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Abstract

This paper examines the reaction of house prices in a panel of euro area countries to monetary policy surprises over the period 2010-2019. Using Jordà's (2005) local projection method, we find that real house prices rise in response to expansionary monetary policy shocks that can be related to unconventional policy measures. In the core countries including Ireland, we also find that lending for house purchases increases relative to nominal output. Thus, household debt rises.

JEL-Codes: E520, E580, E320, G210.

Keywords: Euro area house prices, unconventional monetary policy, local projection method.

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Euro area house prices and unconventional monetary policy surprises

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1 Introduction

Empirical research on the side-effects of loose monetary policy points to financial instability risks. In particular, housing busts in response to a surge in house prices due to low interest rates may be a potentially destabilizing byproduct of continuous easy money (Jordà et al., 2015). Thus, policymakers should be mindful of such risks when implementing expansionary measures, especially if the accommodative policies remain in place for an extended period of time (Adrian, 2020).

In this paper, we examine the effect of the European Central Bank's (ECB) monetary policy on euro area house prices over the period 2010-2019, i.e. after the onset of the sovereign debt crisis. The period covers the introduction of numerous unconventional monetary policy measures, such as sovereign bond purchases under the

Securities Market Programme (SMP) and the Asset Purchasing Programme (APP), the announcement of the Outright Monetary Transaction (OMT) Programme, as well as several long-term refinancing operations (LTROs) with extended maturities, full allotment, and reduced collateral requirements. We use Jordà's (2005) local projection method to analyze the reaction of house prices, mortgage loans and mortgage lending rates to surprises in monetary policy that can be related to unconventional measures. We refer to the shock series of Leombroni et al. (2021), Jarocinski and Karadi (2020), and Kerssenfischer (2019) to identify monetary policy innovations. Since our sample is short we adopt panel techniques.

The ECB's unconventional monetary policy was quite effective in stimulating the economy at the zero lower bound (Boeckx et al., 2017; Dell'Ariccia et al., 2018). However, our analysis suggests that this policy also contributed to a surge in house prices. In particular, we find that real house prices across euro area countries rise after expansionary shocks to monetary policy. The increase is observable in both the core countries including Ireland and the Mediterranean countries. Moreover, in the core countries, we find that lending for house purchases increases relative to nominal output. The latter indicates that household debt rises.

Our analysis is related to a number of studies that explore the effect of monetary policy on house prices. For instance, Iacoviello (2005), Del Negro and Otrok (2007), Goodhart and Hofmann (2008), Musso et al. (2011), Calza et al. (2013), and Jordà et al. (2015) report for several OECD countries that conventional monetary policy causes house prices to rise by lowering the short-term interest rates, which induces a decline in mortgage lending rates. Surging house prices along with a rise in household debt heighten the risk of a financial crisis (Jordà et al., 2015; Mian and Sufi, 2018). Moreover, recent studies analyze the impact of unconventional monetary policy measures. Rahal (2016), Huber and Punzi (2020), and Rosenberg (2019) focus on a number of advanced economies, including the euro area as a whole. They find that house prices increase after accommodative monetary policy shocks in the form of innovations in central bank total assets or the shadow short-rate. We contribute to these studies in two ways. First, we use a panel of euro area countries that allows us to distinguish between country groups. Second, we identify unconventional monetary policy surprises using shocks series that are derived from high frequency data.

The remainder of this paper is organized as follows. Section 2 presents our baseline model, introduces the data, and discusses the shock series that we take from the literature to identify exogenous monetary policy surprises. In Section 3, we present our results. Section 4 concludes.

2 Methodology, data and monetary policy shocks

2.1 Baseline model

We use Jordà's (2005) local projection method for estimating impulse responses. The linear model is given by:

$$X_{i,t+h} = \alpha_{i,h} + \theta_h \text{MP}_t + \phi_h'(L) Z_{i,t-1} + u_{i,t+h} \tag{1}$$

where $X_{i,t+h}$ is the variable of interest, subindex i denotes the country, MP_t is an exogenous monetary policy shock, $\alpha_{i,h}$ captures country-specific fixed effects, $Z_{i,t-1}$ is a vector of control variables, $\phi_h(L)$ is a polynomial in the lag operator and $u_{i,t+h}$ denotes an error term. First, the variable of interest is the log of the real house price.[1] The vector of control variables includes lags of the real house price in logs, the log of residential investment, the mortgage lending rate and the shadow short-rate, which serves as a proxy for the stance of monetary policy. Moreover, as additional variables of interest, we use the nominal house price index relative to the index of nominal output per capita, the outstanding volume of domestic mortgage loans relative to nominal output and the mortgage lending rate. In these cases, the vector of control variables includes lags of these variables, lags of residential investment relative to nominal output and the shadow short-rate.[2] All models are estimated with a lag length of two.[3]

The response of X at time $t+h$ to a monetary policy shock at time t is given by the estimated coefficient θ_h. Thus, the impulse responses are derived by estimating a series of single regressions for each horizon $h = 0, 1, 2, 3...H$ to generate a sequence of the θ_h's. We use the method of Driscoll and Kraay (1998) to obtain heteroskedasticity-consistent standard errors that are robust to very general forms of spatial and temporal correlations. We set the maximum autocorrelation lag to $H+1$.

2.2 Data and exogenous monetary policy surprises

Since the sample is short, we use panel data (Jordà et al., 2015). Our set of countries comprises Austria, Germany, Spain, Finland, France, Ireland, Italy, the Netherlands, and Portugal.[4] The data are taken from the ECB, Eurostat and the Bank of In-

[1] We calculate real house prices by deflating the index of nominal house prices with the GDP deflator.

[2] For the mortgage lending rate, we also considered a model in which lags of the government bond rate are additionally included. Since the mortgage lending rate covers all maturities, we use a yield on sovereign bonds with a 10 years maturity. The estimation results were similar.

[3] Note that we checked the robustness of our results by also considering higher lag orders.

[4] We exclude Belgium due to a lack of residential investment data. Moreover, we exclude Greece because it obtained external finance through financial aid programs from May 2010 onwards.

ternational Settlements, and collected on a quarterly basis covering the period from 2010Q1 to 2019Q3.[5] The shadow short-rate is taken from Krippner (2013). Furthermore, we consider exogenous monetary policy surprises. We refer to Leombroni et al. (2021), who identify pure risk premium shocks of monetary policy communication that summarizes information on new policies, such as asset purchases, liquidity supports, or lending and refinancing operations. Additionally, we refer to Jarocinski and Karadi (2020) and Kerssenfischer (2019), who derive pure monetary policy shocks. All shocks series are extracted from the information contained in high frequency data. Table 1 summarizes the periods over which the shock series are available. We

Table 1: Shock series periods

Leombroni et al. (2021)	2010Q1-2019Q4
Kerssenfischer (2019)	2010Q1-2018Q4
Jarocinski and Karadi (2020)	2010Q1-2016Q4

standardize the shock series to have a mean of zero and a standard deviation of one. Moreover, we normalize the shocks so that they reflect a monetary loosening.

3 Empirical results

3.1 Baseline model impulse responses

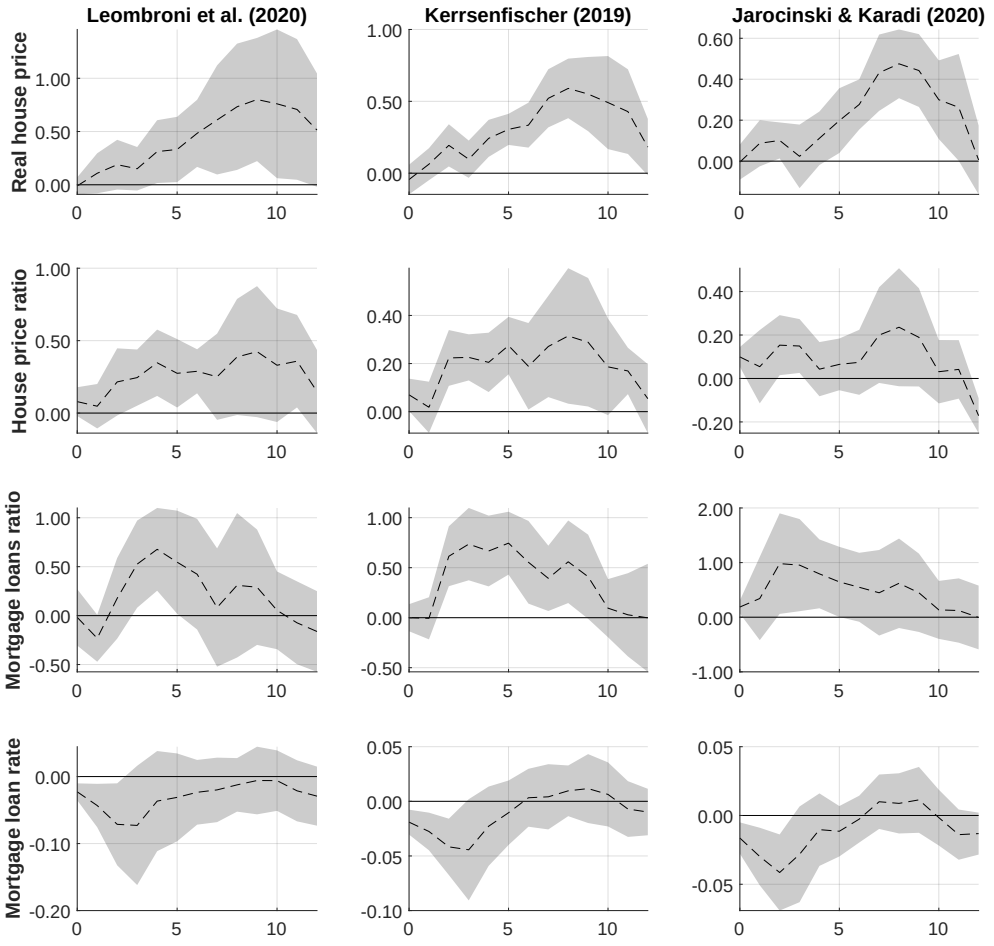
Figure 1 shows the reaction of the variables of interest to the exogenous standardized monetary policy shocks. The dashed lines are the estimated impulse responses. The shaded areas reflect the 90% error bands.

We observe that the reaction of the variables to the monetary policy shocks derived from Leombroni et al. (2021), Jarocinski and Karadi (2020), and Kerssenfischer (2019) are comparatively similar. Real house prices rise after an unexpected monetary policy loosening. The average peak response is 0.6%. The nominal house price ratio, i.e. the index of nominal house prices relative to the index of nominal output per capita, also increases. Accordingly, movements in nominal house prices and average nominal income deviate from each other temporarily after the shocks. Moreover, the mortgage loan ratio rises, i.e. the volume of domestic mortgage loans increases relative to nominal output, which suggests that household debt expands. The mortgage lending rate declines temporarily.

External financing through capital markets did not occur, while at the same time sovereign bond rates increased tremendously. In addition, Greek government bonds were ineligible for the APP over the entire net asset purchase phase.

[5] See the Appendix for a description of the data.

Figure 1: Baseline model impulse responses to monetary policy shocks

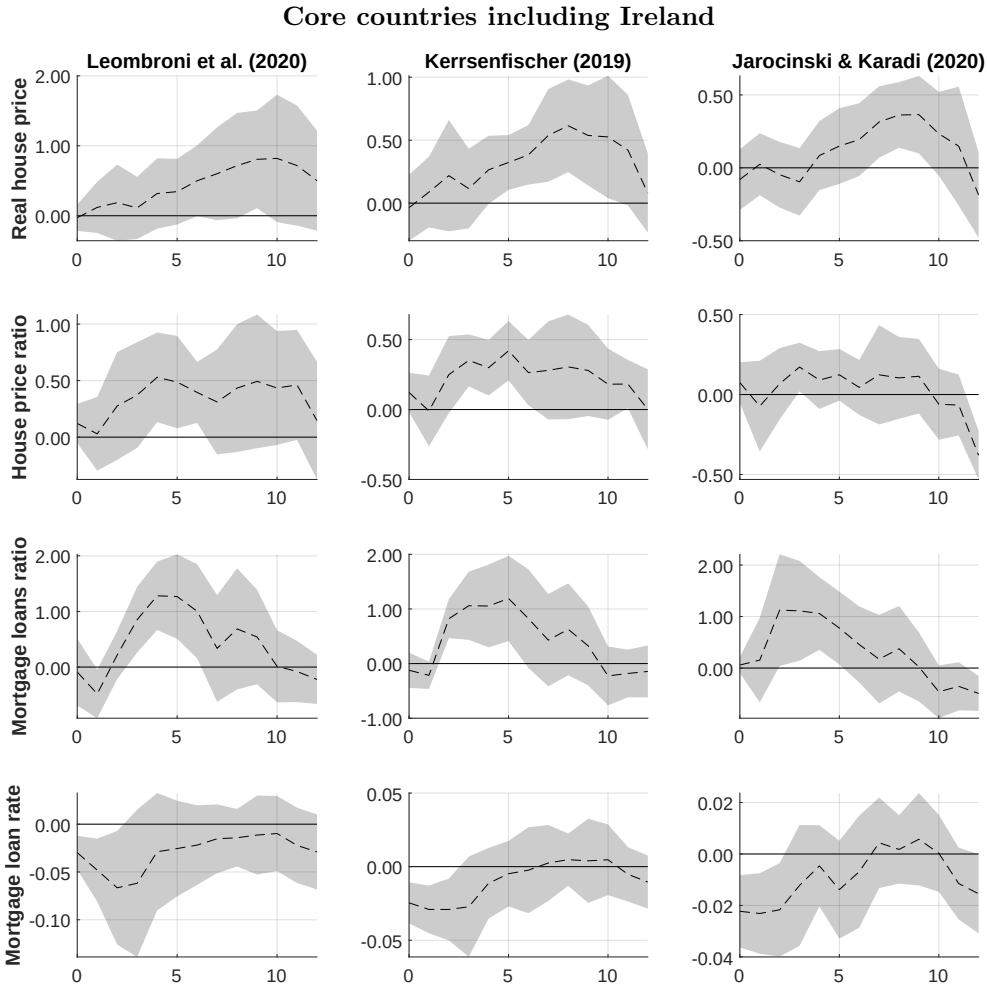


Notes: Impulse responses to monetary policy shocks that reflect a monetary loosening. The dashed lines display the estimated impulse responses to one standard deviation shocks. The shaded areas reflect the 90% error band. The variations in the log of the real house price are expressed in percent. The variations in all other variables are measured in percentage points. See the text for further explanations.

3.2 Country groups

Boeckx et al. (2017) document that euro area countries respond differently to unconventional monetary policy shocks over the period 2007-2014, i.e. output reacts more in countries that have been less affected by the financial crisis. Thus, we proceed by building country groups. We distinguish between the core countries, which include Austria, Germany, the Netherlands, Finland, and additionally Ireland, and the Mediterranean countries that comprise France, Italy, Spain, and Portugal.[6] Figure 2 displays the country groups' impulse responses to expansionary monetary policy innovations.

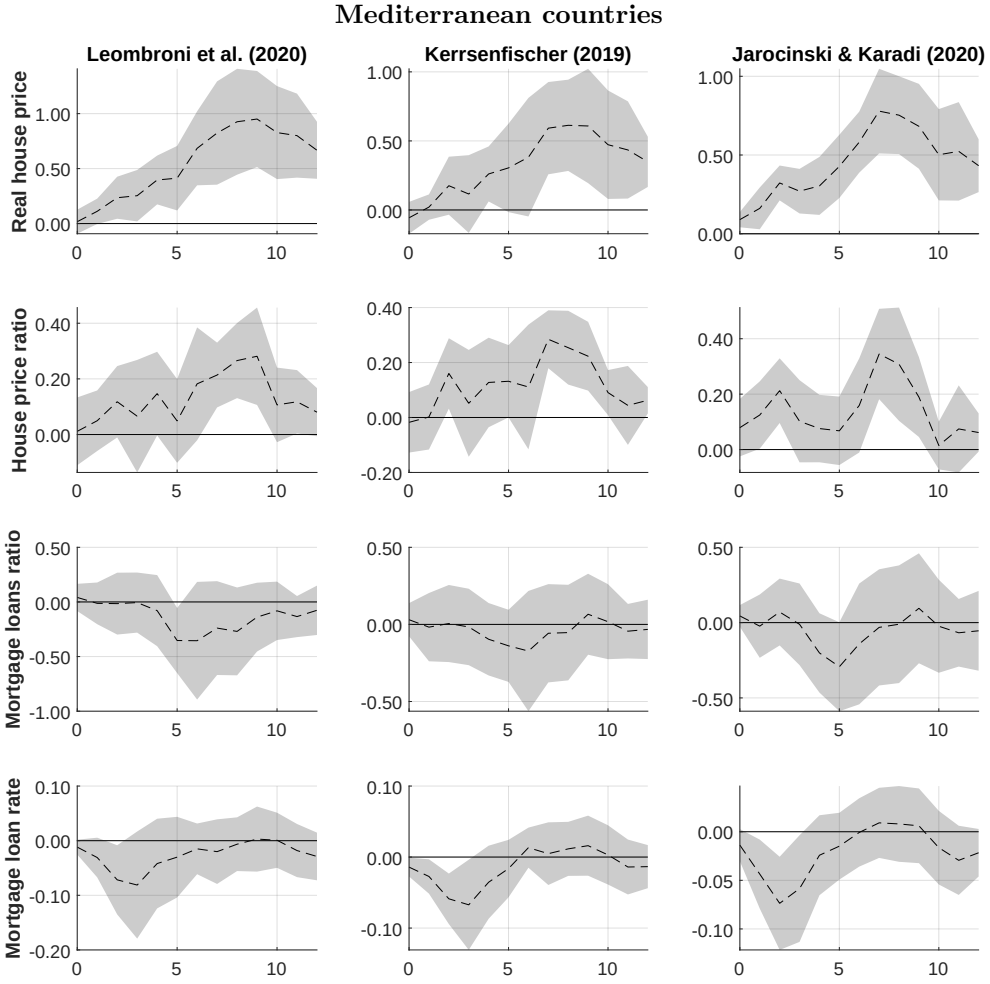
Figure 2: Country groups' impulse responses to monetary policy shocks



Real house prices in both country groups rise in response to the shocks. Moreover, the nominal house price ratios increase. In the core countries, the reaction of

[6] Bräuer and Rünstler (2020) find that the euro area is characterized by regional disparities in the evolution of house price cycles. In particular, differences between the core countries and the Mediterranean countries can be observed.

Fig. 2 continued



Notes: See Figure 1 for explanations.

the ratio seems somewhat more pronounced. Additionally, we observe that in the core countries, the mortgage loan ratio rises. The latter indicates that household debt increases significantly after an unexpected monetary loosening. In the Mediterranean countries, by contrast, a rise in household debt cannot be observed, i.e. the response of the ratio between the volume of loans for house purchases and nominal output is insignificant. Finally, the drop in the mortgage lending rates across the country groups seems qualitatively similar.

4 Conclusion

The ECB's unconventional monetary policy was quite effective in stimulating economic activity, lowering the risk of deflation and removing risk premia on government bonds. However, our results suggest that this policy also contributed to a surge in house prices. We find that real house prices across euro area countries rise after expansionary shocks to monetary policy that can be related to unconventional interventions. Moreover, nominal house prices increase relative to nominal output per capita. In the core countries including Ireland, we also observe that lending for house purchases increases relative to nominal output. Thus, household debt rises, which may increase financial stress.

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Appendix

A Data

Bank of International Settlements:

- Nominal house prices, index 2010=100
  `Q:XX:N:628`

Eurostat:

- Gross domestic product at market prices: current prices, million euro
  Seasonally and calendar adjusted data
- Gross domestic product at market prices: current prices, euro per capita
  Unadjusted data (i.e. neither seasonally adjusted nor calendar adjusted data)
- Gross fixed capital formation, dwellings, current prices, million euro
  Seasonally and calendar adjusted data

ECB Statistical Data Warehouse:

- Volume of domestic mortgage loans: outstanding amounts, end of period
  `BSI.M.XX.N.A.A22.A.1.U6.2250.Z01.E`
  Quarterly data is derived by using end-of-month observations
- Domestic mortgage lending rate, new business, all maturities
  `MIR.M.XX.B.A2C.A.R.A.2250.EUR.N`
  Quarterly data is derived by calculating monthly averages

In the series' codes, XX is a placeholder for the countries' acronyms: Austria (AT), Germany (DE), Spain (ES), Finland (FI), France (FR), Ireland (IR), Italy (IT), the Netherlands (NL), and Portugal (PT). Non-seasonally adjusted data is seasonally adjusted by means of the IRIS Macroeconomic Modeling Toolbox.

Shadow short-rate:

- Leo Krippner's shadow short-rate is obtained from: `https://www.ljkmfa.com/`.

Monetary policy shock series:

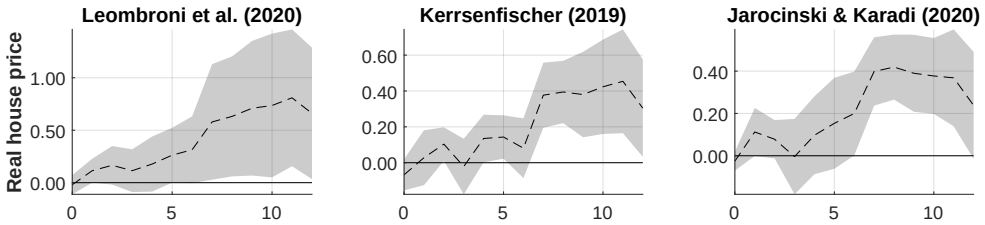
- Leombroni et al. (2021):
  https://sites.google.com/site/gyuriventer/
- Jarocinski and Karadi (2020):
  https://www.aeaweb.org/articles?id=10.1257/mac.20180090
- Kerssenfischer (2019):
  https://sites.google.com/site/markkerssenfischer.

Quarterly shock series are calculated by means of the sum over the respective months.

B Additional Figures

B.1 Real house prices deflated by HCPI

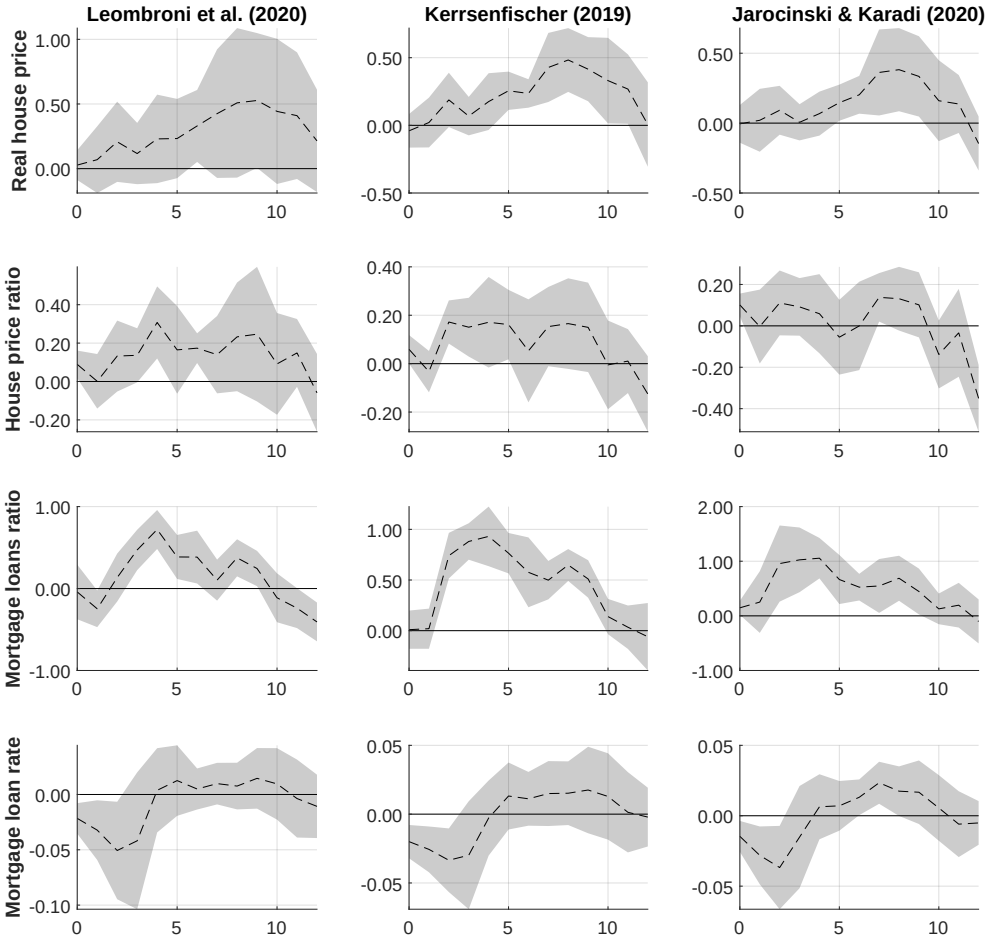
Figure 3: Reaction of real house prices to exogenous monetary policy shocks



Notes: Impulse responses to exogenous standardized monetary policy shocks that reflect a monetary loosening. Real house prices are taken from the Bank of International Settlements and are calculated by using the harmonized consumer price index. All models are estimated with a lag order of two. The dashed lines are the estimated impulse responses. The shaded areas reflect the 90% error band. Variations in the log of the real house price are expressed in percent.

B.2 Higher lag order

Figure 4: Baseline model impulse responses to monetary policy shocks



Notes: Impulse responses to exogenous standardized monetary policy shocks that reflect a monetary loosening. All models are estimated with a lag order of four. The dashed lines are the estimated impulse responses. The shaded areas reflect the 90% error band. The variations in the log of the real house price are expressed in percent. The variations in all other variables are in percentage points. See the text for further explanations.