Is globalization weakening the inflation-output relationship?

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Abstract

This paper investigates whether trade and financial openness has weakened the inflation-output trade-off and caused a shift in the preferences of monetary authorities. Based on the backward-looking Phillips curve and a Taylor-type interest rate rule, our results for France, the UK and the USA for the 1970-2012 period do not provide support for the relevance of globalization in making inflation less responsive to output expansions. Moreover, the change of preferences of Central Banks towards growth-oriented objectives is neither due to higher trade nor to financial globalization.

JEL Classification:
Keywords: Phillips curve, globalization, state-space model, Taylor rule, inflation

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1 Introduction

The last decades are characterized by a deepening of the process of global economic integration. Many authors have suggested that this process of globalization brought about important changes in the behavior of some major macroeconomic variables such as inflation, output and interest rates (Milani, 2012). In particular, the globalization hypothesis, in contrast to the traditional explanation centered on monetary policy credibility, is usually employed to explain some facts such as lower inflation and lower sensitivity of inflation to economic activity (e.g Gamber and Hung; 2001; Rogoff, 2003; Borio and Filardo, 2007; Benigno and Faia, 2010; etc.).

In this literature, globalization could have both a direct and an indirect impact on inflation. On the one hand, globalization could influence inflation directly by affecting the price of imports and thus the general price level. On the other hand, the indirect impact of globalization on inflation would come about from higher competition on goods, services and labor markets. This indirect effect may play an important role in the slope of the Phillips curve. Furthermore, it is suggested that globalization also influences monetary policy by shifting the preferences of monetary authorities.

With some important drawbacks, the recent empirical literature has explored the link between trade globalization and the Phillips curve. However, far less attention has been paid to studying how globalization influences monetary policy decisions. In this paper, we aim at filling this gap by studying how trade and financial openness affect the inflation-output relationship. To this end, we study whether globalization has flattened the slope of the Phillips curve. In addition, we explore the link between globalization and the incentives of monetary authorities to become less aggressive on inflation and more responsive to the output gap in recent years. Our propose model, that includes trade and financial globalization in a state-space framework for

the Phillips curve and the Taylor rule are, to the best of our knowledge, without precedent.

Indeed, a large body of literature suggests that the short-run tradeoff between inflation and economic activity is becoming irrelevant, meaning that fluctuations in resource utilization have smaller implications on inflation than used to be the case (e.g. Roberts, 2006; Mishkin, 2009; Kuttner and Robinson, 2010). However, it is well established that increasing globalization affects the link between domestic demand and inflation, although different authors disagree about the direction. For instance, Romer (1993), Rogoff (2003) and Rogoff (2006) use a Barro-Gordon framework to argue that the curve should become steeper in a more open economy. The theoretical rationalization is that global competition reduces the monopoly power of firms and workers, increasing competition in the markets for goods, services and labor. With higher competition, the slope of the short-term Phillips curve increases as national labor markets become more flexible.

On the opposite camp, Razin and Binyamini (2007) use a New-Keynesian framework to argue that globalization flattens the Phillips curve. More precisely, they consider three channels of openness: international labor mobility, international trade in goods and international trade in financial assets. They suggest that all of these channels increase the degree of openness and imply higher competition and downward pressures on prices and other factor costs, flattening the Phillips curve. From an empirical point of view, Borio and Filardo (2007) provide evidence that with higher globalization, inflation is less sensitive to domestic demand conditions and more to global demand conditions than it used to be.[1]

In spite of their differences, both points of view maintain that globalization results in lower inflation and therefore it affects monetary policy. Given that in-

[1]In an extended Phillips curve, Borio and Filardo (2007) show for a panel of countries that a measure of global output gap exerts a significant effect on inflation. However, based on alternative specifications of the Phillips curve, Pain et al. (2006), Ball (2006) and Ihrig et al. (2010) find that foreign output gaps do not determine domestic inflation.

flation is extremely responsive to the output gap in globalized economies according to the Romer (1993)-Rogoff (2003) proposition, a monetary expansion will lead to higher inflation. This forces central banks in highly open economies to refrain from monetary expansion. In this framework, people are aware of this, which reduces their expectations of inflation. The consequence is that open economies will exhibit less inflationary bias than less open economies. In others words, globalization may strengthen the credibility of monetary policy through its impact on the Phillips curve.

For those claiming that globalization weakens the inflation-output relationship, a given monetary expansion, or a given target in terms of output, are associated with lower inflation (Frankel, 2009). However, a flatter Phillips curve also implies that it is more costly to fight against an increase in inflation.

Note that if one accepts that globalization exerts strong disinflationary pressures, then it follows that globalization eases the job of monetary authorities as it helps to control inflation. Therefore, central banks can pursue an expansionary agenda. Indeed, Woodford (2007) argues that central banks may lose incentive to control inflation if they perceive a weaker trade-off between output expansion and inflation. A similar opinion is held by Greenwood-Nimmo and Shin (2012), who claim that the Taylor Principle was not upheld during the Great Moderation due to the globalization of product markets, which created a series of beneficial supply shocks and restrained inflationary pressures in many industrialized countries. This has allowed monetary authorities to pursue growth-promotion in recent years with little concern for the inflationary consequences.

On the contrary, Razin and Loungani (2005) and Razin and Binyamini (2007) propose that globalization can induce monetary authorities to become more aggressive on inflation and less responsive to the output gap. They propose that households are able to smooth fluctuations in consumption through capital account

liberalization. With trade liberalization, in turn, the economy tends to specialize in production and to diversify in consumption. These features of openness help reduce the distortions associated with output gap fluctuations without affecting the inefficiency associated with fluctuations in inflation. Monetary authorities are then able to reduce the weight of the output gap term in their utility-based loss function and to put greater emphasis on reducing the inflation rate.

When analyzing empirically the link between globalization and inflation, the literature focuses on trade flows as the relevant variable of openness. However, while trade in goods has not changed significantly in recent years in advanced countries, financial openness (measured as the ratio of foreign assets and liabilities to GDP) has increased at an unprecedented rate (see figure 4 in the appendix). Therefore, financial globalization is arguably an equally important feature of the current wave of globalization. Furthermore, international capital mobility is theoretically one of the three channels of openness that may flatten the Phillips curve (e.g. Razin and Binyamini, 2007). Another important drawback of the previous literature is the failing to formally test if globalization –trade or financial globalization– weakens the inflation-output relationship.

The aim of this paper is twofold. First, we analyze the role of both trade and financial openness in making inflation less responsive to domestic output gap in France, the United Kingdom and the United States for the 1970-2012 period. We go further than the previous literature by allowing the estimated slope of the Phillips curve to depend on the extent of globalization by means of a state-space model that allows us to test the relationships postulated in the literature in terms of causality tests. The novelty of our approach is that, instead of estimating a model where the slope varies over time as a random walk -as in Cogley and Sargent (2002), Primiceri (2005), Ball and Mazumder (2011), etc- , we introduce in the state equation our measure of globalization. Therefore, we formally test if the time-variation in the

slope is mainly systematic or if it is also affected by precise indicators of trade and financial globalization.

Second, we also study to what extent the reaction function parameters in a Taylor rule are affected by globalization in the same countries. To do so, we test the hypothesis that monetary policy is influenced by globalization by letting the inflation and output gap coefficients vary as a function of openness. We analyze if policymakers are becoming more aggressive on inflation and less responsive to the output gap due to higher trade and financial openness. In principle, this approach captures in a reduced form, the possible channel of globalization on policy weights.

Our results provide evidence of a flattening of the Phillips curve since the mid 1980s in France, the United Kingdom and the United States. They also provide evidence that the inflation and output gap preferences of the monetary authorities have shifted in recent years. Finally, we show that globalization is not causing the decline in the output-inflation trade-off, nor is it the cause of the changing preferences in the Taylor rule.

This paper is organized as follows. Section 2 introduces the methodology and describes the data. Section 3 presents the results and the discussion. Finally, section 4 concludes.

2 Methodology

In order to analyze the effects of globalization in the slope of the Phillips curve, we first follow the empirical and traditional approach proposed by Gordon (1982) and Gordon (1997), known as the reduced-form Phillips curve. This approach assumes backward-looking expectations -that is, expected inflation is determined by past inflation- and integrates supply shocks in the equation.[2]

[2]We do not follow the "New Keynesian Phillips curve" (NKPC) that relies on rational expectations (i.e expectations are explicitly forward-looking). Estimations based on the NKPC are usually

The equation suggested by Gordon (1982,1997), also called the triangle model, is specified as a single reduced-form equation. In this specification, three elements can influence inflation dynamic. First, the output gap, which determines the effect of goods or labour demand on prices and wages. Second, the delays on prices, which describe the dynamics of anticipations and indexation (see also Gruen, et. al., 1999). Lastly, supply shocks which can affect economic activity from the supply side. Therefore, our first estimated equation, called the measurement equation, is the following one:

$$\pi_t = \alpha + \sum_{i=1}^{n} \beta_i \pi_{t-i} + \phi s_t + z_t(y_t - y_t^*) + G\nu_t \tag{1}$$

where π, s_t and $(y_t - y_t^*)$ are the inflation rate, oil price and the output gap, respectively and $\nu_t \sim N(0, G_t)$. We expand Eq. (1), known as the the measurement equation, with the following state equation that captures the time and state variant characteristics of the slope of the Phillips curve:

$$z_t = z_{t-1} + B_1 x_t + C\epsilon_t \tag{2}$$

where the slope, z, depends on an autoregressive term plus exogenous variables contained in x of unknown coefficients and $\epsilon_t \sim N(0, C_t)$. Equations (1) and (2) constitute the state-space model.

State-space models can be estimated using the Kalman Filter recursive algorithm, which is commonly employed in time-varying coefficient models. The Kalman filter is a method for recursively obtaining linear, least-squares forecasts of unknown coefficients conditional on past information. These forecasts are used then to construct the log likelihood.

More precisely, for each time t, the Kalman filter produces the conditional ex-

criticized because they are derived using methods that are not robust to identification problems (e.g. Dees, et. al., 2009). Furthermore, econometric estimates of purely forward-looking models fit the data poorly (Rudd and Whelan, 2007).

pected state vector $z_{t|t-1}$ and the conditional covariance matrix $\Omega_{t|t-1}$; both are conditional on information up to and including time t. Using the model and previous period results, for each t we begin with:

$$\begin{aligned} z_{t|t-1} &= z_{t-1|t-1} + Bx_t \\ \Omega_{t|t-1} &= \Omega_{t-1|t-1} + CQC' \\ \pi_{t|t-1} &= \alpha + \sum_{i=1}^{n} \beta_i \pi_{t-i} + \phi s_t + z_{t|t-1}(y_t - y_t^*) \end{aligned} \tag{3}$$

The residuals and the mean squared error (MSE) matrix of the forecast error are:

$$\begin{aligned} \hat{\nu}_{t|t} &= \pi_t - \pi_{t|t-1} \\ \Sigma_{t|t} &= y_t^* \Omega_{t-1|t-1}(y_t - y_t^*)' + GQG' \end{aligned} \tag{4}$$

In the last step, we update the conditional expected state vector and the conditional covariance with the information in time t:

$$\begin{aligned} z_{t|t-1} &= z_{t-1|t-1} + \Omega_{t|t-1}(y_t - y_t^*)\Sigma_{t|t}^{-1}\hat{\nu}_{t|t} \\ \Omega_{t|t} &= \Omega_{t|t-1} - \Omega_{t|t}(y_t - y_t^*)\Sigma_{t|t}^{-1}(y_t - y_t^*)'\Omega_{t|t-1} \end{aligned} \tag{5}$$

Equations (3) to (5) are the Kalman filter. The equations denoted by (3) are the one-step predictions. These predictions do not use contemporaneous values of π_t; only its past values, as well as contemporaneous and past values of the exogenous x_t are used. Equations (4) and (5) form the update step of the Kalman filter; they incorporate the contemporaneous dependent variable information into the predicted states. In addition, The Kalman filter requires initial values for the states and a covariance matrix for the initial states to start off the recursive process.[3]

A very important feature of the previous state equations is its flexibility. Indeed,

[3]OLS estimates can be used as initial values.

most of the previous research based on state space models for the Phillips curve rely on a state equation where the the slope varies over time as a random walk.[4] This implies that the time-variation in the slope is largely systematic. Instead, by including a vector of exogenous variables in the state equation -with the exogenous variables our indicators of globalization-, we can formally test if they are a causal driver of the flattening of the Phillips curve, hence representing a formal test for the globalization proposition. Certainly, whether trade or financial openness change the estimated slope of Phillips curve can be verified by applying a Wald test for the null hypothesis H_0: $B_1 = 0$ in Equation (2). The Wald test follows the traditional χ^2 distribution.[5]

A second innovation of our research, is that we analyze if the relative weight on inflation and output has changed in the central bank reaction function. Following Taylor (1993), most empirical studies assume that the central bank adjust the nominal interest rate to the state of the economy. Such policy rule can be written as:

$$i_t^* = \pi_t + \delta(\pi_t - \pi^*) + \gamma(y_t - y_t^*) + r^* \tag{6}$$

where i_t^* is the target for the short-term nominal interest rate, π^* is the target level of inflation, r^* is the equilibrium level of the real interest rate and the rest of the variables were already defined. In his seminal article, Taylor assumes that $r^* = 2\%$, $\pi^* = 2\%$, and that the rate of growth of potential output is time-invariant at 2.2%. Moreover, Taylor notes that the output and inflation gaps enter the central bank's reaction function with equal weights of 0.5.

The parameters π^* and r^* in equation (6) can be combined into one constant term $\mu = r^* - \delta\pi^*$ leading to the following equation:

$$i_t^* = \mu + \phi\pi_t + \gamma(y_t - y_t^*) \tag{7}$$

[4]That is, $z_t = z_{t-1} + C\epsilon_t$ instead of $z_t = z_{t-1} + B_1 x_t + C\epsilon_t$. See, for instance Cogley and Sargent (2002), Primiceri (2005), Ball and Mazumder (2011), etc.

[5]See Leon-Ledesma and Nogueira (2010) for an application in the case of inflation and exchange rate pass-through.

where $\phi = 1 + \delta$. However, the previous static rule in Eq. (7) is likely to be mis-specified owing to the omission of dynamic terms. In particular, Clarida, et. al (2000) emphasize the possibility that the interest rate adjusts gradually to achieve its target level. In this case, the actual observable interest rate is assumed to partially adjust to the target. Therefore, the Taylor rule is usually modified into a partial adjustment model with the lagged terms and dynamics required to model inertial policymaking in the following way:

$$i_t = (1 - \rho)(\mu + \phi\pi_t + \gamma(y_t - y_t^*)) + \rho i_{t-1} + \upsilon \tag{8}$$

where $0 < \rho < 1$ is interpreted as an indicator of degree of smoothing of interest rate changes. It is possible to analyze the implications of the value taken by $0 < \rho < 1$ in a more formal manner by re-writing (8) as they are typically estimated:

$$i_t = \alpha + \rho i_{t-1} + \beta_t \pi_t + \gamma_t(y_t - y_t^*) + \epsilon \tag{9}$$

As in the Phillips curve state-space model, we can test statistically if globalization has affected the weight given to inflation and growth under various policy regimes by enlarging the Taylor rule with the following state equations:

$$\beta_t = \beta_{t-1} + B_2 x_t + C_2 \epsilon_t; \gamma_t = \gamma_{t-1} + B_3 x_t + C_3 \epsilon_t \tag{10}$$

with x_t the globalization indicator. The Wald test for the null hypothesis that globalization does not induces the central bank to put a larger relative weight on inflation than on the output gap in its loss function is given by $H_0 : B_2 = 0$ and $H_0 : B_3 = 0$ in Eq. (10).

2.1 Data description

Quarterly data were collected for France, the United Kingdom and the United States for the 1970:1-2012:2 period. The inflation rate is the seasonally adjusted consumer

price index obtained from the OECD's economic Outlook. The inflation corresponds to its annualized rate of growth. Potential output is calculated using the Hodrick-Prescott filter. The output gap corresponds to the difference, in percentage points, between the real GDP and the potential GDP. The interest rate in the Taylor rule is the short-term nominal interest rate (IMF, series 60b). In addition, supply shocks in the measurement equations of Phillips curve correspond to the annual rate of growth of oil prices (source IMF).

Our series of trade and financial globalization were computed as follows. First, quarterly trade openness corresponds to the sum of export plus import as percentage of the GDP. Second, financial openness relates to a *de facto* measure and it is computed as the sum of foreign assets plus foreign liabilities over GDP. We transformed these series, available at the Lane and Milesi-Ferretti database at an annual basis, to a quarterly series by a quadratic-match average frequency conversion method.[6]

3 Estimation results

We first estimate the standard Phillips curve presented in Equation (1), which constitutes our benchmark model for comparison purposes.[7] The estimated slope coefficient ($\hat{z}$ in Eq. 1) together with the rest of the estimated coefficients and the mean trade and financial openness for the 1970q1-2012q2 period (columns 3 and 4, respectively) are presented in table 1.

As can be seen, in the United Kingdom, which has a relatively high openness ratios (see Figure 4 in the Appendix), the estimated slope is not significant.[8] On

[6]We would like to thank Milesi-Ferretti for providing us with updated data (until 2010) on foreign assets and liabilities.

[7]Some estimates of the Phillips curve include lags of the output gap. In this paper, we prefer to keep our specification parsimonious along this dimension to enrich it by allowing time-variation in the estimated slope coefficient ($\hat{z}$ in Eq. 1).

[8]France and the United Kingdom have relatively high openness ratio owing to high European-intra exchanges.

Table 1: **Phillips curve and globalization: estimated coefficients and average trade and financial openness**

Coefficient	France	UK	USA
π_{t-1}	1.234	1.386	1.026
	(14.96)	(17.70)	(12.99)
π_{t-2}	−0.335	−0.381	−0.235
	(−2.74)	(−2.83)	(−2.04)
π_{t-3}	−0.033	−0.219	0.152
	(−0.26)	(−1.68)	(1.33)
π_{t-4}	0.127	0.177	−0.023
	(1.76)	(2.35)	(−0.32)
s_t	0.008	0.007	0.013
	(5.10)	(3.04)	(6.48)
$(y - y_t^*)$	0.070	0.039	0.075
	(2.83)	(1.18)	(2.86)
Trade openness	0.457	0.538	0.209
Financial openness	1.975	4.582	1.046

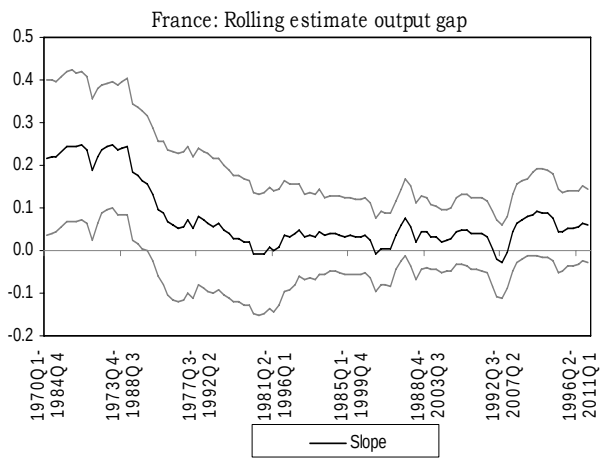
Notes: (1) The estimated coefficients corresponds to $\sum_{i=1}^{4} \hat{\beta}_i \pi_{t-i}$, $\hat{\phi}$ and $\hat{z}$ in equation (1); (2) Trade and financial openness are the the mean values for $(exports + imports)/GDP$ and $(foreign\ \ assets + foreign\ \ liabilities)/GDP$ over the 1970-2011 and 1970-2010 periods, respectively; (3) t-values are in parenthesis.

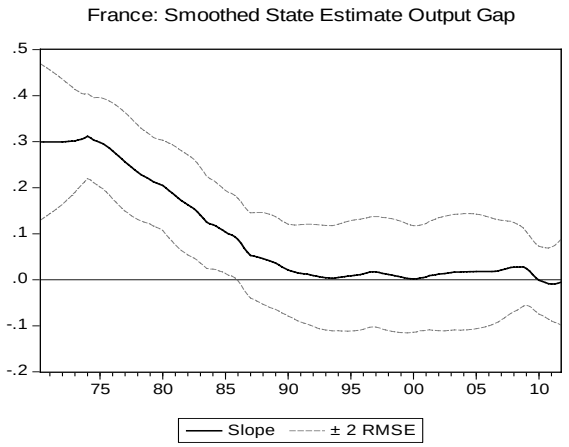
the contrary, France and the USA have a relatively higher estimated coefficients. Though informative about the static inflation-output trade-off, theses results do not provide a satisfactory approach to analyze the changing nature of the Phillips curve.

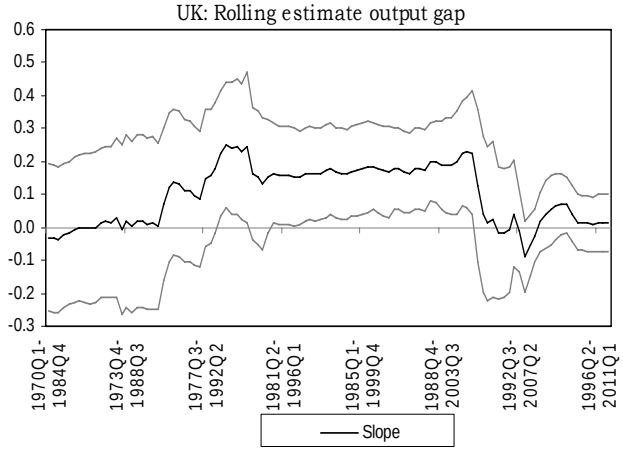
In order to capture the time variation of the relationship between the output gap and the inflation rate, we turn our attention to the simple state-space models (i.e. we include only the autoregressive term in the state equation). Figure 1 shows the estimated output gap varying coefficient, together with ± two standard errors. For comparison purposes, we also present the estimated slopes obtained from rolling estimations with windows length of 80 quarters.

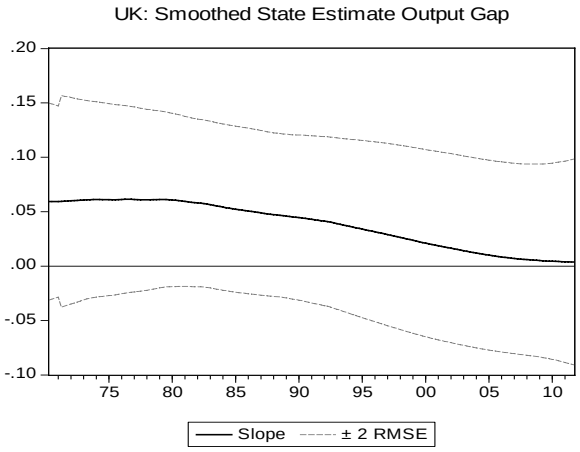
In line with the previous literature (e.g Roberts, 2006; Kuttner and Robinson, 2010, etc.), the plots show that the slope of the Phillips curve has indeed declined over time, suggesting that the short-run trade-off between inflation and economic activity has changed. The estimated coefficient in fact becomes statistically insignificant at the mid 80's in the USA and latter in France. The figures also show that this flattening took place gradually but mainly during the seventies and the eighties. In

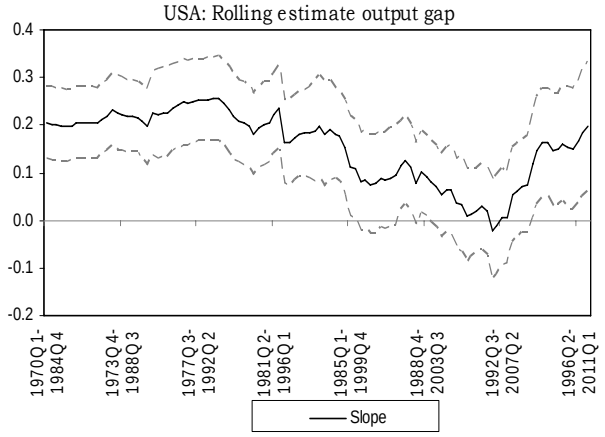
Figure 1: **Rolling and state space models: estimated Phillips curve slope**

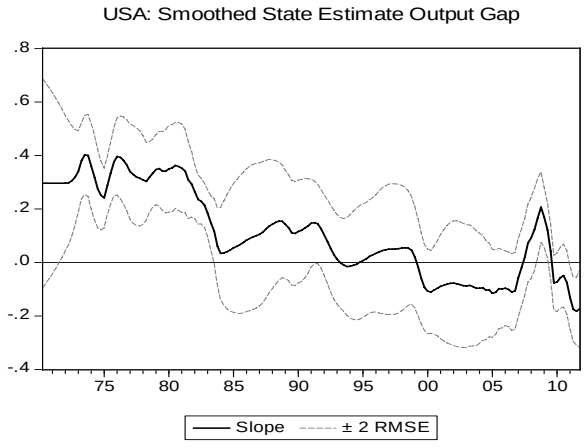












the UK, however, the estimated time-varying parameter is not significant all along the period.

In spite of its interest, the previous results do not provide information about the role of globalization in the slope of the Phillips curve. To overcome this empirical difficulty, we next obtain time-series for the slope of the curve with exogenous variables -trade or financial openness- in the state equation. Our models allow now the slope to be time-varying and dependant on globalization. We then check whether globalization causes the flattening of the Phillips curve in the Granger-causal sense testing the null hypothesis that $H_0 : B_1 = 0$ in Eq. (3). Table (2) reports the estimated p-values for either trade or financial globalization in the state equation.

As can be seen, there is overwhelming lack of evidence that the observed flattening in the Phillips curve is due to higher globalization. Indeed, the probability associated to the Wald test exceeds the conventional critical values in all the cases. Therefore, we are not able to reject the null hypothesis that openness does not Granger-cause the flattening in the three countries.

Table 2: **State space model for the Phillips curve: p-value associated to the Wald test for causality**

	Trade openness	Financial openness
France	0.170	0.707
UK	0.446	0.562
US	0.499	0.607

Notes: (1) The null hypothesis in the Wald test is $H_0 : B = 0$ in Equation (2), with x_t trade or financial openness.

We proceed to the estimation of the Taylor rule equation. Table 3 presents the estimated slopes for the three countries. As seen, the estimated elasticities for both coefficients are significant in France and in the USA but not in the United Kingdom in the case of the inflation rate. Note, however, that these estimates represent only the average value of the coefficients on the 1970q1-2012q2 period.

Figures 2 and 3, in turn, present the rolling estimates and the time-varying state

Table 3: **Estimated coefficients in the Taylor's rule**

	Adjustment speed	Coefficient inflation	Coefficient output gap
France	0.926	0.054	0.176
	(38.04)	(2.16)	(4.63)
UK	0.951	0.031	0.098
	(38.80)	(1.59)	(2.49)
US	0.912	0.113	0.151
	(25.96)	(2.81)	(3.94)

Notes: (1) The adjustment speed, inflation and output gap coefficients are ρ, β and γ respectively in Eq.(9); (2) t-values are in parenthesis.

space Taylor rule coefficients estimated by the Kalman Filter. From this figures, it is easily seen that there has been a shift away from inflation concerns toward resource utilisation (the putput gap) among policymakers in recent years. In France, for instance, we observe an increasing interest for inflation during the 80s and 90s, possibly as a consequence of the European Monetary System (EMS) and their objective of establishing a single currency which promoted the nominal convergence process (see figure 3).

Indeed, the compromises assumed with the EMS to the fight against inflation became a priority, leaving aside economic growth in the reaction function.[9] Since 1998, monetary policy is the responsibility of the European Central Bank (ECB) which manages only common shocks of the area.[10] Although the ECB has implicitly only one objective -that of price stability- it has become (relatively) more concerned by output growth during the common shock of the financial crisis of 2007.

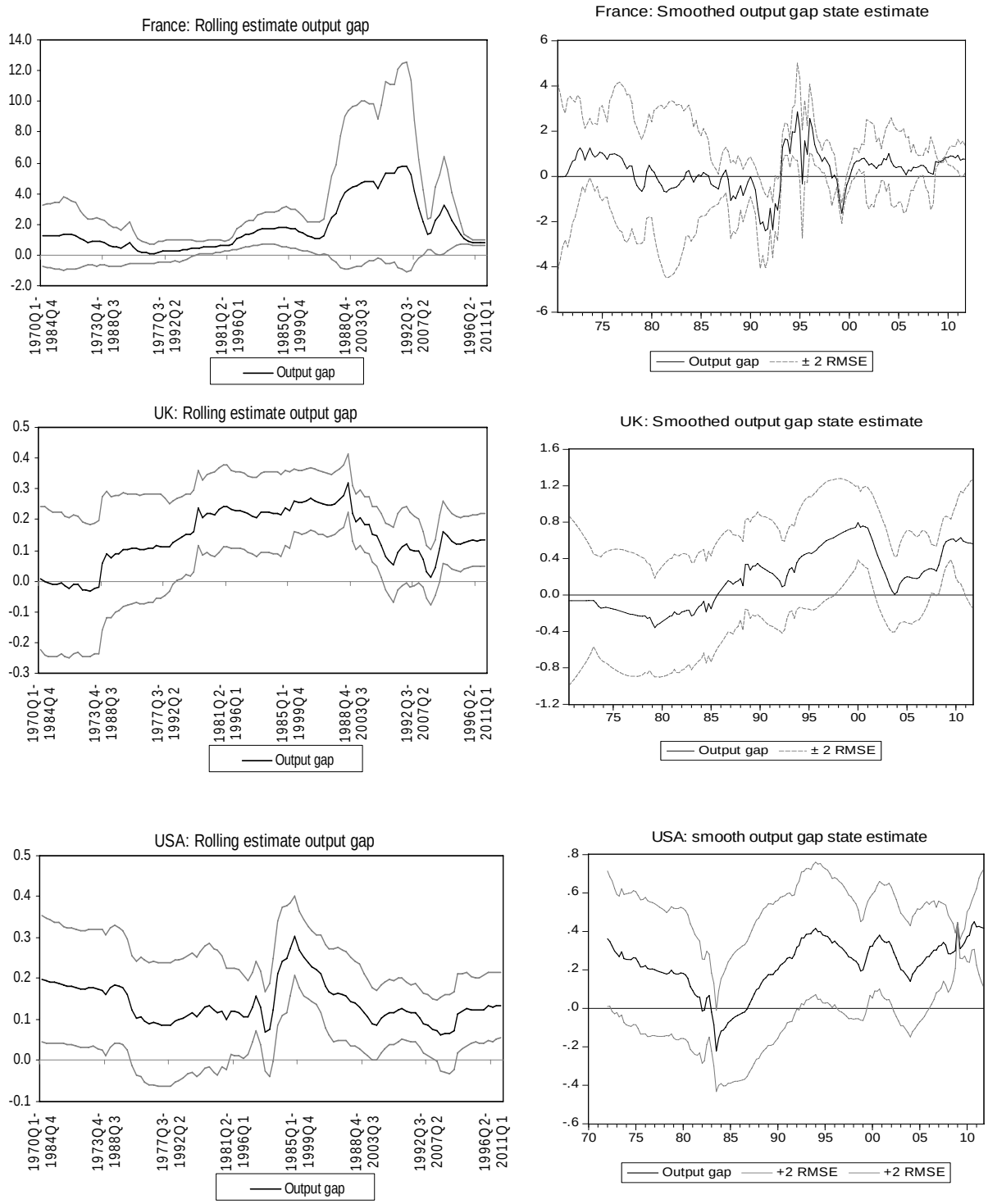
With respect to the US, the figures show that during the eighties, the Fed engaged in quasi-active anti-inflationary policy.[11] During the 1990's, the Fed became predominantly concerned with inflation and largely neglected the output gap. By contrast, since the early 2000s (or even before if we consider the rolling estimates),

[9]From 1983 to the end of the 90s, France sought to align the level of inflation on that of Germany. This objective was coupled with that of the exchange rate stability within the EMS.

[10]Nevertheless, a common shock may very well lead to asymmetric evolutions between the countries of the euro area.

[11]State-space estimations for core inflation, not presented but available upon request, show a similar pattern than the consumer price index.

Figure 2: **Rolling and state space estimated coefficients in Taylor's rule: output gap**



the monetary policy adopted by the Fed seems to be less aggressive in combating inflation and more concerned by the output gap.[12] A similar pattern can be observed in the United Kingdom, at least until the end of nineties.

It is important to remark that a common pattern in all the state-space and rolling estimates figures is that monetary authorities have (almost) completely abandoned counter-inflationary policies for strongly output expansions/contractions oriented interventions in recent years, coinciding mainly with the ongoing financial crisis and a period of low -or even negative- inflation rate.[13] We explore the possibility that these preference shifts in the lost function of the Taylor rule are due to globalization. More precisely, we test whether globalization influenced monetary policy by varying the Taylor rule as a function of openness.

The Wald statistics for testing the null hypothesis of no significance of trade and financial openness in the preference shifts, are presented in table (4). The table shows the estimated p-value for inflation and output gap in the measurement equation and either trade or financial openness in the state equation.

As seen, the probability associated to the Wald test exceeds the conventional critical values in all the cases. Thus, we can not reject the null hypothesis that openness does not Granger-cause the preference shifts in the Taylor rule in all the cases.

4 Concluding remarks

Recent studies show a flattening in the Phillips curve, implying that inflation is becoming less sensitive to economic activity in many advanced countries. As such,

[12]The differences in responses between the ECB and the Fed might be explained largely by the mandates of the two central banks. Indeed, the ECB has only one single inflation objective while the Fed has a dual objective of full employment and inflation.

[13]The problem here is that in periods of low inflation, the room to maneuver for a decline in the interest rate is small because of the well-known lower zero bound in the nominal rate.

Figure 3: **Rolling and state space estimated coefficients in Taylor's rule: inflation**

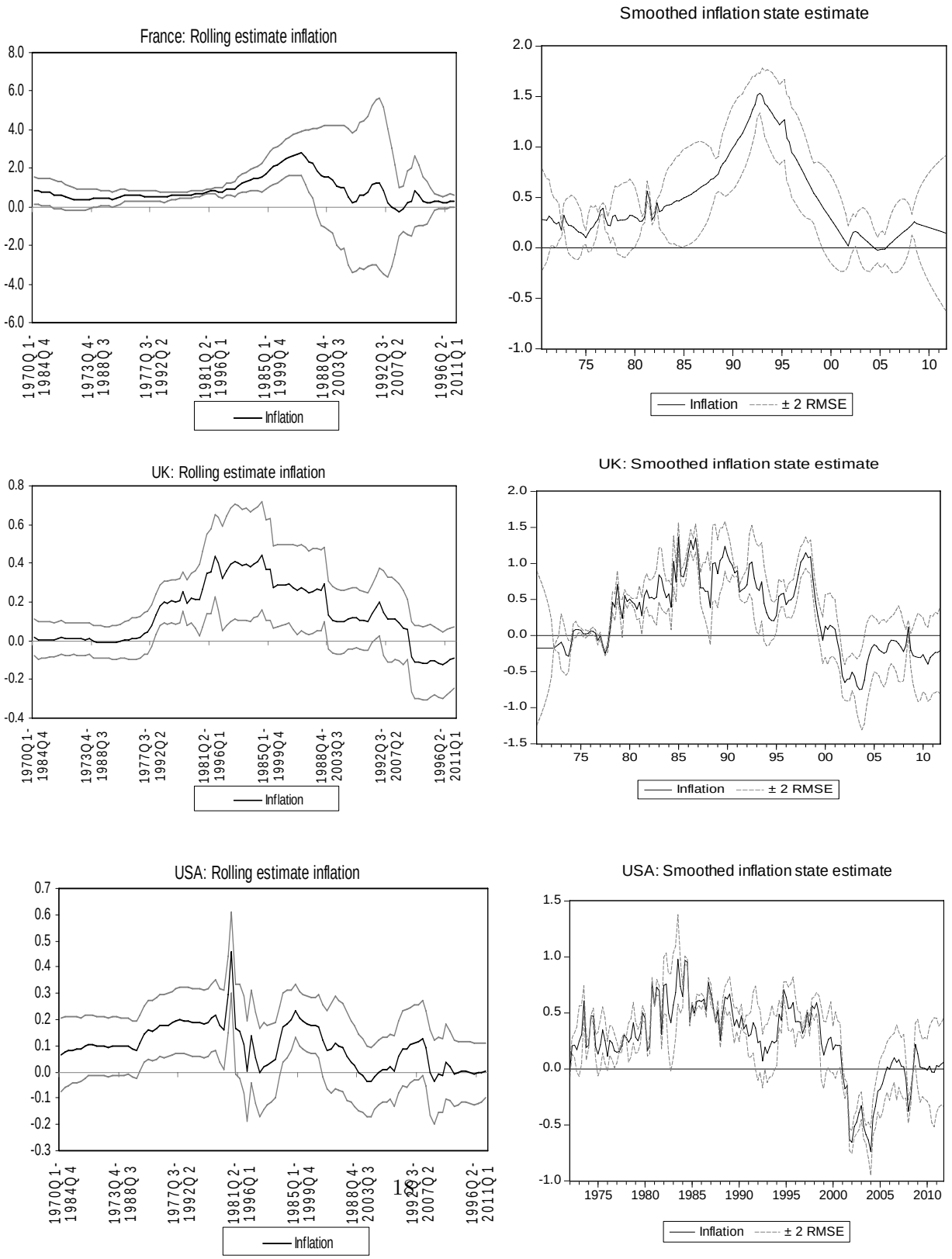


Table 4: **State space model for the Taylor rule: p-value associated to the Wald test for causality**

		Trade openness	Financial openness
France	Inflation	0.918	0.917
	Output gap	0.987	0.941
UK	Inflation	0.962	0.828
	Output gap	0.664	0.641
US	Inflation	0.922	0.919
	Output gap	0.995	0.967

Notes: (1) The null hypothesis in the Wald test is $H_2 : B = 0$ and $H_3 : B = 0$ in Eq. (10), with x_t trade or financial openness.

a higher level of output gap is supposed to be less inflationary in recent years. This weaker sensitivity of inflation to output expansions/contractions is often explained as an effect of globalization. Even though it is generally accepted that globalization impacts inflation dynamics, there are disagreements about the direction and the magnitude of the effect. Furthermore, it is not clear if and how openness influence the optimal monetary policy rule.

In this paper we explore both the flattening effects of globalization (trade and financial openness) on the Phillips curve and the shifting preferences of monetary authorities in France, The United Kingdom and the United States during the 1970q1-2012q2 period. To this end, we present a novel framework based on state-space model with a time-varying slope which is a function of its own lagged values and of trade or financial openness. We provide formal tests for the importance of globalization in the flattening of the Phillips curve. We also test if monetary policy is influenced by globalization by varying the Taylor rule coefficients in order to capture preference-shifts in the objective function of monetary policy. We then test if these shifts are due to trade and financial openness.

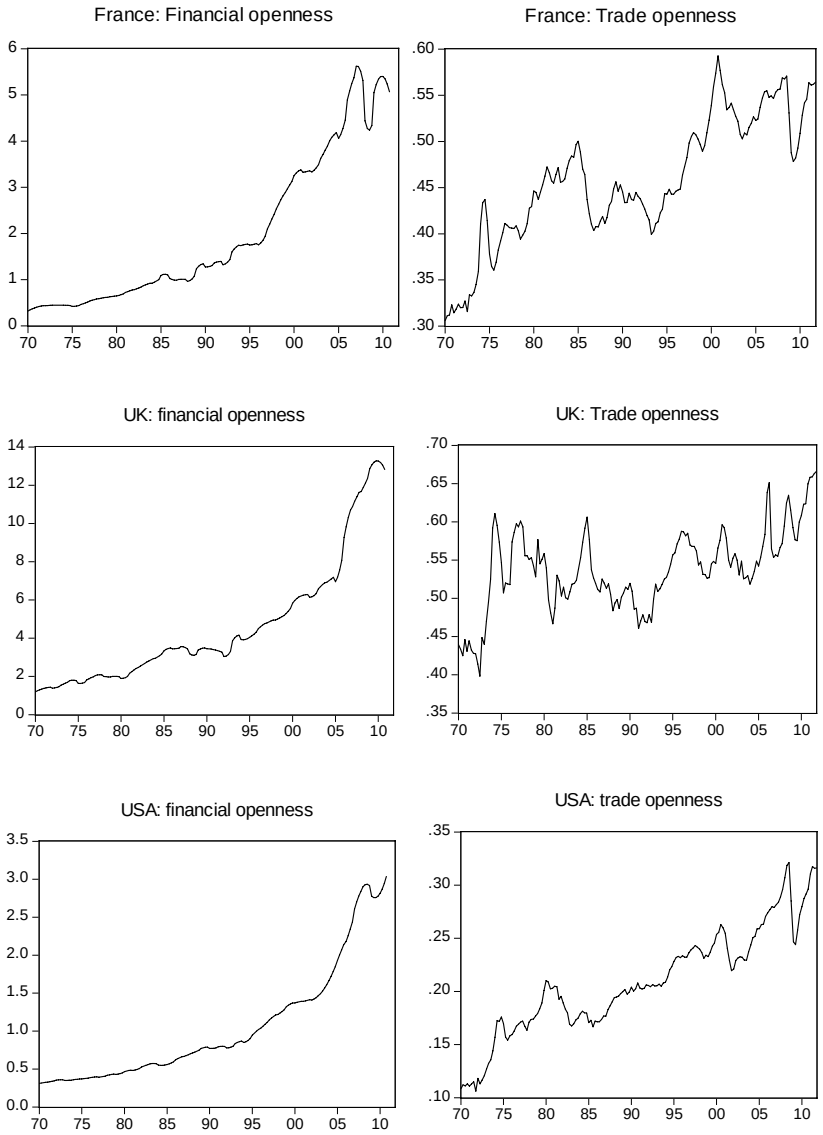
Our results show that the sensibility of inflation to domestic slack has weakened

over time. Contrary to the theoretical proposition that inflation is highly receptive to the output gap in globalized economies, we show that this decline is not due to higher trade or financial globalization. In addition, a shift is observed in the preferences in the loss function of the monetary authorities. In particular, with the recent economic and financial crisis, monetary authorities seem to have changed from having predominantly anti-inflationary objectives to a more output contraction/expansion fostering agenda, particularly in the United States. Nonetheless, neither trade nor financial globalization have exerted profound effects on this modification.

It is important to remark that the impact of globalization on inflation could be achieved by the direct effect of import prices, an aspect not covered by our investigation. Moreover, the last two decades are characterized by big changes in the inflation environment and central bank credibility. Changes in trade in turn have been modest. Therefore, the traditional explanation that focuses on the increase in the credibility of the monetary regime could be more relevant than the globalization hypothesis to explain the flattening of the Phillips curve. Finally, financial openness has risen at an unprecedented rate in recent years, much above trade openness. This aspect of globalization has probably affected the transmission mechanisms of monetary policy, especially due to the influence of global financial markets on national asset prices. The monetary policy dilemma should consider asset inflation as a part of price stability as well, but the discussion of this latter issue is beyond the objectives of the present work.

5 Appendix

Figure 4: **Financial and trade openness. 1970-2012**



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