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A STRUCTURAL MODEL FOR THE HOUSING AND CREDIT MARKETS IN ITALY

by Andrea Nobili* and Francesco Zollino*

Abstract

We estimate a fully-fledged structural system for the housing market in Italy, taking into account the multi-fold link with bank lending to both households and construction firms. The model allows the house supply to vary in the short run and the banking sector to affect the equilibrium in the housing market, through its effect on housing supply and demand. We show that house prices react mostly to standard drivers such as disposable income, expected inflation and demographic pressures. Lending conditions also have a significant impact, especially through their effects on mortgage loans, and consequently on housing demand. Allowing short-run adjustment in house supply implies a weaker response of house prices to a change in the monetary stance or in banks' deleveraging process. Finally, we find that since the mid-eighties house price developments in Italy have been broadly in line with the fundamentals; during the recent financial crisis, the worsening in credit supply conditions dampened house price dynamics, partly offsetting the positive stimulus provided by the easing of the monetary policy stance.

JEL Classification: E51, E52, G21.
Keywords: house prices, credit, system of simultaneous equations.

Contents

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1. Introduction

Since the late nineties several theories suggested a significant interaction between asset prices and credit developments in an economy characterized by information frictions, especially because of their effects on the business cycle (Bernake and Gertler, 1995; Kiyotaki and Moore, 1997). In the same vein, several contributions pointed out that credit imbalances and asset price misalignments represent an important challenge for the conduct of monetary policy, especially in the light of their implications for financial stability (Borio and Lowe, 2004; Detken and Smets, 2004).

As for the housing sector, the global financial crisis led to a growing emphasis on the links between the cycles in the property market and those in the credit sector. In particular, there is a large amount of evidence about the key role of the transmission of "boom-bust" cycles from the property markets to the credit sector in determining financial crises (Collyns and Senhadji, 2002; Caprio and Klingebiel, 2003; Hofmann, 2004) and in affecting the real economy, with particular references to the major recessions in the US (Leamer, 2007). From a policy perspective, an in-depth assessment of the links between housing and credit markets is also necessary to understand the transmission mechanism of monetary impulses and the implications for financial stability (Mishkin, 2007; Iacoviello, 2010; Hofmann and Goodhart, 2008). Finally, especially in the design of banks' stress tests, extreme changes in property prices are a significant ingredient of the macroeconomic scenario envisaged to check the banks' resilience. Typically the modelling of credit demand and supply is very accurate, but the feedback from the banking sector to the housing and the other economic sectors is either absent or imposed ad hoc (for a review, see Foglia, 2009).

The lack of a unified framework to study the multi-fold interactions between house market developments and credit and monetary conditions reflects data constraints, especially for European countries, and the methodological challenges that need to be faced to construct a fully-fledged structural model. The interaction between housing and credit has been addressed in recent theoretical contributions within the traditional framework of the financial accelerator, with property prices affecting the borrowing capacity of households and firms due to changes in the value of collateral under financial frictions (Aoki, Proudman and Vlieghe 2004; Iacoviello, 2005; Arcè and Lopez-Salido, 2006; Iacoviello and Neri, 2010). In these papers, however, there is no explicit modelling of equilibrium in the banking sector, with the credit relationships typically occurring between households, acting as borrowers on one side and lenders on the other.

In most of the existing empirical literature, developments in house prices have been studied in isolation from the credit market (see OECD, 2010, for a survey). Some papers estimated a one-way relationship, finding either that property prices significantly affect credit growth (Goodhart, 1995; Hofmann, 2004) or that mortgage loans are an important driver of house prices (Tsatsaronis and Zhu, 2004; Fitzpatrick and McQuinn 2004). Other contributions explored a two-way link between house prices and either total lending (Gerlach and Peng, 2005; Goodhart and Hofmann, 2010) or mortgages (Gimeno and Martínez-Carrascal, 2006; Casolaro and Gambacorta, 2005) using reduced form models of the economy. A common limitation of this approach is that the structural interpretation of the estimated coefficients is hindered by the lack of identifying restrictions of supply and demand factors in both property and credit markets.

In this paper we first assess the multiple interactions between housing and banking in Italy using a system of simultaneous equations, where the impulses from a set of exogenous drivers can be transmitted to house prices and loans to firms and households through several channels. In this regard, the statistical model allows us to improve upon the existing empirical literature along several dimensions. First, the housing market is modelled with a fully-fledged structural system, thus implying that shocks in the economy can significantly affect the equilibrium in the housing sector through their effects on housing demand, as captured by house prices, as well as on housing supply, as captured by changes in residential investments. Explicitly modelling changes in housing supply is not usual in the empirical literature, due to either the limited availability of data or to the usual assumption that land scarcity and regulation make the construction sector rigid in the short run (Malpezzi and Maclennan, 2001; Panfili and Lecat, 2010). To the best of our knowledge, only Iacoviello and Neri (2010) have recently developed a general model for the United States, in which the responsiveness of the house supply is crucial for the functioning of the housing markets.[1]

Second, as far as the banking sector is concerned, we model in the estimated system two credit segments that might potentially affect the house market equilibrium, namely mortgage loans to households and loans to construction firms. Mortgage loans are usually considered because of their interaction with housing demand, while loans to firms represent a crucial ingredient of housing supply, to the extent that investment plans are heavily dependent on bank credit. In the case of Italy, the leverage ratio for firms in the construction sector is much higher that that observed for households. To the best of our knowledge, this is a novelty in the literature, since a specific link between house prices and loans to construction firms is largely neglected, either due to the assumption of a rigid house supply schedule in the short run (for a survey, see Andrews, Caldera Sánchez and Johansson, 2011) or because construction activity is assumed to be directly performed by banks (Scoccianti, 2010). These assumptions also represent a solution to the problem of the lack of long time series for this credit segment. In this regard, for the purpose of our analysis, we have made an effort to fill the statistical gap still surrounding the different features of the housing market in Italy, ending with a quarterly dataset that covers almost all the candidate drivers of house prices.

Based on the estimated system, we perform some simulation exercises that shed light on the transmission channels through which the impulses coming from variables such as monetary policy, disposable income, demographic pressures and “pure-supply” factors in the banking system affect house prices in Italy. We also evaluate the relative contribution of each driver to house price booms in the past, with a special focus on the developments observed during the financial crisis. We also assess possible misalignments of actual house prices with respect to the fundamentals.

Our empirical analysis shows that in Italy, the changes in house prices largely reflected the dynamics of the demand factors, such as households’ disposable income and demographic pressures. Bank lending also played a crucial role for two main reasons. First, a banks’ deleveraging process, as captured by an increase in the capital-to-asset ratio, leads to a significant increase in the cost of credit for both mortgage loans to households and loans to construction firms. Second, as far as the credit channel of monetary policy transmission is concerned, the short-run responsiveness in the housing supply implies a mitigation of the effects of a change in the money market rates on house prices and a faster adjustment of the construction activity compared with the case of a rigid housing supply curve. Finally, in the most acute phase of the global financial crisis, the banks’ deleveraging process dampened house price dynamics mostly through its effects on the market for mortgage loans, partly offsetting the positive contribution stemming from the monetary easing. All in all, house price developments have been broadly in line with the fundamentals since the mid-eighties, with no clear sign of imbalances over the recent financial crisis, too.

Our results are subject to the caveat that some transmission mechanisms of impulses coming from key macroeconomic factors are not fully modelled in the statistical system. First, we do not consider the potential link between property prices and credit stemming from wealth effects on households’ consumption. According to life-cycle models, households may react to a rise in house prices by increasing their spending and then their borrowing in order to smooth consumption over time. Evidence for the case of Italy is provided by Guiso, Paiella and Visco (2005) and Bassanetti

[1] Iacoviello and Neri (2010) proposed a two-sector model in which firms produce new homes using capital, labour, and land under a given technology. The model generates endogenous dynamics among the housing and non housing investment, house prices and consumption expenditure. A key result is that a slow technological progress in the housing sector explains a large part of the upward trend in real housing prices observed in the US over the last 40 years.

and Zollino (2010). Second, since all the main drivers are assumed to be exogenous in our model, we may rule out additional feedback effects in the transmission mechanism of monetary policy. Interest rate changes can affect house prices and credit also through changes in households' disposable income and in the banks' capital position. Providing similar extensions to the model is at the top of our agenda for future research.

A final remark regards the remaining data constraints, with particular reference to policy-related factors potentially affecting the housing market such as taxation, social housing and land restrictions. In this regard, the available data for Italy are very fragmented and we found it a prohibitive task to estimate a time series covering the full sample used in this study.

The rest of the paper is organized as follows. Section 2 sketches the main facts regarding the Italian housing and credit markets since the eighties. Section 3 briefly discusses the main blocks of the system of equations, with reference to the underlying economic theory, the adopted data set and the estimation strategy. In Section 4 we report the estimated coefficients of the model, while in Section 5 we assess the response of house prices to changes in the main exogenous drivers, with a special focus on the effects of monetary policy. In Section 6 we analyse the contribution of each driver to both house prices and credit developments occurring in the past, followed by an investigation of possible house price misalignments in Section 7. The final section summarizes the main findings and items on the agenda for future research.

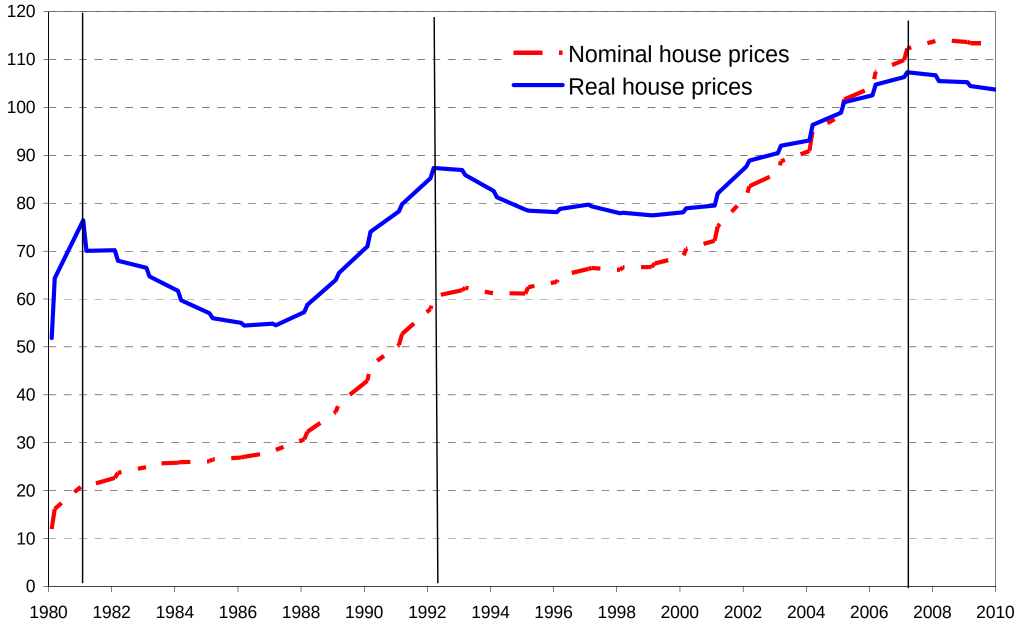
2. The housing and credit markets in Italy: the main stylized facts

Since the early eighties house prices in Italy showed a pronounced cyclical pattern around a positive trend. Figure 1 compares the developments of the house price indicator put forward by Muzzicato, Sabbatini and Zollino (2008) and its version expressed in real terms (e.g. deflated by the Harmonized Index of Consumer Prices, HICP).

Figure 1

HOUSE PRICE DEVELOPMENTS

(quarterly data; index 2005=100)



Sources: Based on data from Bank of Italy, *Il Consulente Immobiliare*, Istat and *Agenzia del Territorio*.

Following the progressive reduction between early 1981 and late 1986, real house prices briskly increased until 1992, up by 17% compared with the previous peak. A new declining phase in real house prices followed the economic and currency crisis of the early nineties, lasting for almost seven years and causing an average reduction of around 2% per year. Since the beginning of Stage III of the European and Monetary Union, in an environment characterized by increasing economic integration, financial innovation and historically low interest rate levels, house prices resumed a rapid increase. After returning in just two years to the previous peak, they kept increasing at a more moderate pace until the eve of the recent global crisis. Overall, between the summer of 1999 and the winter of 2007 real house prices in Italy grew at an average annualized rate of about 4%. As the financial crisis deepened and the economy experienced the worst recession since WWII, real house prices started a gradual decline, cumulating an overall fall of 4% in the three years to the end of 2010.

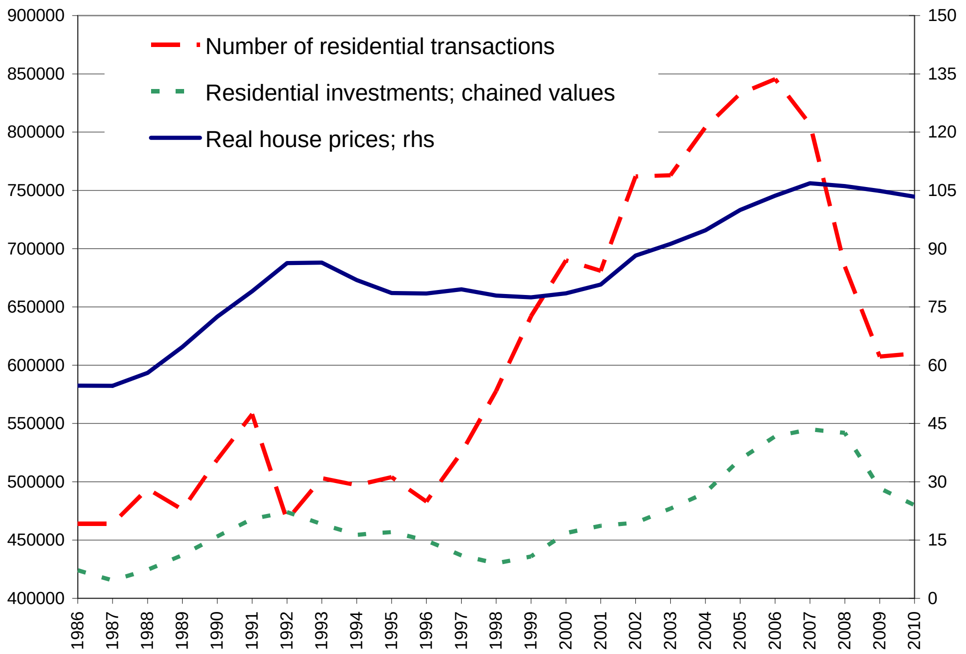
In line with the international evidence (IMF, 2008), the cyclical fluctuations of the housing market have been more timely and pronounced for house volume indicators, such as residential investments and transactions, while affecting price changes with some delay. In more recent years, the number of house transactions, after increasing for ten years, began to decline sharply after late 2006, with a partial recovery in the last part of the decade (see Figure 2). The dynamics of residential investments have been broadly similar, apart from a later and shorter downturn over the second half of the decade. This difference may reflect a higher sensitivity of the construction sector due to different coverage (transactions include both existing and new dwellings while residential investments only refer to new dwellings).

In this respect, in Italy the number of available dwellings per household started declining in the mid-nineties, which signalled an increased potential demand for housing; followed by a virtual stabilization in more recent years (Figure 3). In per capita terms, however, the number of dwellings, after temporarily stalling in the early 2000s, resumed a positive trend thereafter, remaining unchanged in 2010 at a significantly higher level than in the mid-nineties. This makes it more interesting to investigate further the role played by different demographic variables in affecting the housing market.

Figure 2

HOUSE PRICES, TRANSACTIONS AND RESIDENTIAL INVESTMENTS

(thousands of units for transactions, millions of euros for residential investments, index 2005=100 for real house prices)

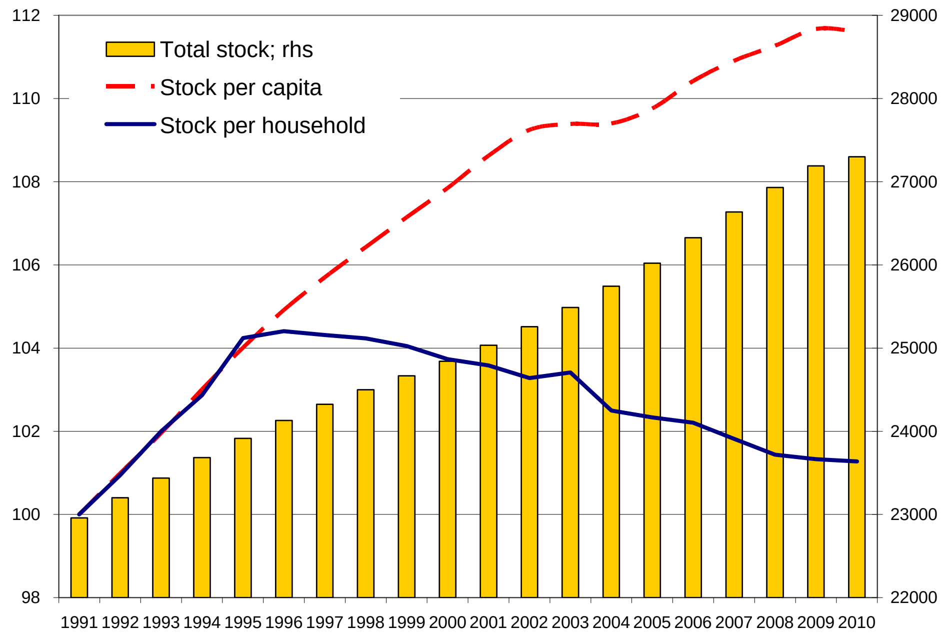


Sources: Based on data from Bank of Italy *Il Consulente Immobiliare*, Istat and *Agenzia del Territorio*.

Figure 3

DWELLING STOCK AND DEMOGRAPHY

(annual data; index 1991=100; total stock is expressed in thousands of units)



Sources: Based on data from Bank of Italy, Istat and *Agenzia del Territorio*.

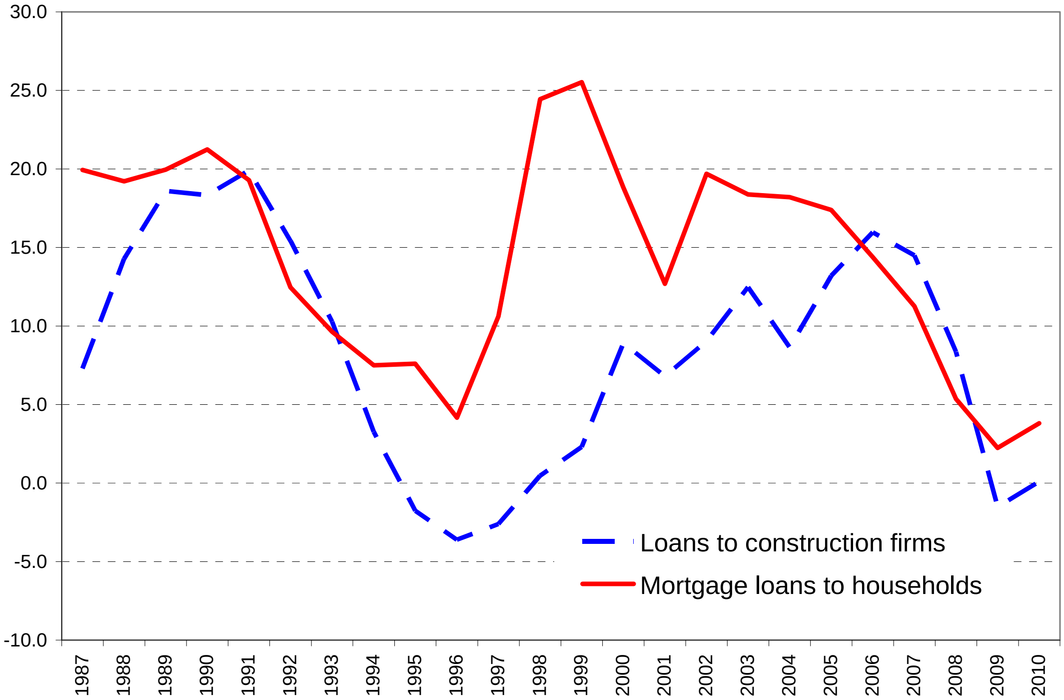
In Italy credit related to the housing market also showed large cyclical fluctuations in timing and phase similar to those observed for house prices. Figure 4 shows the dynamics of mortgage loans to households and loans to construction firms over time. The annual growth rate of mortgages, after stabilizing between 1987 and 1991 at around 20%, declined rapidly until 1996. Following the gradual acceleration between late 1997 and 2006, mortgages registered a marked slowdown with the eruption of the financial crisis. Interestingly, periods of booms and slowdowns in the mortgages sector have been associated with similar developments in the growth rate of loans to construction firms. Apart from the diverging patterns in the late eighties, data suggest that the cycles in the two credit markets are correlated.[2]

The cost of credit in Italy, broadly stable between the late eighties and the start of the nineties, showed a marked increase during the financial crisis of 1992, followed by a sharp decline in the wake of Italy's joining the Economic and Monetary Union (Figure 5). In particular, the average interest rate charged on mortgage loans to households diminished to about 5% in 1999 from 12.5% in 1995; for construction firms, the average loan rate declined from 18% to 8%. With the establishment of the euro area, bank rates closely followed the pattern of money market rates and the effects of monetary policy decisions. A further explanatory factor behind the decline in the cost of credit in recent years stems from the common international trend of financial liberalization and product de-specialization shared by the Italian banking system, as well as from the rapid increase in the number of intermediaries, both domestic and foreign, especially in the mortgage loan market.

[2] The sustained credit expansion in Italy was also associated to the steady increase in the propensity of households to indebtedness since the late nineties, plausibly reflecting also fiscal incentive to house purchase due to the introduction of the tax deductibility of interests paid on mortgages and the expenditures for house restructuring. The positive trend in leverage proves by large more moderate for the construction firms.

Figure 4

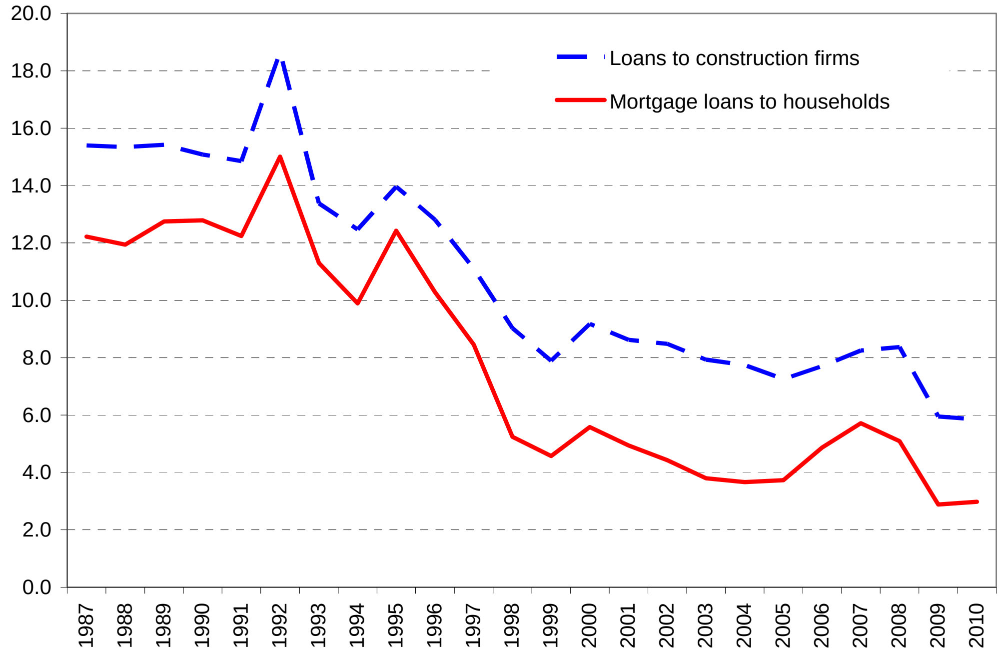
CREDIT DEVELOPMENTS
(annual data; percentage changes)



Source: Bank of Italy.

Figure 5

BANK INTEREST RATES
(annual data; percentage points)



Source: Bank of Italy.

3 A benchmark model for housing and credit

We investigate the multiple linkages between the housing market and credit developments by estimating a structural system comprising three blocks of equations: i) the demand and supply schedules for housing; ii) the demand and supply schedules for mortgage loans to households; iii) the demand and supply schedules for loans to construction firms. The specification of each block is based on the economic theory, as well as on indications from previous empirical literature. It is summarized by equations where the time dynamics in the relationship between variables is not reported for the sake of simplicity. We mark the endogenous variables of the system in bold in order to highlight the feedback between the different blocks of equations.

3.1 The housing block

The housing block is broadly modelled, drawing on the traditional stock-flow adjustment approach put forward by Di Pasquale and Wheaton (1994) and widely adopted in subsequent empirical studies (McCarthy and Peach, 2004; Topel and Rosen, 1988; Riddel, 2004; Steiner, 2010). The target is to account for the sound evidence that house prices take time to clear the market due to the sluggish adjustment of the existing stock to meet demand and that the housing stock changes slowly over time due to adjustment costs and restrictions on usable land.

$$\begin{pmatrix}\text{Housing}\\ \text{market}\end{pmatrix}: \begin{cases} \text{Demand}: \textbf{House prices} = \text{F (diposable income (+), demographic trends (+), expected inflation (+),} \\ \qquad\qquad \textbf{Mortgage loans} \text{ (+), money market rate (-), } \textbf{Hou sin g stock} \text{ (-))} \\ \text{Supply a)}: \textbf{Investments / Hou sin g stock} = \text{F (building cost (−), } \textbf{House prices} \text{ (+), } \textbf{Loans} \text{ (+))} \\ \text{Supply b)}: \textbf{Hou sin g stock} = \text{F (} \textbf{Investments} \text{ (+), depreciation (-))} \end{cases}$$

According to this framework, in the housing demand schedule, prices are the dependent variable and are mostly driven by standard variables. Among these, the demographic developments shape the needs for housing services and explain the strength of competition for the existing house stock. Moreover, it is expected that people will prefer to buy as their disposable income increases and the user cost declines (Poterba, 1984). As measuring user cost is very difficult due to the many fiscal factors affecting the house sector, a reasonable proxy is the risk-free short-term interest rate. However in the empirical literature this variable typically exerts an impact that is either lower than expected or or with a different sign, probably due to a simultaneity bias between interest rates and house prices (Andrews, Caldera Sánchez and Johansson, 2011; Shiller, 2007).

Housing demand might be also expected to be positively correlated with residential rents, since higher rents lead to owners' preferring to rent rather than occupy their house thus increasing the asset value of the house. Alternatively, current house prices may respond positively to future expected prices, and the relevant empirical issue is to identify the mechanism by which households form their expectations. In this respect, we take an empirical short cut based on the evidence that in Italy house inflation mostly drives the households' expectations as regards increases in consumer prices (Del Giovane, et al., 2008). In the house demand equation we test for the significance of the expected general inflation as measured by qualitative surveys across Italian households. Using expected changes in general consumer price inflation in place of marginal rents avoids the risk of simultaneity bias in the estimated coefficient.[3] Finally, housing demand can also increase following an improvement in households' access to mortgage loans. Credit supply conditions may be defined in terms of either costs or volumes, depending on the structure of the banking sector.

The housing supply is modelled by two equations. According to the first, the flow of new constructions, empirically measured by residential investment, depends positively on house prices

[3] In this regard, Gallin (2004) explored the long-run relationship between house prices and rents in the US and found that house prices do correct back to rents rather than rents correcting to house prices. As for Italy, we perform a formal Granger-causality test, with the result that rents can be considered weakly exogenous to house prices in our dataset.

which are an incentive for firms to build new houses, and, negatively on cost-shifting variables, such as building cost and the opportunity costs for investing. In addition, residential investments can be affected by credit conditions, namely they can benefit from either a lower loan cost or a higher loan cost granted to construction firms. Following McCarthy and Peach (2004) and Di Pasquale and Wheaton (1994), we posit that the candidate regressors drive the residential investment rate so as to progressively realize the planned adjustment in the housing stock. In the second equation, we follow the perpetual inventory approach, where the housing stock equates the flow of new constructions net of the depreciation of the existing ones. However the available data for most countries like Italy refer to residential gross fixed capital formation, as defined in the national accounts, which includes both the progress made in constructing new units and extraordinary maintenance work on the existing ones. Accordingly, residential investments do not exactly match the flow of new units used in the perpetual inventory approach; therefore, we leave the coefficient of residential investment to be freely estimated by the data rather than impose the usual identity restriction.[4]

3.2 The credit block

In the system, we model the two credit segments, namely mortgage loans to households and loans to construction firms, independently from one another. This choice reflects the need to control for possible discrepancies in the magnitude and timing of the transmission of the monetary impulses and banks' balance sheet conditions to the credit conditions charged to households and construction firms. The model specification in the two credit segments are sketched as follows:

$$\begin{pmatrix}\text{Mortgage loans}\\ \text{to households}\end{pmatrix} : \begin{cases} \text{Demand}: \textbf{Mortgage loans} = \text{F}(\textbf{House prices}\ (+), \text{diposable income}\ (+/-), \text{financial wealth}\ (+/-), \\ \qquad\qquad\qquad \textbf{Mortgage rate}\ (-)) \\ \text{Supply}: \quad \textbf{Mortgage rate} = \text{F}(\text{money market rate}\ (+), \text{bank capital ratio}\ (+/-), \text{financial wealth}\ (-), \\ \qquad\qquad\qquad \textbf{House prices}\ (-)) \end{cases}$$

$$\begin{pmatrix}\text{Loans to}\\ \text{construction firms}\end{pmatrix} \mathbf{:} \begin{cases} \text{Demand}: \textbf{Loans} = \text{F}(\textbf{Investments}\ (+), \text{building cost}\ (-), \textbf{Loan rate}\ (-), \text{firms' gross value}\ (-)) \\ \text{Supply}: \quad \textbf{Loan rate} = \text{F}(\text{money market rate}\ (+), \text{bank capital ratio}\ (+/-), \text{business cycle}\ (-), \\ \qquad\qquad\qquad \textbf{House prices}\ (-)) \end{cases}$$

In each credit segment, however, we tackle the controversial identification of credit demand and supply schedules in a similar fashion. In particular, we assume that in the economy, the banking sector is characterized by the usual framework of imperfect competition, in which banks set interest rates (Freixas and Rochet, 2008; Degryse, Kim and Ongena, 2009) and fully accommodate credit demand. Accordingly, the loan rate charged by intermediaries is a mark-up on the money market interest rate (as a proxy of the cost of funding), which may fluctuate depending on the borrowers' creditworthiness and banks' balance sheets position. Our identification strategy hinges on the assumption that loan quantities do not enter the credit supply equation and on the fact that the banks' balance-sheet indicators usually shift credit supply but not credit demand.[5]

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[4] As in most countries, in Italy the lack of a long time series prevents us from controlling for the effects of public policies (taxation and subsidies) and usable land restrictions on the housing market. In order to control for land availability, we tried to proxy it, under an inverse metric, by the share of households living on the outskirts of cities based on data from the Bank of Italy Survey on Household Income and Wealth. The estimated coefficient is negative but not significant.

[5] The recent empirical literature was more successful in disentangling credit demand and supply by using survey-data (Lown and Morgan, 2006; Ciccarelli, Maddaloni and Peydró, 2010; Del Giovane, Eramo and Nobili, 2011) rather than indicators based on banks' balance sheet data (Berrospide and Edge, 2010; Gambacorta, 2010; Albertazzi and Marchetti, 2010; Bonaccorsi and Sette, 2011; Gambacorta and Marquez-Ibanez, 2011). The short time coverage prevents the use of surveys in Italy for the purposes of our analysis.

In the paper we use the capital-to-asset ratio as a "sufficient" statistic for the banks' balance sheet conditions. The impact of capital on credit is controversial in the empirical literature. For the US, evidence points to a minor effect of bank capital ratios on credit growth, which mostly reacts to economic activity (Bernanke and Lown, 1991; Berrospide and Edge, 2010). Gambacorta (2010) finds a negative, but rather limited, effect of tighter capital and liquidity requirements on credit dynamics. Recent evidence, based on the impact of the tighter capital requirements envisaged by the Basel III regulation, points to a negative impact on credit supply (Angelini et al., 2010). In particular, for Italian banks the effect of a one per cent increase in the capital requirement on the cost of total credit would range between zero and 32 basis points (Locarno, 2011). Other studies for Italy provide mixed evidence on the role of the capital-to-asset ratio in a supply equation for bank loans (Albertazzi and Marchetti, 2010; Bonaccorsi and Sette, 2012). As discussed in depth in Section 5 this variable enters the credit supply equations significantly in a non-linear form.

The credit supply equations comprise additional shifters. Changes in house prices may affect the loan rates negatively through the potential role of the collateral value in amplifying the transmission of structural shocks to the economy (see Bernanke, Gertler and Gilchrist, 1996; Iacoviello, 2005). At the same time, the higher cost of housing implies a higher borrowing requirement on the part of households, reducing the affordability of a new house and thus raising the banks' risk perception and the mark-up. Finally, as a proxy of borrowers' creditworthiness we include disposable income in the supply equation for loans to households and a business cycle indicator in the construction sector for loans to firms. For both variables the expected sign is negative.

The specification of the credit demand schedules is fairly standard. In particular, the flow of mortgages for house purchases is expected to depend positively on house prices and negatively on the cost of credit. The demand for mortgages could also reflect household characteristics, such as disposable income and financial wealth. However, the expected sign for the former remains uncertain. An increase in disposable income exerts a stimulus to mortgage demand since agents are able to raise more external financing. However, in countries where the loan-to-value ratio is low, the demand for mortgages can be fairly insensitive to income changes (Almeida, Campello and Liu, 2006). Regarding financial wealth, we expect that richer households will need to borrow less to purchase their houses.

In the market segment of loans to construction firms, the credit flows relate positively to investment plans in the construction sector, as they sustain firms' borrowing requirements, and negatively on building cost and the loan rate. As for the latter, we follow most of the existing literature that relies on the seminal paper by Friedman and Knutter (1993), and assume that credit demand is a negative function of the opportunity cost of loan financing, measured by the spread between the bank interest rate and the long-term interest rate. In the case of the Italian non-financial sector as a whole, Casolaro et al. (2006) find that loans to firms are negatively related to the difference between the bank loan rate and the 3-month money market rate. Finally, since credit demand may reflect firms' financing needs not directly related to investment purposes, such as inventories management, working capital and debt restructuring, we also control for gross operative margin in the construction sector. We expect that an increase in firms' profitability should reduce firms' financing needs and their credit demand.

3.3. The dataset

As a preliminary step to the econometric analysis, we managed to fill most of the information gap concerning the housing market in Italy, more so at the quarterly frequency and for a longer time horizon. In some cases, we also estimated some statistics concerning the credit market in a historical perspective since, for the large part of the sample, official data have only been released at a quarterly frequency since 1999. We thus developed a large and balanced dataset on the Italian housing market and related banking sector running from 1986Q1 to 2010Q4.

Among the key variables, the quarterly index of house prices (*hp*) was indirectly estimated starting from the semi-annual indicator put forward by Muzzicato, Sabbatini and Zollino (2008) and updated, for the years after 2008, on the basis of data released by the Agenzia del Territorio.

The index of building cost (*cost*) is regularly released by Istat quarterly. Households' expected inflation (*exp_inflation*) is measured by the balance between consumers' expectations of increasing or decreasing consumer prices over a 12-month horizon, as analysed in Istat surveys.

As a measure of the existing housing stock, we adopt the quarterly dwelling surface (*surf*) estimated in Bassanetti and Zollino (2010). From the same source we borrow the quarterly estimates of households' disposable income (*income*) for years earlier than 2000 when Istat started to release the official statistics.

The source data for most of our estimates come from national accounts, which also provide the time series for residential investments (*invest*) and for gross operative margins in the construction sector The business cycle in the construction sector (*cs_cycle*) is proxied by the discrepancy between the change of value added in the reference quarter and the average change over the previous five years.

The banks' capital ratio (*capital*) is computed as the ratio of capital and reserves over the risk-weighted assets for the entire banking system, consistently with the definition used for supervisory purposes. Data on the loan quantities to construction firms (*loan*) and mortgage loans to households for dwelling purchases (*mortgage*) are from the Bank of Italy. In this regard, the authors' estimates were required to fully cover the time horizon adopted in the econometric analysis. Interest rates charged by banks are, respectively, the average interest rate charged on mortgage loans to households (*r_mortgage*) and the average rate charged on loans to construction firms (*r_loan*). The short-term money market rate *(r_3m)* is the 3-month Euribor since 1999. For the period before 1999 the Italian 3-month interbank rate has been used, which is provided by the Bank of Italy.

3.4. The estimation strategy

Our estimation strategy follows the standard "general-to-specific" approach to macroeconometrics (Hendry, 1993). In particular, we started from the following structural model including a long list of regressors in the quarterly frequency:

$$\mathrm{B}_0 \Delta \log(Y_t) = const + \sum_{k=1,4} \mathrm{B}_k \Delta \log(Y_{t-k}) + \sum_{k=0,4} \Gamma_k \Delta \log(X_{t-k}) + \det + \varepsilon_t$$

where Y stands for the vector of the endogenous variables, namely house prices, residential investment, flows and costs of mortgages to households, and flows and costs of loans to construction firms. *X* is the vector of the exogenous variables. Both endogenous and exogenous variables initially enter the different equations with up to four lags in order to control for dynamic relationships.

Moving from the general to the specific, we progressively deleted variables and lags that were not statistically significant, ending up with a more parsimonious specification. In order to mitigate the risk of misspecification due to sequential testing, which would prove particularly severe under the limited degrees of freedom to estimate the full system in a general form, the selection of the specific model was pursued equation by equation. Moreover, the final outcome has been compared with the specification obtained by progressively adding regressors in an originally simple model (*forward selection*), finding a reassuring convergence between the two approaches.

We estimate the final model for the period 1986Q1-2010Q4 using a three-stage least squared method to rule our simultaneity bias, after performing the usual control for the identification conditions required in a system of structural equations. More generally, the order condition for each structural equation says that there should be at least as many instruments (including the constant) as there are right-hand-side variables in that equation.

All variables are transformed into logs apart from interest rates and the statistics measured by ratios (for example, the capital-to-asset ratio). As for the controversial choice of nominal versus real variables, we prefer data at current prices since we jointly model the housing and the credit markets. Indeed under asymmetric information, lending is affected by changes in nominal house prices, which determine the value of the collateral offered to banks by borrowers. Moreover, a key criterion that banks apply in granting loans concerns the initial ability of borrowers to pay for debt service; accordingly, current income and nominal interest rates may better explain the quantity of debt that households can obtain rather than permanent income and real interest rates (Martínez-Carrascal and del Rio, 2004). Ellis (2005) and Iacoviello (2005) also showed that both nominal interest rates and collateral value are key determinants of mortgage dynamics.[6]

4. The estimated coefficients of the structural model

In this section we offer a discussion of the estimated coefficients of the system in a structural form. In general we find that in each equation the regressors enter with the expected sign; in the case of multiple lags, the sign of the corresponding variable may be assessed by summing all the single coefficients. Diagnostic control is generally satisfactory as well as the goodness of fit for all equations, apart from some loss in the fit of the demand equation for loans to construction firms, plausibly because of the lack of data regarding loan demand for purposes not directly related to production (i.e. mergers and acquisitions, debt restructuring).

As reported in panel A1 of Table 1, we find that a higher growth rate in mortgage loans to households stimulates house demand via the increase in house price inflation. A positive impact, of almost the same magnitude, is also exerted by households' disposable income. The latter, however, exerts a long-lasting effect on house prices, which is four times the estimated coefficient.[7] At the same time, the user cost (e.g. the money market rate) has no significant direct effect on house prices, and has been dropped from the equation.[8] In this respect, we confirm previous evidence pointing to both the pivotal role of income and the controversial role of interest rates in house inflation. We also obtain that sizeable pressures on house prices come from demographic trends, as shown by the negative and significant coefficient for the ratio of available dwelling surface to total population.[9] In line with most of the available literature (IMF, 2008, Leamer, 2007), house prices prove to be fairly persistent as multiple lags resulted to be positive and significant. Moreover, we find evidence that future price expectations add significant support to house inflation, thus

[6] In particular, Ellis (2005) analyses the effects of the income and down-payment constraints on indebtedness; Iacoviello (2005) introduces nominal interest rates in addition to collateral constraints in a business cycle model, based on the widespread observation that in low-inflation countries most debt contracts are set in nominal terms.

[7] Disposable income enters the house demand equation with four lags, all proving highly significant and equal in size. Accordingly, the overall effect is obtained by summing the single coefficients. As a control for households' ability to pay for house purchases and service their mortgages, the unemployment rate, with respect to the total active population or the young people, has also been considered in addition to income and wealth. It was not statistically significant.

[8] In order to control for the opportunity costs of investing in housing, we have also tested for the statistical significance of the long-term interest rate, finding a clear rejection of this hypothesis.

[9] We also test some alternative demographic variables, such as the dependence ratio, the number of households and the share of young people in the total population, which proved not to be statistically significant. For example the effect of demographics in the house demand equation was tested on the basis of several variables such as total population, the dependence ratio, the share of prime-age or retired people in the total population, and the number of households.

confirming that the expectations for future prices are a relevant variable in understanding the dynamics of the housing sector.[10]

Concerning the housing supply (panel A2), in line with the previous evidence, we find that the investment rate, measured by the ratio of residential investments to dwelling surface, reacts positively to a rise in the profitability of construction firms, as captured by the significance of the ratio of house prices to building cost. Bank loans to firms also play a significant role, thus adding a further credit channel through which shocks from the economy can be transmitted to the housing market, in addition to the standard channel of mortgage loans to households. Lagged investments enter significantly and with a negative sign, confirming the sluggish adjustment of the housing stock to demand conditions; however, the abovementioned statistical discrepancy between investment data and the flow of new constructions may also have a role in our estimates.

Looking at the demand schedules on the credit market (Panels B1 and C1 in Table 1), in the mortgages segment we find a negative effect of disposable income, thus confirming that richer households need to borrow less to purchase their houses. In the segment for loans to developers, we find that the demand schedule is positively and significantly related to investment expenditure. The cost of credit plays a negative role in both market segments, which is similar in magnitude; however, demand for loans in the construction sector reacts more rapidly and is significantly related to the interest-rate spread charged by the banks with the long-term interest rate rather than to the lending interest rate itself. A similar result for a credit demand equation is found in Gambacorta (2010) with reference to loans to firms. This outcome may suggest that the opportunity cost of starting to build new houses reduces the propensity of firms to pay for loans, while the same effect does not hold for the purchase of dwelling services by households.

As for the credit supply equations, “pure-supply” factors exert a significant effect in addition to the role played by the money marker rate (see Panels B2 and C2) in a non-linear form. Indeed, we find that only an increase in the capital-to-asset ratio leads to a significant rise in the cost of credit. Following a 1% increase in the capital-to-asset ratio, bank interest rates for households and firms rise by around 30 and 20 basis points, respectively. As a consequence, loan quantities decline after some quarters. A non-linear and negative relationship between the capital-to-asset ratio and loan growth rate may stem from the view that the increase in the capital-to-asset ratio, which in Italy occurred mostly during the financial crises, captures the banks’ deleveraging process in such events. This finding appears to be consistent with evidence found in other recent studies (Locarno, 2011). Interestingly, Del Giovane et al. (2011) showed that the Italian banks participating in the Bank Lending Survey tend to report that only the difficulties in their capital position significantly lead to a tightening in credit standards, while an improvement in their balance sheet indicators does not seem to determine an easing in their credit policies.[11]

[10] In an alternative specification, we find that current rents in new contracts exert a large positive effect on house prices, as found in the literature (McCarthy and Peach, 2002; Di Pasquale and Wheaton, 1994). However, the effects of past rents turn negative or not significant, possibly pointing at a simultaneity bias between house prices and marginal rents. The quarterly index of market rents was obtained using the same method discussed in this section for house prices; this variable focuses on new contracts for non-occupied dwellings, thus showing less sluggish growth than the rent component in the official HICP index.

[11] As additional banks’ balance sheet variables, we also explored the role of the liquidity ratio, measured by cash and securities over total assets, with no statistical significance in the estimated coefficients (both in a linear and non-linear specification). Similar results hold true for banks’ operating costs and a proxy for competitive pressures (Herfindhal index). Due to data constraint over the long time horizon we considered, we could not test the relevance of other factors used in the literature, such as the bank funding composition (Gambacorta and Marques-Ibanez, 2011) and the securitisation activity (Marques-Ibanez and Scheicher, 2009; Altunbas, Gambacorta and Marques-Ibanez, 2010).

Table 1

THE ESTIMATED COEFFICIENTS FOR THE SYSTEM IN STRUCTURAL FORM

A1. House Demand-

*Endogenous variable: Dlog(**hp**(t))*

Variable	Estimated coefficient	Standard Error
Constant	-0.118**	0.05
Dlog(**mortgage**(t))	0.252***	0.08
Dlog(**hp**(t-1))	0.572***	0.09
Dlog(**hp**(t-2))	0.241**	0.02
Dlog(**hp**(t-3))	0.307***	0.10
Dlog(**hp**(t-4))	-0.282***	0.09
Dlog(income))(1)	0.301***	0.10
Dlog(**surf**(t-3)/popul(t-3))	-0.186**	0.08
Dlog(exp_inflation(t))	0.025**	0.01

Adjusted R^2= 0.90; S.E. of regression= 0.006; DW stat=2.00

A2. House Supply –

*Endogenous variable: Dlog(**invest(t)/surf(**t-1))*

Variable	Estimated coefficient	Standard Error
Constant	0.009	0.00
Dlog(**loan**(t)	0.076***	0.02
D(cs_cycle)	0.001***	0.00
Dlog(**ph**(t-2)/cost(t-2))	0.318***	0.09
Dlog(**invest**(t-3))	-0.028***	0.01
Dlog(**invest**(t-4))	-0.038***	0.01

Adjusted R^2= 0.57; S.E. of regression= 0.002; DW stat=1.50

*Endogenous variable: log(**surf(t)**)*

Variable	Estimated coefficient	Standard Error
Constant	0.144**	0.05
log(**surf**(t-1))	0.955***	0.01
log(**invest**(t))(1)	0.021***	0.00

Adjusted R^2= 0.99; S.E. of regression= 0.006; DW stat=0.3

B1. Mortgage demand

*Endogenous variable: Dlog(**mortgage**(t))*

Variable	Estimated coefficient	Standard Error
Constant	0.003*	0.00
Dlog(**hp**(t))	0.174***	0.05
Dlog(income(t-1))	-0.135***	0.05
D(**r_mortgage**(t-1))	-0.003***	0.00
D(**r_mortgage**(t-2))	-0.003**	0.00
Dlog(**mortgage**(t-1))	0.434***	0.08
Dlog(**mortgage**(t-2))	0.414***	0.08

Adjusted R^2= 0.85; S.E. of regression= 0.006; DW stat=1.97

B2. Mortgage supply

*Endogenous variable(**r_mortgage**(t))*

Variable	Estimated coefficient	Standard Error
Constant	-0.039***	0.04
D(r_3m(t))	0.275***	0.04
D(r_3m(t-1))	0.306***	0.04
D(capital(t-2))>0	0.261**	0.12
Dlog(wfinq(t))	-2.978**	0.95
Dlog(hp(t)/income(t))	3.235**	1.53

Adjusted R^2= 0.75; S.E. of regression= 0.27; DW stat=1.76

C1. Demand for loans to firms

*Endogenous variable: D(**loan**(t))*

Variable	Estimated coefficient	Standard Error
Constant	0.001	0.01
Dlog(**invest**(t))	0.086***	0.03
Dlog(invest((t-1))	0.077**	0.03
D(**r_loan**(t)-r_10y(t))	-0.003***	0.00
Dlog(**loan**(t-1))	0.834***	0.04

Adjusted R^2= 0.85; S.E. of regression= 0.006; DW stat=2.6

C2. Supply for loans to firms

*Endogenous variable: D(**r_loan(t)**)*

Variable	Estimated coefficient	Standard Error
Constant	-0.051**	0.02
Dr_3m(t)	0.499***	0.03
Dr_3m(t-1)	0.368***	0.02
D(capital(t-2))>0	0.180**	0.09
D(cs_cycle(t)	-0.001**	0.00

Adjusted R^2= 0.86; S.E. of regression= 0.20; DW stat=1.74

Notes: Variables are defined in Section 3.3. The system is estimated by means of Three-Stage Least Squares (3SLS) over the sample period 1986Q4 2010Q4. Endogenous variables are marked in bold. *,**,*** denote significance at 10, 5 and 1% respectively. (1) Four-term moving average.

The pass-through of changes in money market rates to the cost of credit is sluggish in both credit segments, with a lower effect on the cost of borrowing for households than for developers. Following a one per cent increase in the short-term interest rate, the loan rate for households rises by 27 basis points in the same quarter and by 31 in the subsequent one; the corresponding increase for construction firms is of 50 and 37 basis points. A lagged reaction of bank rates to monetary policy shocks is a common feature of many empirical studies. However, the different pass-through across the two credit sectors may signal somewhat stronger competitive pressures in the market for loans to households due to deeper integration and financial innovation.

As for the value of collateral (proxied by house prices), we do not find a significant effect on the cost of lending to firms and so it has been dropped from the equation. The result is not surprising since many loans to firms are short term and are typically not collateralized. We find that business cycle conditions in the construction sector affect the cost of credit to developers because during a recession the risk premium charged by banks is higher than during an expansion. As for mortgages to households, we find that house inflation leads, *ceteris paribus*, to an increase in the cost of credit due to the worsening of house affordability (as proxied by the ratio of house price to household disposable income). Accordingly, Italian banks seem to pay more attention to the households' creditworthiness than to the value that they can recover in the case of default. The highly significant and negative coefficient for financial wealth confirms the key role of customer scrutiny rather than the market value of collateral in determining bank credit supply.

5. Assessing house price response to the main exogenous drivers

The structural model described in the previous section can be *solved* and rearranged in order to obtain the reduced form, in which each endogenous variable depends on lagged values of all the endogenous variables and on current and lagged values of the exogenous variables. By solving the model, we mean that for a given set of values of the exogenous variables, we find a set of values for the endogenous variables, so that the equations in the model are satisfied. For model solution we rely on the iterative Gauss-Seidel algorithm which is suitable for nonlinear equation system.

The reduced form model is suitable to perform dynamic stochastic simulations useful for policy analysis. In this regard, we assess the overall impact of changes in the exogenous factors on the endogenous variables over a forecast horizon of five years. In this section we focus on the dynamic response of house prices to changes in the relevant drivers, while the estimated effects on the other endogenous variables are reported for completeness in Appendix A. For each stochastic simulation, we generate the empirical distribution of the model solution using a Monte Carlo simulation based on 5,000 independent draws from the standard normal distribution. The resulting distribution reflects uncertainty about both the estimated coefficients and the covariance matrix of the residuals and is summarized by the median and the 10 percent confidence bands over all the different outcomes. The estimated effects of each exogenous driver on house prices are reported in Figure 6a and are computed as deviations from the baseline scenario, namely a scenario in which all exogenous variables do not change over the entire forecast horizon.

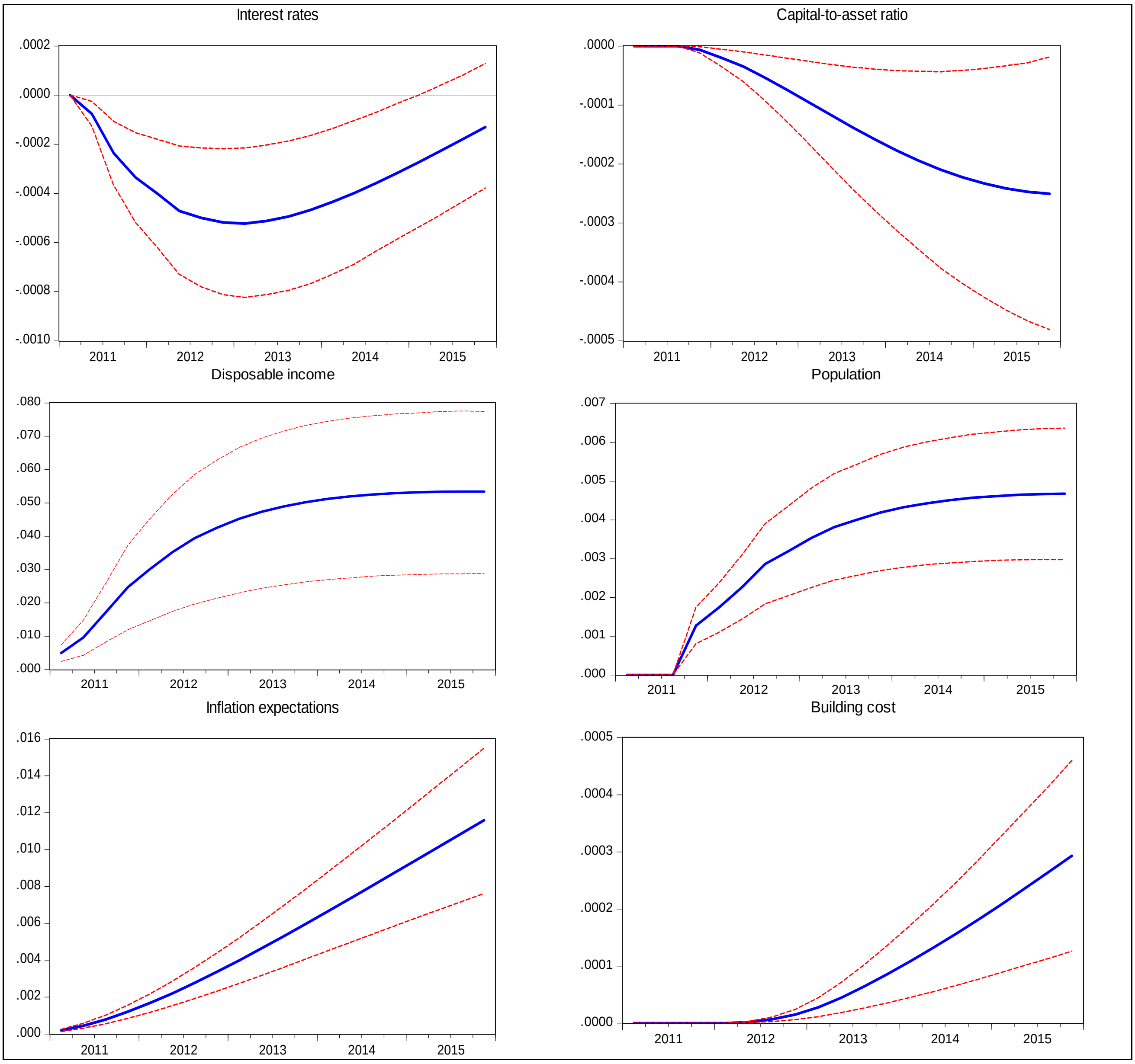
5.1. The transmission channel of monetary policy to house prices

We first undertake a monetary policy experiment according to which the 3-month money market rate increases by 50 basis points in the first quarter and remains at the new level for the rest of the forecast horizon. The upper-left panel of Figure 6a shows house prices with a humped-shaped response that declines sharply for six consecutive quarters and then slowly returns to the starting point. The dynamic linkages between housing and banking are useful to shed light on the transmission mechanism of monetary policy. Following the positive short-term interest rate shock, bank loan rates increase for the two subsequent quarters. The transmission of the higher cost of credit to house prices is twofold in our model. On one side, the increase in the mortgage rate feeds into a persistent decline in loans for house purchases. On the other side, loans to construction firms negatively react to changes in the spread between the bank rate and the long-term interest rate. The decline of loans to construction firms is lower than that recorded for mortgage loans. In the model the negative response to loans to construction firms leads to a drop in residential investment and the housing stock. The overall effect on house price level, however, is a persistent and hump-shaped decline peaking at around 0.2% two years after the initial monetary impulse. This implies that the decline in house supply only partially mitigates the deflationary effect on house prices stemming from the decrease in housing demand. As far as a comparison with the previous literature is concerned, especially for the US, we provide evidence that the response of residential investment is more persistent but of a smaller magnitude.

Figure 6a

ESTIMATED EFFECTS OF MAIN EXOGENOUS DRIVERS ON HOUSE PRICES

(quarterly data; deviations from baseline scenario)



Notes: Each figure reports the estimated effect on the house price level of a 0.5% increase in the indicated exogenous driver. The baseline scenario is based on the assumption that all exogenous variables do not change over the entire forecast horizon. Confidence bands represent the 10th and 90th percentiles of the empirical distribution of the forecasts obtained from a Monte Carlo simulation based on 5,000 draws.

In the case of Italy, Gambacorta and Iannotti (2005) found evidence that the adjustment of retail bank rates to money market rates is asymmetric in the short run. Banks adjust the rate of loans to non-financial firms at a faster peace after monetary tightening than in the case of a decrease in the policy rate. As a result, we might expect a stronger effect on housing supply and, in turn, a lower response from house prices following an increase in the short-term interest rate. We performed an alternative experiment in which we consider separately positive and negative changes in the 3-month money market rate in order to obtain two variables, representing, respectively, monetary tightening and monetary easing. They are included simultaneously in each credit supply equation of the model. Interestingly, we find that a positive change in the short-term rate is transmitted with greater intensity than a negative one in both credit segments. For loans to construction firms, the pass-through is complete after monetary tightening while about 0.8 following monetary easing. For mortgage loans to households the corresponding pass-through values are, respectively, 0.7 and 0.5. These results imply a weaker deflationary effect of monetary tightening on house prices than in the benchmark case, as opposed to a stronger inflationary impact after monetary easing (see Figure A7 in Appendix A).

5.2. The transmission of other shocks to house prices

In an alternative simulation we assess the effects of a credit supply shock. In particular, we perform an experiment in which the total capital-to-asset ratio increases by 0.5% in one quarter. The banks' deleveraging process leads to a lagged increase in bank rates. However, the subsequent decline in bank loans is greater for mortgage loans to households than for loans to construction firms. The resulting fall in house prices begins one year after the shock. This negative effect is more persistent but weaker in magnitude than that implied by the monetary policy shock.

As far as the dynamic effects of housing demand shifters are considered, we compare the response of house prices to three different experiments involving a positive 0.5% positive shock in disposable income, population and expected consumer inflation, one at a time. The cumulated effect on the house price level is particularly strong for households' disposable income. More generally, it is interesting that housing demand shocks in our system imply a stronger response of house prices than in the case of a monetary policy shock. Notice that, for construction, each housing demand shock has no direct effect on credit to construction firms and residential investments in our model. However, the model generates feedback effects on the housing supply in the long run. For example, in the case of the increase in disposable income, the initial rise in house prices leads to an increase in construction firms' profitability (e.g. the ratio of house prices to construction cost increases, *all other things being equal*), to higher residential investments and, in turn, to lower house prices in the long run. In addition, the surge in residential investments also determines a higher demand for loans from construction firms, thus reinforcing this negative indirect effect of housing supply on prices.

Finally, we perform a 0.5% reduction in the building cost, which in the model represents a pure housing supply shock. This experiment is broadly similar to the assessment of a positive technology shock in the construction sector as in Iacoviello and Neri (2010). The inflationary effects on house prices are persistent and significant and comparable in magnitude with those recorded for the monetary policy experiment.

5.3. Effects on house prices in a model with an exogenous housing supply

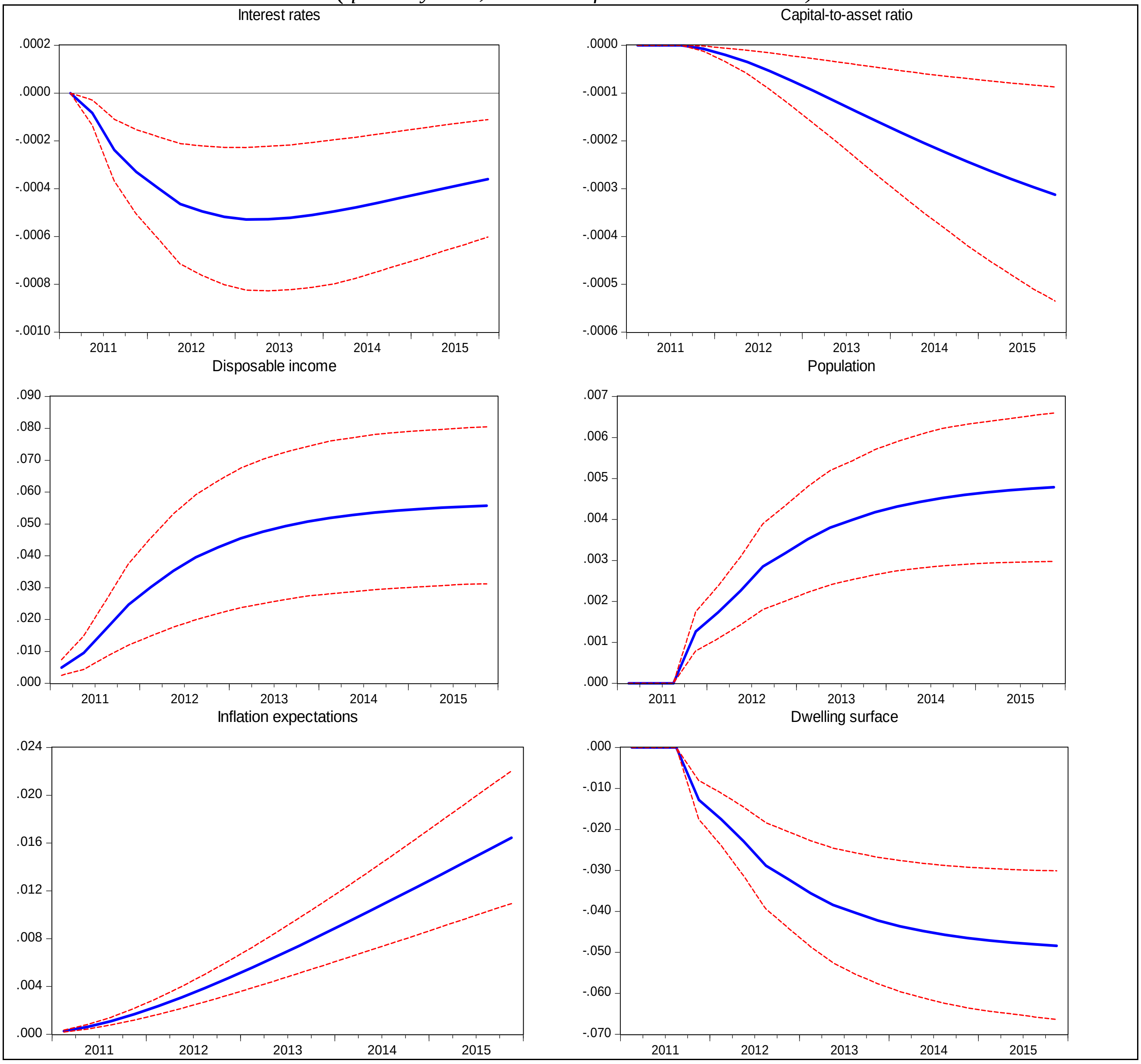
In order to highlight the role of housing supply responsiveness, we compare the simulations based on the benchmark model with those obtained with an alternative one where the housing supply is assumed to be rigid. The exclusion of the transmission channels through the housing supply is obtained by dropping the equation for residential investments in the system and simply by assuming that the dwelling surface is an exogenous driver in the equation for house prices. Notice that a decline in this variable essentially replaces the role of building cost as a pure negative housing supply shock, with a significant deflationary effect on house prices. The estimated effects of the exogenous drivers on house prices with this alternative model are reported in Figure 6b.

A visual comparison with Figure 6a suggests that in general the sign of the overall effect of each exogenous driver on house prices reflects the sign in the housing demand equation. However, the timing and magnitude of the effects are somewhat different under a flexible rather than a rigid housing supply curve. In particular, the deflationary effects of monetary policy restriction or banks' deleveraging are more severe in the long run if the housing supply is exogenous.

Figure 6b

ESTIMATED EFFECTS OF THE MAIN EXOGENOUS DRIVERS ON HOUSE PRICES IN A SYSTEM WITH AN EXOGENOUS HOUSING SUPPLY

(quarterly data; deviations from baseline scenario)



Notes: Each panel reports the estimated effect on the house price level of a 0.5% increase in the indicated exogenous driver. The baseline scenario is based on the assumption that all exogenous variables do not change over the entire forecast horizon. Confidence bands represent the 10th and 90th percentiles of the empirical distribution of the forecasts obtained from a Monte Carlo simulation based on 5,000 draws.

6. What were the main drivers of house prices over the last decades?

In this section we assess the contribution of each exogenous driver to the changes in house prices and credit flows in Italy over the period 1990-2010. The original sample is slightly restricted to eliminate the dynamic effects of the initial conditions. The impact of a single driver is computed by means of counterfactual exercises in which we compare the fitted values of the benchmark model with those obtained by a simulation in which the same driver has been kept fixed over the entire horizon of the simulation; the impact is obtained as the difference between logs of the latter and the former fitted values. As a general caveat, the results of the simulation are affected by the choice of the starting period of the counterfactual exercise, which we uniformly set at 1990 to cover the two main house price cycles.

As clear-cut evidence, housing demand factors provided the main positive contributions to house price dynamics over the entire sample (Figure 7). This outcome was driven, above all, by developments in disposable income, albeit with a declining intensity over time and a negative one in the most recent period. Population growth, which was particularly strong after 2000, made a positive contribution. Mirroring the upward trend in building costs, the adjustment of house supply exerted inflationary effects, which proved particularly intense in the late nineties, and stabilized at a more moderate size in recent years. Credit supply factors provided a dampening effect during the financial turmoil of the mid-nineties, followed by a long period of positive support, albeit to a lesser extent in the global recession. Regarding monetary policy, the estimated effects at a single point in time were influenced by the impact of the policy stance in previous periods, apparently to a greater extent than for the other variables. As a result, we find that monetary policy had a deflating impact on house prices during the turmoil at the beginning on the nineties, followed by a positive impact on the path to the Monetary Union, peaking in 1999 as the cost of credit largely benefited from the decline in the policy rate in the new institutional framework. The monetary policy effects turned largely negative at the beginning of the 2000s, progressively easing the drag on house prices in the following years. During the financial crisis, the monetary policy effects became positive again, broadly at the same level as in the mid-nineties.

In the same vein, we perform the corresponding exercise for credit variables (see Figures A8 and A9 in Appendix A). In particular, the demand factors (i.e. households' disposable income and population growth) played a major role between the early nineties and the start of the Econonic Monetary Union, losing momentum in the cyclical downturn of 2001-02. Demand factors strengthened again until the eve of the financial crisis, becoming almost negligible thereafter. In line with results already reported for house prices, the credit supply factors exerted a relatively stronger negative effect on mortgages in the mid-nineties and, to a lesser extent, in the most recent years; interestingly, in these periods the impact remains negligible on the loans market.

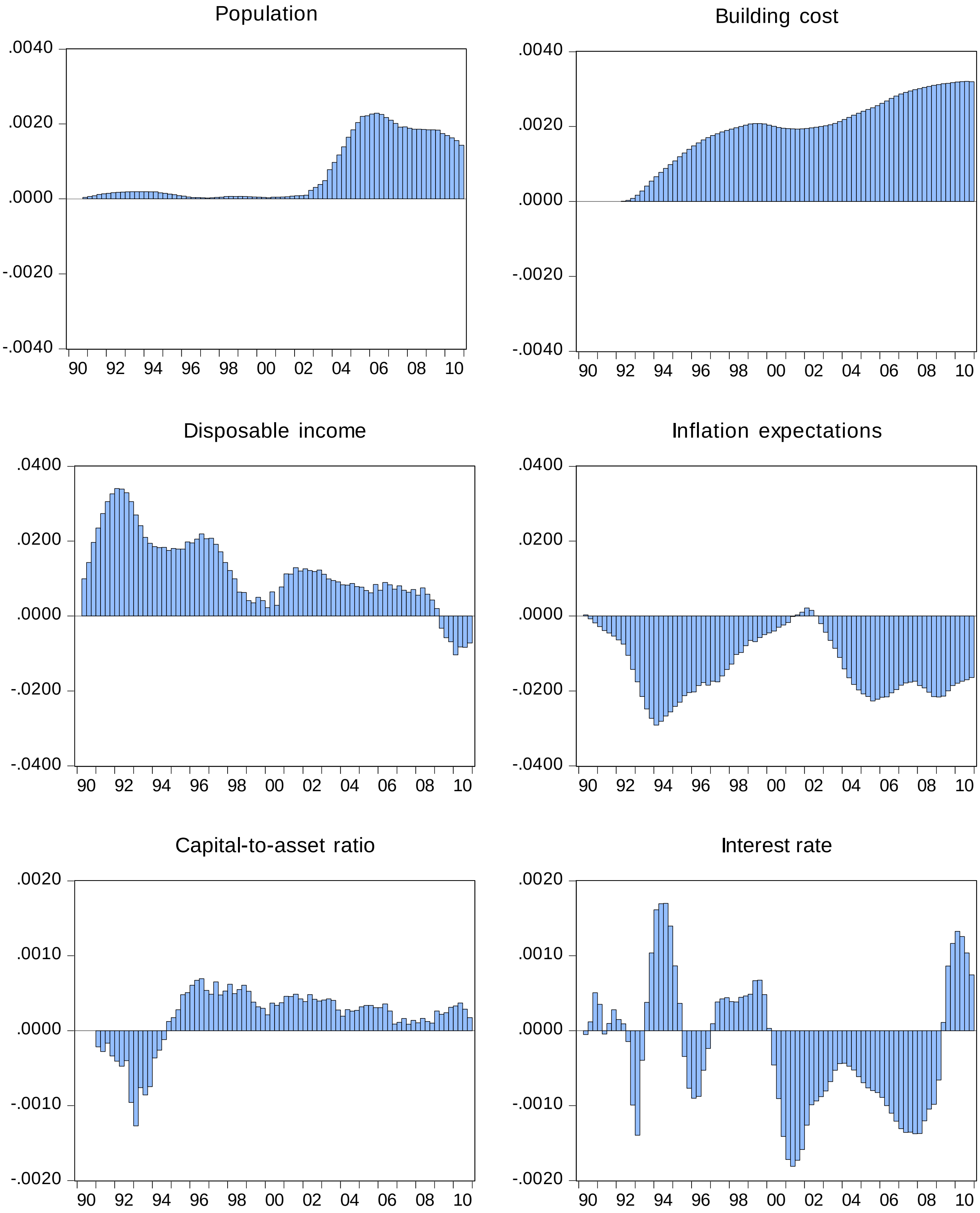
The evidence against a strong effect of supply factors on mortgages during the Great Recession is broadly in line with the results found by Del Giovane, Eramo and Nobili (2011), which are, however, based on qualitative information collected by the Bank Lending Survey. In the same paper, however, it is reported that supply factors have recently affected credit to firms more significantly, albeit with no distinction between the non-construction and the construction sector. This evidence is also confirmed in Albertazzi and Marchetti (2010).

Further, the monetary policy contribution also mirrors the pattern found for house prices, confirming that changes in credit conditions are channelled to the housing sector mostly through the mortgage market. Differences occasionally detected between the effects of monetary policy on house prices and on mortgage flows can be traced back to the different lags by which house prices interact with current changes in prices themselves and credit flows.

Figure 7

HISTORICAL DECOMPOSITION OF HOUSE PRICES

(quarterly data; deviations from baseline)



Notes: Each panel reports the effects on house price levels provided by a single driver at each point in time. The effects are measured as the deviation in logs of the house prices fitted under the assumption of no change of the considered driver and those obtained from the benchmark model.

7. Implications for house price misalignments

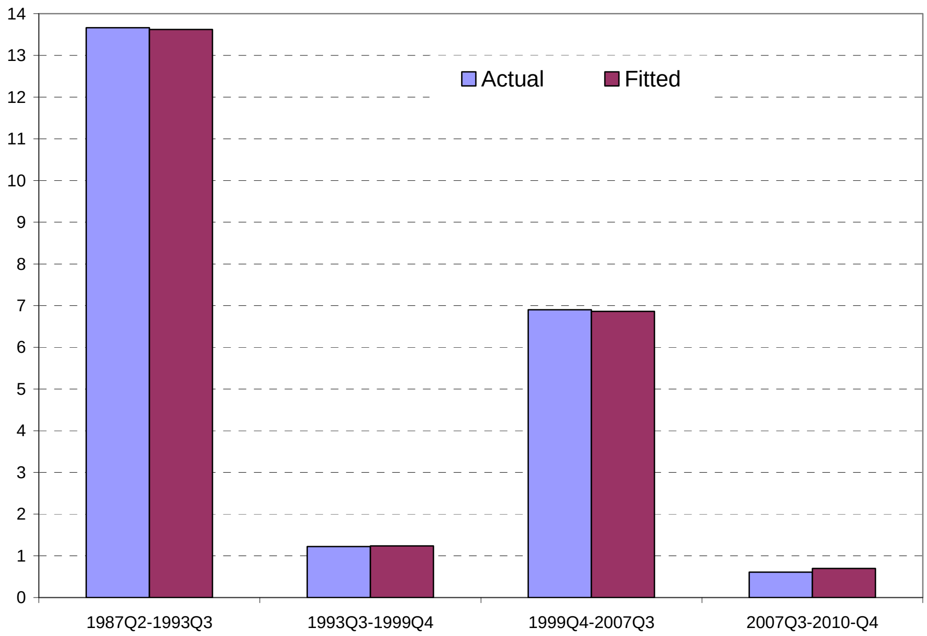
In the empirical literature residuals of an econometric estimation of the price equation provide a useful tool for detecting possible misalignments with respect to the fundamentals. This approach, initially based on a limited set of regressors (interest rates, disposable income, demography), has recently been developing to include financial and credit variables (Tsatsaronis and Zhu 2004; IMF 2007; OECD, 2010). In our model we control for as many as ten exogenous factors, possibly reducing the margin of uncertainty that is usually attached to the econometric approach to house price bubbles (Gürkaynak 2008; ECB 2010). At the same time we have made a special effort to fill the information gaps usually affecting house price determinants. This is even more important in the case of Italy, with our major failures in providing information (?) regarding public policies as well as land availability and prices.

Our results point to negligible misalignments of Italian house prices over all the previous cycles we have identified in Section 2.1. Indeed the discrepancy between the actual and fitted dynamics proves to be very low in the two latest expansionary phases, as it is positive by around 0.2 percentage points against the strong increases of 13.4% and 6.9% registered at current values between the period 1987Q2-1997Q3 and 1999Q4-2007Q3 (Figure 8). The discrepancy is negligible for the recession that began with the crisis of the early nineties, while the abrupt deceleration of house prices observed since 2007 proves marginally more pronounced than implied by determinants (0.6 against 7.0 per cent, respectively).

Figure 8

HOUSE PRICES IN RECENT CYCLES

(current values; annualized average changes in reference periods)



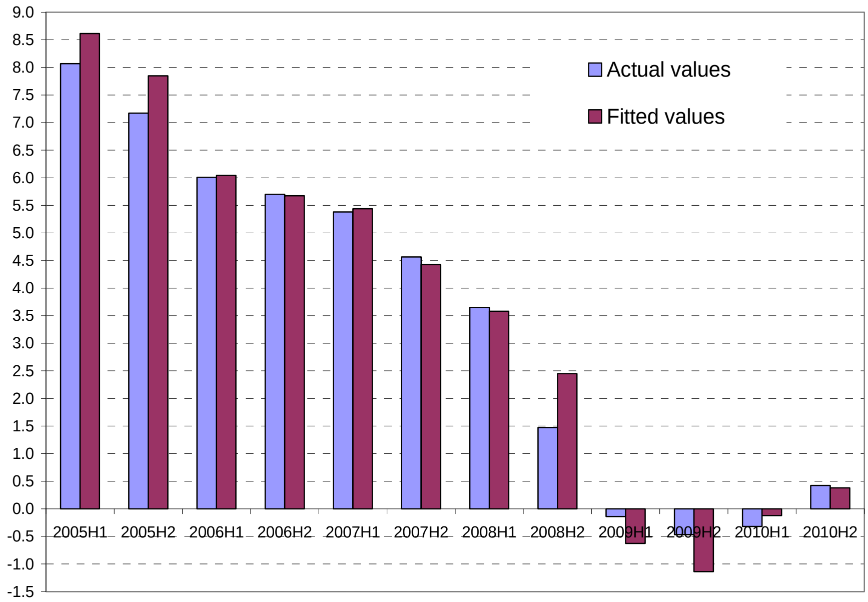
Focusing our attention on the latest developments, we see that the actual increases in house prices, after being lower than implied by the fundamentals over the year 2005, became more or less balanced until the first semester of 2008. As the financial crisis deepened, house price dynamics in Italy lost momentum more severely than implied by our structural model in the second semester of 2008, became moderately negative over the year 2009 despite the fundamentals deteriorating more severely, and were once again virtually balanced in 2010 (Figure 9.A). In terms of levels, the gap between actual and fitted values has been below 0.2 percentage points since the start of 2005 apart from the somewhat significant depreciation detected in the second semester 2008 (-0.8 percentage points), which was fully recovered by the end of 2010 (Figure 9.B). All in all, these results point to a broadly balanced picture in the Italian housing market.

The implications of the econometric model are largely in line with the indicators that are commonly adopted to assess price developments by the community of market analysts and in the institutional debate, even more so when they take account of the prolonged low level of interest rates. On one side, the price-to-rent ratio, after peaking in the second half of 2007, has progressively recovered its long-run average, signalling that the risk of a misalignment was moderate and very temporary.

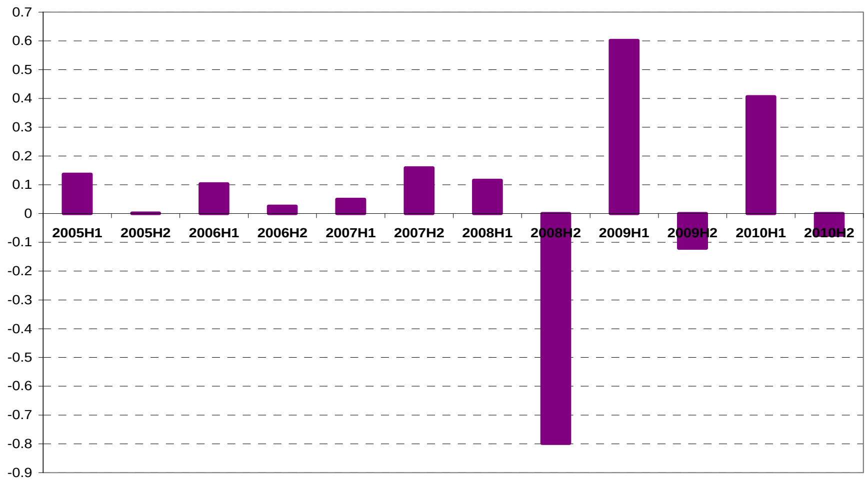
Figure 9

HOUSE PRICES OVER THE FINANCIAL CRISIS

A. Yearly changes of house prices in percentage points



B. Deviation between fitted and actual levels in percentage points

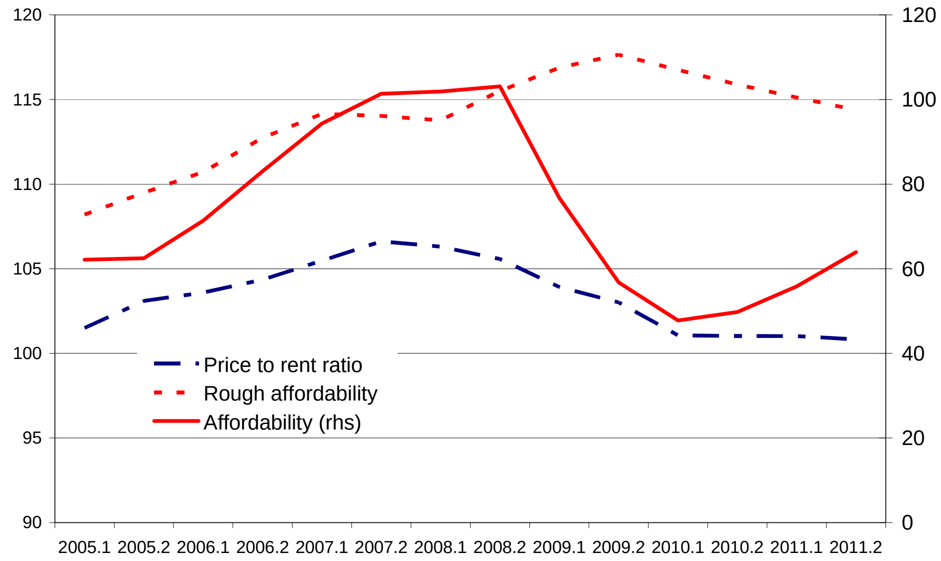


On the other side, the affordability index, assessed in the rough measure that rules out interest rate development, was on the rise until the eve of the financial crisis, remaining significantly above the long-run average thereafter (Figure 10). Noticeably, when the low interest rates come in, the index shows a more reassuring message, as the ability of households to buy a dwelling has significantly improved since 2008, possibly supporting a higher level of the house-price; the partial reversal in the very last period is also in line with a closing gap between the actual and fitted price levels implied by the econometric.

Figure 10

PRICE-TO-RENT RATIO AND AFFORDABILITY INDEX

(Indices 1992-2010=100)



Notes: The rough affordability index is measured by the ratio of house prices to household disposable income in per capita terms. The affordability index is the ratio of the product of house price and the mortgage interest rate to household disposable income in per capita terms. Lower values of both indices signal improved affordability.

8. Concluding remarks

In this paper we put forward a structural model featuring the multi-fold links between the housing and the banking sector in Italy. In this respect, we are contributing to the large body of literature that has flourished since the eruption of the financial crisis by jointly modelling equilibrium in the housing markets and in two related segments of the credit market, namely loans to households for house purchases and to firms for construction. In order to estimate the structural system we tackle the important data constraint regarding the housing sector in Italy by developing a rich dataset covering almost all the candidate drivers of housing supply and demand.

Our empirical analysis shows that house prices in Italy significantly reacted with a positive sign to an increase in household disposable income and demographic pressures and also to monetary easing. With some non-linearity, credit supply conditions, as captured by the capital-to-asset ratio, also exerted a significant and negative effect. Compared with the case of a rigid housing supply, allowing short-run responsiveness of residential investments to shocks in the economy affects the transmission of the monetary impulse to the housing sector, as it implies, for example, a mitigation of the deflationary effects of a policy tightening on house prices and faster recovery in the construction activity.

During the recent financial crisis the banks' deleveraging process, as captured by the increase in the capital ratio, dampened house price dynamics and largely offset the positive support coming from the monetary easing. All in all, house price developments appeared to be broadly in line with fundamentals over the full time horizon of the econometric analysis.

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Appendix A. Simulations with the benchmark model

Figure A1 Estimated effects of a 0.5% increase in the 3-month money market rate
(deviations from baseline scenario)

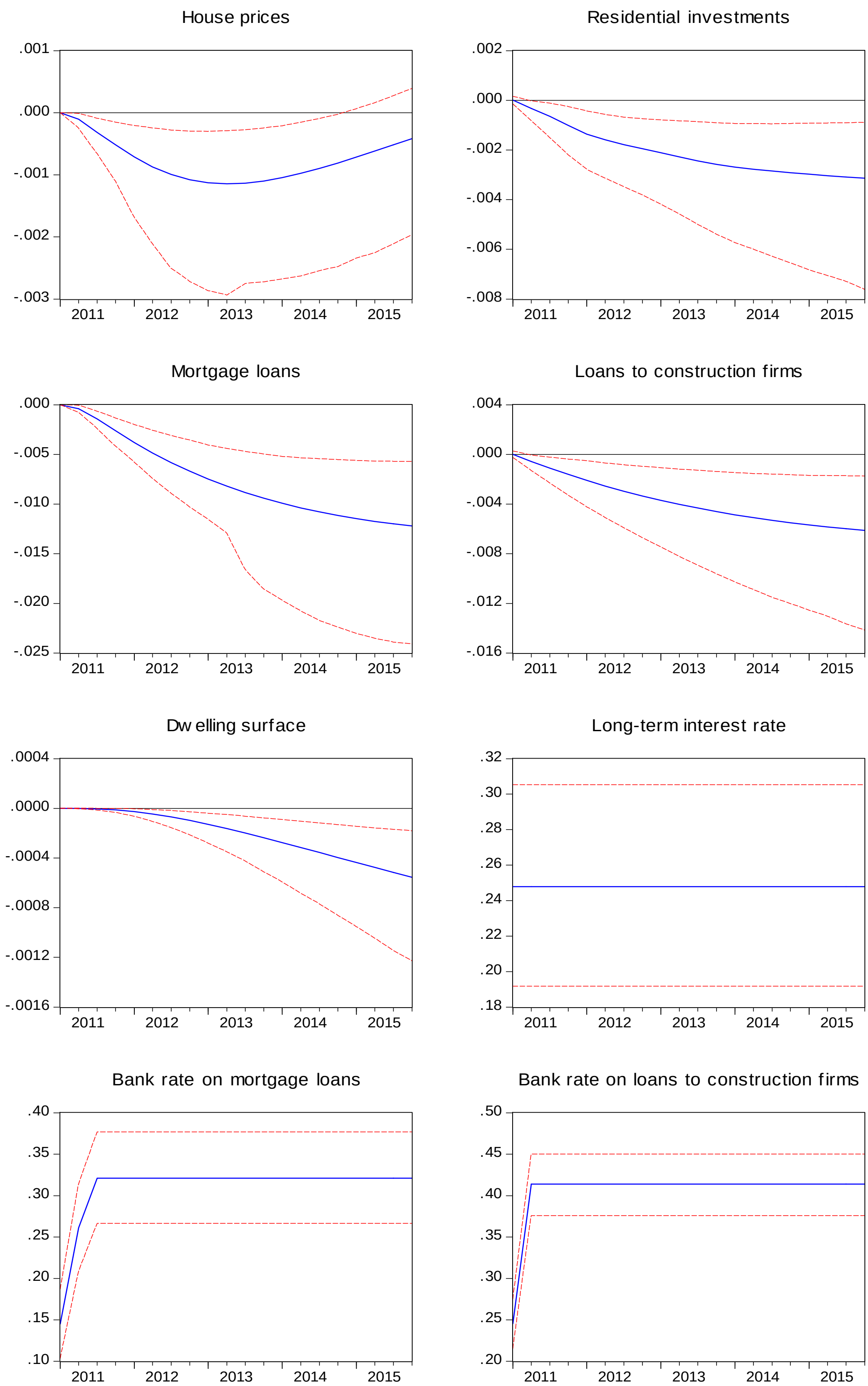


Figure A2 Estimated effects of a 0.5% increase in bank capital ratio
(deviations from baseline scenario)

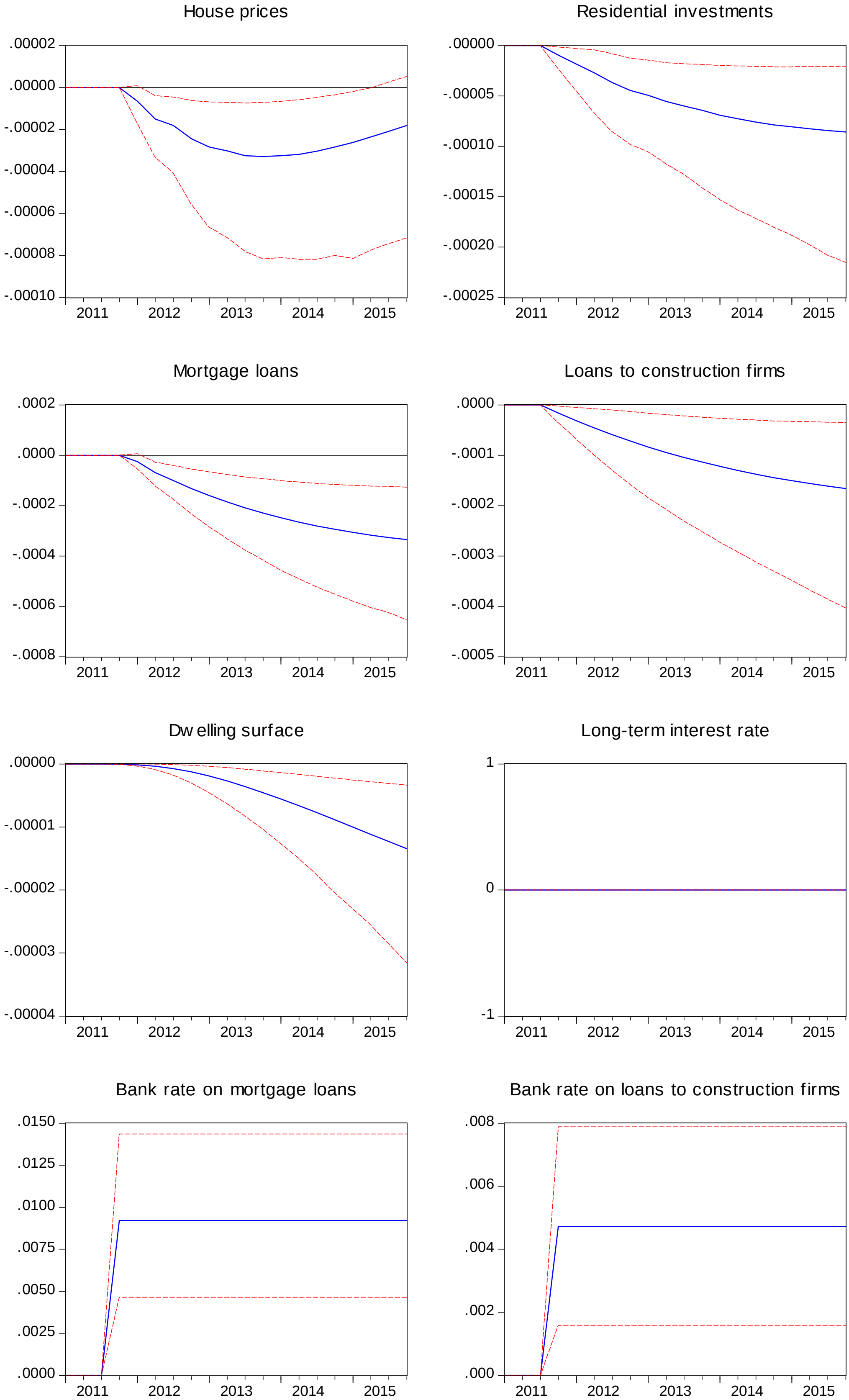


Figure A3 Estimated effects of a 0.5% increase in disposable income
(deviations from baseline scenario)

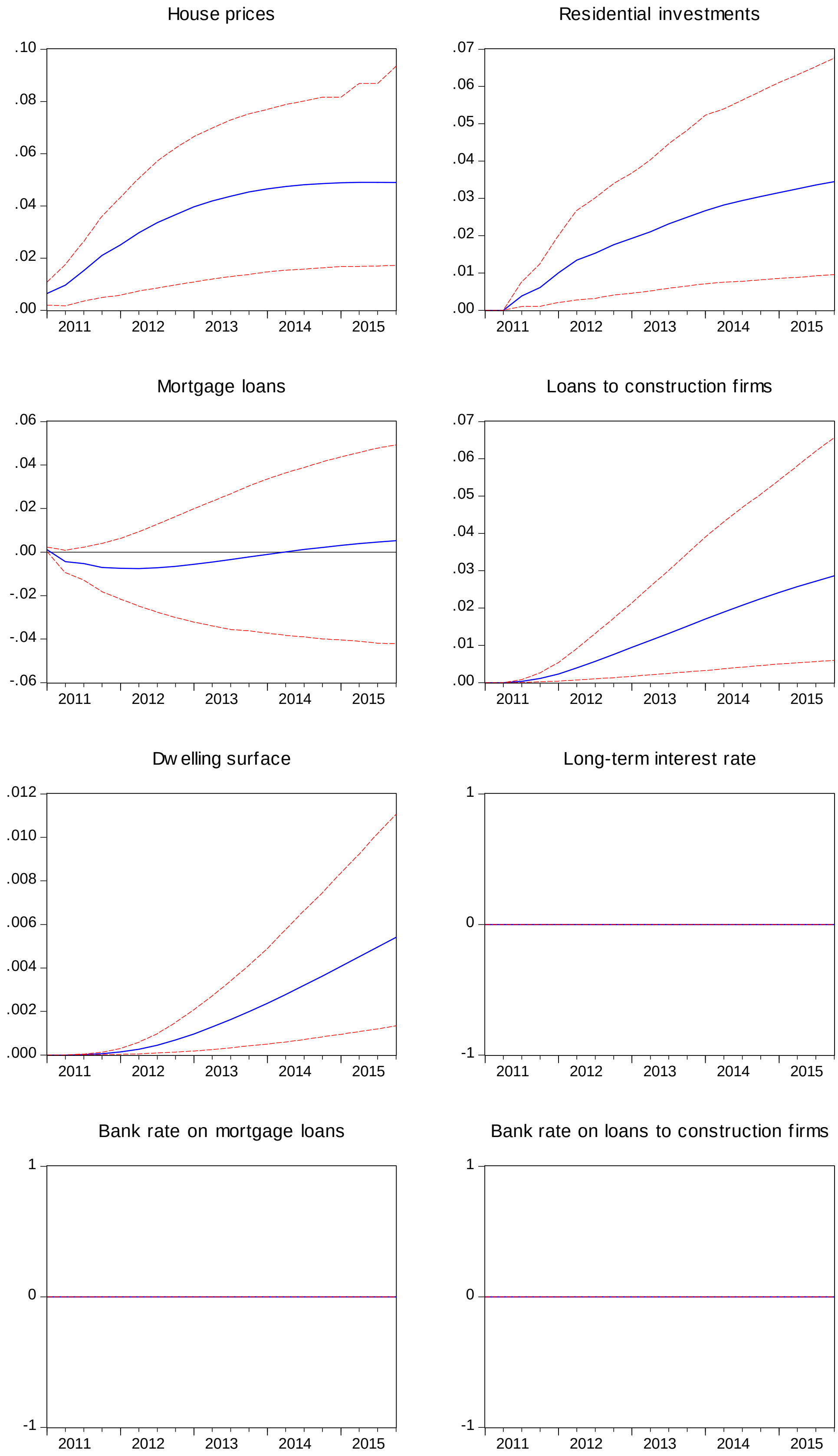


Figure A4 Estimated effects of a 0.5% increase in inflation expectations
(deviations from baseline scenario)

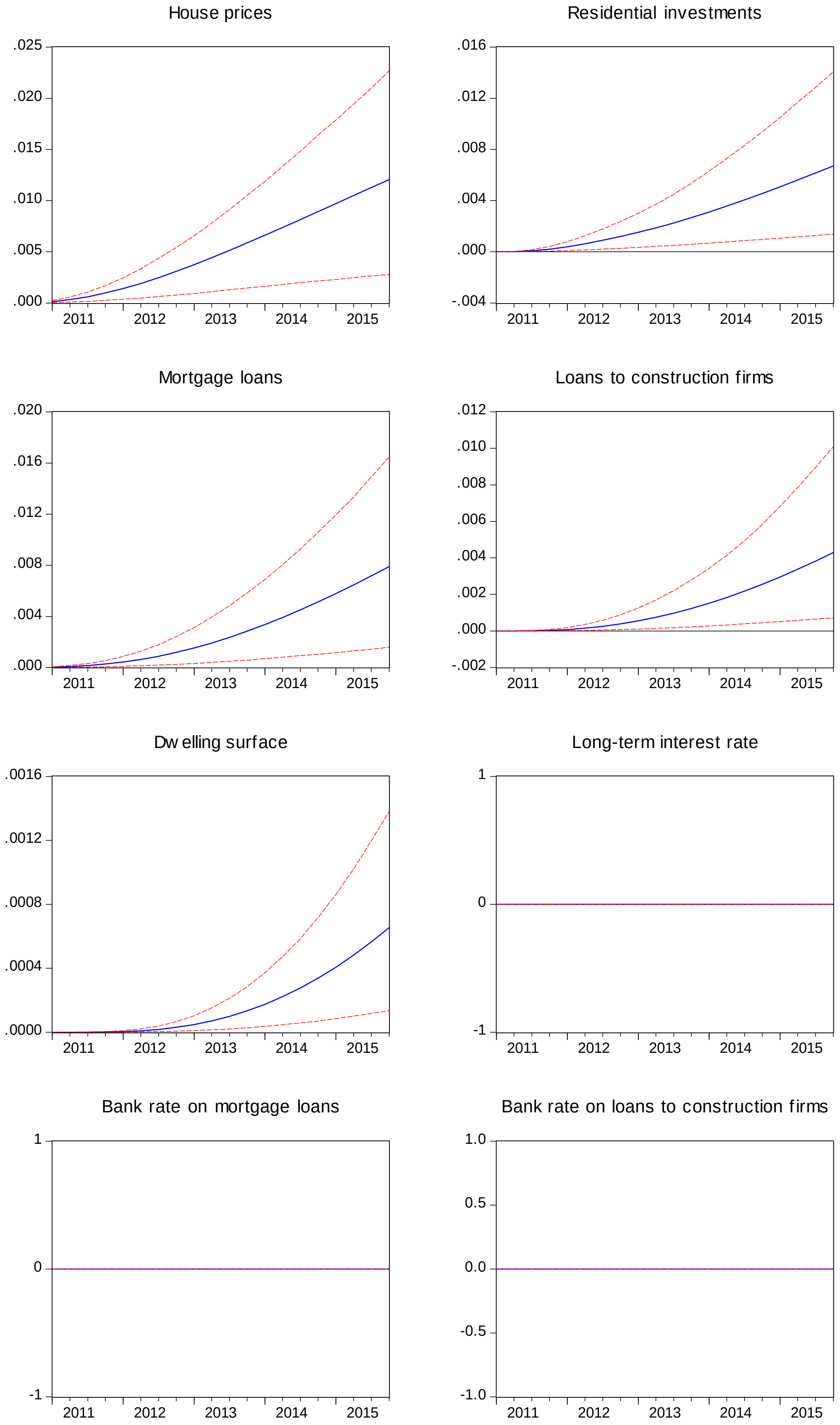


Figure A5 Estimated effects of a 0.5% increase in building cost
(deviations from baseline scenario)

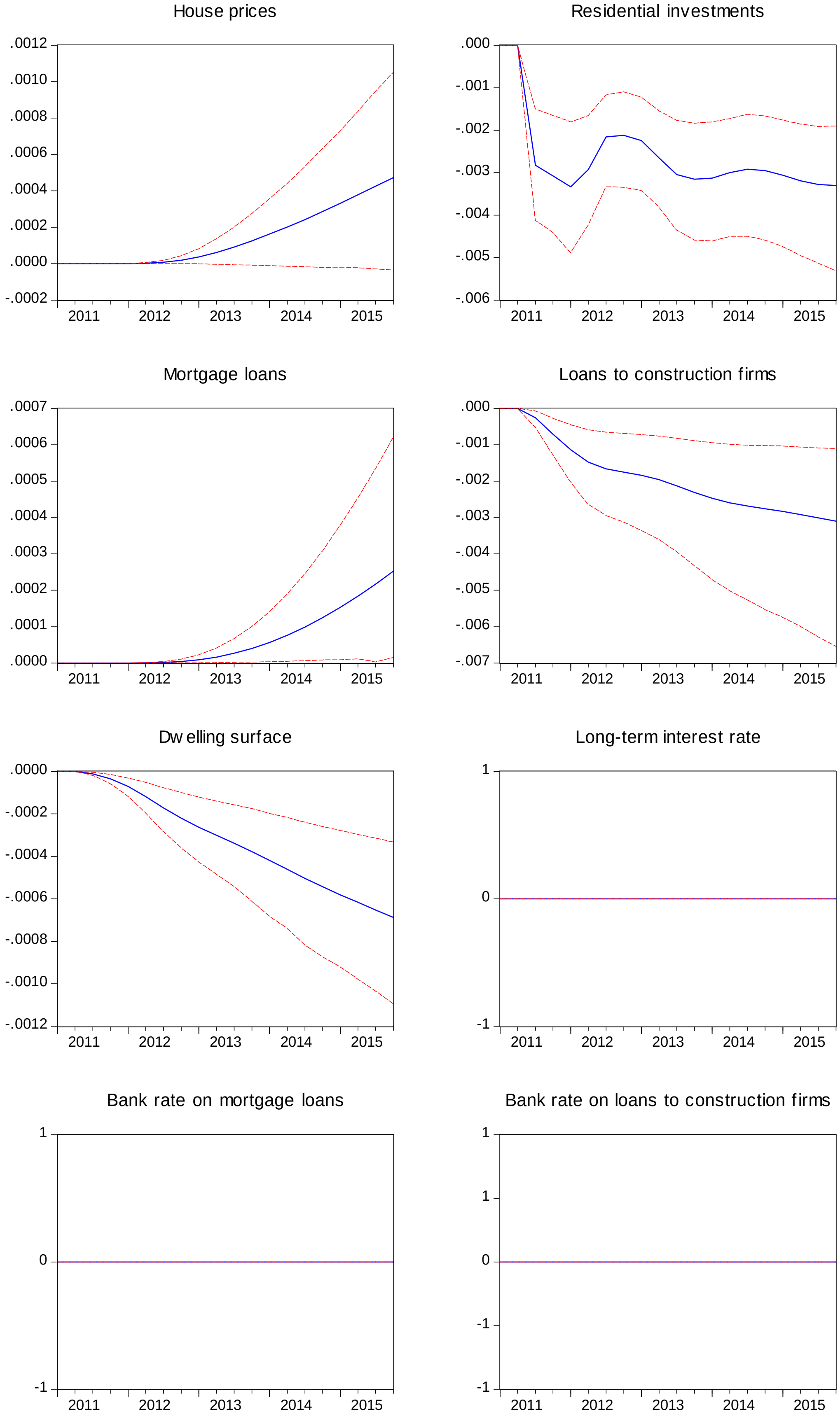


Figure A6 Estimated effects of a 0.5% increase in population
(deviations from baseline scenario)

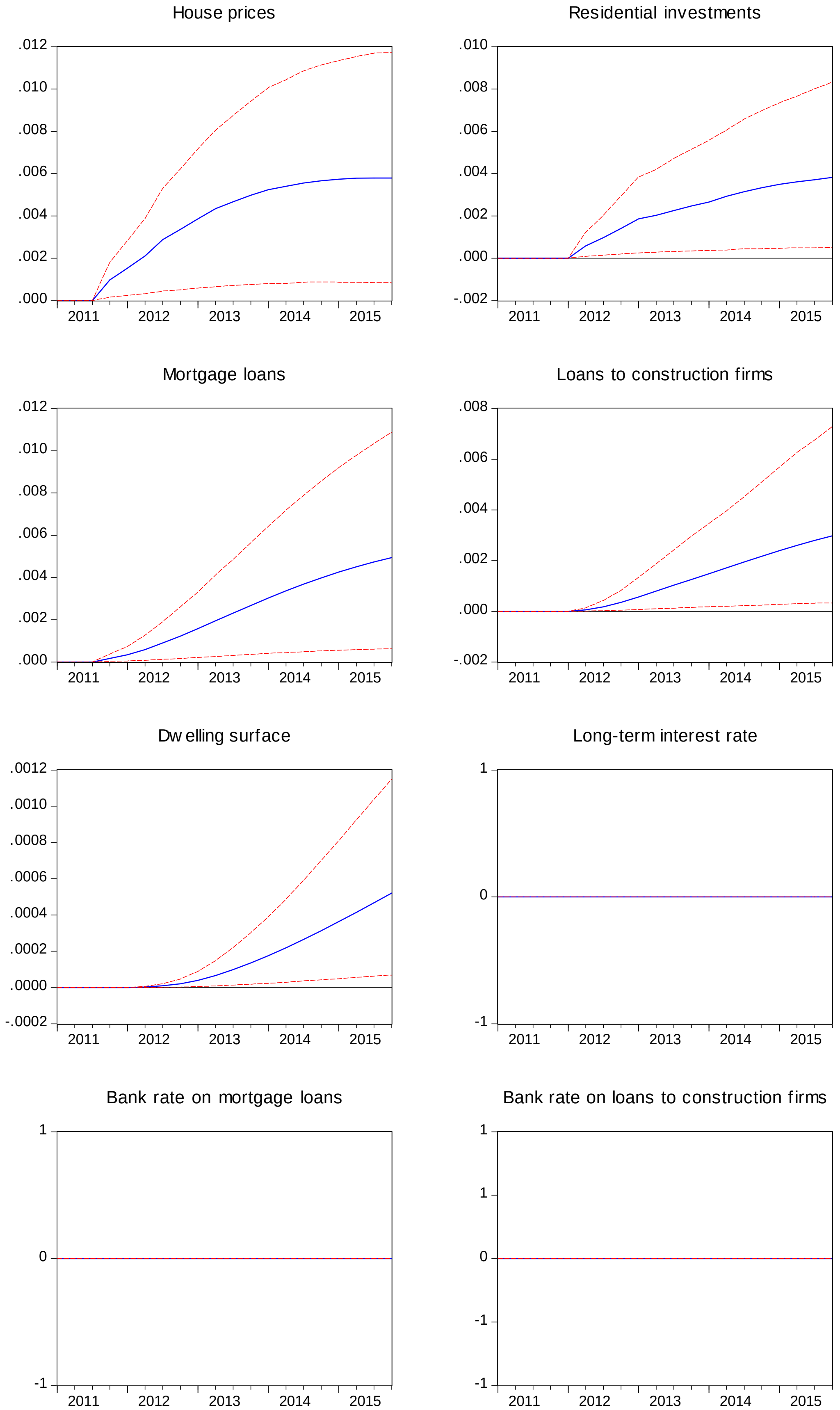


Figure A7 Asymmetric effects of monetary policy
(deviations from baseline scenario)

a) Increase in the 3-month money market rate by 50 basis points

b) Decrease in the 3-month money market by 50 basis points

Figure A8

HISTORICAL DECOMPOSITION OF MORTGAGE LOANS

(quarterly data; deviations from baseline)

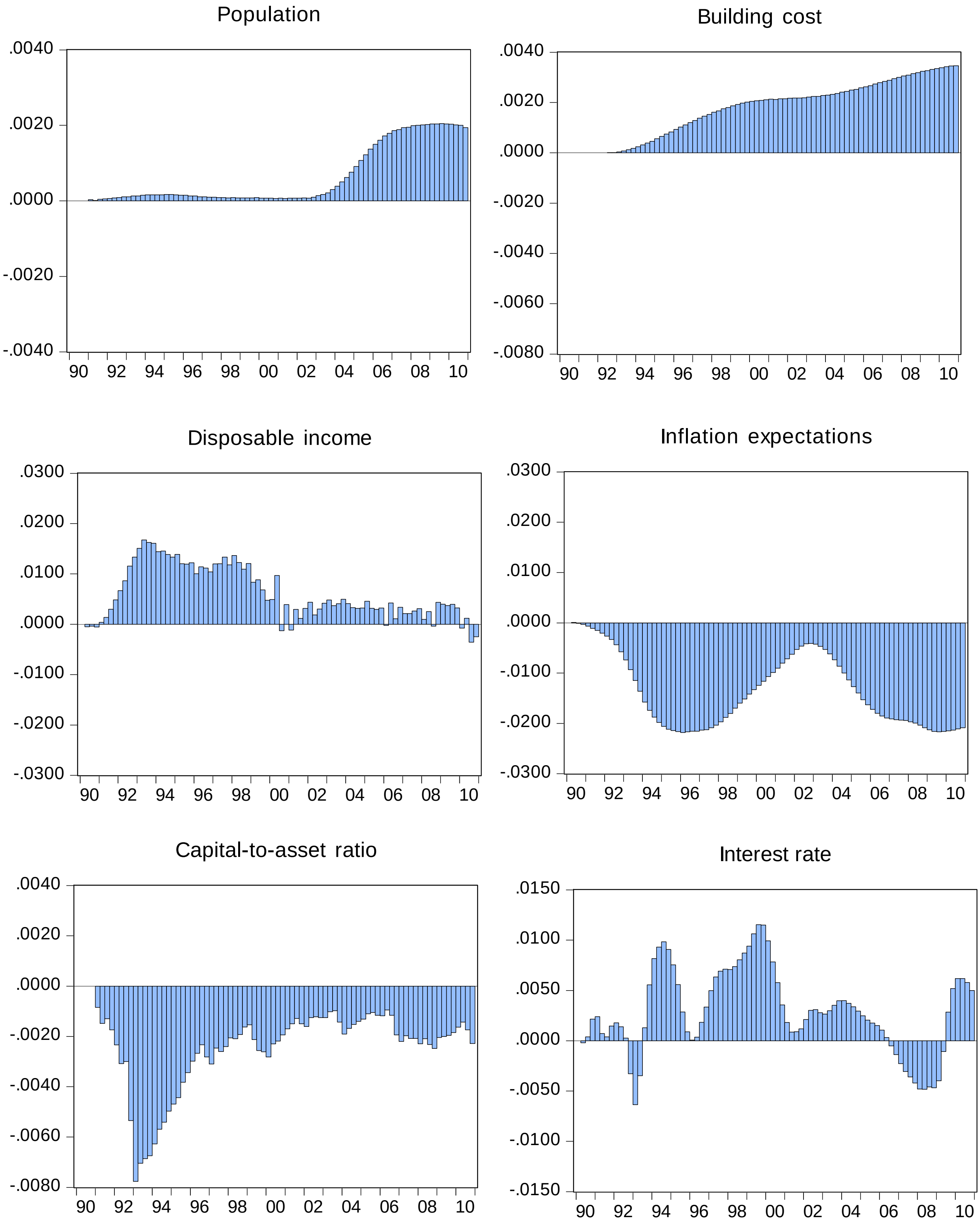
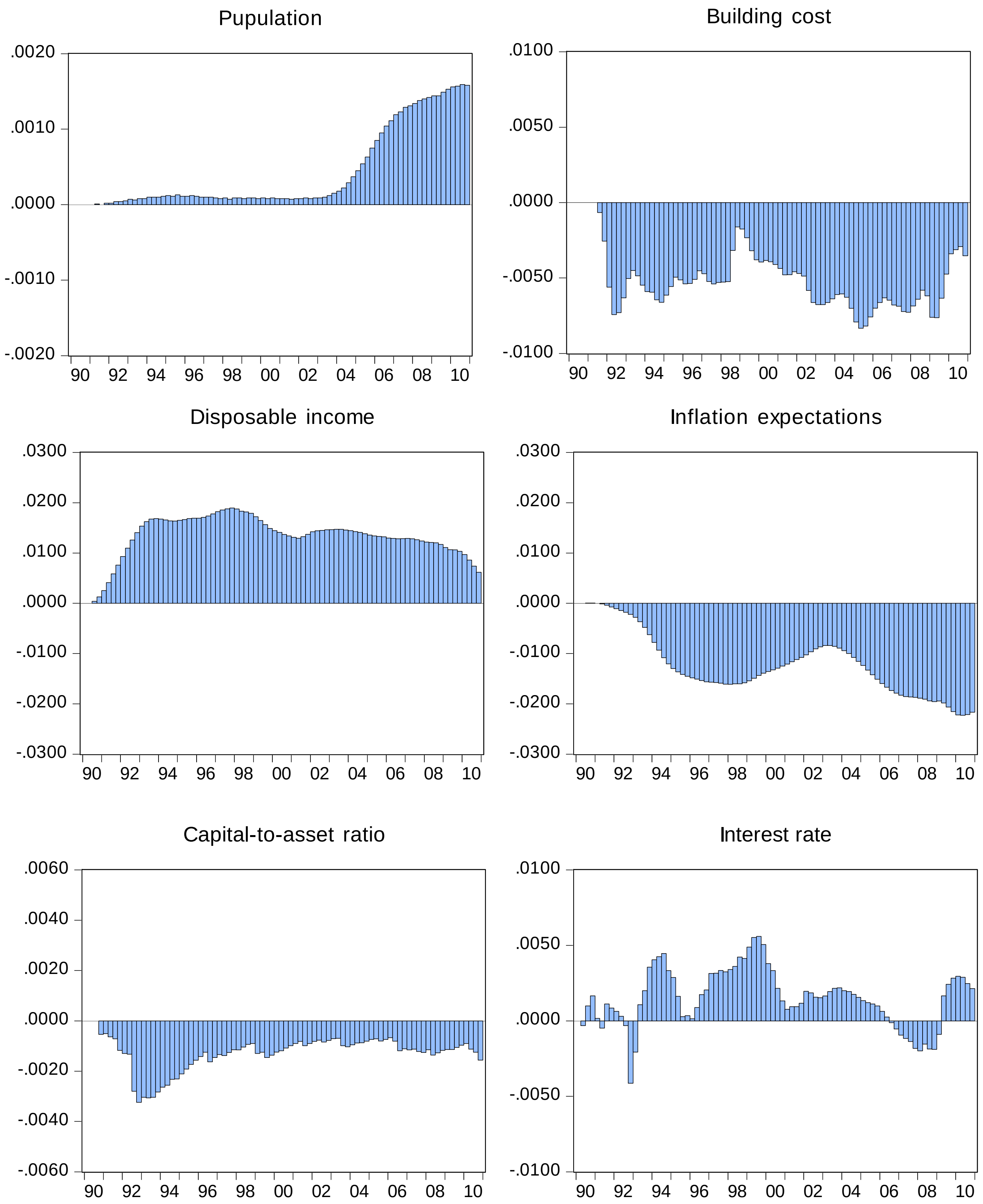


Figure A9

HISTORICAL DECOMPOSITION OF LOANS TO CONSTRUCTION FIRMS

(quarterly data; deviations from baseline)



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