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Structure of Capital Flows and Exchange Rate: The Case of Croatia

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Abstract

The paper analyses the impact of different types of capital flows to Croatia on the kuna exchange rate. SVAR models based on Cholesky decomposition with block exogeneity restrictions are estimated using different types of capital flows and the key finding is that the structure of capital flows matters for their impact on the exchange rate. On the one hand, debt capital inflows lead to kuna appreciation, irrespective of their maturity, while in terms of sectoral structure this is mostly due to corporate and government borrowing. On the other hand, equity capital flows seem to affect it in the opposite direction, which is in line with results from other empirical research. The opposite effects of debt and equity flows could stem from the differences in their relative orientations towards the tradable versus the non-tradable sector, with the latter being more prominent in debt flows. The paper also confirms that capital flows to the banking sector have no effect on the exchange rate, providing support to the intensive use of countercyclical macroprudential measures by the central bank. These findings are relevant for the design of monetary policy, especially in countries like Croatia where central bank uses the exchange rate of the kuna against the euro as the main tool for achieving its primary objective of price stability.

Keywords:
capital inflows, kuna exchange rate, SVAR with block exogeneity

JEL:
F32, F41, C51, C32

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Contents

1 Introduction

Croatia, like other countries in the region, was faced with strong foreign capital inflows in the years before the crisis. Since the onset of the crisis, they have been gradually declining and have recently even been replaced by capital outflows. Capital inflows are desirable in a developing economy because of their numerous positive effects, but they can also have some negative consequences (Lopez-Mejia, 1999)[1]. The macroeconomic effects of capital flows can differ depending on their structure, with equity investments usually viewed as more beneficial since they tend to be more stable compared to debt flows (Committee on the Global Financial System, 2009; Lane and McQuade, 2013).

Regarding the impact of capital flows on the exchange rate, empirical literature examines the importance of their structure and mainly confirms that debt inflows have a more prominent role in exchange rate movements than equity inflows (Brooks et al., 2001; Athukorala and Rajapatirana, 2003; Bakardzhieva et al., 2010; Combes et al., 2011; Davis, 2014). The usual explanation is that equity flows (foreign direct investment), compared to other flows, are generally concentrated more in the tradable sector, leading to a lower pressure on the nominal exchange rate and prices in the non-tradable sector.

Accordingly, the aim of this paper is to determine whether in the last fifteen years all types of capital flows to Croatia have moved the kuna exchange rate in the same direction and with the same magnitude. This topic has not yet been researched with reference to Croatia, and the results could be of particular importance in view of the existing monetary framework, where the Croatian National Bank (CNB) uses a stable nominal exchange rate of the kuna against the euro for achieving its primary objective of price stability. Answering this question would allow a better understanding of the dynamics of the kuna exchange rate and also provide a solid ground for qualitative assessment of future pressures on the exchange rate movements stemming from capital flows. Therefore, the main contribution of this paper is in providing policy makers with empirical evidence on the role of different types of capital flows that should be taken into account when designing monetary policy instruments and macroprudential measures.

In the empirical analysis we apply structural vector autoregressive (SVAR) models with block exogeneity that along with different types of capital inflows include foreign and domestic output, monetary policy indicator and kuna real effective exchange rate deflated by consumer prices. The results indicate that the structure of capital inflows matters for their impact on the exchange rate. It was found that debt capital inflows lead to kuna appreciation, irrespective of their maturity, which is mostly due to corporate and, to a smaller extent, government borrowing. In line with results from other empirical research, equity capital seems to affect it in

1 On the positive side, foreign capital inflows can enable investment and consumption, stimulate growth and increase financial development. On the other hand, they can lead to inflationary pressures, increased exchange rate volatility, deteriorating competitiveness, deepening current account deficit and higher vulnerability of the financial system. Also, they can be followed by capital outflows that are considered undesirable because they are often triggered by unfavourable factors in the country or globally and can lead to adverse consequences, sometimes even currency crises.

the opposite direction, which could be explained by its relatively smaller impact on the non-tradable sector. In addition, results show that capital flows to the banking sector have no effect on the exchange rate, providing support to the intensive use of countercyclical macroprudential measures by the central bank.

The paper is structured as follows. In the second section the relevant empirical literature is briefly examined. Stylised facts on capital inflows and kuna exchange rate developments are presented in the third section, with a short overview of monetary policy framework in Croatia. In the fourth section the econometric model and data are described. The results of econometric estimations in the form of impulse responses and variance decompositions as well as extensive robustness checks are discussed in the fifth section. Finally, section six concludes and discusses the policy implications of the research findings.

2 Literature review

Capital flows between a country and the rest of the world are determined by numerous factors. The empirical literature distinguishes between *push* factors that determine global capital flows (for example, economic activity or interest rates in large countries or international financial centres) and *pull* factors specific to a recipient country (for example, domestic economic growth, interest rates, institutional factors, etc.). In a seminal paper Calvo et al. (1993) showed that capital inflows to Latin American countries could partly be explained by exogenous factors, referring primarily to the US economy. Jevčak et al. (2010) explored the role of push and pull factors in the ten new EU member states and confirmed the importance of external developments, as well as domestic economic and financial conditions and policies.

When it comes to the impact of capital inflows on the receiving economy, one of the main negative side effects is loss of competitiveness caused by an appreciated real exchange rate (Calvo et al., 1993; Corden, 1994; Lartey, 2008). This can occur either through nominal appreciation in a flexible exchange rate regime, or through an increase in prices when the exchange rate is fixed, as well as through a combination of these two in intermediate regimes. The transmission effect of capital inflows on resource reallocation and real exchange rate movement is elaborated in Corden (1994), who uses a small open economy model that includes tradable and non-tradable industries, whose relative prices determine the real exchange rate. Capital inflows enable higher expenditure, which has no impact on the nominal exchange rate or prices, if directed to tradables[2]. On the other hand, excess demand for non-tradables results in an increase in their price relative to tradables and real appreciation, regardless of the exchange rate regime.

The distinction between flows going to the tradable and the non-tradable sector is the key to understanding why different types of capital flows could produce different effects on the exchange rate. Empirical research has shown that the magnitude of exchange rate changes indeed depends on the structure of capital, with a stronger effect on the exchange rate appreciation being usually more associated with the inflow of debt investment than with equity investment (Brooks et al., 2001; Athukorala and Rajapatirana, 2003; Bakardzhieva et al., 2010; Combes et al., 2011; Davis, 2014). Since equity investments in developing countries are more often directed to tradable sectors, this can lead to smaller pressures on the prices of non-tradables. Authors explain the weaker or sometimes even non-existent links between equity investment and exchange rate by the simultaneous effect of foreign direct investment (FDI) on imports, mostly of capital goods, which has the opposite effect on the nominal exchange rate, alleviating the appreciation pressures, in contrast to the inflow of debt investment. FDIs are less volatile than other types of capital flows, which could be an additional factor.

Regarding country-specific empirical papers studying the relationship between capital flows and exchange rates, Brooks et al. (2001) used bivariate equations to examine the impact of net portfolio and direct investment on changes in the nominal bilateral exchange rates of the euro and the yen against the US dollar.

2 A small country is assumed to be a price taker in the world market. Therefore, domestic price of tradables depends only on world price and tariffs/subsidies, transport costs and nominal exchange rate.

They confirmed that portfolio investment leads to appreciation of the euro against the dollar, which does not apply to direct investment. At the same time, the authors could not confirm that capital flows were a significant determinant of yen fluctuations. Following their approach, Yesin (2016) concluded that none of the different forms of capital inflows to Switzerland had a statistically significant impact on the appreciation of the Swiss franc's real effective exchange rate in the 2000-2015 period, although some types of capital over a shorter time period did have such an effect.

Several papers examined the impact of disaggregated capital flows on the real effective exchange rate for a panel of countries. Athukorala and Rajapatirana (2003) compared the role of the composition of capital flows in Asian and Latin American countries and showed that FDI inflows tend to depreciate the exchange rate (to a smaller extent in Latin America), while exchange rate appreciation is mainly associated with other capital flows (to a larger extent in Latin America). Bakardzhieva et al. (2010) investigated the impact of six types of capital and foreign exchange flows on a sample of 57 developing countries. They showed that portfolio investment, foreign borrowing, aid and income from foreign assets led to the appreciation of the real effective exchange rate, while the impact of workers' remittances varies among different groups of countries (in the CEE countries they are even associated with exchange rate depreciation). On the other hand, FDI inflows do not have a significant effect on the exchange rate. Furthermore, Combes et al. (2011) using the panel cointegration technique showed that capital inflows to the private and public sectors were related to the appreciation of the exchange rate, with the strongest effect stemming from portfolio investment and the smallest effect from direct investment, bank loans and transfers to the private sector.

Next to the exchange rate, other macroeconomic variables are also more affected by debt than by equity capital. On a panel of 30 countries, Davis (2014) used external instruments in a SVAR model and found that an exogenous increase in debt inflows leads to an increase in GDP, inflation, stock prices, loans, interest rates and exchange rate appreciation, while no link between equity investment and these variables was found. Likewise, Raghavan et al. (2014) examined the relationships between different portfolio capital flows and macroeconomic variables in Australia, using SVARs with block exogeneity restrictions. They found that net debt portfolio flows are the key drivers of total net portfolio flows and that their positive shock results in increases in gross national expenditure, GDP and credit, as well as in exchange rate appreciation. Conversely, net equity portfolio flows do not have a significant effect on Australian macroeconomic variables.

To the best of the authors' knowledge, no similar research has been performed for Croatia. Still, in a broader sense our analysis can be linked to several strands of existing empirical research. First, some papers examined the transmission of external shocks on domestic GDP and inflation (Krznar and Kunovac, 2010; Dumičić et al., 2015; Jovičić and Kunovac, 2017). Second, much of the literature has been focused on the effects of foreign direct investment (for example, Škudar, 2004; Jovančević, 2007; Marić, 2008; Kersan-Škabić and Zubin, 2009; Vukšić, 2005), in particular on GDP, productivity, exports or employment, but none of them estimated its effects on the exchange rate. Finally, this research is related to the literature on the effectiveness of monetary policy in Croatia (Ljubaj, 2012).

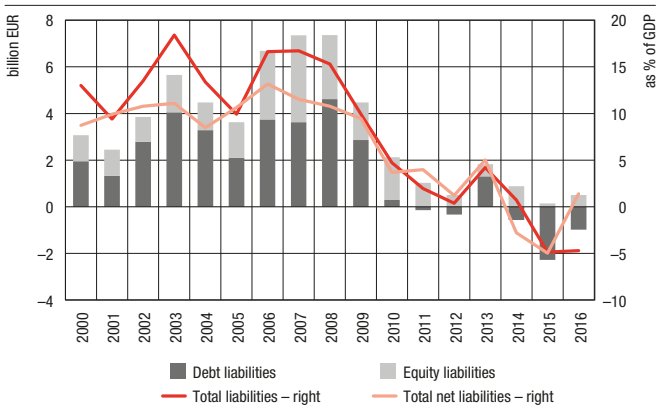
3 The case of Croatia: capital flows, monetary policy response and exchange rate behaviour

In the years before the global financial crisis, Croatia was running relatively high current account deficits, which had to be financed by foreign savings. Simultaneously, there was a surge in the capital inflows[3] in the 2000-2008 period amounting to around 14% of GDP (measured as an average yearly increase in foreign

3 *Capital inflows* refer to the sum of the increase in liabilities based on foreign direct investment, portfolio investment and other investment, excluding the transactions of the central bank and exceptional transactions. The term *capital outflows* is throughout the paper used to define negative capital inflows (decrease in foreign liabilities). Data used in the paper are explained in more detail later in the text.

liabilities). Other new EU Member States were also attracting substantial amounts of foreign capital amid overall favourable developments in the global and European financial markets. After the outbreak of the crisis capital inflows to Croatia, as well as to other peer countries, declined substantially. In the 2009-2014 period, capital inflows to Croatia amounted to around 4% of GDP. In addition, since 2015 Croatia has faced capital outflows (decrease in foreign liabilities). With changes in foreign assets still being much smaller, the overall net external position of Croatia is primarily driven by changes in foreign liabilities (Figure 1).

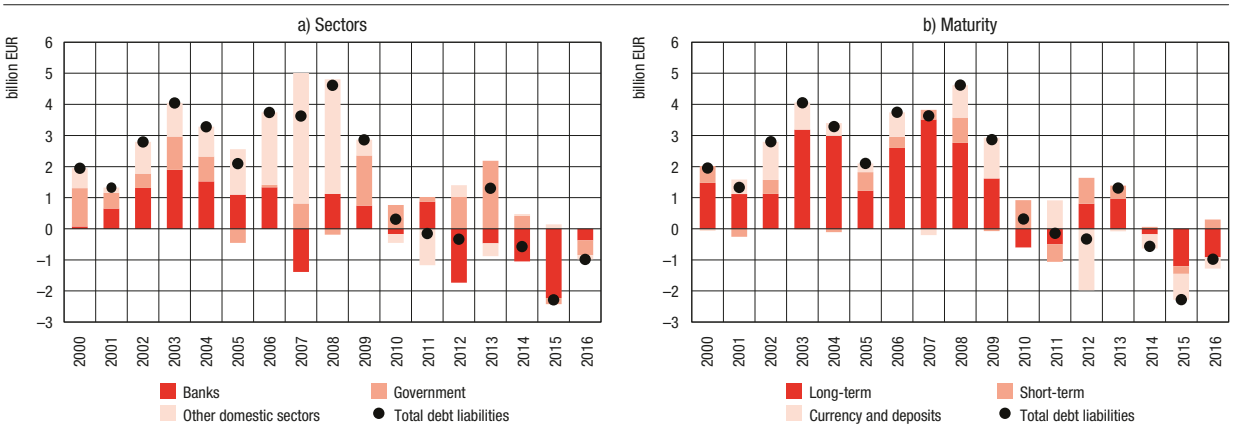
Figure 1 Capital inflows to Croatia



Notes: A positive (negative) value denotes increase (decrease) in foreign liabilities. Data for 2016 refer only to the first quarter of 2016. Total net liabilities are calculated as liabilities minus foreign assets.
Source: CNB.

Looking at different types of capital inflows to Croatia in the 2000-2016 Q1 period, although equity investments (mainly foreign direct investments) were an important source of funding, the domestic economy relied even more on debt capital, which accounted for around 54% of total inflows. Despite significant weakening in the post-crisis period, inflows of equity capital continued, although very modestly. On the other hand, after the outbreak of the crisis the inflow of debt capital diminished gradually and even turned negative (switched to outflow) as a result of domestic sector deleveraging.

Figure 2 Structure of debt capital inflows by:



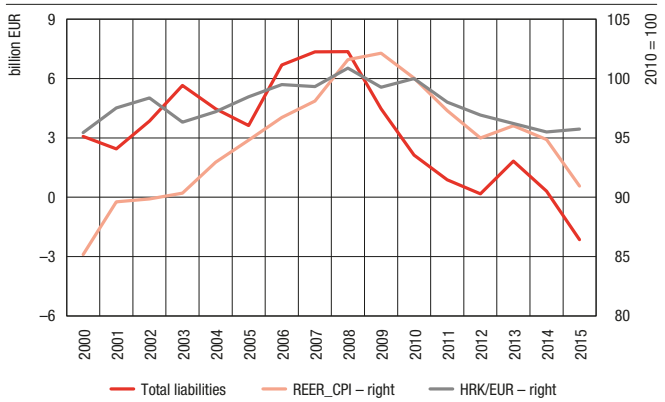
Notes: A positive (negative) value denotes increase (decrease) in foreign liabilities. Data for 2016 refer only to the first quarter of 2016. Maturity structure breakdown is showed for securities, loans and trade credits.
Source: CNB.

Figure 2 provides a breakdown of debt capital inflows by sectoral structure and maturity. In the entire 2000-2016 Q1 period other domestic sectors (besides government and monetary institutions) accounted for

more than half of total foreign borrowing (excluding inter-company lending) and banks for around 10%, with pronounced differences in three specific periods. In the early 2000s a significant share of foreign borrowing was related to banks, which used these funds for the financing of their buoyant credit activity. In response, the CNB designed a set of measures to penalise banks' foreign borrowing and to limit excessive and unsustainable credit growth. As a result, in the mid-2000s banks' foreign borrowing slowed down, which was combined with a stronger inflow of equity capital in the banking sector (recapitalizations), while the foreign borrowing of other domestic sectors intensified, partly due to the fact that banks redirected some of their clients to their mother banks and affiliated enterprises in Croatia and abroad. In the years since the outbreak of the crisis, the abundant foreign borrowing of banks and other domestic sectors declined and was even replaced by deleveraging. On the other hand, only the government continued to borrow in the foreign market. Regarding the maturity structure of foreign borrowing (excluding FDI debt and currency and deposits), long-term instruments accounted for around four fifths of total borrowing. In addition to being much less important, the inflow of short-term capital was almost three times as volatile[4].

Abundant capital inflows to Croatia have been an important factor influencing the implementation of monetary policy. In this small, open and highly euroised economy, the CNB relies on a stable (but not fixed) exchange rate of the kuna against the euro for stabilizing inflation expectations and safeguarding financial stability. In such a monetary policy framework, foreign exchange transactions[5] have been the main instrument for preventing excessive exchange rate volatility in the short term, while the CNB has also used a variety of monetary policy instruments and macroprudential measures[6] to manage banking sector liquidity in domestic and foreign currency, indirectly affecting the exchange rate over the longer time horizon. On the one hand, in the pre-crisis period, CNB implemented measures that required banks to hold large amounts of foreign exchange liquidity, penalised their foreign borrowing or administratively limited credit growth, with the aim of constraining any increase in the external debt and excessive credit growth. On the other hand, in the period from 2008 onwards the CNB significantly relaxed its monetary policy stance, its aim being, among other things, to ensure domestic and foreign currency liquidity during adverse conditions in the financial markets and facilitate financing of the government and other domestic sectors, while also contributing to the lowering of interest rates.

Figure 3 Capital inflows and kuna exchange rate



Notes: REER_CPI stands for kuna real effective exchange rate deflated by consumer prices and HRK/EUR for nominal bilateral exchange rate of the kuna against the euro. A rise in the exchange rate index denotes a real effective *appreciation* (only in this figure).
Source: CNB.

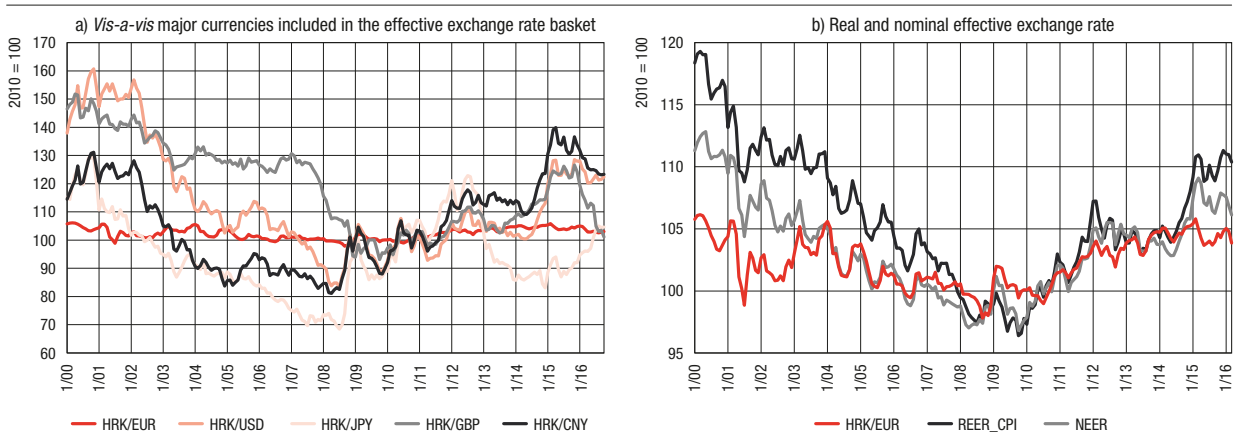
4 Measured by the coefficient of variation.

5 The CNB mainly conducts foreign exchange interventions through which it purchases/sells foreign exchange from/to commercial banks, as well as purchase/sell transactions of foreign currency directly with the Ministry of Finance and European Commission. In addition, bilateral transactions with commercial banks other than interventions are also performed, as well as some other transactions.

6 For more, see for example Ljubaj et al. (2010) and Ljubaj (2012).

Overall, higher capital inflows to Croatia in the years before the crisis were associated with kuna appreciation, while conversely in recent years capital inflows diminished and the kuna depreciated (Figure 3). When it comes to the dynamics of kuna exchange rate against different currencies (Figure 4a), due to the existing monetary policy framework the kuna/euro exchange rate moved within a relatively narrow corridor (± 4% around the average) in the entire 2000-2016 Q1 period. Moreover, kuna appreciation in the pre-crisis period and its depreciation afterwards was more pronounced with respect to other currencies than to euro. Consequently, both nominal and real effective exchange rates were somewhat more volatile than the bilateral kuna/euro exchange rate, but much less volatile than the bilateral exchange rate of the kuna to other currencies. Still, the kuna effective exchange rate is highly correlated with the bilateral kuna/euro exchange rate[7], as could be expected since it constitutes its largest part[8]. Changes in the real effective exchange rate were stronger than of the nominal effective exchange rate because domestic prices grew faster than foreign prices (Figure 4b).

Figure 4 Various measures of the kuna exchange rate:



Notes: A *rise* in the exchange rate index denotes *depreciation*. Based on monthly data.
Source: CNB.

4 Econometric model and data

The effect of different types of capital inflows on the exchange rate in Croatia is estimated using a SVAR model with block exogeneity restrictions. A SVAR model enables simultaneous interaction between variables, relying on the economic theory and stylised facts. Block exogeneity restrictions between domestic and foreign variables are imposed to allow foreign to affect domestic variables without any feedback effect, which is suitable for modelling small open economies. The model includes foreign and domestic factors that affect capital flows and exchange rates, while trying to remain parsimonious due to the relatively small data sample.

Following the model explained in more detail in Lutkepohl (2005), a SVAR model can, in short, with the deterministic term excluded for simplicity, be written as:

$$A_0^* y_t = A_1^* y_{t-1} + \ldots + A_p^* y_{t-p} + \varepsilon_t \quad (1)$$

7 Correlation coefficient of real effective exchange rate and kuna/euro exchange rate is 0.7, and of nominal effective exchange rate and kuna/euro exchange rate 0.8.

8 Effective exchange rates of the kuna reflect the average structure of foreign trade (direct import and export competition and export competition in third markets) and are calculated using time varying weights of trading partners over three consecutive years. Since most of Croatia's foreign trade is conducted with the euro area countries, the euro constitutes the predominant part of the basket (in 2000 its share was around 70%, but by 2009 it had fallen to below 60%), while other important currencies are the yuan renminbi (share increased from 3% to 12%), US dollar (6%), British pound (3%), yen (3%).

where y_t is $(K \times 1)$ the vector of macroeconomic and policy variables, A_j^* is $(K \times K)$ the matrix of structural coefficients for $j = 0, 1, ..., p$, and ε_t is $(K \times 1)$ the vector of structural shocks.

The five variables included in the system are: real GDP of the European Union (*GDP_EU*), gross capital inflows to Croatia (*CF_L*), monetary policy indicator (*MP*), domestic real GDP (*GDP_RH*) and kuna real effective exchange rate deflated by consumer prices (*REER_CPI*).

Modelling macroeconomic developments in a small open economy should take the potentially significant spillover effects of external shocks on the domestic economy into account, as confirmed for Croatia in papers by Krznar and Kunovac (2010), Dumičić et al. (2015), Jovičić and Kunovac (2017). Since domestic variables at the same time have almost no impact on international economic conditions, the model used in the empirical analysis includes block exogeneity restrictions. In other words, variables are divided into two blocks:

$$y_t = [y_{1,t}, y_{2,t}]' \tag{2}$$

where $y_{1,t}$ is the foreign and $y_{2,t}$ the domestic block. Only one variable is included in the foreign block, real GDP of the EU, which is assumed to affect all other variables in the model directly, while domestic variables have no impact. The other four variables are included in the domestic block. It follows that $y_{1,t} = [GDP\_EU]'$ and $y_{2,t} = [CF\_L, MP, GDP\_HR, REER\_CPI]'$.

The SVAR in Equation 1 can now be represented by:

$$A_j^* y_t = \varepsilon_t \tag{3}$$

for $j = 0, 1, ..., p$, where

$$A_j^* = \begin{bmatrix} A_{j,11}^* & A_{j,12}^* \\ A_{j,21}^* & A_{j,22}^* \end{bmatrix} \text{ and } \varepsilon_t^* = [\varepsilon_{1,t}, \varepsilon_{2,t}]'; \tag{4}$$

and the block exogeneity restriction is imposed by setting $A_{j,12}^* = 0$ which ensures that domestic variables are excluded from entering the foreign block equation.

We start by estimating a reduced form VAR, which is obtained by multiplying (1) with A_0^{*-1}:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + u_t \tag{5}$$

where $A_j = A_0^{*-1} A_j^*$, and $u_t = A_0^{*-1} \varepsilon_t$ is a vector of reduced form disturbances.

Next to that, additional identifying restrictions are necessary to uncover the underlying structural shocks in the data. Since at least *K(K−1)/2* restrictions have to be introduced for the identification of the matrix, we impose Cholesky decomposition.

When it comes to the ordering, foreign GDP as the first variable affects all the other domestic variables contemporaneously and with a lag. It serves as a proxy for the international conditions that affect capital flows to Croatia.[9]

Foreign capital inflows, the second variable, respond immediately only to changes in the foreign block, while other domestic variables affect them with a lag. In this way both the push and pull factors that determine capital inflows are taken into account, in line with the empirical literature. To assess the separate effects of different forms of capital inflows, total inflows will be replaced by specific subcomponents as described later in the text.

Although economic theory would suggest that the interest rate be included in the model, the fact that the monetary policy framework in Croatia does not rely on the interest rate channel had led us to replace it with a more relevant measure of monetary policy stance (a similar approach was taken by Ljubaj, 2012). Additionally, investigating the response of net capital flows to interest rate shocks, Globan (2014) showed that among eight Central and East European countries responses to a domestic interest rate shock were ambiguous and in the

9 As a robustness check, we estimate a model including other relevant foreign variables that could affect capital flows (i.e. foreign interest rates and market volatility).

case of Croatia among the least intensive[10]. Therefore, we use a monetary policy stance indicator reflecting the influence of monetary policy and macroprudential measures on the liquidity conditions in the banking sector and order it after capital inflows, implying that it responds contemporaneously to changes in foreign GDP and capital inflows. Changes in domestic GDP and kuna real effective exchange rate are assumed to affect monetary policy only with a lag. Regarding the exchange rate, although in Croatia the nominal bilateral exchange rate against the euro contemporaneously affects monetary policy decisions, the model includes only a lagged monetary policy response due to the fact that the real effective exchange rate depends on other macroeconomic variables as well (exchange rates against other currencies, relative prices).

Domestic GDP is placed after the monetary policy indicator, reflecting the assumption that it is immediately affected by foreign GDP, capital inflows and monetary policy. On the other hand, domestic GDP is likely to have a contemporaneous impact on the real effective exchange rate of the kuna.

Finally, the real effective exchange rate of the kuna is the most endogenous variable in the system, with the assumption that it responds to changes in all the other variables both immediately and with a lag. Using a real effective exchange rate enables us also to measure the effects of capital flows on price developments[11], without the need to include a separate measure of prices (i.e. inflation rate) alongside the nominal exchange rate. This approach has also been used by other authors trying to establish the effects of capital flows on the exchange rate. Moreover, although the central bank tries to keep the bilateral exchange rate of the kuna against the euro relatively stable, developments on global financial markets determine the exchange rate of kuna towards other currencies that can significantly affect some sectors in the economy[12]. Therefore, we find it appropriate to use this more comprehensive exchange rate indicator because it is a standard measure of price competitiveness and more adequate for the assessment of the overall macroeconomic developments.

To sum up, the contemporaneous structure of restrictions as explained above can be written in the matrix form:

$$A_0^* y_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} GDP\_EU \\ CF\_L \\ MP \\ GDP\_HR \\ REER\_CPI \end{bmatrix} \tag{6}$$

Regarding data used in the empirical analysis, capital flow transactions are derived from the CNB's balance of payments and external debt statistics, based on the BPM6 and ESA 2010 methodological standards. The impact of capital flows on the exchange rate is estimated using gross flows, as they have been more in the focus of the recent empirical literature[13], while net flows are considered only as a robustness check. Although theoretically it is net flows that through supply and demand on the foreign exchange market determine the exchange rate, the inclusion of gross flows in the model can provide a more comprehensive view on the forces affecting the exchange rate. This approach has also been taken by Yesin (2016), supported by the findings from the literature that capital inflows and outflows behave differently and carry important information on their own[14].

Total capital inflows (Figure 5) represent the sum of net incurrence of liabilities based on foreign direct investment, portfolio investment and other investment (excluding liabilities of the central bank[15]). Total capital

10 Ineffectiveness of interest rate policy in Croatia can be related to the impossible trinity, stating that interest rates cannot be used as a policy instrument simultaneously with a stable exchange rate policy and free capital movements.

11 Hoggarth and Sterne (1997) argue that when a nominal exchange rate is fixed, adjustments in the economy can happen only through changes in prices and/or wages that usually take much longer to adjust than the exchange rate.

12 For example, some sectors have been issuing USD (government and corporates) or CHF (banks) denominated debt, while in some sectors prices and profits are highly dependent on the exchange rate of the kuna towards other currencies except euro (i.e. shipbuilding industry and oil refineries are strongly influenced by kuna/USD exchange rate).

13 There has been a shift in the recent literature on capital flows from net to gross flows (Lane, 2013; Broner et al., 2013; Hoggarth et al., 2016; Yesin, 2016).

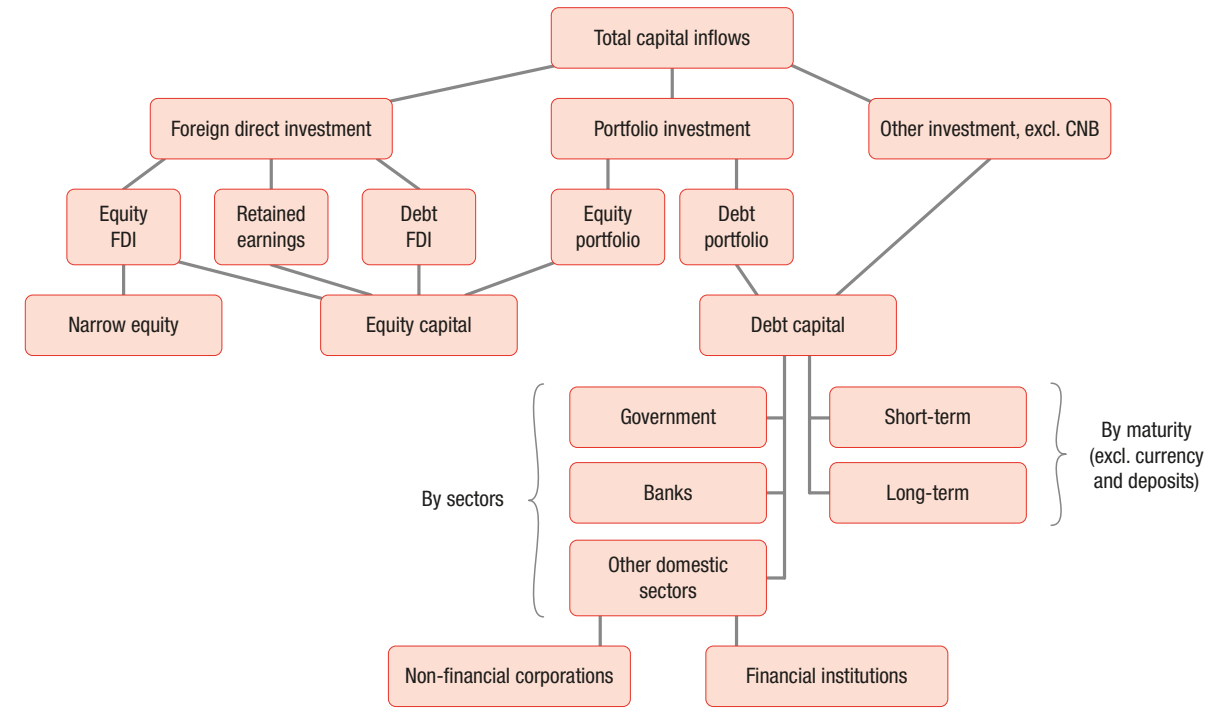
14 For instance, Broner et al. (2013) show that gross capital flows are very large and volatile, especially relative to net capital flows, as well as pro-cyclical.

15 Foreign liabilities of CNB have become significantly volatile since the first quarter of 2015 due to the investment of part of gross international reserves in reverse-repo agreements that were extended into the following month, resulting in the equal and simultaneous increase/decrease in assets and liabilities (thus neutral on the net international position of the central bank). These transactions were in the previous periods closed by the end of each month, and thus did not appear in the CNB's assets/liability position.

inflows are divided into several subcomponents. First, equity and debt inflows are considered. Equity capital includes total foreign direct investment (equity investment, retained earnings and debt liabilities towards affiliated enterprises[16]) and equity portfolio investment. Narrow equity, comprising only the equity capital subcomponent of FDI, was also included in the estimation, as the authors believe that this segment is the best approximation of pure equity investments, in contrast to reinvested earnings that do not represent actual cash flow, or intercompany loans that can be considered a hybrid between equity and debt financing. Debt capital refers to debt portfolio and other investment.

Second, total debt capital inflows are further analysed in more detail. According to their original maturity they are divided into short-term and long-term, excluding currency and deposits for which no full breakdown is available in the entire period. In addition, the sectoral structure of debt inflows is considered. In particular, the effects of foreign borrowing of the government, banks and other domestic sectors are estimated. Other domestic sectors include, mainly, non-financial corporations and other non-monetary financial institutions (mostly leasing and factoring companies), both private and public, covering only borrowing from non-affiliated enterprises. The foreign borrowing of non-financial corporations and other financial institutions is assessed separately. Where relevant, the effects of round-tripping and debt-equity swaps are excluded.

Figure 5 Capital flows structure



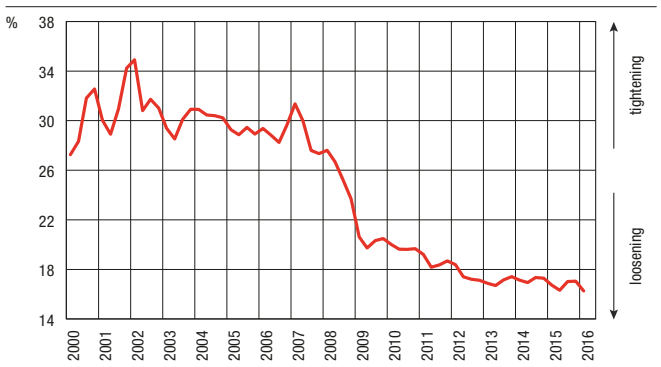
The monetary policy indicator used in the model is defined as a ratio between credit institutions' assets required by regulations (net of excess liquidity) and their total assets. Its increase indicates monetary tightening, for example through an increase in reserve requirements (in kuna and foreign currency) or in the required minimum foreign currency liquidity[17] that raises banks' immobilised funds. On the other hand, its decline

16 In the empirical literature debt FDI is often included in the equity capital, as authors assume that borrowing from affiliated enterprises is more similar to equity than to debt investments. Recent developments in Croatia justify this approach, as a large portion of FDI debt was transformed into equity capital, usually in cases when the borrower was unable to repay its debt. In the 2002-2008 period, debt-equity swaps on average accounted for around 0.3% of GDP compared to 1.4% of GDP in the 2009-2015 period.

17 The minimum required foreign currency claims is a structural monetary policy measure that obliges banks to maintain a certain amount of liquid foreign assets, specified as a minimum ratio of their foreign currency liabilities. When the measure was introduced in February 2003, the ratio was set at 35%. Since then the measure was adjusted several times, including a gradual reduction of the ratio, currently set at 17%. More on the instruments included in the calculation of the monetary policy indicator can be found in Ljubaj (2012).

points to monetary loosening as it leaves banks with more funds, which were previously set aside, to finance their business activity (Figure 6). The effect of the monetary policy indicator on the exchange rate is ambiguous as it includes instruments that regulate both kuna and foreign currency liquidity and can therefore move the exchange rate in the opposite directions. This effect could either come from the influence of those instruments on the nominal exchange rate through the impact on banks' net demand on the foreign exchange market, or on relative prices through the impact on domestic inflation. The monetary policy indicator is calculated using CNB data.

Figure 6 Monetary policy indicator



Notes: Monetary policy indicator = Credit institutions' assets required by regulations/Total credit institutions' assets. Assets required by regulations (net of excess liquidity) include calculated reserve requirement in kuna, allocated reserve requirement in foreign currency, marginal reserve requirement, CNB bills and minimum foreign currency liquidity. Data for 2016 are showed up to the end of the first quarter.
Source: CNB.

Exchange rate developments are measured by the kuna real effective exchange rate index deflated by consumer prices, taken from the CNB database. An increase in the exchange rate index points to real depreciation. It should be taken into account that although this indicator depends on the basket of trading partners, the currency composition of financial flows also confirms the prominent role of the euro.[18]

In all of the estimations, quarterly data were used, ranging from the first quarter of 2000 to the first quarter of 2016. Original data were seasonally adjusted. Capital flows data (expressed in million EUR) and the monetary policy indicator were not additionally transformed, while a logarithmic transformation was applied to GDP and the exchange rate. Stationarity of the time series in levels and first differences was tested using augmented Dickey-Fuller test (ADF) and the results are presented in Table A1 in the Appendix. They suggest that many of the variables are not stationary in levels while they are all stationary in first differences. Therefore, all variables entered the model in first differences.

5 Results

In this chapter, we present the results of the SVAR models with block exogeneity, performed on different types of capital inflows. The imposed assumption that Croatia cannot, because it is a small open economy, influence foreign macroeconomic variables (in our case EU GDP) was verified using the Granger causality test. In general, the results confirm that shocks of domestic variables do not affect EU GDP (Appendix, Table A2).

The number of lags in the models was selected without using a formal criterion. It was discretionarily

18 Euro comprises between 70% and 80% of the external debt stock, while the remaining part in the recent years has been accounted for by the US dollar and the kuna, and in the years before the crisis also by the Swiss franc and the yen. Data on the currency structure of equity investment are not available, while geographical structure of FDI liabilities shows that in the period 2000-2016 around 3/4 of total originated from the euro area.

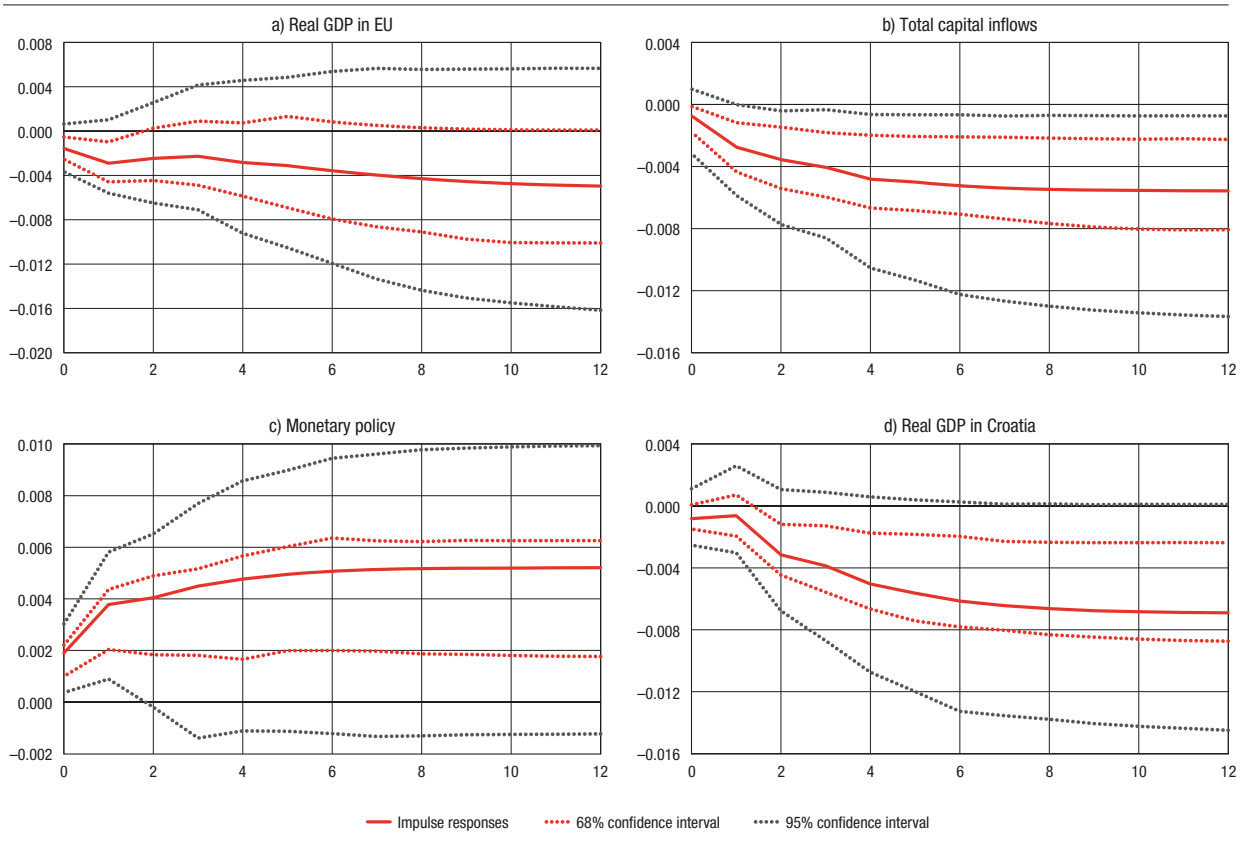
determined at 2, taking into account the relatively short data sample. However, following Krznar and Kunovac (2010), the Portmanteau test was used to verify that additional lags are not left in the errors, which would lead to their autocorrelation. The results confirm that (observed up to 8 lags) there is no autocorrelation among errors. In addition, all models meet the requirement of stability that was verified by the modulus of root, which is always greater than one (Appendix, Table A2).

The rest of this chapter is divided into three parts. Firstly, we interpret the results of impulse response analysis to understand better how a positive shock of one standard deviation[19] in different types of capital inflows affects the change of the kuna real effective exchange rate deflated by consumer prices[20] (for the summary of findings see Appendix, Table A3). Secondly, the results of variance decomposition are presented to identify the contribution of foreign and domestic shocks to variance of the exchange rate. Thirdly, several robustness checks are discussed.

5.1 Impulse responses

The responses of kuna exchange rate to a shock to other variables in the model are given in Figure 7. An increase in total capital inflows to Croatia leads to statistically significant kuna appreciation, which is consistent with the theory and the results of empirical studies for different countries. A positive shock to domestic GDP also results in kuna appreciation. On the other hand, the response of an exchange rate to a shock to

Figure 7 Impulse responses of the exchange rate to a shock to the indicated variables:

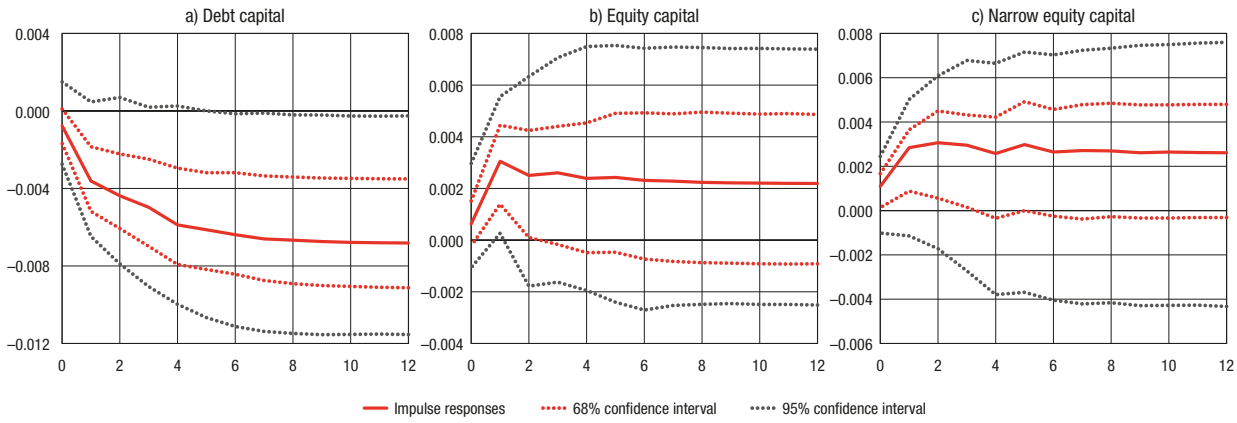


Source: Authors' calculations.

19 Accumulated responses of positive one standard deviation shock are discussed, unless indicated otherwise.

20 In the rest of the paper the term *exchange rate* will be used for the kuna real effective exchange rate deflated by consumer prices, unless otherwise indicated.

Figure 8 Impulse responses of exchange rate on a shock to capital inflows *disaggregated by capital structure*:



Source: Authors' calculations.

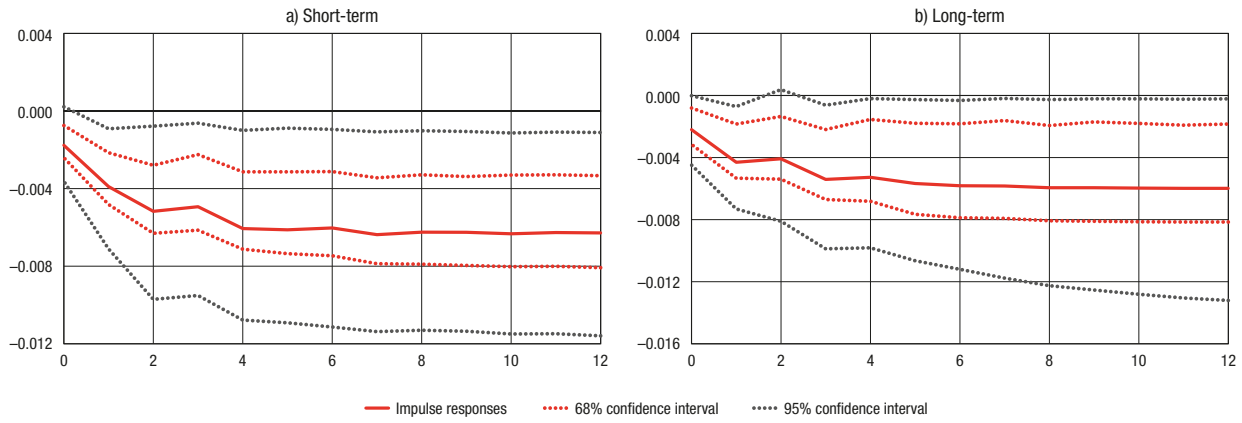
foreign GDP seems to be inconclusive. For comparison, Dumičić et al. (2015) found that foreign GDP does not have significant effect on the kuna real exchange rate against the euro. Regarding monetary policy, a restrictive monetary policy shock leads to depreciation, which could be explained as "leaning against the wind". More precisely, in periods of strong capital inflows, monetary policy tightening restrains foreign currency liquidity and helps to mitigate appreciation pressures, which would otherwise be much more pronounced. The opposite holds for the periods of weakened inflows, when monetary policy loosening allowed banks to use some of the previously immobilised funds, providing extra foreign currency liquidity in the market and containing depreciation pressures. However, this result should be interpreted with caution due to the following reasons. First, changes in the real effective exchange rate reflect developments in the nominal exchange rates of the kuna against other currencies (besides the euro) to which the central bank does not react, as well as price differentials. Second, the monetary policy indicator used in the model has its limitations as it captures not only changes in the monetary policy instruments but also autonomous decisions of commercial banks regarding the size of their balance sheet.

Impulse response functions of other variables included in the model[21], next to the exchange rate, show that a shock in foreign GDP initially has a positive effect on capital inflows, confirming the importance of external factors as the *push* determinants of capital inflows, although afterwards this effect disappears. On the other hand, the effect of a shock to domestic GDP on capital inflows is not statistically significant, indicating that the role of different domestic factors determining capital flows should be investigated in more detail. The importance of the spillover effect of external shocks on domestic GDP, which has been found in other SVAR models for Croatia, is confirmed. In addition, an increase in capital inflows has a positive impact on domestic real activity.

Separating total inflows according to capital structure (ownership relation to creditors) into equity and debt components yields diverging results. Debt capital inflows lead to kuna appreciation (Figure 8a), while equity capital inflows do not have a statistically significant effect (Figure 8b). Since equity capital includes several different types of equity capital flows, the additional variable of *narrow equity capital* (excluding retained earnings, debt to affiliated companies and portfolio equity), which refers to the inflow of money used to establish a new business, acquire existing company or recapitalise them, was also tested. A positive shock to this narrowly defined equity capital has a significant (under 68% confidence intervals) depreciation effect on the exchange rate in the first year and a half, while afterwards the impact is not clear (Figure 8c). Similar results were obtained for capital flows divided by the standard balance of payments classification into foreign direct investment, portfolio investment and other investment (Appendix, Figure A1). It follows that only other investment

21 Available upon request.

Figure 9 Impulse responses of exchange rate to a shock to *debt capital inflows by maturity*:



Source: Authors' calculations.

lead to kuna appreciation, while the effects of FDI and portfolio investment did not prove to be significant.

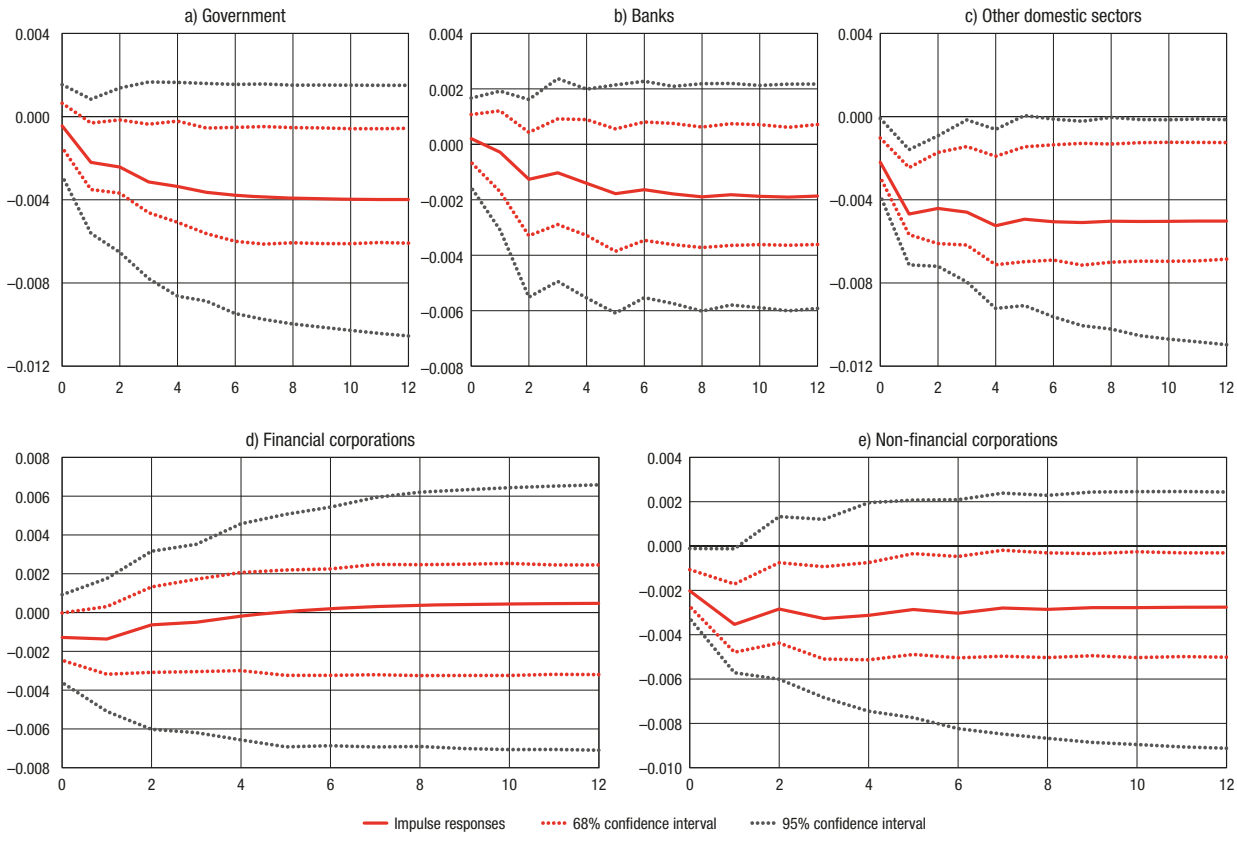
Our findings are in line with the empirical research presented in the second section, indicating that exchange rate appreciation is mainly related to debt and not to equity inflows (e.g. Athukorala and Rajapatirana, 2003; Bakardzhieva et al., 2010; Davis, 2014). This could primarily be explained with differences among debt and equity inflows regarding their relative orientation towards the tradable versus the non-tradable sector, with equity inflows being somewhat more directed to the tradable sector. Also, equity FDI could lead to a surge in imports of machinery and other capital goods that generate demand for foreign exchange and thus alleviate appreciation pressures on the nominal exchange rate, or could lead to a fall in prices due to the increased competition or productivity and a consequent real depreciation. The empirical evidence on the positive impact of FDIs on Croatian economy corroborates this. For example, Škudar (2012) showed that FDI manufacturing firms are more successful than domestic in terms of faster growth in, for example, productivity, while Marić (2008) found positive own-firm as well as spillover effects in terms of increased productivity of industrial firms. Also, Jovančević (2007) indicated that substantial FDI inflows in the telecommunication sector resulted in lower prices and a higher quality of telecommunication services, while foreign investments in wholesale and retail trade contributed to increased competition in this sector and a significant drop in retail prices of imported goods.

When it comes to debt capital, its maturity structure is not relevant for the impact on the exchange rate. Both short-term and long-term foreign borrowing (excluding currency and deposits due to the lack of data) has a statistically significant appreciating effect on the kuna (Figure 9). In addition, the magnitude of their impact seems to be of similar intensity. Nevertheless, it should be taken into account that the majority of foreign borrowing was in the form of long-term instruments that are much more stable than short-term instruments.

In contrast to maturity structure, the sectoral structure of debt capital inflows does matter. Disaggregating debt inflows by domestic sectors (Figure 10) reveals that the most prominent effect on kuna appreciation comes from foreign borrowing of other domestic sectors (from the non-affiliated creditors), as shown in Figure 10c. Such results could indicate that these funds were to a smaller extent, compared to FDI inflows, used for increasing the production capacity of the economy in the tradable sector but were even more oriented towards the non-tradable sector[22]. Among other domestic sectors, foreign borrowing of non-financial corporations affects kuna appreciation (Figure 10e), statistically significant at the 68% confidence interval, which

22 The sectoral structure of other domestic sectors' foreign debt in 2016 reveals that approximately only 10% of total stock refers to manufacturing industry, while the majority of debt inflows went into the real estate sector, construction and financial intermediation (non-banks). On the other hand, the accumulated inflow of foreign direct investment in the period from 1993 until 2016 (proxy for the stock of equity investments) shows that almost one third of the total (excluding financial intermediation, mostly referring to banks) went to the manufacturing sector, while the rest is attributable to real estate, trade and the telecommunication sector.

Figure 10 Impulse responses of exchange rate to a shock to *debt capital inflows disaggregated by sectors*:



Source: Authors' calculations.

could have occurred through both nominal appreciation as well as excess demand for non-tradables leading to an increase in their relative prices. On the other hand, foreign borrowing of financial institutions (leasing or factoring companies) does not affect the kuna exchange rate (Figure 10d)). Anecdotal evidence suggests that this could be related to the extensive financing of tradable goods like cars or machinery, which are imported and priced in euros, thus reducing the immediate impact on the nominal exchange rate. Unlike for the earlier case of equity investment, empirical literature does not suggest that this type of capital flow could have stimulated a fall in prices leading to real depreciation.

The foreign borrowing of government and banks cannot be straightforwardly said to lead to kuna appreciation. However, looking at the 68% confidence intervals, government borrowing (Figure 10a) leads to kuna appreciation with some lag, although of a lower intensity than corporate borrowing[23]. This could partly be explained by the fact that the government usually converts foreign currency from borrowing abroad into kuna (or purchases foreign currency for debt payments) directly through the central bank, so it does not affect the exchange rate immediately, or affects it to a lesser extent. In addition, this is related to the insignificant result yielded for portfolio investments that are mainly driven by new issues and repayments of government bonds, while market for other sectors' portfolio instruments is still relatively underdeveloped.

On the other hand, foreign borrowing of banks (Figure 10b) has a statistically insignificant impact on kuna exchange rate developments. This should not be surprising since capital inflows to the banking sector are partly immobilised by the central bank's measures such as that regarding the minimum foreign currency liquidity. Therefore, banks hold a considerable amount of foreign assets that should also be taken into account. When, instead of gross flows, banks' net flows (defined as liabilities minus assets) are considered, the

23 Based on impulse responses of unit shocks that are available upon request.

results again turn out to be statistically insignificant (Appendix, Figure A2a). Moreover, since as a reaction to the CNB's measures to restrain their foreign borrowing, banks substituted for it with recapitalizations, the combined inflow of debt and equity capital in the banking sector was also tested, and again no impact on the exchange rate is found (Appendix, Figure A2b). All these results indicate that central banks' measures aimed at controlling capital flows to the banking sector were effective in limiting their influence on the exchange rate. However, there is a caveat associated with this, since in the pre-crisis period these measures were partly translated into stronger corporate sector borrowing, which has proved to have had a predominant effect on the exchange rate.

5.2 Variance decomposition

Results of variance decomposition given in Table 1 suggest that total capital inflows account for a relatively modest portion of the variance of the exchange rate (around 7% after two years). However, when total inflows are divided into equity and debt capital inflows, shocks to debt inflows are responsible for a larger proportion of the forecast error variance of the exchange rate (11%, compared to 7% for equity capital). Besides capital inflows, shocks to other domestic variables explain somewhat less than one fourth of the exchange rate variance, with a weaker influence from monetary policy than from domestic economic activity. At the same time, shocks to domestic GDP are more important than shocks to foreign GDP, irrespective of which type of capital inflow is considered. Still, a huge part of exchange rate variance is explained by itself, potentially also reflecting the importance of other variables not included in the model.

Table 1 Variance decomposition of the exchange rate, in models with various types of capital inflows

Period	Shock				
	GDP_EU	Total CF_L	MP	GDP_HR	REER_CPI
1	0.04	0.01	0.06	0.01	0.89
4	0.05	0.06	0.08	0.08	0.72
8	0.06	0.07	0.08	0.10	0.70
12	0.06	0.07	0.08	0.10	0.69
	GDP_EU	Equity CF_L	MP	GDP_HR	REER_CPI
1	0.01	0.01	0.04	0.02	0.92
4	0.03	0.07	0.04	0.10	0.76
8	0.03	0.07	0.04	0.12	0.73
12	0.03	0.07	0.04	0.12	0.73
	GDP_EU	Debt CF_L	MP	GDP_HR	REER_CPI
1	0.05	0.01	0.04	0.01	0.90
4	0.05	0.11	0.06	0.08	0.70
8	0.06	0.11	0.06	0.11	0.67
12	0.06	0.11	0.05	0.11	0.66

Source: Authors' calculations.

5.3 Robustness checks

To examine the robustness of the results presented, we modify the basic model in several ways. First, we use principal component analysis and a more extensive set of variables to represent a foreign and a domestic block of factors determining capital flows. Second, we test whether the results hold with a different ordering of the variables. Third, SVARs with net capital flows instead of gross flows were estimated. Finally, we question whether the results would change if different exchange rate indicators were used.

In the basic model, foreign and domestic macroeconomic and financial conditions are proxied by foreign and domestic real GDP. The main reason for this was to keep the model as simple as possible, especially for the interpretation of the results, and to follow on the existing literature on Croatian economy, which provides evidence for the spillover effects from foreign to domestic GDP. However, this is a very strong simplification, which does not take into account international financial conditions, mainly interest rates and volatility in financial markets, and their importance for the capital flows. Hence, as a first robustness check we use principal component analysis to construct a variable reflecting international conditions that affect global capital flows and a variable reflecting domestic macroeconomic developments.

In detail, variables used for the foreign block include real GDP in the euro area, 3 month interest rates in the euro area, 3 month interest rates in the US, Chicago Board Options Exchange Volatility Index (VIX), Emerging Markets Bond Index (EMBI) and the yield on ten-year US bond. As for the domestic block, the following variables were used: Croatian real GDP, current account balance, total bank credits, official index of the Zagreb Stock Exchange (CROBEX), consumer price index and interest rates on kuna treasury bills (364 days)[24].

The results of models with different proxies for foreign and domestic conditions (Appendix, Figure A3) indicate the appreciating impact of total capital inflows on the exchange rate; in contrast to the basic model, however, this is not statistically significant. Regarding the effects of capital flows separated into equity and debt capital, the results support the conclusion of the depreciating impact of equity and the appreciating impact of debt capital inflows.

Regarding a different ordering of the variables included in the basic model, SVARs with the following ordering were estimated: foreign GDP → domestic GDP → capital inflows → monetary policy indicator → exchange rate. With such an ordering an immediate impact of domestic GDP on capital inflows is assumed, in contrast to the basic model where it affected capital flows only with a lag. In this way, a possible contemporaneous effect of both push and pull factors as determinants of capital inflows is considered. The results obtained (Appendix, Figure A4) show that the conclusions from the basic model did not change, confirming that the appreciating impact of total capital inflows on the kuna exchange rate primarily stems from debt capital inflows, while equity capital has the opposite effect. In addition, SVARs with the following ordering were estimated: foreign GDP → capital inflows → domestic GDP → monetary policy indicator → kuna real effective exchange rate, allowing for contemporaneous impact of domestic GDP on monetary policy. Results also point to a statistically significant (at 68% confidence intervals) appreciation of kuna as a response to inflow of total capital and debt capital, while the response to the inflow of equity capital is not significant (Appendix, Figure A5).

Although the primary focus of this paper is on the impact of gross capital inflows, SVARs with net flows were also estimated. In this case, net capital flows were defined as liabilities minus assets, retaining the same coverage on the assets side as for the liabilities, as explained earlier in the text. Incorporating net capital flows in the basic model yields results almost unchanged from the estimates with gross flows (Appendix, Figure A6). Total net capital inflows have a statistically significant impact on kuna appreciation as a result of net foreign borrowing, while the depreciating effect of net equity capital inflows is again statistically confirmed only up to two quarters, and that of the narrow net equity capital lasts even longer. Disaggregating net debt capital by sectors confirms the appreciating effect of flows to other domestic sectors, while flows to government turn out insignificant. Insignificant results for the banking sector were discussed earlier in the text. Almost identical results for gross and net flows could have been expected given the (still) relatively mild importance of changes in foreign assets for the overall external position of Croatia, as indicated in the third section on capital inflows and exchange rate developments in Croatia.

In addition we performed estimations including other exchange rate indicators, using the same ordering of variables as in the basic model (Appendix, Figure A7). First, the nominal effective exchange rate was used and the results confirmed the statistically significant impact of total capital inflows on the nominal appreciation

24 Data reflecting international conditions were taken from Eurostat, OECD and Bloomberg and data reflecting domestic conditions from CNB, Central Bureau of Statistics and Zagreb Stock Exchange. Logarithmic transformation was applied for most of the original, seasonally adjusted data, except interest rates, US bond yield and current account. Constructed principal components variables did not enter the model in first differences like other variables in the basic model since they were already derived from the data expressed in growth rates and percentages.

of kuna against the basket of currencies. Its response is less intensive than that of the real appreciation, indicating that capital inflows also lead to faster growth of domestic than of foreign prices, as well as to nominal appreciation.

Somewhat different results were obtained by including in the model real bilateral exchange rate of kuna against euro (deflated by consumer prices). Compared to the basic model, it seems that total capital inflows, as well as other variables included in the model, do not have a statistically significant effect on the real exchange rate against euro. These results are to some extent influenced by the lower volatility of bilateral than of effective exchange rate.[25] However, models with different types of capital inflows were further investigated. It follows that the statistically significant (at 68% confidence intervals) depreciating impact of equity capital (with both broad and narrow definitions) and the appreciating impact of foreign borrowing of other domestic sectors, in particular non-financial corporations were retained[26]. This confirms that the appreciating effect of capital inflows is mostly due to the corporate sector borrowing.

Finally, models including these two additional exchange rate indicators and net capital flows were estimated and the results do not differ from the models performed using gross inflows (Appendix, Figure A8). Impulse response of NEER to a shock to net capital flows indicates appreciation, although it is only significant at the 68% confidence interval, while again no statistically significant effect is found for the response of the real bilateral exchange rate of the kuna against the euro.

6 Concluding remarks

This paper found evidence that in the last fifteen years not all capital inflows to Croatia had the same impact on the kuna exchange rate. Structural VAR models with block exogeneity restrictions estimated on different types of capital flows showed that an increase in total capital inflows resulted in kuna appreciation, which was entirely due to debt capital inflows, irrespective of their maturity. The bulk of the effect is associated with the corporate sector and, to a lesser extent, with government. No impact of the banking sector's borrowing is found, indicating that the central bank managed to limit its effect on the exchange rate. Also, some impact of equity capital inflows on the exchange rate depreciation is evident.

Taking all this into account, it follows that in the medium-term no pronounced pressures on the kuna exchange rate stemming from the analysed capital flows are to be expected. Croatia is currently running a current account surplus that is likely to continue in the next few years, although steadily diminishing. Also, capital outflows are expected, but mainly through the banking sector regulated by various monetary and macroprudential measures, thus having no impact on the exchange rate. Regarding the corporate sector, which has the most pronounced effect on the exchange rate, stronger borrowing combined with the pick-up in economic activity could create appreciation pressures on the kuna. However, they could be constrained by the sector's high indebtedness. Gradual recovery of equity inflows in the coming years could be an additional neutralizing factor. In addition, government efforts to stabilise its fiscal position should curb its need for foreign borrowing, also limiting its effect on the exchange rate. However, apart from the analysed capital flows, there are other factors that have become more important in the recent years since Croatia joined EU, like income from residents working abroad (in other EU countries) or transfers from the EU funds, which could strongly influence exchange rate developments in the near future.

Nevertheless, the research findings have important policy implications. They indicate that the central bank's measures were effective in limiting the influence of capital flows to the banking sector on the exchange rate and provide support for the intensive use of these countercyclical policy instruments. In addition,

25 This explanation can also be found in some other studies on Croatian economy where low kuna/euro exchange rate volatility has been addressed as the main obstacle to reaching significant results, for example in estimations of the exchange rate pass-through in Croatia, as indicated in Jankov et al. (2008). Also, Dumičić et al. (2015) found that foreign prices and GDP do not have a significant effect on the kuna real exchange rate against the euro.

26 Additional impulse responses are available upon request.

the structure of capital flows has proved to have an important role for kuna exchange rate developments, which should be taken into account in the future design of monetary policy instruments and macroprudential measures.

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Appendix

Table A1 Results of the stationarity tests

Variable	Level			First difference		
	Without	Constant	Const.+trend	Without	Constant	Const.+trend
Real GDP_Croatia	–	–	–	+	+	+
Real GDP_EU	–	–	–	+	+	+
Total capital inflow	–	–	–	+	+	+
Equity inflow (broad definition)	–	–	–	+	+	+
Equity inflow (narrow definition)	–	+	+	+	+	+
Debt inflow	–	–	+	+	+	+
Short-term investment	+	+	+	+	+	+
Long-term investment	–	–	–	+	+	+
Government's foreign borrowing	+	+	+	+	+	+
Banks' foreign borrowing	–	–	+	+	+	+
Other domestic sectors' foreign borrowing	+	–	–	+	+	+
Non-financial corporations' foreign borrowing	–	–	–	+	+	+
Other financial institutions' foreign borrowing	–	–	–	+	+	+
Monetary policy stance indicator	–	–	–	+	+	+
Real effective exchange rate deflated by CPI	–	–	–	+	+	+
Proxy for domestic conditions	+	+	+	+	+	+
Proxy for international conditions	+	+	+	+	+	+

Notes: The table shows the results of Augmented Dickey Fuller test. Tests are performed on seasonally adjusted data. The choice of number of lags is based on Schwarz Information Criteria. "+" indicates tests that at a 5% level of significance confirm stationarity of the series.
Source: Authors' calculations.

Table A2 Results of the Granger causality, autocorrelation and model stability tests in various SVAR models, using different types of capital inflows

Type of capital inflows	Granger causality (p-value)	Portmanteau test (up to 8 lags)	Stability test (minimum value)
Total	0.43	0.03	1.68
Equity (broad)	0.70	0.23	1.72
Equity (narrow)	0.27	0.07	1.53
Debt	0.55	0.07	1.66
Short-term	0.78	0.10	1.47
Long-term	0.57	0.11	1.62
Government debt	0.76	0.12	1.68
Banks debt	0.32	0.10	1.33
Other domestic sectors debt	0.69	0.04	1.64
Non-financial corporations debt	0.64	0.16	1.48
Financial corporations debt	0.79	0.20	1.68

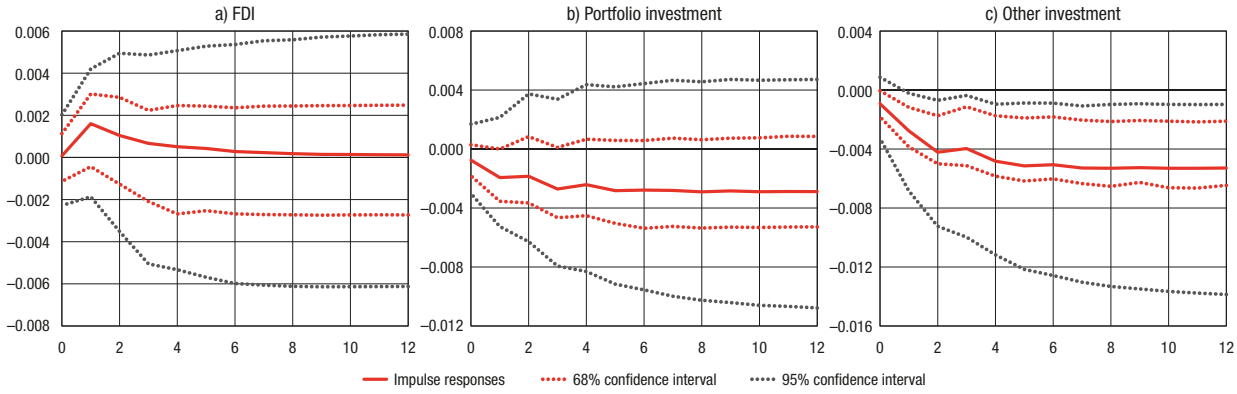
Note: Granger causality test was performed with the null hypothesis that the domestic block (with different types of capital inflows) does not Granger-cause EU GDP.
Source: Authors' calculation.

Table A3 Accumulated impulse responses of real effective exchange rate to a shock to different types of capital flows

Type of capital flow	Number of quarters				
	0	1	4	8	12
Gross inflow – total	NS	A (**)	A (**)	A (**)	A (**)
Gross inflow – equity	NS	D (*)	NS	NS	NS
Gross inflow – narrow equity	D (*)	D (*)	D (*)	NS	NS
Gross inflow – debt	NS	A (*)	A (**)	A (**)	A (**)
Gross inflow – debt, short term	A (*)	A (**)	A (**)	A (**)	A (**)
Gross inflow – debt, long term	A (*)	A (**)	A (**)	A (**)	A (**)
Gross inflow – debt, government	NS	A (*)	A (*)	A (*)	A (*)
Gross inflow – debt, banks	NS	NS	NS	NS	NS
Gross inflow – debt, other domestic sectors	A (**)	A (**)	A (**)	A (*)	A (*)
Gross inflow – debt, other domestic sectors, non-financial corporations	A (**)	A (**)	A (*)	A (*)	A (*)
Gross inflow – debt, other domestic sectors, financial corporations	NS	NS	NS	NS	NS

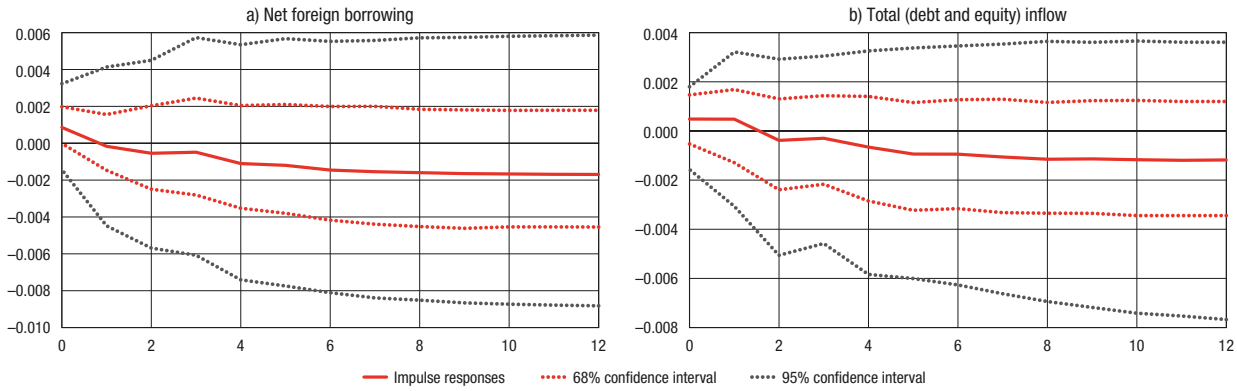
Note: **A** indicates that a positive shock to capital flows leads to real effective appreciation, **D** that it leads to depreciation and **NS** that the result is not statistically significant.
(*) indicates 68% and (**) 95% confidence interval
Source: Authors' calculations.

Figure A1 Impulse responses of exchange rate to a shock to *different types of capital inflows*:



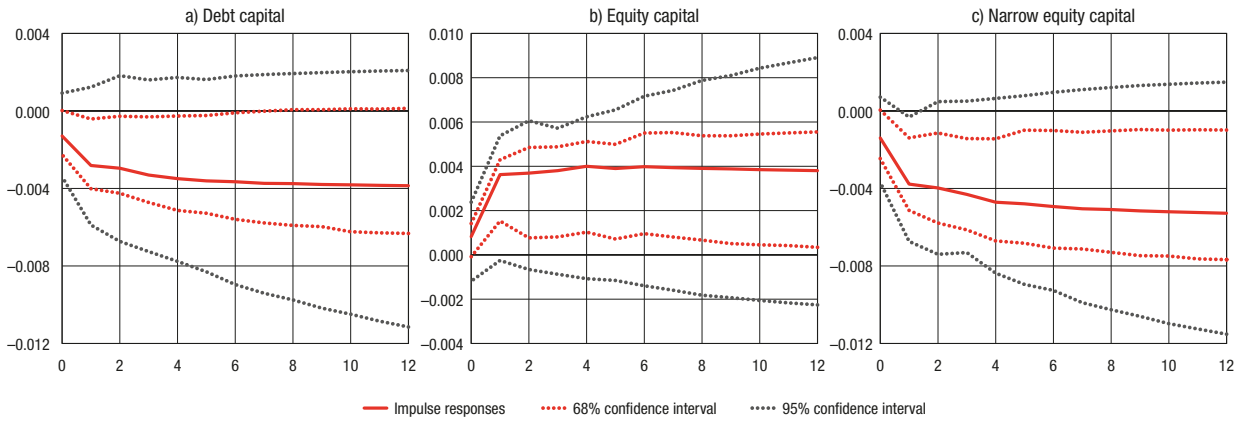
Source: Authors' calculations.

Figure A2 Impulse responses of exchange rate to a shock to the *banking sector's*:



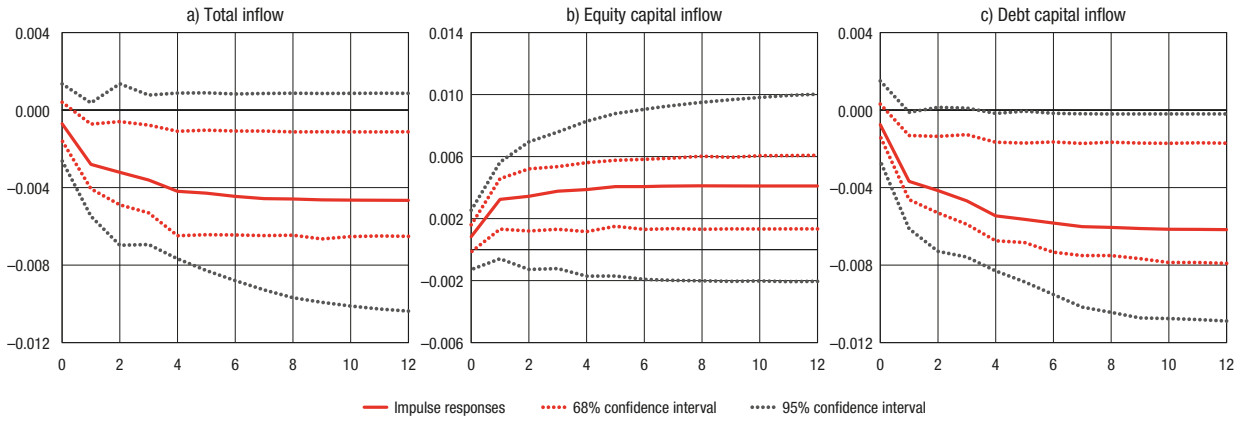
Source: Authors' calculations.

Figure A3 Impulse responses of exchange rate to a shock to different capital inflows, in models *with foreign and domestic principal component variables*:



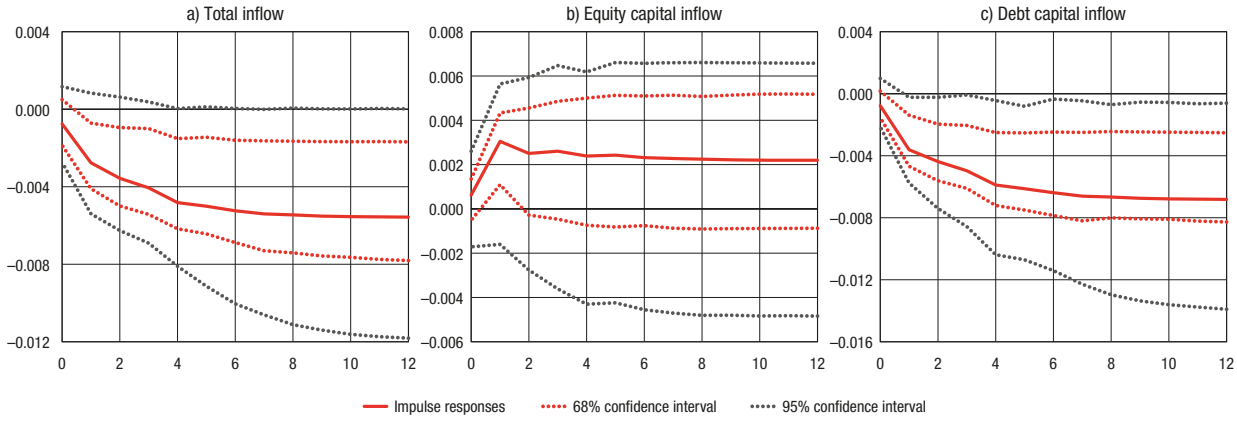
Source: Authors' calculations.

Figure A4 Impulse response of exchange rate to a shock to capital inflows, with *different ordering* of variables (*GDP_EU*, *GDP_HR*, *CF_L*, *MP*, *REER_CPI*):



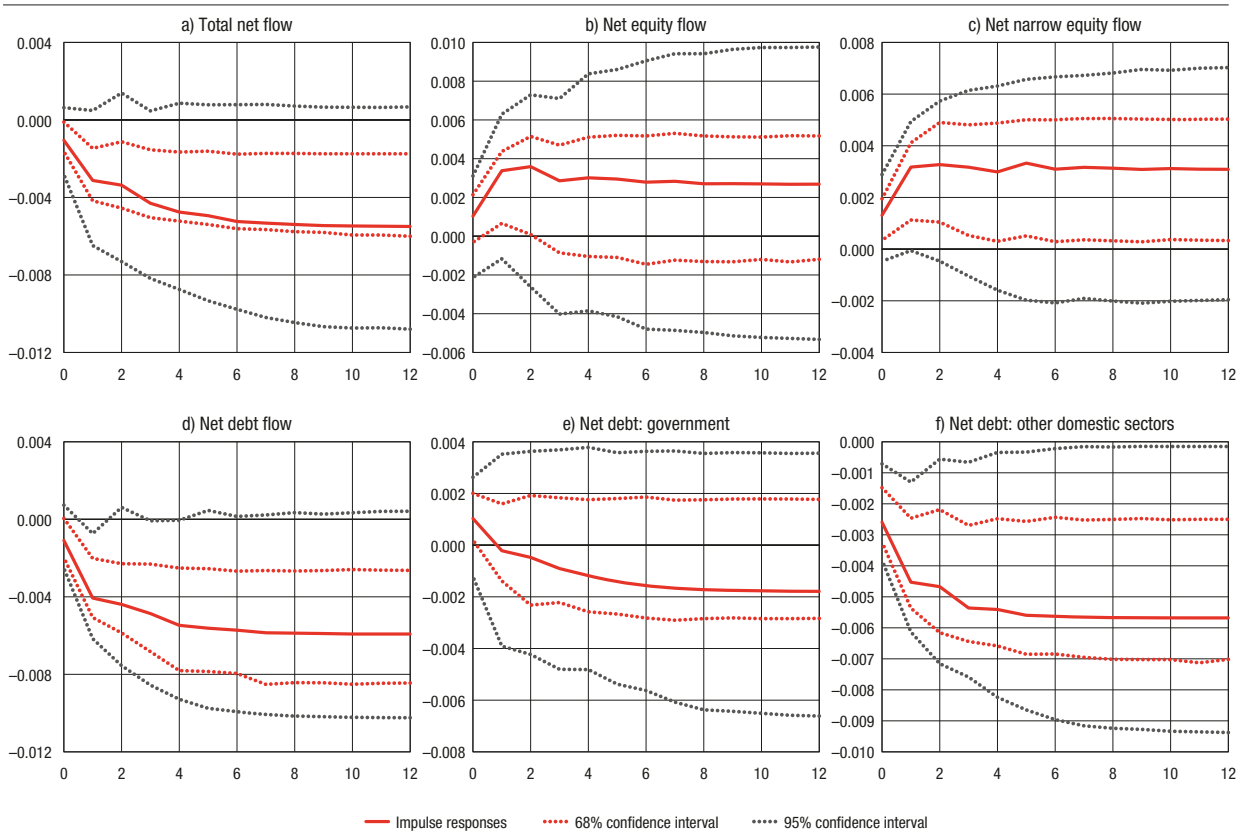
Source: Authors' calculations.

Figure A5 Impulse response of exchange rate to a shock to capital inflows, with *different ordering* of variables (*GDP_EU*, *CF_L*, *GDP_HR*, *MP*, *REER_CPI*):



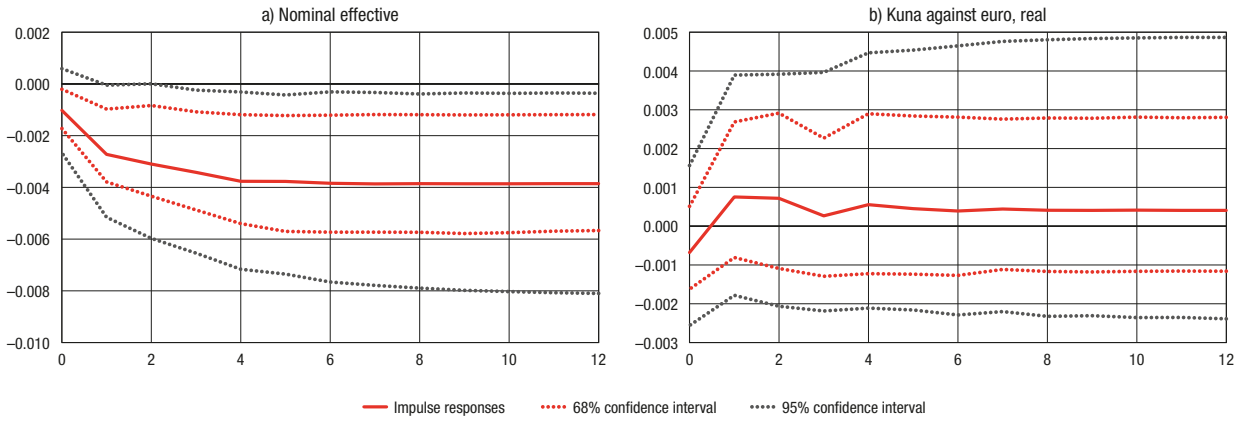
Source: Authors' calculations.

Figure A6 Impulse responses of exchange rate to a shock to *net capital flows*:



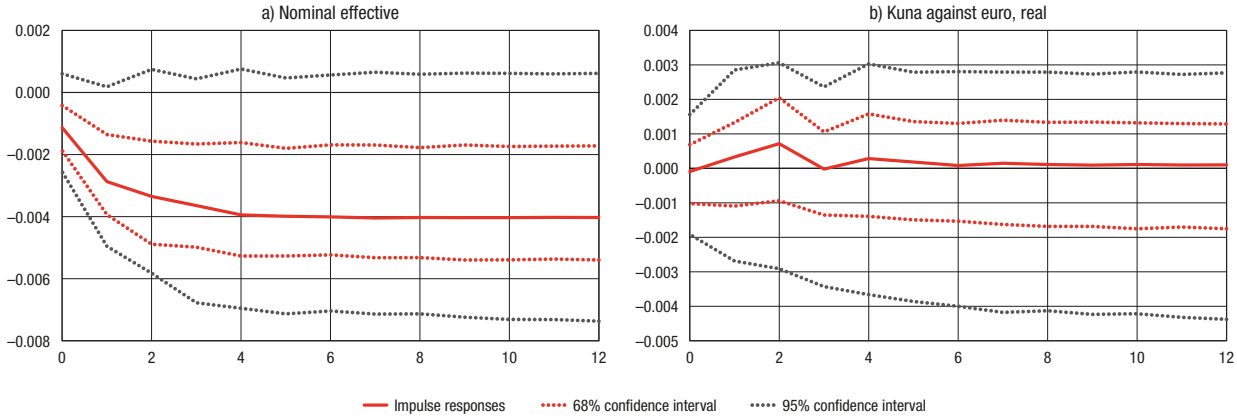
Source: Authors' calculations.

Figure A7 Impulse responses of *different exchange rate indicators* to a shock to total (gross) capital inflows:



Source: Authors' calculations.

Figure A8 Impulse responses of *different exchange rate indicators* to a shock to net capital flows:



Source: Authors' calculations.

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