



Financial market frictions in a model of the Euro area

Giovanni Lombardo ^{a,*}, Peter McAdam ^{a,b}

^a European Central Bank, Kaiserstr. 29, D-60311 Frankfurt am Main, Germany

^b Department of Economics, University of Surrey, UK

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ABSTRACT

We build a model of the euro area incorporating financial market frictions at the level of firms and households. Entrepreneurs borrow from financial intermediaries in order to purchase business capital, in the spirit of the “financial accelerator” literature. We also introduce two types of households that differ in their degree of time preference. All households have preferences for housing services. The impatient households are faced with a collateral constraint that is a function of the value of their housing stock. Our aim is to provide a unified framework for policy analysis that emphasises financial market frictions alongside the more traditional model channels. The model is estimated by Bayesian methods using euro area aggregate data and model properties are illustrated with simulation and conditional variance and historical shock decomposition.

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1. Introduction

The global financial crisis which began around the turn of 2007/2008 has – amongst other things – prompted a re-evaluation of modeling strategies as regards financial linkages. It has long been known that financial markets are and were highly imperfect. This reflects information asymmetries between lenders and borrowers, costly verification of financial contracts, and the possibilities of bankruptcies and contagions, etc. Consequently, a feature of financial markets is that lenders tend to demand a premium (or spread) over risk-less interest rates as compensation against such uncertainties. In the data, that premium tends to be counter-cyclical (i.e., it tightens in economic downturns) thus amplifying the effect of economic downturns. Premia aside, borrowers may also be restricted in the absolute amount of funds available to them, for example as in mortgage loans.

The strength of such “financial frictions” and the soundness of the financial system have implications for how central banks conduct monetary policy and assess inflationary pressures and risks. The widening of spreads and deterioration in private lending from late 2007 onwards in many countries prompted a number of central banks to loosen monetary policy and engage in various forms of enhanced credit

support, reflecting concerns that tensions in financial markets would spill-over to the wider economy.

Nevertheless, many policy models largely assume *frictionless* financial markets (with a few notable exceptions, [Christiano et al. \(2003\)](#)). This reflects, to some degree, likely academic and empirical controversy as to the importance of financial channels. Some analysis stress them as a key amplifier and source of business-cycle fluctuations (see e.g. [Bernanke et al. \(1999\)](#), hereafter BGG) whilst others suggest their impact may be relatively minor (see [Meier and Mueller \(2006\)](#)) or strongest during extreme and particular financial distress such as the Great Depression, the Asian Crisis (see [Gertler et al. \(2007\)](#)) as well as presumably the most recent global financial turbulence.

Notwithstanding, our work builds on recent attempts to model the euro area using the current generation of micro-founded Dynamics Stochastic General Equilibrium (DSGE) models, following [Smets and Wouters \(2003\)](#) and the “New Area Wide Model” (NAWM) of [Christoffel et al. \(2008\)](#), but supplemented with a number of standard financial frictions. For instance, in its current state, the NAWM emphasises international trade channels by modeling the euro area (EA) as a small open economy vis-a-vis the rest of the world. Financial markets, though, are modeled in relatively standard way, except that trade in domestic bonds and international bond takes place at an exogenous premium. Recent episodes of financial market turbulence have increased the demand for general equilibrium models that can account for the interaction between these markets, inflation and the real economy. Central banks’ staff, for example, are increasingly confronted with questions concerning

* Corresponding author.

E-mail addresses: giovanni.lombardo@ecb.europa.eu (G. Lombardo), peter.mcadam@ecb.europa.eu (P. McAdam).

the interaction between asset prices, inflation monetary policy. Our work is a first step in the direction of putting existing and well-known euro area models in the position of being able to address these type of questions.

We extend the baseline model by introducing financial market frictions that can give rise to an interaction between financial market variables and the rest of the economy. There are two common ways of modeling financial constraints: *i*) via limited enforceability and collateralised debt (Iacoviello (2005)) and *ii*) via costly state verification and default risk (e.g. BGG). Here we use both. The first is used to model the financial constraints faced by households. The second is used to model the constraint faced by firms.

Both financing schemes generate a link between the net worth of agents and their creditworthiness, and so would be equally suitable to describe both household finance and firms finance. Nevertheless the collateral constraint model generates quantitative rationing leaving the cost of funds at the risk-less rate level. The costly-state-verification model, instead does not limit the level of debt, but generates instead a cost of funds that is larger than the risk-less rate. Both features are of interest and should ideally be combined: the quantitative constraint could be more powerful in generating spillovers to the real economy; the premium effect has the benefit of reflecting real world interest rate spreads. Aoki et al. (2004) use the BGG for the housing market in a simplified general equilibrium model. Christensen et al. (2007) estimate a DSGE model for Canada with borrowing constraints for both firms and households.

We show that the introduction of financial market frictions in the typical DSGE framework can provide important insights on the response of the economy to financial market shocks, although it need not alter dramatically the predictions on the response of the economy to non-financial shocks. Furthermore, our extensions allow us to explain the effects of non-financial shocks on important financial variables as external-finance premia, house prices and residential investment.

The paper proceeds as follows. Section 2 describes the model.¹ Section 3 takes a general look at the data and underlying calibration and shock structure of the model. We then examine, in Section 4, the Bayesian estimation of variants of the model. This is followed by an examination of the model properties: simulation exercises; stylised facts matching; conditional variance and historical decompositions. Finally, we conclude.

2. The model

The following sections describe the formal representation of the model.

2.1. Households

The population consists of an infinite number of households, which mass is normalised to one. A fraction \mathbf{p} are patient households, the rest being impatient. The former type is denoted with subscript 1, the second with subscript 2, if not otherwise stated.

2.1.1. Patient households

Patient households solve the following program:

$$\max_{C_{1,t}, \mathcal{H}_{1,t}, I_t, B_t^*, B_t, W_{1,t}, D_t^H, D_t^B} \mathbb{E}_t \sum_{k=0}^{\infty} (\tilde{\beta}_1 G_C)^k U(C_{1,t+k} - \kappa \bar{C}_{1,t-1+k}, \mathcal{H}_{1,t+k}, N_{1,t+k}) \quad (1a)$$

¹ A longer description of the model with detailed appendices is available in our working paper version, Lombardo and McAdam (2012).

subject to

$$\begin{aligned} (1 + \tau^C) C_{1,t} + \frac{P_{1,t}}{P_{C,t}} I_t + (\epsilon_t^{RP} R_t)^{-1} \frac{B_{t+1}}{P_{C,t}} + (R_t^* (1 - \Gamma_B (S_{t+1} B_{t+1}^*)))^{-1} \frac{S_t}{P_{C,t}} B_{t+1}^* \\ + \frac{\Xi_t + \Phi_t}{P_{C,t}} = \frac{B_t + S_t B_t^*}{P_{C,t}} - q_{h,t} \mathcal{H}_{1,t} + q_{h,t} (1 - \delta_h) \mathcal{H}_{1,t-1} \\ + \frac{(1 + R_t^{DH}) D_{t-1}^H - D_t^H + (1 + R_t^{DB}) D_{t-1}^B - D_t^B}{P_{C,t}} + \Omega_t \\ + (1 - \tau^N - \tau^W) \frac{W_{1,t}}{P_{C,t}} N_{1,t} - \frac{Q_t}{P_{C,t}} (1 - \delta) K_t + \frac{Q_t}{P_{C,t}} K_{t+1} \\ + (1 - \gamma_t) (T_t^Y - T_t^e) \end{aligned} \quad 1b$$

and to

$$K_{t+1} = (1 - \delta) K_t + \epsilon_t^I \left(1 - \Gamma_I \left(\frac{I_t}{I_{t-1}} \right) \right) I_t \quad (1c)$$

where the instantaneous utility function is defined as

$$U(C_{1,t} - \kappa C_{1,t-1}, \mathcal{H}_{1,t}, N_{1,t}) \equiv \left(1 - \frac{\kappa}{G_C} \right) \ln(C_{1,t} - \kappa \bar{C}_{1,t-1}) \\ + j_{1,t} \ln \mathcal{H}_{1,t} - \frac{1}{1 + \zeta} N_{1,t}^{1 + \zeta}, \quad (2)$$

and where δ is the capital depreciation rate, $\tilde{\beta}_1$ is the households time preference parameter, G_C is the long-run growth rate of consumption (identical to the long-run growth rate of technology), $C_{1,t}$ is a CES index of domestic and foreign goods, described later, $\bar{C}_{1,t}$ is the aggregate consumption of patient households (with habit-persistence parameter κ),² $\mathcal{H}_{1,t}$ is the stock of housing, $N_{1,t}$ is labor supply (with elasticity ζ), I_t is investment, K_t is capital, B_t is domestic bonds, B_t^* is foreign bonds, S_t is the nominal exchange rate, D_t^H is deposits at the Building Societies, D_t^B is deposits at the Banks, Ξ_t and Φ_t are profits re-bated by firms and banks to households including rent of land to residential investment, $W_{1,t}$ is nominal wages, $q_{h,t}$ is the price of houses in terms of households' consumption units, Γ_B is a premium paid on foreign bonds transactions (proportional to the size of foreign borrowing), Γ_I is the investment adjustment cost, $P_{C,t}$ is the consumer price index, $P_{1,t}$ is the price of investment goods, R_t is the policy rate (return on domestic bonds), R_t^* is the return on foreign bonds, R_t^{DH} is the return on deposits at Building Societies, R_t^{DB} is the return on deposits at Banks, Q_t is the price of capital, τ^C is a consumption tax, τ^N is a labor income tax, τ^W is an additional payroll tax, T_t is a lump-sum tax,³ ϵ_t^{RP} is a risk premium shock, ϵ_t^I is an investment specific shock, $j_{1,t}$ is a housing preference shock, γ_t is the entrepreneurs' survival shock discussed further below, T_t^Y is a transfer from exiting entrepreneurs to households, T_t^e is a transfer from households to new entrepreneurs (start-ups), finally Ω_t is a transfer to household consisting of the monitoring costs of the net worth of defaulting firms.⁴

2.1.2. First order conditions

For simplicity re-define $\beta_1 \equiv \beta_1 G_C$. The FOCs to the household problem are:

$$B_{t+1} : \lambda_t^P = \beta_1 \mathbb{E}_t \left[\lambda_{t+1}^P \frac{R_t}{\pi_{t+1}} \right] \quad (3a)$$

$$D_t^H : \lambda_t^P = \beta_1 \mathbb{E}_t \left[\lambda_{t+1}^P \frac{(1 + R_t^{DH})}{\pi_{t+1}} \right] \quad (3b)$$

² We assume that habit formation is "external" to the household but "internal" to the household type. Notice also that we are assuming log-preferences in consumption (cum habits) and in housing.

³ See also Christoffel et al. (2008) on assumptions concerning taxes.

⁴ We can think of the default costs as a tax transferred to households.

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