Monetary Policy Interest Rate and Financial Stability: Empirical Evidence for CARD countries

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Abstract

This article examines the relationship between monetary policy interest rates and financial stability in the Central America and Dominican Republic (CARD) countries. The objective is to determine whether the interest rates set by central banks have macroprudential effects. The analysis is conducted in two stages. In the first stage, an index is constructed to capture the evolution of financial conditions in each CARD country, and the link between this financial index and economic cycles is explored. The findings indicate that financial conditions show a moderate level of correlation across CARD countries. However, it is estimated that financial cycles do not fully align align with economic cycles, synchronizing only 60% of the time. In the second stage, the previously estimated financial cycle index is incorporated into a macroeconometric model to examine the impact of monetary policy on financial conditions. The results reveal that an increase in interest rates leads to financial instability in all CARD countries, suggesting that interest rate decisions have significant macroprudential effects. Consequently, the monetary authorities within the CARD block have the capacity to adjust interest rates and influence financial stability when necessary.

Keywords: Macroprudential policy, monetary policy, dinamic factor model, financial stability.

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1 Introduction

For monetary policy, financial stability fulfills two fundamental roles: (i) it is a condition that allows improving the effectiveness of the policy interest rate on economic activity and inflation (Dudley, 2019; Constancio, 2016; Constancio, 2017 ; Saldías 2017), and (ii) a condition to reduce the possibility of crises that generate strong deviations of inflation or production with respect to the objectives established by the central bank (Jermann and Quadrini, 2012; Nolan and Thoenissen 2009; Zheng, 2013).

Despite the relevance of financial stability for monetary policy, historically the monetary authorities have not fully considered financial conditions in the decision rules (Kitney, 2018; Agénor and da Silva, 2012), since this corresponded to another nature. The objective of preserving financial stability is typical of prudential regulation, which is formulated by institutions that are mostly independent from the central bank and which is managed under different macroprudential and microprudential instruments (Galati and Moessner 2013; Farhi and Werning, 2016).

However, there is currently a debate about whether monetary policy should take financial stability considerations into interest rate decisions and set said instrument with a view to affecting financial conditions. A part of the literature proposes that the interest rate can complement macroprudential instruments or even replace them (Aikman et al., 2019). Another stream of literature argues that the scope of monetary policy to generate stability in a system of multiple financial institutions is insufficient (Korinek and Simsek, 2016; Farhi and Werning, 2016). On the other hand, there is literature that argues that monetary policy can be an optimal tool if macroprudential instruments are incomplete (Gourio et al. 2018; Caballero and Simsek, 2019).

In the economies of Guatemala, Costa Rica, Nicaragua, Honduras, El Salvador, and the Dominican Republic (CARD economic bloc), significant progress has been made in matters of prudential regulation based on Basel II and III standards (Delgado and Meza, 2011; Aguilar, 2016). However, progress in regulation in CARD countries has been mainly on the microprudential front, including tools such as credit limits, monitoring of financial mismatches, sectoral and specific measures. Regarding macroprudential measures aimed at protecting against systemic risks, these are still in the development phase in these countries (Aguilar, 2016). Against this background,

Regarding the previous evidence, the international literature has proposed that monetary policy in general has significant effects on specific financial variables. Thus, it is estimated that real debt levels relative to GDP increase in the short term after a restrictive monetary policy, but decrease in the medium term (Alpandra and Zubairy, 2014; and Gelain, Lansing and Natvik, 2015). Furthermore, other evidence suggests that higher interest rates induce banks to adjust their credit standards (Borio and Zhu, 2012; Acharya and Naqvi, 2012) and shrink their loan portfolio (Ananchotikul and Seneviratne, 2015). On the other hand, various authors find that a restrictive monetary policy decreases the level of leverage of financial institutions (Cecchetti, Mancini-Grifoli and Narita, 2015; Bruno and Shin, 2015), decreases average real estate prices (Jorda, Schularick and Taylor, 2015; Iacoviello and Minetti 2007) and increases credit spreads with respect to treasury bonds (Gertler and Karadi, 2013; Lopez-Salido, Stein and Zakrajsek 2015). Finally, another stream of literature focuses on analyzing the impact of monetary policy on financial conditions using indices that capture the movement of multiple financial variables. In this current, it is estimated that a contractionary monetary policy generates a negative and significant reaction in the financial conditions of the market (Castelnuovo, 2013; Sethi and Acharya 2019). Iacoviello and Minetti 2007) and increases credit spreads with respect to treasury bonds (Gertler and Karadi, 2013; Lopez-Salido, Stein, and Zakrajsek 2015). Finally, another stream of literature focuses on analyzing the impact of monetary policy on financial conditions using indices that capture the movement of multiple financial variables. In this current, it is estimated that a contractionary monetary policy generates a negative and significant reaction in the financial conditions of the market (Castelnuovo, 2013; Sethi and Acharya 2019). Iacoviello and Minetti 2007) and increases credit spreads with respect to treasury bonds (Gertler and Karadi, 2013; Lopez-Salido, Stein, and Zakrajsek 2015). Finally, another stream of literature focuses on analyzing the impact of monetary policy on financial conditions using indices that capture the movement of multiple financial variables. In this current, it is estimated that a contractionary monetary policy generates a negative and significant reaction in the financial conditions of the market (Castelnuovo, 2013; Sethi and Acharya 2019).

The previously cited literature sheds light on the possible effects that monetary policy would have on the financial market. But there is no literature on this topic for CARD countries that require further exploration of the impacts of monetary policy on the financial system in the context in which macroprudential regulation is under development. Thus, the objective of this paper is to quantitatively analyze the impact of monetary policy on financial conditions in the CARD countries. To achieve the objective, the analysis is divided into two stages. The first stage consists of estimating an index of financial conditions that reflects the financial situation on a monthly basis for each of the CARD countries. In this stage, the methodology proposed by Koop and Korobilis (2014) will be used. In addition, At this stage, the evolution of the index will be studied and its link with fluctuations in real activity and inflation will be discussed. The second stage consists of quantifying the effect of monetary policy on financial conditions in all CARD countries. In this stage, the previously estimated financial conditions index will be introduced into a VAR macroeconometric model with changing parameters and stochastic volatility proposed byCogley and Sargent (2005) and Primiceri (2005). Subsequently, the impact of a contractionary monetary policy on the financial conditions index for each of the countries will be analyzed and how the force of impact has evolved throughout the entire sample will be studied.

2 Quantitative analysis

2.1 Empirical strategy for calculating the financial stability index

A Time Changing Factors Model (TVLFM) developed by Koop and Korobilis (2014) is proposed, which allows capturing the unstable nature of the coefficients in a financial series model. The model consists of a panel of financial variables X_{it} which depends on two factors that are common to the entire panel of variables: macroeconomic conditions Y_t and financial conditions f_t. Likewise, there is a VAR-type dynamic with lags between macroeconomic and financial conditions. Establishing separate factors (Y_t and f_t) and to model the financial series apart from the macroeconomic ones allows isolating each component appropriately. In this way the model is,

$$X_{it} = \lambda_t^Y Y_t + \lambda_t^f f_t + v_t$$
$$\begin{bmatrix} Y_t \\ f_t \end{bmatrix} = c_t + \sum_{j=1}^{P} B_{t,j} \begin{bmatrix} Y_{t-j} \\ f_{t-j} \end{bmatrix} + e_t,$$

where both v_t as e_t are Gaussian errors with mean zero and variances V_t and Q_t, respectively, λ_t^Y are the regression coefficients, λ_t^f are the "factor loadings", c_t are the intercepts and $B_{t,j}$ are the autoregressive coefficients of the VAR, all modeled with a structure that changes over time. The law of motion of the coefficients is described by random walks: (i) the coefficients $B_{t,j}$ and intercepts c_t lumped into a vector β_t follow a movement such that $\beta_t = \beta_{t-1} + \eta_t \sim N(0, R_t)$ and (ii) the "loadings" λ_t grouped in a vector follow a process such that $\lambda_t = \lambda_{t-1} + \eta_t \sim N(0, W_t)$

The model considers the macroeconomic conditions factor Y_t as an observable variable. For the estimation, Y_t will be made up of the short-term interest rate of each country. According to the Taylor Rule theory, this variable collects information on the monetary policy stance, the output gap, and inflationary fluctuations. In this way we will be able to isolate the macroeconomic components from the purely financial factors. The observable financial part of the model will consist of a balanced panel of 13 financial series with no mean and the unobservable financial factor of the model f_t is calculated from the algorithm. It should be noted that the model is estimated for each country separately.

The estimation process is based on the algorithm proposed by Koop and Korobilis (2012), Koop and Korobilis (2014). This consists of the use of the two-stage linear Kalman filter (filtering and smoothing) to calculate the analytical posterior distribution of the unobservable factor f_t and the coefficients β_t and λ_t. For the variances V_t and Q_t exponentially weighted moving averages with decrease factors are used and for R_t and W_t fixed estimation windows are used with control weights over the historical memory of the series. As a starting point for the latent index f_t, a simple average of all standardized financial series is used. As for the lags of the VAR part of the model, 12 lags will be included since it works with monthly frequency series. The estimated latent factor f_t of the model is interpreted as the index that includes all the information from the financial series of each country. Once this factor has been estimated, a trend-cycle decomposition process is carried out using filters. In order to avoid the bias that a single filter can generate (Hamilton, 2018), the cycles estimated by the Hodrick and Prescott (1997) and Christiano and Fitzgerald (2003) filters were averaged and rescaled to a level of 50.

To assess the synchrony between financial conditions and macroeconomic fluctuations, an indicator of business cycles is created. Said indicator is built at the quarterly level following the concept proposed by Adrian et al. (2018). This consists of an average indicator of the GDP and inflation cycles, and is called the business cycle. Both the GDP cycles and the inflation cycles are constructed following the methodology developed for the financial index.

2.2 Empirical strategy for calculating the financial stability index

The proposed econometric model is a VAR with changing parameters and stochastic volatility (TVPVARSV) developed by Cogley and Sargent (2005) and Primiceri (2005). The reduced form of the model is,

$$Y_t = B_{0,t} + \sum_{i=1}^{L} B_{i,t} Y_{t-i} + u_t, \tag{1}$$

where$u_t$is a Gaussian error with zero mean and variance, Σ_u, $B_{0,t}$ and $B_{i,t}$ and are the time-changing autoregressive intercepts and coefficients, and Y_t is the vector of endogenous variables. The law of motion of these coefficients is described by random walks such that$\beta_t = \beta_t + \xi_t \sim N(0, \Sigma_\beta)$, and .$\alpha_t = \alpha_t + \zeta_t \sim N(0, \Sigma_\alpha)$ and $\ln(\sigma_t) = \ln(\sigma_t) + \eta_t \sim N(0, \Sigma_\sigma)$. Primiceri (2005) argues that this structure is flexible enough to capture smooth and structural changes in parameters.

he estimation process will be carried out through Bayesian techniques. The parameters to be estimated ar eβ_t, α_t, $\ln(\sigma_t)$, Σ_β, Σ_α, Σ_σ. The assumed prior distributions for these parameters are $\beta_0 \sim N(\widehat{\beta}, \widehat{V}_\beta)$, $\alpha_0 \sim N(\widehat{\alpha}, \widehat{V}_\alpha)$, $\ln(\sigma_0) \sim N(\ln(\widehat{\sigma}_0), I_n)$, $\Sigma_\beta \sim W(s_1 k_1 \widehat{V}_\beta, s_1)$, $\Sigma_\alpha \sim W(s_2 k_2 \widehat{V}_\alpha, s_2)$, $\Sigma_\sigma \sim W(s_3 k_3 I_n, s_3)$ where $N(x, y)$ represents the normal distribution and $W(R, h)$ represents the Wishart distribution. The priors are calibrated by an OLS estimate of $\widehat{\beta}_0$, $\widehat{\alpha}_0$, $\ln(\widehat{\sigma}_0)$, $\widehat{V}_\beta$, $\widehat{V}_\alpha$. The parameters s_1, s_2, and $s_3$are the degrees of freedom of the innovations in β, α and $ln(\sigma)$ and , respectively, which are equivalent to the number of coefficients of each matrix in the VAR. On the other hand, the parameters k_1, k_2 and k_3 represent the weight of the prior in the posterior distribution. In the TVPVARSV model, these parameters represent the variation over time that the investigator suspects a priori. The number of lags chosen is $L = 1$. In the context of changing parameters, there are no tests for specifying the number of lags. However, when estimating a VAR with constant coefficients using the same variables, the criteria propose between one and two lags. To avoid oversizing the model, only one lag is used. The model will be simulated with 30,000 Gibbs iterations and 29,000 will be discarded. The procedure will be such that, out of every 2 simulations, 1 will be stored. In this way, the autocorrelation in the Markov chains will be controlled. The model specifications will be the same for each country estimate.

Regarding the identification scheme, a recursive scheme is used from the Cholesky decomposition. Four variables are used in the model: (i) production, (ii) inflation, (iii) interest rate and (iv) financial conditions. To identify structural shocks, it is first assumed that production does not respond to supply shocks (inflation) at the same time, because volumes adjust more slowly than prices, and to monetary policy shocks (interest rate).) and financial shocks (IMCF). Then, it is assumed that inflation responds contemporaneously to demand (output) shocks, but does not react simultaneously to monetary policy shocks and financial shocks. The assumption that both economic activity and inflation do not respond simultaneously to the interest rate is reasonable to the extent that monetary policy takes time to affect these variables (Bernanke et al. 1999; Batini and Nelson, 2002). Likewise, it is assumed that financial shocks take time to affect production, inflation and the interest rate (Caldara, 2016), but that financial conditions do react contemporaneously to the rest of the shocks because financial variables quickly reflect shocks. emerged in other sectors. In this way, production is ordered as the first variable, then inflation, the interest rate and finally the financial conditions index. but that financial conditions do react contemporaneously to the rest of the shocks because the financial variables quickly reflect shocks that arise in other sectors. In this way, production is ordered as the first variable, then inflation, the interest rate and finally the financial conditions index. but that financial conditions do react contemporaneously to the rest of the shocks because the financial variables quickly reflect shocks that arise in other sectors. In this way, production is ordered as the first variable, then inflation, the interest rate and finally the financial conditions index.

3 Data discussion

Regarding the first stage related to the estimation of the financial conditions index, thirteen financial series are used on a monthly basis. The analysis period is common for all the series, which implies that a balanced panel is used. The horizon goes from January 2003 to September 2019 (201 observations). In addition, as an observable macroeconomic factor in the model, the short-term interest rate will be used, for which the simple average of the active and passive interest rates will be used as a proxy. Data from the Central American Monetary Council (CMCA) will be used as the primary source of information, since the information provided is comparable across the CARD countries.$i$to the country and as the months analyzed and for each one of the 13 series$t$). The estimated means indicate a moderate dispersion between countries. For example, it is estimated that for net international reserves the average of the countries ranges between 5.2% and 35.1% percent and the average growth of credit to non-residents is between 4.6% and 94.7%. %. In the case of the panel data unit root test, it is observed that the null hypothesis of unit root is rejected in most cases, with the sole exception of country risk, which would not imply major problems for the estimation process.

Table 1: Variables of the Financial Index and unit root test

Variable	Median	Unit root test panel data (Im, Pesaran and Shin)
Annual growth Net International Reserves	5.2 – 35.1	-5.85***
Interest rate spread	3.0 – 9.7	-1.84**
Country risk (interbank rate - treasury bills rate)	5.5 – 8.8	-0.35
Annual depreciation Real exchange rate	-2.9 – 2.8	-6.23***
Annual growth credit to GDP ratio	-0.2 – 4.9	-1.42*
Annual growth deposits	4.5 – 17.0	-3.76***
Annual growth volume traded on the stock market	5.3 – 31.4	-6.32***
Annual growth credit to the public sector	2.8 – 22.1	-5.69***
Annual growth credit to the private sector	5.1 – 17.6	-1.45*
Annual growth credit to non-residents	4.6 – 94.7	-4.48***
Real exchange rate volatility	0.9 – 1.6	-9.96***
Interbank interest rate volatility	0.7 – 1.8	-6.51***
Total credit volatility	1.3 – 2.0	-2.22**

Note: In the first column, the series are presented. In the second column, the means are presented, showing the lowest and highest values of the six countries. In the third column, the unit root test is shown, using the W statistic of the unit root test of panel data from Im, Pesaran, and Shin (2003). The symbols ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

As for the second stage related to quantitatively analyzing the effect of monetary policy on financial conditions, four series will be used as mentioned above. Production will be approximated by the annual growth rate of the Monthly Index of Economic Activity (IMAE). Regarding inflation, the annual growth rate of the Consumer Price Index is used. The monetary policy interest rate will be approximated by the average of the active rate and the passive rate of each country. The source of these variables will be theCMCA as in the first stage. In the case of financial conditions, the estimated factor of the first stage will be used. The analysis period is January 2008 to September 2019 (141 observations). The selection of this period responds to the availability of information from the IMAE that is only available from 2008 for the Dominican Republic and with the objective of making the figures comparable, the same period was used in the rest of the countries. Table 2 presents the mean and the unit root test of panel data for the series used in this second stage, except for financial conditions. The estimated range of the average growth of the CARD countries is between 2.0% and 5.1%, while a higher range is estimated for inflation, between 1.7% and 6.6%. Regarding the short-term interest rate, a higher range is estimated than in the previous two variables, a maximum average rate of 14.3% and an average minimum of 5.2%. The results of the panel data unit root test indicate that the null hypothesis of non-stationarity is rejected for all the variables. Since these series do not have a unit root, the assumption of stationarity in the VAR model is fulfilled.

Table 2: Variables of the Financial Index and unit root test

Variable	Median	Unit root test panel data (Im, Pesaran and Shin)
Annual growth IMAE annual	2.0 – 5.1	-3.81***
Annual inflation	1.7 – 6.6	-4.84***
Short-term interest rate	5.2 – 14.3	-1.87**

Note: In the first column, the series are presented. In the second column, the means are presented, showing the lowest and highest values of the six countries. In the third column, the unit root test is shown, using the W statistic of the unit root test of panel data from Im, Pesaran, and Shin (2003). The symbols ***, **, and * are as bellow.

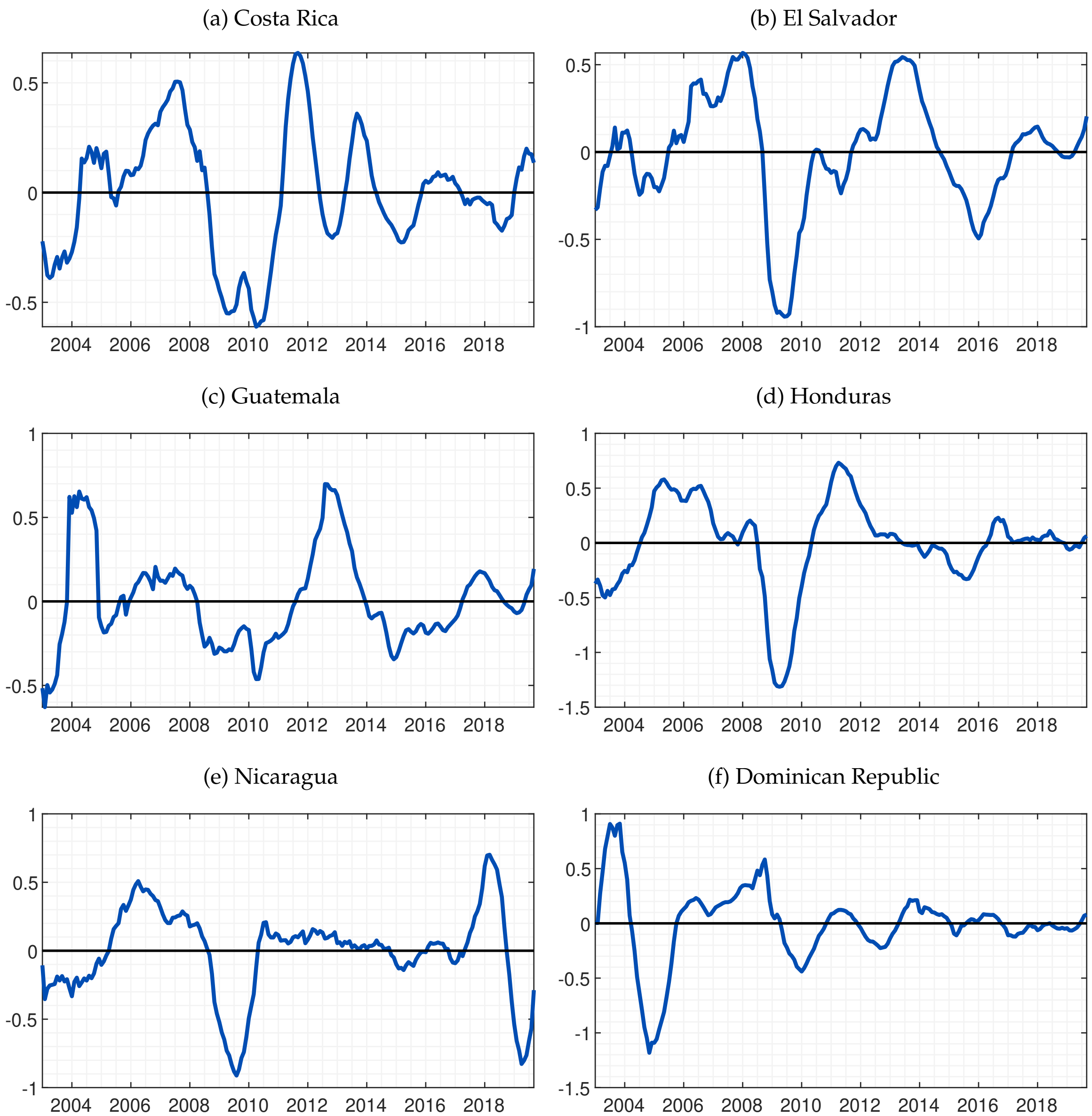
4 Empirical Results

4.1 The evolution of financial conditions over time and economic cycles

The estimated result of the latent financial factor is interpreted as the cyclical evolution of the financial conditions of the corresponding country and will be called the Monthly Index of Financial Conditions (IMCF). Values above 50 represent flexible financial conditions where the financial system is above the average natural evolution of risk, credit, investment and returns. On the other hand, values below 50 represent restrictive financial conditions where the financial system shows a higher risk, financing is scarce, investment decreases and yields fall. Values close to the 50 level are interpreted as periods of stability where the financial system evolves under normal risk, credit and investment conditions.

The results of the IMCF estimation for each country are presented in Figure 1. It is observed that all the CARD economies are moderately correlated in the evolution of financial conditions. In the periods prior to 2008, all the countries registered values above 50, that is, the financial system of the CARD countries was in flexible conditions. In this sense, in this period low risk was observed in the financial system, high willingness to grant financing and low investment capital costs, but in values beyond their natural evolution.

Figure 1: Monthly Index of Financial Conditions (IMCF)



Note: The series are presented in terms of deviations from the trend. A simple average of the cycles calculated by the Hodrick-Prescott and Christiano-Fiztgerald filter was used.

Then, between 2008 and 2009 during the global crisis, it is observed that the financial conditions of the CARD countries quickly became restrictive. This response of the financial system of the CARD countries to a foreign crisis is due to the relatively high level of dollarization of assets and liabilities, and the growing exposure of these economies to cross-border capital flows (Swiston, 2010). Particularly, in the cases of Costa Rica, El Salvador, Honduras and Nicaragua, the financial situation became much more restrictive than in other countries, since a drastic drop in the IMCF is observed. In the case of Guatemala and the Dominican Republic, although there is a financial system that became more restrictive in the 2008 crisis, the change between states was not as drastic as in the rest of the countries, thus showing resilience to external financial shocks. This behavior in these economies would be explained by the low degree of dollarization of liabilities that they had compared to the other CARD countries: for Guatemala and the Dominican Republic the dollarization of liabilities was 16% and 26%, respectively, in 2007, while the average CARD was 54%.

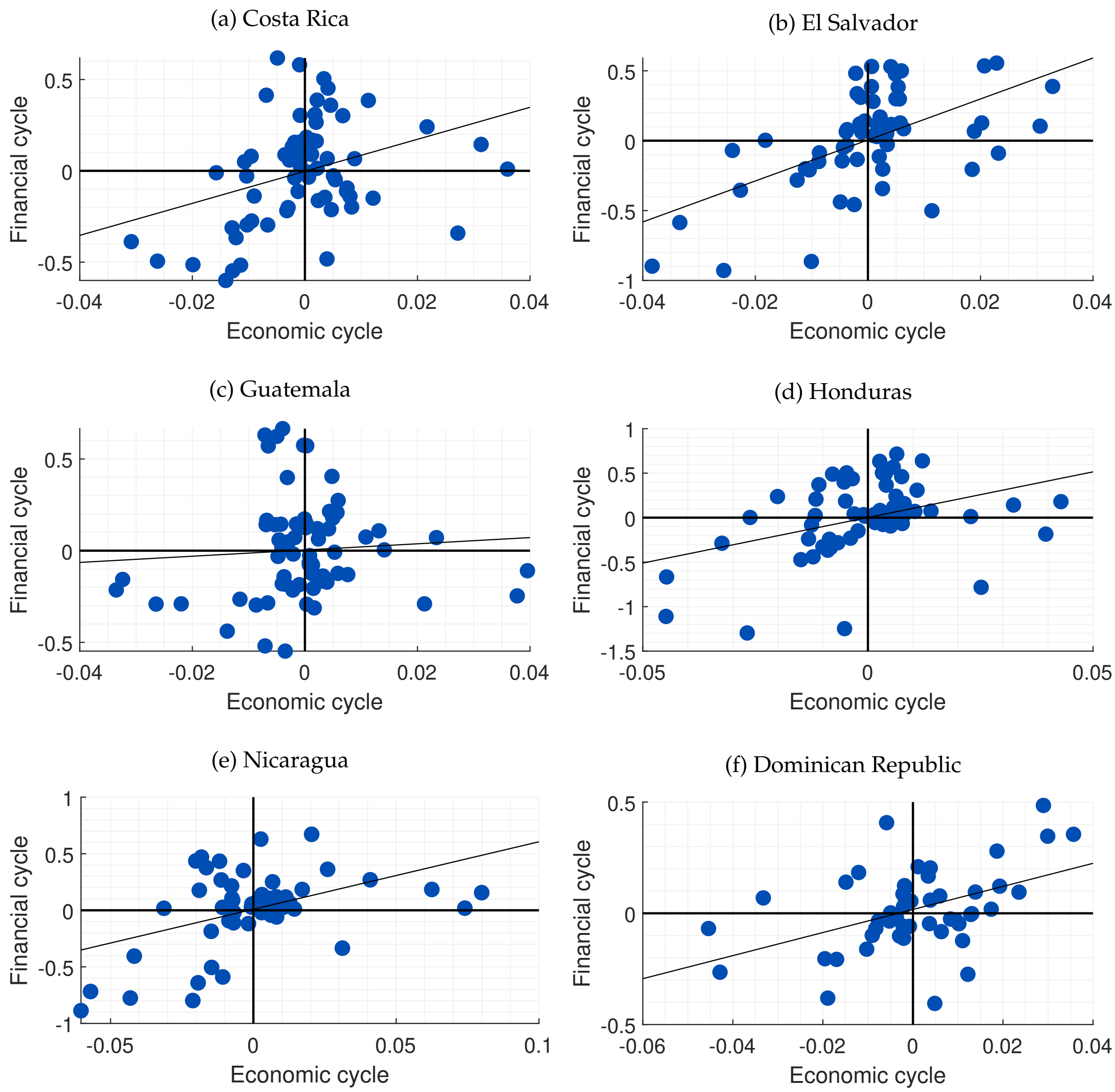
In the periods after the crisis, an improvement in the financial conditions of all countries can be observed. In the case of Costa Rica and Honduras, it can be seen that the financial system showed signs of improvement, but considerably exceeding the natural growth level of 50. As for Guatemala and El Salvador, recovery was recorded in the post-crisis period, reaching levels of high flexibility, but with a more gradual evolution than in previous cases. Finally, in the case of Nicaragua and the Dominican Republic, it is observed that the financial system improved its conditions. However, unlike previous cases, the financial system of these economies did not advance beyond its natural evolution. In that sense, These countries showed a higher level of financial stability than the other countries as they did not present wide fluctuations in the IMCF. In recent periods, the evolution of financial conditions according to their natural evolution was interrupted in Nicaragua by the sociopolitical crisis of 2018.

The degree of synchronization between the cycles of financial conditions and the economic cycles will allow us to know to what extent the monetary authority can incorporate the objective of financial stability as a complement to monetary policy and thus use the interest rate to influence financial conditions. In the event that there is a high level of synchronization between the economic and financial gaps, it is irrelevant for the monetary authority to include financial conditions in its decision rule, since both gaps contain the same cyclical information about the economy. In the other case where there is a lack of synchronization, the central bank can introduce financial conditions into its analysis and improve the set of information on which the central bank makes decisions. In this case, the central bank can evaluate the financial system in a separate set of information, and set the interest rate to affect the financial set if required. The analysis of the impact of the interest rate on the IMCF is presented in the following section.

Figure 2 presents multiple scatterplots that associate business cycles with cycles of financial conditions for each country. There is synchronization when the points are located in plane I (both gaps are positive) or in plane III (both gaps are negative). It is estimated that the synchronization order of the CARD countries is at 60%, which implies that the monetary authority can complement its policy considering the financial conditions and use the interest rate to influence its fluctuations and generate stability in the financial system.

At the country level, Guatemala is the economy with the lowest order of synchronization, approximately 48%, followed by the Dominican Republic and Costa Rica, both countries with an order of approximately 55%. This indicates that around 50% percent of the periods analyzed, the cycles of financial conditions and business cycles do not agree in these economies. On the other hand, El Salvador, Honduras and Nicaragua show a higher level of synchronization, between 70% and 60%. In these last cases, despite a higher concordance, there is a margin for implementing a macroprudential policy in the monetary policy rule.

Figure 2: Financial Conditions and Economic Cycles



Note: Scatterplots link business cycle and financial conditions. The economic cycle series corresponds to the simple average of the fluctuations of the IMAE and inflation. In the latter case, each cyclical series was constructed using an average of the Hodrick-Prescott and Christiano-Fiztgerald filters.

4.2 Analysis of the impact of monetary policy on financial stability

The results of the macroeconometric model will be analyzed in terms of the impulse response function. The simulated shock is a contractionary monetary policy reflected in a 100 basis point increase in the short-term interest rate. Faced with this impact, a negative response from the IMCF will imply that the monetary authority has contractive effects on financial activity.

The average results of the impact of the monetary policy shock on financial conditions are presented in Figure 3. It is estimated that a rise in the policy interest rate has a negative impact on the Monthly Index of Financial Conditions in all CARD countries. This result implies that in a state where the financial system is in considerably flexible conditions where risk, credit, investment and returns are above their natural evolution, the monetary authorities of the CARD countries can raise the interest rate. interest and cause the financial system to become more restrictive and thus stabilize the market.

At the level of each country, heterogeneity can be observed in the negative response of the IMCF to the policy shock. On the one hand, it is estimated that the short-term response of the IMCF is not significantly different from zero in Costa Rica, Guatemala, Honduras, El Salvador, and the Dominican Republic. But the negative behavior of the IMCF becomes significant from the fifth period, this in the case of Guatemala and El Salvador.

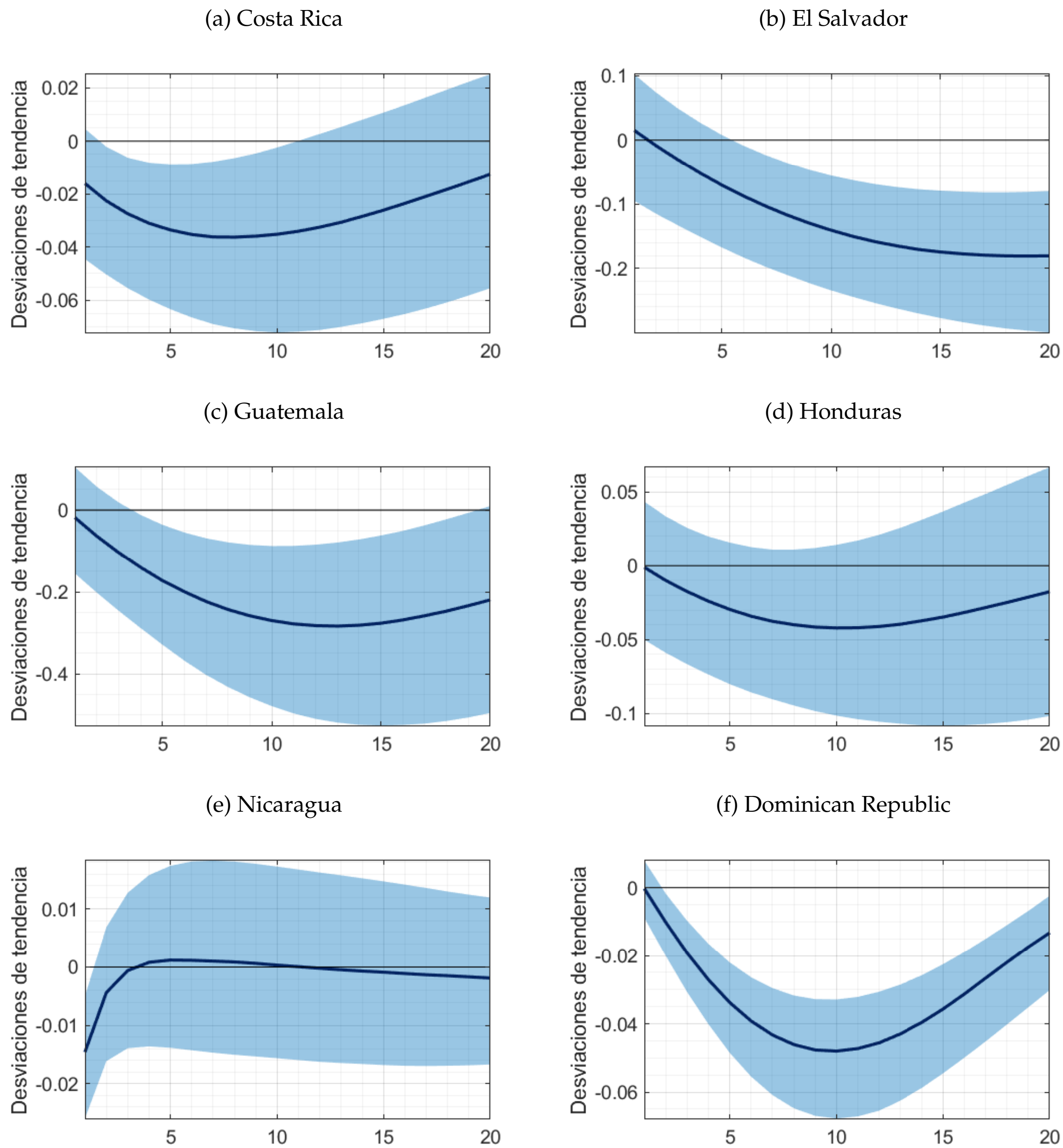
In the case of Costa Rica and the Dominican Republic, it is estimated that the response is significant from the second period on. In the case of Honduras, it is estimated that the IMCF response is negative, but it turns out to be insignificant in all impulse response horizons. Unlike the countries previously analyzed, Nicaragua shows a negative and significant response in the IMCF at the moment of impact and said contractive effect lasts for two periods. Then it is estimated that the impact is not statistically different from zero in the subsequent periods.

On the other hand, it is observed that in most CARD countries the impulse response function of the IMCF has an increasing behavior up to a certain period and then it becomes decreasing. In Costa Rica and the Dominican Republic, the maximum effect is reached around period ten, that is, three quarters after the initial impact. In the case of El Salvador, the effect is highest six quarters after the policy shock, and in Guatemala, the greatest effect occurs in the fourteenth period after the impact. At the persistence level, it is observed that the monetary policy shock is highly persistent in El Salvador and the Dominican Republic, while in Nicaragua it is estimated that the effect dissipates quickly.

Since the model allows for changing parameters, the evolution of the impact of the monetary policy shock on financial conditions can be analyzed through the entire sample. Figure 4 shows the evolution of the accumulated response of the IMCF to the monetary policy shock for the entire period of analysis 2008-2019. Given that an increase in monetary policy is restrictive in terms of the financial market, the more negative the response, the greater the effect the interest rate has to impact financial conditions. Likewise, if a downward trend is observed, it will imply that the interest rate has had a greater impact on the financial system. Thus, the estimates indicate that the impact of monetary policy on financial conditions shows an evolution over time,

In the case of Costa Rica and Guatemala, it is estimated that monetary policy has had a greater impact on financial conditions in the quarters following the initial shock. The increase in the effect is observed between 2008 and 2013, while in subsequent periods said impact force has remained constant. On the other hand, in Nicaragua the results indicate that the impact of monetary policy shows a negative trend throughout the entire sample, which implies that the impact force of the interest rate has increased steadily in that country. However, it is observed that in the quarters after the initial shock, the interest rate had a positive effect in the 2008-2011 period. In this period, an interest rate hike had a counterproductive effect on the Nicaraguan financial system, but in the years after 2012 monetary policy began to have a negative effect and this effect has become stronger. Regarding the economy of the Dominican Republic, the estimates indicate that the effect

Figure 3: The impact of a contractionary monetary policy on IMCF

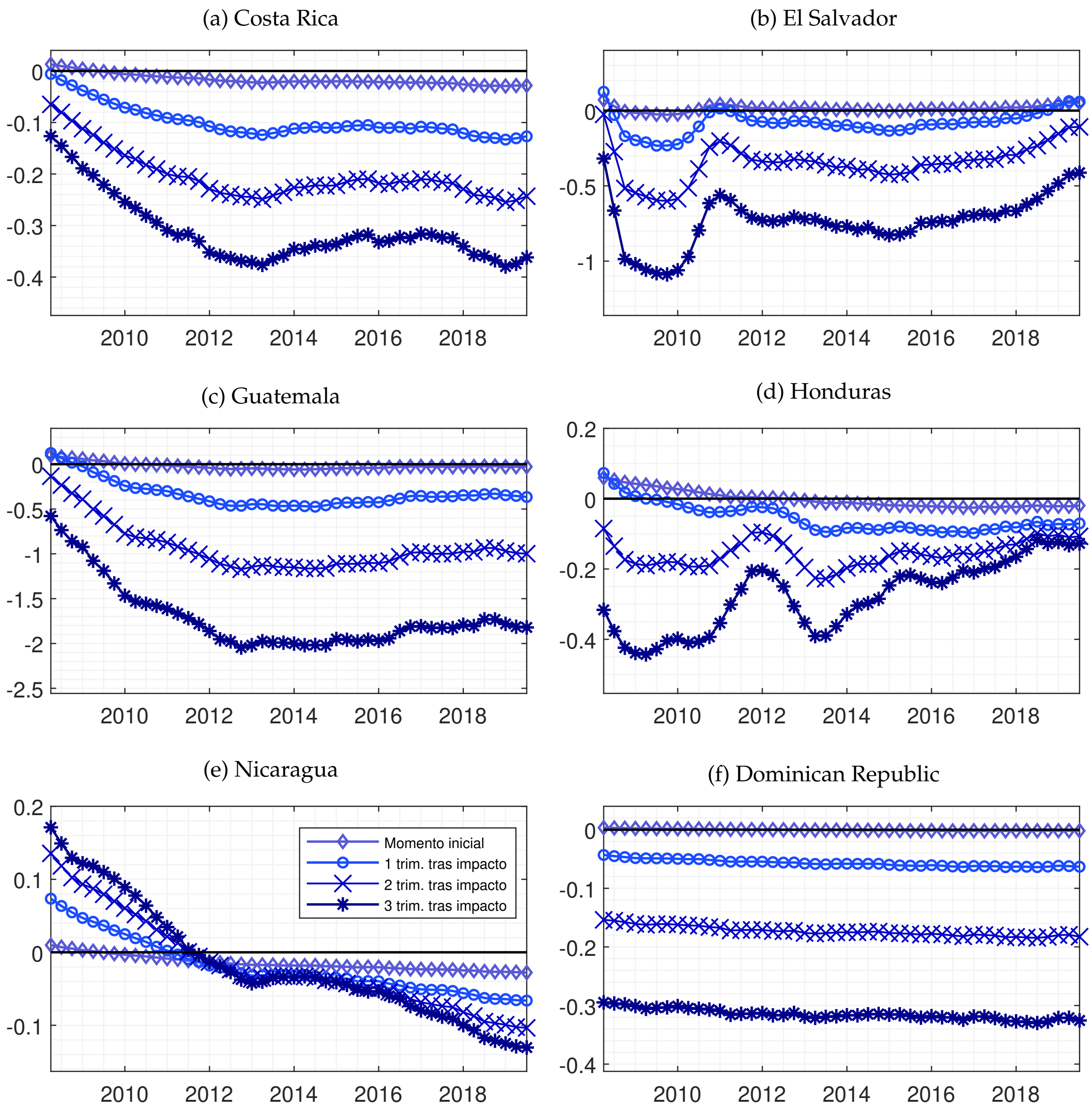


Note: The IMCF average impulse response function is presented against the positive interest rate shock for each country. The model generates impulse responses for each moment in time. For the presentation of this graph, the average of the evolution of the impulse responses was taken. The bands represent the confidence interval and represent the probability space between the 16% and 84% percentiles.

of the interest rate on the IMCF has a slight downward trend, but the changes in the magnitude of the effect throughout said trend are marginal, so the impact is on average the same. Regarding El Salvador and Honduras, it can be seen that the effect of monetary policy has remained stable in the first part of the sample, while its force of impact has decreased by converging to zero levels in the second part of the sample.

The effect of the interest rate on financial conditions has been analyzed and it has been identified

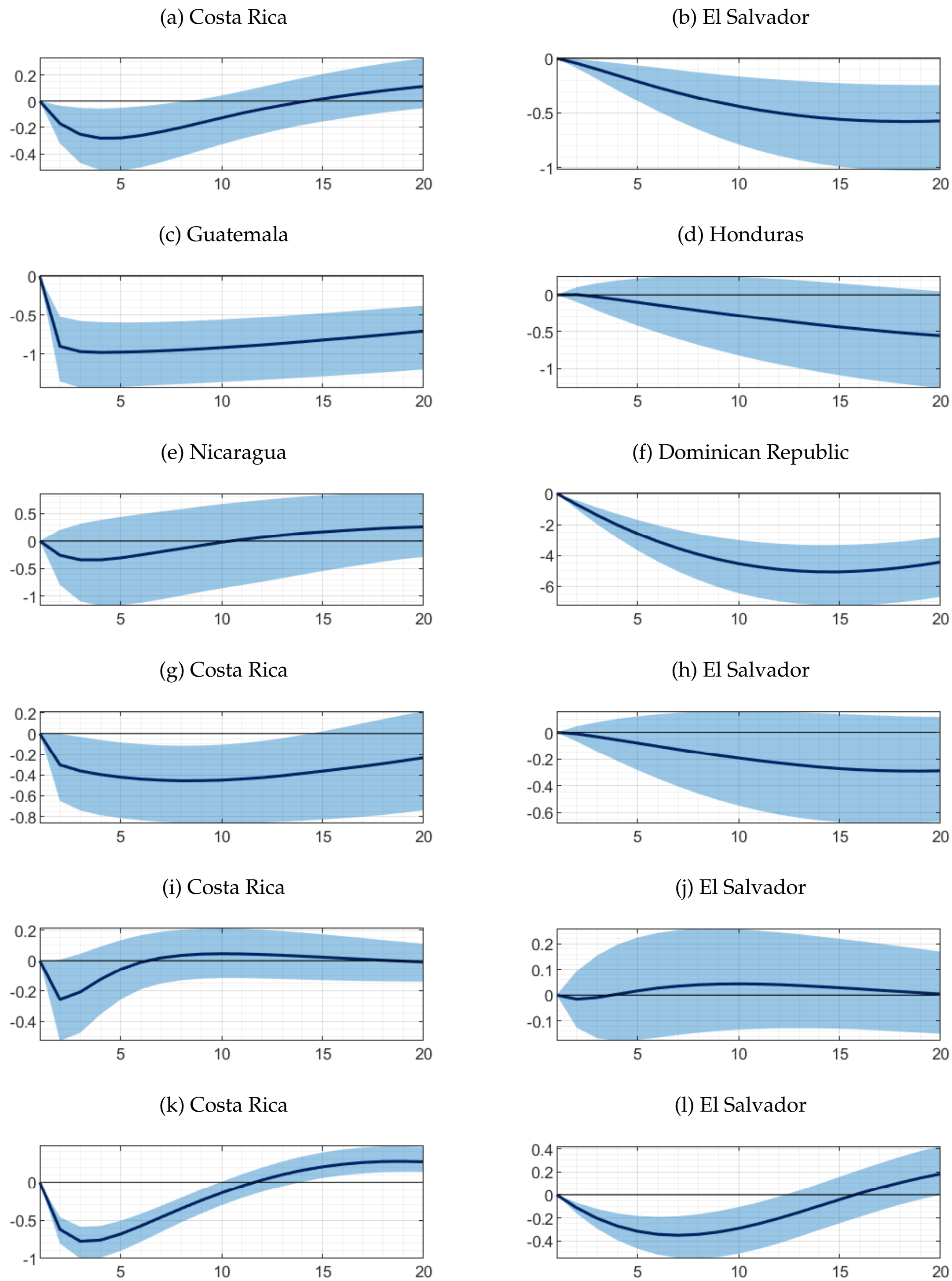
Figure 4: The impact of a contractionary monetary policy on IMCF



Note: The evolution of the cumulative response impulse function is presented for different response horizons: (i) time of the initial shock, plotted with diamonds; (ii) 1 quarter after the shock or three months later, plotted with circles; (iii) 2 quarters after the shock or 6 months after the shock, plotted with crosses; and (iv) 3 quarters after the initial shock or 9 months after the shock, plotted with asterisks. The lines presented are the median of the space of 500 generated simulations.

that the central banks of the CARD countries can use the interest rate to stabilize the financial system. But stabilizing financial conditions can be counterproductive for the monetary authority if primary objectives such as inflation or production respond differently than expected. To study these implications, the response of IMAE and inflation to the contractive shock of monetary policy is presented in Figure 5. Thus, it can be observed that the responses of economic activity and prices are negative in the CARD countries, which implies that there is no a “trade-off” between stabilizing financial conditions and stabilizing production and prices.

Figure 5: The Impact of Monetary Policy on Production and Inflation



Note: The average impulse response function of the IMAE annual growth rate and annual inflation versus the positive interest rate shock for each country is presented. The simulation of the interest rate rise corresponds to the same as in Figure 3. The bands represent the confidence interval and represent the probabilistic space between the 16% and 84% percentiles.

At the individual level, in Costa Rica and the Dominican Republic it is estimated that the policy shock significantly decreases production and inflation, with the strongest impact being in the case of the Dominican Republic. As for El Salvador and Honduras, a reduction in production and inflation is observed simultaneously, but the inflation response is not significant in both countries. In the case of Guatemala, the impact of the policy shock on inflation is estimated to be the largest of all the CARD countries, but the effect on production is statistically close to zero. On the other hand, for Nicaragua a reduction in production is estimated, but not significant, while in the case of inflation the effect is statistically zero for all impulse response horizons.

5 Conclusions

This research explores the effect of monetary policy on the financial conditions of the CARD block countries. In the first stage of the analysis, an index of financial conditions is estimated, its evolution and its relationship between the CARD countries are analyzed. A moderate correlation is estimated between the fluctuations in the financial conditions of the CARD countries. In addition, it is observed that the order of synchronization between the financial index and the business cycles is approximately 65%. Since financial cycles and business cycles are not fully synchronized, monetary authorities may affect the real sector and the financial sector differently. In the second stage, it is quantitatively examined whether the interest rate can affect financial conditions, given the previous results. The estimation of the model indicates that a contractive monetary policy has a negative and significant impact on the financial conditions index, which implies that the monetary policy rate has macroprudential effects.

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