigidities.

On the financial side, the structure is as follows. There are three types of consumers: patient households, impatient households, and (impatient) entrepreneurs. In equilibrium, the latter two borrow from the former and from the rest of the world. Debt contracts are long-term. In periods in which borrowers are able to receive new credit flows, they do so subject to collateral constraints. Real estate is the only collateralizable asset. We will henceforth refer to impatient and patient households as 'constrained' and 'unconstrained' households, respectively.

All variables are in real terms unless otherwise specified, with the consumption goods basket acting as the numeraire.

3.1 Households

There is a representative constrained household and a representative unconstrained household, denoted respectively by superscripts c and u.

3.1.1 Cost minimization

Before analyzing dynamic household optimization, we first derive the static cost minimization problem, which is common to both households types. Households consume a basket of home and foreign goods, denoted respectively by subscripts H and F,

$$c_t^x = \left(\omega_H^{1/\varepsilon_H} \left(c_{H,t}^x \right)^{(\varepsilon_H - 1)/\varepsilon_H} + (1 - \omega_H)^{1/\varepsilon_H} \left(c_{F,t}^x \right)^{(\varepsilon_H - 1)/\varepsilon_H} \right)^{\varepsilon_H/(\varepsilon_H - 1)}, \qquad (1)$$

for $x = c, u$; $c^x_{H,t}$ is a basket of domestic good varieties,

$$c^x_{H,t} = \left(\int_0^1 c^x_{H,t}(z)^{(\varepsilon_p - 1)/\varepsilon_p} \, dz \right)^{\varepsilon_p/(\varepsilon_p - 1)}, \tag{2}$$

where $\varepsilon_p > 1$ is the elasticity of substitution across consumption varieties $z \in [0,1]$. Let $P_{H,t}(z)$ denote the price of home good variety z, and $P_{F,t}$ the price of the foreign goods basket. Household $x = c, u$ minimizes nominal consumption expenditure, $\int_0^1 P_{H,t}(z) c^x_{H,t}(z) \, dz + P_{F,t} c^x_{F,t}$, subject to (1) and (2). The first order conditions can be expressed as

$$c^x_{H,t} = \omega_H \left(\frac{P_{H,t}}{P_t} \right)^{-\varepsilon_H} c^x_t, \quad c^x_{F,t} = (1 - \omega_H) \left(\frac{P_{F,t}}{P_t} \right)^{-\varepsilon_H} c^x_t, \quad c^x_{H,t}(z) = \left(\frac{P_{H,t}(z)}{P_{H,t}} \right)^{-\varepsilon_p} c^x_{H,t}, \tag{3}$$

where

$$P_t = \left(\omega_H P_{H,t}^{1-\varepsilon_H} + (1 - \omega_H) P_{F,t}^{1-\varepsilon_H} \right)^{1/(1-\varepsilon_H)}, \quad P_{H,t} = \left(\int_0^1 P_{H,t}(z)^{1-\varepsilon_p} \, dz \right)^{1/(1-\varepsilon_p)}$$

are the *consumer price index* (CPI) and the *producer price index* (PPI), respectively. Nominal spending in domestic goods equals $\int_0^1 P_{H,t}(z) c^x_{H,t}(z) \, dz = P_{H,t} c^x_{H,t}$, whereas total nominal consumption spending equals $P_{H,t} c^x_{H,t} + P_{F,t} c^x_{F,t} = P_t c^x_t$.

As noted before, consumption goods are also used as inputs by construction firms and equipment capital producers. The latter are assumed to combine home and foreign goods analogously to households, and similarly for domestic good varieties. This gives rise to investment demand functions analogous to (3).

3.1.2 Unconstrained households

The unconstrained household maximizes

$$E_0 \sum_{t=0}^{\infty} (\beta^u)^t \left\{ \log(c^u_t) + \vartheta \log(h^u_t) - \chi \int_0^1 \frac{n^u_t(i)^{1+\varphi}}{1+\varphi} di \right\},$$

where $n_t^u(i)$ are labor services of type $i \in [0,1]$ and h_t^u are housing units, subject to the following budget constraint (expressed in units of the consumption goods basket),

$$c_t^u + d_t + p_t^h \left[h_t^u - (1-\delta_h) h_{t-1}^u\right] = \frac{R_{t-1}}{\pi_t} d_{t-1} + (1-\tau_w) \int_0^1 \frac{W_t(i)}{P_t} n_t^u(i)\, di - T_t,$$

where d_t is the real value of net holdings of riskless nominal debt, R_t is the gross nominal interest rate,[4] δ_h is the depreciation rate of real estate, p_t^h is the real price of real estate, $\pi_t \equiv P_t/P_{t-1}$ is gross CPI inflation, $W_t(i)$ is the nominal wage for labor services of type i, τ_w is a tax rate on labor income and T_t are lump-sum taxes. The first order conditions are standard. They are listed in Appendix A, together with all other equilibrium conditions.

3.1.3 Constrained households

The constrained household's preferences are given by

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \log(c_t^c) + \vartheta \log(h_t) - \chi \int_0^1 \frac{n_t^c(i)^{1+\varphi}}{1+\varphi} di \right\},$$

where $\beta < \beta^u$, i.e. the constrained household is relatively impatient. The household faces the following budget constraint,

$$c_t^c + p_t^h \left[h_t - (1-\delta_h) h_{t-1}\right] = b_t - \frac{R_{t-1}}{\pi_t} b_{t-1} + (1-\tau_w) \int_0^1 \frac{W_t(i)}{P_t} n_t^c(i)\, di - T_t,$$

where b_t is the real value of household debt outstanding at the end of period t.

Unlike in most of the literature, which typically assumes short-term (one-period) debt, we assume that debt contracts are *long-term*. In the interest of tractability, we assume that at the beginning of time t the household repays a fraction $1-\gamma$ of all nominal debt outstanding at the end of period $t-1$, regardless of when that debt

[4] In order to guarantee stationarity in the net foreign asset position, we assume $R_t = R^* \exp(-\psi nfa_t^y)$, where R^* is the world gross nominal interest rate and nfa_t^y is the net foreign asset position as a fraction of GDP (to be derived below).

was issued.[5] This type of perpetual debt is similar to the one proposed by Woodford (2001) as a tractable way of modelling long-term debt. In *real* terms, the outstanding principal of household debt then evolves as follows,

$$b_t = \frac{b_{t-1}}{\pi_t} + b_t^{new} - (1-\gamma)\frac{b_{t-1}}{\pi_t} = b_t^{new} + \gamma\frac{b_{t-1}}{\pi_t}, \tag{4}$$

where b_t^{new} is gross new credit net of *voluntary* amortizations, i.e. amortizations beyond the contractual debt repayment $(1-\gamma)\, b_{t-1}/\pi_t$.

We assume that, in 'normal times' (in a sense to be specified below), household borrowing is subject to collateral constraints, as in Kiyotaki and Moore (1997). Following Iacoviello (2005), outstanding debt b_t cannot exceed a fraction m_t (the 'loan-to-value ratio', which we assume to be exogenously time-varying) of the expected discounted value of the household's residential stock: $b_t \leq m_t R_t^{-1} E_t \pi_{t+1} p_{t+1}^h h_t$. For brevity, we will refer to such pledgeable value of collateral as *collateral value*. This debt limit, however, is only effective as long as it exceeds $\gamma b_{t-1}/\pi_t$, which we will henceforth refer to as the *contractual amortization path*. Indeed, if the collateral value falls below such path, lowering b_t to the value of collateral would require lenders not only to reduce gross new credit to zero (its lower bound), but also to *impose* additional amortizations beyond those agreed in the contract (i.e. $b_t^{new} < 0$). Since lenders cannot force borrowers to pay back faster than the contractual amortization rate, the contractual amortization path becomes the effective debt limit. Therefore, long run debt implies the following *asymmetric borrowing constraint*,

$$b_t \leq R_t^{-1} m_t E_t \pi_{t+1} p_{t+1}^h h_t, \text{ if } \frac{m_t}{R_t} E_t \pi_{t+1} p_{t+1}^h h_t \geq \gamma\frac{b_{t-1}}{\pi_t}, \tag{5}$$

$$b_t \leq \gamma\frac{b_{t-1}}{\pi_t}, \qquad \text{if } \frac{m_t}{R_t} E_t \pi_{t+1} p_{t+1}^h h_t < \gamma\frac{b_{t-1}}{\pi_t}. \tag{6}$$

This asymmetry gives rise to a *double debt regime*. In 'normal times' in which collateral values exceed the contractual amortization path, debt is restricted by the former. In this baseline regime, households can receive new credit against their housing col-

[5] Total debt repayments in each period are then $(1-\gamma) + (R_{t-1} - 1)$ times nominal debt outstanding, i.e. the sum of amortization and interest payments.

lateral, with the constraint that such new credit does not exceed the gap between collateral values and the amortization path.[6] However, in the face of shocks that reduce collateral values sufficiently, the economy switches to an alternative regime, in which new credit disappears and debt is restricted instead by the contractual amortization path. Notice that changes from one regime to the other take place *endogenously*. This is an important element of our framework, as will become clear when we analyze the effects of structural reforms.

The Appendix contains the first order conditions of the constrained household's optimization problem. For future reference, we show here the optimal choice of housing,

$$\frac{p_t^h}{c_t^c} = \frac{\vartheta}{h_t} + \beta E_t \frac{(1-\delta_h)\, p_{t+1}^h}{c_{t+1}^c} + \xi_t \frac{m_t}{R_t} E_t \pi_{t+1} p_{t+1}^h, \tag{7}$$

where ξ_t is the Lagrange multiplier associated to the collateral constraint (eq. 5). Equation (7) illustrates that, when the collateral constraint is binding ($\xi_t > 0$), the marginal value of housing is higher due to the possibility of borrowing against it. This possibility disappears once the economy enters into the alternative debt regime, in which the collateral constraint ceases to be effective.

3.2 Production

Entrepreneurs produce an intermediate good and sell it to retailers, who transform it into consumption good varieties. Entrepreneurs and retailers conform the consumption goods sector. In addition, construction firms produce real estate, both for residential and commercial use, whereas equipment capital is produced by capital goods producers. All sectors operate under perfect competition, except retailers who enjoy monopolistic power.

3.2.1 Entrepreneurs

A representative entrepreneur produces an intermediate product and sells it to retailers at a perfectly competitive real (CPI-deflated) price mc_t. The entrepreneur

[6] Indeed, from (4) and (5) we obtain $b_t^{new} \leq m_t R_t^{-1} E_t \pi_{t+1} p_{t+1}^h h_t - \gamma b_{t-1}/\pi_t$.

maximizes

$$E_0 \sum_{t=0}^{\infty} \beta^t \log c_t^e,$$

with the consumption basket c_t^e defined analogously to (1), subject to

$$c_t^e + p_t^h \left[h_t^e - (1-\delta_h) h_{t-1}^e\right] + q_t \left[k_t - (1-\delta_k) k_{t-1}\right] = mc_t y_t^e - \frac{W_t}{P_t} n_t^e + b_t^e - \frac{R_{t-1}}{\pi_t} b_{t-1}^e + \sum_{s=r,h,k} \Pi_t^s,$$

$$y_t^e = k_{t-1}^{\alpha_k} \left(h_{t-1}^e\right)^{\alpha_h} \left(n_t^e\right)^{1-\alpha_k-\alpha_h},$$

where y_t^e is output of the intermediate good, k_{t-1} is equipment capital with unit price q_t, δ_k is the depreciation rate of equipment capital, h_{t-1}^e is commercial real estate, n_t^e is a basket of labor services, W_t is a nominal wage index, b_t^e is the real value of entrepreneurial debt outstanding at the end of period t, and $\{\Pi_t^s\}_{s=r,h,k}$ are real profits from the retail, construction and equipment goods-producing sectors.[7]

Entrepreneurs' maximization is also subject to an asymmetric borrowing constraint analogous to the one on constrained households,

$$b_t^e \leq R_t^{-1} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e, \text{ if } \frac{m_t^e}{R_t} E_t \pi_{t+1} p_{t+1}^h h_t^e \geq \gamma^e \frac{b_{t-1}^e}{\pi_t}, \tag{8}$$

$$b_t^e \leq \gamma^e \frac{b_{t-1}^e}{\pi_t}, \text{ if } \frac{m_t^e}{R_t} E_t \pi_{t+1} p_{t+1}^h h_t^e < \gamma^e \frac{b_{t-1}^e}{\pi_t}, \tag{9}$$

where we allow for a different loan-to-value ratio (m_t^e) and contractual amortization rate ($1-\gamma^e$) for entrepreneurs. Again, it is instructive to analyze here the optimal demand for commercial real estate,

$$\frac{p_t^h}{c_t^e} = \beta E_t \left\{ \frac{mc_{t+1} \alpha_h y_{t+1}^e / h_t^e + (1-\delta_h) p_{t+1}^h}{c_{t+1}^e} \right\} + \xi_t^e \frac{m_t^e}{R_t} E_t \pi_{t+1} p_{t+1}^h, \tag{10}$$

where ξ_t^e is the Lagrange multipliers associated to constraint (8). Analogously to the case of constrained households, in periods in which the collateral constraint

[7] Notice that entrepreneurs are assumed to own the firms in the latter sectors. We adopt this specification because we are interested in analyzing how profit accumulation affects productive investment decisions, which in our model are made by the entrepreneurs.

binds ($\xi_t^e > 0$) the marginal value of commercial real estate is higher thanks to the possibility of borrowing against it.

3.2.2 Retailers

A continuum of monopolistically competitive retailers indexed by $z \in [0,1]$ purchase the intermediate input from entrepreneurs at the real price mc_t, and transform it one for one into final good varieties. Retailers' real marginal cost is thus mc_t. Each retailer z faces a demand curve

$$y_t(z) = \left(\frac{P_{H,t}(z)}{P_{H,t}}\right)^{-\varepsilon_p} y_t \equiv y_t^d\left(P_{H,t}(z)\right), \tag{11}$$

where y_t is aggregate demand of the consumption basket (to be derived below). Assuming Calvo (1983) price-setting, a retailer that has the chance of setting its nominal price at time t solves

$$\max_{P_{H,t}(z)} E_t \sum_{s=0}^{\infty} (\beta\theta_p)^s \frac{c_t^e}{c_{t+s}^e}\left[(1-\tau_p)\frac{P_{H,t}(z)}{P_{t+s}} - mc_{t+s}\right] y_{t+s}^d\left(P_{H,t}(z)\right),$$

where θ_p is the probability of not adjusting the price and τ_p is a tax rate on retailers' revenue. The first-order condition is standard (see Appendix), with all time-t price setters choosing a common optimal price $\tilde{P}_{H,t}$. If retailers were able to reset prices in every period ($\theta_p = 0$), they would set

$$\tilde{P}_{H,t} = \frac{1}{1-\tau_p}\frac{\varepsilon_p}{\varepsilon_p - 1} P_t mc_t.$$

Therefore, the term $\frac{1}{1-\tau_p}\frac{\varepsilon_p}{\varepsilon_p - 1}$ represents the *desired price markup* over nominal marginal cost, and thus measures the degree of monopolistic distortions in product markets.

3.2.3 Construction firms

A representative construction firm maximizes its expected discounted stream of profits, $E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_0^e}{c_t^e} \Pi_t^h$, where $\Pi_t^h = p_t^h I_t^h - \frac{W_t}{P_t} n_t^h - i_t^h$, subject to the production technology

$$I_t^h = \left(n_t^h\right)^{\omega} \left\{ i_t^h \left[1 - \frac{\Phi_h}{2} \left(\frac{i_t^h}{i_{t-1}^h} - 1 \right)^2 \right] \right\}^{1-\omega},$$

where n_t^h are labor services, i_t^h are consumption goods, and I_t^h are new real estate units.[8]

3.2.4 Equipment capital producers

A representative equipment capital producer maximizes its expected discounted stream of profits, $E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_0^e}{c_t^e} \Pi_t^k$, where $\Pi_t^k = q_t I_t - i_t$, subject to the technology

$$I_t = i_t \left[1 - \frac{\Phi_k}{2} \left(\frac{i_t}{i_{t-1}} - 1 \right)^2 \right],$$

where i_t are consumption goods, and I_t are new equipment capital goods.

3.3 Wage setting

Both entrepreneurs and construction firms use a basket of labor services by constrained and unconstrained households,

$$n_t^s = \left(n_t^{s,c}\right)^{\mu_s} \left(n_t^{s,u}\right)^{1-\mu_s},$$

where $n_t^{s,x}$ are labor services provided by type-x household, $x = c, u$, to each sector $s = e, h$. We assume that both worker types (constrained and unconstrained) earn the same wage. Cost minimization then implies $(1-\mu_s)\, n_t^{s,c} = \mu_s n_t^{s,u}$, for $s = e, h$.

[8] We include labor services in the production function of construction firms so as to allow for long-run changes in real estate prices. Without labor in construction ($\omega = 0$), real estate prices are always unity in the long run. More generally, it can be shown that $p_{ss}^h = (w_{ss})^{\omega}\, \omega^{-\omega}\, (1-\omega)^{-(1-\omega)}$.

From each household type, each sector demands in turn a basket of labor service varieties,

$$n_t^{s,x} = \left(\int_0^1 n_t^{s,x}(i)^{(\varepsilon_w - 1)/\varepsilon_w} \, di \right)^{\varepsilon_w/(\varepsilon_w - 1)},$$

for $x = c, u$ and $s = e, h$, where $\varepsilon_w > 1$ is the elasticity of substitution across labor varieties $i \in [0, 1]$. Cost minimization implies $n_t^{s,x}(i) = (W_t(i)/W_t)^{-\varepsilon_w} n_t^{s,x}$, for $x = c, u$ and $s = e, h$, where $W_t \equiv (\int_0^1 W_t(i)^{1-\varepsilon_w} \, di)^{1/(1-\varepsilon_w)}$ is the nominal wage index. Total demand for each variety of labor services is thus

$$n_t^x(i) \equiv n_t^{e,x}(i) + n_t^{h,x}(i) = \left(\frac{W_t(i)}{W_t} \right)^{-\varepsilon_w} \left(n_t^{e,x} + n_t^{h,x} \right) \equiv n_t^{d,x}(W_t(i)),$$

for $x = c, u$. Total nominal wage income earned by each type-x household equals $\int_0^1 W_t(i) n_t^x(i) \, di = W_t n_t^x$, where $n_t^x \equiv n_t^{e,x} + n_t^{h,x}$.

As in Erceg, Henderson and Levin (2000; EHL), nominal wages are set *à la* Calvo (1983). In particular, a union representing all type-i workers maximizes the utility of the households to which such workers belong. Let $\lambda_t^x \equiv 1/c_t^x$ denote the marginal utility of real income for each household type $x = c, u$. Then a union that has the chance to reset the nominal wage at time t chooses $W_t(i)$ to maximize

$$\sum_{x=c,u} E_t \sum_{s=0}^{\infty} (\beta^x \theta_w)^s \left[\lambda_{t+s}^x (1 - \tau_w) \frac{W_t(i)}{P_{t+s}} n_{t+s}^{d,x}(W_t(i)) - \chi \frac{\left(n_{t+s}^{d,x}(W_t(i)) \right)^{1+\varphi}}{1+\varphi} \right],$$

where θ_w is the probability of not adjusting the wage and $\beta^c = \beta$. All time-t wage-setters choose a common optimal wage $\tilde{W}_t$; see the first-order condition in the Appendix. If workers were able to reset wages in every period ($\theta_w = 0$), then they would charge a markup

$$\frac{1}{1 - \tau_w} \frac{\varepsilon_w}{\varepsilon_w - 1}$$

over a weighted average of constrained and unconstrained households' marginal rates of substitution between consumption and labor. Therefore, the term $\frac{1}{1-\tau_w} \frac{\varepsilon_w}{\varepsilon_w - 1}$ represents the *desired wage markup*, and thus measures the degree of monopolistic dis-

tortions in the labor market.

3.4 Foreign sector

A representative exporter produces the following basket of domestic consumption goods: $x_t = (\int_0^1 x_t(z)^{(\varepsilon_p-1)/\varepsilon_p} dz)^{\varepsilon_p/(\varepsilon_p-1)}$, where $x_t(z)$ is demand for each domestic good variety. Cost minimization implies that the exporter's demand for each variety is $x_t(z) = (P_{H,t}(z)/P_{H,t})^{-\varepsilon_p} x_t$, and total spending is $\int_0^1 P_{H,t}(z) x_t(z) dz = P_{H,t} x_t$. The exporter sells the basket x_t in export markets under perfect competition. The zero profit condition implies that the market price of the export basket is exactly $P_{H,t}$. Assuming that foreign consumers' preferences are analogous to those of domestic consumers, foreign demand for the basket of domestic goods is given by

$$x_t = \zeta \left(\frac{P_{H,t}}{P_{F,t}} \right)^{-\varepsilon_F} y_{F,t},$$

where $P_{F,t}$ and $y_{F,t}$ are the foreign price level and aggregate demand (both exogenous) and ε_F is the price elasticity of exports. Defining the *terms of trade* $p_t^* \equiv P_{H,t}/P_{F,t}$, the latter evolve according to $p_t^* = p_{t-1}^* \pi_{H,t}/\pi_{F,t}$,where $\pi_{F,t} \equiv P_{F,t}/P_{F,t-1}$ is foreign inflation.

3.5 Fiscal authority

For simplicity, we assume that the fiscal authority balances its budget period-by-period,

$$\tau_w \frac{W_t}{P_t} (n_t^c + n_t^u) + \tau_p \frac{P_{H,t}}{P_t} y_t + 2T_t = 0.$$

3.6 Aggregation and market clearing

Each retailer z demands $y_t^d(P_{H,t}(z))$ units of the intermediate input, as given by (11). Total demand for the latter equals $\int_0^1 y_t^d(P_{H,t}(z)) dz = y_t \Delta_t$, where $\Delta_t \equiv \int_0^1 (P_{H,t}(z)/P_{H,t})^{-\varepsilon_p} dz$ denotes relative price dispersion. Market clearing in the

intermediate good market thus requires

$$k_{t-1}^{\alpha_k}\left(h_{t-1}^e\right)^{\alpha_h}\left(n_t^e\right)^{1-\alpha_h-\alpha_k}=y_t\Delta_t.$$

As noted before, investment-goods producers and exporters demand the same combination of domestic consumption goods as consumers. Therefore, aggregate demand for the basket of domestic consumption goods is given by,

$$y_t=c_{H,t}^c+c_{H,t}^u+c_{H,t}^e+i_{H,t}+i_{H,t}^h+x_t. \tag{12}$$

Total demand for real estate must equal total supply,

$$h_t+h_t^u+h_t^e=I_t^h+(1-\delta_h)\left(h_{t-1}+h_{t-1}^u+h_{t-1}^e\right).$$

Total demand for equipment capital must equal total supply: $k_t=I_t+(1-\delta_k)\,k_{t-1}$. Labor market clearing requires $n_t^c+n_t^u=n_t^e+n_t^h$. This completes the model. We may combine all market clearing conditions and budget constraints to obtain the current account identity (which is redundant as a result of Walras' Law),

$$nfa_t=\frac{R_{t-1}}{\pi_t}nfa_{t-1}+\frac{P_{H,t}}{P_t}x_t-\frac{P_{F,t}}{P_t}\left(c_{F,t}^c+c_{F,t}^u+c_{F,t}^e+i_{F,t}+i_{F,t}^h\right),$$

where $nfa_t\equiv d_t-b_t-b_t^e$ is the real (CPI-deflated) net foreign asset position. We finally define real (PPI-deflated) GDP as

$$\begin{aligned}gdp_t &\equiv y_t+\frac{P_t}{P_{H,t}}\left(q_tI_t-i_t\right)+\frac{P_t}{P_{H,t}}\left(p_t^hI_t^h-i_t^h\right)\\ &= \frac{P_t}{P_{H,t}}c_t^{tot}+\frac{P_t}{P_{H,t}}\left(q_tI_t+p_t^hI_t^h\right)+\left[x_t-\frac{P_{F,t}}{P_{H,t}}\left(c_{F,t}^{tot}+i_{F,t}+i_{F,t}^h\right)\right],\end{aligned}$$

where in the second equality we have used (12) and $z_{H,t}=\frac{P_t}{P_{H,t}}z_t-\frac{P_{F,t}}{P_{H,t}}z_{F,t}$ for $z=c^c,c^u,c^e,i,i^h$, and where $c_t^{tot}\equiv c_t^c+c_t^u+c_t^e$ is total consumption (total consumption imports $c_{F,t}^{tot}$ are defined analogously). The net foreign asset position as a fraction of GDP is then simply $nfa_t^y\equiv P_tnfa_t/P_{H,t}gdp_t$.

3.7 Calibration

We calibrate the model to the Spanish economy. As explained in the introduction, we are motivated by the recent experience of the peripheral EMU economies, for which structural reforms in product and labor markets have been advocated as a means of fostering economic recovery. Spain's labor market has traditionally been considered as particularly inefficient within the EMU context, while some room for improved competitiveness also exists in its product markets.[9] This feature, together with the on-going deleveraging process of Spanish households and firms, make Spain an ideal case study for the purpose of our analysis.

The time period is a quarter. We match the model's steady state to a number of empirical targets in 2007, the year prior to the start of the financial crisis. We do not claim, however, that the Spanish economy was in (or close to) a steady state in 2007. Instead, our model's steady state should be interpreted as the economy's initial condition for the purpose of our simulation exercises.

The discount factor of the impatient agents is set to $\beta = 0.98$, following Iacoviello (2005). For patient households, we choose $\beta^u = 1.025^{-1/4}$, which is consistent with a steady state nominal interest rate of $R_{ss} = 1.025^{1/4}\pi_{ss} = R^* e^{-\psi(nfa^y_{ss})}$. We set world inflation to $\pi_{F,ss} = 1$, which implies $\pi_{H,ss} = \pi_{ss} = 1$ in a stationary equilibrium. Choosing $R^* = 1.02^{1/4}$ for the world nominal interest rate, we then set ψ to replicate net foreign assets over GDP in 2007, $nfa^y_{ss} = -79.3\%$. The inverse labor supply elasticity is set to $\varphi = 4$, consistently with a large body of micro evidence. The weight parameter in the consumption basket, ω_H, is set to match gross exports over GDP in 2007 (26.9%). Based on evidence for Spain in García *et al.* (2009), the price elasticity of exports and imports is set to $\varepsilon_F = \varepsilon_H = 1$. The scale parameter in export demand, ζ, is chosen such that steady-state terms of trade p^*_{ss} are normalized to 1.

The elasticities of substitution across varieties of consumption goods and labor services, ε_p and ε_w, and the tax rates on retailers' revenue and labor income, τ_p and τ_w, determine the desired markups in product and labor markets, respectively. We set

[9] See e.g. European Commission (2011) and International Monetary Fund (2011).

$\varepsilon_p = 7$ and $\tau_p = 0$, implying an initial price markup of $(1-\tau_p)^{-1}\varepsilon_p/(\varepsilon_p - 1) = 1.17$, which is broadly consistent with estimates by Montero and Urtasun (2013) based on Spanish firm-level data. Wage markups are hard to estimate empirically, so we adopt an alternative calibration strategy. We follow Galí (2011) in reinterpreting the EHL model of wage-setting in a way that delivers equilibrium unemployment (see Appendix B for details). Targeting an unemployment rate of 8.6% in 2007, we obtain an initial wage markup of $(1-\tau_w)^{-1}\varepsilon_w/(\varepsilon_w - 1) = 1.43$, which we achieve by setting $\tau_w = 0$ and $\varepsilon_w = 3.31$.[10]

The elasticity of entrepreneurial output with respect to equipment capital and commercial real estate are set to $\alpha_k = 0.11$ and $\alpha_h = 0.21$, which are chosen to replicate the labor share of GDP in 2007 (61.6%) and the share of equipment capital in the total stock of productive capital.[11] As in Iacoviello and Neri (2010) we set $\delta_h = 0.01$, whereas δ_k is set to a standard value of 0.025. The elasticity of construction output with respect to labor ω is set to match the construction share of total employment in 2007 (13.4%). The weight of utility from housing services, ϑ, is chosen to replicate gross household debt over annual GDP (80.2%). The share of constrained and unconstrained workers in the labor baskets are set to $\mu_h = \mu_e = 1/2$. The scale parameters of convex investment adjustment costs, Φ_h and Φ_k, are chosen such that the fall in construction and equipment capital investment in our baseline deleveraging scenario resembles their behavior during the crisis.[12]

The Calvo parameters are set to $\theta_p = 2/3$ and $\theta_w = 3/4$, such that prices and wages are adjusted every 3 and 4 quarters on average, respectively. This is consistent with survey evidence for the Spanish economy (see e.g. Druant et al., 2009).

The parameters that regulate the debt constraints are calibrated as follows. Ac-

[10] Our choice of τ_p and τ_w is motivated as follows. In our baseline setup, we implement structural reforms by changing the elasticity parameters ε_p and ε_w. Setting $\tau_p = \tau_w = 0$ allows us to isolate the effects of structural reforms from additional fiscal effects operating through the budget constraints of credit-constrained agents. Section 5 provides further discussion of this issue. Section 6 considers the robustness of our baseline results to implementing the reforms via changes in τ_p and τ_w.

[11] Using data from BBVA Research, we obtain that the value of equipment capital was 21.4% of the total value of productive capital in 2007.

[12] In particular, we set Φ_h and Φ_k such that the accumulated fall in construction and equipment capital investment 8 quarters after the financial shock replicate their accumulated fall 8 quarters after their peak in 2007:Q4 (24.5% and 28% respectively).

Table 1: Baseline calibration

Parameter	Value	Description
Preferences		
β^u	0.994	unconstrained household discount factor
β	0.98	constrained household discount factor
φ	4	(inverse) labor supply elasticity
ϑ	0.38	weight on housing utility
ε_p	7	elasticity of subst. across consumption varieties
ε_w	3.31	elasticity of substitution across labor varieties
ω_H	0.72	weight home goods in consumption basket
ε_H	1	elasticity of imports wrt terms of trade
ε_F	1	elasticity of exports wrt terms of trade
ζ	0.87	scale parameter export demand
Technology		
α_h	0.21	elasticity output wrt real estate
α_k	0.11	elasticity output wrt equipment
ω	0.43	elasticity construction wrt labor
δ_h	0.01	depreciation real estate
δ_k	0.025	depreciation equipment
μ_e, μ_h	0.5	share of constr. households in labor baskets
Φ_h	6.1	investment adjustment costs construction
Φ_k	2.4	investment adjustment costs equipment
Price/wage setting		
θ_p	0.67	fraction of non-adjusting prices
θ_w	0.75	fraction of non-adjusting wages
Debt constraints		
$\bar{m}$	0.70	household LTV ratio
$\bar{m}^e$	0.64	entrepreneur LTV ratio
γ	0.98	amortization rate household debt
γ^e	0.97	amortization rate entrepreneurial debt

cording to data from the Spanish Land Registry office, loan-to-value ratios (LTV) for new mortgages prior to the crisis were slightly below 70 percent. We thus set $\bar{m} = 0.70$ for the household's initial loan-to-value ratio. The entrepreneurial initial loan-to-value ratio is chosen to match the ratio of gross non-financial corporate debt to annual GDP (125.4% in 2007), which yields $\bar{m}^e = 0.64$. Finally, we calibrate the contractual amortization rates, $1-\gamma$ and $1-\gamma^e$, in order to replicate the average age of the stock of outstanding mortgage debt prior to the crisis. This yields $1-\gamma = 0.02$ and $1-\gamma^e = 0.03$ per quarter.[13] Table 1 summarizes the calibration.

4 Baseline scenario: adjustment to a deleveraging shock

As our baseline scenario, we subject the model economy to a severe financial contraction that reduces the availability of credit for borrowers. Our 'credit crunch' consists of an unexpected, gradual, permanent drop in the LTV ratios of both households and entrepreneurs, m_t and m_t^e respectively. In particular, we assume an autoregressive process for both LTV ratios: $x_t = (1-\rho^x)\,\bar{x} + \rho^x x_{t-1}$, $x = m, m^e$, where we set $\rho^m = \rho^{m^e} = 0.75$. We then simulate an unanticipated fall in the long-run LTV ratios $(\bar{m}, \bar{m}^e)$ of 10 percentage points from their baseline values in Table 1, which accords well with recent experience in Spain.[14]

We assume perfect foresight in all our simulations. We solve for the fully nonlinear equilibrium path, using a variant of the Newton-Raphson algorithm developed by Laffargue (1990), Boucekkine (1995) and Juillard (1996) (LBJ).[15] As discussed in

[13] Under our debt contracts (with a constant fraction of outstanding debt amortized each period), the average age of the debt stock converges in the steady state to $\gamma/(1-\gamma)$ and $\gamma^e/(1-\gamma^e)$ for households and entrepreneurs, respectively. According to calculations by Banco de España, based on data from the Land Registry office and large financial institutions, the average age of outstanding mortgage debt prior to the crisis was close to 12.5 years for households and 8 years for nonfinancial corporations and entrepreneurs. This yields $\gamma = 12.5 \times 4/(12.5 \times 4 + 1) = 0.98$ and $\gamma^e = 8 \times 4/(8 \times 4 + 1) = 0.97$.

[14] Data from the Spanish Land Registry office shows that average LTV ratios for new mortgages declined by 7.7 percentage points in the 6 years between 2007:Q3 and 2013:Q3.

[15] See also Juillard et al. (1998) for an application of the LBJ variant of the Newton-Raphson

the previous section, our assumption of long-run debt contracts gives rise to two debt regimes for households and entrepreneurs. If collateral values are above the contractual debt amortization paths, then debt levels are restricted by the former, according to equations (5) and (8). If the opposite holds, then new credit flows collapse to zero and debt is restricted by the contractual amortization path (equations 6 and 9). We have therefore modified the LBJ algorithm to allow for endogenous change of debt regime. In particular, the dates at which the regime changes take place are solved as equilibrium objects.

Figure 1 displays the response to the credit crunch of collateral values (dashed lines) and contractual amortization paths (thin solid lines), together with the actual equilibrium path of outstanding debt (thick solid lines), both for entrepreneurs and households. Before the shock ($t = 0$), the economy rests in the steady state of the baseline regime, where debt levels equal pledgeable collateral values.[16] The credit crunch shock drives collateral values *below* the contractual amortization paths already on impact ($t = 1$). Therefore, the economy switches on impact to the alternative regime in which entrepreneurial and household debt stocks decay at the contractual amortization rates. In this phase, the economy undergoes a gradual and prolonged deleveraging process.

Eventually, collateral values rise again above the contractual amortization path, at which point borrowers are able to regain access to fresh funds. We denote by T^* and T^{**} the time at which the endogenous regime change takes place for entrepreneurs and households, respectively. Notice that collateral values and debt both experience a surge at the time of the regime change. This is because real estate becomes again valuable as collateral (see equations 7 and 10), which pushes up borrowers' demand for real estate, and hence its price. Thus, T^* and T^{**} also represent the *duration* of the deleveraging phase for entrepreneurs and households. In our baseline simulation, deleveraging lasts longer for households ($T^{**} = 22$ quarters) than for entrepreneurs ($T^* = 13$ quarters), which mainly reflects the slower amortization rate assumed for

algorithm.

[16] Indeed, the fact that constrained households and entrepreneurs are both more impatient than unconstrained households, $\beta < \beta^u$, guarantees that the collateral constraint binds for both agents in the steady state.

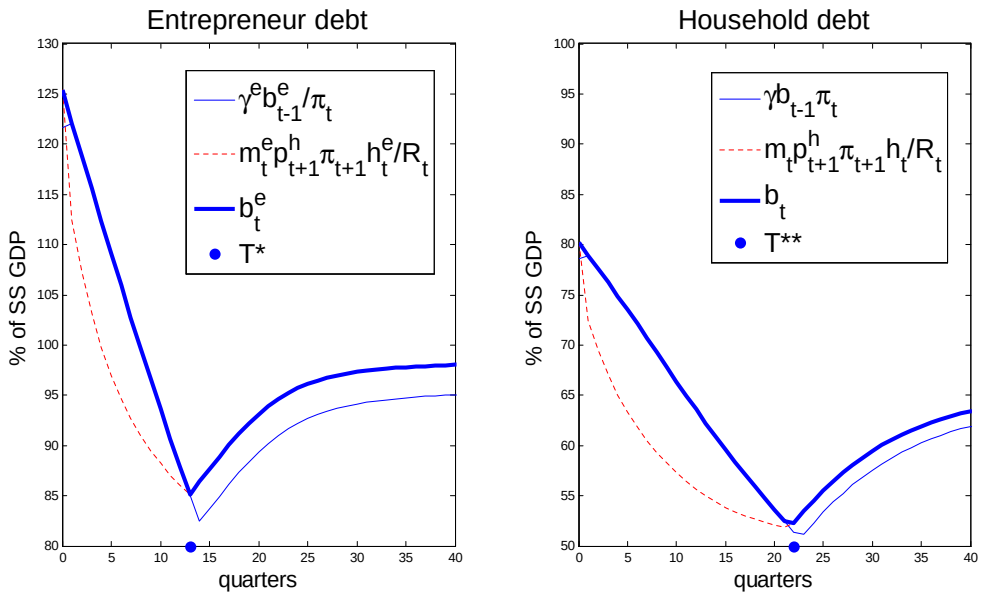

Figure 1: Baseline deleveraging scenario: debt dynamics

the former $(1-\gamma < 1-\gamma^e)$.[17]

The blue solid-dotted lines in Figure 2 show the economy's response to the deleveraging shock. Total consumption declines as a result of the deleveraging process, and then experiences successive recoveries when first entrepreneurs and then households regain access to new loans. The shock has also a negative impact on total investment, driven by lower expenditure in both real estate and equipment capital. Interestingly, investment starts recovering at $t = 11$, i.e. before the period in which entrepreneur debt actually starts increasing $(t = 14)$. This initial *creditless recovery* in investment is financed with an increase in borrowers' internal saving.[18] Such a

[17] Figure 1 shows that the debt constraints (6) and (9) are binding during $t = 1, ..., T^{**} - 1$ and $t = 1, ..., T^* - 1$, respectively, whereas the collateral constraints (5 and 8) are binding for $t \geq T^{**}$ and $t \geq T^*$, respectively. We have verified that the corresponding Lagrange multipliers are indeed strictly positive in the relevant periods, both in the baseline scenario and in all subsequent simulations. Results are available upon request.

[18] In particular, between the impact period and T^* entrepreneurs continuously reduce their consumption, which in our framework may be interpreted as dividend payments, thus increasing their retained earnings.

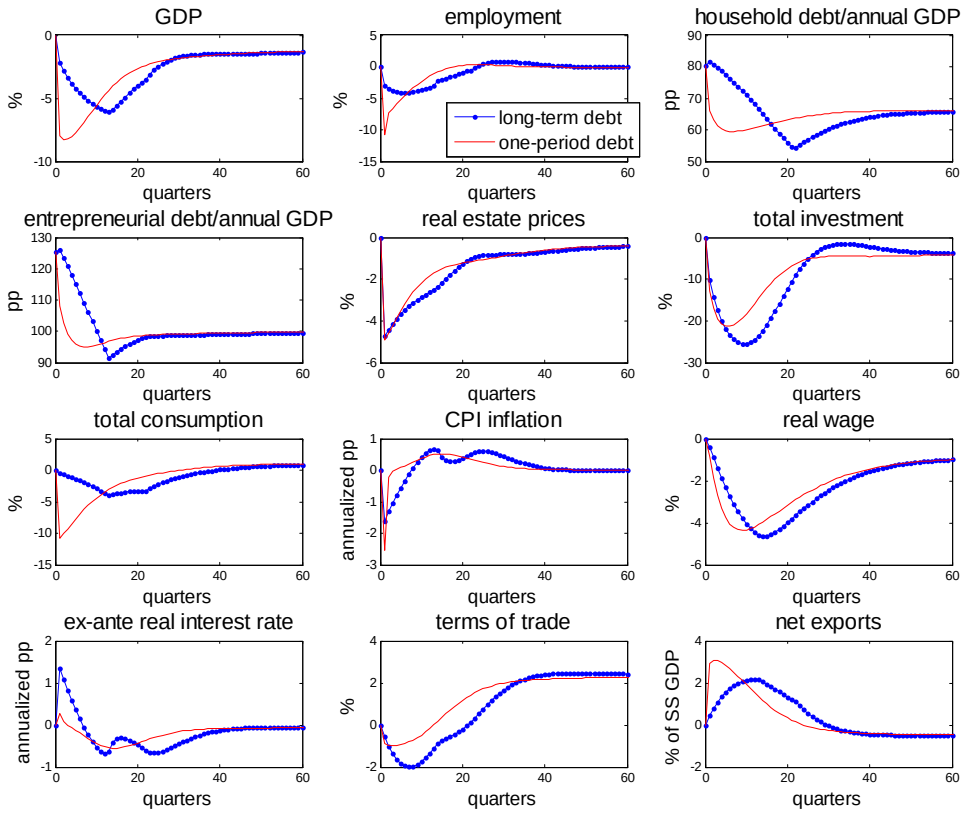

Figure 2: Baseline deleveraging scenario: long-term vs. one-period debt

self-financed investment recovery is akin to those observed in some emerging and advanced economies in similar economic conditions (see e.g. Abiad, Dell'Ariccia and Li, 2011).

The deflationary process caused by the financial shock leads to a temporary depreciation of the terms of trade, which fosters gross exports. On the other hand, imports fall due to the combined effect of the terms-of-trade depreciation and a severe contraction in domestic demand. Both effects give rise to a substantial improvement in net exports during the deleveraging period. The positive contribution of the external sector, however, is not sufficient to avoid a protracted recession that lasts for

13 quarters. This recession produces a significant reduction in employment, despite the induced moderation of real wages.

To understand how long-term debt affects the economy's response to a deleveraging shock, the red solid lines in Figure 2 show such response in the case of one-period debt contracts ($\gamma = 0$). Under this last assumption, the deleveraging shock produces a much faster reduction in debt ratios.[19] This is because debt in that scenario is always directly linked to collateral values, which fall sharply on impact, mostly as a result of the sudden drop in real estate prices. The abrupt reduction in debt carries over to total consumption, GDP and employment, all of which fall sharply on impact and then recover very quickly. By contrast, with long-term debt, the fact that collateral constraints cease to bind for a number of periods implies an initial decoupling between asset prices and debt levels. In the short term, this provides some relief to borrowers' expenditure capacity, giving rise to a smoother and more persistent decline in consumption, GDP and employment. In this way, long term debt produces a realistic scenario of prolonged recession caused by a slow process of debt reduction.

To assess the plausibility of debt dynamics in our baseline deleveraging scenario with long-term debt, we compare them with those observed in historical deleveraging episodes. We use data from the Bank for International Settlements (BIS) on credit to the private nonfinancial sector and European Commission (AMECO) data on nominal GDP to compute the ratio of private-sector debt over GDP in OECD countries since 1960. Following McKinsey (2010), we define concluded historical episodes as those in which in the debt-to-GDP ratio declined by at least 10 percentage points and for at least 3 years before increasing again. Given our interest in debt ratio reductions driven by actual reductions in debt volumes, as in McKinsey (2010) we discard those episodes that were due to unusually high inflation or real GDP growth ('grow out of debt' deleveraging). This leaves us with 13 episodes of genuine 'belt-tightening' deleveraging, in McKinsey's (2010) terminology.[20] We also extend this

[19] Actual debt levels (rescaled e.g. by initial GDP) fall even more abruptly than the debt-to-GDP ratios displayed in Figure 2, due to the sharp fall in GDP.

[20] Appendix C contains further details on the data sources and treatment, the specific criteria for selecting deleveraging episodes, as well as detailed information on each episode.

analysis to a number of *ongoing* deleveraging processes that are of particular interest for the purpose of this paper. In particular, we focus on the current deleveraging in three EMU periphery economies: Ireland, Portugal and Spain.[21] For illustrative purposes, we also include the ongoing deleveraging in the US and the UK.

Table 2: Baseline deleveraging scenario: comparison to historical episodes

	Data (1960-2014)				
	Historical	Ongoing		Model	
	(concluded)	IE,PT,ES	US,UK	Long-term	One-period
Duration (years)	5.15	-	-	5.25	1.75
Intensity (pp/year)	5.23	13.7	6.3	10.13	29.16

Note: Data values are averages across the deleveraging episodes listed in Appendix C. 'Intensity' is the average annual reduction in the private sector debt-to-GDP ratio during the deleveraging episode. In the data, private-sector debt is credit to the nonfinancial private sector (households, nonfinancial corporations, nonprofit institutions serving households). Sources: BIS and European Commission. See Appendix C for details on data sources and treatment. In the model, private-sector debt is the sum of household and entrepreneur debt.

Table 2 reports the average duration and intensity (defined as average annual reduction in the debt ratio) of historical deleveraging episodes and our selected ongoing processes. The last two columns display the duration and intensity of private-sector (households plus entrepreneurs) deleveraging in our model, both for long-term and one-period debt. The model with long-term debt replicates well the duration of historical episodes, of about 5 years. Also, while the speed of deleveraging is somewhat faster than in the latter episodes, in this dimension the model with long-term debt greatly improves on the standard one-period debt model, which generates too drastic a reduction in the debt ratio. Finally, the model with long-term debt produces an intensity comparable to those in the ongoing processes, which are being so far more intense than previous, completed episodes (especially those in the EMU periphery).

[21] The two other EMU periphery economies, Italy and Greece, do not qualify as ongoing deleveraging processes because they do not satisfy the 10 percentage point criterium. See Appendix C for further details.

To summarize, unlike the standard model with one-period debt, the model with long-term debt is able to produce a deleveraging process with a duration and intensity comparable to those historically or currently observed.

5 Structural reforms

Despite the fact that financial crises evolve into mostly demand-driven recessions, policy makers and academics have advocated supply-side measures, most notably reductions in monopolistic distortions in labor and product markets, as a way of expanding output and employment. These structural reforms are more strongly recommended for those economies in which such distortions were larger during the upswing, as was the case in the periphery of the euro area. In this section we investigate the short run and long run effects of product and labor market reforms within the context of our model and against the background of the deleveraging scenario described in the previous section.

We implement structural reforms by means of reductions in desired price and wage markups, following much of the theoretical literature on the macroeconomic effects of product market reforms (e.g. Blanchard and Giavazzi, 2003; Eggertsson et al. 2014; Fernández-Villaverde et al. 2014) and labor market reforms (e.g. Forni et al., 2010; Eggertsson et al. 2014). In our setup, reductions of desired price and wage markups may be achieved either by raising the price elasticity of demand for product and labor services varieties (ε_p and ε_w), or by lowering the tax rates on price-setters' revenues and wage-setters' labor income (τ_p and τ_w). In a model where all consumers are Ricardian, both approaches yield essentially the same results.[22] However, in our framework changes in tax rates (and, through the fiscal rule, in lump-sum taxes) have additional effects through the budget constraints of credit-constrained agents. We do not think such fiscal side effects are an appealing channel through which stronger competition in product and labor market affect the macroeconomy. For this reason, we choose to implement reforms by changing demand elasticities. Nonetheless, in

[22] For instance, in such a model setup both approaches deliver exactly the same results up to a first order approximation of the equilibrium conditions.

section 6 we assess the robustness of our findings to implementing structural reforms via changes in taxes.

5.1 Product market reform

We first implement a measure aimed at strengthening competition in goods markets. In particular, we consider an unanticipated, instantaneous and permanent reduction in the gross desired price markup, $\varepsilon_p/(\varepsilon_p - 1)$, of 5%. The latter thus falls from 1.17 to 1.11. This measure is assumed to take place contemporaneously to the deleveraging shock. The effects of this reform (relative to the baseline, no-reform scenario) are displayed in Figure 3.

The main message from the figure is that the assumed product market reform has a positive differential effect on GDP not only in the long run, as one would expect, but *also* in the short and medium run. Indeed, the reform reduces both the severity and the duration of the recession caused by the deleveraging shock. This improvement in the short/medium run is clearly driven by investment. Intuitively, agents anticipate the long-run gains in economic activity, which leads them to increase their demand for investment goods already in the short run. Both construction and equipment capital investment benefit from this effect.

The short/medium-run improvement in investment is reinforced by two related channels. First, due to stronger demand for real estate, the reform scenario features a much smaller drop in real estate prices. Thus, borrowers anticipate higher collateral values (relative to the no-reform scenario) from the period in which they will regain access to new credit. To see how this affects asset demand, consider the entrepreneur's optimal demand for real estate, equation 10 (the argument for constrained households is analogous). Integrating it forward, rescaling it by c_t^e, normalizing the impact period to $t = 1$, and finally using the fact that the collateral constraint does not bind during the deleveraging phase ($\xi_s^e = 0$ for $s = 1, ..., T^* - 1$), we obtain the

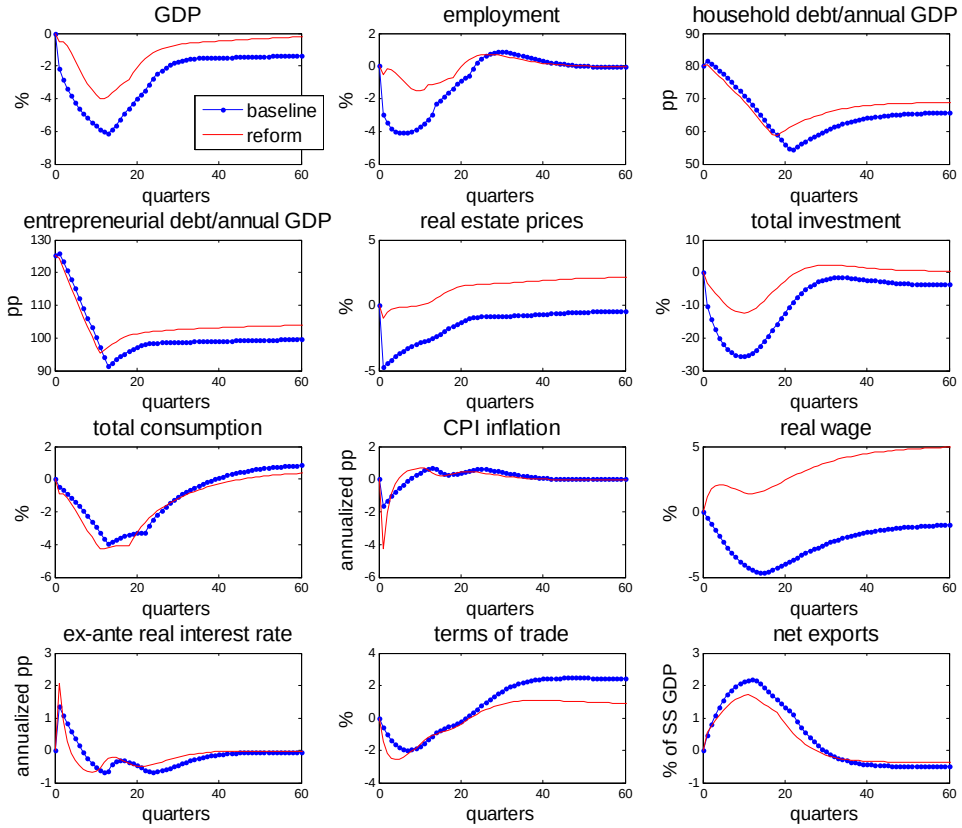

Figure 3: Effects of the product market reform

following expression,

$$\begin{aligned} p_1^h &= E_1 \sum_{s=1}^{\infty} \beta^s (1-\delta_h)^{s-1} \frac{c_1^e}{c_{s+1}^e} mc_{s+1} \alpha_h \frac{y_{s+1}^e}{h_s^e} \\ &\quad + c_1^e E_1 \sum_{s=T^*}^{\infty} \beta^{s-1} (1-\delta_h)^{s-1} \xi_s^e \frac{m_s^e}{R_s} \pi_{s+1} p_{s+1}^h. \end{aligned} \tag{13}$$

As illustrated by the term in the second line of (13), the fact that asset prices p_{s+1}^h are higher in the reform scenario implies that so is the marginal collateral value of real estate, $\xi_s^e \frac{m_s^e}{R_s} \pi_{s+1} p_{s+1}^h$, from the end of deleveraging onwards, $s \geq T^*$. This effect shifts up entrepreneur's demand for real estate, thus raising investment demand *ceteris paribus*.

Second, the reform *brings forward* the end of the deleveraging phase for entrepreneurs and households. Indeed, we now have $(T^*, T^{**}) = (11, 18)$, versus $(T^*, T^{**}) = (13, 22)$ in the no-reform scenario. The reason is simple: since the reform scenario features a smaller drop in collateral values, the latter catch up earlier with the contractual debt amortization paths, allowing borrowers to regain access to new credit at an *earlier* date.[23] This implies that real estate becomes valuable as collateral also at an earlier date, i.e. T^* happens sooner in equation (13). In addition, since consumption experiences a surge after the end of both deleveraging processes, agents also anticipate an earlier recovery in economic activity. Both effects (possibility of borrowing against real estate at a sooner date and an earlier exit from recession) feed back into higher investment demand today, leading to higher real estate prices, higher collateral values, and so on.[24] In sum, by accelerating the end of the deleveraging phase, the product market reform fosters investment and GDP in the short run even further.

[23] Graphically, in Figure 1 the collateral values (the dashed lines) cross the contractual amortization paths (the thin solid lines) at an earlier date. We note that the contractual amortization paths, $\gamma b_{t-1}/\pi_t$ and $\gamma^e b_{t-1}^e/\pi_t$, look very similar with and without reform, such that the change in T^* and T^{**} is driven essentially by the effect of the reform on the collateral values.

[24] In the case of entrepreneurs, the higher investment demand (relative to the baseline scenario) is partially financed by a fall in their consumption, which as mentioned before may be interpreted as a cut in dividend payments.

We note that neither consumption nor net exports are much affected in the short run by the product market reform. In the case of consumption, one reason is that, while the deflationary effect of the reform produces an additional increase in real interest rates and a rise in the real value of debt payments, this is largely compensated by the positive income effect stemming from the anticipation of the long run gains and by the lower fall in current asset prices. Moreover, as we will see later on, the negative debt deflation effect produced by the reform turns out to be substantially weakened by the presence of long-term debt. As regards the external balance, the increase in gross exports, due to the additional depreciation in the terms of trade, is mostly dominated by the increase in the real (PPI-deflated) value of imports, due both to stronger domestic demand and the terms-of-trade depreciation itself.

Finally, notice that the long-run gains in GDP do not carry over to employment. The reason is that the reform permanently increases the consumption of both household types.[25] This produces an upward shift in the labor supply schedule (i.e. a negative income effect on labor supply) that essentially undoes the upward shift in labor demand due to stronger activity. As a result, the reform raises the long-run real wage while keeping employment unchanged.

5.2 Labor market reform

Analogously to the product market reform, we implement an improvement in labor market competition by means of an unexpected, instantaneous and permanent fall of 5% in the desired wage markup, $\varepsilon_w/(\varepsilon_w - 1)$, which falls from 1.43 to 1.36. This simulation proxies for a labor market reform that affects unions' bargaining power. The effects of this reform are depicted in Figure 4.

Unlike in the case of the product market reform, here the impact effects on GDP and employment are essentially nil. From then on, the reform gathers momentum over time and eventually generates a long run positive effect on GDP quite similar to that from the product market reform. This long-run gain extends also to employ-

[25] The product market reform raises the long-run consumption of constrained and unconstrained households by 6.1% and 6.4%, respectively, relative to the baseline scenario. Appendix D contains the long-run (steady state) effects of each structural reform.

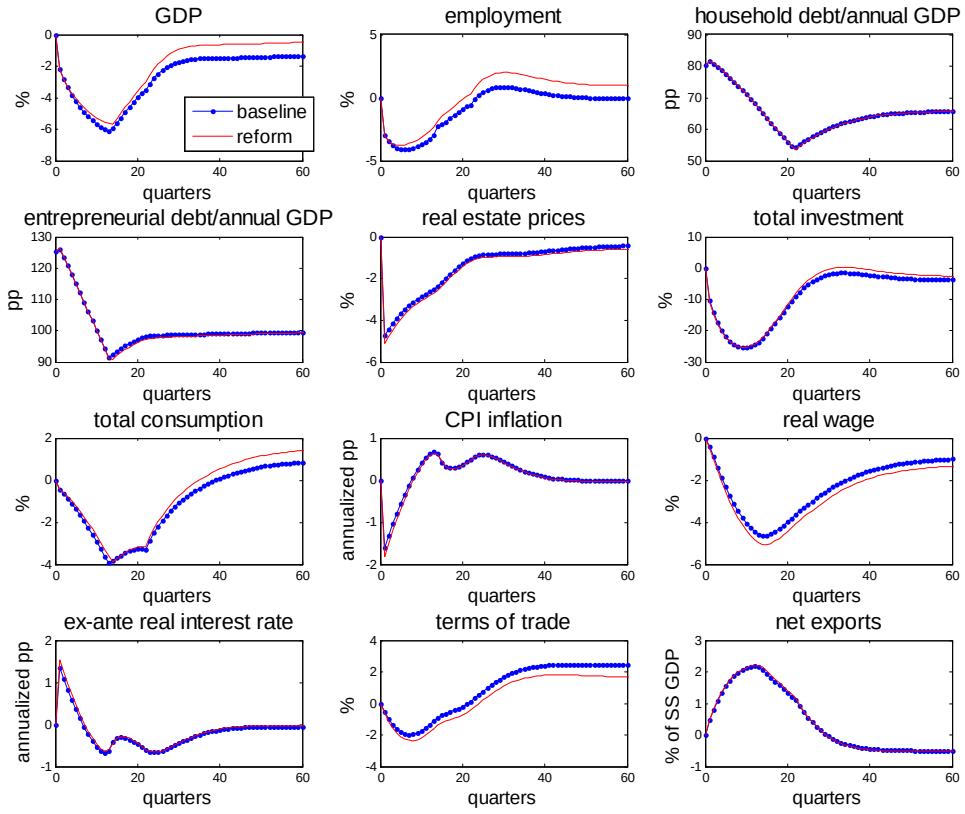

Figure 4: Effects of the labor market reform

ment, in contrast with the case of the product market reform. This difference stems from the fact that real wages now experience a long-run decline (as opposed to an increase), a logical consequence of permanently stronger labor market competition.

Unlike in the case of a product market reform, the labor market reform does not have a noticeable effect on investment or on the duration of the deleveraging process. One reason is that the permanent reduction in real wages shifts relative factor demand towards labor and away from capital, which offsets the positive effect on investment from the anticipation of long-run gains in economic activity. The absence of an improvement in the demand for investment goods carries over to asset prices, and hence to collateral values. As a result, the duration of the deleveraging phases are not affected by this reform.

Instead, the gradual improvement in GDP relative to the baseline scenario is driven mostly by consumption. On the one hand, Ricardian (unconstrained) households enjoy a positive income effect stemming from the anticipation of long-run gains. This effect dominates the negative substitution effect coming from the increase in real interest rates, which results from the reform-driven deflation. On the other hand, constrained households' wage income increases as times go by, as the increase in employment gradually overcomes the decline in real wages.

Another reason why the labor market reform is not as growth-friendly in the short run as the product market reform is that, unlike the reduction in price markups, the reduction in wage markups must overcome a double layer of nominal rigidities (first wages, then prices) before affecting actual production prices and hence international competitiveness. To visualize this more clearly, Figure 5 displays the *differential* effect of each reform on the terms of trade. As is clear from the figure, the product market reform (dotted line) improves the economy's competitiveness much more quickly than the labor market reform (thin-solid line). Motivated by this observation, the next subsection considers a broader labor market reform that also facilitates nominal wage adjustment.

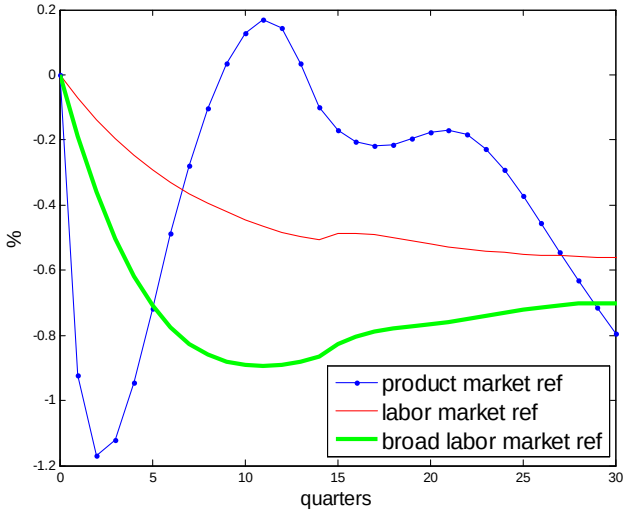

Figure 5: Diferential effect of reforms on terms of trade

5.2.1 Broader labor market reform: increased wage flexibility

In the previous section we considered a reduction in desired wage markups, in analogy with the product market reform analyzed in section 5.1. However, labor market reforms typically affect not only desired markups over reservation wages (as a reduced-form measure of workers' bargaining power), but also the speed or *flexibility* with which nominal wages adjust to changes in these reservation wages.[26] In this section, we consider a broader labor market reform that includes both a reduction in wage markups *and* a simultaneous increase in wage flexibility. In particular, we reduce the Calvo wage parameter θ_w from 0.75 (its baseline value) to 0.66, such that the average wage duration falls from 4 to 3 quarters.

The results are displayed in Figure 6. Comparing the latter with Figure 4, it is clear that adding higher wage flexibility increases significantly the short/medium-run gains in GDP and employment from a labor market reform. The reason is that higher wage flexibility allows a faster adjustment of nominal wages, production

[26] A clear example is the labor market reform of 2012 in Spain. The latter included modifications in the regulation of collective bargaining agreements aimed at facilitating nominal wage adjustments in response to changing economic conditions.

prices, and ultimately terms of trade, with the resulting improvement in international competitiveness.[27] This last effect becomes apparent in Figure 5: under this broader labor market reform (thick solid lines), the pass-through from lower wage markups to terms of trade is much stronger than under the basic labor market reform. Of course, in the long-run the gains in economic activity are the same in both cases, because by then wages have fully adjusted to their flexible levels.

6 Robustness

Our baseline results indicate that, while a reduction in desired price markups generates sizable short-run gains in GDP and employment, a comparable reduction in desired wage markups brings far more modest results in the short run, with its expansionary effects materializing slowly over time. We now investigate the robustness of these results to alternative calibrations of some key structural parameters and the way reforms are implemented. Results are displayed in Table 2. We first discuss briefly a number a robustness exercises. We then analyze in greater detail the effect of two important determinants of the impact of reforms: long-term debt, and the external sector.

Long-run elasticity of real estate prices. The elasticity of the construction technology with respect to labor, ω, controls the long-run elasticity of real estate prices to changes in real wages.[28] As we saw in section 5.1, the product market reform has a strong positive effect on long-run wages, and hence on real estate prices, which tends to amplify the short-run expansionary effects of the reform via the collateral channel. We find that reducing the long-run elasticity of real estate prices reduces the short-run effects of the product market reform. However, even when construction supply is fully elastic in the long-run ($\omega = 0$, such that p^h_{ss} always equals 1),

[27] Notice that this is not incompatible with the lack of improvement in net exports in Figure 6. Indeed, output can be expressed both net of imports and gross of imports. In the latter case, output is just the sum of gross exports and domestic demand of domestic goods. Both components improve *ceteris paribus* as a result of the additional terms-of-trade depreciation.

[28] In particular, in can be shown that $p^h_{ss} = (w_{ss})^{\omega} \omega^{-\omega} (1-\omega)^{-(1-\omega)}$, where w_{ss} is the steady-state real wage.

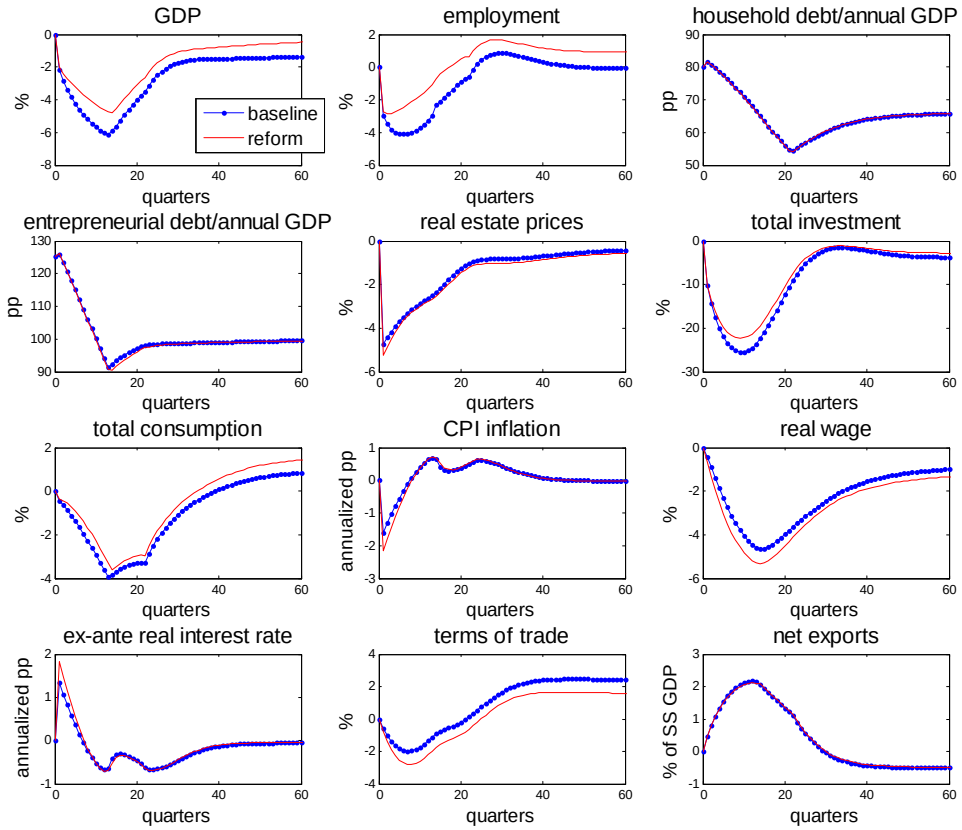

Figure 6: Broader labor market reform (wage markups and wage flexibility)

Table 3: Short-run effects of structural reforms

	Product market ref.		Labor market ref.	
	GDP	Employment	GDP	Employment
Baseline	2.29	3.35	0.01	0.06
Price elasticity of gross trade flows				
$\varepsilon_F = 1.5$	2.58	3.75	0.13	0.21
$\varepsilon_F = 0.5$	1.38	2.07	-0.55	-0.73
$\varepsilon_H = 1.5$	2.29	3.63	0.09	0.16
$\varepsilon_H = 0.5$	1.81	2.68	-0.24	-0.30
Long-run elasticity of real estate prices				
$\omega = 0.2$	1.62	2.32	0.01	0.05
$\omega = 0$	1.12	1.58	0.04	0.09
Initial level of indebtedness				
$(\bar{m}, \bar{m}^e) = (0.60, 0.54)$	2.14	3.15	0.03	0.07
$(\bar{m}, \bar{m}^e) = (0.50, 0.44)$	2.04	3.00	0.02	0.05
Transitory deleveraging shocks				
$\rho_m = \rho_{m^e} = 0.99$	2.23	3.27	0.03	0.07
$\rho_m = \rho_{m^e} = 0.90$	2.31	3.38	0.00	0.00
$\rho_m = \rho_{m^e} = 0.75$	2.85	4.17	0.01	0.00
Amortization rate				
$(1-\gamma, 1-\gamma^e) = (0.04, 0.06)$	2.35	3.50	-0.11	-0.11
$(1-\gamma, 1-\gamma^e) = (0.06, 0.08)$	2.64	3.93	-0.15	-0.17
$\gamma = \gamma^e = 0$ (one-period debt)	3.68	4.31	-0.29	-0.22
Reforms via subsidies	1.34	1.96	0.11	0.19

Note: The table displays average effects in the first 4 quarters following each reform (in %). 'Baseline' refers to the baseline calibration: $\varepsilon_F = \varepsilon_H = 1$, $\omega = 0.43$, $(\bar{m}, \bar{m}^e) = (0.70, 0.64)$, $(1-\gamma, 1-\gamma^e) = (0.02, 0.03)$; see Table 1.

the product market reform continues to have first-order positive effects on GDP and employment in the short term. Indeed, as long as the reform impacts positively on asset prices, the collateral channel continues to operate, even if such an impact is transitory. The effects of the labor market reform are not much affected, given that it barely affects long-run asset prices.

Initial level of indebtedness. In a nonlinear model such as ours, initial conditions may have a non-trivial effect on the results. Given the importance of the collateral channel in the case of the product market reform, it is interesting to analyze how the initial level of indebtedness of households and firms matters for our findings. With this purpose, we consider different values for the initial LTV ratios, $\bar{m}$ and $\bar{m}^e$, which are key determinants of initial indebtedness and, presumably, of the strength of the collateral channel. We find that reducing the initial LTV ratios weakens the expansionary effects of the product market reform. However, even for initial LTV ratios 20 percentage points lower than in the baseline, such expansionary effects continue to be large. Again, the effects of the labor market reform are barely affected, due precisely to the near irrelevance of the collateral channel in that case.

Transitory deleveraging shocks. So far we have assumed that deleveraging shocks have a permanent nature. But one could also consider transitory deleveraging shocks. With this aim, we allow for an iid shock ε_t^x in the LTV ratio process of households and firms, $x_t = (1-\rho^x)\,\bar{x} + \rho^x x_{t-1} + \varepsilon_t^x$, $x = m, m^e$. We then simulate an instantaneous reduction of 10 pp in both LTV ratios ($\varepsilon_t^m = \varepsilon_t^{m^e} = -0.10$), as opposed to a 10 pp reduction in $\bar{m}$ and $\bar{m}^e$. We find that shorter-lived deleveraging shocks (lower ρ_m and ρ_{m^e}) imply stronger expansionary effects from the product market reform. The reason is that, the shorter-lived the shock to LTV ratios, the earlier households and firms exit their respective deleveraging processes, and hence the earlier they are able to take advantage of the improvement in collateral values brought by the reform.

Reforms implemented via taxes/subsidies. As we explained in section 5, in our baseline exercises we reduce desired price and wage markups by raising the demand elasticities ε_p and ε_w, respectively. We now consider the alternative of achieving the same 5% markup reductions by lowering the tax rates τ_p and τ_w; this is the

approach followed e.g. by Eggertsson et al. (2014).[29] Given our baseline calibration ($\tau_p = \tau_w = 0$), this amounts to subsidizing retailers' revenue and workers' labor income, respectively. We find that a product market reform implemented via a reduction in τ_p produces smaller short-run gains than in the baseline exercise. The reason is that, by virtue of the balanced-budget fiscal rule, such a policy must be paid for by an increase in lump-sum taxes, which reduces constrained households' disposable income and hence their consumption. By contrast, implementing the labor market reform via a reduction in τ_w produces slightly larger short-run gains. This is because such a policy has a direct positive effect on households' disposable income. Therefore, we find that implementing reforms via subsidies, while preserving the channels discussed so far, introduces additional budgetary implications that are relevant for the quantitative impact of reforms.

6.1 The role of debt maturity

The presence of long-term mortgaged debt is one of the main departures of our model from most previous analysis of the macroeconomic implications of deleveraging. In this subsection we take a closer look at the implications of this assumption for the assessment of structural reforms.

Table 2 displays the short-run effects of reforms for different speeds of contractual debt amortization for households and entrepreneurs ($1-\gamma$, $1-\gamma^e$). We find that shortening the maturity of debt strengthens the expansionary effects of the product market reform; by contrast, the labor market reform becomes contractionary and increasingly so. In the limiting case of one-period debt ($1-\gamma = 1-\gamma^e = 1$), the assumption most commonly used in the literature, the product market reform raises output in the impact year by 3.7%, whereas the labor market reform *lowers* it by 0.3%. Figure 7 compares the differential GDP effects of both reforms under one-period debt and long-term debt (for our baseline calibration).[30] One-period debt

[29] Galí and Monacelli (2014) consider the effects of 'wage moderation', implemented by means of a reduction in payroll taxes.

[30] The differential effects in the one-period debt scenario are a good approximation of the effects of reforms in 'normal times', i.e. in the absence of a negative financial shock. This is because, while

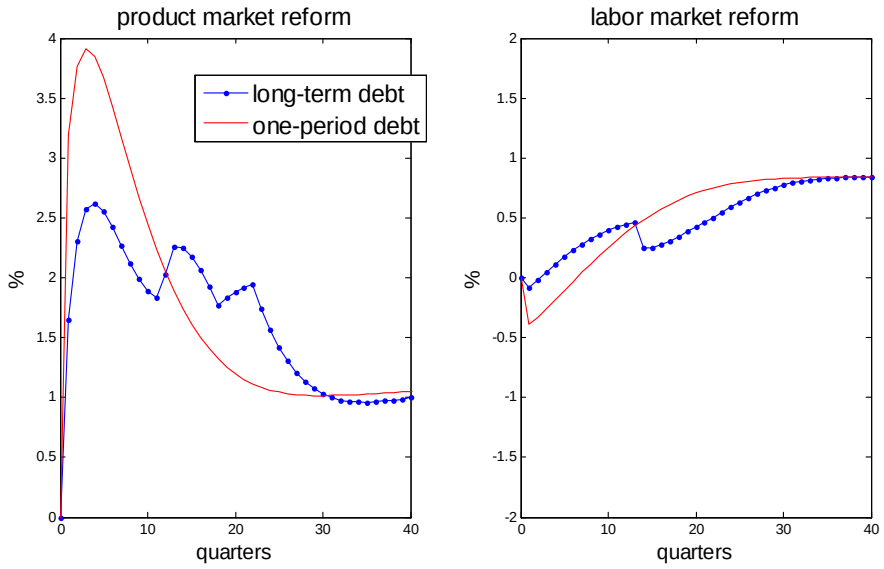

Figure 7: GDP effects of reforms: long-term vs. one-period debt

amplifies the gains from the product market reform in the first 3 years, but renders the labor market reform contractionary for one and a half years.

The intuition for these effects is as follows. As we have already seen, the product market reform unchains a strong positive impact on investment, which is reinforced by its beneficial effect on the path of collateral values. Relative to a one-period debt scenario, in which debt always tracks collateral values, long-term debt breaks the link between debt dynamics and collateral values during borrowers' deleveraging processes (i.e. until periods T^* and T^{**}) and thus *delays* the moment in which the collateral channel kicks in. Under one-period debt contracts, the collateral channel is active from the very moment the reform is implemented, hence amplifying its expansionary effect.

By contrast, in the case of the labor market reform the investment and collateral channels are basically absent. As a result, other channels become dominant. Among

the model solution is fully nonlinear, the absence of regime change under one-period debt implies that the joint effects of deleveraging and reform are approximately additive. Indeed, simulations available upon request show that the effect of reforms without deleveraging are very similar to the red solid lines in Figure 7.

the contractionary ones, two of them are particularly affected by the presence of long-term debt: the real interest rate and the debt deflation channels. First, the existence of long-term debt breaks the link between real interest rates and borrowers' debt during the deleveraging phase. In practical terms, this implies that the direct impact of changes in real interest rates on the consumption decisions of constrained debtors is only indirect, given that they do not obtain new loans.[31] Second, long-term debt weakens the effect of reforms-driven deflation on borrowers' net debt flows and hence on their spending capacity. To see this, consider the entrepreneur's real debt cash flows, net of interest payments, during her initial deleveraging phase ($t < T^*$),

$$b_t^e - \frac{R_{t-1}}{\pi_t} b_{t-1}^e = -\frac{R_{t-1} - \gamma^e}{\pi_t} b_{t-1}^e,$$

where we have used $b_t^e = \gamma^e b_{t-1}^e / \pi_t$.[32] We learn from the above expression that the negative effects of deflation on real debt cash flows are mitigated by the existence of long-term debt ($\gamma^e > 0$). For instance, under our baseline calibration, γ^e is close to 1, implying that $R_{t-1} - \gamma^e = (R_{t-1} - 1) + (1 - \gamma^e)$ (i.e. the sum of the net interest and amortization rates) is actually first-order in magnitude. As a result, a first-order effect of reforms on inflation will only have *second-order* effects on borrowers' spending capacity. Under one-period debt ($\gamma^e = \gamma = 0$), the debt deflation effect is strong enough to send the effects of the labor market reform into negative territory for a number of quarters.

Summing up, the role played by long term debt on the short-run impact of reforms is important but by no means mechanical. Importantly, its presence waters down the impact of asset prices, when limited access to new loans reduces the relevance of available collateral temporarily.

[31] In fact, in the debt regime in which debtors are constrained by the (binding) contractual amortization path, their consumption Euler equations only serve to determine the Lagrange multipliers on the latter constraints.

[32] The following argument also applies to constrained households.

6.2 The role of the foreign sector

An important channel in the transmission of the effects of structural reforms is the foreign sector. Figures 3, 4 and 6 suggest that reforms have little effect (or even a negative one) on the trade balance in the short/medium run. In fact, this hides two counteracting forces: structural reforms foster gross exports and depress imports by further depreciating the terms of trade relative to the baseline scenario, but they also boost (the PPI-deflated value of) imports by improving domestic demand and making them more expensive relative to domestic goods. An important question is how this balance between opposing forces, and thus the short-run effects of reforms, depends on the elasticity of exports and imports with respect to the terms of trade, ε_F and ε_H respectively.

In Table 2 we display the results from varying both elasticities around their baseline values ($\varepsilon_F = \varepsilon_H = 1$). Clearly, more elastic trade flows improve the assessment of structural reforms. The product market reform remains expansionary even for relatively low terms-of-trade elasticities, reflecting the fact that the investment and collateral channels continue to be the dominant forces. By contrast, low elasticities make the labor market reform contractionary. In other words, a reform aimed at reducing wage markups may be counterproductive if exports and imports do not respond sufficiently to the resulting depreciation of the terms of trade.

To summarize our sensitivity analysis, the positive short-run effects of product market reforms are fully robust to a wide range of parametrizations and modelling assumptions. This suggests that the powerful investment channel unchained by such reform (reinforced by the collateral channel) consistently outweighs the opposing forces, such as the deflationary channel. By contrast, the absence of such investment channel in the case of the labor market reform makes the sign its short-run effects sensitive to factors such as the duration of debt contracts or the terms-of-trade elasticity of trade flows.

7 Concluding Remarks

In this paper we assess the effects of reforms in product and labor markets in a small open economy undergoing a protracted deleveraging of the private sector, with no room for fiscal or monetary stimuli. We argue that in a context of widespread credit restrictions and pre-existing long-term debt, which are core features of the current deleveraging processes faced by the periphery countries of the Euro area, reducing desired markups in product markets mitigates the short-run output and employment losses caused by the deleveraging shock. Furthermore, by stimulating a faster recovery of investment and, hence, of collateral values, such a reform brings forward the end of the contractionary deleveraging phase. A reduction in desired wage markups, complemented by enhanced nominal wage flexibility, is found to have also the potential to moderate the output and employment losses in the short-run, although with little effects on investment and, hence, on the duration and depth of deleveraging.

The foreign sector plays an important role in the short-run effects of reforms: the deflationary effect of the reforms lead to a terms-of-trades depreciation, with the resulting expansion in gross exports. In this regard, we find that the intensity with which improved international competitiveness carries over to actual trade flows is an important determinant of the short-run effects of structural reforms. In the case of labour market reforms aimed at moderating wages, a low responsiveness of net exports to the ensuing gains in competitiveness may render the reform negative for GDP and employment in the short term.

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Appendix

A. Equilibrium conditions

Let $\tilde{p}_t \equiv \tilde{P}_{H,t}/P_{H,t}$, $p_{H,t} \equiv P_{H,t}/P_t$, $w_t \equiv W_t/P_t$, $\tilde{w}_t \equiv \tilde{W}_t/W_t$, $\pi_{wt} \equiv W_t/W_{t-1}$. Equilibrium conditions:

- Unconstrained household budget constraint and first-order conditions (d_t, h_t^u),

$$c_t^u + d_t + p_t^h \left[h_t^u - (1-\delta_h)\, h_{t-1}^u\right] = \frac{R_{t-1}}{\pi_t} d_{t-1} + (1-\tau_w)\, w_t n_t^u - T_t, \tag{14}$$

$$\frac{1}{c_t^u} = \beta^u E_t \frac{R_t}{\pi_{t+1}} \frac{1}{c_{t+1}^u}, \tag{15}$$

$$\frac{p_t^h}{c_t^u} = \frac{\vartheta}{h_t^u} + \beta^u E_t \frac{(1-\delta_h)\, p_{t+1}^h}{c_{t+1}^u}. \tag{16}$$

- Constrained household budget constraint, debt constraints, and first-order conditions (b_t, h_t),

$$c_t^c + \frac{R_{t-1}}{\pi_t} b_{t-1} + p_t^h \left[h_t - (1-\delta_h)\, h_{t-1}\right] = b_t + (1-\tau_w)\, w_t n_t^c - T_t, \tag{17}$$

$$b_t \leq \begin{cases} R_t^{-1} m_t E_t \pi_{t+1} p_{t+1}^h h_t, & \text{if } m_t R_t^{-1} E_t \pi_{t+1} p_{t+1}^h h_t \geq \gamma b_{t-1}/\pi_t, \\ \gamma b_{t-1}/\pi_t, & \text{if } m_t R_t^{-1} E_t \pi_{t+1} p_{t+1}^h h_t < \gamma b_{t-1}/\pi_t, \end{cases} \tag{18}$$

$$\frac{1}{c_t^c} = \beta E_t \frac{R_t}{\pi_{t+1}} \frac{1}{c_{t+1}^c} + \xi_t \mathbf{1}\left(\vartheta_t \geq 0\right) + \mu_t \mathbf{1}\left(\vartheta_t < 0\right) - \beta\gamma E_t \frac{\mu_{t+1}}{\pi_{t+1}} \mathbf{1}\left(\vartheta_{t+1} < 0\right), \tag{19}$$

$$\frac{p_t^h}{c_t^c} = \frac{\vartheta}{h_t} + \beta E_t \frac{(1-\delta_h)\, p_{t+1}^h}{c_{t+1}^c} + \xi_t \mathbf{1}\left(\vartheta_t \geq 0\right) \frac{m_t}{R_t} E_t \pi_{t+1} p_{t+1}^h, \tag{20}$$

  where μ_t is the Lagrange multiplier on constraint (6) in the text, $\mathbf{1}(\cdot)$ is the indicator function and $\vartheta_t \equiv R_t^{-1} m_t E_t \pi_{t+1} p_{t+1}^h h_t - \gamma b_{t-1}/\pi_t$.

- Entrepreneur budget constraint, debt constraints, and first-order conditions

$(b_t^e,\, h_t^e,\, n_t^e,\, k_t)$,

$$\begin{aligned} c_t^e &= mc_t k_{t-1}^{\alpha_k} \left(h_{t-1}^e\right)^{\alpha_h} \left(n_t^e\right)^{1-\alpha_h-\alpha_k} - w_t n_t^e - p_t^h \left[h_t^e - (1-\delta_h)\, h_{t-1}^e\right] \\ &\quad + b_t^e - \frac{R_{t-1}}{\pi_t} b_{t-1}^e - q_t \left[k_t - (1-\delta_k)\, k_{t-1}\right] + \Pi_t^r + \Pi_t^h + \Pi_t^k, \end{aligned} \tag{21}$$

$$b_t^e \leq \begin{cases} R_t^{-1} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e, & \text{if } m_t^e R_t^{-1} E_t \pi_{t+1} p_{t+1}^h h_t^e \geq \gamma^e b_{t-1}^e/\pi_t, \\ \gamma^e b_{t-1}^e/\pi_t, & \text{if } m_t^e R_t^{-1} E_t \pi_{t+1} p_{t+1}^h h_t^e < \gamma^e b_{t-1}^e/\pi_t, \end{cases} \tag{22}$$

$$\frac{1}{c_t^e} = \beta E_t \frac{R_t}{\pi_{t+1}} \frac{1}{c_{t+1}^e} + \xi_t^e \mathbf{1}\left(\vartheta_t^e \geq 0\right) + \mu_t^e \mathbf{1}\left(\vartheta_t^e < 0\right) - \beta\gamma^e E_t \frac{\mu_{t+1}^e}{\pi_{t+1}} \mathbf{1}\left(\vartheta_{t+1}^e < 0\right), \tag{23}$$

$$\frac{p_t^h}{c_t^e} = \beta E_t \frac{mc_{t+1} \alpha_h k_t^{\alpha_k} \left(h_t^e\right)^{\alpha_h - 1} \left(n_{t+1}^e\right)^{1-\alpha_h-\alpha_k} + (1-\delta_h)\, p_{t+1}^h}{c_{t+1}^e} + \xi_t^e \frac{m_t^e}{R_t} E_t \pi_{t+1} p_{t+1}^h \mathbf{1}\left(\vartheta_t^e \geq 0\right), \tag{24}$$

$$w_t = mc_t \left(1 - \alpha_h - \alpha_k\right) k_{t-1}^{\alpha_k} \left(h_{t-1}^e\right)^{\alpha_h} \left(n_t^e\right)^{-\alpha_h-\alpha_k}, \tag{25}$$

$$\frac{q_t}{c_t^e} = \beta E_t \frac{mc_{t+1} \alpha_k k_t^{\alpha_k - 1} \left(h_t^e\right)^{\alpha_h} \left(n_{t+1}^e\right)^{1-\alpha_h-\alpha_k} + (1-\delta_k)\, q_{t+1}}{c_{t+1}^e}, \tag{26}$$

where μ_t^e is the Lagrange multiplier on constraint (6) in the text, and $\vartheta_t^e \equiv R_t^{-1} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e - \gamma^e b_{t-1}^e/\pi_t$.

- Retailers' optimal price decision, and aggregate profits,

$$E_t \sum_{s=0}^{\infty} (\beta\theta_p)^s \frac{c_t^e}{c_{t+s}^e} \left[\frac{(1-\tau_p)\, \tilde{p}_t}{\prod_{j=1}^s \pi_{H,t+j}} p_{H,t+s} - \frac{\varepsilon_p}{\varepsilon_p - 1} mc_{t+s}\right] \left(\frac{\prod_{j=1}^s \pi_{H,t+j}}{\tilde{p}_t}\right)^{\varepsilon_p} y_{t+s} = 0, \tag{27}$$

$$\Pi_t^r = y_t \left((1-\tau_p)\, p_{H,t} - mc_t \Delta_t\right), \tag{28}$$

- Dynamics of PPI inflation and price dispersion,

$$1 = (1-\theta)\, \tilde{p}_t^{1-\varepsilon_p} + \theta \pi_{H,t}^{\varepsilon_p - 1}, \tag{29}$$

$$\Delta_t \equiv (1-\theta)\, \tilde{p}_t^{-\varepsilon_p} + \theta \pi_{H,t}^{\varepsilon_p} \Delta_{t-1}. \tag{30}$$

- Construction firm output, first order conditions (n_t^h, i_t^h), and profits,

$$I_t^h = \left(n_t^h\right)^{\omega} \left\{ i_t^h \left[1 - \frac{\Phi_h}{2} \left(\frac{i_t^h}{i_{t-1}^h} - 1 \right)^2 \right] \right\}^{1-\omega}, \tag{31}$$

$$w_t = p_t^h \omega \left(n_t^h\right)^{\omega-1} \left\{ i_t^h \left[1 - \frac{\Phi_h}{2} \left(\frac{i_t^h}{i_{t-1}^h} - 1 \right)^2 \right] \right\}^{1-\omega}, \tag{32}$$

$$\begin{aligned} 1 \;=\; & p_t^h \left(n_t^h\right)^{\omega} (1-\omega) \left\{ i_t^h \left[1 - \frac{\Phi_h}{2} \left(di_t^h\right)^2 \right] \right\}^{-\omega} \left[1 - \frac{\Phi_h}{2} \left(di_t^h\right)^2 - \Phi_h \left(di_t^h\right) \frac{i_t^h}{i_{t-1}^h} \right] \\ & + \beta \frac{\lambda_{t+1}^e}{\lambda_t^e} p_{t+1}^h \left(n_{t+1}^h\right)^{\omega} (1\text{-}\omega) \left\{ i_{t+1}^h \left[1 - \frac{\Phi_h}{2} \left(di_{t+1}^h\right)^2 \right] \right\}^{-\omega} \Phi_h di_{t+1}^h \left(\frac{i_{t+1}^h}{i_t^h} \right)^2 \end{aligned} \tag{33}$$

$$\Pi_t^h = p_t^h I_t^h - w_t n_t^h - i_t^h, \tag{34}$$

for $di_t^h \equiv i_t^h / i_{t-1}^h - 1$.

- Equipment capital producers output, first order condition (i_t), and profits,

$$I_t = i_t \left[1 - \frac{\Phi_k}{2} \left(\frac{i_t}{i_{t-1}} - 1 \right)^2 \right], \tag{35}$$

$$1 = q_t \left[1 - \frac{\Phi_k}{2} \left(di_t\right)^2 - \Phi_k \left(di_t\right) \frac{i_t}{i_{t-1}} \right] + E_t \frac{\lambda_{t+1}^e}{\lambda_t^e} q_{t+1} \Phi_k di_{t+1} \frac{i_{t+1}^2}{i_t^2}, \tag{36}$$

$$\Pi_t^k = q_t I_t - i_t, \tag{37}$$

for $di_t \equiv i_t / i_{t-1} - 1$.

- Optimal wage decision,

$$\sum_{x=c,u} E_t \sum_{s=0}^{\infty} \left(\beta^x \theta_w\right)^s \left[\frac{(1\text{-}\tau_w)\, \tilde{w}_t}{\prod_{j=1}^{s} \pi_{w,t+j}} \frac{w_{t+s}}{c_{t+s}^x} - \frac{\varepsilon_w \chi \left(n_{t+s}^x\right)^{\varphi}}{\varepsilon_w - 1} \left(\frac{\tilde{w}_t}{\prod_{j=1}^{s} \pi_{w,t+j}} \right)^{-\varepsilon_w \varphi} \right] \left(\frac{\prod_{j=1}^{s} \pi_{w,t+j}}{\tilde{w}_t} \right)^{\varepsilon_w} n_{t+s}^x = 0, \tag{38}$$

with $\beta^c = \beta$.

- Dynamics of wage inflation and wage dispersion,

$$1 = (1-\theta_w)\,\tilde{w}_t^{1-\varepsilon_w} + \theta_w \pi_{wt}^{\varepsilon_w - 1}, \tag{39}$$

$$\Delta_t^{w,n} = (1-\theta_w)\,\tilde{w}_t^{-\varepsilon_w} + \theta_w \pi_{wt}^{\varepsilon_w} \Delta_{t-1}^{w,n}. \tag{40}$$

- Fiscal authority's budget constraint,

$$\tau_w w_t \left(n_t^c + n_t^u\right) + \tau_p p_{H,t} y_t + 2T_t = 0.$$

- Aggregate employment,

$$N_t^c = n_t^c \Delta_t^{w,n}, \tag{41}$$

$$N_t^u = n_t^u \Delta_t^{w,n}, \tag{42}$$

$$N_t = N_t^c + N_t^u, \tag{43}$$

- Export demand,

$$x_t = \zeta \left(p_t^*\right)^{-\varepsilon_F} y_{F,t}. \tag{44}$$

- Intermediate good market clearing,

$$y_t \Delta_t = k_{t-1}^{\alpha_k} \left(h_{t-1}^e\right)^{\alpha_h} \left(n_t^e\right)^{1-\alpha_h-\alpha_k}, \tag{45}$$

- Labor market clearing,

$$n_t^c + n_t^u = n_t^e + n_t^h. \tag{46}$$

- Consumption goods basket market clearing,

$$y_t = c_{H,t}^c + c_{H,t}^u + c_{H,t}^e + i_{H,t} + i_{H,t}^h + x_t. \tag{47}$$

- Real estate market clearing,

$$h_t + h_t^u + h_t^e = I_t^h + (1 - \delta_h)\left(h_{t-1} + h_{t-1}^u + h_{t-1}^e\right). \tag{48}$$

- Equipment capital market clearing,

$$k_t = (1 - \delta_k)\, k_{t-1} + I_t. \tag{49}$$

- Real wages,

$$w_t = w_{t-1}\frac{\pi_{wt}}{\pi_t}, \tag{50}$$

- Terms of trade,

$$p_t^* = p_{t-1}^*\frac{\pi_{H,t}}{\pi_{F,t}}. \tag{51}$$

- Relative demand for domestic goods,

$$c_{H,t}^c = \omega_H p_{H,t}^{-\varepsilon_H} c_t^c, \tag{52}$$

$$c_{H,t}^u = \omega_H p_{H,t}^{-\varepsilon_H} c_t^u, \tag{53}$$

$$c_{H,t}^e = \omega_H p_{H,t}^{-\varepsilon_H} c_t^e, \tag{54}$$

$$i_{H,t} = \omega_H p_{H,t}^{-\varepsilon_H} i_t, \tag{55}$$

$$i_{H,t}^h = \omega_H p_{H,t}^{-\varepsilon_H} i_t^h, \tag{56}$$

- Relative demand for constrained/unconstrained household labor,

$$(1 - \mu)\, n_t^c = \mu n_t^u, \tag{57}$$

  where $\mu \equiv \mu_e = \mu_h$.

- Relative domestic producer prices,

$$p_{H,t} = p_{H,t-1}\frac{\pi_{H,t}}{\pi_t}, \tag{58}$$

- CPI inflation,

$$\pi_t^{1-\varepsilon_H} = \frac{\omega_H \left(p_{t-1}^*\right)^{1-\varepsilon_H}}{\omega_H \left(p_{t-1}^*\right)^{1-\varepsilon_H} + 1 - \omega_H} \pi_{H,t}^{1-\varepsilon_H} + \frac{1-\omega_H}{\omega_H \left(p_{t-1}^*\right)^{1-\varepsilon_H} + 1 - \omega_H}, \tag{59}$$

- Real (PPI-deflated) GDP,

$$gdp_t = y_t + \frac{1}{p_{H,t}} \left(q_t I_t - i_t\right) + \frac{1}{p_{H,t}} \left(p_t^h I_t^h - i_t^h\right), \tag{60}$$

- Gross nominal interest rate,

$$R_t = R^* \exp\left(-\psi \frac{d_t - b_t - b_t^e}{p_{H,t} gdp_t}\right). \tag{61}$$

B. Equilibrium unemployment

Following Galí (2011), we assume that each representative household consists of a unit squared of individuals indexed by $(i,j) \in [0,1] \times [0,1]$, where i represents the variety of labor service provided by the individual and j indexes her disutility from working, given by χj^{φ}. Let $n_t^x(i)$ denote the number of variety-i workers in household $x = c, u$ employed at time t. Total household disutility from working is given by

$$\chi \int_0^1 \int_0^{n_t^x(i)} j^{\varphi} dj di = \chi \int_0^1 \frac{n_t^x(i)^{1+\varphi}}{1+\varphi} di,$$

for $x = c, u$. Given the type-specific wage $W_t(i)$, the number of type-i workers that each household *would like to* send to work is given by

$$\arg\max_{n_t^x(i)} \left\{ \lambda_t^x \frac{W_t(i)}{P_t} n_t^x(i) - \chi \frac{n_t^x(i)^{1+\varphi}}{1+\varphi} \right\} = \left(\frac{\lambda_t^x}{\chi} \frac{W_t(i)}{P_t} \right)^{1/\varphi} \equiv l_t^x(i),$$

for $x = c, u$, where $\lambda_t^x \equiv 1/c_t^x$. Unemployment in the market for type-i labor is just the number of workers willing to work at the going wage minus effective labor

demand: $u_t(i) \equiv \sum_{x=c,u} l_t^x(i) - \sum_{x=c,u} n_t^x(i)$ .Let

$$l_t^x \equiv \int_0^1 l_t^x(i)\, di = \left(\frac{\lambda_t^x}{\chi}\frac{W_t}{P_t}\right)^{1/\varphi} \int_0^1 \left(\frac{W_t(i)}{W_t}\right)^{1/\varphi} di = \left(\frac{\lambda_t^x}{\chi}\frac{W_t}{P_t}\right)^{1/\varphi} \Delta_t^{w,l},$$

$$N_t^x \equiv \int_0^1 n_t^x(i)\, di = n_t^x \int_0^1 \left(\frac{W_t(i)}{W_t}\right)^{-\varepsilon_w} di = n_t^x \Delta_t^{w,n},$$

denote total household-specific labor supply and labor demand, respectively, for $x = c, u$, where $\Delta_t^{w,l} \equiv \int_0^1 (W_t(i)/W_t)^{1/\varphi}\, di$ and $\Delta_t^{w,n} \equiv \int_0^1 (W_t(i)/W_t)^{-\varepsilon_w}\, di$ are indexes of wage dispersion. Then aggregate unemployment is

$$u_t \equiv \int_0^1 u_t(i)\, di = l_t - N_t.$$

where $l_t \equiv \sum_{x=c,u} l_t^x$ and $N_t \equiv \sum_{x=c,u} N_t^x$ are aggregate labor supply and labor demand, respectively. Finally, the unemployment rate is $u_t^{rate} \equiv u_t/l_t$.

C. Historical deleveraging episodes: data sources and treatment

We use BIS quarterly data on credit, from all sectors of the economy, to the private non-financial sector (non-financial corporations, households and non-profit institutions serving households), adjusted for breaks.[33] We also use annual data on nominal GDP (identifier: UVGD) and GDP deflator (PVGD) from the European Commission's AMECO database.[34] We take annual averages of the quarterly credit data and divide by nominal GDP so as to obtain an annual series for the debt-to-GDP ratio. The sample period is 1960-2014.[35] We focus on OECD economies.[36]

[33] http://www.bis.org/statistics/credtopriv.htm?m=6%7C326

[34] http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

[35] For some countries, the BIS credit data start later than 1960; for these countries, we use the available data. Also, the BIS dataset ends in 2014:Q2. Therefore, the credit stock for 2014 is the average in the first 2 quarters.

[36] The BIS database does not include Estonia, which belongs to the OECD. For this country, we use data from the Estonian central bank (Eesti Pank) on loans to non-financial corporations, households, and non-profit institutions serving households. The data ends in

Following McKinsey (2010), we define 'concluded historical deleveraging episodes' as those in which the debt-to-GDP ratio fell (i) by at least 10 percentage points and (ii) during at least 3 years.[37] Given our interest in deleveraging episodes driven by actual reductions in debt (or decelerations in its growth rate), as opposed to unusually high inflation and/or real growth, following also McKinsey (2010) we discard those episodes in which the average annual inflation during the episode exceeded 10% ('high inflation' deleveraging episodes, in McKinsey's terminology), or in which the compound annual growth in real GDP during the episode was at least 2 times that in the ten years before the start of the episode, or in the longest time series available ('growing-out-of-debt' deleveraging episodes). This leaves us with 13 deleveraging episodes.

In the countries that we have selected as 'ongoing deleveraging episodes' (Spain, Portugal, Ireland, US and UK), the debt-to-GDP ratio was still falling as of the latest available credit data (2014:Q2). Since these processes are likely to continue in the future, we do not require these episodes to have lasted (so far) at least 3 years. We do continue to require that the debt ratio has declined at least 10pp; two EMU periphery countries such as Italy and Greece do not satisfy the latter criterium.[38] For these episodes, 'intensity' is defined as the average annual reduction in the debt ratio between the starting year and 2014.

Table 4 below shows the dates, duration, total reduction in leverage and intensity

2014:Q3; again, the debt stock for 2014 is the average in the first three quarters. Website: http://statistika.eestipank.ee/?lng=en#listMenu/1252/treeMenu/FINANTSKONTO

[37] We do not consider deleveraging episodes to be interrupted by increases in the debt-to-GDP ratio of less than 1 percentage point for only 1 year (with further reductions afterwards). This way, we do not allow our analysis of deleveraging processes to be affected by negligible, transitory blips in debt ratios. This only affects the episodes Belgium 79/86 (where leverage increased by 0.7pp between 1980 and 1981) and Denmark 75/83 (+0.1pp between 1976 and 1977, and +0.7pp between 1979 and 1980). Nonetheless, excluding these episodes would barely affect the moments reported in Table 2.

[38] In Greece, the debt-to-GDP ratio increased steadily until 2011, fell slightly (2.2pp) in 2012, only to be followed by another increase in 2013 (4.0pp). The available data for 2014 show a moderate fall relative to 2013. It should be born in mind however that nominal debt has indeed declined since 2010, but the large simultaneous fall in nominal GDP has prevented a signficant reduction in our measure of private-sector leverage. For Italy, the reduction in the period 2009-2014 has been 4.2pp only.

(defined as average annual reduction in the debt ratio) for each of the 13 historical private-sector deleveraging episodes. It also displays the initial date, debt reduction (so far, i.e. as of the latest available data), and intensity (as defined in the previous paragraph) for our selected ongoing episodes.

Table 4: Deleveraging episodes

Country	Start	End	Duration (yrs)	Total deleveraging (pp)	Intensity (pp/yr)
Concluded historical episodes					
Switzerland	1969	1974	5	11.4	2.3
Denmark	1975	1983	8	15.8	2.0
Belgium	1979	1986	7	12.9	1.8
Norway	1989	1996	7	31.9	4.6
Denmark	1991	1995	4	14.3	3.6
Australia	1991	1994	3	12.4	4.1
Finland	1992	1998	6	48.8	8.1
Sweden	1993	1996	3	22.8	7.6
Japan	1998	2007	9	47.5	5.3
Korea	1998	2001	3	25.6	8.5
Germany	2003	2008	5	14.7	2.9
Norway	2009	2012	3	17.5	5.8
Estonia	2009	2013	4	45.1	11.3
Selected ongoing episodes					
Spain	2009	-	-	34.9	7.0
Portugal	2012	-	-	18.5	9.2
Ireland	2012	-	-	49.6	24.8
US	2009	-	-	24.5	4.9
UK	2009	-	-	38.6	7.7

D. Steady state effects of structural reforms

Table 5: Steady-state effects of structural reforms

	Product mkt. ref.	Labor mkt. ref.
GDP	1.22	0.92
Employment	-0.02	1.01
Real wages	6.17	-0.34
Construction investment	3.51	0.81
Real estate price	2.63	-0.15
Equipment capital inv.	6.13	0.67
Gross exports	1.39	0.94
Terms of trade	-1.37	-0.93
Unconstrained HH cons.	6.41	0.65
Constrained HH cons.	6.14	0.67
Entrepreneur consumption	-13.73	0.67

Note: The table displays the % difference in terminal steady-state values between (a) the scenario with deleveraging and product/labor market reform and (b) the scenario with deleveraging but no structural reform.