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The bank lending channel of monetary policy transmission in South Africa

Ekaterina Pirozhkova* and Nicola Viegi†

Abstract

This paper studies the bank lending channel of monetary policy transmission in South Africa where the bank loan-level data, which are typically used for this type of analysis, are unavailable. Supply-side changes in credit provision are measured with data on the composition of home-loan supply by banks versus nonbanks. High-frequency surprises in forward rate agreements are used to instrument for exogenous shifts in monetary policy in a proxy-structural vector autoregression model. The bank lending channel is found to be operative, as banks reduce the supply of home loans following monetary tightening, with a negative effect on the housing market. The effectiveness of the deposits channel is shown: banks widen the deposit spread after monetary tightening, and the volume of deposits shrinks. As retail deposits provide a unique, stable source of funding for banks, the deposits channel underlies the operativeness of the bank lending channel in South Africa, consistent with theory.

JEL classification

E52, G21, G23

Keywords

Monetary policy transmission, bank lending channel, credit channel, nonbank financial institutions, housing finance

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1. Introduction

Since seminal papers by Bernanke and Blinder (1988, 1992), the credit channel of monetary policy transmission has received considerable attention in the literature. The idea of the 'broad' credit channel is that monetary policy can have real effects via induced changes in credit availability independent from variations in the cost of capital and/or income. In turn, the bank lending channel – the 'narrow' credit channel – works through the supply side of credit provision driven by shifts in monetary policy.[1] The bank lending channel has received renewed attention in the aftermath of the global financial crisis (GFC), with a call to devise a modelling framework of financial intermediaries that better conforms to reality (Woodford 2010).

This paper provides empirical evidence that the bank lending channel of monetary policy transmission in South Africa is operative. By using high-frequency identification of monetary policy shocks, we first show that the macroeconomic effects of monetary tightening are contractionary and that bank deposits fall consistent with the deposits channel. Second, we demonstrate that the broad credit channel in South Africa is effective, as shifts in monetary policy induce significant changes in bank loan issuance and lending rates. Third, our results suggest that the composition of home-loan supply is non-neutral to exogenous changes in monetary policy: contractionary policy shocks induce a shift away from bank lending by increasing the share of home loans issued by nonbanks. Fourth, we show that changes in the composition of home-loan supply have real implications by inducing shifts in the housing market. Fifth, we demonstrate that this latter effect is heterogeneous and is stronger for housing market segments with smaller-size properties. The paper thus shows that the appropriate macroeconomic policy modelling framework in the South African context must include the banking sector, with the balance sheet variables subject to the deposits and bank lending channels of monetary policy transmission.

Analysis of the bank lending channel in South Africa is motivated by the need to provide empirical evidence on this channel's operativeness to underpin the macroeconomic

[1] See, among others, Kashyap, Stein and Wilcox (1993), Stein and Kashyap (2000), Gambacorta and Marques-Ibanez (2011) and Jiménez et al. (2014).

policy modelling framework. Given recent advances in estimation methods and in approaches to identifying monetary policy shocks, there is scope to refine the existing empirical evidence on this topic. Furthermore, evidence on this channel's effectiveness in emerging economies is still limited.

In this context, the objective of this paper is to establish whether the bank lending channel in South Africa is operative. This question is especially pertinent given that the required reserves mechanism suggested as underlying the bank lending channel (Bernanke and Blinder 1988) has been found to be quantitatively implausible.[2] Instead, the deposits channel has come to be viewed as providing a theoretical ground for how monetary policy affects banks' funding and supply of lending (Drechsler, Savov and Schnabl 2017). Theory suggests that a rise in the short-term interest rate makes cash more costly to hold, thereby increasing the market power of banks as deposit providers. Banks thus widen deposit spreads, triggering the outflow of deposits from the banking sector, which results in shrinking banks' balance sheets and reducing banks' issuance of loans. We identify the banking sector's role in monetary policy transmission against this theoretical background, providing an empirical foundation for financial intermediaries' modelling, which can then inform the country's macroeconomic policy framework in South Africa.

The use of a unique dataset containing information on loans provided by nonbank credit issuers allows us to identify the credit supply-side effects and ensures the originality of the work. Bank and nonbank credit providers both have home loans on the asset side of their balance sheets, but how they fund their lending operations differs. While banks rely mainly on retail deposits, nonbanks use wholesale funding by issuing debt securities and taking out loans. Crucially, these funding sources have different exposure to monetary policy, resulting in different patterns of loan provision by banks versus nonbanks after policy shifts. Analysing the variable composition of loan supply by different types of credit providers in response to monetary policy shocks thus allows us to understand the specific features of bank credit-supply dynamics.

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[2] The size of required reserves is found to be too small to bring about significant effects on banks' balance sheets (see Romer and Romer (1990), Bernanke and Gertler (1995) and Woodford (2010)).

High-frequency surprises in asset prices are used to instrument for exogenous changes in monetary policy. Following Kuttner (2001) and Gürkaynak et al. (2005), we use surprises in the interest rate derivatives – forward rate agreements (FRAs) on the short-term rate – around policy announcements to measure monetary news. The depth and liquidity of financial markets in South Africa ensure that the interest rate derivatives' market data are informative about market expectations of central bank policy. As suggested by Gertler and Karadi (2015), surprise changes in FRAs provide a direct measure of structural disturbance and are used as an instrument for monetary shocks in a proxy-structural vector autoregression (SVAR) (Stock and Watson 2012; Mertens and Ravn 2013).

This paper's focus on housing loans is motivated by the important role that the housing market and housing finance play in monetary policy transmission. Collateral and wealth effects of house prices result in spillovers from the housing market to consumer spending and households' borrowing capacity (Iacoviello and Neri 2010). On the credit-supply side, banks' willingness to lend is affected by house prices, as the latter determine collateral values. Jordà, Schularick and Taylor (2020) document that the growth of mortgage credit amplifies monetary restraint, while Calza, Monacelli and Stracca (2013) demonstrate that monetary policy is more powerful when mortgages are of a variable-rate type.[3] Notably, it has been argued that the housing market is particularly exposed to the credit channel and is therefore better suited than the broader economy to capture the presence of this channel. Specifically, the relative illiquidity of mortgages might cause banks to reallocate their asset portfolios and reduce the share of home loans on their balance sheets in anticipation of negative liquidity shocks (Iacoviello and Minetti 2008).[4] There are also country-specific reasons to examine housing loans. Mortgage loans take the biggest share – up to 35% – in the asset portfolios of South African banks, so it is essential to establish the presence and nature of credit-channel transmission for this type of credit to understand the macro-

[3] Home loans with a variable rate strongly dominate the South African housing finance market.

[4] Consequently, realistic features of the housing market are being incorporated into quantitative macroeconomic models used for monetary policy analysis (see, among others, Justiniano, Primiceri and Tambalotti (2015), Guerrieri and Iacoviello (2017), Garriga, Kydland and Sŭstek (2017) and Bluwstein et al. (2020)).

financial linkages in the country. Furthermore, the banking sector's dominance as a home-loan provider in South Africa means that limited credit supply in this market could significantly affect house purchases.

Our contribution is to document a significant shift in the composition of home-loan supply following changes in monetary policy: the share of bank home loans falls, while the share of mortgages issued by nonbanks increases. Banks are found to increase their deposit spread, and the level of deposits falls, which underlies the subdued issuance of loans by banks and provides evidence of the deposits channel of monetary policy transmission. This finding is particularly relevant to the highly concentrated South African banking sector, as policy rate hikes increase the market power of banks, enabling them to raise deposit spreads to maximise profits (Drechsler, Savov and Schnabl 2017).

With respect to existing literature, our study uses recent methodological advancements for the VAR model estimation and a unique, previously unavailable dataset to provide novel empirical results on the effectiveness of the bank lending and deposits channels of monetary policy transmission in South Africa. An important strand of existing literature on the bank lending channel relies on bank loan-level data and/or loan-application data to identify the channel's effects, which allows one to control for credit-demand effects by making use of multiple lending relationships of borrowers.[5] Data of this level of disaggregation are currently not available for South Africa, however, so this approach cannot be used in our context.

While we follow the existing method adopted by Iacoviello and Minetti (2008) and Ludvigson (1998) of using the composition of home-loan supply to control for credit supply-side effects, we extend their analysis by providing evidence of the effectiveness of the deposits channel that underlies the bank lending channel operativeness.

The broad credit channel in South Africa has also been analysed in Ludi and Ground (2006), Gumata, Kabundi and Ndou (2013) and Loate and Viegi (2021), but none of

[5] See, among others, Stein and Kashyap (2000), Khwaja and Mian (2008), Altunbas, Gambacorta and Marques-Ibanez (2010), Jiménez et al. (2012) and Abuka et al. (2019).

these studies uses the high-frequency identification of monetary policy shocks. Compared to other identification methods, high-frequency identification allows the most precise and non-controversial estimation and interpretation of results produced by structural VAR models. In their empirical study, Loate and Viegi (2021) disentangle the effects of the bank lending and balance sheet channels, using an alternative approach to identify credit supply-side effects by controlling for differences in the structure of liabilities between big and small banks. Our study complements their results. Finally, to the best of our knowledge, our paper is the first to provide empirical evidence that corroborates the existence of the deposits channel of monetary policy transmission in South Africa.

The paper is organised as follows. Section 2 provides contextual background on housing finance in South Africa. Section 3 discusses the data and empirical methodology, while section 4 provides a discussion of the results. Section 5 concludes.

2. Housing finance in South Africa

To provide context for our analysis, in this section we discuss the institutional features of the housing finance market and give further details of bank and nonbank credit providers in South Africa.[6]

2.1 Housing finance market

The housing finance market in South Africa is regulated by the National Credit Act (South Africa 2005) and is highly standardised. Regardless of type (bank or nonbank), a mortgage provider must engage in a standardised process of bond issuance that is registered by the National Deeds Registry of South Africa. The high degree of mortgage standardisation reduces the exposure of credit providers to liquidity risk and weakens the incentive to shift away to more liquid assets, potentially decreasing liquidity shock buffers (Iacoviello and Minetti 2008). In the context of the bank lending channel, the high degree of mortgage issuance standardisation contributes to the

[6] We exclude the category of microloans in our analysis. This is because microloans, introduced as part of the 1994 Housing White Paper solutions and 2004 Financial Sector charter, are a financial product aimed at credit mobilisation and housing environment stabilisation for low-income population groups. Microloans are unsecured, short term and small, which significantly differentiates them from the typical long-term secured mortgages we focus on.

stability of the share of home loans on the balance sheets of mortgage providers and reduces the sensitivity of this share to liquidity shocks.

Banks dominate the market for home loans in South Africa: their share of home-loan issuance has consistently exceeded 90% since 2004 (Figure 1). The share of banks providing mortgages fell temporarily in 2011, when new mortgage issuance by banks decreased as nonbank issuance showed a positive growth rate (Figure 2). Borrower and lender caution restrained credit extension in early 2011, notwithstanding the low interest rate environment (South African Reserve Bank (SARB) 2011).[7] Bank mortgage issuance has been low since 2011 and has not reached pre-2011 levels. The growth trend of new mortgage provision – negative in 2007–2008 and positive in 2013–2018 – generally coincides for banks and nonbanks (Figure 2), reflecting their common exposure to changes in demand for housing finance.

Figure 1: The MIX – share of nonbanks in issuance of new home loans

Source: SARB, National Deeds Registry of South Africa

[7] Banks may have adopted a more cautious approach to the announcement of regulatory changes for the banking sector. In particular, the SARB issued circular 3/2010 in October 2010, endorsing and giving notice to banks to prepare for the implementation of Basel 2.5. In December 2010, the Basel III framework was published, introducing the liquidity coverage ratio and the net stable funding ratio (Bank for International Settlements (BIS) 2010). While the Basel III framework was scheduled to be introduced between 2013 and 2015, the earlier announcement of planned changes may have contributed to a change in banks' perception of risk and asset portfolios in 2010. The requirements of Basel III are shown to have induced a shift in bank assets, from long- to shorter-term loans, concurrently with the increase in the volume of liquid assets (Anthonyrajah and Malwandla 2022).

Figure 2: New mortgage loans granted for residential dwellings and flats

Source: SARB, National Deeds Registry of South Africa

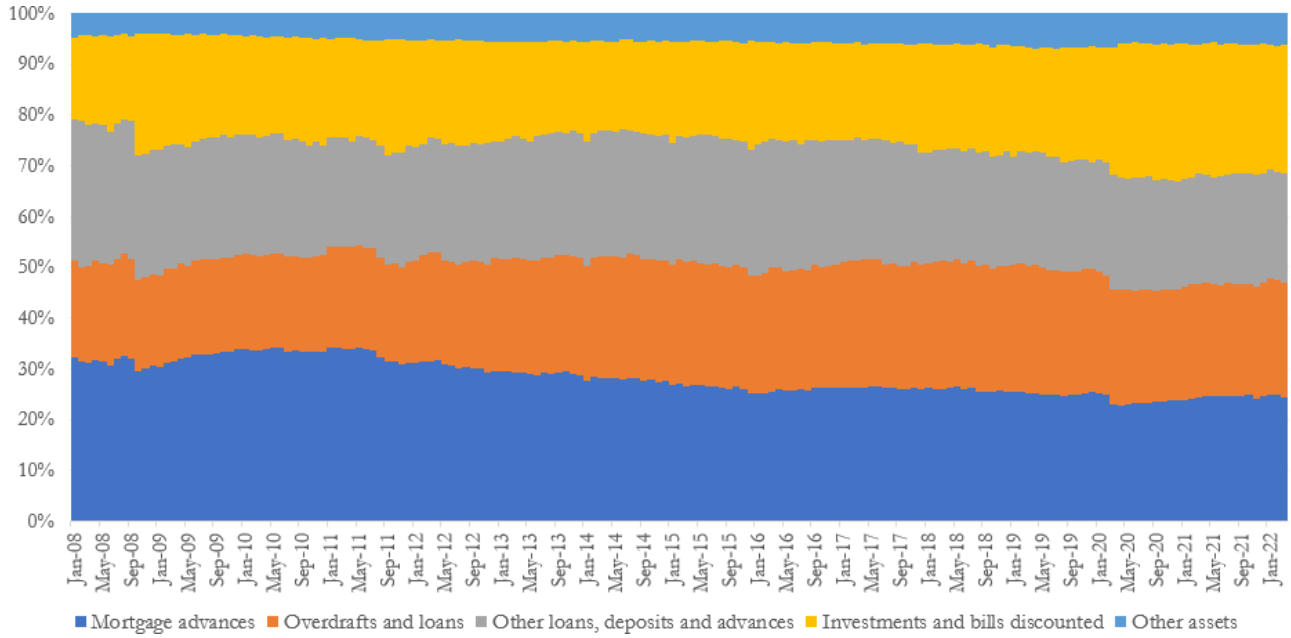
2.2 The banking sector

The banking sector plays an important role in the macroeconomic and financial performance of the South African economy and is characterised by several features.[8] First, South African banks are primarily domestically owned. Second, deposits are by far the most important source of bank liabilities. Third, real estate loans make up the highest share of banks' assets. We discuss the banking sector features in detail below.

Mortgages are the largest loan category on banks' balance sheets in South Africa. Mortgages comprised 31−34% of bank assets in the post-GFC period of 2010–2011, but their importance has gradually fallen to 23−25% in the period after 2020 (Figure 3). They nonetheless represent the most sizeable loan category in banks' asset portfolios during our sample period.

[8] Results of the forecast-error variance decomposition in the VAR model indicate that bank sector shocks explain 15% of error variance in industrial production, 22% in consumer prices, 20% in house prices and 25% in nominal exchange rate at the four-year horizon in South Africa (see Table 2 in Annexure B for details).

Figure 3: Asset structure of banks' balance sheets



Note: 'Mortgage advances' include mortgage loans (KBP1109M); 'Overdrafts and loans' include overdrafts and loans (KBP1122M); 'Other loans, deposits and advances' include all loans apart from mortgages and overdrafts (KBP1124M less KBP1122M less KBP1109M); 'Other assets' include non-financial assets (KBP1130M), central bank money and gold (KBP1104M) and other assets (KBP1131M).

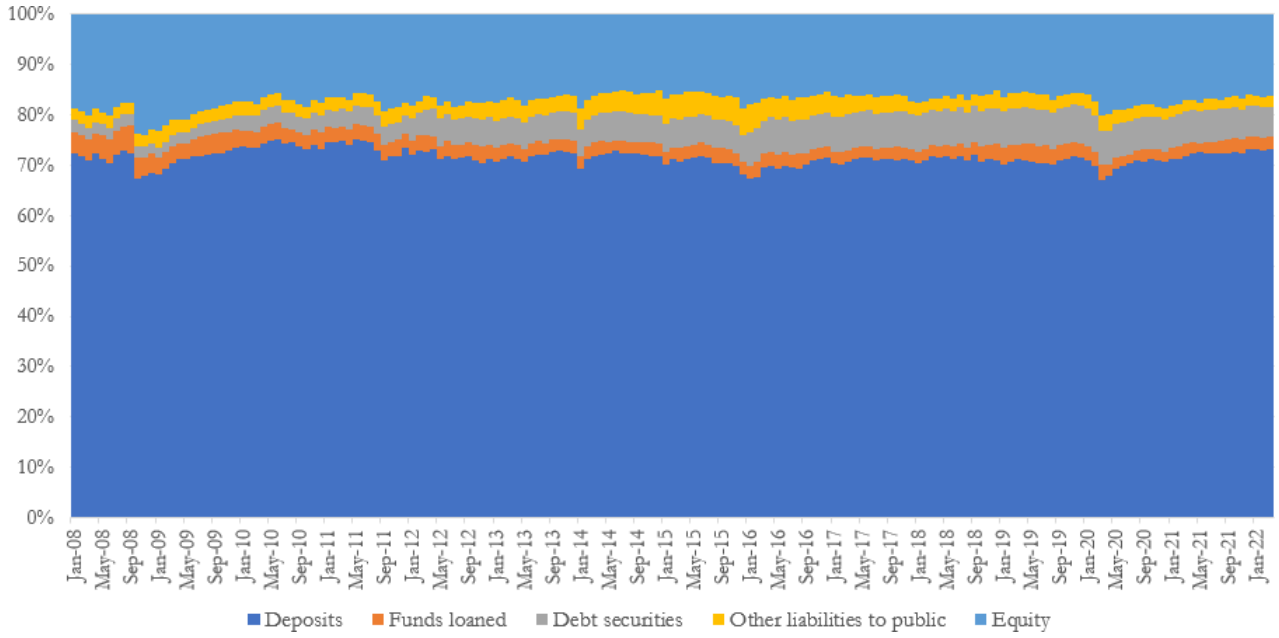
Source: SARB Quarterly Bulletin series, with respective KBP codes from the SARB's Quarterly Bulletins database

On the liabilities side, deposits are the main source of funding for banks. The share of total deposits in banks' total liabilities and equity has consistently exceeded 70% since 2000 (see Figure 4).[9] The role of wholesale funding is small, with debt securities issued by banks representing 5−7% of their liabilities.[10]

9 We plot the bank liabilities structure for the period starting from 2008, as data for the 'Debt securities' category (wholesale funding) is only available from 2008.

10 This can be seen as a moderate level relative to other emerging economies. For example, the share of wholesale funding in Chile ranges from 17–20% of liabilities (Alegría, Cown and García 2018).

Figure 4: Liabilities structure of banks' balance sheets

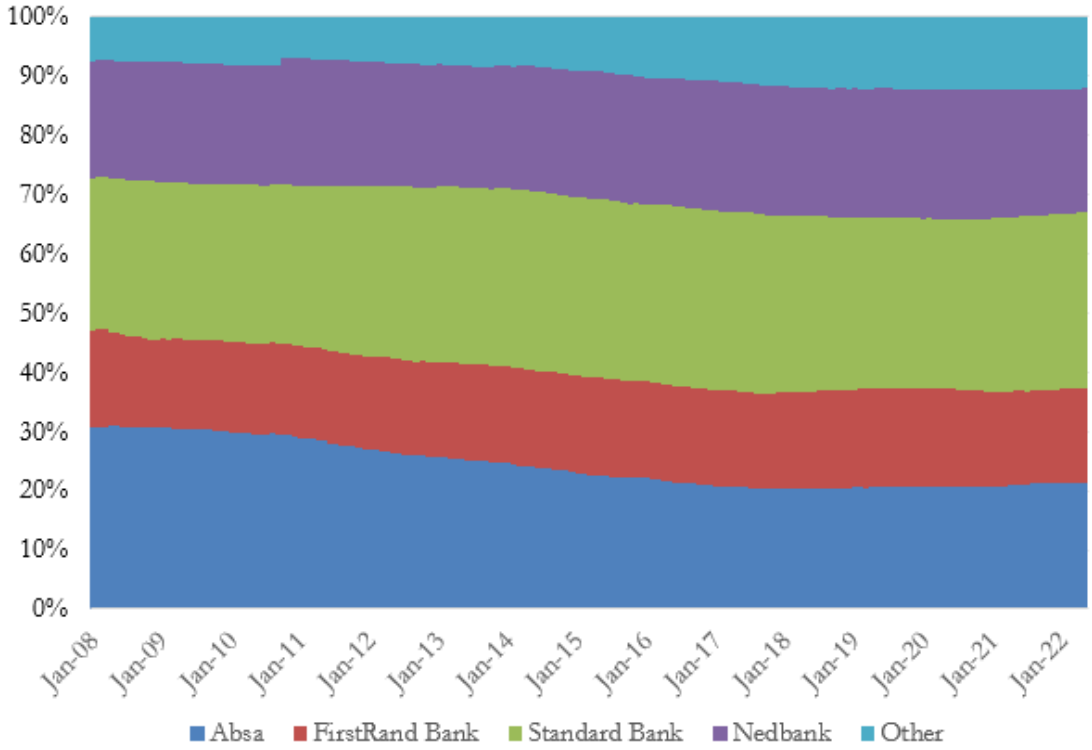


Note: 'Deposits' are total deposits (KBP1077M); 'Funds loaned' include loans received under repurchase agreements from SARB (KBP1500M), other domestic creditors (KBP1501M) and foreign creditors (KBP1514M); 'Debt securities' include debt securities issued by banks (KBP1082M); 'Other liabilities to public' include foreign currency funding from domestic and foreign sectors (KBP1080M and KBP1081M) and other liabilities to public (KBP1083M); 'Equity' includes capital and other liabilities (KBP1089M).

Source: SARB Quarterly Bulletin series with respective KBP codes.

The banking system in South Africa is very concentrated. The share of the four biggest banks in the total volume of mortgage advances has been in the range of 87−93% since 2008 (Figure 5). The share of mortgages issued by the four biggest banks to households has been even higher at 92−97% (Figure 6). The share of the four biggest banks in the deposit market is also high, in the range of 82–85% (Figure 7). Falkena et al. (2004) and Okeahalam (2002) find evidence of a high degree of market concentration, while South African banks' strong market power is documented in Rapapali and Simbanegavi (2020).

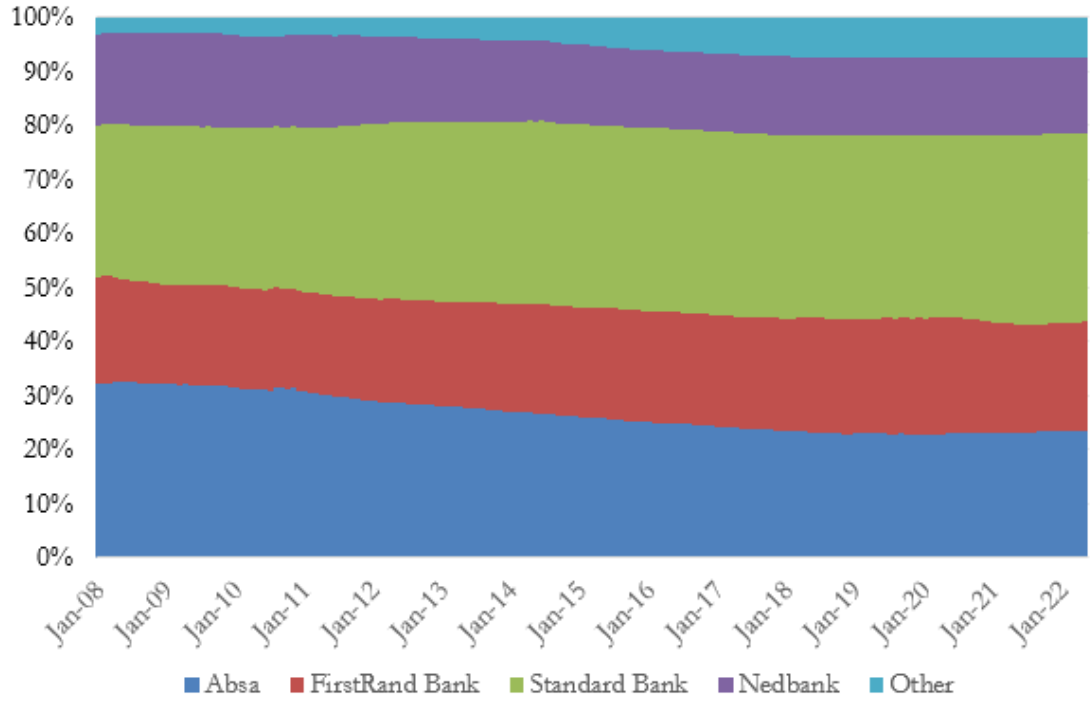
Figure 5: Mortgage advances – bank volumes



Note: 'Mortgage advances' are line 150 series in BA900 forms of respective banks.

Source: SARB

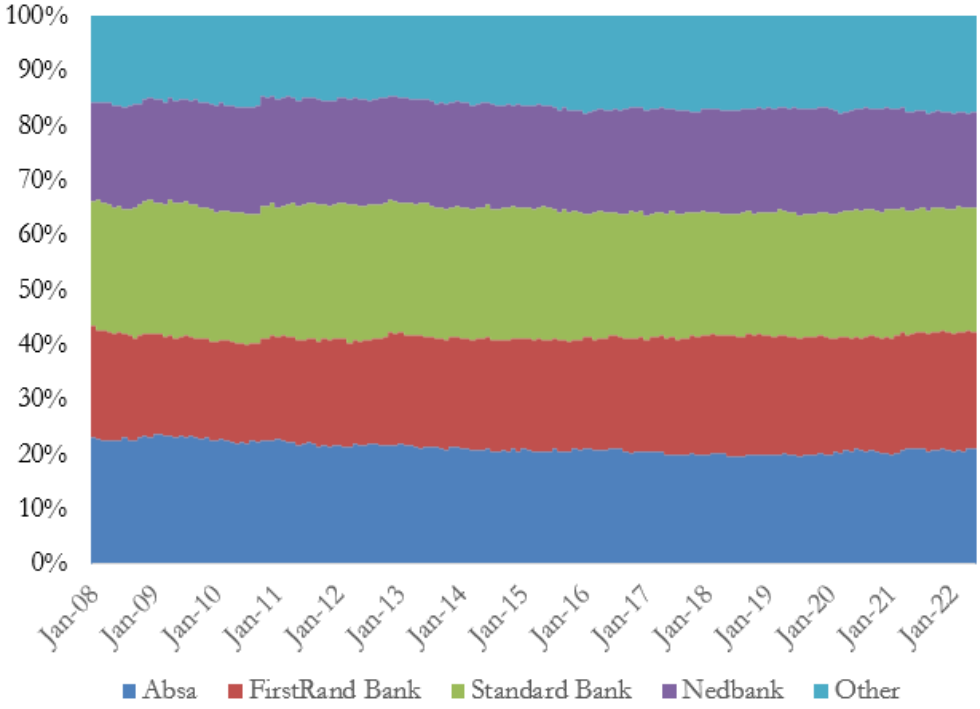
Figure 6: Mortgage advances to household sector – bank volumes



Note: 'Mortgage advances to household sector' are line 157 series in BA900 forms of respective banks.

Source: SARB

Figure 7: Banks' market shares – total deposits



Note: 'Total deposits' is line 1 series in BA900 forms of the respective banks.

Source: SARB

Deposit market concentration is particularly relevant to analysis of the bank lending channel, as it explains why the sensitivity of the deposit spread to interest rate shifts in South Africa translates into the responsiveness of the level of deposits. The latter in turn accounts for changes in banks' liabilities induced by shifts in the policy rate. According to the deposits channel of monetary policy, policy rate hikes increase the market power of banks, enabling them to raise deposit spreads in pursuit of profit maximisation (Drechsler, Savov and Schnabl 2017).[11] The depth and liquidity of the South African financial market give depositors the flexibility to switch between liquidity instruments (BIS 2020) and, in particular, to substitute deposits with bonds in response to shifts in the interest rate, thereby providing the ground for the deposits channel of monetary policy to operate.[12]

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11 As Drechsler, Savov and Schnabl (2017) show, the effect of monetary policy on the supply of bank lending in the economy is explained by the deposits channel. Specifically, an increase in the interest rate makes cash more costly to hold, increasing the market power of banks as deposit providers. Banks widen deposit spreads, triggering an outflow of deposits from the banking sector to bonds and other instruments, resulting in shrinking bank balance sheets and reduced bank-issued loans.

12 The South African bond market is dominated by government debt instruments denominated in domestic currency and is characterised by high turnover (Kapingura and Ikhide 2015). The

Several factors thus underlie the effectiveness of bank lending and deposits channels in South Africa. First is the banks' reliance on deposits as their main source of funding. Second is the high concentration of the banking sector. Third is the developed bond market, ensuring substitutability between liquidity instruments. In section 4, we provide empirical evidence to suggest that the bank lending and deposits channels in South Africa are operative.

2.3 Nonbank credit providers

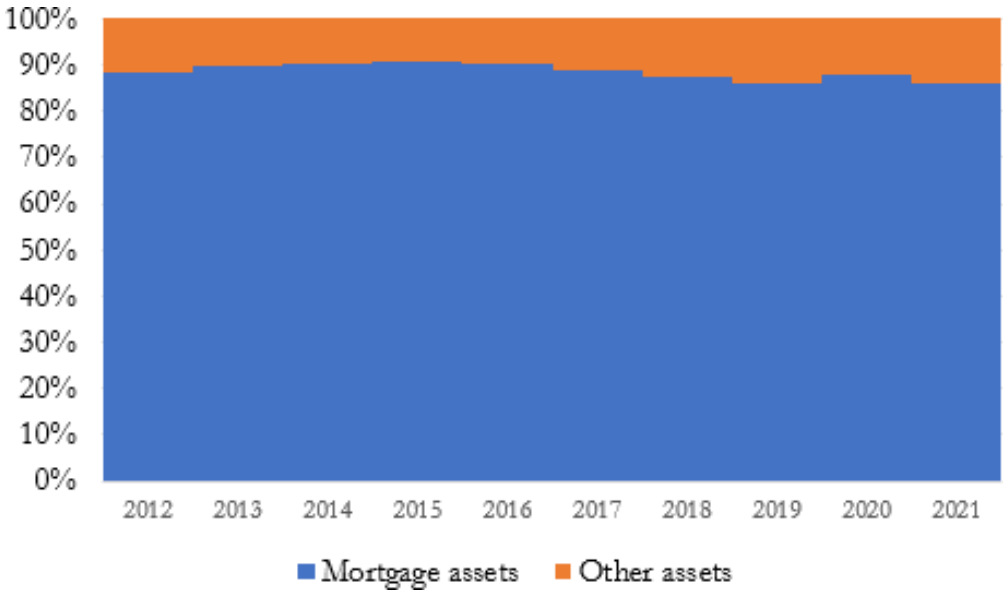
Nonbank credit providers are not required to disclose their financial statements on a regular basis in South Africa, so no aggregate data on the assets and liabilities of nonbanks exist. We thus use discrete data points for the analysis. The nonbank credit sector is dominated by the SA Home Loans Group, which issues 78.65% of home loans to households among all nonbanks.[13] We focus our attention on this credit provider as representing the largest market share. Mortgages is the most sizeable asset on the SA Home Loans' balance sheet (see Figure 8), reflecting its primary importance to the company. The structure of SA Home Loans' funding sources contrasts with that of banks: wholesale funding ranges between 60% and 80% for the former, while loans received make up 10−32% of liabilities, which have been increasing over the last 10 years (see Figure 9).

Since October 2023, the SA Home Loans has been owned by Standard Bank (50% ownership share), the Public Investment Corporation (25%) and the BHC Consortium (25%) reflecting its affiliation with the banking sector.

Johannesburg Stock Exchange Debt Market section operates and regulates the bond market in South Africa (see https://www.jse.co.za/trade/debt-market/bonds).

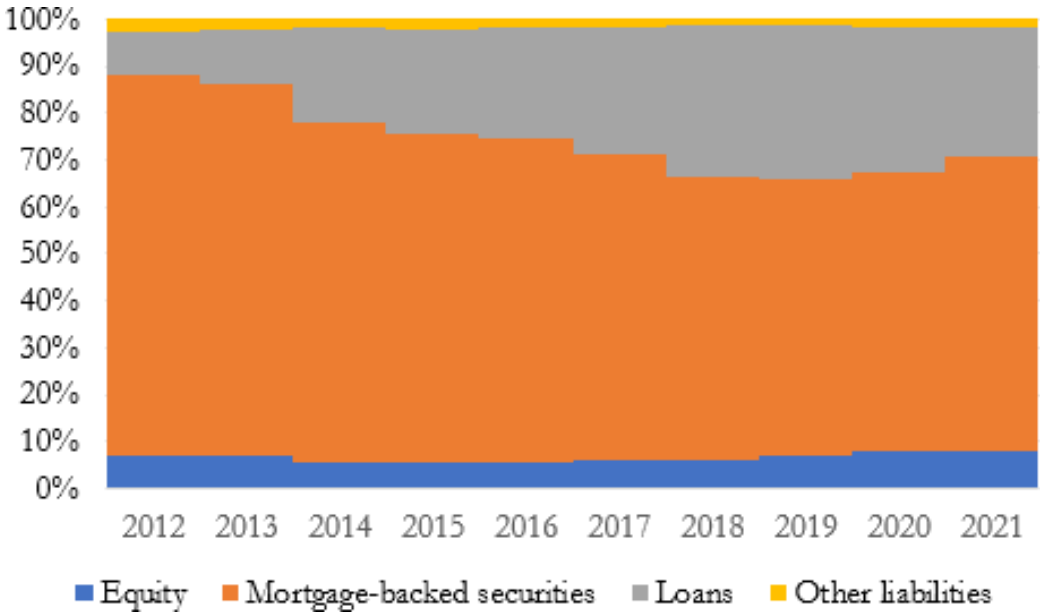
[13] The data are sourced from the National Deeds Registry of South Africa for September 2019.

Figure 8: South African home loans – assets



Source: SA Home Loans website (https://www.sahome loans.com/). Data available at annual frequency.

Figure 9: South African home loans – liabilities



Source: SA Home Loans website (https://www.sahome loans.com/). Data available at annual frequency.

3. Empirical methodology and data

Extracting the dynamic causal relationships from the aggregated data for the bank lending channel of monetary policy analysis is challenging without bank loan-level data. Our approach combines three components: the use of data on nonbank credit provision (sections 3.1 and 3.4), high-frequency identification of monetary policy shocks (section 3.2) and Bayesian estimation of VAR models to handle large datasets (section 3.3).

3.1 Identifying loan-supply effects

To isolate the effect of the bank lending channel, we use data on mortgage loans issued by banks and nonbank credit institutions.[14] While banks and nonbanks have common exposure to the demand-side effects of unexpected shifts in monetary policy associated with households' variations in demand for home loans, they fund their lending activity differently. Banks rely mainly on reservable retail deposits, while nonbanks use wholesale market instruments – debt securities and loans (see sections 2.2 and 2.3). The different sensitivities of bank and nonbank sources of funding to unexpected shifts in monetary policy make it possible to identify the bank lending channel of monetary policy transmission.

The drop in banks issuing home loans in response to monetary contractions shows that banks' shrinking funding sources constrain their loan provision by more than is the case for nonbanks – and thus that the bank lending channel of monetary policy is operative. The bank lending channel can be seen as effective when changes in the bank loan supply brought about by monetary policy shifts induce real effects in the economy.

Detecting the operativeness of the bank lending channel involves two steps. First, it requires testing whether the composition of the supply of home loans is affected by monetary policy shocks. In our context, we aim to detect if exogenous changes in monetary policy have a significant effect on the composition of home-loan supply or the MIX variable. Second, we test whether variations in the composition of the home-loan supply induced by monetary policy shifts have implications for the housing market

[14] This approach to identifying the bank lending channel was introduced in Kashyap, Stein and Wilcox (1993) and is employed in Ludvigson (1998) and Iacoviello and Minetti (2008).

– if so, the bank lending channel is viewed as operative (Ludvigson 1998; Iacoviello and Minetti 2008).

We identify unexpected shifts in monetary policy to evaluate the direct causal effect of interest rate hikes on mortgage provision. Drechsler et al. (2017) address the issue of causal-effect identification by using the cross-sectional data, exploiting geographic variation in the market power of banks induced by differences in the concentration of local deposit markets. In the absence of cross-section data in the South African context, we identify exogenous monetary policy shifts to establish causality. We adopt the definition of monetary policy shocks suggested by Miranda-Agrippino and Ricco (2021) – specifically that monetary policy shocks are exogenous shifts in the policy instrument that surprise market participants, are unforecastable and are not due to the central bank's systematic response to its own assessment of the macroeconomic outlook.

Following Iacoviello and Minetti (2008), we construct the so-called MIX variable to measure the share of nonbank credit in the overall supply of home loans, thereby reflecting the composition of credit supply:

$$\mathrm{MIX}_t = \frac{\mathrm{NonbankLoans}_t}{\mathrm{BankLoans}_t + \mathrm{NonbankLoans}_t} * 100\% \qquad (1)$$

where $\mathrm{NonbankLoans}_t$ is the value of home loans issued by nonbanks in period *t*, and $\mathrm{BankLoans}_t$ is the value of home loans issued by banks in the same period.

The share of nonbank housing loans ranges between 3% and 10% in our sample period, with a mean value of 5.4% (see Figure 1). This share has been moderately stable over time, indicating the relative constancy of the nonbank credit providers' market share and the viability of their business model in the context of the competition for profitable lending opportunities, with the banking sector dominating the market. These aspects indicate the important role of nonbanks as credit providers in South Africa.

3.2 Identification of monetary policy effects

To analyse their transmission and effects, we separate exogenous changes in monetary policy from the systematic response of policy to macroeconomic conditions. We adopt the approach of high-frequency identification of monetary policy shocks that are seen as exogenous shifts in policy unanticipated by market participants (as in Gürkaynak et al. (2005) and Gertler and Karadi (2015)). Following Kuttner (2001) and Gürkaynak et al. (2005), we construct a measure of monetary policy surprises by employing changes in interest rate derivatives' values around monetary policy announcements that take place on the SARB Monetary Policy Committee (MPC) meeting dates. These surprises are used as a measure of monetary news induced by announcements – or, put differently, as a proxy for the market revision of expectations about the short-term interest rate. Following Kuttner (2001), interest rate derivatives are employed to measure market expectations of the central bank policy; forward rate agreement (FRA) values before and after monetary policy announcements are used to calculate monetary policy surprises. In line with Kuttner (2001), FRA value before the announcement is seen as reflecting the market's expectation about the policy rate decision to be made at the upcoming MPC meeting. FRA value after the monetary policy announcement is seen as capturing the reaction of the market to the announcement. The difference between these values reflects the surprise component of monetary policy announcements, or monetary news. We measure monetary policy surprises over a daily window[15] by looking at changes in FRA1x4 values.[16] In

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[15] The use of an intraday window is a convention for the high-frequency identification of monetary policy shocks in the literature, but we do not use it for two reasons. First, high-frequency (minute- or tick-) data are available on Bloomberg (our asset prices data source) starting from 2008 only, so using these data would substantially reduce the size of our sample. Second, the somewhat lower liquidity of the South African secondary market relative to developed financial markets in advanced economies such as the US, UK and the euro area implies that price changes in a tight window do not necessarily reflect the surprise component of market value induced by a policy announcement, as it takes longer for agents to find a counterparty for a deal. This could induce delays for market values to reflect changes in agents' reaction to announcements. We tried different windows – 30 minutes, 1 hour, 1 day, 2 days – and found that using a 1-day window ensured enough time lag for the market to absorb announced MPC policy rate decisions while not allowing other news to affect market prices in a systematic manner.

[16] FRA1x4 is an FRA on the three-month Jibar (interbank) rate with settlement in one month and expiration in four months. This is the FRA with the shortest tenor at the South African market of interest rate derivatives. Given that the SARB makes policy rate decisions once every two months, FRA1x4 incorporates market expectation about a policy rate change to be made at the next MPC meeting.

particular, we take the difference between the closing value of the FRA1x4 on the day of an MPC meeting and its closing value on the previous day. The latter value reflects the market expectation about the policy rate decision to be made at the upcoming MPC meeting, while the former is the FRA1x4 value after the policy rate announcement was made, reflecting the market response to the policy decision.

$$\mathrm{Surp}_{t_{\mathrm{MPC}}} = \mathrm{FRA1x4}_{t_{\mathrm{MPC}}} - \mathrm{FRA1x4}_{t_{\mathrm{MPC}-1}} \qquad (2)$$

where $\mathrm{FRA1x4}_{t_{\mathrm{MPC}}}$ is the closing value of FRA1x4 on the MPC meeting day t_{MPC}. The measure of monetary surprise $\mathrm{Surp}_{t_{\mathrm{MPC}}}$ is used as an external instrument to identify monetary policy shock in a proxy-SVAR/SVAR-IV approach (Stock and Watson 2012; Mertens and Ravn 2013).

3.3 Empirical models

The significance of the effects discussed above is tested using two VAR models, using the Bayesian approach for their estimation. Using surprises in the forward rate agreement FRA1x4 around MPC announcements discussed in section 3.2 as an external instrument for monetary policy shocks, the first model is used to estimate the effect of exogenous shifts in monetary policy and to test whether the broad credit channel is operative. This model includes 12 lags of endogenous variables: the manufacturing production index, the consumer price index (CPI), the three-month Jibar interbank rate, the interest rate spread on long-term deposits, the volume of total bank deposits, the volume of long-term bank deposits, banks' wholesale funding, the volume of mortgages issued by banks, banks' interest rate on mortgage loans, the volume of mortgages issued by nonbanks, the MIX variable (see section 3.1 for details), the aggregate house price index, the JSE stock market index, and the nominal exchange rate of the rand against the US dollar.[17] In addition to macroeconomic variables conventionally accounted for by a monetary VAR, such as the manufacturing production index, the CPI and the short-term interest rate, we also include in the model

[17] We chose to include 12 lags in the VAR because 12 lags at monthly frequency represent one year of data. This choice is conventional in the BVAR literature. Banbura, Giannone and Reichlin (2010) show that due to the combination of the large information set used for estimation and Bayesian shrinkage that controls for overfitting, the BVAR methodology outperforms the standard approach of lag selection that uses information criteria for the medium and large VAR models.

a rich set of bank balance sheet variables that enables us to trace the transmission of monetary policy shocks to banks' balance sheets; this allows us to judge the efficiency of the deposits and the credit channels of monetary policy transmission. The stock market index is included to control for the asset price channel playing an important role in shaping changes in the banks' and borrowers' balance sheet values. By including the nominal exchange rate variable, we take into account the monetary policy effects on inflation, aggregate demand and financial markets that are essential for South Africa as a small open emerging economy.

To address the issue of overfitting associated with using a large number of variables in the VAR, we employ Bayesian shrinkage. As suggested by Banbura et al. (2010), we use dummy observations to implement the natural conjugate Normal-Inverse-Wishart prior[18] and adopt the sum-of-coefficients prior (Doan, Litterman and Sims 1983) to address the issue of unit root in some variables, implementing it by supplying the dummy initial observation. We automatically infer the appropriate amount of shrinkage by selecting the tightness of the prior distribution, using the hierarchical Bayesian VAR (BVAR) approach suggested by Giannone, Lenza and Primiceri (2015). The Gibbs sampler is used to sample from the posterior distribution and to construct confidence bands. To establish the stability of the VAR models, we ensure that posterior estimates of eigenvalues' absolute values of the VAR companion matrices are below unity (Hamilton 1994; Lütkepohl 2005).[19] The monetary policy shock is identified using the external instruments approach (Stock and Watson 2012; Mertens and Ravn 2013). The model is estimated on the sample 2004M5–2019M8,[20] and identification is obtained on the sample that spans the length of the instrument.

The second VAR specification is used to estimate the effect of exogenous changes in the composition of home-loan supply and to test whether the bank lending channel is operative. This VAR model differs from that outlined above in its approach to shock identification and in a set of variables. Theory offers no guidance for identifying a shock

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18 We chose the Normal Inverse Wishart prior because it allows us to relax the assumption of fixed covariance matrix inherent to the Minnesota prior.

19 The results are available from the authors on request.

20 The sample period is given by data availability.

to credit supply composition, and we follow Ludvigson (1998) and Iacoviello and Minetti (2008) in identifying the MIX shock recursively and by choosing variables for the second VAR model. Following Ludvigson (1998), the short-term interest rate is not included in this model specification, implying that innovations in the MIX reflect both monetary and non-monetary effects. As a result, the MIX shock can be seen as encompassing the effects of the monetary policy shock, allowing us to view the response of house prices to the shock in MIX induced by exogenous shifts in the short-term interest rate. Importantly, the changes in MIX induced by monetary policy shocks are primarily tested as being significant or insignificant using the first VAR model specification, with exogenous monetary policy shifts identified using the external instrument. Based on the same rationale, the bank balance sheet variables, the stock market index and the nominal exchange rate are not included in the second VAR model, such that the MIX shock reflects shifts in the composition of the home loan supply induced by changes in the banks' liabilities and interest rate spreads, stock prices and the value of domestic currency, thereby allowing a meaningful interpretation of the MIX shock and its effects.[21] In sum, the second VAR model includes the manufacturing production index, the CPI, the MIX and the house price (HP) index variables.

In the second VAR model, the MIX variable that captures the composition of the credit supply is ordered after the manufacturing production and prices and before the house price index. The rationale for this timing assumption is that innovations in the composition of loan supply have no contemporaneous effect on consumer prices and aggregate demand, while house prices are contemporaneously affected by shifts in the composition of credit supply. This assumption is based on the observation that house prices are a fast-moving variable that is unconstrained to respond to housing finance conditions within a month. We also perform robustness checks by adopting alternative timing assumptions to identify the MIX shock in the second VAR model.[22]

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[21] A series of robustness checks were performed to ensure that the composition of the second VAR model with these variables did not drive our results. Alternative sets of variables were tested to be included in the second model, with results supporting the robustness of our baseline outcome. The results of robustness tests are available from the authors on request.

[22] A plausible alternative timing assumption used for the robustness check is that house prices are not contemporaneously affected by innovation to the composition of loan supply and respond to it with delay. In both the baseline case and robustness check exercise, aggregate demand and

We use four disaggregated house price indices for the second VAR model: house price indices for flats, freestanding houses, two-bedroom flats and three-bedroom houses.[23] The disaggregated house prices are employed for the second VAR model for two reasons. First, this allows us to avoid reduced data precision inherent to aggregation. Second, using disaggregated indices allows us to compare the effects for different market segments.

3.4 Data

Our dataset contains macroeconomic and financial variables for South Africa over the sample period 2004M5–2019M8.[24] The inflation-targeting regime implemented by the SARB from 2000M1 applies to the whole duration of the sample. The frequency of the dataset is monthly, and the end-of-month values are used for variables with daily data frequency. Most of the data series are from the SARB and are publicly available. The nonbank credit volumes data collected by the National Deeds Registry of South Africa are supplied by Lightstone Property, a private agency specialising in property information and valuations.[25]

The macroeconomic and financial indicators used in the dataset allow us to capture the macro-financial linkages that characterise the response to a monetary policy shock in the economy. The precise sets of variables employed in each VAR model are discussed in section 3.3. Details of the dataset are provided in Table 1 of Annex A.

4. The bank lending channel of monetary policy transmission in South Africa

To analyse the bank lending channel of monetary policy transmission, we first investigate how the broad credit channel works and then look at the credit supply-side effects on the housing market induced by shifts in monetary policy.

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consumer prices are assumed to be slow-moving variables, responding to innovations in faster-moving variables with a delay, as is convention in recursive identification (Christiano, Eichenbaum and Evans 1999).

23 We use all the house price indices that are disaggregated by the type and size of housing available in South Africa.

24 The sample period is limited by the availability of nonbank credit issuance data.

25 The Lightstone Property website is at https://www.lightstoneproperty.co.za/.

4.1 The broad credit channel of monetary policy

The broad credit channel plays its role via the induced changes in credit values: equilibrium volumes of credit provided and/or the price of credit (i.e. the lending rate). The channel is seen as operative when credit values are sensitive to exogenous shifts in monetary policy, with corresponding macroeconomic implications.

Evidence from the first VAR model indicates that the macroeconomic effects of monetary policy tightening shocks are contractionary. Consumer prices and manufacturing production fall, with the effect on consumer prices being especially persistent (see Figure 10). Credit values are significantly affected by monetary policy shocks. The interest rate on mortgage loans jumps on impact and stays elevated for 10 months after the shock, making it more costly for borrowers to fund their home loan purchases (panel 'RateMortg' in Figure 10). The volume of mortgages issued by banks falls persistently by 10 percentage points (pp) – loan issuance remains subdued for 18 months after the shock (panel 'MortgBank' in Figure 10).[26] The total issuance of home loans by banks and nonbanks follows a similar pattern and falls by 8.5 pp (panel 'MortgTot' in Figure 20 in Annex B).[27] Thus, despite the increase in nonbank credit issuance and the increased share of nonbanks in the total issuance as measured by the MIX variable (panel 'MIX' in Figure 10), overall mortgage provision falls significantly following the monetary tightening shock. Borrowers' constrained access to credit reinforces the contractionary response of aggregate demand and prices to monetary tightening.

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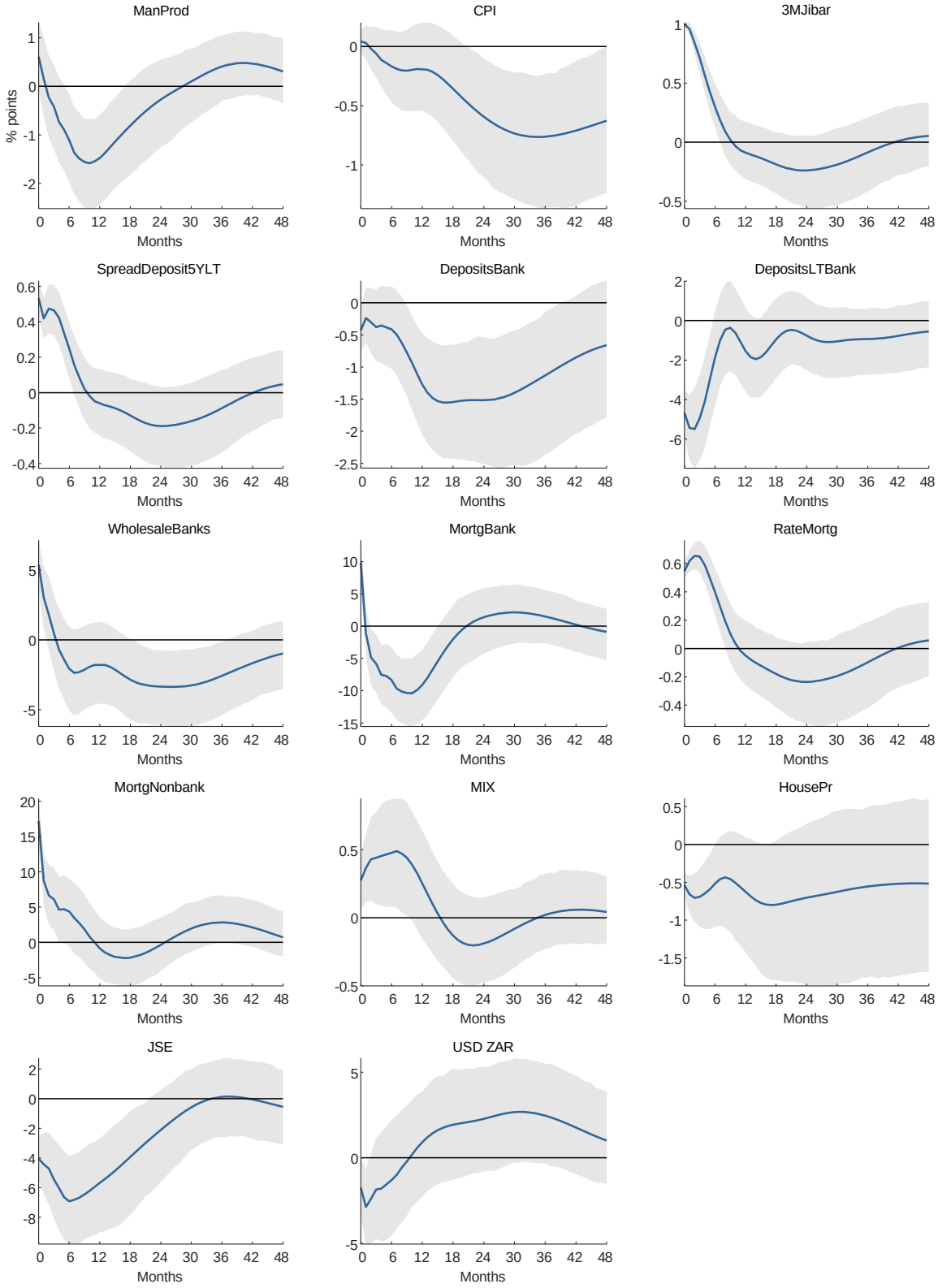
[26] The immediate positive response of bank mortgages to the monetary tightening shock is consistent with banks increasing mortgage issuance to benefit from a temporarily elevated interest rate margin. The latter arises due to the wider gap between the increased loan rate on mortgages and a relatively low interest rate on fixed deposits attracted by banks not yet allocated to assets. Newly attracted deposits are not immediately allocated to mortgages due to the lengthy evaluation of mortgage applications, implementation of internal risk and liquidity management procedures and other operational factors. This creates a transient opportunity for banks to benefit from an increased interest rate margin in the event of unexpected monetary tightening.

[27] We estimated the effect of monetary tightening on total home-loan issuance in a separate VAR model, where the latter model is the same as our first VAR specification, with bank mortgages replaced with total mortgages. This is done to avoid the singularity issue that arises when bank and total mortgages are included in the same VAR model, as these two series are essentially collinear.

Figure 10: VAR impulse response functions to monetary tightening shock



Note: 14-variable BVAR(12). Monetary policy shock is identified with high-frequency surprises in FRA1x4 around SARB MPC announcements (see section 3.2). The shock is normalised to induce a 100-basis-point increase in the short-term three-month Jibar (interbank) rate. The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands. F statistic of the first stage regression of the reduced-form innovations on the instrument is 71.98. Reliability of the instrument is 0.64.

What underlies the reduced lending activity of banks? To answer this, we first note that the deposit spread[28] jumps on impact following a monetary policy tightening shock (panel 'SpreadDeposit5YLT' in Figure 10).[29] An increase in the interest rate makes cash a more expensive source of liquidity than deposits, making demand for deposits more inelastic. This change in elasticity increases banks' market power, and banks widen their deposit spreads optimally.[30] Increased deposit spreads make deposits a more costly liquidity instrument than bonds,[31] so depositors substitute deposits with bonds in their portfolios, driving a persistent negative deposit response to monetary tightening (panels 'DepositsBank' and 'DepositsLTBank' in Figure 10). Banks offset the fall in deposits by increasing wholesale funding (panel 'WholesaleBanks' in Figure 10) to fund profitable lending operations; this offset is partial, however, as wholesale funding is costly.

The shift in liabilities of banks' balance sheets is evidence of the deposits channel of monetary policy being operative. To the best of our knowledge, this is the first empirical evidence of this channel's effectiveness in the context of an emerging market economy. Our finding is consistent with the high degree of concentration of the South African banking sector (see section 2.2) that underlies the effectiveness of the deposits channel.

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28 Deposit spread is calculated as the difference between the short-term interest rate and the deposit rate.

29 The panel 'SpreadDeposit5YLT' in Figure 10 reflects the spread on deposits with maturity of five years and longer. Qualitatively, the same result (a significantly positive response) is found for spreads on deposits of all maturities that the data are available for – notice deposits 1 to 32 days, 32 to 91 days, 91 to 185 days, 1 year, 1 to 3 years and 3 to 5 years maturity fixed deposits (results are available on request). No weighted average deposit rate data are available for our sample period, 2004M5–2019M8. In the baseline setup, we show the response of the deposit spread on fixed deposits with maturity of five years and longer, as long-term deposits serve as the most relevant funding source for long-term mortgage lending.

30 Drechsler, Savov and Schnabl (2017) show that the increase of deposit spread in response to monetary tightening is optimal for banks' profit maximisation until the elasticity of demand for bank deposits reaches the level -1, at which point a further increase becomes unprofitable.

31 Pirozhkova, Ricco and Viegi (2024) show that the yield curve in South Africa shifts upward in response to a monetary policy tightening shock.

4.2 Supply-side effects of monetary policy shifts

In this section, we use the variation in composition of the supply of housing finance to identify the credit supply effects induced by monetary policy and show that shifts in credit supply have real implications.

Evidence from the first VAR model indicates that, unlike banks, nonbank mortgage providers increase their issuance of home loans in response to monetary policy tightening (panel 'MortgNonbank' in Figure 10). As the funding sources of nonbanks are wholesale instruments and not deposits subject to significant and persistent reduction following monetary tightening, nonbanks retain their capacity to provide credit and meet the demand for home loans that is not met by the banking sector. Nonbank mortgage issuance goes up by 16 pp on impact and stays elevated for about 12 months. The shift in the composition of the supply of home loans is captured by a persistent positive response of the MIX variable to a monetary policy shock, implying an increase in the share of home loans issued by nonbanks versus banks ('MIX' panel in Figure 10). Exogenous changes in monetary policy thus bring about a significant and persistent shift in the supply of housing finance.

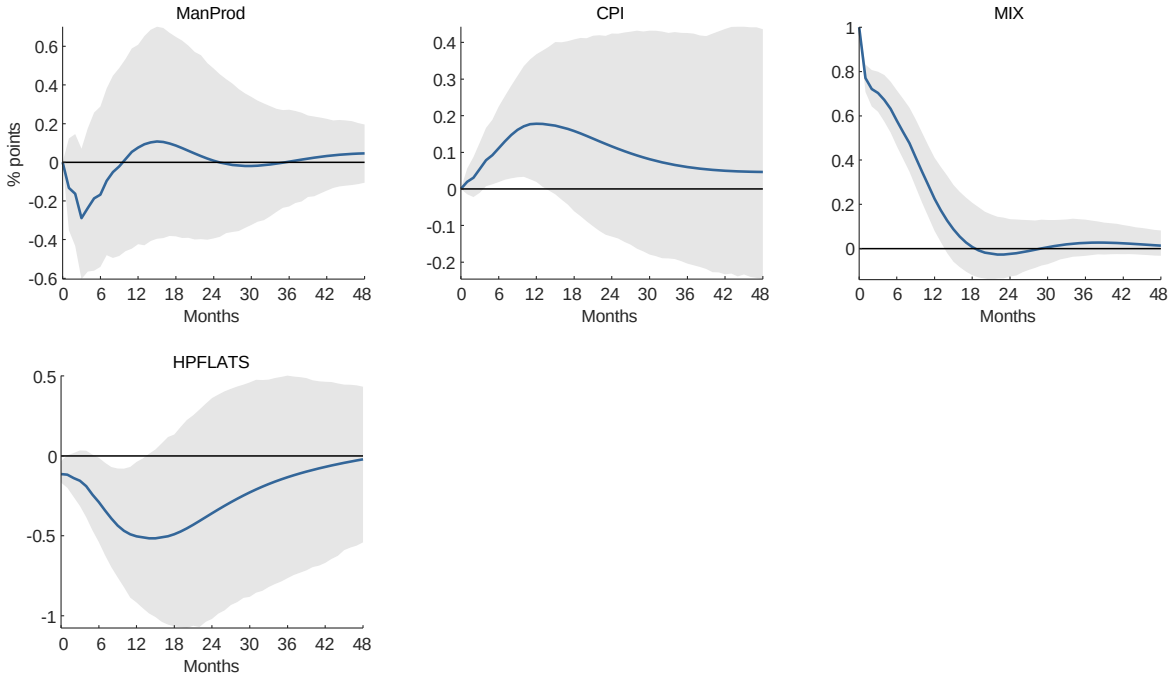
We employ evidence from the second VAR model to show that changes in the composition of home-loan supply have real implications. Each of the disaggregated house price indices is individually added to a separate VAR, which helps to reduce uncertainty around the estimated impulse responses associated with recursive identification of the MIX shock.[32]

House prices in the different segments of the housing market – in fact, in all segments covered by available data series – are significantly affected by shifts in the composition of home-loan supply as captured by the MIX shock. A reduction in the share of mortgages issued by banks or an increase of the MIX variable induces a significant decrease of the house prices for freestanding houses, flats, smaller-size (two-bedroom) flats and smaller-size (three-bedroom) houses (see panels 'HPHOUSFREE',

[32] As a robustness check, the validity of results is also shown in an alternative specification, where all individual house price indices are included in one VAR model.

'HPFLATS', 'HP2' and 'HP3' in Figures 12, 11, 13 and 14 respectively).[33] The negative response of house prices is consistent with the fall in housing demand induced by the reduction in the share of bank lending in the overall supply of home loans that is driven, inter alia, by monetary policy tightening. The robustness check that employs an alternative timing assumption yields qualitatively similar results (see Figures 15–18 in Annex B).[34]

Figure 11: Impulse responses to a MIX shock – flat prices

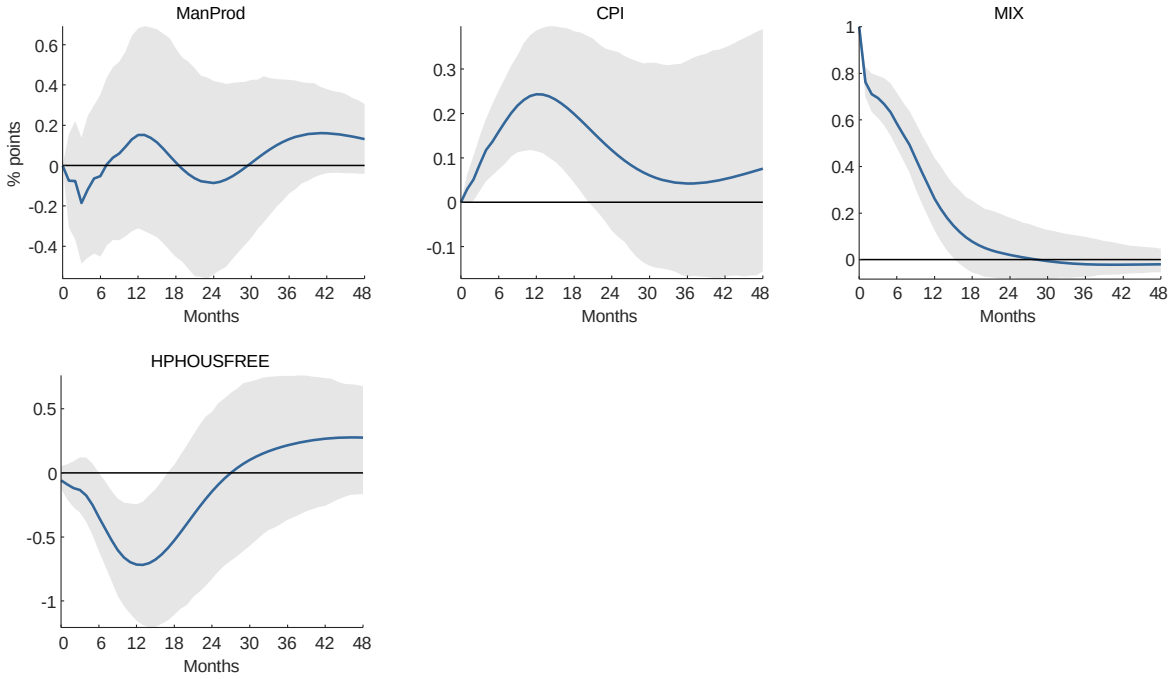


Note: 4-variable BVAR(12). MIX shock identification is based on Cholesky ordering (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

33 The result of the robustness check in the alternative specification of the model, where all disaggregated house prices indices are included in one VAR model, are shown in Figure 19 in Annex B. Impulse responses feature a higher uncertainty of estimated responses as captured by wider confidence bands relative to the baseline case associated with the use of recursive restrictions for shock identification.

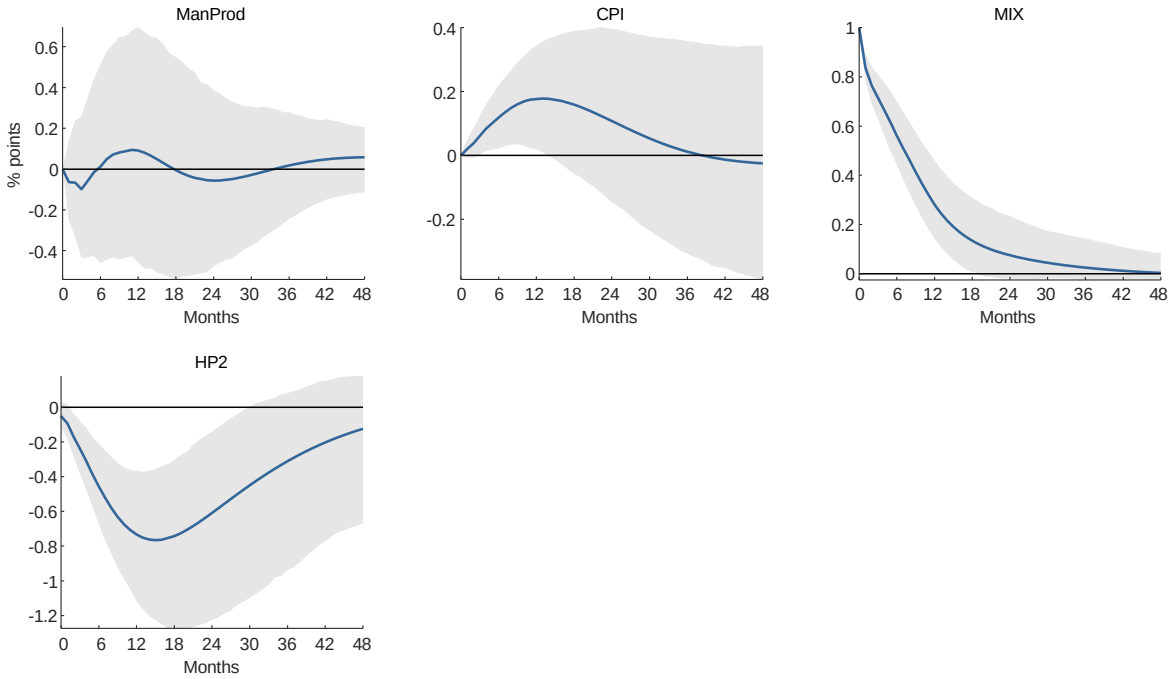
34 Impulse responses in the robustness check exercise are only different from the baseline specification for the flat price index response to the MIX shock, which is insignificantly negative when alternative timing assumption is used.

Figure 12: Impulse responses to a MIX shock – house prices for freestanding houses



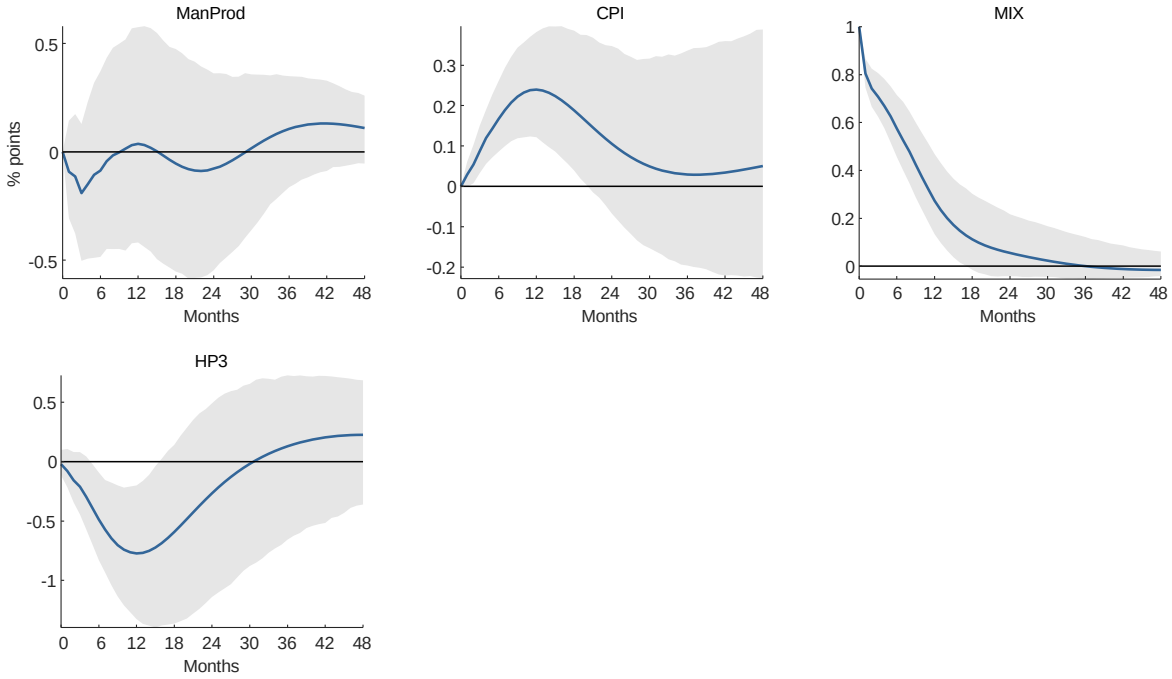
Note: 4-variable BVAR(12). MIX shock identification is based on Cholesky ordering (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

Figure 13: Impulse responses to a MIX shock – two-bedroom flat prices



Note: 4-variable BVAR(12). MIX shock identification is based on Cholesky ordering (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands

Figure 14: Impulse responses to a MIX shock – three-bedroom house prices



Notes: 4-variable BVAR(12). MIX shock identification is based on Cholesky ordering (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

The demand for smaller-size properties is to a larger extent affected by shifts in the composition of housing finance – house price indices for smaller-size flats and houses (two-bedroom and three-bedroom respectively) feature a more sizeable fall in response to the MIX shock (see panels ‘HP2’ and ‘HP3’ in Figures 13 and 14). This result is consistent with financially constrained households being more dependent on banks to fund their house purchases and being more exposed to monetary policy changes. This finding is also in line with the literature. In particular, Hedlund et al. (2017) develop a heterogeneous agents New Keynesian model with frictional housing market and long-term mortgages to study the role of housing and mortgage debt in the transmission of monetary policy. They demonstrate that house prices are more responsive to shocks in the case of low loan-to-value ratios. The latter result matches our finding that price sensitivity to shocks is greater for housing market segments with smaller-sized properties. The results of Hedlund et al. (2017)is also in line with bank practice to adjust loan-to-value constraints based on borrowers’ repayment capacity, which is captured indirectly by property size, to mitigate the risk of the mortgage portfolio.

In sum, our empirical results indicate that changes in the bank supply of home loans induced by monetary policy shifts have real implications and significantly affect house prices. This result implies that the bank lending channel of monetary transmission in South Africa is operative.

5. Conclusion

This paper provides evidence of the effectiveness of the bank lending channel of monetary policy transmission in South Africa. Exogenous changes in monetary policy have significant implications for the housing market via shifts in the composition of home-loan supply. The deposits channel of monetary transmission is also operative – banks increase deposit spread, while deposits flow out of the banking system in response to monetary policy tightening. As deposits are the main funding source for banks' lending operations, the effective deposits channel provides a foundation for the bank lending channel to operate, such that monetary policy shocks have real effects via the financial channel.

Our results imply that a macro-financial framework for monetary policy analysis should incorporate a banking sector featuring the banks' market-power characteristics and balance-sheet variables that propagate and amplify monetary policy shocks' effects on the real economy.[35]

[35] For examples of such modelling frameworks, see Diamond and Rajan (2005, 2011), Bruche and Suarez (2010), Iacoviello (2015) and Ferrante (2019), among others.

Annexures

Annex A: Data

Table 1: Variables used in the models

Series	Source	Label used in charts
Manufacturing production index	SARB	ManProd
CPI	SARB	CPI
3-month Jibar (interbank) rate	SARB	3MJibar
Deposit spread on fixed deposits with maturity exceeding 5 years	SARB	SpreadDeposit5YLT
Total bank deposits	SARB	DepositsBank
Long-term bank deposits	SARB	DepositsLTBanks
Bank wholesale (non-deposit) funding	SARB	WholesaleBanks
Volume of home loans issued by banks	SARB	MortgBank
Predominant rate on new mortgage loans: banks	SARB	RateMortg
Volume of home loans issued by non-banks	National Deeds Registry of South Africa	MortgNonbank
Aggregated house price index	Standard Bank of South Africa	HousePr
House price index: flats and townhouses	Standard Bank of South Africa	HPFLATS
House price index: freestanding houses	Standard Bank of South Africa	HPHOUSFREE
House price index: 2-bedroom flats and townhouses	Standard Bank of South Africa	HP2
House price index: 3-bedroom houses	Standard Bank of South Africa	HP3
Johannesburg stock exchange index	SARB	JSE
Nominal bilateral US dollar-rand exchange rate	Bloomberg	USD ZAR

Note: The end-of-month values are used for the series with daily (or higher) data frequency – 3-month Jibar interbank rate, JSE/stock exchange index and USD-ZAR exchange rate

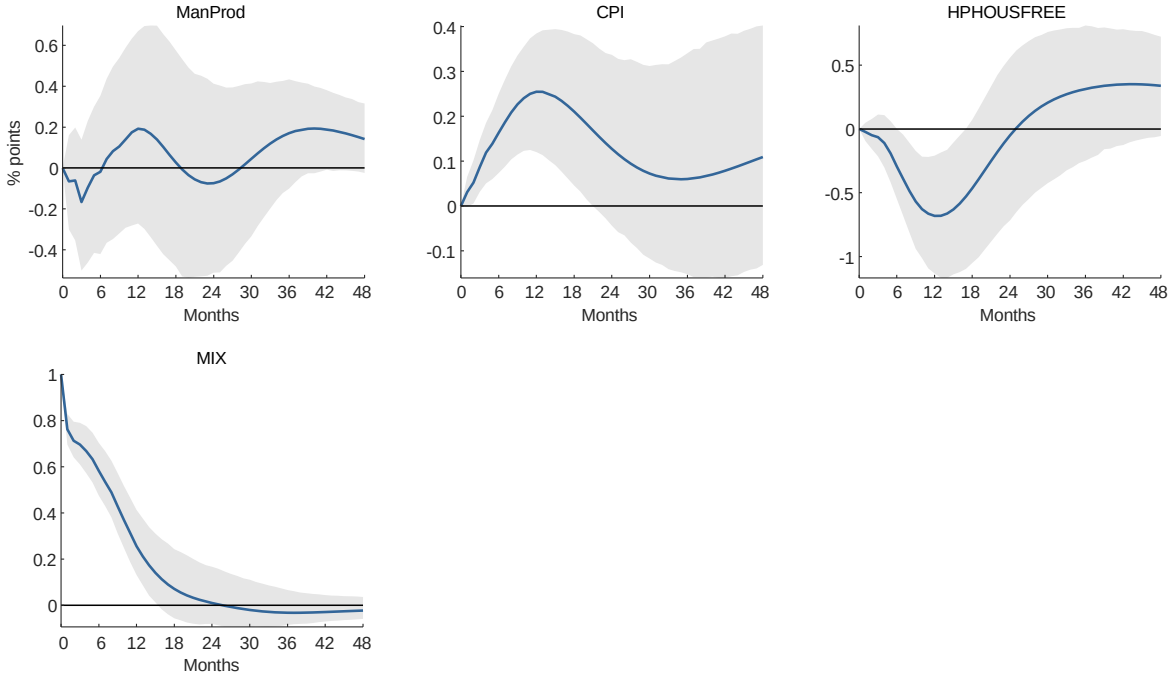
Annex B: Additional results on VAR analysis

Table 2: Forecast error variance decomposition

Variables	Horizon (months)								
	1	6	12	18	24	30	36	42	48
ManProd	0.00	0.06	0.10	0.11	0.12	0.13	0.14	0.15	0.15
CPI	0.00	0.07	0.12	0.16	0.18	0.20	0.21	0.22	0.22
House prices	0.08	0.12	0.15	0.15	0.16	0.17	0.18	0.19	0.20
JSE	0.05	0.07	0.09	0.12	0.13	0.14	0.15	0.15	0.16
USD ZAR	0.16	0.20	0.23	0.25	0.25	0.25	0.26	0.26	0.26

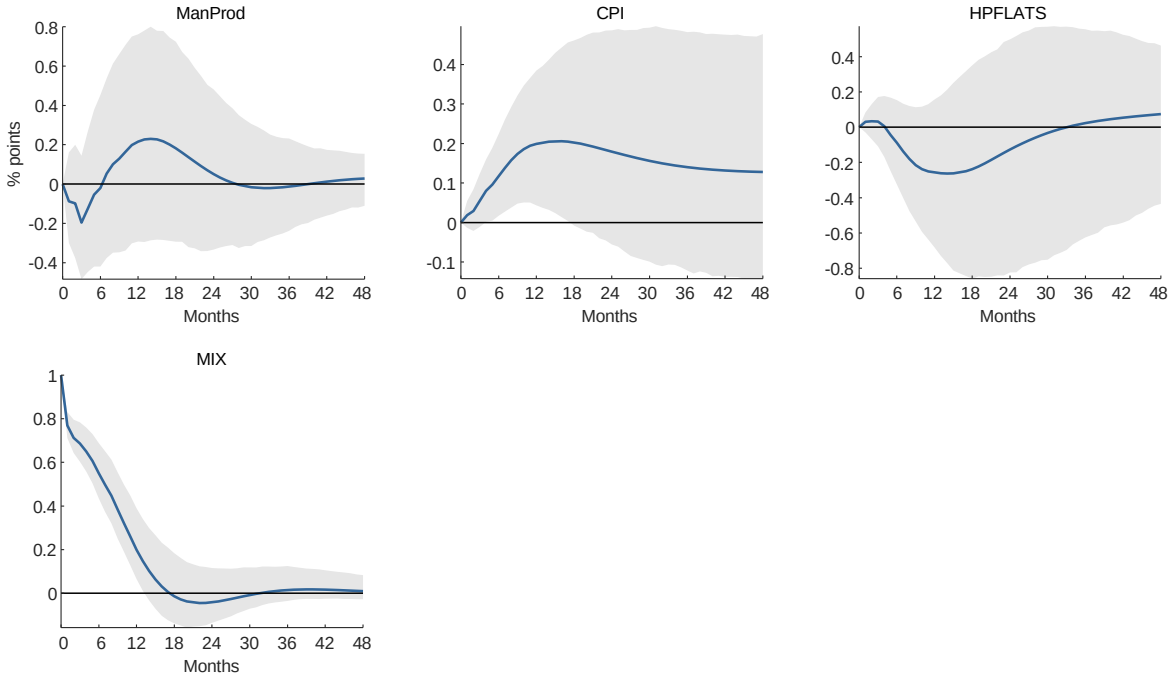
Note: The table shows the share of the variables' total forecast error variation explained by exogenous shocks to the banking sector variables in a Bayesian VAR. The banking sector characteristics include deposits spread, total bank deposits, long-term bank deposits, bank wholesale funding, value of home loans issued by banks and bank rate on mortgage loans (see Table 1 for details). Cholesky ordering is used for shocks' identification. The manufacturing production index, consumer prices and short-term rate are slow-moving variables and are placed before the banking sector factors. House prices, stock market index and nominal exchange rate are placed after the banking sector variables, as they are seen as fast-moving. To compute the error variance induced by credit shocks, we sum the error variance driven by shocks to all banking sector variables – a shock to deposits spread, a shock to total bank deposits, a shock to long-term bank deposits, a shock to bank wholesale funding, a shock to value of home loans issued by banks and a shock to bank rate on mortgage loans. Normal Inverse Wishart priors are used for shrinkage. Sample is 2004M1-2019M8.

Figure 15: Impulse responses to a MIX shock – house prices for freestanding houses: alternative timing assumptions



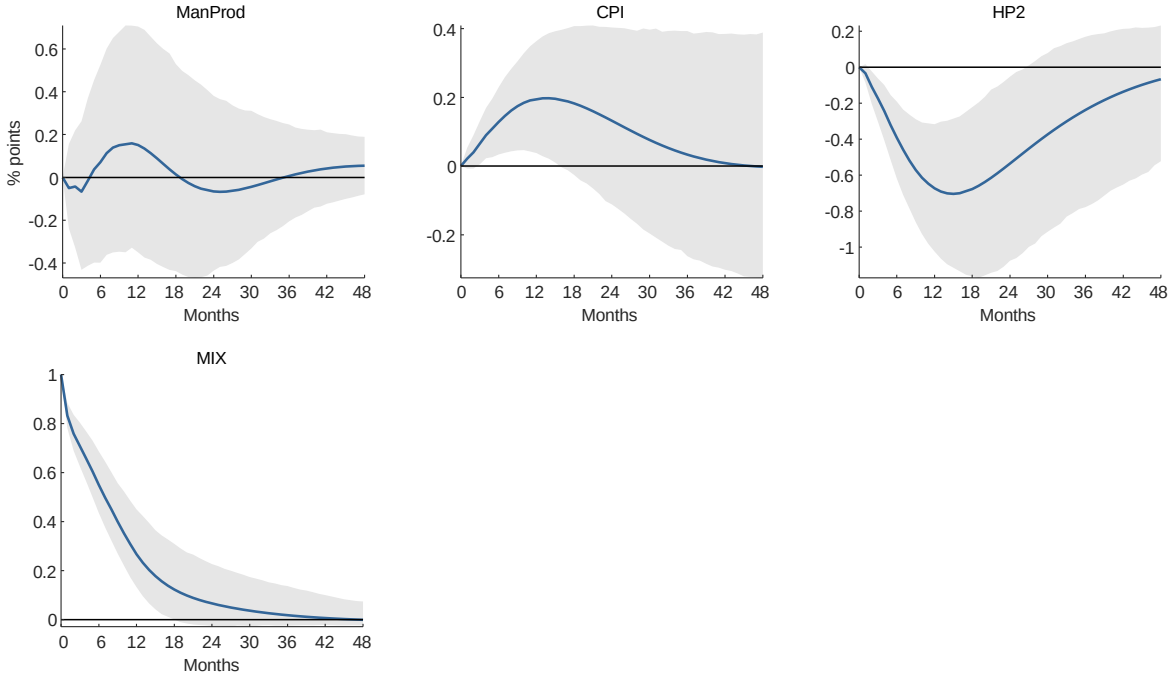
Note: 4-variable BVAR(12). MIX shock identification is based on an alternative Cholesky ordering where house prices is a slower moving variable than the composition of supply of housing loans (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

Figure 16: Impulse responses to a MIX shock – flat prices: alternative timing assumptions



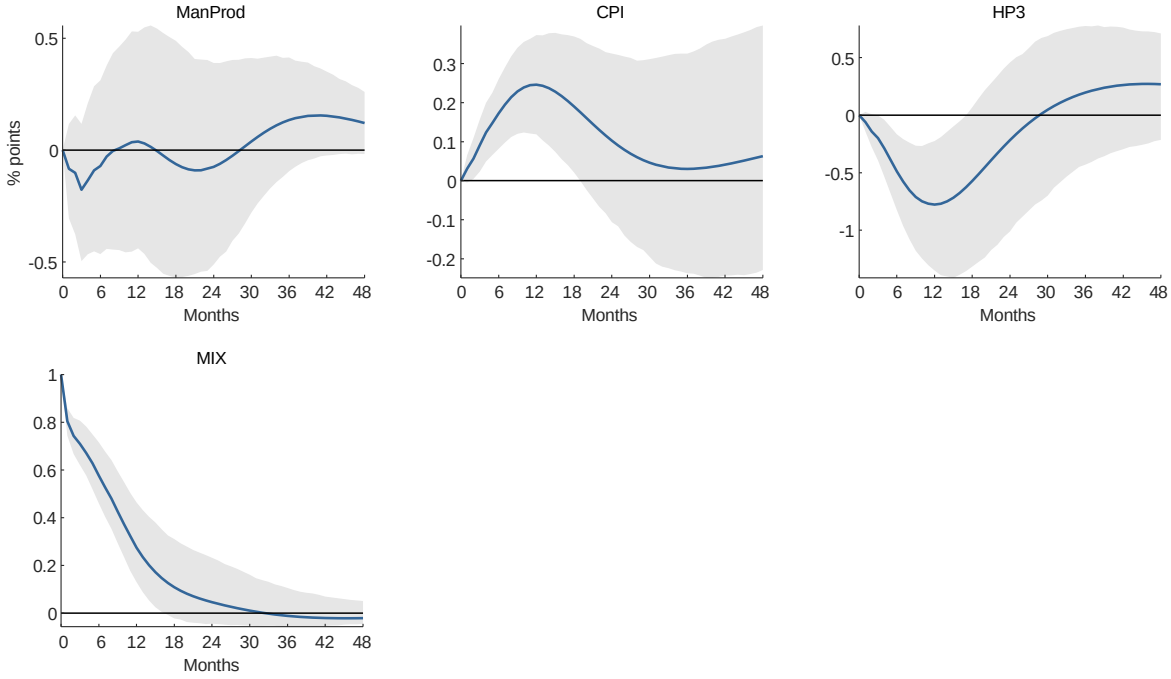
Note: 4-variable BVAR(12). MIX shock identification is based on an alternative Cholesky ordering where house prices is a slower moving variable than the composition of supply of housing loans (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

Figure 17: Impulse responses to a MIX shock – 2-bedroom flat prices: alternative timing assumptions



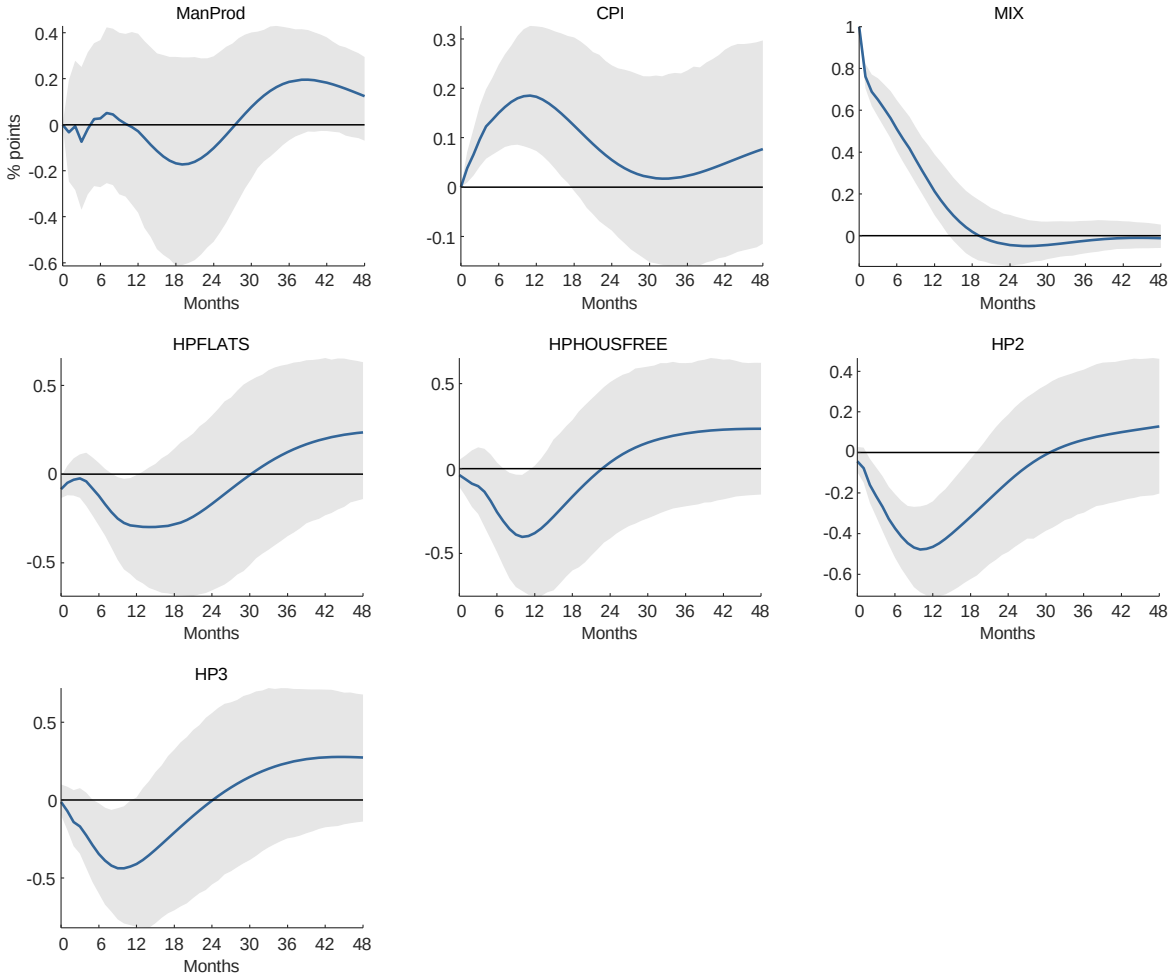
Note: 4-variable BVAR(12). MIX shock identification is based on an alternative Cholesky ordering where house prices is a slower moving variable than the composition of supply of housing loans (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

Figure 18: Impulse responses to a MIX shock – 3 bedroom house prices: alternative timing assumptions



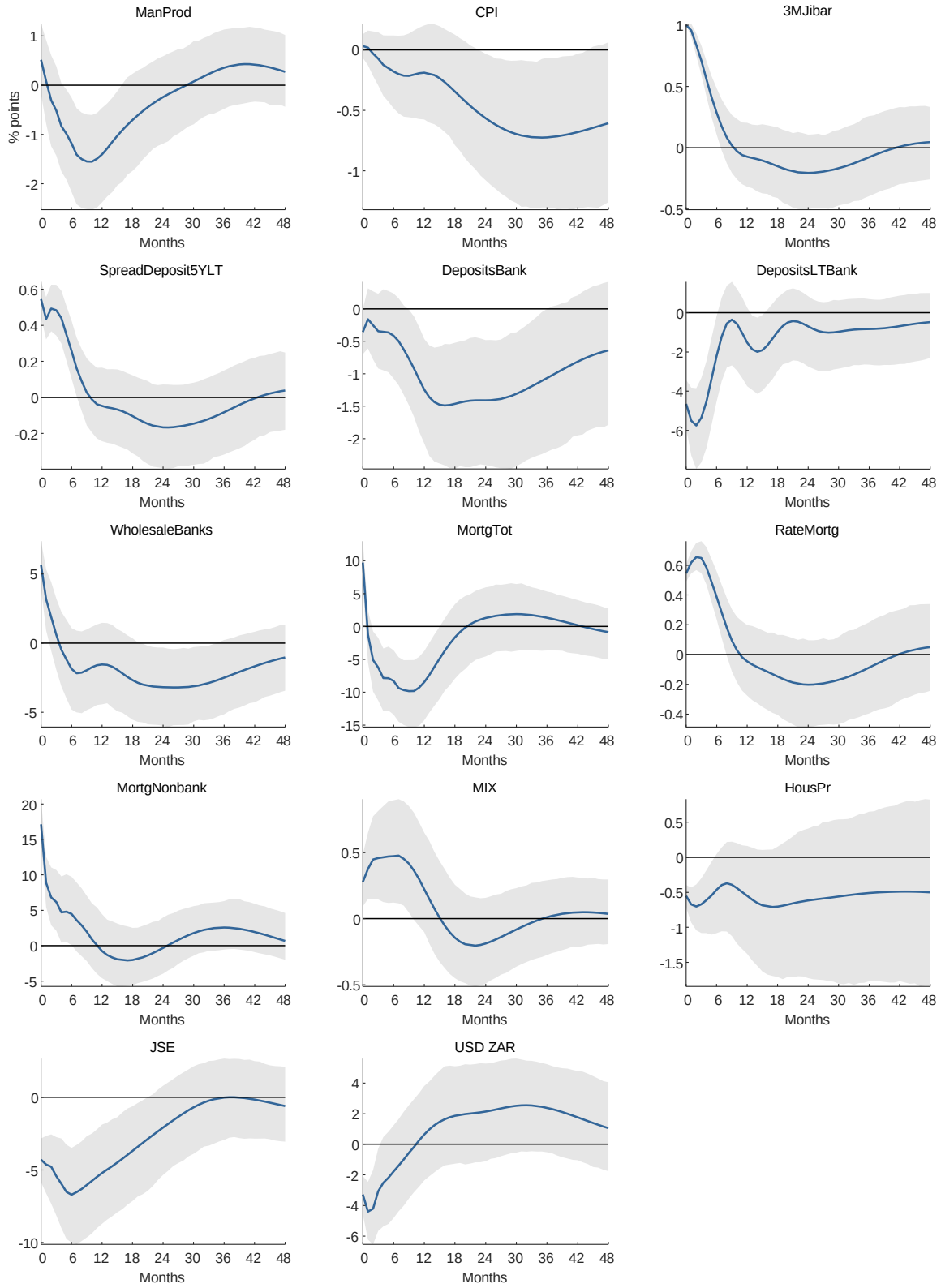
Note: 4-variable BVAR(12). MIX shock identification is based on an alternative Cholesky ordering where house prices is a slower moving variable than the composition of supply of housing loans (see section 3.1). The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

Figure 19: Impulse responses to a MIX shock – alternative specification with all disaggregated house price indices



Note: 7-variable BVAR(12). MIX shock identification is based on Cholesky ordering, see section 3.1. The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands.

Figure 20: VAR impulse response functions to monetary tightening shock – alternative specification with total mortgage issuance



Note: 14-variable BVAR(12). Monetary policy shock is identified with high-frequency surprises in FRA1x4 around SARB MPC announcements (see section 3.2). The shock is normalised to induce a 100 basis point increase in the short-term 3-month Jibar (interbank) rate. The sample is 2004M5–2019M8. Shaded areas are 90% posterior coverage bands. F statistic of the first-stage regression of the reduced-form innovations on the instrument is 71.84. Reliability of the instrument is 0.64.

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