Is Inflation Persistence Over?

Fernando N. de Oliveira and Myrian Petrassi*

1. INTRODUCTION

One of the most important characteristics of the dynamics of inflation is its degree of persistence. It is related to how quickly inflation reverts to its initial level after a shock. As Mishkin (2007) points out, if inflation is persistent, it increases the costs of monetary policy (in terms of product or unemployment) to keep inflation under control.[1]

In the last years, both industrial and emerging economies have experienced important changes in the degree of their inflationary persistence. As Cechetti et al. show (2007) both the volatility and level of inflation has decreased in industrial economies. In these economies the decades of 1960 and 1970 were considered periods of high and persistent inflation, while the more recent decades, 1990 and 2000, have low levels of inflation as well as low persistence.

Contrary to industrial countries, emerging economies have experienced high levels of inflations for a longer period. Some of these countries, such as Brazil, Argentina, Bolivia, Peru, Mexico, Israel, Poland and Turkey, have had periods of *hyperinflation* in the last thirty years.[2] Only recently, in the decade of 1990, the levels of inflation have started to decrease in these countries. This, in part, is due to the important changes in

* F. N. de Oliveira and M. Petrassi, Research Department Central Bank of Brazil.

[1] In a more formal way, we can define inflation persistence as the propensity of inflation to converge slowly towards its long run equilibrium following a shock that has taken inflation away from this equilibrium.

[2] Sometimes is hard to define if an inflationary process experienced by a country is a *hyperinflation* episode. That is why we have decided to use it in italics.

the conduct of their macroeconomic policies.[3] However, it is not clear if the decrease of the level of inflation has been accompanied by a reduction of their inflationary persistence.[4]

Our objective in this paper is to analyze empirically the inflation persistence of several industrial and emerging countries in the recent past. We selected a very representative group of 23 industrial and 17 emerging economies. We want to answer the following questions: Is inflation persistence low for both industrial and emerging economies? Has persistence been stable throughout our sample period for all countries? Is inflation persistence in countries that have experienced *hyperinflation* in the recent past higher[5] than the ones observed in the other countries?

Our results show that inflation persistence is low and has been stable for both industrial and emerging economies in general. We observe that persistence seems to be lower in industrial economies relative to emerging ones. We also show that even economies that had experience *hyperinflation* in the near past have low inflation persistence nowadays, albeit apparently higher than the ones observed in the other countries of our sample. One explanation for this is that inflationary memory can be still alive among the economic agents.

To obtain our results we estimate several reduced form inflation dynamics. We estimate the following types of models: models with lags of inflation with and without GDP gap; new Keynesian Phillips curves with foreign exchange rates; and models that are reduced-form inflation dynamics of structural models that incorporate some form of wage rigidity

[3] As examples of some macroeconomic policies we can list: inflation targeting adoption, reduction of budget deficits, improvement of financial regulation, trade liberalization and flexible exchange rate policies among others.

[4] See Stock and Watson (2003) for a brief analysis of monetary policy in some industrial countries in the last years.

[5] Our sample of emerging economies is Argentina, Brazil, Bolivia, Chile, Colombia, Czech Republic, Hungary, Israel, Korea, Mexico, Peru, Philippines, Poland, South Africa, Slovak Republic, Thailand, and Turkey. Our sample of industrial countries is: Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States. Various factors can explain persistence: persistence may be inherited from persistent fluctuations in the determinants of inflation, like marginal cost or output gap (this is called extrinsic persistence); the dependence of inflation on its own past, also called intrinsic persistence and persistence due to the formation of inflation expectations. Each one of this persistence can be associated with one of the three terms of a new Keynesian Phillips curve.

in the spirit of Blanchard and Galí (2005). Our sample period starts in the first quarter of 1995. We have quarterly data and use headline consumer inflation as our[6] measure of inflation.

This finding of a low and stable persistence parameter for a great number of different countries may be somewhat surprising considering the obvious relevance of Lucas (1976) critique for our exercise. However, it is consistent with recent evidence for the United States as Rudebusch (2005) shows. Rudebusch estimates a new Keynesian Phillips curve to show that the parameters of reduced form regression will tend to be relatively stable even in the presence of realistic changes in monetary policy rules.

For many of the countries we considered, substantial shifts in monetary policy have occurred over the past two decades. In the case of European countries the introduction of the euro is a very important milestone. In the case of emerging economies, we can cite more sound macroeconomic policies including, for many of them, the choice of inflation targeting as a framework for monetary policies. Therefore, one of our key approaches was to allow for the possibility of structural breaks in the inflation dynamics in order to avoid spurious estimates of degree of persistence.

We observe that there is very little instability in the parameters of inflation persistence for most of the economies we study. We did several tests of stability and also recursive least squares estimation. Our full sample estimation of the persistence parameter is in general far away from 1 and stable as the results from unknown break points are consistent with the null hypothesis of no change over time in the persistence of inflation. Overall, our results are in accordance with a stable reduced-form representation for inflation and a low level of inflation persistence.

Our results are consistent with a vast literature that shows that inflation persistence has decreased, such as: Dossche and Everaert (2005), Taylor (1999), Altissimo et al. (2006), Benati (2008) and Batini (2002). Our paper, however, contributes to the literature by looking at a greater and more diversified group of countries, including several emerging ones, by

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considering a more recent period and by estimating various inflation dynamics specifications.

Other papers look at how inflation persistence has evolved over a longer period of time also estimating reduced form inflation processes. For example, Mishkin (2007) studies inflation persistence in the United States in the last 40 years using autoregressive models and decomposing inflation in cycle and trend as in Stock and Watson (2006). Mishkin confirms the results of Stock and Watson (2006), showing that inflation persistence is decreasing worldwide since the 1990s, compared with persistence[7] observed in the 1960s and 1970s.

Nason (2006) describes the dynamics of inflation in the United States with several different models of inflation and confirms the results of Mishkin (2007) and Stock and Watson (2006) that inflation persistence is decreasing in the United States in the last years. Rudd and Whelan (2005) estimate a new Keynesian hybrid Phillips curve with lags in inflation and show that inflation in the United States is much more forward looking than backward looking, that shows that inflation persistence is decreasing. Fuhrer (2005) also models inflation using a hybrid Keynesian Phillips curve. He separates persistence in two types: one related to the dynamics of the output gap and the other to marginal cost and that depends on lags of inflation. Fuhrer shows that the more relevant part of inflation in the last years is due to intrinsic inflation and not to output gap.

An important explanatory factor behind this low level and stability of inflation persistence in the recent past is the anchoring of inflation expectations of economic agents. By conducting monetary policies such that inflation expectations of economic agents are anchored, the central banks can ensure that actual inflation does not deviate for too long and in a very persistent way from its medium term objective. We believe that long-term inflation expectations have been successively anchored in the recent years and, as a result, inflation expectations are much less dependent on past inflation. Also, actual inflation developments are less persistent.

The rest of the paper is the following. Section 2 describes the data. Section 3 presents the empirical analysis. Section 4 concludes.

[7] Stock and Watson (2006) show the inflation dynamic in the United States is well described by several latent factors, such as cycle and trend, both with stochastic volatility. Cycle is a stationary process while trend in non-stationary. Inflation persistence is described as a trend. The authors show that persistence in inflation has decrease substantially in the United States in the last decade.

2. DATA

Our data is quarterly and starts in the first quarter of 1995. It is composed by 40 countries: 23 industrial and 17 emerging. Our data source was International Financial Statistics from International Monetary Fund. Our measure of inflation is headline CPI inflation. We also use as exogenous the following variables: the nominal foreign exchange rate and the GDP gap, that is the difference between nominal GDP and potential GDP obtained through Hodrick-Prescott filtering.

For the purpose of our analysis, we separate our sample of countries in three groups: one group is comprised of industrial countries (Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States), emerging countries that did not experienced *hyperinflation* in the recent past (Chile, Colombia, Czech Republic, Hungary, Korea, Philippines, South Africa, Slovak Republic and Thailand), and emerging economies that have had *hyperinflation*, such as Argentina, Brazil, Bolivia, Peru, Mexico, Turkey, Israel and Poland.

Table 1 shows descriptive statistics of inflation for our economies: emerging (total), emerging with *hyperinflation* experience and industrial economies. We can see that average quarterly inflation in emerging market (EM) economies was 1.84% and average standard deviation was 0.018. As far as GDP gap is concerned, average GDP gap is 0.14 per cent.

TABLE 1. DESCRIPTIVE STATISTICS – INFLATION AND OUTPUT GAP (in percentages)

	Emerging Market Countries		*Non - Emerging Market Countries*
	Total	*"Hyperinflation" Experience*	*Total*
Average inflation	1.84	2.32	0.54
Average standard deviation	0.018	0.022	0.006
Maximum inflation	19.43	19.43	5.55
Minimum inflation	–4.10	–1.42	–3.99
Average output gap	–0.14	–0.30	–0.01

SOURCE: IMF.

Table 1 column 2 shows descriptive statistics of inflation for the group of emerging economies that has had some *hyperinflation* episode in the last thirty years. We can see that average inflation was 2.32% and average standard deviation was 0.022. Average output gap was –0.30% in this

subgroup. Column 3 shows us that in non-emerging countries of our sample, average inflation was only 0.54%. Average output gap, in other hand, was greater: –0.01%.

It is clear from Table 1 that inflation is higher in emerging economies that have had *hyperinflation* in the recent past. The average inflation in these economies was one percentual point higher than average inflation in the emerging economies that did not experience *hyperinflation* and 1.78 percentual points higher than industrial economies that also did not experience *hyperinflation*. Not only average, but also volatility is much higher than non-emerging countries and also non-hyperinflation ones.

In the next section, we will present our empirical analysis based on the estimation of reduced form inflation dynamics for these groups of countries.

3. EMPIRICAL ANALYSIS

3.1 Traditional Models of Inflation

The overall degree of inflation persistence can be measured in several ways. The results reported in this section are based on the methods that are most frequently used in the literature. In order to show how fast inflation returns back to its mean following a disturbance, or its persistence, we measure the dependence of inflation on its past values.

The most obvious way of measuring inflation persistence is to regress inflation on several of its lags as in equation (1) and then calculate the sum of coefficients on lagged inflation. If the sum of coefficients is close to one, then shocks to inflation have long lived effects on inflation. The higher the sum of the coefficients of inflation lags, the longer it takes for inflation to return back to its mean. In other words, inflation behaves like a random walk so that when inflation goes up it stays up. If the sum of coefficients is well below 1 then a shock to inflation has only temporary effect on inflation and inflation soon reverts to its trend level.

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \sum_{k=2}^{L} \phi_k \pi_{t-k} + \varepsilon_t, \; E[\varepsilon_t] = 0 \; \text{var}(\varepsilon_t) = \sigma_\varepsilon^2, \tag{1}$$

where π_t is headline consumer inflation.

To the extent that lagged inflation captures true persistence in the price setting process the model implies that rapid reductions of inflation can only be produced at the cost of substantial increase in unemployment

or decrease in product. Hence, the model points to a gradualist approach as providing the best way to effect a large reduction in inflation.

An equivalent approach for analyzing persistence (and the one we will follow in this paper) is to estimate ρ in equation (2) as O'Reilly and Whelan (2005) show.

$$\pi_t = \beta_0 + \rho\pi_{t-1} + \sum_{k=2}^{L} \phi_k \Delta\pi_{t-k} + \varepsilon_t,\ E[\varepsilon_t] = 0\ \text{var}(\varepsilon_t) = \sigma_\varepsilon^2. \tag{2}$$

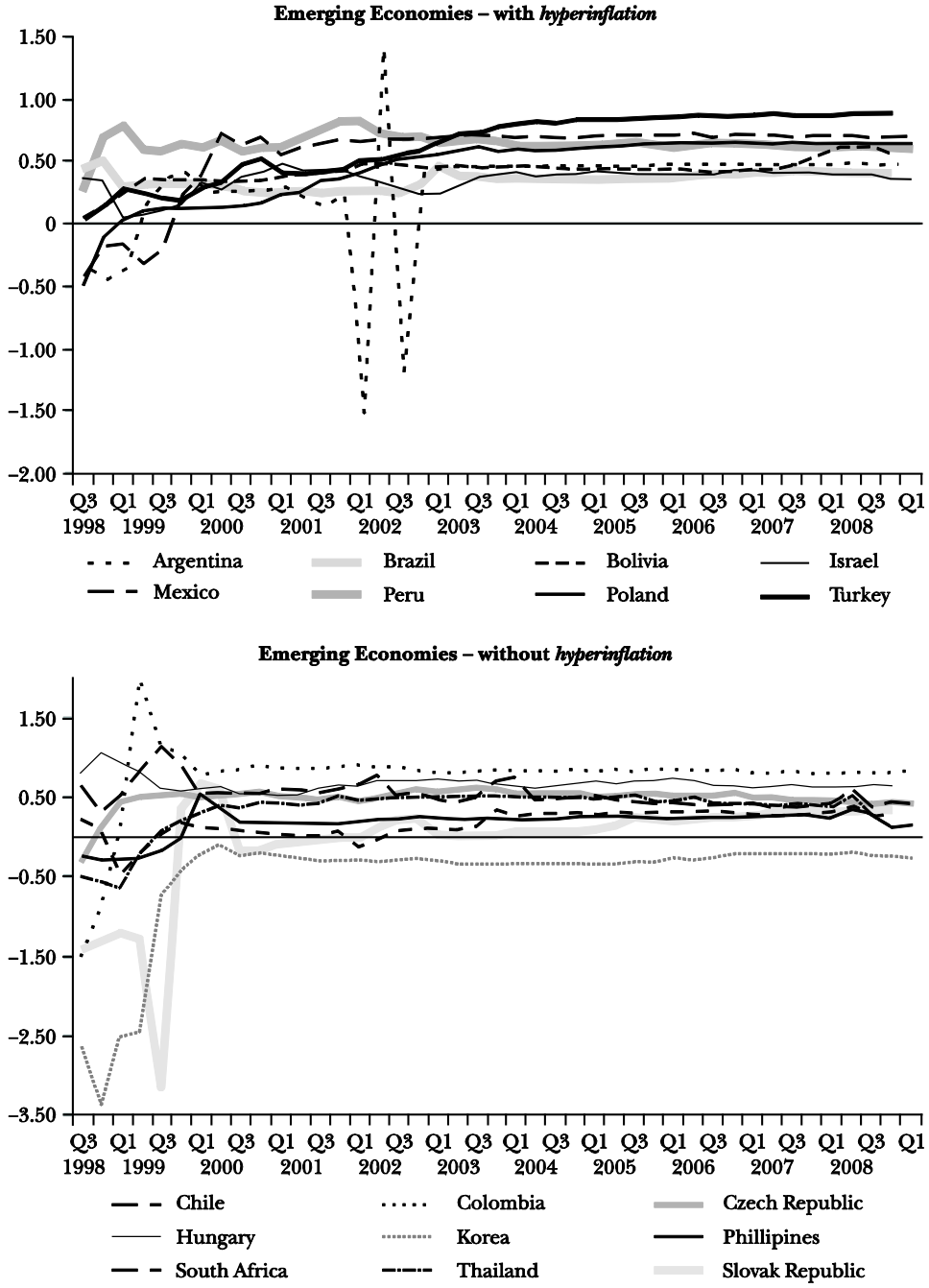
There are a number of good reasons for focusing on ρ as our main measure of inflation persistence. For example, in this model, ρ is a crucial determinant of the response to shocks over time. It can also be shown that $1/(1 - \rho)$ gives the infinite-horizon cumulative impulse response to shocks. Moreover, an advantage of focusing on the estimate of ρ rather than on sum of coefficients is that the first one remains pertinent even when the underlying process contains a unit root or is explosive.

We chose the number of lags of first difference of headline consumer inflation in (2) so as the residuals do not present serial correlation, using Lagrange Multiplier (LM) test to identify serial correlation. We also checked for heteroskedasticity with White and Breush-Pagan. If there is evidence of heteroskedasticity, we correct it with the Newey-West robust errors. We did a Wald test of $\rho = 1$ for all estimations of the traditional models and we rejected $\rho = 1$ for all estimations. We also compared the average of the persistence coefficient of inflation of the three groups by doing Wald tests in a system of equations estimated with ordinary least squares (OLS) in which each equation is the same one we estimated individually.

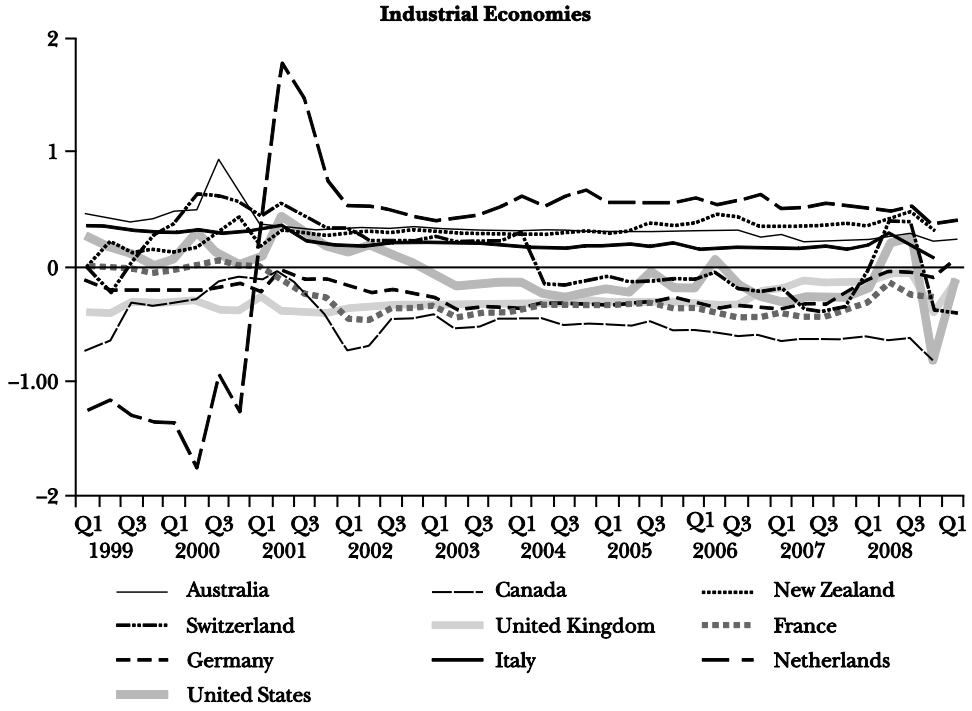
It is also crucial from an econometric point of view to allow for structural breaks in the dynamics of inflation. Otherwise, we could be estimating biased and inconsistent coefficients. We test for breaks using different methods, such as Andrews-Quandt and Chow. We found indication of structural breaks for some countries: Argentina, Austria, Greece and Poland. We then choose some possible breakpoints with the Chow test. We changed the specification including dummies as regressors or interacting them with the lag of inflation regressors. Our results did not change with these new specifications.

In figure 1, we show the recursive least squares estimations for the inflation persistence coefficient *(ρ)* in (2): emerging countries that have had high inflation episodes and those that had not and 10 (from 23) industrial countries. Inflation persistence for all countries seems to be stable, especially after 2003. Emerging countries appear to have inflation persistence

FIGURE 1. STABILITY OF PERSISTENCE PARAMETERS MODELING INFLATION AS AN ARMA



PROCESS, 1998-2009



that fluctuates around 0.5 while industrial countries persistence appears to fluctuate around zero.

Table 2 (column 1) shows the estimated ρ for this specification. The average persistence coefficient was 0.15, and Turkey has the largest one: 0.879. Emerging market economies seem to have, on average, greater coefficients: 0.45 compared to 0.07 of the industrial economies. Also, *hyperinflation* EM countries seem to have even larger persistence. Considering only these countries increases persistence coefficient to 0.59. The average persistence of EM economies that do not experience hyperinflation also seems to be greater than industrial countries (0.33 compared to 0.07).[8]

We repeated the estimation above including in equation (2) the output gap calculated using Hodrick-Prescot filter.[9] The results are very similar

[8] We compared the average of persistence coefficient of the three groups by doing Wald tests in a system of equations estimated with OLS in which each equation is the same one we estimated individually.

[9] Again, we tested for serial correlation, heteroskedasticity, structural breaks and

to the ones described above (see Table 2 column 2). Again, economies that had *hyperinflation* episodes in the recent past showed greater average as well as greater volatility of inflation persistence.

If inflation has indeed become less persistent because monetary policy has anchored inflation expectations more solidly the monetary authorities may find they have less need to induce large swings in economic activity to control inflation. This is a key benefit of establishing a strong nominal anchor. If this is correct, cyclical movements in interest rates need not be as great as it was necessary when expectations are anchored. To try the capture this possibility we will estimate in the following section new Keynesian models of inflation that incorporate inflation expectations.

3.2 New Keynesian Models Estimation

The most important implication of the pure new Keynesian model of inflation is that there is no intrinsic persistence in inflation in the sense that there is no structural dependence of inflation on its own lagged values. Instead, inflation is determined in a completely forward-looking manner. One implication of this model in contrast to traditional ones is that it is much easier to quickly reduce inflation in this model than in the traditional one. In fact, according to the new Keynesian model, inflation can be costless controlled by a credible commitment to keep output close to its potential.

It has been shown that in economies where central banks have adopted explicit inflation objectives, long-term inflation expectations are not related to past inflation. In this context, central bank transparency is crucial. In such a setting, agents will try to disentangle persistent shifts in inflation objective from transitory disturbances and will manage to do so more quickly the more transparent and credible the central bank is.[10]

Due to the difficulty of fitting the data with new Keynesian pure forward-looking model, a vast literature that incorporates lags of inflation in

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compared the statistical differences of averages of the inflation persistence coefficient of different groups. We did once more a Wald test of $\rho = 1$ for all estimations of the traditional models with GDP gap. We rejected $\rho = 1$ for all estimations.

[10] The most popular formulation of the new Keynesian framework is based on Calvo (1983) model of price random adjustment. The model assumes that in each period a random fraction of firms reset their price while all other firms keep their prices unchanged. Calvo assumes an imperfectly competitive market structure as well. These two hypotheses generate the basic new Keynesian model of inflation.

TABLE 2. ESTIMATED INFLATION PERSISTENCE PARAMETERS

	Ecuation (2)	*Ecuation (2)*	*Ecuation (3)*	*Ecuation (4)*	*Ecuation (5)*
	AR(ρ)	*Including output gap*	*NKPC*	*NKPC including output gap (–1)*	*Galí and Gertler with unemployment*
Argentina	0.479	0.428	0.296	0.412	0.539
Austria	0.123	–0.149	–0.018	0.146	–0.102
Australia	0.250	0.282	0.018	0.125	0.065
Belgium	–0.265	–0.397	0.198	–0.051	0.118
Bolivia	0.581	0.596	–0.026	0.070	–
Brazil	0.416	0.426	0.441	0.509	0.503
Canada	–0.805	–0.883	0.021	0.067	0.157
Chile	0.435	0.288	0.073	0.101	–
Colombia	0.825	0.782	0.408	0.481	0.445
Czech Republic	0.404	0.508	–0.079	–0.221	0.124
Denmark	–0.199	–0.184	0.147	0.140	0.229
Finland	–0.038	–0.095	–0.126	0.600	0.050
France	–0.250	–0.357	0.147	–0.150	0.317
Germany	0.068	–0.057	–0.188	0.148	0.036
Greece	0.393	–1.431	–	–	–
Hungary	0.657	0.656	0.641	0.596	0.714
Iceland	0.577	0.568	–0.387	–0.270	–
Ireland	0.297	0.141	–	–	0.601
Israel	0.366	0.381	0.158	–0.071	–
Italy	0.095	–0.046	0.481	0.399	–
Japan	–0.343	–0.473	0.370	0.292	0.323
Korea	–0.284	–0.416	–1.008	–0.464	–0.641
Luxembourg	0.177	0.068	–0.049	0.406	0.036
Mexico	0.404	0.783	0.534	0.455	–
Netherlands	0.409	–0.082	–0.523	1.124	–0.739
Norway	–0.504	–0.599	0.173	0.119	0.187
New Zealand	0.319	0.123	0.260	0.347	0.263
Peru	0.601	0.617	0.229	0.245	–
Phillipines	0.136	0.183	0.158	0.138	–
Poland	0.661	0.659	0.616	0.591	0.547
Portugal	–0.340	–0.101	–1.058	–0.397	–
South Africa	0.290	–0.071	–0.099	–0.134	0.397
Slovak Republic	0.347	0.007	–0.127	–0.116	–0.180
Spain	–0.385	–0.394	–0.906	0.103	2.921
Sweden	0.115	–0.040	0.045	0.112	–0.304
Switzerland	–0.383	–0.436	–0.934	–0.834	–0.396
Thailand	0.134	–0.263	0.316	0.312	0.350
Turkey	0.879	0.864	–0.177	0.100	0.224
United Kingdom	–0.110	–0.250	0.170	0.224	0.437
United States	–0.817	–1.337	0.166	0.154	0.172

the new Keynesian Phillips curve (NKPC) has emerged.[11] For many, this class of models represents a sort of common-sense middle ground that preserves the insights of standard rational expectations models while allowing for better empirical fit by dealing directly with a well known deficiency of the pure forward looking model of inflation. As a result this class of models has been widely used in applied monetary policy analysis.

The structural equation for inflation that we estimate is in the spirit of hybrid new Keynesian Phillips curve as in (3). These models add a dependence of inflation on its lagged values to otherwise purely forward looking models. Such models are often considered as a compromise between the need for rigorous micro foundations of the sort underlying the pure new-Keynesian Phillips curve and the need to fit the data empirically.

$$(3) \quad \pi_t = \rho\pi_{t-1} + (1-\rho)E_t[\pi_{t+1}] + \beta_2 h_{t-1} + \gamma X_{t-1} + \varepsilon_t,\ E[\varepsilon_t] = 0\ \mathrm{var}(\varepsilon_t) = \sigma_\varepsilon^2,$$

where h_t is output gap and X_t is foreign exchange rate.

The parameter that measures inflation persistence is ρ. We estimated equation (3) above, using lags of consumer headline inflation as instruments. We also checked for serial correlation with LM test and for heteroskedasticity with White test. In the presence of serial correlation, we included more lags of regressors, until there is no more evidence of serial correlation. In the presence of heteroskedasticity, we corrected with Newey-West robust matrix. We, again, compared the statistical differences of averages of the inflation persistence coefficient of different groups.

Table 2 column 3 shows the estimated ρ. The average persistence estimator was 0.009, and the standard deviation was 0.43. The country with the highest average was Hungary while the one with the lowest was Portugal. Considering our three groups, emerging economies that did not experience *hyperinflation* had an average persistence estimator of 0.03. Within the industrial economies group, the average coefficient was –0.095. The country with the highest persistence was Italy.

Considering countries that experienced *hyperinflation*, the highest persistence was from Poland (0.62) while the one with the lowest was Turkey (–0.18). The average of this group was 0.26.

In figure 2, we show the recursive least squares estimations for the inflation persistence coefficient *(ρ)* in NKPC. Again, emerging market economies

[11] See Fuhrer and Moore (1995), Galí and Gertler (1999) and Christiano et al. (2005) for some theoretical models that justify the inclusion of lags of inflation in the new Keynesian Phillips curves.

appear to have higher levels of persistence. And countries that had a *hyperinflation* history have an even higher persistence level.

As we can see these results do not differ from the estimation of the more traditional models presented in section 3.1. Once again, higher inflation in the past implies higher persistence of inflation in the present.

In the next section, we will include wage rigidity in the new Keynesian framework in line with Blanchard and Galí (2005). The objective is to see if there is a change in estimated persistence due to these rigidities.

3.3 New Keynesian Models Estimation with Wage Rigidities

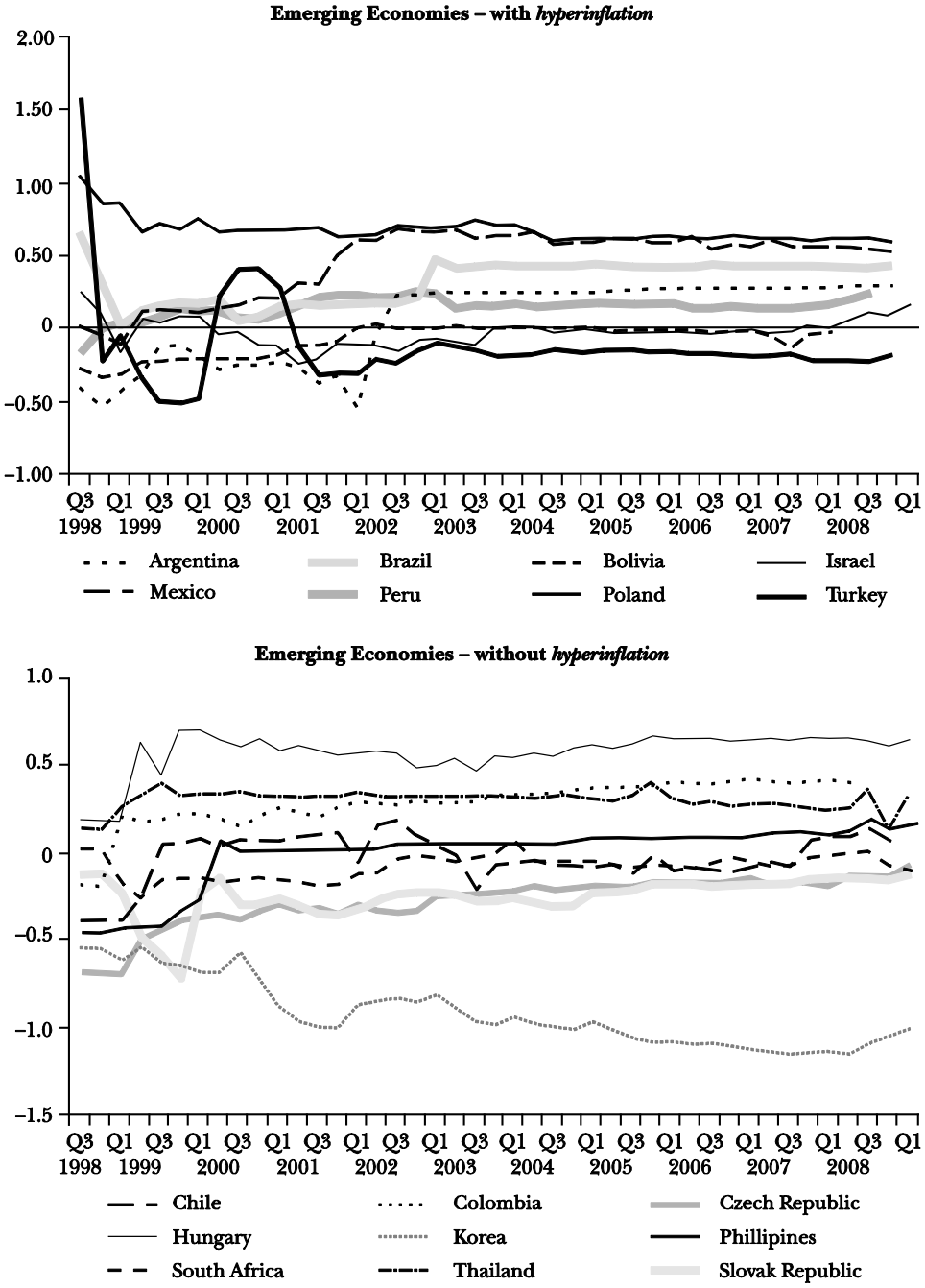
Blanchard and Galí (2005) incorporate wage rigidities in the structural model of inflation. The reduced form equation that results from their structural model is equation (4) below. Note that this equation is very similar to the hybrid new Keynesian Phillips curves specification used in many empirical and policy analysis applications and that allows for both backward looking and forward looking inflation terms (with coefficients whose sum is close to one). In our model the relative weight of lagged inflation is tightly linked to the degree of real wage rigidities. The novelty is the inclusion of the first difference of lagged output gap. This is the result of wage rigidity and makes the divine coincidence –where the central bank stabilizing inflation also stabilizes the welfare relevant gap– not possible anymore. The ρ coefficient continues to measure inflation persistence. Galí and Blanchard show that this coefficient is an increasing function of wage rigidity.

$$(4) \quad \pi_t = \rho\pi_{t-1} + (1-\rho)E_t\left[\pi_{t+1}\right] + \beta_1 h_{t-1} + \beta_2 \Delta h_{t-1} + \varepsilon_t,\ E\left[\varepsilon_t\right] = 0\ \ \mathrm{var}\left(\varepsilon_t\right) = \sigma_\varepsilon^2.$$

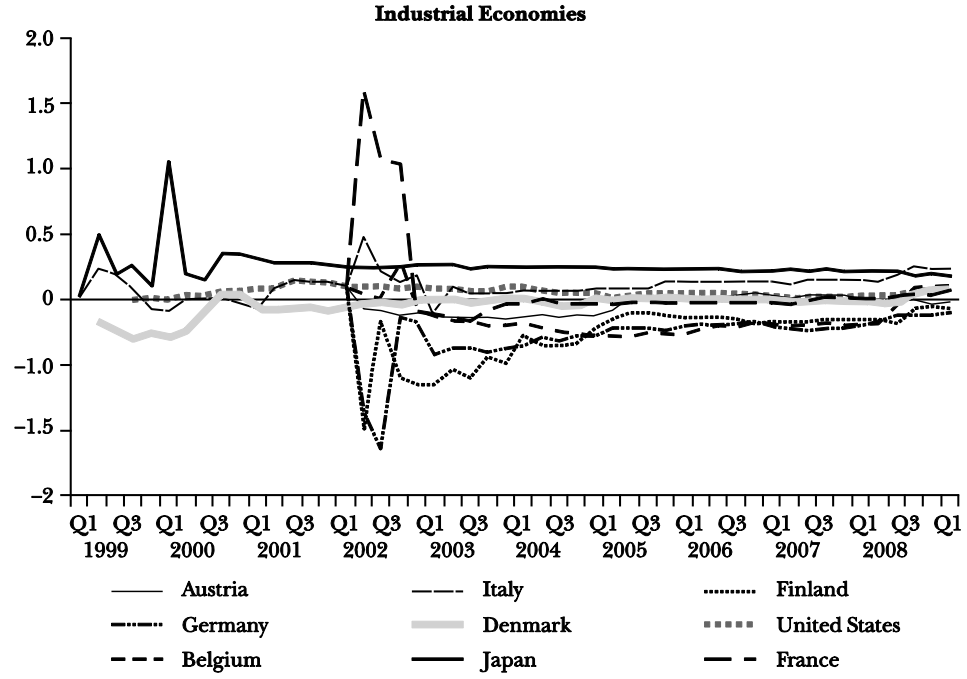
Table 2 (column 4) shows the estimated ρ for this specification. The average persistence coefficient was 0.16 and Netherlands has the highest one: 1.124. Emerging market economies that experienced *hyperinflation* in the recent past seem to have greater coefficients on average: 0.289 compared to 0.134 of the industrial economies.

For all estimations we tested for structural breaks using Andrews-Quandt Chow and recursive least squares. No breaks were observed in the estimated processes. We did once more a Wald test of $\rho = 1$ for all estimations. We rejected $\rho = 1$ for almost all economies with the exception of Netherlands. We, again, compared the statistical differences of averages of the inflation persistence coefficient of different groups with a system of equations approach.

FIGURE 2. STABILITY OF PERSISTENCE PARAMETERS MODELING INFLATION AS A NEW



KEYNESIAN PHILLIPS CURVE, 1998-2009



Another implication of Blanchard and Galí (2005) model is the relation between inflation and unemployment as in equation (5). As Mishkin (2007) points out, when researchers estimate this equation they typically find that the coefficients on the unemployment gap have declined in the absolute value since the 1980s often by a marked amount. In other word, the evidence suggests that the Phillips curve has flattened.

$$\pi_t = \rho\pi_{t-1} + (1-\rho)E_t[\pi_{t+1}] + \beta_1 u_{t-1} + \varepsilon_t,\ E[\varepsilon_t] = 0\ \text{var}(\varepsilon_t) = \sigma_\varepsilon^2. \tag{5}$$

Table 2 (column 5) shows the estimated ρ for this specification. The average persistence coefficient was 0.246 and Spain has the highest one: 2.921. Emerging market economies that experienced *hyperinflation* in the recent past once again seem to have greater coefficients on average: 0.453 compared to 0.23 of the industrial economies.

For all estimations we test for structural breaks using Andrews-Quandt, Chow and recursive least squares. We did not observe any break in any of the processes we estimated. Wald tests rejected $\rho = 1$ for almost all economies with the exception of Ireland and Spain.

As we can see, once again the results for both models of wage rigidities are similar to the ones of traditional and hybrid new Keynesian models. There is clear evidence that persistence is higher and more volatile in emerging economies that had *hyperinflation* than in the rest of our sample.

4. CONCLUSION

We analyzed inflation persistence in several industrial and emerging countries in the recent past by estimating various reduced-form models of inflation. Our results show that inflation persistence is low and stable, albeit lower for the former than for the latter. We also show that even countries that experienced *hyperinflation* in the recent past showed low levels of persistence but still have higher levels than the other countries in our sample. Overall, our results are consistent with a stable reduced-form representation for inflation and a low level of inflation persistence worldwide.

In interpreting our results, we must first recognize that all of them are based on reduced form relations. Thus, they are about correlations and not necessarily about true structural relations. Explanatory variables in our inflation estimations are themselves influenced by changes in economic conditions. So, changes in the underlying monetary policy regime are likely to be a source changes in reduced-form inflation dynamics. This problem is especially acute for structural relations involving expectations or other factors that are not directly observable and so cannot be included in reduced form regressions. In such cases, we cannot use the reduced form equations to disentangle the effects of such unobserved factors which themselves may be driven by changes in monetary policy from that of other influences.

Mishkin (2007) makes it clear that inflation expectations must be a key driving force behind inflation. This dependence has long been implicit in traditional Phillips curve analysis but now expectations are explicit and are also a central feature of new Keynesian Phillips curves in which current period inflation is a function of expectations next period and output gap.

Anchoring of inflation expectations must be related to monetary policy. During the past years most central banks have increased their commitment to price stability in both words and action. The Federal Reserve, the European Central Bank and several central banks of emerging

economies have been committed to keep inflation under control. The result has been low and stable inflations but also, as we report in this paper, low and stable inflation persistence.

The pursuit of more aggressive monetary policy to control inflation and the achievement of anchored inflation help explain in part our results. With expectations of inflation anchored the sacrifice ratio becomes lower and monetary policy much more effective to improve the welfare of the economy.

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