Monetary rules and inflation targeting: Do they also contribute to exchange rate stability?

Carmen Díaz-Roldán
(Universidad de Castilla-La Mancha, Spain)
María A. Prats
(Universidad de Murcia, Spain)
María del Carmen Ramos-Herrera
(CUNEF, Spain)

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Abstract

In this paper, inspired by Taylor (2018), we will try to explore the extent to which monetary policies following a monetary rule could guarantee not only a sustainable monetary path but also to define a real interest rate trend compatible with the exchange rate stability.

To that aim, we will show the way in which the monetary policy rule guide approach, based on interest rate control (Taylor 1993), could guarantee price stability; i. e. the so-called *inflation targeting* regime. Next, we will explain the reasons for lay aside the conventional monetary policy, based on rules, and move to unconventional monetary policies for dealing with the zero-lower bound, as well as their implications on exchange rate regimes. Finally, we will estimate the threshold values of the monetary policy rule parameters, as well as the sizes of the responses, compatible with a no negative value of real interest rates and, consequently with a proper path of exchange rate stability.

Our hypothesis would be that, using appropriate parameters, a sound monetary policy stance would be possible, compatible with sustainable monetary and exchange rate policies. The methodology will be based on the panel data approach, and we will estimate the parameters of the monetary rule, and their threshold values, for the eurozone, from 1999.

Our expected results would show the extent to which is possible to provide some estimations of parameters allowing for a monetary policy based on rules without destabilizing exchange rate. This analysis will allow us to have a framework of reference that could contribute to a better understanding of the relationship between prices and exchange rates.

Key words: *monetary policy, Taylor rules, exchange rates.*
JEL codes: *E52, E58, F31, F41*

1. Introduction:

For a long time, the evolution of social and economic environment has put into question the sustainability of certain policy measures, even more criticized in crisis time. Depending on the socioeconomic situation and the dominant school of thought, recursively remain, as open questions, how demand policies can be implemented to guarantee short-run stabilization without putting a brake on economic growth. Moreover, how the so-called structural, or supply-side, policies could really become growth-driven.

Recently, the speed of adoption of new technologies, joint with the emergence of innovations in both production processes and trade channels, has led to an unprecedented market expansion worldwide. In this environment, a new economic and social order is being born fuelled by the technological changes. How do economic policies react to the new economic framework? How are policy instruments being adapted to the potential adverse shocks? From Economic History and History of Economic Thought, we could review several examples. But, in an attempt of looking at the future, inspired by Taylor (2018), in this paper we will try to explore the extent to which monetary policies following a monetary rule could guarantee not only a sustainable monetary path but also to define a real interest rate trend compatible with the exchange rate stability.

After the 2007-2008 crisis there has been *"a shift of policy away from rules as rates were held too low for too long"* (Taylor, 2017). And nowadays, there is a return to the rules-based approach. Some suggestions on the reform of inflation targeting are being made, trying to reduce the need for unconventional policy instruments, as they are poor substitute for conventional interest-rate policy in stabilizing the economy (Sheedy, 2017).

As our main objectives, first, we will show how the shift to monetary policy rule guide approach, based on interest rate control (Taylor 1993), was due to the obsolescence of the traditional approach based on the quantity of money. Next, we will explain the reasons for lay aside the conventional monetary policy, based on rules, and move to unconventional monetary policies for dealing with the zero-lower bound, as well as their implications on exchange rate regimes. Finally, we will estimate the threshold values of the monetary policy rule parameters, as well as the sizes of the responses, compatible with a no negative value of real interest rates. Our hypothesis would be that using appropriate parameters, a sound monetary policy stance would be possible; and compatible with a proper path of exchange rate stability.

2. A new approach for monetary policy

2.1. From the LM function to a monetary policy rule

In the nineties, the increasing pace of financial innovations began to alter, dramatically, the making of monetary policy. Policymakers needed to examine continuous and widely an important range of financial variables in formulating monetary policy and, thus, they introduced new monetary redefinitions, with broader measures of money, based on characteristics like term to maturity, and size and purpose of the deposits.

Goodhart (1975) pointed out three effects of financial innovation on monetary policy: the demand for money has higher short-run instability, the relation between economic activity and M1 is less consistent and, it appears a slower growth in Ml than its historical relation with GDP.

In this context, there have been important factors, which have changed the slope of the LM curve, and others which have shifted it: the bigger volatility of interest rates, the higher financial intermediaries (both reducing the slope in the LM curve) and the more market-related payments of returns to more forms of deposit (increasing the slope). These changes in the curve make difficulties in the assignment of adopting the money supply as an intermediate target (Friedman, 1982).

Financial innovations are due to a very unstable demand for money, as it makes difficult to control the interest rate by managing the money supply.

The monetary authority would control the money supply, but the LM function would shift due to the instability of the demand for money, and the resulting level of income would escape from the control of the monetary authority.

Poole (1970) showed that if the random shocks on aggregate demand are of a real nature, affecting the IS function, the instrument that must be used would be the amount of money; but if the random shocks are of a monetary nature, affecting the LM function, the instrument to be used it will be the interest rate.

Following this stance pointed out by Poole (1970), with the evidence that monetary demand is unstable and that the shocks that have the greatest impact on aggregate demand are the monetary ones, the short-term interest rate became to be the main monetary policy instrument. This was the main argument established by Wicksell in 1898, and later developed by Taylor (1993) in his famous Taylor rule in the 20th century.

Among the advantages of a monetary rule we could mention that it would provide greater stability to the economy, the monetary authority would be independent of the government, it would guarantee the effectiveness and credibility of monetary policy, and it would minimize the uncertainty of the private sector (consumption and investment decisions).

2.2. Monetary policy rules.

Literature on monetary policy based on rules dates from Friedman (1959) and his rule of growth of the money supply, Kidland and Prescott (1977), and Barro and Gordon (1983) that addressed questions on temporal coherence and credibility. However, the most quoted contribution is that by Taylor (1993), where the monetary policy followed by the Fed is described.

"At a basic level, a monetary policy rule is a contingency plan that lays out how monetary policy decisions should be made" (Taylor and Williams, 2011, p.833-834). The Taylor rule says that short-term deviations of the instrument of monetary policy (the official short-term interest rate, like the federal fund rate) $(x - x^*)$ are a response to deviations of the policy objective variables $(z - z^*)$: the stabilization of the level of activity and price stability. Thus, the nominal short-term interest rate, as instrument of monetary policy, adjusts both to deviations of inflation rate from its target and to changes in the output gap.

Taylor-type rules, in general, show that short-term deviations of the instrument $(x - x^*)$ are a response to deviations of the policy objective variables

$$(x - x^*) = \theta(z - z^*) \qquad (1)$$

Deviations of the instrument are a linear combination of the monetary objectives: the stabilization of the level of activity and price stability.

$$\left((i_t - \pi_t) - r^*\right) = (\beta - 1)(\pi_t - \pi^*) + \gamma({y_t}^{gap}) \qquad (2)$$

Where it denotes the short-term interest rate (official interest rate), r^* the equilibrium real interest rate, π_t denotes the inflation rate in period t, π^* is the desired long run, or "target," inflation rate, and y denotes the output gap (the percent deviation of real GDP from its potential level). In other words, deviations of the instrument (real interest rate) from the objective, responds proportionally to the inflation deviations and the output

deviations; or in a different way: the instrument deviations are a linear combination of goals deviations.

Thus, the management of monetary policy is characterized by assigning the targets of output stabilization and price level stabilization (inflation targeting). Taylor (1993) set the equilibrium interest rate r* equal to 2 and the target inflation rate π* equal to 2, r* = π* = 2, and $(\beta - 1) = \gamma = 0.5$. That is, in principle, the monetary authority would be giving equal importance to price stability than to the macroeconomic stabilization.

Rearranging terms, the Taylor Rule says that the short-term interest rate should equal one-and-a-half times the inflation rate plus one half times the output gap plus one.

$$i_t = 1 + 1.5\pi_t + 0.5{y_t}^{gap} \quad (3)$$

Or in general terms,

$$i_t = \alpha + \beta\pi_t + \gamma{y_t}^{gap} \quad (4)$$

Where α would proxy, together with other exogenous variables, the nominal interest rate goal.

The value of the coefficients represent the weight that the Central Bank gives to the inflation rate and the level of activity in its objective function. If the parameters were different, the rule would indicate which objective (inflation or economic growth) has more weight in determining monetary policy. Thus, with $\beta > 1$ the Central Bank has to adopt an anti-inflationist monetary policy raising the real interest rate to slow the economy and reduce inflationary pressures contributing to macroeconomic stabilization (Clarida et al., 2000). For the output gap coefficient $\gamma > 0$ the Central Bank has to adopt a countercyclical monetary policy, increasing the official interest rate by a particular amount when real GDP rises above potential GDP and by decreasing the interest rate by the same amount when real GDP falls below potential GDP (Taylor and Williams, 2011).

When setting the nominal interest rate, the Central Bank uses a rule similar to:

$$i_t = \alpha + \beta\pi_t^e + \gamma{y_t}^{gap} \quad (5)$$

That is, the Central Bank decides the nominal interest rate for the period t based on the nominal interest rate goal, modified according to the deviation of inflation expectations and the deviation of output expectations from its long-term tendency. If the Central Bank gives priority to the inflation target, and does not include output stability objective of monetary

policy, then it implies that $\gamma = 0$ and then the monetary rule, would be as follows:

$$i_t = \alpha + \beta\pi_t^e \quad (6)$$

That is similar to monetary policy rule followed by the European Central Bank.

Assuming rational expectations, the expected inflation rate would match the true inflation rate, π_t, except for a random prediction error, ε_t,

$$\pi_t^e = \pi_t + \varepsilon_t \quad (7)$$

So, we would get

$$i_t = \alpha + \beta\pi_t + \omega_t \quad (8)$$

Where $\omega_t = \beta\pi_t^e$

If we consider exchange rate in the rule (4), following Taylor (2001), we have:

$$i_t = \beta\pi_t + \gamma {y_t}^{gap} + \sigma_0\, e_t + \sigma_1\, e_{t-1} \quad (9)$$

Where e_t is the real exchange rate. In equation (9) no intercept appears in the equation so, the inflation targeting is zero and the interest rate and the exchange rate are measure relative to the long-run steady-state values.

If β>1, γ>0 and $\sigma_0 = \sigma_1 = 0$ then we obtain the monetary policy rule with no reaction to the exchange rate.

It has been pointed out that, in practice, when it comes to stabilizing the evolution of the inflation rate and the level of activity, the monetary policy rules, which depend on the exchange rate, do not work better than those that do not include it, mainly for two reasons (Taylor, 2001). First, although the monetary rule does not include the exchange rate, there will be an indirect reaction of the interest rate to it. Second, there may be deviations from the exchange rate with respect to the purchasing power parity which should not be compensated by variations in the interest rate.

For these reasons, and taking into account that the introduction of the exchange rate in the monetary policy rule would considerably complicate the operation of the model without significantly affecting the results we will assume that the monetary policy of the open economy is going to be the same as that of the closed economy as in (4).

2.3 Unconventional monetary policy

Most central banks implement conventional monetary policy over the basis of two elements: signalling the orientation of monetary policy, through an interest rate, and managing the ordinary liquidity operations with the balance sheet. The variations of these official rates are always consistent with the objective of price stability over the medium term while liquidity management operations allow reaching that level.

Unconventional monetary policies (or policies of quantitative monetary expansion of the balance sheet) are an extension of the conventional operations of Central Banks when official interest rates reach very low levels (*liquidity trap*).
There are several balance sheet policies, commonly intervening the currency markets. After the last crisis, the balance sheet policies have intervening the conditions of the wholesale interbank markets, the credit markets (public and private) and the general conditions of the economy.

Historically, the policies of balance sheet expansion led to episodes of inflation or hyperinflation due to the absence of fiscal discipline (Anderson et al. 2010). Currently, all central banks that have used large-scale balance sheet monetary policies (USA, ECB, UK, Switzerland, Canada and Australia, among others) are strongly committed with maintaining price stability.

After the last crisis, the monetary authorities of the main developed countries began to implement unconventional monetary policies. These policies have contribute to the considerable expansion and increased of the balance sheets of the main central banks during and after the financial turmoil. The size and composition of central bank balance sheet have changed significantly as the result of the implementation of unconventional monetary policy. This unconventional policy could be seen as the natural extension of the conventional operations when: official interest rates reached the zero lower bound (ZLB) in a liquidity trap scenario; and the money markets collapsed with a serious disruption in monetary transmission based in the interest rate channel.

After the financial turmoil intensified in the fourth quarter of 2008, the central banks of the main economies undertook a number of measures, including Quantitative Easing (QE), which triggered a significant expansion in their respective balance sheets. The QE consisted in a large-scale asset purchases (government bonds or other financial assets) in order to stimulate the economy and increase liquidity.

Each country adopted different tools, conditioned by the structure of their financial system, and changing them as the crisis intensified. For exemple, prior to September 2008, the Eurosystem and the Federal Reserve increased the number of refinancing operations and introduced foreign currency liquidity-providing operations. In October 2008, the Eurosystem launched a series of enhanced credit support measures and the Federal Reserve introduced a Credit Easing Programme, but in January 2009 began its Quantitative Easing Programmes (QE) with three rounds (QE1, QE2, QE3) until September 2012.

The Eurosystem changed to a QE policy in March 2015, through the Asset Purchase Programme (APP) that finished in December 2018. The pace of the expansion of the ECB balance sheet has been more moderated than the Fed due to different reasons: the ECB has only one objective in terms of price stability; the existence of large disparities in the Eurozone countries and in its banking systems; and the EMU lack of a Public Treasury.

Things have not been easy in the Eurozone. Addressing a long-term solution to the crisis have required strong concerted action on the part of the national governments most affected by the crisis, the European authorities and the ECB. In the first place, the actions of governments of countries under the severest pressures have focused on the introduction of macroeconomic programmes, important structural reforms and fiscal consolidation. Secondly, the action of the European authorities shed an important light, since the current crisis has underlined the need for in-depth strengthening and the implementation of new economic governance in Europe. The meeting of the European Council on 14 December 2012 closed with a new roadmap for a new EMU, based on tighter integration and greater solidarity. The project proposes that over the next decade there should be a move towards a more solid EMU architecture based on four columns: an integrated financial framework (fiscal union), an integrated framework of economic policy (economic union) and the strengthening of democratic legitimacy and responsibility. Bank union, which seeks to create an integrated financial framework that safeguards financial stability and minimises the costs of bank bankruptcy, comprises a single regulatory system that is the responsibility of the European Banking Authority (EBA) and three mechanisms: the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM), and a Single Resolution Fund (SRF). The assumption of the role of single supervisor by the BCE, on 4 November 2014, has supposed a landmark in the creation of a banking union and a more authentic EMU (Esteve and Prats, 2015).

The available empirical evidence is favourable regarding the effectiveness of the unconventional measures implemented by the main central banks (Peersman, 2011; Gambacorta et al., 2014, Gambetti and Musso, 2017, Moder, 2017, Boeckx et al., 2017 and Zabala and Prats, 2018).

Anderson et al. (2010) addressed the conditions ensure the effectiveness of unconventional monetary policy. First, the large-scale balance sheet expansion can be viable over a short time, in the context of an independent central bank. Second, the aims of the action should be clear for households and firms in order to maintain inflation expectations anchored. Third, the core of the expansion is the size of the asset purchases not the kind of assets. Finally, the balance sheet should be reverted as soon as possible once the economic environment permits it (exit strategy).

3. The return to conventional monetary policies?

As we have said before, it is natural to come back to conventional monetary policy when the crisis, and the new situation, do it possible, like in USA or the Eurozone, at a later pace, or in other developed countries. The debate, in this post-crisis period, is quite interesting and rich due to the variety of opinions that are being discussing in the existing literature, in terms of the central paper of the policy rules (Taylor rule, monetary rule, etc.) or the new targeting proposals. One of the most important issues is to deal, in the post-crisis time, with the evidence that the monetary policy has come to be constrained by a lower bound on the nominal interest rate (Sheedy, 2018).

The debate over the new targeting proposals has been widely treated in USA recently, to evaluate different alternatives of monetary policy strategies: price level targeting, nominal GDP targeting and different inflation targets (Summers, 2018 and Wessel, 2018). All of them are worry with the ZLB on the interest rates. They point out the possibility of different targets to 2% of the inflation rate. It could be more or less, and with different approaches like in Canada, Chile or New Zealand (Murray, 2018). In this context the solution for Taylor (2018) is that all of those solutions, always, might be consistent with a Taylor-rule approach: “Now is an opportune time to move in the direction of a rules-based international system by simply reporting on the policy strategy in each country. Changing the inflation target in these strategies unilaterally will make this more difficult…. For all these reasons I would hesitant to change the inflation target introduced 25 years ago”.

Taylor (2017) explains the enormous advantages of policy rules during the Great Moderation period, or in emerging countries like Mexico or India,

when implementing inflation targeting regimes, and the benefits of a return to this kind of policy. After the crisis, the evidence is favorable to policy-rules instead of discretion. In the post crisis world, the expectation of a new implementation of policy rules could be profitable for the economy. The new application of a simple rule, as the Taylor rule or another functional form, would aid as a benchmark for policymakers and not a mechanical formula. In addition, deviation from policy rules can be useful as measures of accountability. In this context, policymakers will have to clarify the deviations from the rule and be accountable for them (Levin and Taylor, 2009). In addition, Taylor (2018) pointed out the international concerns due to the increase of exchange rate and capital flow volatility consequently, in part, of deviations of a rules-based system. In this context could be appropriate to move to a rules-based international system

Yellen (2016) argue the possibility of a time-varying interest rate (r*) into a policy rule for the interest rate.

Woodford (2012) purposes an alternative to rules-based policy. This new way could be to use a rule for the instruments of policy that is the same as a new inflation forecast targeting. In this strategy, the central bank would select its official short-term interest rate by a linear combination of its forecasts of different variables.

Reifschneider and Williams (2000) refer to fix an effective lower bound (ELB) to avoid the zero lower bound (ZLB). In this case, the central bank maintains the official rate at low levels for a while following periods when the bound is binding (Taylor, 2017).

Ireland and Belongia (2017) point out that another way to deal with the zero bound is to go back to money growth rules.

Taylor (2018) is concern with the importance that the Fed's clarify its strategy to solve two problems. The obsession for the numerical inflation target that could accelerate the economy dangerously. In addition, the low attention to others parameters, but the numerical inflation target, that could diminish the importance of the size of the response of the monetary policy: "trying to give more precision to π^* may have led to to less precision about other parameters, including the sizes of the responses…"

The "Principles for the Conduct of Monetary Policy" on the Fed's web site, addresses:

" … (The Taylor rule) prescribes that the federal funds rate be adjusted by more than one-for-one when inflation rises or falls--this feature is sometimes called the Taylor principle"

In this paper, we will estimate the threshold values of the parameters of the monetary policy rule, compatible with inflation targeting and exchange rate stability, which can guarantee a non-negative value of real interest rates

4. Monetary policy: the parameters compatible with inflation targeting and exchange rate stability.

The data used in this paper are quarterly for Eurozone and cover the period 1999(Q1) to 2015(Q3). The variables utilized in the empirical application are the nominal short-term interest rate (official interest rate), the inflation rate (measured as the Price index, implicit deflator, percentage change compared to same period in previous year) and the output gap (the percent deviation of real GDP from its potential level). The series have been obtained from Eurostat and *World Economic Outlook Database* of the International Monetary Fund.

Keeping $(\beta - 1) = \gamma = 0{,}5$ and $r^* = \pi^* = 2$

Average $\pi_{Eurozone} = 1.80$

Average $y^{gap}_{Eurozone} = -0.42$

From $i = 1 + 1{,}5\,\pi + 0{,}5\,y^{gap}$ → $i = 3.49$ $r = 1.49$

From $i = 1 + 1{,}5\,\pi$ → $i = 3.7$ $r = 1.7$

That is, keeping the parameters of the original Taylor rule ($\beta > 1$), the Taylor principle, would have guaranteed $r = 1.49$, i.e. a non-negative real interest rate.

The exchange rates, because of the financial innovation and the liberalization of the capital movements, are determined in the international financial markets. Taking into account the uncovered parity of interest rates, we have

$$i = i^* - TC^E \qquad (10)$$

Where, i is the nominal interest rate of the economy, i^* the interest rate in other economy and TC^E the expected exchange rate.

Average $TC_{Eurozone}$ = 1.22

Average $i_{Eurozone}$ = 1.99

Average i^*_{USA} = 2.16

From equation (10) → TC^E = 0.173 which is lower than the registered value of the exchange rate.

However, what has happened in the Eurozone? In a recent work Díaz and Prats (2018), using data for the Eurozone in the period 1999-2015, found β = 0.37 < 1

- Monetary policy has not been anti-inflationary enough
- The contribution to ensuring macroeconomic stability would be limited

4.1. A contrafactual analysis

Díaz and Prats (2018), found β = 0.37 < 1

They estimate $i_t = \alpha + \beta\pi_t + \nu_t$

Capturing the ECB monetary policy rule, aimed to controlling inflation and neglecting output gap control.

Where:

i_t is the nominal interest rate in t

π_t is the inflation rate in t

v_t is a prediction error

Eurozone 1999-2015:

π_{Eurz} average = 1.80 i_{Eurz} average= 1.99 (eonia).	Díaz and Prats (2018) Estimate β = 0.37 < 1

Allowing for different values of β we find non-negative real interest values, but negative exchange rates:

β	i	r	ER	RER	$Overval$ (%)	
	1.99	0.19	0.17	0.13	−86	registered value
0.37	0.64	**−1.15**	**0.51**	**1.22**	**24**	Díaz and Prats (2018)
1	1.78	−0.02	0.38	0.30	−69	
1.01	1.80	0.001	0.36	0.29	−71	
1.5	2.68	**0.88**	**−0.55**	**−0.42**	**−143**	**Taylor principle**
2	3.58	1.78	−1.42	−1.14	−217	

Note: own elaboration based on data from Eurostat and IMF.

β parameter of monetary rule
i nominal interest rate
r real interest rate
ER nominal Exchange rate
RER real Exchange rate
Overval overvaluation: [[TC (given by PPA) – registered TC]/ registered TC]/] x 100
Overval > 0 national currency is overvalued; Overval < 0 national currency is undervalued

As an extension of the preliminary version of this paper, we will estimate the parameters of the monetary rule, and their threshold values, for the Eurozone, from 1999. Once given, we will work with 19 countries, we will use panel data estimations, to combine the power of average the cross section with the advantages of temporary dependence (see Baltagi, 2008), and Hsiao (2003)). Among the advantages with respect to a single cross section or time series are the following: a) more precise inference of the parameters of the model, b) greater capacity to capture the complexity of economic relations, c) more informative results, d) to control the unobserved individual heterogeneity, and e) simplifies the calculation and statistical inference.

4.2. Results and discussion:

Our preliminary results show that:

- The sustainability of monetary policy based on rules requires coefficient β > 1 as it implies:
    - control of inflation
    - guarantee of non-negative real interest rates
- The monetary policy of the Eurozone has not been anti-inflationary enough.
- Nominal interest rates have been too low:
    - Liquidity trap
    - need for an unconventional monetary policy, due to a non-sustainable (conventional) monetary policy.
- But β > 1 as it implies:
    - negative real exchange rates
    - national currency undervalued

5. Summary and (preliminary) conclusions:

(i) the obsolescence of monetary control was the result of financial innovations that caused the volatility of the demand for money.

(ii) the need to address financial innovation led to the use of monetary rules that:

- ensure the independence of the monetary authorities
- provides an automatic reaction to adjust changes in macroeconomic variables (inflation, output gap and unemployment)

(iii) there are several solutions to deal with ZLB

(iv) it is possible to find parameters that allow a sustainable monetary policy based on rules.

We have obtained that, the sustainability of monetary policy based on rules:

a) Requires coefficient β > 1 as it implies:
    - control of inflation
    - guarantee non-negative real interest rates compatible with

- Inflation control
- stabilization of production (if the output gap is included as an objective)

b) Which, in turn, favours economic growth.
c) But produces negative exchange rates and undervalued currencies.

In the next future we plan to estimate the parameters of the monetary rule, and their threshold values, for the eurozone using panel data estimations. Our expected results would show that: (i) the obsolescence of managing money, was the product of financial innovations which provoked the volatility of money demand. The necessity of dealing with financial innovation led to use monetary rules as a way of assuring authorities' independence and an automatic reaction to adjust changes on macroeconomic variables, such as inflation, output gap and unemployment; (ii) there are several solutions to deal with the zero lower bound, it is possible to provide some estimations of parameters allowing for a sustainable monetary policy based on rules; and (iv) it is possible to provide some estimations of parameters allowing for a monetary policy based on rules without destabilizing exchange rate.

This analysis will allow us to have a frame of reference that could contribute to a better understanding of monetary policy rules, paying special attention to the situation of the eurozone. And to shed light on possible institutional reforms that could be considered necessary.

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