BANCA D'ITALIA

EUROSISTEMA

Temi di Discussione

(Working Papers)

Macroeconomic effects of non-standard monetary policy measures in the euro area: the role of corporate bond purchases

by Anna Bartocci, Lorenzo Burlon, Alessandro Notarpietro and Massimiliano Pisani

September 2017

Number 1136

BANCA D'ITALIA
EUROSISTEMA

Temi di discussione

(Working papers)

Macroeconomic effects of non-standard monetary policy measures in the euro area: the role of corporate bond purchases

by Anna Bartocci, Lorenzo Burlon, Alessandro Notarpietro and Massimiliano Pisani

Number 1136 - September 2017

The purpose of the Temi di discussione *series is to promote the circulation of working papers prepared within the Bank of Italy or presented in Bank seminars by outside economists with the aim of stimulating comments and suggestions.*

The views expressed in the articles are those of the authors and do not involve the responsibility of the Bank.

ISSN 1594-7939 (print)
ISSN 2281-3950 (online)

Printed by the Printing and Publishing Division of the Bank of Italy

MACROECONOMIC EFFECTS OF NON-STANDARD MONETARY POLICY MEASURES IN THE EURO AREA: THE ROLE OF CORPORATE BOND PURCHASES

by Anna Bartocci*, Lorenzo Burlon*, Alessandro Notarpietro* and Massimiliano Pisani*

Abstract

This paper evaluates the macroeconomic effects of the corporate sector purchase programme (CSPP) implemented in the euro area by the Eurosystem. For this purpose we calibrate and simulate a monetary-union dynamic general equilibrium model. We assume that entrepreneurs can finance their spending by issuing bonds in the domestic corporate bond market and by borrowing from domestic banks. We found that the March 2016 CSPP boosts euro-area GDP by around 0.3% in the second year (peak level). Inflation rises too but by a smaller amount. Second, taking into account the programme's extension in December 2016, its overall impact on GDP amounts to 0.6%. Third, the CSPP also stimulates banking activity, because the improvement in macroeconomic conditions leads to higher demand for loans from households and entrepreneurs. Fourth, an early exit from the CSPP negatively impacts its macroeconomic effectiveness, while forward guidance on monetary policy rate enhances it.

JEL Classification: E43, E44, E52, E58.
Keywords: DSGE models, financial frictions, open-economy macroeconomics, non-standard monetary policy, corporate bonds, forward guidance, euro area.

Contents

* Bank of Italy, Directorate General for Economics, Statistics and Research.

1 Introduction[1]

On 8 June 2016 the Eurosystem started to purchase corporate bonds under its Corporate Sector Purchase Programme (CSPP). The CSPP was announced by the ECB's Governing Council following its meeting on 10 March, with the aim to further strengthen the pass-through of the Eurosystem's asset purchases to the financing conditions of the real economy.[2] Under the CSPP, the Eurosystem purchases securities issued by non-bank corporations in both primary and secondary markets.

This paper evaluates the macroeconomic effects of the CSPP. To this purpose, we simulate a large-scale New Keynesian dynamic general equilibrium model calibrated to the euro area (EA) and the rest of the world (RW). The EA is modelled as a monetary union of two regions, Home (also referred to as 'domestic economy', calibrated to Italy for illustrative purposes) and rest of the EA (REA), where Home is of medium size (its GDP being around 20% of overall EA GDP). Modeling the EA as a monetary union allows to capture (in an admittedly stylized way) possible cross-country differences in the transmission of the CSPP, associated with possible structural differences among EA Member States and (country-specific) corporate bond markets.

The model has the following crucial features.

In each EA region there are (non-financial) entrepreneurs. Entrepreneurs hold shares of domestic physical capital producers, that invest in physical capital accumulation and rent it to domestic firms. Entrepreneurs finance their spending by issuing securities to domestic households (savers) and by borrowing from the domestic banking sector. Securities and loans are imperfect substitutes. Securities are uncollateralized long-term bonds in the form of perpetuities with exponentially decaying coupons.[3] Bank loans are collateralized by entrepreneurs' real estate,

[1]We thank Stefano Siviero and an anonimous referee for useful comments. The opinions expressed are those of the authors and should not be attributed to the Bank of Italy. Any remaining errors are the sole responsibility of the authors.

[2]The CSPP is part of the Eurosystem's Expanded Asset Purchase Programme (APP), which was announced in January 2015 by the European Central Bank and includes mostly sovereign bonds' purchases.

[3]This is consistent with one of the main features of the CSPP, i.e., that its eligible maturity spectrum ranges from a minimum remaining maturity of six months to a maximum remaining

which is a durable good that enters the production function of regional intermediate goods. The collateralization takes the form of a loan-to-value (LTV) ratio (entrepreneurs' bank loans are proportional to the expected value of real estate).

In each EA region there is a banking sector. It collects deposits from and issues equities to domestic savers and lends to domestic entrepreneurs and other domestic households (borrowers). As in the case of entrepreneurs, the borrowers use real estate as collateral when demanding bank loans. The banking sector also buys domestic long-term sovereign bonds.

The presence of sovereign bonds makes more complete the banks' balance sheet (sovereign bonds are a non-negligible share of assets held by European banks) and nontrivial the financial choices of the bank (i.e. the allocation of resources from deposits and capital among different investment opportunities).

The presence of both bank loans and corporate bonds allows us to model and calibrate the financial structure of entrepreneurs, which represent the non-financial corporate sector in our model. It also allows us to assess the indirect effects of the CSPP on the banking sector.

Moreover, we model another category of households, labeled 'restricted' (thus, in the model there are three different, non-overlapping types of households: savers, borrowers, and restricted). Restricted households represent non-bank financial institutions investing in shares of capital producers and long-term sovereign bonds. The feature is consistent with empirical evidence for the EA on the preferred-habitat theory provided by Altavilla et al. (2015). Thus, it allows for a more complete description of EA financial markets and of the transmission mechanism and real and financial effects of the CSPP.

Given these features, the core of the transmission mechanism of the CSPP is as follows. The higher demand from the Eurosystem increases corporate bond prices and reduces interest rates. Thus, entrepreneurs have an incentive to issue bonds so as to finance investment in physical capital (because of their stake in capital producers) and purchases of real estate and consumption goods.

The remaining model features are in line with existing large-scale dynamic general equilibrium models of the EA, such as the ECB New Area Wide Model (see Christoffel et al. 2008). In particular, we distinguish between final (nontrad-

maturity of 30 years at the time of the purchase.

able) consumption and investment goods and between intermediate tradable and nontradable goods, produced according to sector-specific technologies exploiting domestic capital and labor. We also include standard nominal (price and wage) and real (consumption habit and investment adjustment costs) frictions.

The following scenarios are simulated. First, the Eurosystem credibly announces that it immediately implements purchases of corporate bonds that last for four quarters. This is consistent with the fact that the CSPP was announced on 10 March 2016 (we consider this as the beginning of 2016Q2 for simplicity), the purchases started on 8 June 2016 (thus, during 2016Q2), and they were intended to last until March 2017 (that is, 2017Q1 included). The amount of quarterly purchases was around €6bn in 2016Q2, €23bn in 2016Q3, €21bn in 2016Q4, and €24bn in 2017Q1 (around 0.3% of quarterly average EA GDP in the first quarter of simulation and 1% in the following ones).[4] We assume that the bonds are held to maturity (the latter is set to around 8 years, roughly the average maturity of non-banking corporate securities in the EA). The EA (short-term) monetary policy rate is kept constant at the baseline level for 8 quarters (forward guidance on monetary policy rate, FG). Thereafter, it follows a standard Taylor rule and reacts to EA-wide inflation and economic activity.

We then run alternative scenarios. Specifically, we evaluate the role of exit policy (corporate bonds are held by the Eurosystem for an amount of time shorter than the bonds' maturity) and FG (longer or shorter than two years). In all scenarios the sequence of purchases is fully anticipated by households and firms (perfect foresight assumption).

Finally, we simulate the extension of the CSPP (leg of APP) as announced on 8 December 2016 (we consider this as the beginning of 2017Q1 for simplicity). The additional purchases start after March 2017, i.e., in 2017Q2, and should last for three quarters until the end of 2017 (that is, 2017Q4). Hence, we assume that the extension, which we label 'CSPP2,' consists of a first quarter of simulation with zero purchases (corresponding to 2017Q1) followed by quarterly purchases equal to €24bn, that is, of the same amount as the last recorded quarter (2017Q1).

The main results are as follows. First, the March 2016 CSPP boosts EA GDP by around 0.3% in the second year (peak level). Inflation rises too but by a smaller

[4]See ECB (2017) for details on CSPP holdings at book value by quarter.

amount. Second, taking into account the extension of December 2016, the overall impact of the programme on GDP amounts to 0.6%. Third, the CSPP also stimulates banking activity. The improvement in macroeconomic conditions induces a higher demand for real estate, whose price increases in both effective and expected terms. Since real estate is used as collateral, households and entrepreneurs increase their demand for banking loans. Banks match the increase in demand mainly by increasing the supply of loans. Fourth, the early exit from the CSPP negatively affects its macroeconomic effectiveness, while the FG on the policy rate enhances it.

There are reasons to believe that our estimates of CSPP's macroeconomic effects are a lower bound. The inclusion into the model of portfolio choices that distinguish among different classes of corporate bonds would allow to assess the indirect impact of the CSPP on less safe corporate sectors such as the high yield, whose relatively tight financial conditions are likely to indirectly benefit more from the CSPP.

The paper builds upon several recent contributions. Burlon et al. (2015, 2016a, 2016b) evaluate the macroeconomic effects of the PSPP, i.e., purchases of sovereign bonds by the Eurosystem. Different from them, we focus on the CSPP, and evaluate its macroeconomic effects on the EA economy. The banking sector is akin to Gerali et al. (2010) and, more recently, to Bokan et al. (2016). Different from them, we allow entrepreneurs to finance investment by issuing also corporate bonds. To the best of our knowledge, this is the first attempt to provide an evaluation of the CSPP macroeconomic effects with a structural model of the EA. The CSPP is rather effective in stimulating the economy, as it directly affects the financing conditions of the entrepreneurs. However, the corporate bond market is smaller than the sovereign bond market. Thus, the size of the possible purchases by the central bank is necessarily smaller than in the case of the PSPP.

The paper is organized as follows. Section 2 describes the main features of the model, in particular the problem of the entrepreneurs, the corporate bonds and banking sector. Section 3 describes the simulated scenarios. Section 4 reports the main results. Section 5 concludes.

2 The model

We first provide an overview of the model. Subsequently, we illustrate the crucial features for the simulations (entrepreneurs and banking sector). Finally, we report the calibration.

2.1 Overview

The model represents a world economy composed of three regions, that is, Home, REA (Home+REA=EA), and RW. The size of the world economy is normalized to one. Home, REA, and RW have sizes equal to n, n^*, and $(1 - n - n^*)$, with $n > 0$, $n^* > 0$, and $n + n^* < 1$.[5] Home and REA share the currency and the monetary authority. The latter sets the nominal short-term interest rate according to EA-wide inflation and GDP.

The crucial features of the model are those determining its financial structure.

In both EA regions there are (i) three types of households – i.e., savers, borrowers, and restricted, (ii) the banking sector, (iii) (non-financial) entrepreneurs, (iv) capital producers, and (v) (non-financial) firms in the wholesale and retail sectors.[6]

The (non-financial) entrepreneurs hold shares of domestic (physical) capital producers. The latter choose the optimal amounts of the (end-of-period) stock of physical capital and investment. They rent capital to domestic wholesale firms and rebate profits to entrepreneurs and restricted households according to corresponding (exogenous) shares. Entrepreneurs finance their investment in physical capital (as they hold shares of capital producers) by borrowing from domestic banks (their loans are collateralized by the owned real estate) and by issuing uncollateralized long-term "corporate" bonds in the domestic corporate bond market.

All households consume and supply labor services to domestic (non-financial) firms. Savers invest in deposits with domestic banks, internationally traded bonds,

[5] For each region, size refers to the overall population and to the number of firms operating in each sector (intermediate tradable, intermediate nontradable, final nontradable, capital producer, and banking sector).

[6] There is no overlap across household types, as the set $\{\text{savers}, \text{borrowers}, \text{restricted}\}$ constitutes a partition of the set of households in each region.

domestic short- and long-term sovereign bonds, domestic corporate bonds, domestic real estate; they hold domestic firms, other than capital producers. Borrowers get loans from the banking sector and pledge their real estate as collateral. Restricted households invest in long-term sovereign bonds and physical capital, as they hold shares of capital producers. Restricted households represent non-bank financial institutions investing in shares of capital producers and long-term sovereign bonds. The feature is consistent with empirical evidence for the EA on the preferred-habitat theory provided by Altavilla et al. (2015). Thus, it allows for a more complete description of EA financial markets and of the transmission mechanism and real and financial effects of the CSPP.

The banking sector collects deposits from domestic savers, lends to domestic borrowers and entrepreneurs, and buys domestic long-term sovereign bonds. Thus, the model features a rather exhaustive description of the assets held by the banking sector.

Given that entrepreneurs issue corporate bonds, the model can be used to evaluate the macroeconomic impact of CSPP. The presence of the banking sector allows us to model entrepreneurs' financial characteristics in a more exhaustive way and to evaluate the impact of CSPP on the banking sector conditions.

Real estate is in fixed aggregate supply. It is exchanged between entrepreneurs, savers, and borrowers, under perfect competition. It is a durable nontradable good that provides utility (housing services) to households and that entrepreneurs rent as input to domestic wholesale firms.

The remaining features of the model are rather standard and in line with New Keynesian open economy models. Households consume a final good, which is a composite of intermediate nontradable and tradable goods. The latter are domestically produced or imported. All households supply differentiated labor services to domestic firms and act as wage setters in monopolistically competitive labor markets by charging a mark-up over their marginal rate of substitution between consumption and leisure.[7]

On the production side, perfectly competitive firms produce two final goods (consumption and investment goods), and intermediate goods are produced by mo-

[7]Following common practice in the New Keynesian literature, the assumption of cashless economy holds in the model.

nopolistic firms. The two final goods are sold domestically and are produced combining all available intermediate goods using a constant-elasticity-of-substitution (CES) production function. The two resulting bundles may have different composition. Intermediate tradable and nontradable goods are produced combining domestic capital, labor and real estate, that are assumed to be mobile across sectors. Intermediate tradable goods can be sold domestically and abroad. Because intermediate goods are differentiated, firms have market power and restrict output to create excess profits. We also assume that markets for tradable goods are segmented, so that firms can set a different price for each of the three markets (Home, REA, and RW). In line with other dynamic general equilibrium models of the EA, we include adjustment costs on real and nominal variables, ensuring that consumption, production, and prices react in a gradual way to a given shock. On the real side, habits and quadratic costs delay the adjustment of households consumption and investment, respectively. On the nominal side, quadratic costs make wages and prices sticky.[8]

In what follows, we report the main new equations for the Home country. Similar equations hold in the REA. Different from Home and REA, in the RW there exists only one (standard) representative household. We do not report other main equations, as they are standard for a New Keynesian model.[9]

2.2 Entrepreneurs

There exists a continuum of entrepreneurs e having mass $0 < \lambda_E < 1$ in the Home population. The generic entrepreneur e maximizes the intertemporal utility function

$$E_0 \sum_{t=0}^{\infty} \beta_E^t \frac{\left(C_{e,t}\left(e\right) - hC_{e,t-1}\right)^{1-\sigma}}{\left(1-\sigma\right)}, \tag{1}$$

where E_0 denotes the expectation conditional on information set at date 0, C is consumption of (non-durable) goods, $0 < \beta_E < 1$ is the discount factor, $1/\sigma$ is the elasticity of intertemporal substitution ($\sigma > 0$). The parameter h ($0 < h < 1$)

[8] See Rotemberg (1982).

[9] They are available upon request.

represents external habit formation in consumption.

Entrepreneurs borrow from domestic banks and issue corporate bonds in the domestic market, which are sold to savers and, when the CSPP is implemented, to the central bank of the monetary union.

The entrepreneur e gets one-period (short-term) loans from banks subject to a collateral constraint à la Kiyotaki and Moore (1997),

$$-Loan_{e,t}(e) \leq m_e E_t \left(\frac{Q_{t+1} h_t(e)}{R_t^{Loan,e}} \right), \tag{2}$$

where $Loan_e < 0$ is the bank loan, $0 \leq m_e \leq 1$ is the loan-to-value ratio, Q is the real estate price, h is the real estate (a durable good), and $R^{Loan,e}$ is the gross interest rate on loans.[10]

The entrepreneur also issues long-term corporate bonds B_{CORP}, modelled as a perpetuity paying an exponentially decaying coupon $\kappa_{CORP} \in (0, 1]$.[11] The budget constraint is

$$\begin{aligned} & P_{CORP,t} B_{CORP,t}(e) - R_{CORP,t} P_{CORP,t} B_{CORP,t-1}(e) \\ & + Loan_t(e) - Loan_{t-1}(e) R_{t-1}^{Loan,e} \\ = \; & \Pi^K(e)_t(e) + R_t^h h_{t-1}(e) - P_{c,t} C_t(e) - Q_t(h_t(e) - h_{t-1}(e)), \end{aligned} \tag{3}$$

where $\Pi_t^K(e)$ are after-tax revenues from ownership of domestic capital producers, R^h is the (net) return from renting real estate to domestic firms on a period-by-period basis, P_c is the consumption deflator, and $R_{CORP,t}$ is the gross yield to maturity on corporate bonds,

$$R_{CORP,t} = \frac{1}{P_{CORP,t}} + \kappa_{CORP}, \tag{4}$$

where P_{CORP} is the price of the corporate bond.[12].

[10] As in Iacoviello (2005), it is assumed that entrepreneurs are more impatient than savers, i.e., their discount factor is relatively low. This guarantees that the borrowing constraint holds in the deterministic steady state and, by continuity argument, in a neighborhood of it.

[11] See Woodford (2001).

[12] See the Technical Appendix of Chen *et al.* (2012) for details.

2.3 Capital producers

There exists a continuum of mass $0 \leq n \leq 1$ of firms that produce physical capital. Each capital producer maximizes discounted future profits. In discounting, the producer uses the stochastic discount rates of entrepreneurs and restricted households, aggregated according to the (parametric) shares ω and $(1-\omega)$, respectively (capital producers are owned by entrepreneurs and restricted households, to whom rebate profits in a lump-sum way). Each capital producer optimally chooses the end-of-period capital K_t and investment I_t subject to the law of capital accumulation, the adjustment costs on investment, distortionary taxes on capital income levied by the domestic government, and taking all prices as given. The law of motion of capital accumulation for the generic capital producer p is

$$K_t(p) = (1-\delta) K_{t-1}(p) + \left(1 - AC_t^I(p)\right) I_t(p), \tag{5}$$

where $0 < \delta < 1$ is the depreciation rate. The adjustment cost on investment AC_t^I is

$$AC_t^I(p) \equiv \frac{\phi_I}{2}\left(\frac{I_t(p)}{I_{t-1}(p)} - 1\right)^2, \tag{6}$$

where $\phi_I > 0$ is a parameter. Investment is a final nontradable good, composed of intermediate tradable (domestic and imported) and nontradable goods. Capital producers buy it in the corresponding market at price P_I.[13] Capital producers rent existing physical capital stock $K_{t-1}(p)$ at the nominal rate R_t^K to domestic firms producing intermediate tradable and nontradable goods.

2.4 Banks

There is a banking sector both in the Home economy and in the REA economy. In each banking sector there is a continuum of commercial banks.

In the Home economy, each bank $b \in [0, n]$ consists of two branches, the wholesale branch and the retail branch.[14]

The wholesale branch acts under perfect competition. It maximizes profits by taking all interest rates as given and subject to a bank capital requirement. It

[13] Because of the adjustment costs on investment, a "Tobin's Q" holds.

[14] We assume the same size n for the banking sector as for the region without loss of generality.

optimally issues deposits and equities (i.e., bank capital) to domestic savers (patient households), buys domestic long-term sovereign bonds, and makes resources available to the domestic bank retail branch.

The latter operates under monopolistic competition and makes loans to domestic borrowers and, crucially, to domestic entrepreneurs. It maximizes profits by optimally setting the interest rate on loans taking as given (i) the interest rate paid on resources it gets from the wholesale banking branch and (ii) the demand for loans from entrepreneurs and households. It also faces adjustment costs when setting the interest rate.

In what follows we initially describe the main equations of the wholesale branch and, subsequently, those of the retail branch.

2.4.1 Banks - Wholesale branch

The optimal decisions of the wholesale branch solve a profit maximization problem subject to the balance sheet constraint, the capital requirement, and taking prices and interest rates as given.

The balance sheet constraint of the generic wholesale branch b is

$$LOANS_t^{wh,s}(b) + P_{m,t}B_t^{long,bank}(b) = D_t^{bank,d}(b) + V_t K_t^{bank,s}(b), \tag{7}$$

where $LOANS^{wh,s} > 0$ are loans to the retail branch, $B^{long,bank}$ are holdings of the domestic long-term sovereign bonds (P_m is their price), $D^{bank,s}$ are the deposits, and $K^{bank,s}$ are bank equities (V is their market price).[15]

The profits are equal to

$$\begin{aligned} & R_{wh,t}^{LOANS} LOANS_t^{wh,s}(b) + R_t^{long} P_{m,t} B_t^{long,bank}(b) \\ & - R_t^{DEP} D_t^{bank,d}(b) - V_t K_t^{bank,s}(b) \\ & - \frac{\phi_{LOAN}}{2}\left(LOANS_t^{wh}(b) - \overline{LOANS^{wh}}\right)^2 - \frac{\phi_D}{2}\left(D_t^{bank,d}(b) - \overline{D^{bank,d}}\right)^2 \\ & - \frac{\phi_{BK}}{2}\left(V_t K_t^{bank,s}(b) - \kappa LOANS_t^{wh}\right)^2, \end{aligned} \tag{8}$$

[15] The long-term sovereign bonds are formalized as perpetuities following Woodford (2001).

where R_{wh}^{LOANS} is the (gross) interest rate on loans $LOANS^{wh,s}$ to the retail branch, R^{long} the return on sovereign bonds, R^{DEP} the gross interest rate on deposits, and V is the price of equity. The branch pays quadratic adjustment costs on loans, deposits and on the deviations of the bank capital from the capital requirement $\kappa LOANS^{wh}$ ($0 \leq \kappa \leq 1$, ϕ_{LOAN}, ϕ_D, $\phi_{BK} > 0$ are parameters, $\overline{LOANS^{wh}}$ and $\overline{D^{bank,d}}$ are the steady-state values of loans and deposits, respectively).

The wholesale branch optimally chooses deposits, equities, loans, and long-term sovereign bonds so that, at the margin, it equates the costs of the two sources of financing (deposits and capital) to each other and to the returns on the two assets (loans and sovereign bonds).

2.4.2 Banks - Retail branch

The retail branch lends to domestic entrepreneurs and domestic borrowers. It differentiates wholesale loans, $LOANS^{wh}$, at zero cost.[16] The loans are then sold to households and entrepreneurs at their individual rates. The retail branch acts under monopolistic competition. It sets the interest rate on loans to maximize profits taking as given (i) the interest rate that it pays to borrow from the wholesale branch and (ii) the entrepreneurs' and borrowers' demand for loans, and subject to quadratic adjustment costs on the loans' interest rate (this allows us to get a gradual adjustment of retail interest rates to a given shock).

The resulting first-order conditions imply that the interest rates on loans to entrepreneurs and households, $R_{retail}^{LOANS,entr}$ and $R_{retail}^{LOANS,bor}$ respectively, are given by a (time-varying) mark-up on the interest rate paid to the wholesale sector,

$$R_{retail,t}^{LOANS,entr} = mkp_t^{entr} R_{wh,t}^{LOANS} \quad (9)$$

$$R_{retail,t}^{LOANS,bor} = mkp_t^{bor} R_{wh,t}^{LOANS}, \quad (10)$$

where the mark-up depends on the elasticity of substitution among differentiated loans and, in the short run, also on quadratic adjustment costs paid to change the lending rate. The implied profits are rebated to the savers, as a return on bank

[16] The total amount of loans supplied to entrepreneurs and households is equal to the loans the retail branch gets from the wholesale branch.

equity, according to the owned amount of bank capital (equities).

2.5 Restricted households

There exists a continuum of restricted households j', having mass λ_R ($0 \leq \lambda_R < 1$ is the share of restricted households in the Home population). Their preferences are additively separable in consumption and labor effort. The generic restricted household j' receives utility from consumption $C_R(j')$ and disutility from labor $L_R(j')$. The household's expected lifetime utility is

$$E_0 \sum_{t=0}^{\infty} \beta_R^t \left[\frac{\left(C_{R,t}\left(j'\right) - hC_{R,t-1}\right)^{1-\sigma}}{(1-\sigma)} - \frac{L_{R,t}\left(j'\right)^{1+\tau}}{1+\tau} \right], \tag{11}$$

where β_R is the discount factor ($0 < \beta_R < 1$), $1/\sigma$ is the elasticity of intertemporal substitution ($\sigma > 0$), and $1/\tau$ is the labor Frisch elasticity ($\tau > 0$). The parameter h ($0 < h < 1$) represents external habit formation in consumption. Restricted households have access only to the market of long-term sovereign bonds. The budget constraint is

$$\begin{aligned} & P_t^L B_{R,t}^L\left(j'\right) - R_{t-1}^L P_t^L B_{R,t}^L\left(j'\right) \\ = \; & \Pi_t^K\left(j'\right) + W_{R,t}\left(j'\right)\left(1-\tau_t^\ell\right) L_{R,t}\left(j'\right) \\ & -P_t\left(1+\tau_t^c\right) C_{R,t}\left(j'\right) - AC_{R,t}^W\left(j'\right), \end{aligned} \tag{12}$$

where B_R^L is the amount of long-term sovereign bonds, Π^K is after-tax profit from ownership of the Home capital producers, $0 \leq \tau^c \leq 1$ is the tax rate on consumption. Long-term sovereign bonds have price P^L and are formalized as perpetuities paying an exponentially decaying coupon $\kappa \in (0, 1]$, following Woodford (2001). Finally, households act as wage setters in a monopolistic competitive labor market. Each household j' supplies one particular type of labor services which is an imperfect substitute to services supplied by other households. In the generic period t it sets its nominal wage W_R taking into account of the labor income tax rate $0 \leq \tau^\ell \leq 1$, labor demand, and quadratic adjustment costs AC_R^W à

la Rotemberg on the nominal wage $W_R(j')$:

$$AC^W_{R,t}(j') \equiv \frac{\kappa_W}{2}\left(\frac{W_{R,t}(j')/W_{R,t-1}(j')}{\Pi^{\alpha_W}_{WR,t-1}\bar{\Pi}^{1-\alpha_W}_{EA}} - 1\right)^2 W_{R,t}L_{R,t}, \tag{13}$$

where $\kappa_W > 0$ and $0 \leq \alpha_W \leq 1$ are parameters that regulate wage stickiness and indexation, respectively, the variable $\Pi_{WR,t} \equiv W_{R,t}/W_{R,t-1}$ is the gross wage inflation rate, and $\bar{\Pi}_{EA}$ is the long-run gross inflation target of the EA monetary authority (assumed to be constant). The adjustment costs are proportional to the per-capita wage bill of restricted households, $W_R L_R$.[17] Restricted households represent non-bank financial institutions investing in particular classes of assets, i.e., long-term sovereign bonds and shares of the capital producers.

2.6 Savers

There exists a continuum of savers, indexed by j, having mass $0 \leq \lambda_S < 1$ (λ_S is the share of savers in the Home population). The generic household has preferences separable in consumption of goods other than housing, housing services h, and labor,

$$E_0 \sum_{t=0}^{\infty} \beta_S^t \left[\frac{(C_{S,t}(j) - hC_{S,t-1})^{1-\sigma}}{(1-\sigma)} + \chi \ln(h_t(j)) - \frac{L_{S,t}(j)^{1+\tau}}{1+\tau}\right]. \tag{14}$$

The savers have access to multiple financial assets (all denominated in euro terms): the short-term (one-period) sovereign bond B^G, exchanged with the domestic government; the short-term private bond B^P, exchanged with REA savers and RW households and paying the interest rate R^P; the long-term sovereign bond B^L_S, exchanged with domestic restricted households and the domestic government; the corporate bonds, B^S_{CORP}, issued by domestic entrepreneurs; the bank equities, $K^{bank,d}$, issued by domestic banks at price V. Thus, they have several opportunities to smooth consumption when facing a shock. The budget constraint of the generic saver j is

[17] As the implied first order conditions are rather standard we do not report them to save on space. They are available upon request.

$$
\begin{aligned}
&P_t^L B_{S,t}^L(j) - R_t^L P_t^L B_{S,t-1}^L(j) \\
&+P_{CORP,t} B_{CORP,t}^S(j) - R_{CORP,t} P_{CORP,t} B_{CORP,t-1}^S(j) \\
&+B_t^G(j) - B_{t-1}^G(j) R_{t-1} \\
&+B_t^P(j) - B_{t-1}^P(j) R_{t-1}^P (1-\phi_t) \\
&+V_t K_t^{bank,d} - V_t K_{t-1}^{bank,d} \\
&= \left(1-\tau_t^{\ell}\right) W_{S,t}(j) L_{S,t}(j) + \Pi_t^P(j) + \Pi_t^{bank} K_{t-1}^{bank,d}(j) \\
&-P_t\left(1+\tau_t^c\right) C_{S,t}(j) + TR_t(j) - Q_t(h_t(j) - h_{t-1}(j)) - AC_{S,t}^W(j) \\
&-AC_{S,t}^B(j),
\end{aligned}
\tag{15}
$$

where the short-term government bond B^G pays the EA monetary policy rate R. The dividends $\Pi^P(j)$ and Π^{bank} are from ownership of domestic monopolistic firms and bank equity holdings, respectively.[18] The term ϕ represents an exponential adjustment costs, needed to stabilize the position in the internationally traded bond.[19] The term TR represents lump-sum transfers from the government. Savers supply labor services under monopolistic competition and face quadratic adjustment costs AC_S^W when setting nominal wages (the cost is similar to the one paid by restricted households, see eq. 13). They also pay adjustment costs AC_S^B on long-term sovereign bond holdings.[20] First order conditions imply no-arbitrage conditions.[21] Thus, in equilibrium the interest rates paid by the different bonds

[18] Claims to firms' profits are not internationally tradable.

[19] The adjustment cost is defined as

$$
\phi_B \equiv \phi_{b1} \frac{\exp\left(\phi_{b2}\left(B_t^P - \bar{B}^P\right)\right) - 1}{\exp\left(\phi_{b2}\left(B_t^P - \bar{B}^P\right)\right) + 1}, \text{ with } \phi_{b1}, \phi_{b2} > 0
$$

where $\bar{B}^P$ is the steady-state position of the representative Home saver. Both are taken as given in the maximization problem. A similar cost holds for the RW household.

[20] We assume a standard quadratic form for the adjustment cost, that is,

$$
AC_{S,t}^B(j) \equiv \frac{\phi_{b^L}}{2}\left(P_t^L B_{S,t}^L(j) - \bar{P}^L \bar{B}_S^L\right)^2, \text{ with } \phi_{b^L} > 0,
$$

where $\bar{P}^L \bar{B}_S^L$ is the (symmetric) steady-state value of the long-term sovereign bond. The adjustment cost guarantees that the bond holdings follow a stationary process and that the economy converges to the steady state.

[21] As the implied first order conditions are rather standard we do not report them to save on

are equal to the monetary policy rate R_t, net of the spreads induced by the longer maturity and the adjustment costs.[22]

2.7 Borrowers

There exists a continuum of households, labeled 'borrowers,' indexed by j'', having mass $0 \leq \lambda_B < 1$ (λ_B is the share of borrowers in the Home population). The generic borrower has preferences separable in consumption of goods other than housing, housing services h, and labor similar to those of savers (14). The only difference is the the discount factor, which is lower for borrower than for savers (borrowers are more impatient than savers). Borrowers get one-period (short-term) loans from domestic banks subject to a collateral constraint à la Kiyotaki and Moore (1997),

$$-Loan_{borr,t}(j'') \leq m_{borr} E_t \left(\frac{Q_{t+1} h_t(j'')}{R_t^{Loan,borr}} \right), \tag{16}$$

where $Loan_{borr} < 0$ is the bank loan, $0 \leq m_{borr} \leq 1$ is the loan-to-value ratio, Q is the real estate price, h is the real estate, and $R^{Loan,borr}$ is the gross interest rate on loans.

2.8 Monetary policy

The EA (short-term) monetary policy rate is controlled by the EA monetary authority, which keeps it constant for an announced number of periods (FG on the monetary policy rate) or sets it according to a standard Taylor rule. When the policy rate is not set according to the FG, it reverts to the Taylor rule. The latter is

$$\frac{R_t}{\bar{R}} = \left(\frac{R_{t-1}}{\bar{R}} \right)^{\rho_R} \left(\frac{\Pi_{EA,t}}{\bar{\Pi}_{EA}} \right)^{(1-\rho_R)\rho_\pi} \left(\frac{GDP_{EA,t}}{GDP_{EA,t-1}} \right)^{(1-\rho_R)\rho_{GDP}}, \tag{17}$$

where R_t is the gross monetary policy rate. The parameter ρ_R ($0 < \rho_R < 1$) captures inertia in interest rate setting, while the parameter $\bar{R}$ represents the

space. They are available upon request.

[22] See Chen *et al.* (2012) for the details. Our calibration implies that households can modify their financial positions without facing relevant adjustment costs.

steady-state gross nominal policy rate. The parameters ρ_π and ρ_{GDP} are respectively the weights of EA consumer price index (CPI) inflation rate ($\Pi_{EA,t}$) (taken as a deviation from its long-run constant target $\bar{\Pi}_{EA}$) and GDP ($GDP_{EA,t}$).[23]

Finally, the EA monetary authority adopts the CSPP. It is modelled as exogenous Home and REA corporate bonds' purchases. Thus, the central bank directly intervenes in the corporate bonds markets.

The market clearing condition for the Home corporate bond is

$$\int_0^{n\lambda_S} B^S_{CORP,t}(j)dj + B^{CSPP}_t = \int_{n\lambda_S}^{n\lambda_S+n\lambda_e} B_{CORP,t}(e)de, \tag{18}$$

where the variable $B^S_{CORP}(j)$ represents the corporate bonds held by the generic household (saver) j (whose share in the population is λ_S), B^{CSPP} represents the demand for corporate bonds from the EA monetary authority, and $B_{CORP}(e)$ the corporate bonds issued by the generic entrepreneur e. A similar market clearing condition holds for the REA corporate bonds market.[24]

2.9 Equilibrium

In each country the initial asset positions, preferences, and budget constraints are the same for households belonging to the same type and firms belonging to the same sector. Moreover, profits from ownership of domestic firms acting under monopolistic competition are equally shared among savers. Profits from ownership of domestic capital producers are distributed to entrepreneurs and restricted households according to the corresponding shares held by each type of agent, and are equally shared within each type. Thus, we consider the representative entrepreneur and household for each household type (restricted, savers, and borrowers). Moreover, we consider the representative capital producer and the representative firm for each sector (final nontradable, intermediate tradable, intermediate nontradable, wholesale banking branch, and retail banking branch). The implied sym-

[23]The CPI inflation rate is a geometric average of Home and REA CPI inflation rates (respectively Π_t and Π^*_t) with weight equal to the correspondent country GDP (as a share of the EA GDP). The EA GDP, $GDP_{EA,t}$, is the sum of Home and REA GDPs.

[24]To keep the model parsimonious we consider, in each EA region, the overall corporate bond market. Thus, we do not distinguish between primary and secondary market.

metric equilibrium is a sequence of allocations and prices such that, given the initial conditions and considered monetary policy measures (the shocks affecting the model): households and firms satisfy their corresponding first order conditions; the monetary policy rules, the fiscal rules, and the government budget constraints hold; and all markets clear.[25]

2.10 Calibration

The model is calibrated at quarterly frequency. We set parameter values so that steady-state ratios are consistent with great ratios (average values of main variables as a ratio to GDP). For remaining parameters we resort to previous studies and estimates available in the literature.[26]

Table 1 contains parameters for preferences and technology. Parameters with "$*$" and "$**$" are related to the REA and the RW, respectively. The discount factor of EA savers is set to 0.996, so that the steady-state short-term interest rate is equal to 1.6% on an annual basis. The discount factor of RW households is set to 0.996 as well. The discount factor of restricted households determines the steady-state value of the long-term interest rate and is set to 0.99, so that in steady state the interest rate on EA long-term sovereign bonds is equal to 4.1% on annualized terms. The discount factor of entrepreneurs determines the steady-state value of the corporate interest rate. It is set to 0.99, so that the steady-state interest rate on corporate bonds is equal to 4.1% on annualized terms. The discount factor of borrowers is set to 0.991. The loan-to-value ratios of Home and REA entrepreneurs are set to 0.4 and 0.45, respectively; those of Home and REA households to 0.55 and 0.70, respectively.

In each region the population shares of savers, borrowers, entrepreneurs, and restricted households are set to 0.3, 0.5, 0.1, and 0.1, respectively. Given the lack of micro-evidence on those shares, we set them to get a response of investment to the (benchmark) CSPP around four times as large as the response of consumption,

[25]We assume that the supply of long-term sovereign bonds is constant and that lump-sum taxes paid by the savers stabilize short-term public debt and deficit according to a standard fiscal rule. Details are available upon request.

[26]See the New Area Wide Model (NAWM, Christoffel et al. 2008) and Smets and Wouters (2003).

in line with standard business cycle facts, and at the same time to calibrate the adjustment cost on investment to a rather standard value (i.e., 9.5, as reported in Table 3).[27]

Table 2 reports gross mark-ups and the related elasticities of substitution among intermediate goods.

Table 3 reports real and nominal adjustment costs. The parameters in the adjustment costs on deviations of corporate bond positions from steady-state levels have been calibrated following two criteria. First, they should not greatly affect the model dynamics and yet help to stabilize it. Second, the response of the interest rate on corporate bonds to the benchmark CSPP should be in line with existing evidence for the EA.[28]

Table 4 reports the parameterization of the systematic feedback rule followed by the monetary authority. The central bank of the EA targets the contemporaneous EA-wide consumer price inflation (the corresponding parameter is set to 1.7) and the output growth (the parameter is set to 0.1). Interest rate is set in an inertial way and hence its previous-period value enters the rule with a weight equal to 0.92. The values are identical for the corresponding parameters of the Taylor rule in the RW.

Table 5 reports the steady-state great ratios implied by the chosen parameterization. The corporate bonds-to-(nominal annualized) GDP ratio is set to 6% and 9% for Home and REA, respectively (in steady state, the bonds issued by the entrepreneurs are held by the domestic savers). The share of capital producers held by entrepreneurs is equal to 50% (and, thus, the share held by restricted households is 50% as well). The amount of bank capital (share to total loans) is equal to 10%. We calibrate the duration of the corporate bonds to eight years

[27]Moreover, the chosen calibration of restricted households allows us to get in the benchmark case results for the PSPP that are in line with Blattner and Joyce (2016). Specifically, using a small macro-finance BVAR model, they find that the ECB government bond purchases, as announced on 22 January 2015, reduced EA ten-year bond yields, on average, by around 30bps in 2015, and had a positive impact on the output gap and inflation in 2016, of the order of 0.2ppt and 0.3ppt respectively. The authors state that their estimates are likely to underestimate the overall impact of the ECB's purchases on interest rates and inflation, as they do not consider all possible transmission channels of the purchases programme. To save on space, we do not include the robustness analysis on the relative shares of the different household types. It is available upon request.

[28]See ECB (2016) and Zaghini (2017).

(thirty-two quarters), in line with Zaghini (2017).[29] The duration of the long-term sovereign bonds is set to eight years as well. Short-term public debt (ratio to yearly GDP) is set to 13% for Home and 8% for the REA. Long-term public debt is set to 121% and 93% of (yearly) GDP for Home and the REA. [30] We assume that in each country long-term sovereign bond holdings that are not in the banks' balance sheets are equally shared between savers and restricted households. The long-term sovereign bonds held by banks, as a share of the overall amount of long-term sovereign bond, is set to 30% in both regions. We set the markup and the adjustment costs of the retail interest rates to rather small values.

The chosen calibration yields impulse response functions to a standard monetary policy shock (+0.25 bp) for GDP and inflation in each EA region that are in line with the workhorse estimated models of the EA in the literature.[31]

3 Simulated scenarios

We simulate the following scenarios. First, the Eurosystem credibly announces that it immediately implements purchases of corporate bonds that last for four quarters. This is consistent with the fact that the CSPP was announced on 10 March 2016 (we consider this as the beginning of 2016Q2 for simplicity), the purchases started on 8 June 2016 (thus, during 2016Q2), and they were intended to last until March 2017 (that is, 2017Q1 included). The amount of quarterly purchases was around €6bn in 2016Q2, €23bn in 2016Q3, €21bn in 2016Q4, and €24bn in 2017Q1 (around 0.3% of quarterly average EA GDP in the first quarter of simulation and 1% in the following ones).[32] We assume that the bonds are held to maturity. The EA (short-term) monetary policy rate is kept constant at the baseline level for eight quarters (FG). Thereafter, it follows a standard Taylor rule and reacts to EA-wide inflation and economic activity. We also simulate the extension of the CSPP leg of the APP as announced on 8 December 2016 (we consider this as the beginning of 2017Q1 for simplicity). The additional purchases

[29] The quarterly duration is $\frac{R_{CORP,t}}{(R_{CORP,t}-\kappa_{CORP})}$.

[30] Thus, total public debt as a share of GDP is 134% in Home (roughly consistent with Italian data) and 101% in REA.

[31] See, for example, the New Area Wide Model (NAWM, Christoffel, Coenen and Warne 2008).

[32] Check ECB (2017) for details on CSPP holdings at book value by quarter.

start after March 2017, i.e., in 2017Q2, and should last for three quarters until the end of 2017 (that is, 2017Q4). Hence, we assume that the extension, which we label 'CSPP2,' consists of a first quarter of simulation with zero purchases (corresponding to 2017Q1) followed by quarterly purchases equal to €24bn, that is, of the same amount as in the last recorded quarter (2017Q1).

We also run alternative scenarios. Specifically, we evaluate the role of exit policy (corporate bonds are held by the Eurosystem for an amount of time shorter than the bonds' maturity) and FG (longer or shorter than two years). In all scenarios the sequence of purchases is fully anticipated by households and firms (perfect foresight assumption).

4 Results

4.1 The CSPP

Fig. 1 shows the simulated effects of the CSPP on the corporate bond market. The interest rate on corporate bonds persistently decreases (by roughly 50 bp at its trough). The size of the reduction is in line with the estimates provided by Zaghini (2017) and ECB (2016).[33] Savers reduce their bond holdings, because they sell them to the monetary authority. Entrepreneurs initially decrease their holdings and, starting from the fourth quarter (in correspondence of the interest rate trough), persistently increase the issuance of bonds.[34]

Fig. 2 illustrates the responses of the main macroeconomic variables. In both EA regions economic activity and, in a rather mild way, inflation increase. Effects are rather symmetric among the two regions. Both regions' GDP increase by around 0.3% (peak level, achieved after six quarters).

[33] According to the results reported by ECB (2016), based on a time-series panel analysis of the determinants of corporate bond spreads estimated over the October 1999-March 2016 period, over the identified period from 10 to 24 March, 11bp of the total decline of 16bp in the spreads of EA investment-grade corporate bonds was related to the monetary policy measures announced in March, more specifically the launch of the CSPP.

[34] Given that we do not distinguish between primary and secondary markets, the initial decrease reflects the sale to the monetary authority of previously issued corporate bonds held by entrepreneurs. As the price of bonds gradually decreases from the peak reached right after the announcement, entrepreneurs find more profitable to stop selling the bonds and start issuing new ones, thus exploiting the improved financing conditions established by the programme.

All GDP components increase. Entrepreneurs' investment benefits from the reduction in the corporate interest rates. The lower interest rates induce them to gradually issue new bonds so as to finance the increase in physical capital accumulation, real estate demand, and consumption.

The induced increase in capital accumulation makes labor and real estate more productive. Thus, firms producing intermediate tradable and nontradable goods increase demand for labor and real estate. Home exports benefit from the increase in REA aggregate demand. REA exports increase to a lower extent than Home exports do, because they are more oriented towards the RW, whose aggregate demand is not affected by the CSPP (the euro depreciates in a rather mild way vis-à-vis the RW currency).

Fig. 3 reports the effects on labor market variables. The increase in capital accumulation makes labor more productive. Thus, firms increase labor demand. Consistently, real wages increase.

Higher capital accumulation and employment favor a persistent increase in real estate demand for production and consumption purposes by entrepreneurs and constrained households (see Fig. 4). The increase in real estate demand from entrepreneurs is gradual and achieves a peak after four quarters, when the corporate interest rate achieves its trough. Given that in each region the overall (economy-wide) stock of real estate is constant, the higher demand for real estate from the borrowers and entrepreneurs is satisfied by the lower demand by savers (the latter sell the real estate to the former). The price of real estate persistently increases.

Consistent with the increase in the value of collateralizable real estate (see Eq. 2 and Eq. 16), entrepreneurs and borrowers persistently increase their demand for loans from the banks (Fig. 5). Banks finance loans by raising deposits and, to a lower extent, banking capital (the bank capital-to-loan ratio declines in a very slight way). The higher demand of deposits and capital is matched by the increase in supply of funds by domestic savers. Banks match the higher demand for loans by readily increasing supply. Thus, there is only a very mild increase in the interest rates on loans (Fig. 6). Similarly, the interest rate on deposits increases only mildly. The limited increase in interest rates is not surprising, given that the stance of the EA monetary policy is accommodative and interest rates on

the financial assets are linked by no-arbitrage conditions. Banking sector equity prices and return increase, consistent with the increase in lending and increase in banks' demand for additional capital.

Overall, we find that the CSPP has expansionary effects on EA economic activity. The effects on inflation are positive but milder. The programme also benefits the banking sector, by favoring the demand for loans.

4.2 Early-exit strategies from the CSPP

In the benchmark scenario we assume no reinvestment, i.e., the monetary authority holds the bonds to maturity. We compare the benchmark with two scenarios that are different in the duration of the CSPP. In the first scenario, the monetary authority announces that it will gradually sell the bonds 2 years before they reach maturity, that is, it will hold them for only 6 years instead of 8. In the second scenario, the monetary authority announces that it will gradually sell the corporate bonds only one year before they reach maturity.[35] As in the benchmark scenario, purchases and sales of the corporate bonds by the central bank are modeled as a sequence of exogenous shocks to its position in the corporate bond market. The sequence is fully anticipated by households and firms in the initial period. In the early exit case, the sales of bonds holdings is faster than in the baseline.

Fig. 7 reports the results. The main message is that the earlier the announced exit from the programme, the lower the decrease in the interest rate of corporate bonds and the less expansionary the macroeconomic effects.

In the case of exit after 6 years, the central bank supports demand for corporate bonds for a rather short amount of time. Thus, the price of the bond increases and the interest rate decreases to a smaller extent than in the benchmark. The responses of EA CPI inflation and GDP are consistent with those of the long-term interest rates. The earlier is the exit, the less pronounced is the increase in economic activity and inflation. Demand for real estate increases to a lower extent as well. The implied increase in its price is rather modest, limiting the increase of real estate value and, thus, the increase in borrowing from the banks.

[35] For an analysis of the macroeconomic effects of the early exit from the PSPP (the other leg of the APP), see Burlon et al. (2016b).

In the case of exit after 7 years, the central bank supports demand for Home and REA corporate bonds for a longer amount of time than in the case of an exit after only 6 years. Thus, the prices of the bonds, which reflect current and future demand conditions, increase to a larger extent; correspondingly, the interest rate decreases to a larger extent. Entrepreneurs increase their demand for investment in physical capital and real estate relatively more. The larger increase in real estate prices further favors entrepreneurs and consumers' borrowing from the banking sector.

4.3 Duration of the FG

In the benchmark simulation the EA monetary authority announces in the initial period that it will keep the short-term policy rate at the baseline level during the first two years (two-year FG). We now assess the role of this commitment by changing the announced number of periods during which the monetary policy rate is kept constant. Specifically, we consider a first scenario with three-year FG and a second scenario with one-year FG. In all scenarios, the policy rate increases after the end of the commitment period, because the central bank returns to follow the Taylor rule and therefore increases the policy rate to stabilize macroeconomic conditions.

Fig. 8 shows the results. The interest rate on corporate bonds does not greatly change across the three scenarios, because its dynamics largely reflect the direct effects of the CSPP, which is identical in the two scenarios.

The initial increase in demand for investment and real estate favors economic activity and inflation. The later the exit from the FG, the more expansionary are these effects. The larger amplification is due to the fact that households anticipate the slower increase in the policy rate and, thus, increase their aggregate demand for consumption to a larger extent. Consistent with the larger aggregate demand, there is a larger increase in bank loans to borrowers and entrepreneurs.

Overall, in the case of three-year FG the larger increase in aggregate demand implies higher GDP growth and inflation in the first two years.

Finally, in the case of one-year FG there is a smaller increase in aggregate demand. The boost to EA GDP is around 0.1-0.2% (peak).

4.4 The CSPP extension

Fig. 9 reports the responses of interest rates on corporate bonds and real GDP to the CSPP (i) as announced in March 2016 (analyzed in the previous sections) and (ii) as prolonged in December 2016. We use calendar dates on the horizontal axis to gauge the cumulated macroeconomic consequences of the two decisions. It is assumed that in March 2016 households and firms did not anticipate the December 2016 announcement. Thus, the latter is a surprise that enters the agents' information set in December 2016. Moreover, it is assumed that in December 2016 agents expect that a two-year FG holds. Following the announcement, the interest rate on corporate bonds drops by another 50 bp in 2017Q1.[36] The overall decrease is equal to almost 100 bp. The 2016Q2 and 2017Q1 decreases are similar to each other. The reason is the size of the purchases, which is the same in the two announcements. The larger drop in the interest rate is an an incentive for firms to further increase investment. Economic activity further increases. The EA GDP increases by 0.6% (peak level) in the beginning of 2018. Without the programme extension, the GDP would increase by roughly 0.3%. The higher aggregate demand induces firms to increase prices. EA inflation increases by 0.2pp in 2017. The increase would be much lower without the programme extension.

Overall, the macroeconomic effects of the combination of the initial announced CSPP and its (subsequent) extension are not trivial.

5 Conclusions

This paper evaluates the macroeconomic effectiveness of the CSPP. According to our results, the CSPP favors economic activity and inflation. Moreover, it also favors the recovery of the demand for bank loans and, thus, the improvement in banking sector conditions through its expansionary effects on aggregate demand (for consumption and investment). Overall, the CSPP can contribute to restore a standard monetary policy regime, the relative small dimension of the EA corporate market notwithstanding.

[36] If the December 2016 announcement would have been anticipated by households and firms, the decrease in the interest rate would have materialized before December.

Our work can be extended along several dimensions. First, investors may see the CSPP as an opportunity to cash in on their eligible holdings and move into different asset classes with the potential for higher returns. The inclusion into the model of portfolio choices that distinguish among different classes of corporate bonds would allow to assess the (indirect) impact of the CSPP on less safe corporate sectors such as the high yield. Related to this, one could take into account the presence of risk premia on corporate bonds' interest rates. Ajello and Tanaka (2017) for example document how the introduction of multi-period defaultable debt contracts in an otherwise standard New Keynesian DSGE model improves the fit of observed credit spreads, credit risk premia, leverage ratios, and interest rates' term structure data. Second, the CSPP favors the demand for investment from firms by improving their financial conditions. Investment could also rise because of incentives associated with lower taxes and increase in competition. Thus, there can be interaction between the CSPP on the one hand and fiscal or structural reforms on the other. We leave these issues for future research.

References

[1] Ajello, A. and H. Tanaka (2017). Term premium, credit risk premium, and monetary policy. Mimeo, Board of Governors of the Federal Reserve System.

[2] Altavilla, C., R. Motto, and G. Carboni (2015). Asset purchase programmes and financial markets: lessons from the euro area Working Paper Series 1864, European Central Bank.

[3] Bokan, N., A. Gerali, S. Gomes, P. Jacquinot, and M. Pisani (2016). EAGLE-FLI. A macroeconomic model of banking and financial interdependence in the euro area. ECB Working Paper Series no. 1923, June.

[4] Blattner, T., and M. Joyce (2016). Net debt supply shocks in the euro area and the implications for QE. ECB Working Paper no. 1957, September.

[5] Burlon, L., A. Gerali, A. Notarpietro, and M. Pisani (2015). Inflation, financial conditions and non-standard monetary policy in a monetary union. A model-based evaluation. Temi di discussione (Economic working papers) 1015, Bank of Italy, Directorate General for Economics, Statistics and Research.

[6] Burlon, L., A. Gerali, A. Notarpietro, and M. Pisani (2016a). Non-standard monetary policy, asset prices and macroprudential policy in a monetary union. Temi di discussione (Economic working papers) 1089, Bank of Italy, Directorate General for Economics, Statistics and Research.

[7] Burlon, L., A. Gerali, A. Notarpietro, and M. Pisani (2016b). Macroeconomic effectiveness of non-standard monetary policy and early exit. A model-based evaluation. Temi di discussione (Economic working papers) 1074, Bank of Italy, Directorate General for Economics, Statistics and Research.

[8] Chen, H., V. Cúrdia, and A. Ferrero (2012). The macroeconomic effects of large-scale asset purchase programmes. *The Economic Journal*, vol. 122, pp. 289-315.

[9] Christoffel, K., G. Coenen and A. Warne (2008). The New Area-Wide Model

of the Euro Area: A Micro-Founded Open-Economy Model for Forecasting and Policy Analysis. ECB Working Paper Series 944.

[10] ECB (2016). The corporate bond market and the ECB's corporate sector purchase programme. ECB Economic Bulletin, Issue 5, Box 2.

[11] ECB (2017). Asset purchase programmes, `https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html`, accessed on 19 April 2017.

[12] Gerali A., S. Neri, L. Sessa, F. M. Signoretti (2010). Credit and Banking in a DSGE Model of the Euro Area. *Journal of Money, Credit and Banking, Blackwell Publishing*, vol. 42, pp. 107–141.

[13] Iacoviello, M. (2005). House Prices, Borrowing Constraints and Monetary Policy in the Business Cycle. *American Economic Review*, vol. 95(3), pp. 739–764.

[14] Kiyotaki, N. and J. Moore (1997). Credit Cycle. *Journal of Political Economy*, 105 (2), pp. 211–248.

[15] Rotemberg, Julio J. (1982), Monopolistic price adjustment and aggregate output. *Review of Economic Studies*, 49, pp. 517–31.

[16] Smets, F. and R. Wouters (2003). An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area. *Journal of the European Economic Association*, MIT Press, vol. 1(5), pp. 1123–1175.

[17] Woodford, M. (2001). Fiscal requirements for price stability. *Journal of Money, Credit and Banking*, vol. 33, pp. 669–728.

[18] Zaghini, A. (2017). The CSPP at work: yield heterogeneity in the euro-area corporate bond market. Bank of Italy, mimeo.

Table 1: Preferences and technology

Parameter	H	REA	RW
Savers' discount factor $\beta_S, \beta_S^*, \beta^{**}$	0.996	0.996	0.996
Restricted households' discount factor β_R, β_R^*	0.99	0.99	–
Borrowers' discount factor β_B, β_B^*	0.991	0.991	–
Entrepreneurs' discount factor β_E, β_E^*	0.99	0.99	–
Intertemporal elasticity of substitution $1/\sigma$	1.0	1.0	1.0
Habit (households and entrepreneurs) h	0.8	0.8	0.8
Inverse of Frisch elasticity of labor supply τ	2.0	2.0	2.0
Share of savers λ_S	0.3	0.3	1.0
Share of restricted households λ_R	0.1	0.1	–
Share of borrowers λ_B	0.5	0.5	–
Share of entrepreneurs λ_E	0.1	0.1	–
Entrepreneurs' loan-to-value ratio m_e	0.4	0.45	–
Borrowers' loan-to-value ratio m_{borr}	0.55	0.7	–
Depreciation rate of capital δ	0.025	0.025	0.025
Tradable intermediate goods			
Substitution between factors of production $\xi_T, \xi_T^*, \xi_T^{**}$	0.90	0.90	0.90
Bias towards capital $\alpha_T, \alpha_T^*, \alpha_T^{**}$	0.50	0.60	0.55
Bias towards housing $\beta_T, \beta_T^*, \beta_T^{**}$	0.05	0.05	–
Nontradable intermediate goods			
Substitution between factors of production $\xi_N, \xi_N^*, \xi_N^{**}$	0.90	0.90	0.90
Bias towards capital $\alpha_N, \alpha_N^*, \alpha_N^{**}$	0.50	0.60	0.55
Bias towards housing $\beta_N, \beta_N^*, \beta_N^{**}$	0.05	0.05	–
Final consumption goods			
Subst. btw. dom. and imported goods $\phi_A, \phi_A^*, \phi_A^{**}$	1.50	1.50	1.50
Bias towards domestic tradable goods a_H, a_F^*, a_G^{**}	0.68	0.59	0.90
Subst. btw. tradables and nontradables $\rho_A, \rho_A^*, \rho_A^{**}$	0.50	0.50	0.50
Bias towards tradable goods a_T, a_T^*, a_T^{**}	0.68	0.50	0.50
Final investment goods			
Subst. btw. dom. and imported goods $\phi_E, \phi_E^*, \phi_E^{**}$	1.50	1.50	1.50
Bias towards domestic tradable goods $\upsilon_H, \upsilon_F^*, \upsilon_G^{**}$	0.50	0.49	0.90
Subst. btw. tradables and nontradables $\rho_E, \rho_E^*, \rho_E^{**}$	0.50	0.50	0.50
Bias towards tradable goods $\upsilon_T, \upsilon_T^*, \upsilon_T^{**}$	0.78	0.70	0.70

Note: H=Home; REA=rest of the euro area; RW= rest of the world. "*" refers to REA, "**" to RW.

Table 2: Gross mark-ups

Mark-ups and elasticities of substitution			
	Tradables	Nontradables	Wages
H	1.2 ($\theta_T = 6.0$)	1.33 ($\theta_N = 4.0$)	1.33 ($\psi = 4.0$)
REA	1.2 ($\theta_T^* = 6.0$)	1.33 ($\theta_N^* = 4.0$)	1.33 ($\psi^* = 4.0$)
RW	1.2 ($\theta_T^{**} = 6.0$)	1.33 ($\theta_N^{**} = 4.0$)	1.33 ($\psi^{**} = 4.0$)

Note: H=Home; REA=rest of the euro area; RW= rest of the world.
"*" refers to REA, "**" to RW.

Table 3: Real and nominal adjustment costs

Parameter	H	REA	RW
Real adjustment costs			
Investment ϕ_I, ϕ_I^*,ϕ_I^{**}	9.50	9.50	9.50
Adjustment costs on bonds			
Savers' long-term sovereign bond positions ϕ_{b^L}, $\phi_{b^L}^*$	0.0002	0.0002	–
Savers' corporate bond positions $\phi_{b_S^C}$, $\phi_{b_S^C}^*$	0.005	0.009	–
Entrepreneurs' corporate bond positions $\phi_{b_E^C}$, $\phi_{b_E^C}^*$	0.00025	0.0001	–
Savers' short-term private bond positions			
ϕ_{b1}, ϕ_{b1}^{**}	0.01	–	0.01
ϕ_{b2}, ϕ_{b2}^{**}	0.01	–	0.01
Nominal adjustment costs			
Wages κ_W, κ_W^*, κ_W^{**}	600	600	600
Home produced tradables κ_H, κ_H^* κ_H^{**}	400	400	400
REA produced tradables κ_G, κ_G^* κ_G^{**}	400	400	400
RW produced tradables κ_F, κ_F^* κ_F^{**}	400	400	400
Nontradables κ_N, κ_N^*, κ_N^{**}	800	800	800

Note: H=Home; REA=rest of the euro area; RW= rest of the world.
"* " refers to REA, "** " to RW.

Table 4: Monetary policy rule

Parameter	EA	RW
Lagged interest rate ρ_R, ρ_R^{**}	0.92	0.92
Inflation ρ_Π, ρ_Π^{**}	1.70	1.70
GDP growth $\rho_{GDP}, \rho_{GDP}^{**}$	0.10	0.10

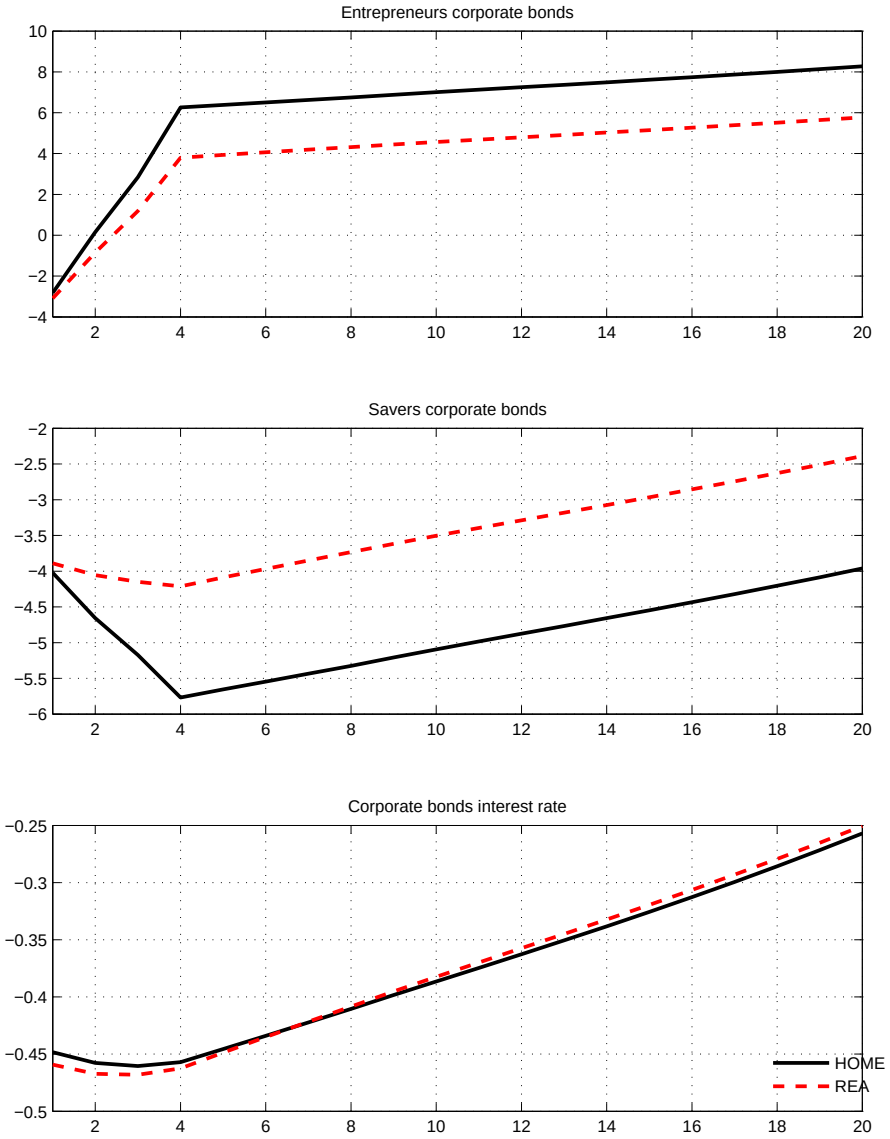
Note: EA= euro area; RW= rest of the world; "* " refers to REA, "** " to RW.

Table 5: Main variables

	H	REA	RW
Macroeconomic variables			
Private consumption (% of GDP)	63.0	56.0	54.0
Public consumption (% of GDP)	20.0	21.0	21.0
Private Investment (% of GDP)	17.0	20.0	22.0
Imports (% of GDP)	25.0	19.0	4.0
GDP (% of world GDP)	3.0	15.0	82.0
Financial variables			
Shares of capital producers held by entrepreneurs (%)	50.0	50.0	–
Corporate bonds (% of annual GDP)	6.0	9.0	–
Bank capital (% of total loans)	10.0	10.0	–
Bank loans to entrepreneurs (% of annual GDP)	44.0	55.0	–
Bank loans to borrowers (% of annual GDP)	24.0	28.0	–
Short-term public debt (% of annual GDP)	13.2	8.0	–
Long-term public debt (% of annual GDP)	121.3	93.3	–
Long-term public debt held by banks (% of long-term public debt)	30.0	30.0	–
Duration corporate bonds (quarters)	32.0	32.0	–
Duration long-term sovereign bonds (quarters)	32.0	32.0	–
Net Foreign Asset Position (ratio to GDP)	0.0	0.0	0.0

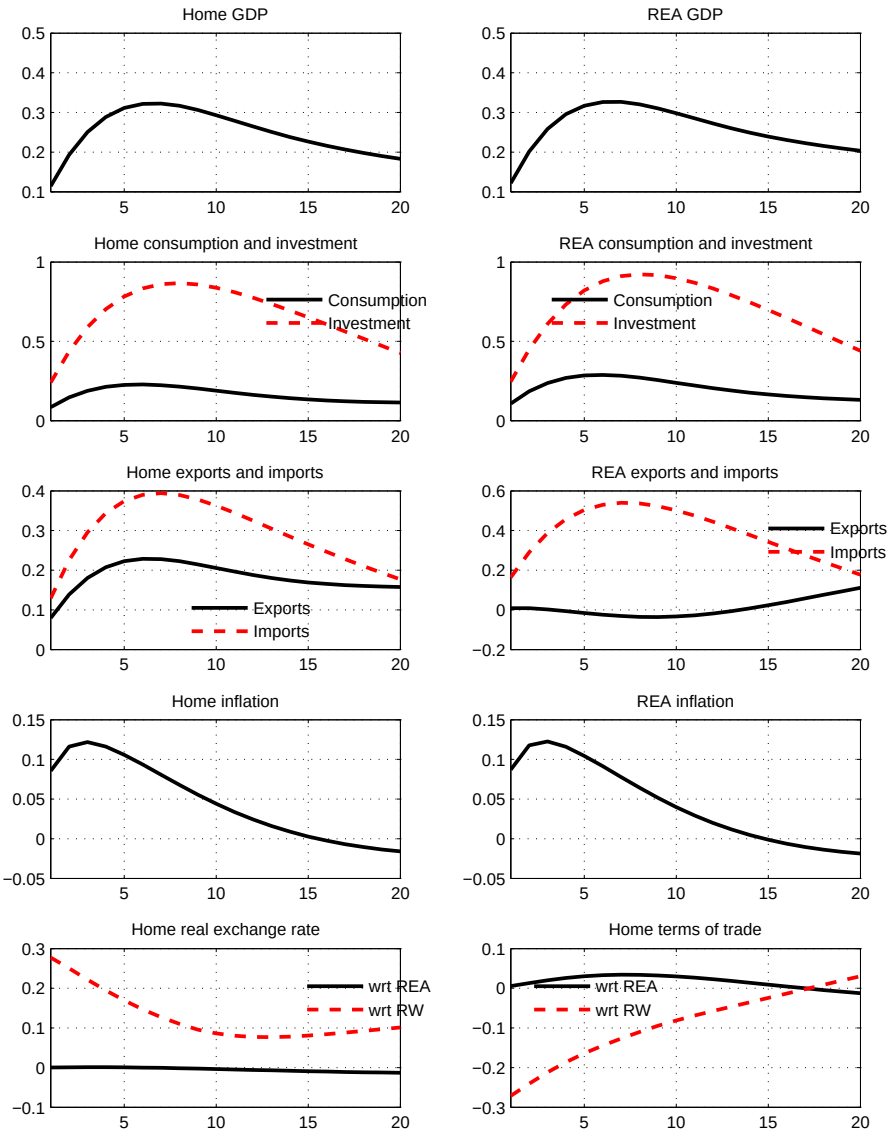
Note: H=Home; REA=rest of the euro area; RW= rest of the world.

Figure 1: Corporate bond market



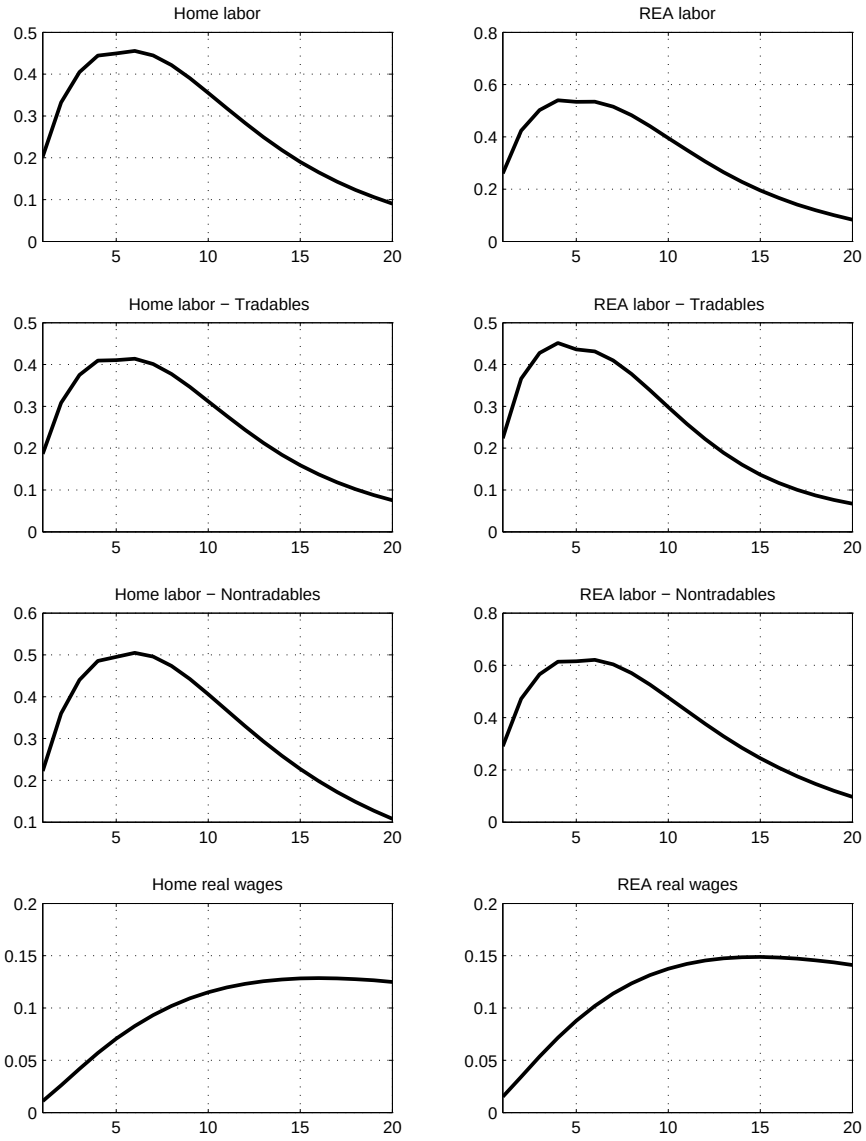
Notes: horizontal axis, quarters; GDP and its components in real terms; vertical axis, % deviations from the steady state. For nominal interest rate, annualized pp. dev.

Figure 2: Main macroeconomic variables



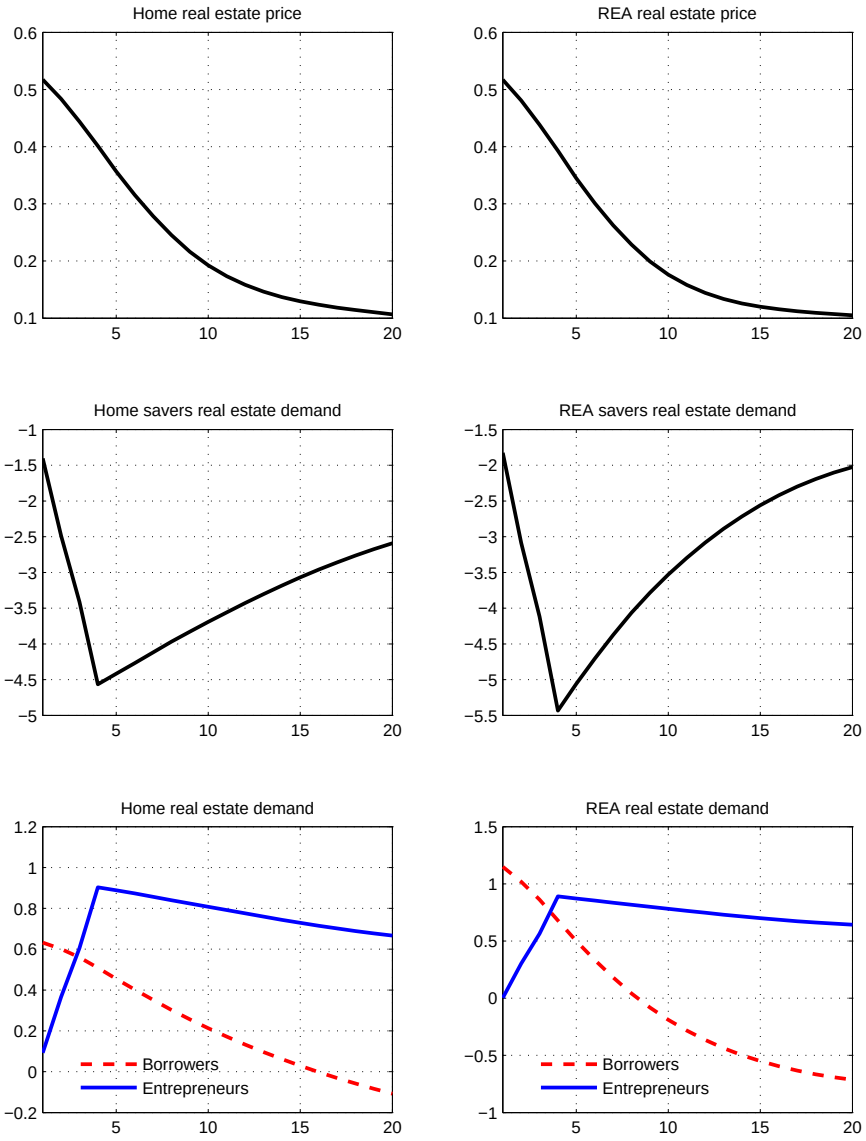
Notes: horizontal axis, quarters; vertical axis, % deviations from the steady state. For inflation, annualized pp. dev.

Figure 3: Labor market



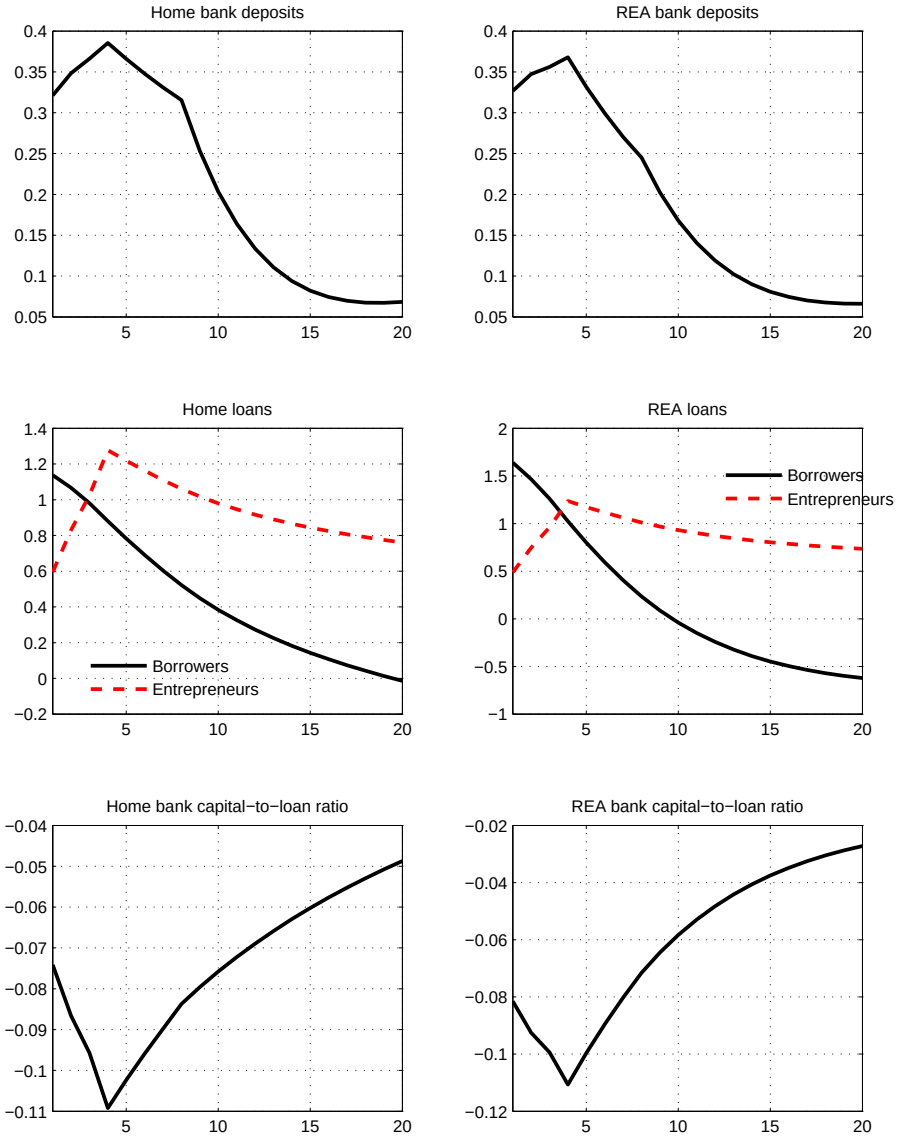
Notes: horizontal axis, quarters; vertical axis, % deviations from the steady state.

Figure 4: Real estate market



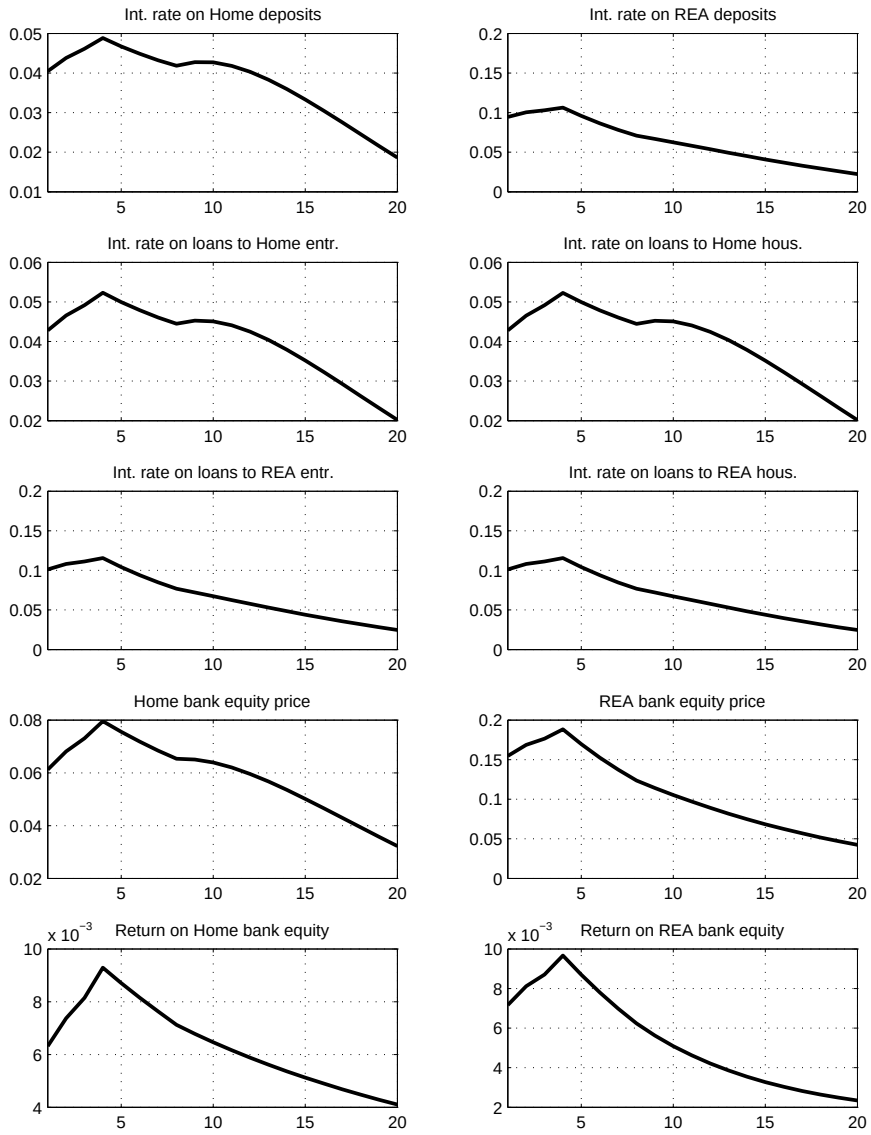
Notes: horizontal axis, quarters; vertical axis, % deviations from the steady state.

Figure 5: Banking sector: quantities



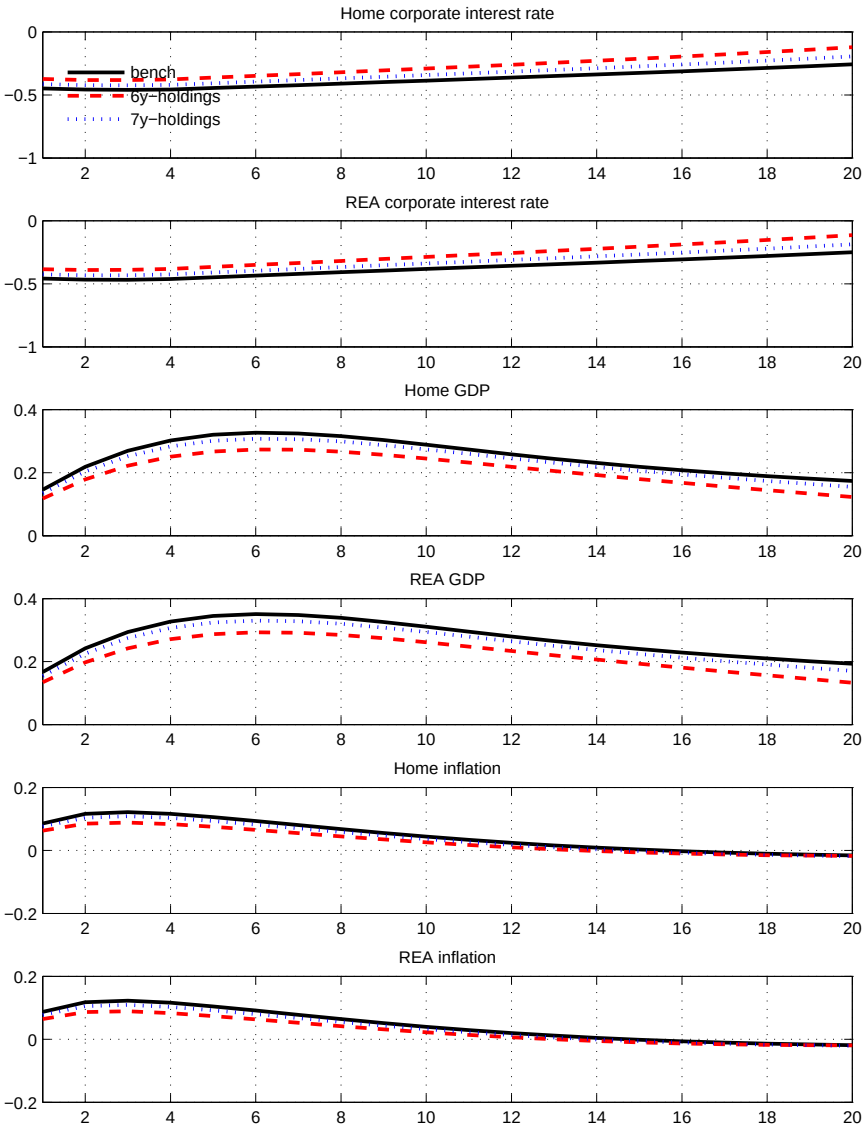
Notes: horizontal axis, quarters; vertical axis, % deviations from the steady state; for the bank capital-to-loan ratio, pp. dev.

Figure 6: Banking sector: prices



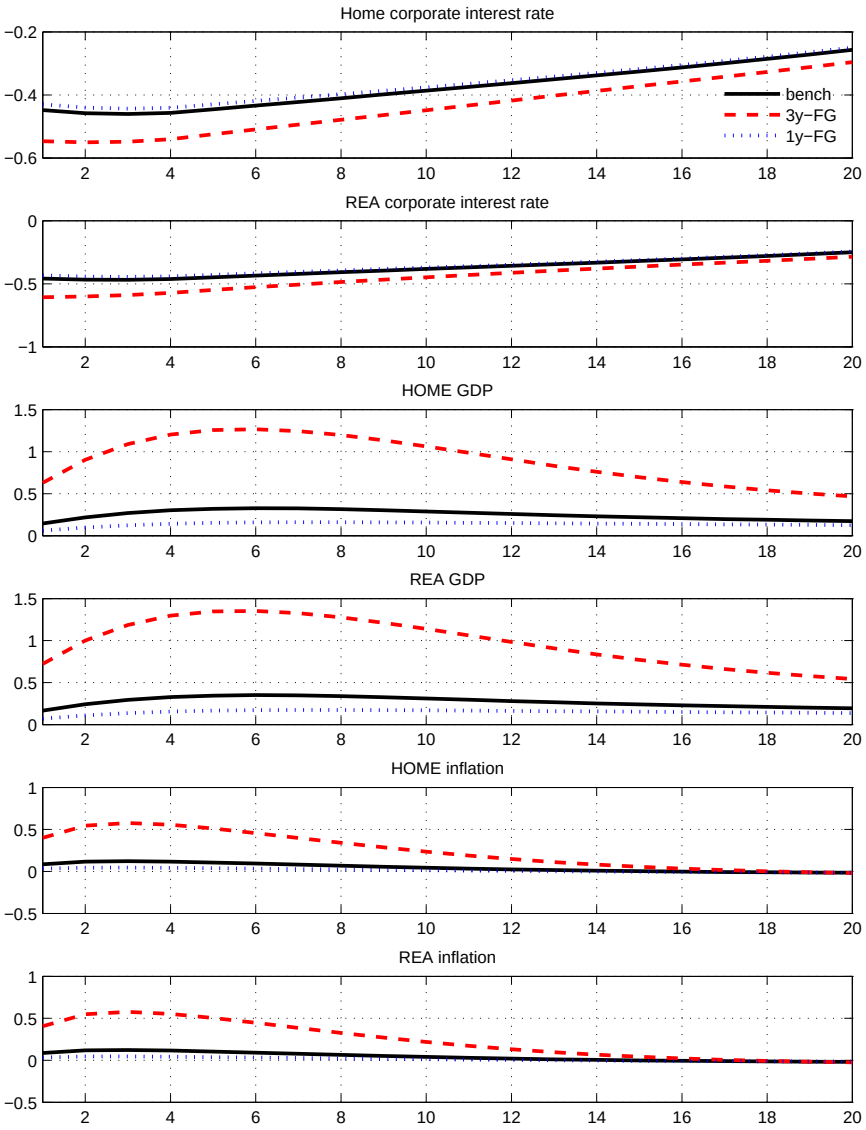
Notes: horizontal axis, quarters; vertical axis, annualized pp dev. from the steady state; for equity prices, % dev.

Figure 7: Alternative exit strategies from CSPP



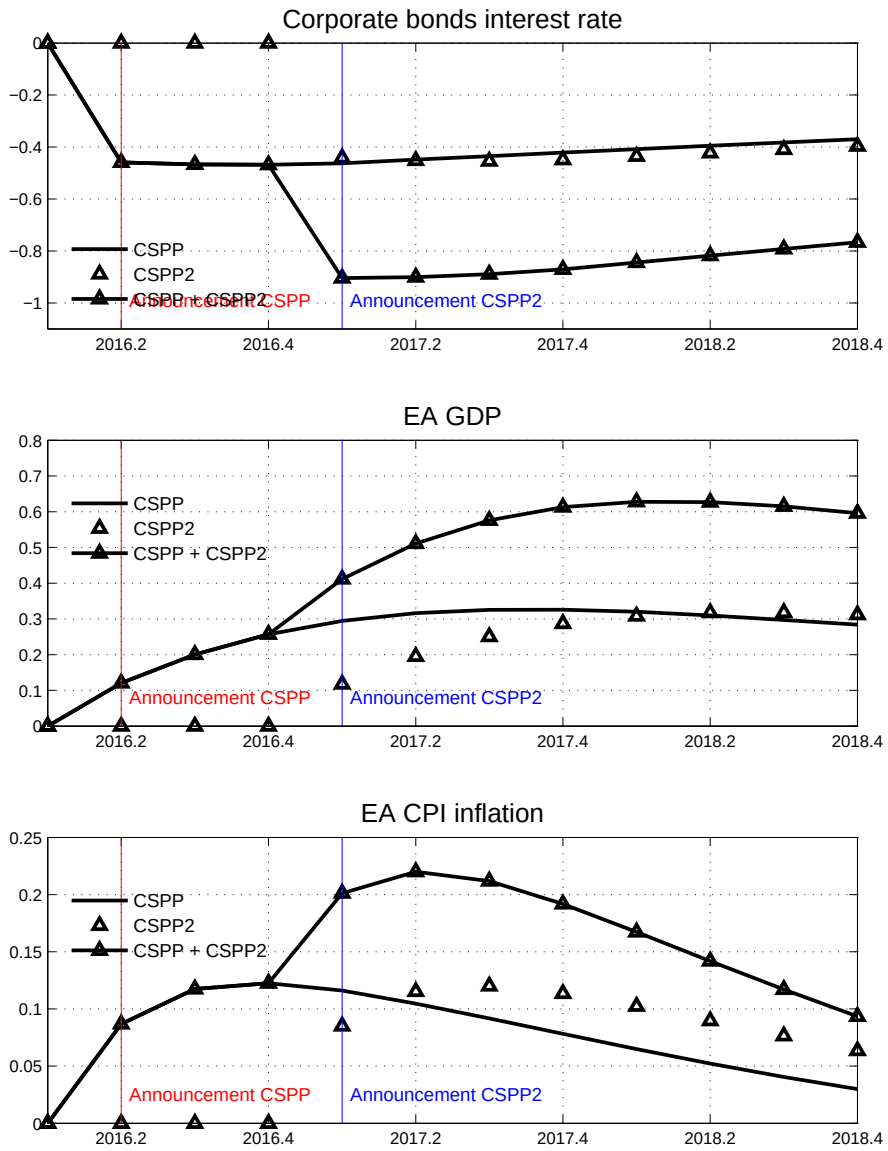
Notes: horizontal axis, quarters; GDP in real terms; vertical axis, % deviations from the steady state; for nominal interest rate and inflation, annualized pp.

Figure 8: Forward guidance



Notes: horizontal axis, quarters; GDP in real terms; vertical axis, % deviations from the steady state; for nominal interest rate and inflation, annualized pp.

Figure 9: Combined impact of CSPP and CSPP2 on EA economy



Notes: horizontal axis, quarters; GDP in real terms; vertical axis, % deviations from the steady state; for nominal interest rate and inflation, annualized pp.

RECENTLY PUBLISHED "TEMI" (*)

N. 1110 – *Services trade and credit frictions: evidence from matched bank-firm data*, by Francesco Bripi, David Loschiavo and Davide Revelli (April 2017).

N. 1111 – *Public guarantees on loans to SMEs: an RDD evaluation*, by Guido de Blasio, Stefania De Mitri, Alessio D'Ignazio, Paolo Finaldi Russo and Lavina Stoppani (April 2017).

N. 1112 – *Local labour market heterogeneity in Italy: estimates and simulations using responses to labour demand shocks*, by Emanuele Ciani, Francesco David and Guido de Blasio (April 2017).

N. 1113 – *Liquidity transformation and financial stability: evidence from the cash management of open-end Italian mutual funds*, by Nicola Branzoli and Giovanni Guazzarotti (April 2017).

N. 1114 – *Assessing the risks of asset overvaluation: models and challenges*, by Sara Cecchetti and Marco Taboga (April 2017).

N. 1115 – *Social ties and the demand for financial services*, by Eleonora Patacchini and Edoardo Rainone (June 2017).

N. 1116 – *Measurement errors in consumption surveys and the estimation of poverty and inequality indices*, by Giovanni D'Alessio (June 2017).

N. 1117 – *No free lunch, Buddy: past housing transfers and informal care later in life*, by Emanuele Ciani and Claudio Deiana (June 2017).

N. 1118 – *The interbank network across the global financial crisis: evidence from Italy*, by Massimiliano Affinito and Alberto Franco Pozzolo (June 2017).

N. 1119 – *The collateral channel of unconventional monetary policy*, by Giuseppe Ferrero, Michele Loberto and Marcello Miccoli (June 2017).

N. 1120 – *Medium and long term implications of financial integration without financial development*, by Flavia Corneli (June 2017).

N. 1121 – *The financial stability dark side of monetary policy*, by Piergiorgio Alessandri, Antonio Maria Conti and Fabrizio Venditti (June 2017).

N. 1122 – *Large time-varying parameter VARs: a non-parametric approach*, by George Kapetanios, Massimiliano Marcellino and Fabrizio Venditti (June 2017).

N. 1123 – *Multiple lending, credit lines, and financial contagion*, by Giuseppe Cappelletti and Paolo Emilio Mistrulli (June 2017).

N. 1124 – *Law enforcement and political participation: Italy, 1861-65*, by Antonio Accetturo, Matteo Bugamelli and Andrea Lamorgese (July 2017).

N. 1125 – *The consequences of public employment: evidence from Italian municipalities*, by Marta Auricchio, Emanuele Ciani, Alberto Dalmazzo and Guido de Blasio (July 2017).

N. 1126 – *The cyclicality of the income elasticity of trade*, by Alessandro Borin, Virginia Di Nino, Michele Mancini and Massimo Sbracia (July 2017).

N. 1127 – *Human capital and urban growth in Italy, 1981-2001*, by Francesco Giffoni, Matteo Gomellini and Dario Pellegrino (July 2017).

N. 1128 – *The double bind of asymmetric information in over-the-counter markets*, by Taneli Mäkinen and Francesco Palazzo (July 2017).

N. 1129 – *The effects of central bank's verbal guidance: evidence from the ECB*, by Maddalena Galardo and Cinzia Guerrieri (July 2017).

N. 1130 – *The Bank of Italy econometric model: an update of the main equations and model elasticities*, by Guido Bulligan, Fabio Busetti, Michele Caivano, Pietro Cova, Davide Fantino, Alberto Locarno, Lisa Rodano (July 2017).

(*) Requests for copies should be sent to:
Banca d'Italia – Servizio Studi di struttura economica e finanziaria – Divisione Biblioteca e Archivio storico – Via Nazionale, 91 – 00184 Rome – (fax 0039 06 47922059). They are available on the Internet www.bancaditalia.it.

2015

AABERGE R. and A. BRANDOLINI, *Multidimensional poverty and inequality*, in A. B. Atkinson and F. Bourguignon (eds.), Handbook of Income Distribution, Volume 2A, Amsterdam, Elsevier, **TD No. 976 (October 2014).**

ALBERTAZZI U., G. ERAMO, L. GAMBACORTA and C. SALLEO, *Asymmetric information in securitization: an empirical assessment*, Journal of Monetary Economics, v. 71, pp. 33-49, **TD No. 796 (February 2011).**

ALESSANDRI P. and B. NELSON, *Simple banking: profitability and the yield curve*, Journal of Money, Credit and Banking, v. 47, 1, pp. 143-175, **TD No. 945 (January 2014).**

ANTONIETTI R., R. BRONZINI and G. CAINELLI, *Inward greenfield FDI and innovation,* Economia e Politica Industriale, v. 42, 1, pp. 93-116, **TD No. 1006 (March 2015).**

BARONE G. and G. NARCISO, *Organized crime and business subsidies: Where does the money go?*, Journal of Urban Economics, v. 86, pp. 98-110, **TD No. 916 (June 2013).**

BRONZINI R., *The effects of extensive and intensive margins of FDI on domestic employment: microeconomic evidence from Italy*, B.E. Journal of Economic Analysis & Policy, v. 15, 4, pp. 2079-2109, **TD No. 769 (July 2010).**

BUGAMELLI M., S. FABIANI and E. SETTE, *The age of the dragon: the effect of imports from China on firm-level prices*, Journal of Money, Credit and Banking, v. 47, 6, pp. 1091-1118, **TD No. 737 (January 2010).**

BULLIGAN G., M. MARCELLINO and F. VENDITTI, *Forecasting economic activity with targeted predictors,* International Journal of Forecasting, v. 31, 1, pp. 188-206, **TD No. 847 (February 2012).**

BUSETTI F., *On detecting end-of-sample instabilities*, in S.J. Koopman, N. Shepard (eds.), Unobserved Components and Time Series Econometrics, Oxford, Oxford University Press, **TD No. 881 (September 2012).**

CESARONI T., *Procyclicality of credit rating systems: how to manage it*, Journal of Economics and Business, v. 82. pp. 62-83, **TD No. 1034 (October 2015).**

CIARLONE A., *House price cycles in emerging economies,* Studies in Economics and Finance, v. 32, 1, **TD No. 863 (May 2012).**

CUCINIELLO V. and F. M. SIGNORETTI, *Large banks,loan rate markup and monetary policy*, International Journal of Central Banking, v. 11, 3, pp. 141-177, **TD No. 987 (November 2014).**

DE BLASIO G., D. FANTINO and G. PELLEGRINI, *Evaluating the impact of innovation incentives: evidence from an unexpected shortage of funds,* Industrial and Corporate Change, v. 24, 6, pp. 1285-1314, **TD No. 792 (February 2011).**

DEPALO D., R. GIORDANO and E. PAPAPETROU, *Public-private wage differentials in euro area countries: evidence from quantile decomposition analysis,* Empirical Economics, v. 49, 3, pp. 985-1115, **TD No. 907 (April 2013).**

DI CESARE A., A. P. STORK and C. DE VRIES, *Risk measures for autocorrelated hedge fund returns*, Journal of Financial Econometrics, v. 13, 4, pp. 868-895, **TD No. 831 (October 2011).**

FANTINO D., A. MORI and D. SCALISE, *Collaboration between firms and universities in Italy: the role of a firm's proximity to top-rated departments,* Rivista Italiana degli economisti, v. 1, 2, pp. 219-251, **TD No. 884 (October 2012).**

FRATZSCHER M., D. RIMEC, L. SARNOB and G. ZINNA, *The scapegoat theory of exchange rates: the first tests*, Journal of Monetary Economics, v. 70, 1, pp. 1-21, **TD No. 991 (November 2014).**

NOTARPIETRO A. and S. SIVIERO, *Optimal monetary policy rules and house prices: the role of financial frictions,* Journal of Money, Credit and Banking, v. 47, S1, pp. 383-410, **TD No. 993 (November 2014).**

RIGGI M. and F. VENDITTI, *The time varying effect of oil price shocks on euro-area exports,* Journal of Economic Dynamics and Control, v. 59, pp. 75-94, **TD No. 1035 (October 2015).**

TANELI M. and B. OHL, *Information acquisition and learning from prices over the business cycle*, Journal of Economic Theory, 158 B, pp. 585–633, **TD No. 946 (January 2014).**

ALBANESE G., G. DE BLASIO and P. SESTITO, *My parents taught me. evidence on the family transmission of values*, Journal of Population Economics, v. 29, 2, pp. 571-592, **TD No. 955 (March 2014).**

ANDINI M. and G. DE BLASIO, *Local development that money cannot buy: Italy's Contratti di Programma*, Journal of Economic Geography, v. 16, 2, pp. 365-393, **TD No. 915 (June 2013).**

BARONE G. and S. MOCETTI, *Inequality and trust: new evidence from panel data*, Economic Inquiry, v. 54, pp. 794-809, **TD No. 973 (October 2014).**

BELTRATTI A., B. BORTOLOTTI and M. CACCAVAIO, *Stock market efficiency in China: evidence from the split-share reform*, Quarterly Review of Economics and Finance, v. 60, pp. 125-137, **TD No. 969 (October 2014).**

BOLATTO S. and M. SBRACIA, *Deconstructing the gains from trade: selection of industries vs reallocation of workers*, Review of International Economics, v. 24, 2, pp. 344-363, **TD No. 1037 (November 2015).**

BOLTON P., X. FREIXAS, L. GAMBACORTA and P. E. MISTRULLI, *Relationship and transaction lending in a crisis*, Review of Financial Studies, v. 29, 10, pp. 2643-2676, **TD No. 917 (July 2013).**

BONACCORSI DI PATTI E. and E. SETTE, *Did the securitization market freeze affect bank lending during the financial crisis? Evidence from a credit register*, Journal of Financial Intermediation , v. 25, 1, pp. 54-76, **TD No. 848 (February 2012).**

BORIN A. and M. MANCINI, *Foreign direct investment and firm performance: an empirical analysis of Italian firms*, Review of World Economics, v. 152, 4, pp. 705-732, **TD No. 1011 (June 2015).**

BRAGOLI D., M. RIGON and F. ZANETTI, *Optimal inflation weights in the euro area*, International Journal of Central Banking, v. 12, 2, pp. 357-383, **TD No. 1045 (January 2016).**

BRANDOLINI A. and E. VIVIANO, *Behind and beyond the (headcount) employment rate*, Journal of the Royal Statistical Society: Series A, v. 179, 3, pp. 657-681, **TD No. 965 (July 2015).**

BRIPI F., *The role of regulation on entry: evidence from the Italian provinces*, World Bank Economic Review, v. 30, 2, pp. 383-411, **TD No. 932 (September 2013).**

BRONZINI R. and P. PISELLI, *The impact of R&D subsidies on firm innovation*, Research Policy, v. 45, 2, pp. 442-457, **TD No. 960 (April 2014).**

BURLON L. and M. VILALTA-BUFI, *A new look at technical progress and early retirement*, IZA Journal of Labor Policy, v. 5, **TD No. 963 (June 2014).**

BUSETTI F. and M. CAIVANO, *The trend–cycle decomposition of output and the Phillips Curve: bayesian estimates for Italy and the Euro Area*, Empirical Economics, V. 50, 4, pp. 1565-1587, **TD No. 941 (November 2013).**

CAIVANO M. and A. HARVEY, *Time-series models with an EGB2 conditional distribution*, Journal of Time Series Analysis, v. 35, 6, pp. 558-571, **TD No. 947 (January 2014).**

CALZA A. and A. ZAGHINI, *Shoe-leather costs in the euro area and the foreign demand for euro banknotes*, International Journal of Central Banking, v. 12, 1, pp. 231-246, **TD No. 1039 (December 2015).**

CIANI E., *Retirement, Pension eligibility and home production*, Labour Economics, v. 38, pp. 106-120, **TD No. 1056 (March 2016).**

CIARLONE A. and V. MICELI, *Escaping financial crises? Macro evidence from sovereign wealth funds' investment behaviour*, Emerging Markets Review, v. 27, 2, pp. 169-196, **TD No. 972 (October 2014).**

CORNELI F. and E. TARANTINO, *Sovereign debt and reserves with liquidity and productivity crises*, Journal of International Money and Finance, v. 65, pp. 166-194, **TD No. 1012 (June 2015).**

D'AURIZIO L. and D. DEPALO, *An evaluation of the policies on repayment of government's trade debt in Italy*, Italian Economic Journal, v. 2, 2, pp. 167-196, **TD No. 1061 (April 2016).**

DE BLASIO G., G. MAGIO and C. MENON, *Down and out in Italian towns: measuring the impact of economic downturns on crime*, Economics Letters, 146, pp. 99-102, **TD No. 925 (July 2013).**

DOTTORI D. and M. MANNA, *Strategy and tactics in public debt management*, Journal of Policy Modeling, v. 38, 1, pp. 1-25, **TD No. 1005 (March 2015).**

ESPOSITO L., A. NOBILI and T. ROPELE, *The management of interest rate risk during the crisis: evidence from Italian banks*, Journal of Banking & Finance, v. 59, pp. 486-504, **TD No. 933 (September 2013).**

MARCELLINO M., M. PORQUEDDU and F. VENDITTI, *Short-Term GDP forecasting with a mixed frequency dynamic factor model with stochastic volatility*, Journal of Business & Economic Statistics , v. 34, 1, pp. 118-127, **TD No. 896 (January 2013).**

RODANO G., N. SERRANO-VELARDE and E. TARANTINO, *Bankruptcy law and bank financing*, Journal of Financial Economics, v. 120, 2, pp. 363-382, **TD No. 1013 (June 2015).**

ZINNA G., *Price pressures on UK real rates: an empirical investigation*, Review of Finance,v. 20, 4, pp. 1587-1630, **TD No. 968 (July 2014).**

2017

ADAMOPOULOU A. and G.M. TANZI, *Academic dropout and the great recession*, Journal of Human Capital, V. 11, 1, pp. 35–71, **TD No. 970 (October 2014).**

ALBERTAZZI U., M. BOTTERO and G. SENE, *Information externalities in the credit market and the spell of credit rationing*, Journal of Financial Intermediation, v. 30, pp. 61–70, **TD No. 980 (November 2014).**

ALESSANDRI P. and H. MUMTAZ, *Financial indicators and density forecasts for US output and inflation*, Review of Economic Dynamics, v. 24, pp. 66-78, **TD No. 977 (November 2014).**

BRUCHE M. and A. SEGURA, *Debt maturity and the liquidity of secondary debt markets*, Journal of Financial Economics, v. 124, 3, pp. 599-613, **TD No. 1049 (January 2016).**

DE BLASIO G. and S. POY, *The impact of local minimum wages on employment: evidence from Italy in the 1950s*, Journal of Regional Science, v. 57, 1, pp. 48-74, **TD No. 953 (March 2014).**

LOBERTO M. and C. PERRICONE, *Does trend inflation make a difference?*, Economic Modelling, v. 61, pp. 351–375, **TD No. 1033 (October 2015).**

MOCETTI S., M. PAGNINI and E. SETTE, *Information technology and banking organization*, Journal of Journal of Financial Services Research, v. 51, pp. 313-338, **TD No. 752 (March 2010).**

MOCETTI S. and E. VIVIANO, *Looking behind mortgage delinquencies*, Journal of Banking & Finance, v. 75, pp. 53-63, **TD No. 999 (January 2015).**

PALAZZO F., *Search costs and the severity of adverse selection*, Research in Economics, v. 71, 1, pp. 171-197, **TD No. 1073 (July 2016).**

PATACCHINI E., E. RAINONE and Y. ZENOU, *Heterogeneous peer effects in education*, Journal of Economic Behavior & Organization, v. 134, pp. 190–227, **TD No. 1048 (January 2016).**

FORTHCOMING

ADAMOPOULOU A. and E. KAYA, *Young Adults living with their parents and the influence of peers*, Oxford Bulletin of Economics and Statistics, **TD No. 1038 (November 2015).**

BOFONDI M., L. CARPINELLI and E. SETTE, *Credit supply during a sovereign debt crisis*, Journal of the European Economic Association, **TD No. 909 (April 2013).**

BRONZINI R. and A. D'IGNAZIO, *Bank internationalisation and firm exports: evidence from matched firm-bank data*, Review of International Economics, **TD No. 1055 (March 2016).**

BURLON L., *Public expenditure distribution, voting, and growth*, Journal of Public Economic Theory, **TD No. 961 (April 2014).**

BUSETTI F., *Quantile aggregation of density forecasts*, Oxford Bulletin of Economics and Statistics, **TD No. 979 (November 2014).**

CESARONI T. and R. DE SANTIS, *Current account "core-periphery dualism" in the EMU*, World Economy, **TD No. 996 (December 2014).**

CESARONI T. and S. IEZZI, *The predictive content of business survey indicators: evidence from SIGE*, Journal of Business Cycle Research, **TD No. 1031 (October 2015).**

CONTI P., D. MARELLA and A. NERI, *Statistical matching and uncertainty analysis in combining household income and expenditure data*, Statistical Methods & Applications, **TD No. 1018 (July 2015).**

D'AMURI F., *Monitoring and disincentives in containing paid sick leave*, Labour Economics, **TD No. 787 (January 2011).**

D'AMURI F. and J. MARCUCCI, *The predictive power of google searches in forecasting unemployment*, International Journal of Forecasting, **TD No. 891 (November 2012).**

FEDERICO S. and E. TOSTI, *Exporters and importers of services: firm-level evidence on Italy*, The World Economy, **TD No. 877 (September 2012).**

GIACOMELLI S. and C. MENON, *Does weak contract enforcement affect firm size? Evidence from the neighbour's court,* Journal of Economic Geography, **TD No. 898 (January 2013).**

MANCINI A.L., C. MONFARDINI and S. PASQUA, *Is a good example the best sermon? Children's imitation of parental reading,* Review of Economics of the Household, **D No. 958 (April 2014).**

MEEKS R., B. NELSON and P. ALESSANDRI, *Shadow banks and macroeconomic instability,* Journal of Money, Credit and Banking, **TD No. 939 (November 2013).**

MICUCCI G. and P. ROSSI, *Debt restructuring and the role of banks' organizational structure and lending technologies,* Journal of Financial Services Research, **TD No. 763 (June 2010).**

NATOLI F. and L. SIGALOTTI, *Tail co-movement in inflation expectations as an indicator of anchoring,* International Journal of Central Banking, **TD No. 1025 (July 2015).**

RIGGI M., *Capital destruction, jobless recoveries, and the discipline device role of unemployment,* Macroeconomic Dynamics, **TD No. 871 July 2012).**

SEGURA A., *Why did sponsor banks rescue their SIVs?,* Review of Finance, **TD No. 1100 (February 2017).**

SEGURA A. and J. SUAREZ, *How excessive is banks' maturity transformation?,* Review of Financial Studies, **TD No. 1065 (April 2016).**