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EFFECT OF MONETARY POLICY ON INFLATION AND ECONOMIC CYCLES THROUGH RELATIVE PRICE CHANGES: AN EMPIRICAL ANALYSIS FOR THE BRAZILIAN ECONOMY.

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Resumo

O objetivo deste artigo é avaliar os efeitos da política monetária sobre o ciclo econômico e a taxa de inflação por meio de variações nos preços relativos da economia no Brasil, com base em séries temporais mensais para o período de março de 2007 a setembro de 2017. A econométrica os resultados obtidos pelo GMM corroboram com a teoria austríaca dos ciclos econômicos e mostram que a oferta de moeda não afeta apenas os preços relativos da economia, mas também indiretamente o hiato do produto (ciclos econômicos) e a inflação no curto prazo. Considerando também que uma expansão monetária contribui para a expansão do crédito e que são fortes as evidências de implicações microeconômicas decorrentes de uma variação na oferta de moeda, esses resultados tornam-se relevantes para avaliar os efeitos das políticas monetária e de crédito sobre o nível de atividade econômica e a taxa da inflação, por meio de variações nos preços relativos da economia.

Palavras-chave: Política monetária, preços relativos, ciclo econômico, oferta de moeda

Abstract

The purpose of this paper is to evaluate the effects of the monetary policy on the economic cycle and inflation rate through changes in the relative prices of the economy in Brazil, based on monthly time series for the period from March 2007 to September 2017. The econometric results obtained through GMM corroborate with the Austrian business cycle theory and show that money supply not only affects the relative prices of the economy but also indirectly affects the output gap (economic cycles) and inflation in the short-run.

Considering also that a monetary expansion contributes to credit expansion and that the evidence of microeconomic implications deriving from a variation in the money supply is strong, these results become relevant to evaluate the effects of monetary and credit policies on the level of economic activity and the rate of inflation, through changes in the relative prices of the economy.

Key Words: Monetary policy, relative prices, economic cycle, money supply

1 INTRODUCTION

The financial crisis of 2008 was the largest in the history of capitalism since the Great Depression of 1929. It began in the United States after the collapse of the speculative bubble in the real estate market, fueled by the huge expansion of bank credit and potentialized by the use of new financial instruments, the financial crisis has spread all over the world in a few months. The event that triggered the crisis was the bankruptcy of investment bank Lehman Brothers on September 15, 2008, following the Federal Reserve's refusal to bail out the institution. To overcome the recession, the Federal Reserve applies the old Keynesian revenue and implements an expansionist policy to reactivate the economy. Before that, he decided to lower the Federal Tax Rate (FFR), from around 6% in 2000 to a rate of about 1.6% in 2002. This level, until that moment, was at a record low in recent years. The fall in this rate, caused by yield curves, results in a decline in the long-term rate, this, added to the institutional changes that stimulated the purchase of housing, generated incentives for the increase of real estate loans. In the last quarter of 2008, industrial production in the developed countries experienced a significant reduction, with in some cases a drop of more than 10 % compared to the last quarter of 2007. Even the developing countries, which did not have problems as its financial systems, such as Brazil, also saw a very strong fall in industrial production and Gross Domestic Product (GDP). In fact, in the Brazilian case, industrial production fell by almost 30% in the last quarter of 2008 and the GDP showed an annualized contraction of 14% during this period.

The governments in developed countries responded to this crisis through the use of expansionary fiscal and monetary policies. Decisions to reduce interest rates and to promote monetary expansion were also taken by the European Central Bank, which further liberated the tax brackets of the Maastricht Treaty and were authorized to increase fiscal deficits beyond the limits imposed by the Treaty under consideration. Through 2008 and 2009, the focus was on the interventions put forward by the European Central Bank in response to the global financial shock rather than on the country-specific financial risks (Lane, 2012). In the second half of 2009 some EU economies such as Greece, Ireland, Italy, Portugal and Spain went into recession and experienced a large increase in the unemployment rate. The euro area countries experienced an increase in the deficit / GDP ratio from 1997 to 2008, the non-financial corporate debt rose from 250% to 280% of GDP, the banks debt increased from 190% to 250% of GDP and household debts increased by nearly 50% Arrests et. al (2011).

With the impact of the subprime crisis in Brazil from mid-2008, the Brazilian government applies anticyclic policies to mitigate the effects on the product and employment. In this context, the Government artificially promoted the reduction of interest rates of official banks under its control, such as the Caixa Econômica Federal (CEF), Banco do Brasil (BB) and the National Bank

for Economic and Social Development (BNDES). Furthermore, through the Central Bank of Brazil, it promoted monetary and credit expansion.

The subsequent global economic recession created in the Academy a renewed interest in the Austrian theory of economic cycles (ABCT), also known as the theory of the endogenous monetary cycle. According to (ABCT), money supply increases will trigger unsustainable expansions, whether they are fully anticipated or not, mainly through their impact on the accumulation of producer goods Mises et.al.(1983). In recent decades, several authors have resorted to econometric methods to analyze the austrian theory of economic cycles, Lucas RE (1972) it raised new theoretical approaches and among them the discussion about Mises (1912) and Hayek's theory (1933) was resumed.

We believe that the result of the systematic and persistent reduction of interest rates for a reasonable period in lower levels than interest rates that would have been practiced by the market may have caused undesired effects on the level of economic activity and the behavior of the aggregate level of prices as well as may have caused distortions of the relative prices of the economy. These decisions led the country in a second moment to a strong reduction in investments and a strong economic recession. This policy resulted in a negative growth rate of more than 3% of GDP in 2015 and 2016 for the Brazilian economy, in addition to a virtually null rate in 2014 (IBGE, Brazil). In other words, an artificial expansion of money supply and credit leads to poor investment decisions, because economic agents compared the return rates of their investment projects with an interest rate that does not correspond to reality, but at a rate momentarily lower than the interest rate that would occur if there was no government intervention, that is, a rate less than rates market interest. The initial effect of this monetary policy is increases in the level of employment, consumption, production and investment that proved unsustainable in the future.

Imagine that a given project has a return rate of 5% per year and that the market interest rate is 7%. Also admit that this is a project with return on initial investment only in the medium or long term. Of course the investment project would have been aborted because the investor could apply its resources in the financial market earning 2% a year with lower risk. Now imagine that the government has artificially reduced the interest rate to 3% per year. In this case, the investor would opt for the development of the investment project, but, for his unhappiness, in the second or third year the interest rate does not sustain itself and returns to the market level, 7% per year. In this case, possibly the investor would stop the investments, despite the losses, generating unemployment, fall in the level of economic activity and defaults. Admitting that hundreds of thousands of investors were deceived or let yourself be deceived by the artificial fall in market interest, then the conditions for the economic cycle advocated by the Austrians have been formed. Admit that the government decides to direct credit to some sectors that it considers priority such as the sectors of durable consumer goods such as automobiles and white-line appliances, besides the civil construction sector. These sectors sell their products funded with subsidized loans, through banks under government influence. In this way there is an artificial expansion of the production of these goods and also of their demand. In this case, greater demand is generated by the production factors of these goods or by the inputs used for the production of the same assets. This results in the increase in the prices of goods and inputs in these sectors benefited by the credit policy. In this context, there is a change in the prices of these sectors in relation to the prices of the other sectors of the economy, i.e. the relative prices are changed.

Relative prices act as signs for economic agents, so that the increase in prices of some sectors in relation to others induces, on the one hand, the agents to invest more in these sectors, because higher prices encourage greater offer. On the other hand, workers are moving from other less profitable sectors to the sectors benefiting in search of greater remuneration.

The results outlined in this paper provide very strong evidence that traditional money demand studies may well be misspecified in omitting a role for relative prices. These considerations lead to the following conclusions, based on the Austrian theory of business cycles. An artificial expansion of money and credit distorts the prices of the economy, such as interest rates and wages, for example, but also distorts the relative prices of goods and services. This, such distortions cause bad investment decisions that result initially in artificial and temporary expansion of the level of economic activity, succeeded by contraction of the economy. Bad decisions stem from the artificial changes caused by the economy's price system as a result of the government's monetary and credit expansionist policies. However the effects of such policies are not painless, they change the allocation of resources in the economy, generating losses and gains between the various economic agents and loss of purchasing power in relation to the change not only of relative prices, but also of the general level of prices (MOREIRA, et. al 2016).

For these reasons, the aim of this paper was to evaluate the effects of the monetary policy on the economic cycle and inflation rate through changes in the relative prices of the economy in Brazil, based on monthly time series for the period from March 2007 to September 2017.

Using monthly data from March 2007 to September 2017 we conduct a econometric analysis to evaluate the following issues: i) the direct effect of the variations of money supply on relative prices; ii) The indirect effect of changes in money supply through relative prices on inflation; iii) The indirect effect of changes in money supply through relative prices at the level of economic activity. To represent the relative prices of the economy we chose the ratio of the producer price index (PPI) and the consumer price index (CPI) as variable. The econometric results show the distortions caused in the prices related to the money supply and its impact on the level of economic activity and the aggregate prices of the economy. Such facts issue an alert to governments and the market, because the supposed remedy through expansionist monetary policies can be in reality the main cause of economic cycles or at least a propeller for a future recession. The negligence or malpractice of decision makers can generate serious consequences for the economy, such as increasing inequality and unemployment in addition to causing fiscal imbalance that triggered a reduction in social welfare.

In the aforementioned context, this article is divided into five sections, in addition to this first; the second section makes a brief allusion to the theoretical reference and the revision of the literature on the subject. The third section discusses the methodological aspects. The fourth section presents and discusses the results and the fifth section denotes the final considerations.

2 THEORETICAL REFERENCE

This paper combines three distinct literatures: the quantity theory of money, the Austrian business cycle theory and the effects of changes in relative prices and the Phillips curve.

2.1 Quantity theory of money

The discussion about the intensity of the impact of changes in the money supply on real variables, such as real output, inflation, or the unemployment rate, has been widely debated in the literature of the monetary economy. Money is considered neutral if changes in money stock are independent of changes in real variables, while it is postulated non-neutral if dependent. Specifically, the theory of monetary neutrality, such as the quantitative theory of money (QTM), has expressed that there is a long-term neutrality (LRN) of money if a permanent change in the nominal money stock will not have any effect on the level of production in the long run, but will only have a proportional effect on nominal prices in the long run.

One of the great controversies among economists to date concerns the so-called classical dichotomy of money that states that changes in the money supply do not affect real variables. Especially since the 2008 US financial crisis, monetary policies and central bank interventions have been strongly contested and the war between economists who advocate the money neutrality and those who believe it has real effects on the economy got warmer. The long term neutrality of money is documented, for example, in Barro (1997) that show in one of the conclusions of the study that periods of high inflation goes along low rate of economic growth and suggests that the analysis of growth through high inflation may have inverse effect.

The short-term effects of money on output were examined in several studies. In his classic work, Friedman and Schwartz (1963) provide ample evidence that money was important in the United States in the period before World War II. In their book Friedman and Schwartz (1963) conclude that the FED is responsible for the great depression, they raise the discussion of how shocks in the money supply can cause effects in the economy, showing that in several periods the output was accompanied by money supply variations, demonstrating strong evidence that money has real effects on the economy. Romer and Romer (1989) following the work of Friedman and Schwartz, but with a different perspective analyze some post-war periods and find strong evidence that possibly the Fed has promoted deceleration to reduce inflation, in other words cause recession. They show that these monetary policies and transmission mechanisms had an impact on unemployment and industrial production. Several other studies have evaluated the effects of the money supply variation - for the United States, Barro (1978); for UK, Attfield et al.(1981); for Canada, Wogin (1980); for a cross-country analysis, Attfield-Duck (1983) and Kormendi – Meguire (1984). Some monetary works use Granger-causality tests and vector auto regressions (VARs) for studying the impact of money in production.

However, there are insufficient studies on the specific role played by the amount of money in the structure of relative prices. This may be the case, even money is neutral in the traditional approach to quantity theory of money (QTM), changes in the money supply can change the relative prices in the economy.

In other words, despite the macroeconomic effect considering the general level of prices, a cannot ignore the possibility of microeconomic implications change in the supply of money even in the long run. A several macroeconomic models allow for short term non-neutrality, although exactly how money can affect output and other real variables in the short term remains a contentious issue. Our contribution in this paper is to evaluate the the effects of money supply variation on inflation and in the economic cycle through relative prices in Brazil, using GMM in the period from 2007 to 2017.

Over the past few decades, voluminous studies have been conducted to discover the influence of money on real economy activity. Lucas RE (1972) show that monetary fluctuations lead to real output movements in the same direction. Several models and methodologies were used to empirically examine neutrality as the validity of money to generate the answer on money supply is postulated monetary policy variable. Recently Fisher and Seatter (1993) left the subject open for discussion by saying that the results depended on the database. King and Watson's (1997) use US quarterly data (1949:1 to 1990:4) apply multivariate econometric methodology testing long-term neutrality of money, and concludes that is little evidence against (LRN). In the same line Ekomie (2013) examined the LRN of money in the economies of Central Africa and the countries of the Economic Union, such as the Central African Republic, Chad, Cameroon, Congo and Gabon. Using M2 and real output data from 1970 to 2008, Ekomie (2013) found that M2 has significant positive impacts on real production for all CAMEU countries with Gabon as an exception. The empirical evidence from his study also showed that the assumption of LRN of money was rejected for all CAMEU countries where the permanent changes in the money supply have long-term effects on the real product.

2.2 Austrian business cycle theory and the effects of changes in relative prices

The economic cycle is characterized by periods of expansion and contraction of the level of economic activity. Among the theories of the economic cycle stands out the theory of Austrian economists whose exponents were Ludwig von Mises and Friedich Hayek, and the latter won the Nobel Prize in Economics in 1974. Among the works of these authors, they stand out Hayek (1984) and Mises(1912, 1953 and 1966). The ABCT focuses on the fact that production takes time and examines the policy induced change in interest rates on the allocation of production process, which the austrians call Btime's production structure. If the interest rate reflects the temporal preference of the economic agents, then the interest rate is the price of time. It is to be expected, then, that by adjusting the price of time equilibrium level, there is an imbalance in the production process. In a simplified way, the austrian school argues that when the economic expansion is generated without the formation of prior savings, that is, when the expansion of the investment is generated by an artificial reduction of the basic interest rate of the economy via monetary expansion and, by consequence, via the expansion of the credit, there is initially an artificial expansion of the production of goods and services that does not sustain for a long time.

A theoretical explanation of the relationship between price level variation and relative price dispersion was offered by Barro (1976). Using localized markets of the type described by Phelps (1970) and employed by Lucas (1973), Barro links the dispersion of prices relative to variation in the money supply. The key elements of this model are, in on the one hand, individuals who have incomplete updated information and, on the other hand, demand and supply in each market reacting to relative prices because they are perceived locally. Thus, agents are confronted with the problem of determining whether the locally observed price the movements are caused by general inflation or shifts in relatives excessive demand. The greater the variation of the money supply, agents are likely to attribute local price movements to inflation rather than relative changes. Consequently, as money increase of variance, local price changes induce lower supply and demand responses - that is, excess demand becomes less elastic. Consequently, stochastic changes to excess local demand produce individual prices, so that the dispersion of prices between markets tends to increase with the variation of money.

Although some economists Friedman (1968), Lucas (1973), Sargent, (1978) Sanford J (1981) have already developed jobs in monetary economics with microeconomic foundations, there are still some relevant aspects that an aggregate analysis cannot contemplate.

The theory of the equilibrium business cycle of Robert E. Lucas and others opened up new theoretical approaches, and among these, Hayek's theory reappeared. In its model, Hayek (1984) shows the commercial cycle as a result of rational reactions to monetary expansion and subsequent distortions of the price structure. This approach to the crisis, as an inevitable process of rebalancing, provoked much debate in the 1930 Trautwein (1996). In this context, Lawrence (1999) shows a critical assessment of Hayek's theory and monetary policy. Recently a several of econometrics works are coming up to evaluate the propositions of the austrian business cycle theory, Horwitz (2000), Garrison (2001) and Huerta de Soto (2009).

There are some insightful discussions about how the credit policy pursued by a central monetary authority can be a source of distortion throughout the economy in the intertemporal allocation of resources and therefore an important cause of business cycles based on canonical austrian theory of economic cycles, Garrison (1989, 1991 and 2001).

In recent decades, several authors have resorted to econometric methods to analyze the austrian business cycle teory (ABCT) propositions. Bismans and Maugeot (2009) find results consistent with the ABCT using quarterly data from January 1980 to January 2006 for Germany, England, the United States and France. They show strong evidences of effects in the economy caused by monetary shocks and propagated through relative prices. In the same line Helmersson and Selleby (2009) analyzes the ABCT for the UK economy on the short-term outlook using quarterly data from 1984 to 2006 and find robust short-term results in line with Austrian business cycle theory.

One of the first and most robust empirical analyzes on the ABCT is produced by Wainhouse (1984) showing that monetary policy affects interest rates and consequently impacts the output, through the causality test Granger (1969) and using monthly US data for the period from 1959 to 1981, empirically find strong evidences of the austrian business cycle theory.

Similarly, Le Roux e Levin (1998) reproduce the Wainhouse with a new data between 1980 and 1986 for South Africa and relate unsustainable expansionist policies promoted by the government that had undesirable effects on the economy. Finally Keeler (2001) analyzes several US economic cycles for the period from 1950 to 1991 and confirm that the monetary shocks caused cycles that propagated through changes in interest rate.

Garrison (2001) analyzes the functioning of the economy on the perspective of each macroeconomic model (Keynesian, Monetarist and Austrian) argues that changes in interest rates cause the demand for manpower to increase in some stages of the productive process to the detriment of others in line with the austrian business cycle theory, which he considered more authentic to explain the recent economic cycles.

Finally, Mulligan (2006), illustrates the existence of cointegration relations between U.S. consumption expenditure and the inclination of the income curve between 1959 and 2003. This author points out that the structure of the prevailing interest rate affects the allocation of resources

between the different stages of the production process, approximated by the changes observed in the behavior of consumption and investment. On the other hand, it shows that a decrease in short-term interest rates leads to a more complex capital structure and a drop in the production of immediate consumer goods. In general, the main limitation of these jobs is that they continue to use excess aggregate production, which prevents us from seeing the differential behavior of the structure Intertemporal Capital in the expansive and recessive phases of the economic cycle. However, the austrian theory exposes the macroeconomic distortions suffered by the productive structure as a consequence of the processes of monetary and credit inflation as an essential propagation factor of the cycle.

In the same line Lester and Wolff (2013) show empirical evidence of the Mises-Hayek theory of the economic cycle, while Lawrence (2008) and Douglas(2014) provide an interesting discussion about the Great Depression.

Previously Luke (1972 and 1981) used a general balance frame with a chance of rational expectations to model the natural rate of unemployment and to demonstrate the neutrality of money. The general level of prices is a statistical average of prices in an economy. Therefore, it is difficult to assess the changes in the structure of relative prices and its consequence for the allocation of resources based on this concept.

It is reasonable to accept the hypothesis that, if the management of monetary policy is mild, it does not produce any relevant changes in the relative prices Moreira et. al.(2016). There are other situations where the conduct of monetary policy can generate relevant effects on resource allocation. In the opinion of the authors, this happened during the US economic crisis of 2008, for example, where the Federal Reserve Bank kept low the federal funds rate for a long time and the government promoted regulatory policies to fund residential mortgages for low and medium-income. For some economists, the conjugation of these two facts resulted in a speculative bubble in the credit market, which can be perceived as responsible for the crisis Andre (2010) and Luca and Schuknecht (2009).

In addition to the arguments already mentioned, the Austrian school emphasizes that the expansion of monetary and creditworthiness affects in a non-uniform way and in different intensities the relative prices in the different sectors of the economy. As a result, changes in relative prices lead to changes in the allocation of resources on one side and, on the other, lead to changes in purchasing power in the different sectors of the economy. In other words, some sectors lose and others win with relative price changes Moreira et.al. (2016).

2.3 Phillips Curve

Unemployment is a cornerstone of economic cycle analysis. The existence of a the short-term negative relationship between inflation and unemployment is also provided by "natural rate" theories, according to which monetary policy could change in cyclical unemployment in the presence of the expected rate of inflation. However, these models predict the long-term independence between inflation and unemployment. Although, a different story seems to emerge from Economy, since a declining inflation rate coexisted in the 1990s with decline of the unemployment rate. Note that a the symmetric situation was experienced in the 1970s, when a sequence of adverse effects supply shocks produced an increase both in the inflation rate and in

the unemployment rate. Thus, from the observation that in the last decades The US economy was characterized by low frequency movements of these variables, a recent aspect of the research investigated the possible existence of a long-term relationship. Although some economists ; Moghaddam & Jenson (2008); Mulligan (2011); Niskanen (2002); Reichel (2004); Ribba (2006); Tallman (2008, p. 29). Gordon (2011, p. 13, fig. 1) finds inflation and unemployment have a strong positive correlation, with inflation leading unemployment by about one year.

An extensive literature on the inflation dynamics is based on the New Keynesian Phillips curve, i.e., a fixing pricing model with nominal rigidities that implies that inflation can be explained by the expected evolution of the real marginal cost Cogley and Sbordone (2006). Fisher (1981) finds some conclusions. First, the association between relative price variability and inflation after of 1956 in the United States is dominated by food and energy shocks. Second, even after removing the effects of these shocks, monetary shocks or unforeseen changes in money or interest rates are associated with increased relative price variability. And finally, from the point of view of welfare economics, relative price variability is at best an indirect measure of well-being. Domberger (1987) concludes that there is strong evidence based on quarterly price data for the UK that the relative variability of prices at the aggregate and disaggregated levels is strongly related to the rate of inflation in the economy.

Others study also discussed the existence of a relationship between relative prices and inflation, Cukierman (1983), Roberts (1985), Çatik, Martin and Onder (2011)

Ball and Mankiw (1995) show that when menu costs create a variety of inactivity in response to shocks, the distribution of relative price changes influences the price level. Aoki (2001) presents a optimizingmodel, with a flexible price sector and a sticky price sector, is presented to analyze the effects of relative price changes on inflation fluctuations. On his model the relative price of the flexible-price good represents a shift parameter of the New Keynesian Phillips curve. Parks and Cutler (1983) express after examining the 1970s and 1980s that there was strong evidence that the aggregate level of prices was strongly correlated with relative prices in the economy.

Empirically there is a large econometric debate on the relevance of the New keynesian Phillips curve. The studies of Galí and Gertler (1999) and Galí and Lopez-Salido (2001) present statistical results favorable to the NKPC, we also have studies suggesting that the empirical relevance of the Phillips curve should be considered weak Rudd and Whelan (2005); Lindé (2005); and Bardsen et al. (2004).

Recently Mulligan (2016) examined monthly data from 1980 to 2014 to determine how employment responds to the cash shocks in Canada and the United States. The focus of the analysis is a comparison of the responses of real economies to the financial crisis and the great recession. Employment is used as a proxy for real output, although it may respond to monetary shocks in long run time. The empirical results show that in the long run the trade-off is that inflation creates more unemployment. In the same line Karanassou & Sala (2007 and 2009) analyze the long-run dynamics of inflation and unemployment in response to permanent changes in the growth rate of the money.

It is possible to consider that Friedman (1968) and Phelps (1968) criticisms of the Phillips curve did not consider the impact of Cantillon's effects of expansionist policy. Monetary expansion, or expansive fiscal policy, such as public works programs, increases demand for production and labor in specific sectors at the expense of from others. The highest real wage in the sectors where the expansion is located resource reallocation, including labor. The highest real wage is eventually spread throughout the economy, as these workers consumer sectors, often geographically close to who first benefit from the Cantillon effect. In each successive wave of spending, the real wage increase is dissipated, until it is overcome by the general increase in prices, which increase to reach it across the economy, and eventually increase beyond the average increase in nominal wages introduced by the expansionist policy.

In summary, intertemporal coordination failures aided and encouraged by the monetary system are both logically possible, and they seem to happen. Theoretical models of cycle quantity have time to occur when nominal interest rates can't keep up with inflation and therefore, allow the real market interest rate to fall short of the real natural rate. Bubbles and subsequent collapses appear to be accompanied by instability in the price level.

3 METHODOLOGY

3.1 Data base

Table 1 shows the description of the variables or time series with monthly frequency for the period from March 2007 to September 2017. The availability of credit data was limited by the methodological change implemented by Central Bank (Brazil). In this way, it was not possible to work with data prior to 2007.

Table 1-Description of variables (frequency: Monthly-2007:03 to 2017:09)

Series	Nomenclature	Title of the series	unit
PPI	PPI	Producer price index - IPA-EP - Geral - Economic Juncture - IGP (FGV/Econ. junct. - IGP) - IGP12_IPADI12. Secundary source: IPEA (Brazil).	index (aug. 1994 = 100)
Money Supply (M3)	M3	M3 - end period - new concept - (% GDP) - Central Bank of Brazil, Economic and Financial Notes for the public press, monetary policy and credit operations of the SFN (Bacen / Not Imp./Moeda) - BM12_M2NCNY12. Secundary Source: IPEA (Brazil).	Percentage
CPI	CPI	National consumer price index - IPCA - Geral - IBGE, National Consumer Price Index System (IBGE/SNIPC) - PRECOS12_IPCA12. Secundary Source: IPEA (Brazil).	index (dec. 1993 = 100)
Interest Rate	IR	Interest rate - Over / Selic - (% a.m.) - Bacen, Bulletin, financial and Capital Market section (Bacen/Bulletin/M. Finan.) - BM12_TJOVER12. Secundary Source: IPEA (Brazil).	Percentage
Expectation CPI (Inflation)	EXP_CPI	Average expectation of inflation - IPCA - Accrued rate for the next twelve months - (% a.a.) - Bacen, Bulletin, Section, Economic Activity (Bacen / Bulletin / Ec. Act.) - BM12_IPCAEXP1212. Secundary Source: IPEA (Brazil).	Percentage
GDP	GDP	Gross domestic Product (GDP) Accumulated over the last 12 months - Bacen, Time Series manager System (Bacen	R$ (millions)

		Others/SGS) - BM12_PIBAC12. Secundary Source: IPEA (Brazil).	
Trade Terms	Trade_Terms	Exchange Terms – Ratio of export price indices and import price indices-Foundation Centre for Foreign Trade Studies (Funcex) - FUNCEX12_TTR12. Secundary Source: IPEA (Brazil).	index (mid 2006 = 100)

Source: IBGE (Brazil)

3.2 Methodological Aspects

Considering endogeneity problems, it applies the GMM method that uses instrumental variables to remedy such a problem. The use of GMM also solves problems of non-stationary or non-integrated time series (Johnston and Dinarate, 1997; Hsiao, 1997; Hsiao, 1997b). Considering the problems of unknown heteroskedasticity and the serial correlation of the waste, the procedure of Newey and West is used for all the estimated models.

Equations (2) and (3) define a model of simultaneous equations. Due to the endogeneity problem, we apply (GMM), which requires the use of instrumental variables. For the proper use of the method, instruments must be "good" instruments to be relevant and valid. This implies that the instruments should be not only correlate with endogenous regressors, but also be orthogonal to the disturbance. The following tests are applied to our econometric specification: the underidentification test cragg jg, donald sg (1993), the overindentification Sargan-Hansen test also known as J-Statistic, and the Yogo stock test Stock JH, Yogo M (2005) to check the Hypothesis of instrument weakness.

For an equation to be identified in model, both the order condition of the model (L> = K), where L is the number of instrumental variables and K is the number of regressors, the condition of classification must be fulfilled. The latest notes that Qxz = E (X'Z) must be full rank, where X = (x1, x2) = (endogenous, exogenous) is the array of regressors, whereas Z = (Z1, Z2) = (excluded, included) is the array of instruments, and Z2 = x2. When this does not happen, we say that the model is underidentified or unidentified.

The independence of the instrument in relation to the error term can only be accessed if, and only if, there is a "abundance" of instruments, that is, if the equation is excessively identified. This happens when the condition of order is satisfied in inequality: the number of excluded instruments exceeds endogenous returns. The Sargan/Hansen test is used to test the over-identification hypothesis, under the null hypothesis that the instruments are valid, i.e., that is, not correlated with the disturbance. Even this hypothesis, the test statistic has a chi-Square distribution with L-K overidentifying restrictions.

The instruments that have a low explanation of the variation (weak correlation between X and Z) of the endogenous explanatory variable are considered to be weak instruments. The Stock-Yogo test is calculated based on the F-Cragg-Donald statistic. Under the null hypothesis the estimator is weakly identified in the sense that the observed bias is unacceptably large.

Econometric Research on instrumental variables has greatly emphasized the problem of weak instruments. In this context, MA A (2002) notes that the use of instruments can be a serious

problem. When instruments are weak, two problems can occur. The first is prejudice. Although the estimator can be consistent, estimates are always biased for small samples.

Secondly, when the instruments are weak the estimated standard error becomes very small. Thus, the confidence interval is unreliable because the midpoint of this estimator is biased and the confidence interval becomes large. As shown by Staiger D and Stock JH (1997), the problem of weak instruments can happen even if in the first phase the tests are significant at conventional levels (5% or 10%) in a large sample.

Several tests are suggested in the literature to check the hypothesis of weak instruments. A commonly used statistic is the first phase R2 with "instruments included" Bound J, Jaeger da, Baker RM (1995). Alternatively, this can also be expressed as a test set F the meaning of the instruments excluded Z1. However, when more than one variable is endogenous, this indicator is no longer valid. Shea (1997) proposed a statistic named by "partial R2" that captures the correlation between the instruments. When just one regressor is endogenous, the two R2 measures are equivalent. Another rule applied when there is only one endogenous regressor is the value of the F statistic in the first stage. In this case, a value less than 10 indicates the instruments are weak.

Alternatively, Stock (2005) suggested a test where the null hypothesis is that the bias of the estimator 2 SLS is less than a fraction (say 10%) of the OLS estimator. According to Murray (2006), the latest approach to the problem of hypothesis testing with weak instruments and one endogenous regressor is the "ratio test conditional likelihood" Moreira MJ (2003); Andrews Dwk (2006). The test of Moreira MJ (2003) overcomes the distortions found in conventional tests adjusting critical values according to each sample to generate the appropriated level of significance. Thus, the critical values are conditioned on the data available and are not constant.

Finally, when the variables are not stationary, specific problems arise in conventional inference based on ordinary last squares (OLS) regressions. In this sense, Johnston J (1997) stress the importance of knowing whether similar problems occur in the context of two-stage least squares regressions. Notwithstanding, Hsiao C(1997a); Hsiao C (1997b) analyzes this issue and concludes that the inference with two stage least squares estimators using instrumental variables remains valid, even when time series are non-stationary or non-co-integrated. In that context, Hsiao's conclusions are also valid when GMM is applied.

To take into account the two problems of unknown heteroskedasticity and the serial correlation of the residuals, we use the procedure of Newey and West for all estimated models Newey W, West K. (1987a); Newey W, West K. (1987b). The authors have proposed a more general covariance estimator that is consistent in the presence of both heteroskedasticity and autocorrelation of an unknown form.

3.3 Econometric Model

Expanded means of payment are leading indicators of real demand pressures on the real sector rather than restricted means of payment, since currently the portfolio relocation facilities allow M1 to always be at the level required for transactions and passively respond to increases in the price level. It should be stressed, however, that even in monetary policy models that favor

interest rate control, monetary aggregates continue to be important instruments for monitoring the effects of this policy, both as indicators of liquidity and as indicators of internal funding of resources, by the issuing system, for the multiplication of credit in the country.

The new concepts of expanded means of payment represent a change in the ordering criteria of its components, which no longer follow the degree of liquidity, starting to define the aggregates by their issuing systems. In this sense, M1 is generated by institutions that are strictly monetary, M2 corresponds to M1 and other high liquidity issuances carried out primarily in the domestic market by depository institutions - those that multiply credit. M3, in turn, is composed of M2 and domestic funding through fixed income funds and securities portfolios registered in the Special System of Settlement and Custody (Selic). The M4 comprises the M3 and highly liquid public securities. (BACEN, Brazil). Thus, the criterion adopted allows to discriminate the exposure of the financial system to the demand for liquidity by including in M3 only deposits and deposit funds with the public. The table below shows the components and the new concept of payment means.

Table 2 – Means of Payments

Restricted Means of Payment	
M1	Currency paper in public power + Cash deposits
Expanded Means of Payment	
M2	M1 + Paid special deposits + Savings deposits + Securities issued by depository institutions
M3	M2 + Quotas for fixed income funds + Committed operations registered in Selic
M4	M3 + High liquidity public bonds

Source: BACEN (Brazil)

To represent the money supply, we choose (M3) monthly series that has a more complete composition of monetary aggregates than (M2), which better represents the variation of the money supply in the economy. The (M3) are denoted by the percentage of end-of-period balances in relation to GDP. A more reliable performance is expected when expressing values as a proportion of GDP. Admit that $(M3)_t = Z_t$ for every instant of time (month) t. The variation of Z_t is given by the application of the diference of reason (Z_t/Z_{t-1}) = D_M3_GDP, which is equivalent to a percentage variation of money supply. The money supply series shall be denoted in this work by the (M3)

The relative price indicator series is given by the ratio of the producer price index (PPI) and the national consumer price index (CPI) and will be denoted by PPI/CPI. Admit that $(PPI/CPI)_t = Z_t$ for every instant of time (month) t. The variation of Z_t is given by the application of the logarithm (log) of reason (Z_t/Z_{t-1}) = D_PPI_CPI, which is equivalent to a percentage variation of relative prices. The variation rate of the relative prices shall be denoted in this work by the (P_i/P_j) nomenclature.

To calculate GDP at constant prices or real GDP, the monthly GDP series (nominal GDP) accumulated over the last twelve months deflated by CPI will be used. The real GDP is denoted by GDP_Real. The growth rate of the GDP_Real is given by log ($GDP\_Real_t/GDP\_Real_{t-1}$) which will be denoted as (GDPR_Rate).

The output gap is defined as the difference between the logarithm of GDP at constant prices, i.e. log (GDP_Real), and the real potential GDP, which is calculated by means of the HP filter, in a reference to the initials of the authors of this statistical tool, Hodrick and Prescott. The HP filter is a kind of ' trend ' of the series. If the difference is positive, there is a situation of excessive demand; Otherwise, there is idle capacity in the economy.

The actual interest rate is calculated by the difference between the nominal interest rate annualized (IR %) and the average expectation of inflation (CPI) accumulated rate for the next twelve months- denoted by (CPI_Expec), where CPI refers to the inflation rate of the economy.

The growth rate of trade terms is given by log ($Trade\_Terms_t$ / $Trade\_Terms_{t-1}$), being denoted as (Trade_Terms) and whose evolution is presented in figure 6 below.

Relative prices can be affected by supply and demand shocks. Breaking agricultural crop or strong variations in the price of the oil barrel are examples of supply shocks. Abrupt elevations or reductions in interest rates or tax rate may be considered as demand shocks. Shocks can be positive or negative. When they are positive, production increases. Otherwise, it can be classified as a negative shock.

Positive shocks contribute to increased production and, in the case of food overproduction, prices fall. If it is negative, in the case of drought or excessive rainfall, the supply or production of food is reduced and prices rise. In this second case, there is a negative supply shock, as production decreases. Relative prices change because there can be a great variation between consumer food prices and inputs prices for the producer, for example. Then the ratio of the producer price index (PPI) and the consumer price index (CPI) does not remain stable. As a result of the supply shock, PPI, which reflects the costs of inputs to producers, affects in different intensities the various productive sectors. On the other hand, the increase in food costs will affect consumers ' intensities, as it will depend on the composition of the basket of each consumer, their income, preferences, etc. Hardly an supply shock will affect PPI and CPI in the same magnitude. Soon, abrupt changes in these relative prices will occur with great likelihood. The same reasoning goes for the shocks of demand.

In this context, a proxy was created that we noted of shock in this work to capture, throughout the time series analyzed, the shocks of supply and demand that occurred in the economy and that had relevant economic impacts. Considering the variable rate of growth of the real GDP (GDPR_Rate), the average of the series and the standard deviation are calculated. Values above and below a standard deviation in relation to the average of the real GDP variation are considered to explain the shocks of supply and demand. The intuition arising from the results obtained is that relevant shocks of supply and/or demand can explain in good part the strong variations of the volatility of the actual monthly product of the Brazilian economy. In this way, this proxy is represented by the product of two variables, Rate_GDPR_1DP * D (GDP_REAL), where Rate_GDPR_1DP represents a dummy-type variable, where 1 are the values above or

below a standard deviation (DP) relative to the actual GDP growth rate and 0 are the values located between a standard deviation above or below the average.

3.4 Systems Equation

Equation 1 shows the variation of the relative prices $\Delta(P_i/P_j)$ as the dependent variable or the variable to be explained, such that P_i represents the producer price index (PPI) and P_j represents the consumer price index (CPI). The reason P_i/P_j represents the relative price and the symbol Δ represents variation of the variable of interest P_i/P_j. The dependent variable is the function of the relative price variations lagged in up to n terms, that is, it can be explained by the values of the months preceding the current period t, such as $\Delta(P_i/P_j)_{t-1}$, $\Delta(P_i/P_j)_{t-2}$,..., $\Delta(P_i/P_j)_{t-n}$ and α_z represents the coefficient of these variables lagged, so that z = 1, 2,..., N. In addition to the outdated terms, $\Delta(P_i/P_j)_t$ can be explained by the variation of money supply as a proportion of the GDP, where β_1 represents, respectively, the coefficients of Δ $(M3/GDP)_t$. The variable that represents supply and/or demand shocks of the economy has β_2 as a coefficient. Finally, the coefficient of the intercept given by β and the end of the v_t error should be highlighted.

Equation (1):

$$\Delta(P_i / P_j)_t = \beta_0 + \sum_{1}^{n} \alpha_z \Delta(P_i / P_j)_{t-z} + \beta_1 \Delta(\mathrm{M3})_t + \beta_2 \, Shock_t + v_t$$

Equation 2 represents the market for goods or aggregate demand, which stems from the balance between investment and savings. This equation, also known as the IS curve, shows that the output gap is function of the output gap lagged, $(Output\_Gap)_{t-1}$, where i = 1, 2,... N, whose coefficient is given by γ_i. of course, the variable relevant to the balance of the market of goods is given by the actual interest rate of the economy (IR). In this case, the difference between the actual interest rate and the HP filter (HP_IR_REAL) is used as a proxy. The R_t coefficient is represented by $\delta 1$ and a negative relationship is expected between the IR variable and the output gap, i.e. $\delta_1 < 0$. Considering an open economy, the external variable is represented by the rate or variation of the terms of exchange, $(Trade\_Terms\_Rate)_t$, which has as δ_2 coefficient. A positive relationship between the variation of the terms of exchange and the output gap is expected, such that $\delta_2 > 0$. It is also used the variable of interest for this study which is the variation of the relative prices that has impact on the output gap, which is given by the coefficient δ_3. Finally, the coefficient of the interception given by δ_0 and the end of the z_t error should be highlighted.

Equation (2):

$$Output\_Gap_t = \delta_0 + \sum_{1}^{n} \gamma_i (Output\_Gap)_{t-n} + \delta_1 (R)_t + \delta_2 (Trade\_Terms)_t + \delta_3 + \Delta(P_i/P_j)\, z_t$$

Equation 3 shows the Phillips curve with the introduction of relative price variation, which is the variable of interest. The Phillips curve usually used shows the relationship between the current inflation rate (π_t) and the inflation rates passed (π_{t-1}) and expected (π^e_t), in addition to the output gap and the exchange rate $(Exchange\_Rate)_t$, which have the following coefficients $\rho_1 > 0$, $\rho_2 > 0$, $\rho_3 > 0$, and $\rho_4 > 0$ with their respective signals expected. The coefficient of the variable of interest, Δ (Pi/Pj), is given by ρ_5. Finally, it must be emphasized the coefficient of the interception given by P_0 and the end the error term (u_t).

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Equation (3):

$$\pi_t = \rho_0 + \rho_1 \pi_{t-1} + \rho_2 \pi_t^{\varepsilon} + \rho_3 (Output\_Gap)_t + \rho_4 \Delta\ (Trade\_Terms)_t + \rho_5\ \Delta(P_i/P_j)_t + z_t$$

In the face of the above, we work with two systems of equations. The first system shows the simultaneous estimation of equations (1) and (2) and the second shows the simultaneous estimation of equations (1) and (3).

As already informed, by means of the models econometric presented, it is sought to evaluate: i) if changes in the money supply directly affect variations of the relative price (equation 1) given by the ratio between PPI and CPI and ii) if the changes of the respective relative price affect the economic cycle or the real output gap (equation 2), in this way, it is also evaluated whether changes in money supply indirectly affect the GDP through relative prices change. This is the first system of simultaneous equations evaluated.

The second system of analyzed equations shows the interaction between the same relative price equation (equation 1) and the Phillips curve (Equation 3) in the same way, it is also evaluated whether changes in money supply indirectly affect the inflation rate through relative prices change.

4 RESULTS

This section aims to evaluate the effects of the variation of the balances of the money supply as a proportion of GDP (M3) on the economic activity (output gap) and the inflation rate (CPI), through relative prices changes which is represented by the ratio of the producer price index (PPI) and the consumer price index (CPI). A econometric analysis of time series with monthly data is used in the period from March 2007 to September 2017. All the variables used were collected in the IPEADATA (Brazil) and in addition, logarithm applies in all of them.

The estimated coefficients in tables 3A, 3B, 4A and 4B are statistically significant except the variable shock and the constant term presented in table 3A, in which it presents a probability above 0.79 and 0.27 respectively. This way the other estimated coefficients in the four tables are statistically different from zero, with a confidence level of 1%. This put, all statistically significant variables have positive or negative impacts on their dependent variables, according to the second column of coefficients in each of the tables.

Finally, the variables of interest present highly significant estimated coefficients at the level of 1%. The money supply variation as a proportion of the GDP (M3) presents value of the estimated coefficient of -0.041 in the first system equation. The first system shows the simultaneous estimation of equations (1) and (2), relative prices equation an IS curve equation. This means that for every 1% increase in the growth rate of the money supply (M3), the relative price growth rate decreases by approximately 0.041%. In other words, PPI grows in a larger proportion than CPI. In this case, an expansion of the money supply disadvantages the producers more, because they have a higher cost increase than consumers, which will have cheaper goods and services baskets compared to producers.

Table 3A – Estimation via GMM: Dependent variable: (P_i/P_j) (2007:03 – 2017:09)

Variables	Coefficient	Standard-deviation	statistic t	Probability
Constant	0.015615	0.014287	1.092948	0.2756
(P_i/P_j) (-1)	0.344349	0.085274	4.038169	0.0001***
M3	-0.041503	0.013781	-3.011528	0.0029***
SHOCK	-0.006378	0.024481	-0.260522	0.7947
	R2	0.175158	R2 Adjusted	0.154008
	Estatistic J	0.119526	Prob. (Est. J)	0.926594

Source: Prepared by authors. Note 1: – Instrument specification: L_IPA_IPCA(-2TO-6) D_M3_PIB(-1TO-4)@TREND PIB_12 IPCA IPCA(-1) C. Note 2 – All variables are parked on the basis of the ADF and Phillips_Perron unit root tests. Note 3-The J statistic based on the probability value of 0.95 does not reject the null hypothesis of overidentification and thus the specification of the model is not rejected.

It can be concluded then that changes in monetary policy, for directly affecting the money supply, and the allocation of resources in the economy and also the distribution of income of the population. In this context, the relevance of this discussion is highlighted, which lists the direct and indirect effects of the monetary policy on the change in relative prices and consequent effect on the level of economic activity and the inflation rate.

The estimate associated with table 3A and 3B is based on an equation that reflects the balance of the market of goods, known as the equation or curve IS, where (I) represent the investment and (S) the savings, such that I = S. Considering the results of table 3B, it can be observed that the two lags of the output gap [output gap (-1), output gap (-2)] show estimated coefficients with opposite signals, 2.287 and -1.228 respectively. The opposite signals are necessary to control the seasonal pattern of inertia and dynamics present in the time series. In addition, the lagged values of the dependent variable correct autocorrelation problems of the respective series. The trade terms presents an estimated coefficient of 2.429 approximately.

As expected, the actual interest rate, IR, which is calculated by the difference between the interest rate and the CPI rate, has a negative effect on the output gap, with an estimated coefficient of -0.649 approximately. The output gap is defined as the difference between GDP at constant prices and potential GDP, which is calculated by means of the HP filter. The HP filter is a kind of "trend" of the series. If the difference is positive, there is a situation of excessive demand; Otherwise, there is idle capacity in the economy.

Table 3B – Estimation via GMM system: Dependent variable: Output Gap (2007:03 – 2017:09)

Variables	Coefficient	Standard - deviation	Statistic t	Probability
Constant	3.285203	1.105281	2.972278	0.0033***
Output Gap(-1)	2.287412	0.200208	11.42519	0.0000***
Output Gap(-2)	-1.228280	0.221521	-5.544766	0.0000***
(P_i/P_j)	-46.74768	14.18232	-3.296193	0.0011***

Interest Rate (IR)	-0.649890	0.235392	-2.760882	0.0062***
Trade_Terms	2.429506	0.428115	5.674888	0.0000***
	R2	0.835382	R2 Adjutesd	0.828225
	Estatistic J	0.119526	Prob.(Est. J)	0.95

Source: Prepared by authors. Note 1: Instruments: L_IPA_IPCA(-2TO-6) D_M3_PIB(-1TO-4)@TREND PIB_12 IPCA IPCA(-1) C. Note 2 – All variables are parked on the basis of the ADF and Phillips_Perron unit root tests. Note 3-The J statistic based on the probability value of 0.95 does not reject the null hypothesis of overidentification and thus the specification of the model is not rejected.

Finally, it is observed that the relative price variation affects the product gap with a highly significant estimated coefficient at a level of 1%, with a negative value of 46.747. Thus, for each 1% increase in the rate of growth of the relative price, the level of economic activity is reduced and therefore the product gap by 46%. However, there is an indirect effect that shows that variations in money supply as a proportion of GDP affect the relative price (table 3A), which in turn affects the output gap (table 3B).

The estimate for table 4A and 4B shows an inverse relationship between inflation rate and unemployment rate, or, as is the case, a direct relationship between the inflation rate and the output gap, this relationship is known as the Phillips curve. The money supply variation as a proportion of the GDP (M3) presents value of the estimated coefficient of -0.031 in the second system equation. The second system shows the simultaneous estimation of equations (1) and (3), relative prices equation and Phillips curve equation. This means that for every 1% increase in the growth rate of the money supply (M3), the relative price growth rate decreases by approximately 0.041%.

Table 4A – Estimation via GMM system: Dependent variable: (P_i/P_j) (2007:03 – 2017:09)

Variables	**Coefficient**	**Standard-deviation**	**statistic t**	**Probability**
Constant	0.010260	0.004575	2.242916	0.0258**
(P_i/P_j) (-1)	0.381413	0.052604	7.250575	0.0000***
M3	-0.031910	0.004287	-7.444042	0.0000***
SHOCK	-0.009860	0.010083	-0.977947	0.3291
	R2	0.230520	R2 Adjusted	0.210789
	Estatistic J	0.150727	Prob. (Est. J)	0.926594

Source: Prepared by authors. Note 1: Instruments: L_IPA_IPCA(-2TO-6) D_M3_PIB(-1TO-4)@TREND PIB_12 IPCA IPCA(-1) C.. Note 2 – All variables are parked on the basis of the ADF and Phillips_Perron unit root tests. Note 3-The J statistic based on the probability value of 0.95 does not reject the null hypothesis of overidentification and thus the specification of the model is not rejected.

Considering the results of table 4B, it is noted that the effect of an increase in the relative price variation, (Pi/Pj), on the rate of inflation is positive in the value of 15.039 and the coefficient of the output gap presents a positive value, as expected, of 0.062. The larger the output gap or the excess of demand, the greater pressure for rising inflation.

Table 4B – Estimation via GMM system: Dependent variable: (CPI) Inflation Rate (2007:03 – 2017:09)

Variables	Coefficient	Standard-deviation	Estatistic t	Probability
Constant	2.074108	0.167022	12.41820	0.0000***
CPI (-1)	0.663661	0.019011	34.90914	0.0000***
(P_i/P_j)	15.03941	1.701068	8.841155	0.0000***
Output Gap	0.062788	0.007750	8.101244	0.0000***
	R2	0.353744	R2 Adjusted	0.337173
	Estatistic j	0.150727	Prob. (Est. J)	0.95

Source: Prepared by authors. Note 1: Instruments: L_IPA_IPCA(-2TO-6) D_M3_PIB(-1TO-4)@TREND PIB_12 IPCA IPCA(-1) C.. Note 2 – All variables are parked on the basis of the ADF and Phillips_Perron unit root tests. Note 3-The J statistic based on the probability value of 0.95 does not reject the null hypothesis of overidentification and thus the specification of the model is not rejected.

5 FINALS CONSIDERATIONS

This paper evaluates the direct impact of changes in money supply on relative prices in Brazil, based on monthly time series for the period from March 2007 to September 2017 using GMM. In addition, we also investigate the indirect impact of money supply variation through changes in relative prices on the inflation rate and the level of economic activity (output gap).

In the face of the above, it can be concluded that there are empirical evidence that the expansion of money supply affects the relative prices of the economy, in the specific case of this study, affects a relative price of the economy very relevant, because it compares the prices of the producer's baskets and of the consumer. Changes in relative prices affect the decisions of economic agents related to consumption and investment, for example. The excessive expansion of the money supply and the consequent expansion of credit distorts the system of incentives or signals received by investors due to the change in relative prices. The allocations of resources and investments, influenced by artificial interest rates, which at the first time have high return rates artificially explain an initial economic boom followed by a subsequent reduction in the level of economic activity. The impact on the allocation of resources of the economy will ultimately affect the distribution of income of consumers and producers. The redistribution of wealth and income is favorable to those who received the credit at the beginning of the process at the expense of those who will only receive it later. Therefore, there are two types of relative price changes: The first is the redistribution of late income for the first recipients of new money, which occurs during the inflationary process. The second is the permanent change in wealth and income that continue to occur even after the money has already spread throughout the economy. The consequent reduction in the level of economic activity increases the chances of a fiscal imbalance and forces governments to take budgetary compression measures that triggers in a reduction in social welfare and increased inequality with the inflationary process.

In addition, there is a serious implication that should be considered when evaluating the mechanisms of transmission of monetary policy, which occur through changes in relative prices, because given the complexity of predicting the actual results that the shocks in relative prices and therefore at the level of economic activity and inflation, as the relevant contribution of this work, becomes a challenge for central banks to find a balance in monetary policies. Considering that a monetary expansion contributes to the creditworthiness expansion, these results are relevant to assess the effects of monetary and creditworthiness policies on the level of economic activity and the rate of inflation, through the relative prices change of the economy. Considering that a monetary expansion contributes to the creditworthiness expansion, these results are relevant to assess the effects of monetary and creditworthiness policies on the level of economic activity and the rate of inflation, through the relative prices change of the economy.

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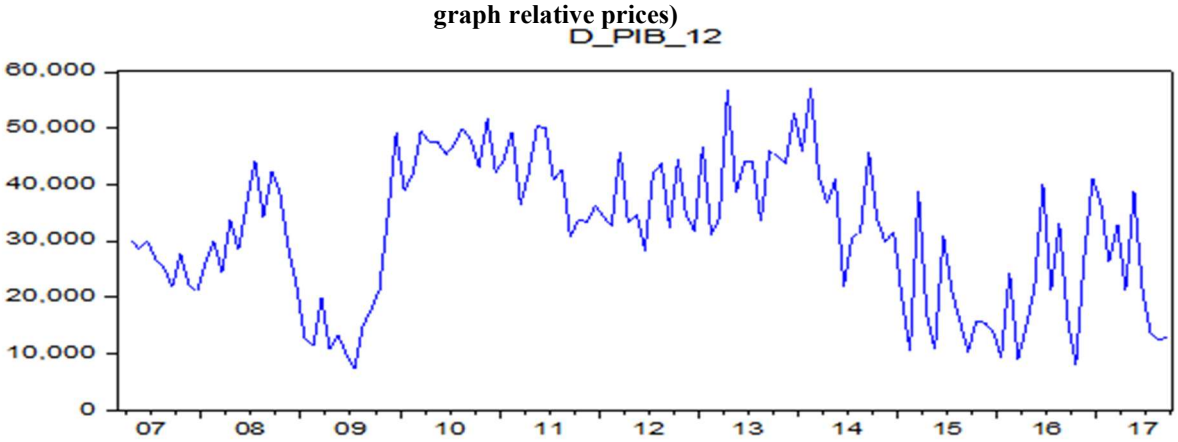
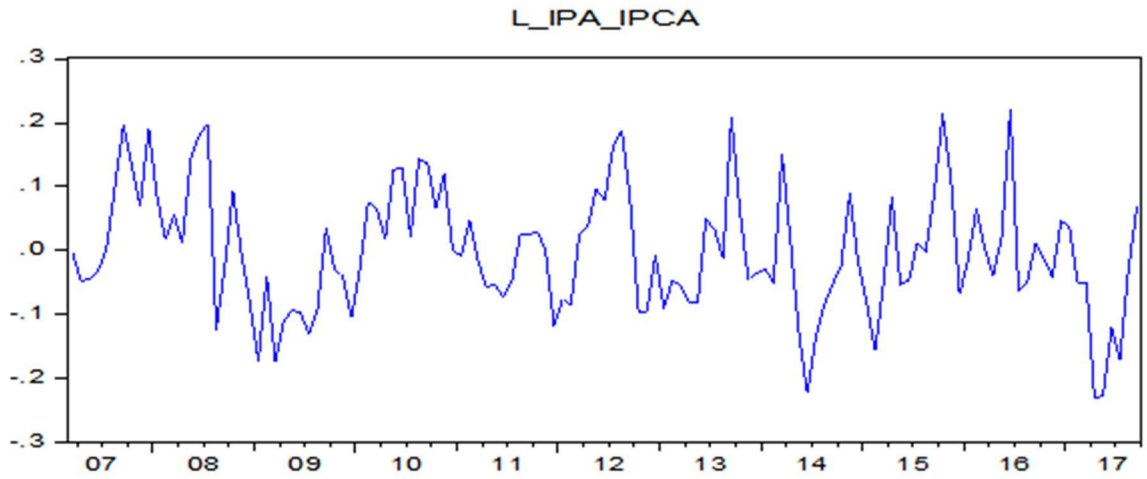
FIGURES

Figure 2: Evolution of the rate of variation of the relative prices (P_i/P_j) (reference to the graph relative prices)



Source: Prepared by authors

Figure 3: Evolution of the growth rate of GDP_Real at constant prices (reference to the variant GDP_Real)



Source: Prepared by authors

Figure 4: Evolution of the Output Gap (reference to the variant Output Gap)

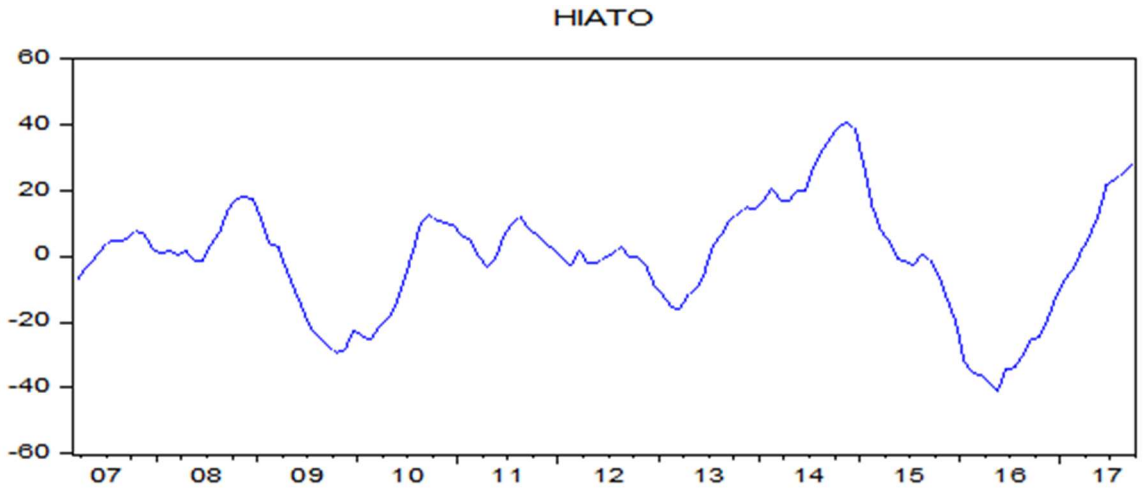


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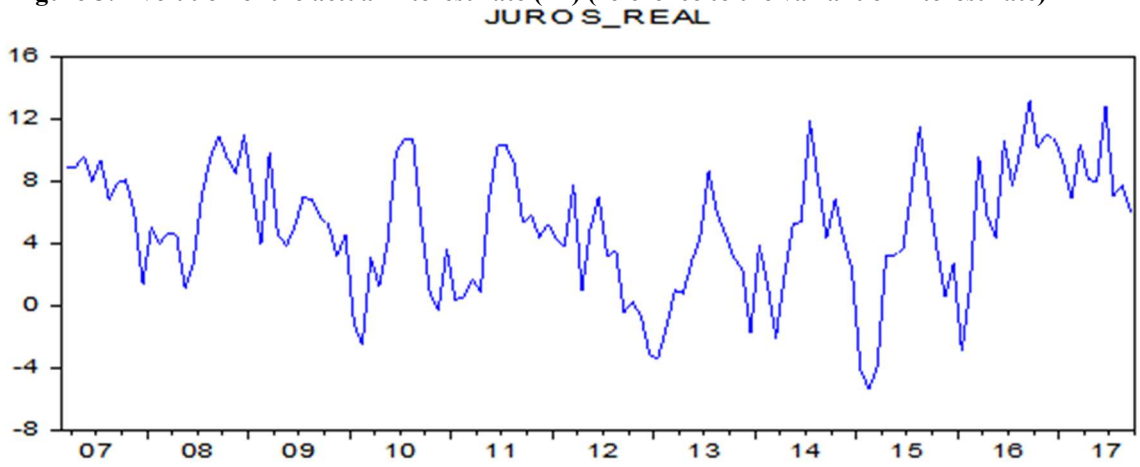
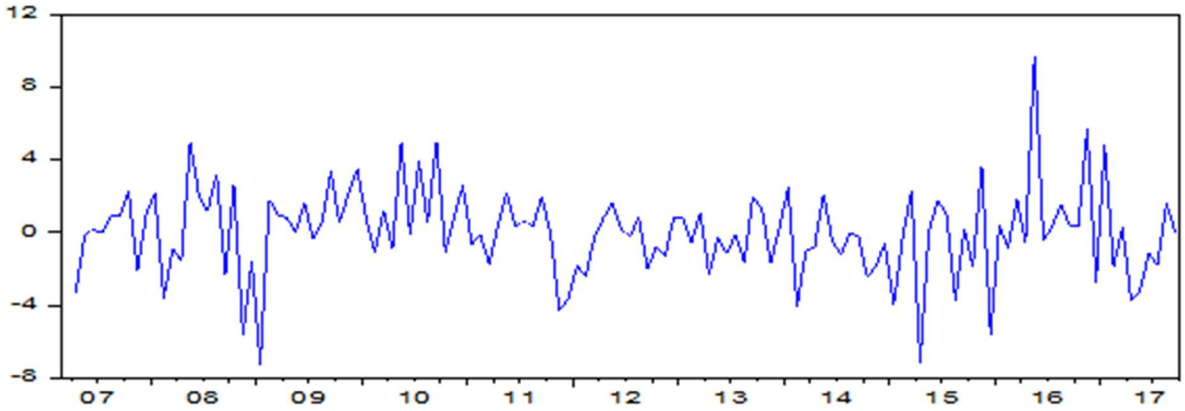
Figure 5: Evolution of the actual interest rate (IR) (reference to the variant of interest rate)



Source: Prepared by authors

Figure 6: Evolution of the trade terms (reference to the variant trade terms)



Source: Prepared by authors