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Research article

Inflation Targeting, Economic Growth and Financial Stability: Evidence from Emerging Countries

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Abstract: Our aim of this paper is to determine whether inflation targeting could improve economic growth and financial stability in 35 emerging economies of which 19 inflation-targeting and 16 non-inflation-targeting countries over the 1995–2017 period. To this end, we first determine the preconditions needed to adopt the inflation targeting regime using the Qualitative Comparative Analysis method (QCA). We then construct a Financial Stability Index (FSI) for emerging markets using a Principal Components Analysis (PCA). Finally, we determine the impact of shocks on economic growth and financial stability in inflation-targeting and non-inflation-targeting countries through a Panel VAR model estimated using the GMM method. The results show that some structural and institutional preconditions, should be set up during the pre-adoption period. In addition, the results indicate that the inflation-targeting regime allows emerging countries to control their economic growth and financial stability in the event of shocks to a greater extent than non-targeting countries, although the magnitude of the shock persists only in the short run, given that economic and financial conditions return to their normal state in the long run.

Keywords: inflation targeting; financial stability; economic growth; shock analysis; QCA, P-VAR

JEL Codes: E44, E52, E58, G18, G28.

1. Introduction

With the outbreak of the global financial crisis in 2007–2008, a period of "great moderation", known by low macroeconomic volatility and non-inflationary global economic growth, came to an end. In addition, a new global outlook is emerging, aimed at redefining the concerns of the monetary authorities with regard to macroeconomic and financial objectives. As a result, the new macroeconomic framework underlines, on the one hand, the importance of clear and appropriate regulation in fighting financial instability and, on the other hand, underlines the close link between monetary and financial stability. In this regard, it is necessary to review the role of the central bank with regard to its primary objective of price stability, in conjunction with the promotion of financial stability. This issue started to take hold especially after the onset of the crisis in 2007–2008. Although central banks were the ones protecting economies, they did not support economic recovery. This debate is constructive from an economic and financial point of views. The complex processes of liberalizing and globalizing financial flows developed in recent decades remain damaging to the financial system. This complicates the relationship between financial and monetary stability. Specifically, in theory, monetary stability is considered to be a factor generating financial stability (Schwartz, 1995).

Our aim of this paper is first to determine the ideal prerequisites that lead to the adoption of inflation targeting. Second, it aims to construct a Financial Stability Index (FSI) for emerging countries. Third, our aim of this paper is to study whether the inflation targeting framework could improve economic growth and financial stability in emerging countries. Specifically, we study the magnitude of inflationary shocks on economic growth and financial stability in inflation-targeting and non-inflation-targeting emerging-market economies.

Our contribution is three-fold. First, we adopt an econometric method to determine what optimal preconditions or their combination thereof that lead to the adoption of inflation targeting. Specifically, we use the configurational method, also known as the Qualitative Comparative Analysis (QCA) method, which is new for this kind of topic. Second, we construct a financial stability index for a group of emerging countries which would allow monetary authorities to track down their financial state of affairs. Indeed, to our knowledge, this study is one of the few that constructed such an index for emerging countries. Third, we focus on a research niche that, to our knowledge, has not been addressed before. This niche consists in studying the magnitude of shocks on economic growth and financial stability in inflation-targeting and non-inflation-targeting emerging countries, using a Panel-VAR model. Thus, we prove that the respect of structural and institutional preconditions is essential for emerging countries in order to better succeed in their inflation targeting policy. We also prove that the inflation targeting regime allows inflation-targeting emerging countries to control to a greater extent their financial stability during shocks than non-inflation-targeting countries. Nevertheless, the magnitude of the shock persists only in the short term as economic and financial conditions return to their equilibrium in the long term.

The paper is divided into six major sections. The second section reviews the relevant literature. The third section presents the methodology. The fourth section reports the data. The fifth section presents and discusses the results. The final section concludes the paper.

2. Review of the literature

The emergence of the inflation-targeting regime as part of the overhaul of monetary policy in the 1990s spread not only to developed countries but also to emerging countries (Angeriz and Arestis 2007, 2008). According to Mishkin (2004, 2011) inflation targeting bears on five basic elements: An institutional commitment to price stability, an evolving and developed communication system and the explicit and public medium-term announcement of numerical and ad hoc inflation targets. In addition, the inflation-targeting regime must be based on a high degree of accountability and an inclusive information strategy. This is manifested by the inclusion of a wide range of information about monetary aggregates and the exchange rate, thus making it easier to determine the instrument of monetary policy.

2.1. The preconditions needed to adopt the inflation targeting regime

Any country intending to adopt inflation-targeting should meet certain institutional and structural preconditions. Such preconditions should preserve the regime's successful entry into effect, insuring thus price stability. Specifically, these institutional preconditions bear on the Central Bank's (CB) independence, transparency and communication. In this regard, it should be noted that the independence of the Central Bank lies in its freedom to choose its final objective[1] and its own monetary instruments[2] without any government intervention. As a result, authors like Alesina and Summers (1993) and Cuckierman et al. (1992) insisted that central bank independence and the inflation rate work in opposite directions. Specifically, the more institutionally independent the central bank, the lower the inflation rate will be. This has been true for both developed and emerging economies. This endorses the fact that such a condition is crucial for the effectiveness and success of the inflation targeting regime, while giving explicit credibility to the monetary authorities.

However, Mishkin and Schmidt-Hebbel (2001) and Baltensperger et al. (2007) tried to study the relationship between the two types of independence, in particular the objective and instrumental independence of CBs, and different types of monetary policy regimes. To do so, the authors selected three types of monetary regimes, namely the nominal exchange rate anchoring, monetary aggregates targeting and inflation targeting. Indeed, these regimes are represented by dichotomous variables; considered dependent variables in the Probit model. As for the two types of independence, the authors measured their autonomy degree drawing on the study of Mahadeva and Sterne (2000). In our study, we surveyed the autonomy degree of 92 central banks using a scale between 0 and 10, ranging from the lowest to the highest degree of independence. The authors showed that the probability of adopting inflation targeting has a positive but a statistically insignificant relationship with both instruments and objectives. These results are inconsistent with those of Mishkin and Schmidt-Hebbel (2001). Such a finding can be explained by the low explanatory power of the model because the latter model did not include control variables while the pseudo-R2 coefficients range between 0.001 and 0.049. Furthermore, the Central Bank has to maintain a high transparency level, making the announced inflation rate more

[1]Goal independence: guaranteeing price stability as the ultimate objective of the central bank pursuing a statutory obligation without any government intervention in the setting of this institutional choice.

[2]Operational independence: setting one's monetary policy instrument without government intervention.

credible. Specifically, the central bank should clarify to the public the strategic plans, the main monetary instruments, as well as the intentions of the monetary authorities about the ultimate objective. In order to do this, the central bank should dispose of the communication channels that serve to convey the necessary information to the public, in order to illuminate their strategic intentions about inflation targeting and forecasts. Specifically, this involves the publication of monetary policy reports that cover the strategic actions, future inflation forecasts, other macroeconomic variables and future policy decisions. This information should be either annually or quarterly in order to clarify the intentions of the monetary authorities to the public. It should be noted that transparency requirements have been respected by a large number of emerging countries, in particular Brazil, Chile, Colombia, South Africa and South Korea. These countries publish reports two to four times a year, as well as disclose minutes of their general assemblies (Svensson, 2010; Hammond, 2012). As for the structural preconditions for inflation targeting, they report to advanced technical infrastructure. Batini and Laxton (2007) and Hammond (2012) define this precondition in terms of three key provisions. These are: *(1)* Each central bank should have sufficient aptitude to collect the data and information needed for its research reports and to study past and future inflation. *(2)* Each central bank should have the technology able to maximize its capacity to use the collected data in an efficient manner. This is to adjust real inflation to that anticipated, while taking into account the country's economic conditions. *(3)* Finally, each central bank should maximize its ability to identify developed models able to make conditional forecasts. In addition, the second structural precondition bears on a stable economic structure. Specifically, the theory assumes that when economic conditions are positive for an economy, there will be less chance that a country will be able to abandon its nominal inflation anchoring strategy in favor of inflation targeting. Conversely, a country that suffers from economic difficulties will be more likely to adopt an inflation targeting strategy at the expense of a nominal anchor. In this regard, Truman (2003), using logit model, has retained independent variables that represent a country's economic conditions. These are the inflation rate, the nominal and real interest rate, GDP growth rate, volatility of the real GDP growth rate, the output gap and an indicator of pressure on the exchange rate. The results show a positive and a significant relationship between exchange rate pressure, the real interest rate and the probability of inflation targeting.

Nevertheless, these results show a negative and a significant relationship between the probability of adopting inflation targeting and economic growth. Moreover, this negative relationship indicates that a disinflation policy has been carried out beforehand with an inflation targeting regime. On the other hand, the estimated coefficients associated with the volatility of the real GDP growth rate, the nominal interest rate and the output gap remain insignificant. Similarly, Truman (2003) includes government's fiscal balance sheet[3] as an additional independent variable in his model. According to the author, the relationship between this variable and the probability of adopting inflation targeting is positive and significant. This result supports the idea that for this regime to be credible and effective, monetary authorities should avoid budget pressures. Nevertheless, these results are not in line with those of Levya (2008). The author used a bivariate probit model and showed that the relationship between the probability of adopting inflation targeting and the balance sheet remains insignificant. Furthermore, Samaryna and De Haan (2011) found that public debt has a negative impact on whether

[3]It is the difference between revenues and expenditures. When the difference is positive it is a surplus balance, however, it is a deficit balance in the opposite case.

to adopt or not inflation targeting. Specifically, the credibility of this monetary instrument is likely to be threatened as a result of an unsustainable budget policy. These results corroborate those of Gonçalves and Carvalho (2008) who assume that any highly indebted country tends more not to adopt an inflation targeting strategy, in order not to undermine the leverage of public deficit financing. In addition, these results are explained by the case when banking and financial markets engage in external indebtedness. More specifically, the banking system of inflation-targeting countries deteriorates as a result of a surge in foreign currency debt. In other words, a depreciation of the exchange rate can only lead to an increase in the real value of the debt. However, the financial vulnerability of the banking system will be greater when the monetary authorities do not apply a flexible exchange rate regime.

Indeed, alongside these preconditions, a stable and a healthy financial and banking system is a precondition for the success of inflation targeting. In this regard, Truman (2003) studied the relationship between the adoption of inflation targeting and financial development, represented by the ratio of financial system assets (M2) to GDP. The results reveal an insignificant relationship. In addition, Levya (2008) also examined this relationship by including credit to the private sector (%GDP) as an indicator of financial development. The relationship remains positive and significant in emerging markets. This shows that a developed financial system contributes to the adoption of inflation targeting under the best conditions. On the other hand, Samaryna and De Haan (2011) also looked at financial development and its link with the probability of inflation targeting adoption. Importantly, the authors found a counter-intuitive result, namely that financial development has a significant negative impact on the choice of adopting inflation targeting regardless of the selected financial indicator. Nevertheless, when the authors exclude OECD countries from their base sample, they found a positive relationship between this probability and domestic credit to the private sector.

Finally, this study corroborates that of Truman (2003) on the inverse relationship between a country's inflation rate and its choice of inflation targeting. Mukherjee and Singer (2008) extend this line of research by examining the impact of political institutions on the authorities' choice of inflation targeting. The authors drew on four types of political variables studied in the literature. These are the presence or absence of veto players, degree of political instability, the nature of the legislative system and the partisan orientation of the government in power. Similarly, Mukherjee and Singer (2008) consider political indicators that potentially relate to the likelihood of adopting inflation targeting. These are democracy level, the number of veto players in the political system, a dummy variable that represents the type of political regime, a parliamentary or a presidential regime. After estimating these variables in a probit model, the results do not reveal any significance, thus showing that none of the indicators can influence the monetary authorities to choose or not to choose the inflation targeting regime Lucotte (2012).

2.2. The macroeconomic performance of the inflation targeting

The review of the literature dealing with the link between the adoption of inflation targeting and its macroeconomic performance addresses different areas. More specifically, several studies have chosen various macroeconomic indicators. Notably, Goncalves and Carvalho (2009) showed that inflation targeting is effective in controlling and stabilizing prices, as well as anchoring expectations, which allows target countries to move into a period of disinflation. In addition, the adoption of inflation

targeting does not penalize the loss in output for target countries. The results of Goncalves and Carvalho (2009) show that inflation-targeting countries lose less output than non-targeting countries. This is due to the high degree of transparency and communication on the part of monetary authorities. Moreover, Brito and Bystedt (2010) challenges this result when the author considers a loss in output following a period of disinflation.

Overall, these results corroborate those of Batini and Laxton (2007) who confirm the significant effect of the inflation targeting regime on both average inflation and its variability in emerging countries. They also corroborate those of Hyvonen (2004), Vega and Winkelried (2005), Mishkin and Shmidt Hebbel (2007), Pétursson (2009) and Armand and Roger (2013). Nevertheless, Ftiti and Essadi (2013) found counter-intuitive results. The authors limited themselves to studying the performance of the inflation-targeting regime only in New Zealand and Canada during the 1990s. They conclude that the inflation-targeting regime is not effective in controlling or stabilizing inflation in these countries. In contrast, Goncalves and Carvalho (2009) studied a sample of 30 OECD countries and found that countries adopting inflation targeting suffer a much smaller output loss than non-inflation-targeting countries do. Specifically, any country with an inflation-targeting strategy gains a 7 percent loss in output compared with countries with other monetary regimes which lose more and more output. These results are consistent with those of Vega and Winkelried (2005), Batini and Laxton (2007), Goncalves and Salles (2008), Armand and Roger (2013), Marcel et al. (2020) and Yasuo et al. (2020). According to the authors, inflation-targeting countries have always lower average inflation volatility combined with higher output growth than non-targeting countries. Such an aggregate situation therefore helps to stabilize the economy. This differs from Lin and Ye's (2010) findings, as they indicated that the inflation targeting regime does not significantly affect the average output growth in emerging nations. However, another study by Omid et al. (2018) demonstrates that while this regime may not greatly influence output growth, it does lead to decreased output volatility in emerging economies, leading to low inflation in both emerging and developing countries.

The literature on inflation targeting has also examined the relationship between this regime and long-term and short-term interest rates. For instance, Ball and Sheridan (2003, 2005) examined a sample of 20 OECD countries, of which 13 inflation-targeting countries and 7 non-targeting countries. The authors found that the inflation targeting regime stabilizes the average short-term interest rate for inflation-targeting countries more than for non-targeting countries. The authors also proved that a high volatility of the interest rate shows that inflation-targeting countries mobilize their interest rates more than non-targeting countries, and this in order to best respond to increased inflation. Moreover, the exchange rate remains one of the most important macroeconomic variables that represents the performance and effectiveness of the inflation targeting regime. In this regard Hu (2006), Lin and Ye (2007, 2009), Mukherjee and Singer (2008) and Hammond (2012) found that the flexible exchange rate regime makes the inflation targeting regime more efficient. The authors show that a fixed exchange rate regime can act as a powerful nominal anchor, thereby promoting price stability, but requires greater vigilance in the face of external economic shocks. On the other hand, a flexible exchange rate regime allows a more rapid adaptation to economic shocks, thus facilitating price stability. In addition, Goldfajn and Werlang (2000) tried to show whether the inflation-targeting regime causes exchange rate volatility. To do so, the authors examined a sample of 7 inflation-targeting countries. The authors compared the pre-adoption and post-adoption of inflation-targeting in each country and found no positive effect of inflation targeting on exchange rate variability.

2.3. The relationship between inflation targeting and financial stability

Despite the ambiguity of the real effect of low inflation on the macroeconomic aggregates, a period of disinflation generates a positive effect on financial stability. This phenomenon was initially advocated by Schwartz's (1995) hypothesis, which assumes that an unstable price level generates uncertain future real returns on investment. Furthermore, the Schwartz's hypothesis is an explanation of how price-level instability can generate financial instability. In the case of destabilized inflation, the risk of default increases as a result of inflation control via rising interest rates, which reduces income of depositors. Hence, the problem of deterioration of the banking spread prevails, which leads to panic in the banking system causing financial institutions to fail. Similarly, a stable monetary policy based on a stable level of interest rate improves financial stability. The interest rate is a major determinant of raising investment levels and of keeping inflation at stable levels This leads to expectations of price increases that encourage speculative investment. Several studies supported Schwartz's (1995) hypothesis, like those of Bordo and Wheelock (1998), Bordo et al. (2001), Issing (2003) and Bordo (2008).

In the face of the financial revolutionary changes brought about by the consequences of the recent global financial crisis (2007–2008), inflation targeting remains limited and is unable to withstand crises. Moreover, despite the robustness of some economic fundamentals, it cannot withstand exogenous shocks, subsequently generating financial vulnerability Pierre et al. (2013). In this regard, central banks need to review their roles in terms of price stability so that they are consistent with the promotion of financial stability. Following these developments, Schwartz's (1995) hypothesis has been challenged and contradicted by the recent work of several economists, including White (2006), Issing (2009), Blanchard et al. (2010), Fouejieu and Roger (2013) and Dinabandhu and Debashis (2019) who show the negative effect of monetary stability on financial stability. This can be explained by the fact that an expansionary monetary policy based on a low interest rate pushes banks to take additional risks by granting excessive credit, as was the case during the pre-crisis period in 2008. This expanded the risk of default leading to banking panic. Therefore, we suggest improving the inflation targeting framework by incorporating financial stability as an objective to be reached. Borio and Zhu (2012) support this view, showing that low short-term interest rates generate increased investor speculation, thus impacting the rise of asset price bubbles, thus threatening financial stability.

Accordingly, the recent empirical literature on the debate on the inflation targeting regime has broadened their vision to incorporate the financial stability dimension in this new monetary policy regime. However, some studies, subscribing to the Schwartz's (1995) hypothesis, remain controversial without reaching an ultimate consensus, confirming or denying the positive correlation between price and financial stability. In this regard, Bordo et al. (2001), Issing (2003) and Bordo (2008) studied the impact of the shock of the price aggregate on a financial stability index of the United States to estimate individual series in terms of the instability index. Their results prove that an unanticipated movement in price level generates instability in the US economy and therefore confirm Schwartz's hypothesis. These results are consistent with those of Woodford (2012), Nair and Anand (2020), Fazio et al. (2018) and Umar and Wen (2020) who shows that monetary stability eliminates sources of financial stability.

This field of study is extended by more recent research, such as Fazio et al. (2015) who studied the impact of inflation targeting on the stability of the banking system, as reflected in a Z-score calculation. They showed that inflation-targeting countries have a more stable banking system than non-targeting

countries. Specifically, the level of risk-taking for commercial banks in inflation-targeting countries, with strong communication and accountability, is lower than for those in non-targeting countries.

Furthermore, studies that support Schwartz's hypothesis have been challenged by those of Borio and Lowe (2002), Borio et al. (2003), Rajan (2005), White (2006) and Leijonhufvud (2007) which showed that the view that price stability is beneficial for financial stability needs to be revised. A possible decline in inflation rate reflects an optimistic investor perception. Investors expect inflation to remain low over the long term, which encourages them to buy more shares. This behavior will excessively increase the value of shares, which threatens the financial market. This finding has been confirmed by Taylor (2009) who showed that low interest rates increase the probability of a bubble in house prices. Indeed, a low interest rate generates an increase in asset prices. As a result, the investor behaves rationally by taking advantage of the gap between the quoted value and the fundamental value. Subsequently, investors will dispose of their assets and subsequently reduce speculative bubbles. In other words, according to these results, a central bank which has maintained its credibility via low inflation makes the financial system vulnerable. Frappa and Mesonnier (2010) studied the relationship between inflation targeting and the formulation of real estate price bubbles. The empirical estimation of this study focused on the treatment effect approach, to show that the inflation-targeting regime positively acts on the formulation of real estate bubbles, thereby reflecting a risk to financial stability. Similarly, to explore the relationship between monetary policy and financial stability, Munoz and Schmidt-Hebbel (2012) examined policy formulation by integrating financial stability variables, namely the development of private credit and share prices, into the Taylor rule alongside the exchange rate. The results of this study support the "leaning against the wind" approach, which reflects the concern of the central banks of the various countries about financial stability. This is in line with the work of Cecchetti et al. (2000) and Bordo and Jeanne (2002) who examined a group of OECD countries, and estimated the augmented Taylor rule. They argued that there is no clear consensus on whether inflation targeting alone ensures financial stability, or in combination with output stability. This was confirmed by Roubini (2006) and Posen (2006) who found controversial results on the relationship between monetary stability and the stability of asset bubbles.

3. Methodology

3.1. The preconditions for the adoption of the inflation targeting regime

Recently, the study of the conditions that may affect the probability of adopting an inflation targeting regime has opted for a new econometric method, the Qualitative Comparative Analysis (QCA) method. This method was introduced by the American sociologist and political scientist Charles Ragin[4] and has been developed since the late 1980s, particularly in political science [5] and sociology. Nevertheless, this method has rarely been used in economics, management and criminology. QCA has established itself in North America and it has been used at the Université Libre de Bruxelles and the Université Catholique de Louvain in Europe. In addition, this new method has gained momentum in recent years in business and management research Bell et al. (2014) and Wagemann et al. (2016).

[4]Cf. Ragin, (1987).

[5]Under the framework of a comparative politics and a public policy analysis.

Technically, and unlike linear algebra-based traditional linear regressions, the QCA depends on Boolean algebra [6]. In other words, QCA aims to compare phenomena that vary both qualitatively and quantitatively, in terms of nature (present or absent) or in terms of degree Rihoux (2006). In addition, this method consists in analyzing data by listing and counting all combinations of variables in the data set rather than correlations. Overall, there is a fundamental advantage to this method over traditional regression analysis. It is a multi-factor, multi-interaction method, as it ignores variations and distributions of individual variables and does not focus on the isolated net independent effect of a single variable Aguilera and Desender (2012). Furthermore, this implies that it is not just a single component or condition that explains the result, but rather combinations of several conditions that jointly explain the result. Indeed, the traditionally used linear regressions follow the cause-and-effect paradigm, which consists in estimating whether an individual variable has a significant effect (positive or negative), net of the effects of other variables, on the dependent variable. However, QCA examines whether a condition or a combination of conditions is necessary and/or sufficient to achieve a given result. In addition, it looks for a minimum combination of conditions necessary to achieve a specific result Vis (2012).

We identify seven independent variables that represent the conditions to adopt inflation targeting. These are the inflation lagged by one year *(INF_1)* measured by the consumer price index; the total external debt expressed as a percentage of gross national income *(EXT_DEBT)*; the credit granted to the private sector as a percentage of GDP *(PCRED)*, which refers to the financial resources provided to the private sector; the (M2/GDP) ratio, which measures the share of M2 in GDP[7]. This ratio allows for measuring liquidity degree weighted against the needs of the economy. From the stock market, we retain the market capitalization variable *(MARK_CAP)*, which reflects the total value of all publicly traded stocks as a percentage of GDP.

These variables are extracted from the World Development Indicators (WDI) and International Financial Statistics (IFS) databases. In addition, we identify the rotation rate of the governor of the Central Bank over a five-year period *(TOR_5)*. This variable is extracted from the websites of the Central Banks and Dreher et al. (2008) and lucotte (2012). Finally, the (POLITY2) indicator extracted from the Polity4 Project database. This variable represents the most common measure of a country's political regime. More specifically, it is a score that reflects the adopted political regime and it ranges from −10 (total autocracy) to 10 (total democracy). Moreover, the adoption of inflation targeting is referred to by a binary variable called the dummy variable (*CI_dummy*), which takes 1 if the country adopts inflation-targeting at time t and 0 otherwise.

3.2. Construction of the financial stability index

The complexity of the financial system, manifested by the close relationships between financial and non-financial institutions and market participants, makes it difficult to measure financial stability Gadanecz and Jayaram (2008). Nevertheless, a multidimensional measure of financial stability is needed. Specifically, it amounts to aggregating a set of information incorporating not only the financial but also the macroeconomic dimension into a single index. Bearing on the literature on financial stability

[6]Logic algebra.

[7] M2 contains M1 (banknotes + coins) as well as cash money (agents' deposits) + deposits with an agreed maturity of less than 2 years and deposits that are redeemable at notice of up to 3 years.

measurement, we construct our composite index. In particular, we were inspired by the indicators of Seow et al. (2017) and Fouejieu (2017). Given the multidimensional nature of the composite index, we will focus not only on the banking dimension but also on the financial and economic dimensions as well. To this end, to construct the aggregate financial stability index we drew on four sub-indices, each consists of individual indicators. In other words, the four sub-indexes, also called composite indices, represent financial development, vulnerability of the macroeconomic environment, soundness of the financial system and global governance, respectively. These sub-indices will be combined into a single index called the Financial Stability Index (FSI). To do so, we will use a Principal Component Analysis (PCA). PCA is a factor analysis technique that is used to explore multidimensional data. In addition, it is used to identify the factors that cause inertia of the variables. Nevertheless, PCA retains only the variables with high factor loadings. Furthermore, through this measurement technique, it will be interesting to discover the structural relationships between many time series and to identify the orthogonal eigenvectors of the variance-covariance matrix of the data Ben Ali and Krammer (2016). Before the factorial analysis, it should be noted that in any data analysis, there is a disparity problem in the variables retained in the analysis. This disparity stems mainly from the difference of the units of the variables. To remedy for this, we will base our PCA on standardized variables[8].

The construction of the FSI bears on the combination of four sub-indices in particular; the Financial Development Index (FDI), the Economic Vulnerability Index (EVI), the Financial Strength Index (FSI) and the World Governance Index (WGI). All the selected indicators are summarized in Table 1 below. They are defined in Appendix 1 (Table A1).

Table 1. Selected Indicators for the construction of the financial stability index.

Sub-indices	Selected indicators
Financial Development Index (FDI)	Banking spread
	Domestic credit to private sector (% GDP)
	Stock Market capitalization (% GDP)
Economic Vulnerability Index (EVI)	Inflation rate
	Budgetary Balance (% GDP)
	Bank loans/deposits
	Real GDP per capita growth rate
Financial Strength Index (FSTI)	Non-performing loans (NPLs)
	Equity/Total assets
	Z-score
	Bank liquid reserves /bank assets
World Governance Index (WGI)	Control of Corruption
	Government Effectiveness
	Political stability and absence of violence/terrorism
	Regulatory Quality
	Rule of Law
	Voice and accountability

Source: The authors.

[8] The variable x is said to be standardized if it is transformed into $x^{norm} = \frac{xi-\bar{x}}{s}$whose x' and s represent respectively its mean and standard deviation. This facilitates comparison of variables.

3.3. Impact of shocks on economic growth and financial stability in emerging countries: Comparative analysis

Throughout our study, we use a Panel-VAR model estimated using the GMM in-system method. According to Michael et al. (2016) the pest-order PVAR model presented in equation 1 below takes into account individual and temporal specificities:

$$Y_{it} = Y_{it-1}A_1 + Y_{it-2}A_2 + \cdots + Y_{it-p+1}A_{p-1} + Y_{it-p}A_p + X_{it}B + u_i + e_{it} \quad (1)$$

$$i \in \{1,2,\dots,N\}, t \in \{1,2,\dots,T_i\}$$

With Y_{it} a stationary vector of dependent variables of size (1xK), X_{it} a stationary vector of exogenous variables of size (1xL). The matrix $A_1 + A_2 + \cdots + A_{p-1} + A_p$ and that of B are coefficients to be estimated of size (KxK) and (LxK) respectively. u_i and e_{it} are two vectors of size (1xK), the first represents the individual fixed effect and the second represents the idiosyncratic error term (of zero mean, constant variance, not autocorrelated and uncorrelated from one individual to $E[e_{it}] = 0, E[e'_{it}e_{it}] = \Sigma$ and $E[e'_{it}e_{is}] = 0$ for $t > s$.

Our PVAR model considers macroeconomic and financial indicators. More specifically, we use macroeconomic indicators such as real GDP per capita, reflecting a country's economic growth, and the inflation rate measured by the consumer price index. These indicators are taken from the World Development Indicators database of the World Bank (WDI). As for the variable reflecting financial stability, the Financial Stability Index (FSI) (see Appendix 2 (Table A2)) was used, which is constructed by combining four sub-indices, using a Principal Component Analysis (PCA). It should be noted that the indicators used to construct this index are also taken from the WDI and International Financial Statistics (IFS) databases.

4. Data

Here, we examine a sample of 35 emerging countries, including 19 inflation-targeting and 16 non-inflation-targeting countries, as shown in Table 2 below. More specifically, the study compares between these two groups of countries in terms of shock analysis. In addition, we study this relationship within inflation-targeting and non-inflation-targeting countries over the 1995–2017 period. Specifically, we retained all emerging countries with inflation-targeting regimes, with the exception of Ghana because of missing data. To ensure that the inflation targeting countries and non inflation targeing countries are reasonably comparable, our control group (Non IT countries) was selected relying on the criteria defined by Lin and Ye (2009), based on the level of economic development and the size of the country. In addition, our control group only includes non-targeting emerging countries that have a real GDP per capita at least as large as that of the poorest targeting country and with a population size at least as lar.e as that of the smallest targeting country in our control group (Lucotte, 2012 and Kadria and Ben Aissa, 2016). In this regard, the set of countries selected and their sampling period is summarized in Table 2 below.

Table 2. Dates of adopting the inflation-targeting regime in emerging-market countries.

Adoption date		
Targeting countries		Non-targeting countries
Brazil	1999	Argentina
Chile	2000	Bulgaria
Colombia	2000	Dominican Republic
Czech Republic	1998	Ecuador
Guatemala	2005	Egypt
Hungary	2001	Ghana
Indonesia	2005	Malaysia
Israel	1997	Morocco
Mexico	2001	Nigeria
Peru	2002	Pakistan
Philippines	2002	Russia
Poland	1999	Senegal
Romania	2005	Singapore
Serbia	2006	Tunisia
Slovakia	2005	Uruguay
South Africa	2000	Venezuela
South Korea	1998	
Thailand	2006	
Turkey	2006	

Source: Lin and Ye (2009); Lucotte (2012), Kadria and ben Aissa (2016) and central banks' web sites.

5. Results

5.1. The results on the preconditions for the adoption of the inflation targeting regime

Table 3 below summarizes the results and the crisp previous conditions. Each variable has been coded to facilitate readability of the tables below. (CI_dummy: C ; inf_1: F ; ext_debt: D ; pcred: R ; m2pib: P ; mark_cap: K ; tor_5: T ; polity2: L). The "Crispy Split At" column groups the medians of each variable. Specifically, each value above the median takes 1 and each value below the median takes 0. This makes the variable binary in nature.

Table 3. Distribution of each variable and its corresponding set.

Variable	Coding	Original mean	Crispy Split At
Ci_dummy	C	-	-
inf_1	F	10.87	5.80
ext_debt	D	47.82	38.66
pcred	R	46.92	33.29
m2pib	P	54.10	48
mark_cap	K	41.73	22
tor_5	T	0.21	0.20
polity2	L	5.73	8

Source: Authors' calculations, Note: All variables are expressed in Logarithm.

Table 4 below shows the combination of preconditions that determine the adoption of inflation targeting. Of the cited seven preconditions, one configuration was found to sufficiently bear on the adoption of inflation targeting in emerging countries. This combination, also called configuration, shows that the presence of the seven conditions contributes to the adoption of the inflation targeting regime. The results show a high probability of compliance with this condition. In this regard, this condition must be respected by emerging countries. In addition, compliance with this condition consists in controlling the level of debt of emerging countries in order to guarantee a stable macroeconomic framework leading to an inflation-targeting policy. This combination leads to a better adoption of inflation targeting.

Table 4. Configurations leading to inflation targeting.

Antecedents	Solution
	1
inf_1 (F)	⓪
ext_debt (D)	❶
pcred (R)	❶
m2pib (P)	❶
mark_cap (K)	❶
tor_5 (T)	⓪
polity2 (L)	❶
Set	f*D*R*P*K*t*L
Consistency	0.947
Raw coverage	0.058
Unique coverage	0.058
Overall solution coverage	0.058
Overall solution consistency	0.947

Source: Authors' calculations.

Notes: ❶ Presence of the conditions in the model predicting the outcome; ⓪ Absence or negation of the conditions; All variables are expressed in Logarithm.

5.2. Results of analysis of the financial stability index

For each of the 3 sub-indexes (EVI, FSTI and WGI) and the overall index (FSI), the first two components are used, since their eigenvalue is >1 according to the Kaiser rule. With the exception of the first sub-index (FDI), for which only the first component is used. This also checked the eigenvalues of the factor axes, as presented in Figure 1, figure 2, figure 3 and figure 4. In other words, any eigenvalue < 1 will not be retained. In this regard, and according to figures 1, 2, 3 and 4, we notice that any axis that is above the abscissa line (the red line) is retained. Nevertheless, any axis that falls at the level of the lower part of the red line is not retained and indicates that it has eigenvalues < 1.

5.2.1. Financial development index

In Table 5 below, only one factor is accepted, and all information included in the data and a portion of the variance of the studied variables are not used. Specifically, on average 40.2% (1–0.5908) of total variance is not explained. Figure1 illustrates the Eigenvalues of FDI factor axes.

Table 5. Proportion of variance explained of FDI.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.77255	0.871583	0.5908	0.5908
Comp2	0.900964	0.574476	0.3003	0.8912
Comp3	0.326488	.	0.1088	1.0000

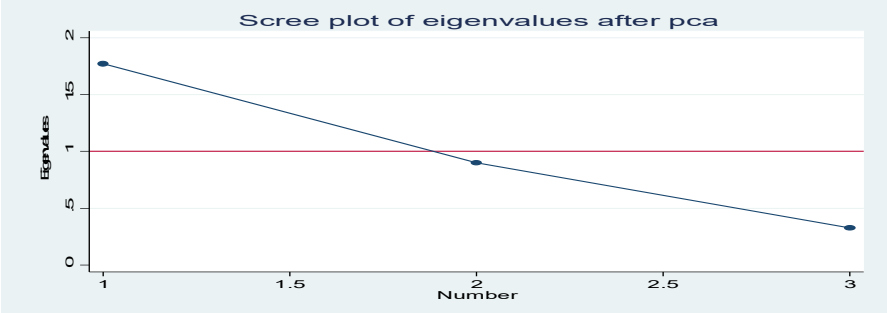


Figure 1. Eigenvalues of FDI factor axes.

5.2.2. Economic vulnerability index

In Table 6 below, only two factors are accepted, and all information included in the data and a portion of the variance of the studied variables are not used. Specifically, on average 42.63% (1–0.5737) of total variance is not explained. Figure 2 illustrates the Eigenvalues of EVI factor axes.

Table 6. Proportion of variance explained of EVI.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.19882	0.102981	0.2997	0.2997
Comp2	1.09584	0.13705	0.2740	0.5737
Comp3	0.95879	0.212244	0.2397	0.8134
Comp4	0.746547	.	0.1866	1.0000

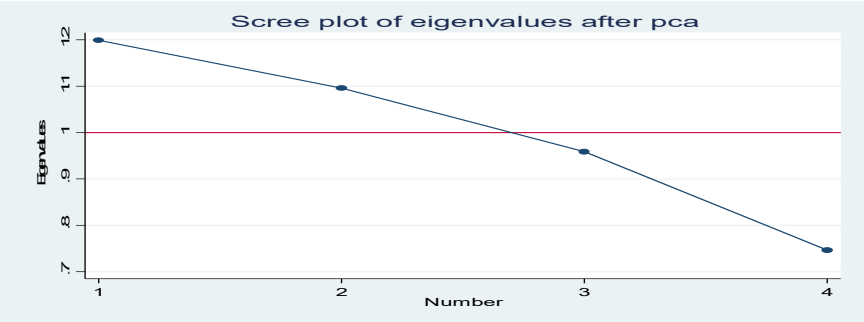


Figure 2. Eigenvalues of EVI factor axes.

5.2.3. Financial strength index

In Table 7 below, the first two factors account for 56.39% of total variance. However, with the two factors retained, we note that a portion of the variance of the studied variables is not used. Specifically, on average 43.61% (1–0.5639) of total variance is not explained. Figure 3 illustrates the Eigenvalues of FSTI factor axes.

Table 7. Proportion of variance explained of FSTI.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.18135	0.106971	0.2953	0.2953
Comp2	1.07438	0.16074	0.2686	0.5639
Comp3	0.913636	0.0829942	0.2284	0.7923
Comp4	0.830641	.	0.2077	1.0000

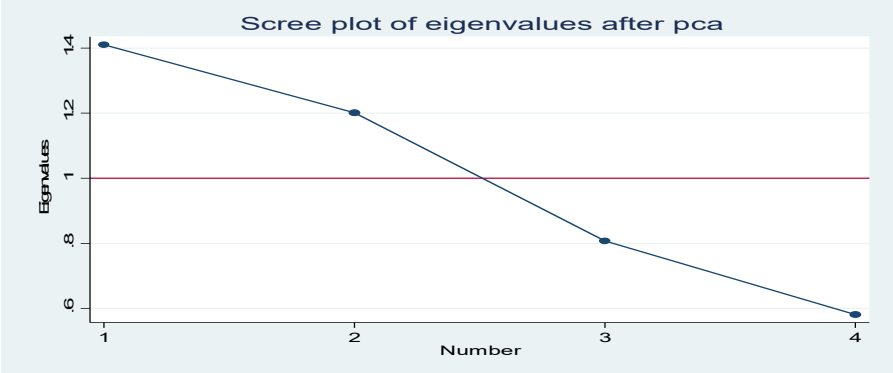


Figure 3. Eigenvalues of FSTI factor axes.

5.2.4. World government index

In Table 8 below, the first two factors explain 47.82% and 16.62% of total variance, respectively. This amounts to a total variance of 64.44%. These two factors better explain the variation in the

governance of an economy than the four remaining factors. Nevertheless, on average 35.56% (1–0.6444) of total variance is not explained. Figure 4 illustrates the Eigenvalues of WGI factor axes.

Table 8. Proportion of variance explained of WGI.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.86923	1.87183	0.4782	0.4782
Comp2	0.997394	0.2373	0.1662	0.6444
Comp3	0.760094	0.178751	0.1267	0.7711
Comp4	0.581344	0.160881	0.0969	0.8680
Comp5	0.420462	0.0489856	0.0701	0.9381
Comp6	0.371477	.	0.0619	1.0000

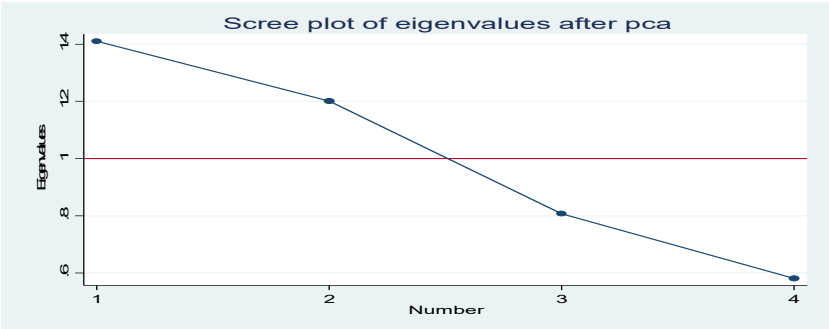


Figure 4. Eigenvalues of WGI factor axes.

5.2.5. Financial stability index

In Table 9 below, the first two factors explain 35.25% and 30.03% of the total variance, respectively. This amounts to a total variance of 65.28%. These two factors explain the variance of the dependent variable better than the two remaining factors. Nevertheless, on average, 34.72% (1–0.6528) of the total variance is not explained. Figure 5 illustrates the Eigenvalues of FSI factor axes.

Table 9. Proportion of variance explained of WGI.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.41016	0.209013	0.3525	0.3525
Comp2	1.20115	0.393878	0.3003	0.6528
Comp3	0.807269	0.225844	0.2018	0.8546
Comp4	0.581425	.	0.1454	1.0000

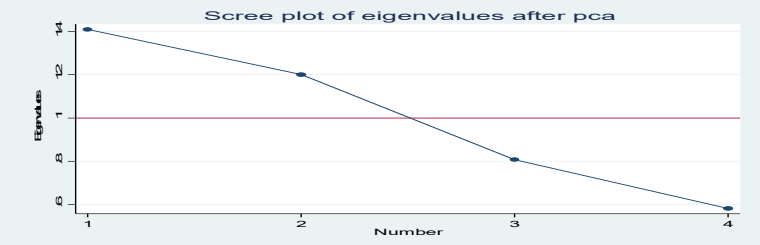


Figure 5. Eigenvalues of FSI factor axes.

In conclusion, by combining the PCA-constructed four sub-indices with the first two major factors, we obtain the financial stability index, which is written as follows:

$$Financial\ Stability\ Index = 0.6834\ FDI + 0.4394EVI - 0.5812FSTI - 0.0469WGI \quad (2)$$

Figure 6 below shows the evolution of the newly constructed financial stability index. Indeed, in this figure, we can see that the financial stability index experienced a notable drop in emerging countries in the early 1990s. This coincides with the different crises that took place then, notably the Mexican crisis in 1994. Then, the level of financial stability increased slightly before the 2000s. Nevertheless, the FSI fell in the early 2000s following the burst of the internet bubble. Similarly, the financial stability index fell following the sub-prime crisis that spread to emerging countries, followed by the global financial crisis of 2008. On the other hand, it is also noted that the financial stability index fell in 2011 following the changes in the socio-political environment in the Arab world, notably the Tunisian and Egyptian revolutions. This decline also persists in 2012, which coincides with the Venezuelan economic crisis causing a political and a social crisis.

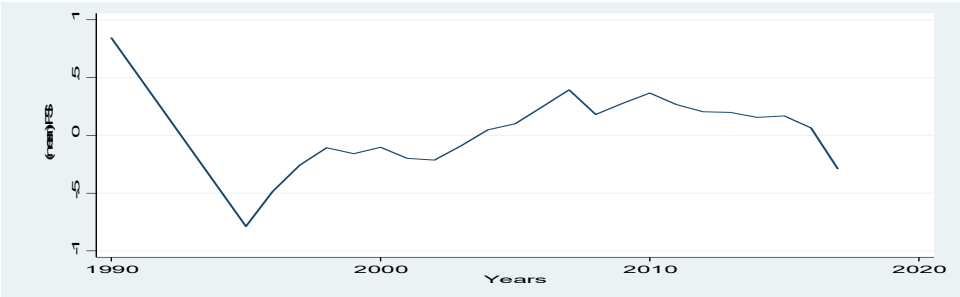


Figure 6. The evolution of the financial stability index.

5.3. *Results of the impact of shocks on economic growth and financial stability in inflation-targeting emerging countries*

In this section, we identify the impact of shocks on economic growth and financial stability in both inflation-targeting and non-inflation-targeting countries. To this end, we opt for a multistage analysis using the VAR panel model estimated by GMM in system. We begin by determining the optimal number of lags in our model as well as its stationarity (see Appendix 3). In this regard, we

estimate two separate panels, the first examines the impact of shocks on economic growth, while the second deals with the impact of shocks on financial stability. In addition, we carry out the Granger causality test, which allows us to determine the statistically significant effects of the variables on each other. Such an analysis is a necessary precondition to study the dynamics of the model.

Table 10 below summarizes the results of the causality tests for economic growth and financial stability for inflation-targeting emerging economies. In the Granger sense and at the 1% significance threshold, we accept the hypothesis of the presence of a two-way causality. The first direction of causality shows that the evolution of the level of inflation in inflation-targeting emerging countries affects the level of economic growth, and the second direction of causality is the opposite.

Similarly for causality between level of inflation and financial stability in inflation-targeting countries, we accept the hypothesis of the presence of a two-way direction of causality, in the Granger sense and at the 1% significance threshold. The first direction of causality shows that an unstable level of inflation affects the stability of the financial system. As for the second direction of causality, a stable and a healthy financial system contributes to a good control of inflationary pressures.

Table 10. Panel VAR-Granger causality Wald test (inflation-targeting countries).

Panel VAR_1				
Equation/excluded		*Chi2*	*Df*	*Prob>chi2*
GDP_pcg	Inf	6.741	1	0.009
	All	6.741	1	0.009
inf	GDP_pcg	2.890	1	0.089
	All	2.890	1	0.089
Panel VAR_2				
Equation/exluded		*Chi2*	*Df*	*Prob>chi2*
FSI	Inf	8.064	1	0.005
	All	8.064	1	0.005
Inf	FSI	6.093	1	0.014
	All	6.093	1	0.014

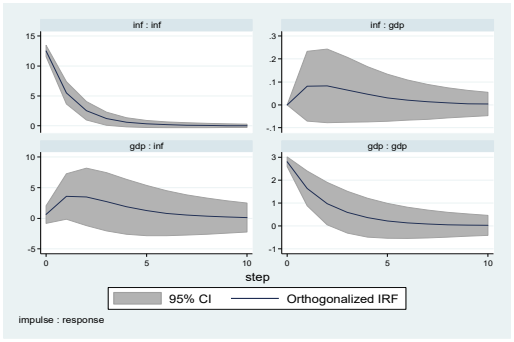
Ho Excluded variable does not Granger-cause equation variable.

Ha Excluded variable Granger-causes equation variable.

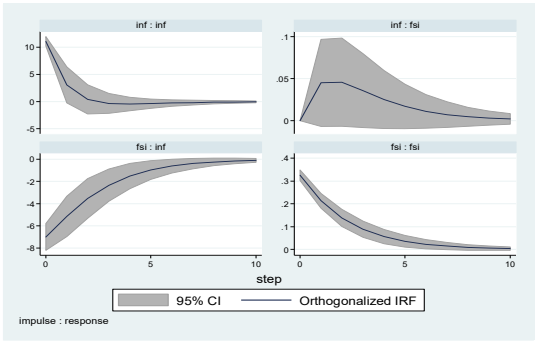
In Figure 7, a shock to inflation causes the output to return to its normal long-run level. This is because the economy has become richer because of the excessive lending generated by lower interest rates. This generates liquidity excess that favors investment and production, yet in the short term. Then, an increase in interest rates is expected in order to cope with the excessive demand for credit, which reduces long-term economic growth.

As for financial activity, a shock to inflation leads to an improvement in financial stability in the short term, while financial stability returns to its normal state in the long term. This finding shows that the magnitude of the shock persists only in the short term to both economic growth and financial stability. More specifically, an expansionary monetary policy leads to an increase in credit volume for investment and consumption. This leads to an improvement in the performance of financial institutions in terms of achieved returns, which is beneficial for financial stability. This confirms Schwartz's (1995) hypothesis as supported by Bordo et al. (2001), Borio and Lowe (2002), Issing (2003) and Woodford

(2012) who sustain the idea that monetary stability generates financial stability. Nevertheless, this improvement is only short-lived, since the interest rate is expected to rise as a result of excessive demand for credit. As a result, debt cost will increase, which will lead to a decrease in the demand for credit. The increase in debt cost is associated with an increase in risk and credit arising from the inability of borrowers to meet their commitments. This makes the financial system more vulnerable to distress. In this case, expansionary monetary policy is found to generate long-term financial instability. Moreover, this is observed in Figure 2 below, which shows that the curve rises slightly and then returns to its normal state in the long term. This contradicts Schwartz's (1995) hypothesis, but is in line with the results of Borio and Lowe (2002), White (2006), Leijonhufvud (2007), Issing (2009), Blanchard et al. (2010) and Fouejieu (2014).



(1)Economic growth



(2)Financial stability

Figure 7. The impact of the Inflation shock on economic growth and financial stability in inflation-targeting emerging countries.

5.4. Results of the impact of shocks on economic growth and financial stability in non-inflation-targeting emerging countries

Table 11 below reports all the results of the causality tests estimating economic growth and financial stability of inflation targeting and non-targeting emerging countries. The results of the Granger causality analysis at the 10% threshold between inflation and economic growth in non-targeting countries retain the hypothesis and points to the presence of a unidirectional causality direction between economic growth and inflation. This link shows that a rise in economic growth contributes to an increase in price levels.

Moreover, there is a two-way relationship between inflation and financial stability. The first causality direction shows that an unstable inflation affects the stability of the financial system. The second causality direction shows that a stable financial system contributes to controlling price levels.

Table 11. Panel VAR-Granger causality Wald test (inflation-targeting countries).

Panel VAR_1				
Equation/exluded		*Chi2*	*Df*	*Prob>chi2*
GDP_pcg	Inf	1.156	1	0.282
	All	1.156	1	0.282
Inf	GDP_pcg	3.303	1	0.069
	All	3.303	1	0.069
Panel VAR_2				
Equation/exluded		*Chi2*	*Df*	*Prob>chi2*
FSI	Inf	2.860	1	0.091
	All	2.860	1	0.091
Inf	FSI	5.087	1	0.024
	All	5.087	1	0.024

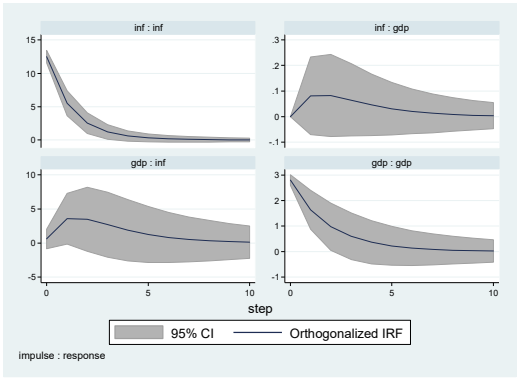
Ho Excluded variable does not Granger-cause equation variable.

Ha Excluded variable Granger-causes equation variable.

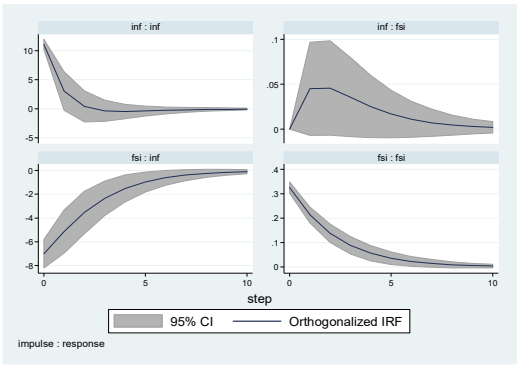
Figure 8 shows that a shock to inflation leads to an increase in the output in the first place. The level of output returns to its normal in the long-run. This figure shows precisely that an enrichment of the economy via a monetary injection by credit generates over-indebtedness of households and investors, which improves economic growth for a certain period (short period), and then this over-indebtedness is remedied by an increase in interest rates, which will curb economic growth.

As for financial activity, and according to Figure 8, a shock to inflation leads first to an increase in financial stability, followed later by a decrease in financial stability. This shows that the magnitude of the shock persists only in the short term. More specifically, in a context of economic enrichment marked by falling interest rates, credit level increases and is channeled to investment and household consumption. Such a situation leads to an improvement in the performance of financial institutions, particularly banks, in terms of achieved returns, which is beneficial to financial stability. This confirms Schwartz's (1995) hypothesis as supported by Bordo et al. (2001), Borio and Lowe (2002), Issing (2003) and Woodford (2012). These authors sustain the idea that monetary stability generates financial stability. Nevertheless, this improvement is only short-lived, since the interest rate is expected to rise as a result of excessive demand for credit. Therefore, in the long term, economic agents will be unable to repay their debts due to an increase in credit cost. This certainly increases the risk of insolvency of borrowers, thus threatening the banking and financial sector. In this case, monetary stability generates financial instability in the long term. Moreover, this is checked in Figure 3 below, which shows that the curve increases slightly and returns to its normal state in the long term. This contradicts Schwartz's (1995) hypothesis, and replicates the results of Borio and Lowe (2002), White (2006), Leijonhufvud (2007), Issing (2009), Blanchard et al. (2010), Fouejieu (2014), Fazio et al. (2018) and Umar and Wen (2020).

The above results indicate that during the 1995–2017 period and in the event of an inflation shock, inflation-targeting countries improve economic growth and financial stability in the short run more than non-inflation-targeting countries. Nevertheless, economic and financial conditions return to their normal state in the long-term.



(1) Economic growth



(2) Financial stability

Figure 8. The impact of Inflation shock on economic growth and financial stability in non-targeting emerging countries.

6. Conclusions

The scope of the concept of financial stability has gradually broadened in the wake of the recent global financial crisis. The resulting debate is constructive from economic and financial perspectives. Therefore, an attempt has been made in this paper to explore the possible relationships that can link monetary and financial stability and economic growth. To this end, we began with an overview of the literature that dealt with the relationship between the inflation-targeting regime and financial stability. Next, this study outlined the appropriate empirical validation. Specifically, we first determined the optimal configuration of the preconditions that best encourage the adoption of an inflation targeting policy in a sample of 35 emerging countries. Second, we tried to construct a financial stability index for this group of countries by combining four sub-indices into a composite index. Then, in order to investigate whether the inflation-targeting regime could improve economic growth and financial stability in emerging-market economies, we examined a sample of 35 emerging-market economies, of which 19 are inflation-targeting countries and 16 are non-inflation-targeting countries. In addition, we focused on exploring the dependency relationship between macroeconomic indicators and financial stability in inflation-targeting and non-inflation-targeting countries. This amounted to studying the magnitude of economic and financial shocks in emerging-market economies. Specifically, through a panel-VAR model, we compared between the two groups of inflation-targeting and non-inflation-targeting countries.

We conclude that the inflation-targeting regime allows emerging-market countries to control their economic growth and financial stability in the event of shocks more than non-targeting countries. Nevertheless, the magnitude of the shock persists only in the short run, as economic and financial conditions return to their normal state in the long-term (Issing, 2009; Blanchard et al., 2010; Fouejieu 2014). Moreover, this shows that inflationary shocks generate a slight improvement in economic growth (in the short term) accompanied by a fall in economic growth, which is explained by the enrichment of the economy marked by an excessive granting of credit generated by the fall in interest rates. This situation generates cash excess, which certainly favors investment and production, but in the short term. In this regard, an increase in interest rates is expected in order to cope with the excessive

demand for credit, which reduces long-term economic growth. On the other hand, in the face of these shocks, financial stability also stabilizes in the short term. This corroborates the findings of Bordo et al. (2001), Issing (2003), Woodford (2012), Carvalho, (2010), Anderson et al. (2015) and Nair and Anand (2020), which are checked by the magnitude of the resulting shocks. Consequently, in the long term, monetary stability certainly contributes to financial instability, as concluded by Borio and Lowe (2002), White (2006), Leijonhufvud (2007), Issing (2009), Blanchard et al. (2010), Fouejieu (2014), Huang et al. (2019) and Dinabandhu and Debashis (2019).

As recommendations, emerging countries wishing to adopt an inflation targeting regime should maintain the structural and institutional preconditions needed before adoption. Indeed, the late implementation of these preconditions will not have the desired effect. Similarly, emerging countries are recommended to separately pursue price and financial stability objectives. Specifically, it is in the interest of the Central Banks of emerging countries to pursue their traditional objectives of macroeconomic performance. In addition, these emerging countries should also consider pursuing the macroprudential policies that ensure financial stability. Such measures should guarantee both economic growth and financial stability as well as address conflicting institutional and regulatory objectives. In this regard, the study of the relationship between macroprudential policy and financial stability should be considered by future research projects.

Use of AI tools declaration

The authors affirm that no artificial intelligence (AI) tools are used in the creation of this work.

Conflict of interest

All authors declare no conflicts of interest in this paper.

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