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Article

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The effect of central bank transparency on inflation persistence

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Abstract

In this paper, we examine the effect of central bank transparency on inflation persistence, using panel data analysis. The existing literature has shown a significant impact of central bank transparency on macroeconomic variables, such as inflation, but not many efforts have been made about its effect on inflation persistence. We use yearly data for 14 countries and the Eurozone (EU19). We find that monetary policy transparency has a negative statistically significant impact on inflation persistence, while controlling also for important variables such as GDP growth, interest rates, economic openness and unit labor cost.

Keywords: monetary policy; central bank transparency; inflation persistence; panel data
JEL Classification Codes: E52, E58

1. Introduction

Historically, the issue of inflation persistence attracted the attention of the international literature for many decades, with researchers focusing both on the effects and the causes of this phenomenon. Many researchers (Taylor, 1980; Calvo, 1983; Fuhrer and Moore, 1995; Calvo *et al*., 2002; Christiano *et al*., 2005; Blanchard and Gali, 2007) showed that the phenomenon is a structural feature by focusing on price and wage stickiness, and indexation or staggered wage contracts. Another strand of the literature (Huh and Lansing, 2000; Andolfatto and Gomme, 2003 and Erceg and Levin, 2003) argue that in the case of imperfect transparency and credibility, there is a learning process from the public that generates additional inflation persistence. In the same spirit, Westelius (2005) has shown that a discretionary monetary policy does not succeed in incorporate the impact of credibility and transparency on inflation expectations, generating thus a considerable amount of persistence in inflation. Ball (1995) explained inflation

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fluctuations regarding tougher or looser monetary policies, where the latter is more likely to produce more persistent inflation. Baxa *et al*. (2015) suggest that inflation targeting policies reduce inflation persistence[1]. To the same extend, Canarella and Miller (2016), after analyzing data from 13 inflation targeting countries found that these policies reduce inflation persistence and raise monetary policy credibility. Kočenda and Varga (2018) focusing on inflation targeting policies, show that explicit policies reach better results in controlling inflation persistence, than implicit inflation targeting policies do[2]. Moreover, regarding the effects of labour market, Jaumotte and Morsy (2012) and Geronikolaou *et al*. (2016) suggested that labour markets rigidities are responsible for higher and more persistent inflation.

Little attention has been given so far to the link between central bank characteristics and inflation persistence. However, central bank independence and transparency proved to be important elements for the efficiency of monetary policy and therefore their performance in terms of inflation and inflation variability (see, among others, Alesina and Summers, 1993; Eijffinger et al., 2000; Geraats, 2005; Hughes Hallett and Libich, 2006; Crowe and Meade, 2007; Demertzis and Hughes-Hallett, 2007; de Mendonça and Galveas, 2013; Dincer and Eichengreen, 2014; Papadamou and Arvanitis, 2015; Montes and Gea, 2018, Weber, 2018). However, there are also some theoretical studies which show that the effects of central bank transparency may also be negative (Sørensen, 1991; Gruner, 2002; Sibert, 2002; Westelius, 2009)[3].

Focusing thus on the effects of central banks' independence on inflation persistence, findings by Diana and Sidiropoulos (2004) suggest that more independent central banks are associated with lower degrees of inflation persistence. In the same way, Papadamou *et al*. (2017) suggest that an independent central banker could better manage inflation expectations and therefore inflation persistence despite the occurrence of persistent public investment shocks.

Considering the effects of central banks' transparency on inflation persistence, Van der Cruijsen and Demertzis (2007) argue that there is a negative link between central bank transparency and inflation persistence using a dataset of nine OECD countries. Dincer and Eichengreen (2007), using a much larger set of countries, have shown that central bank transparency negatively affects inflation persistence[4]. These results are consistent with the view that higher levels of monetary policy transparency allow the public to adjust their expectations more quickly, limiting thus policymakers' willingness to run persistently inflationary policies. However, Van der Cruijsen et al. (2010) suggest that there is an optimal intermediate degree of transparency that minimizes inflation persistence.

This paper is one of the few studies that empirically investigate the effects of central banks' transparency on inflation persistence, providing also an update of the time period of investigation and including some neglected, although relevant, control variables. Using data from 14 OECD countries plus EU19 (regarding ECB's transparency) over the period 2002-2016 and applying a panel data approach, we show that transparency reduces inflation persistence.

The paper is structured as follows. Section 2 presents the data and the basic model. Section 3 analyzes the relationship between inflation persistence and central banks' transparency, GDP growth and interest rates. Section 4 concludes.

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[1] Alogoskoufis (2018) considered that monetary policy rules targeting unanticipated changes in unemployment rates, could improve results in terms of inflation persistence.

[2] For more studies on monetary policy orientation effects on inflation persistence, see, among others, Taylor (2000), Goodfriend and King, (2001), Conrad and Eife, (2012), Meller and Nautz, (2012), Qin *et al.* (2013), and Noriega *et al*. (2013).

[3] It is to notice that according to Cukierman (2002), if a central banker does not publish its economic models and objectives, it is more likely to have higher levels of credibility.

[4] It is to mention that Dincer and Eichengreen (2010) did not find a statistically significant effect for this relationship.

2. Data and methodology

In this paper we use data for 14 countries, all of them being OECD members (Australia, Canada, Croatia, Denmark, Hungary, Iceland, Israel, Mexico, New Zealand, Norway, South Korea, Sweden, Switzerland, United Kingdom) and the Euro-zone (EU19) member countries, in order to test also the ECB's inflation persistence and transparency. The time period used is from 2002 to 2016.

Transparency (TRNS) is taken from Dincer and Eichengreen (2014) for the time period of 2002-2010 and for the time period 2011-2016 we use data from Oikonomou and Spyromitros (2017), as both of them use the same methodology of calculation developed by Eijffinger and Geraats (2006)[5]. According to Fuhrer (2010), there is no universally accepted method of calculating inflation persistence. Summarising the methods, we have the conventional unit root tests, the autocorrelation function of the inflation series, the first autocorrelation of the inflation series, the dominant root of the univariate autoregressive inflation, the sum of autoregressive coefficients and the unobserved components decomposition of inflation[6,7]. In our analysis inflation persistence is calculated using the functional form:

$$persistence = \rho = \frac{Cov(\pi_t, \pi_{t-1})}{Var(\pi_t)} \tag{1}$$

where ρ is the correlation coefficient between π_t and π_{t-1}, where π_t is the annual inflation rate at year t. We apply a rolling window approach of 10 years, where for each year we consider the previous ten- year inflation rates[8]. For inflation persistence (INFp), we use inflation data from OECD database. Interest rates (IR) are taken from the OECD database and concern the annual money market interest rates for each country. In case of European countries, we use the annual EURIBOR rate, taken from the EURIBOR website and in the case of United Kingdom we apply the annual LIBOR rate, taken from the LIBOR website. For GDP growth rate (GDPg), we use the OECD database. The trade openness (OPN) of each country is measured as the percentage of the total trade over GDP. Unit labour costs (ULC) is our final control variable, in order to measure the effect of the labour market on inflation persistence. Finally, we apply a European union country dummy variable (EUDUMMY) in order to capture the effect of being a member of the European union on inflation persistence, which in case of European union is equal to 1, otherwise 0 (descriptive statistics for all countries and variables are presented in Table 1)[9]. Mexico, UK and Iceland are found with the highest inflation persistence mean, while Australia has the lowest. Regarding central bank transparency, Sweden and New Zealand have the highest mean, while the lowest means are Mexico's and Denmark's.

[5] Another index of transparency is the one developed by Fry et al. 2000.

[6] It is to notice that several authors use multivariate models to calculate the response of inflation to various disturbances (Batini and Nelson, 2001; Batini, 2002). Another alternative method considers that if inflation is not very persistent, it should cross its mean relatively frequently and measures the measures of these incidents (Marques, 2004; Dias and Marques, 2010).

[7] For a discussion on the advantaged and disadvantages of several methods of persistence calculation see Marques (2004) in the context of the univariate approach.

[8] See among the others Geronikolaou et al. (2019).

[9] The variables we apply in our model are widely used as controls for inflation persistence. As for the effect of GDP growth on inflation persistence the sign is expected to be positive (as in Geronikolaou et al., 2019). Concerning the effect of Interest Rates, the sign is expected to be negative (see among the others Alogoskoufis, 1992; Taylor, 2000; Bratsiotis et al., 2015). Trade openness and inflation are expected to be negatively correlated (Romer, 1993; Lane, 1997). Unit labour costs as a proxy for price competitiveness is expected to have a positive sign (Van der Cruijsen et al., 2010). Finally, the European Union dummy is expected to have ambiguous effect on inflation persistence, depending on the structural characteristics over the economies, as well as the economic policies applied in the economies in our sample.

Table 1. Descriptive Statistics.

Variable / Country		*INFp*	*TRNS (min. 0 max. 15)*	*GDPg*	*IR*	*OPN*	*ULC*
Australia	Mean	0.093607	10.05263	5.242307	4.625307	40.88947	87.79727
	St. Dev	0.419355	1.649029	2.421824	1.456992	1.853793	12.98885
Canada	Mean	0.135825	11.63158	4.169545	2.647923	68.7	93.80543
	St. Dev	0.254217	1.352386	2.622089	1.697962	7.223496	10.82732
Denmark	Mean	0.209836	7	4.101758	2.453515	92.06316	91.39726
	St. Dev	0.349166	1.092906	2.755152	1.605402	10.95781	10.49293
EU19	Mean	0.23383	10.71053	3.87668	2.397895	74.24211	94.41398
	St. Dev	0.41539	1.228321	2.236187	1.556505	7.939655	8.077965
Hungary	Mean	0.516574	10.89474	5.184218	5.111982	144.5474	88.51721
	St. Dev	0.392437	3.860696	2.985408	5.385875	21.93775	17.66838
Iceland	Mean	0.598433	9.394737	4.669444	8.670527	84.16316	89.82187
	St. Dev	0.377672	2.850823	4.234015	3.324697	13.48597	25.72941
Israel	Mean	0.410732	9.736842	5.109891	4.430885	69.72632	97.7222
	St. Dev	0.345666	1.873562	3.904975	3.696676	7.616637	7.526801
Mexico	Mean	0.652247	6.342105	4.963373	9.223948	58.53684	81.52017
	St. Dev	0.514794	1.624916	3.165078	6.806284	8.098574	19.747
New Zealand	Mean	0.154312	13.68421	5.097353	5.04386	58.96316	89.29085
	St. Dev	0.272218	0.836835	2.388005	2.078556	4.178146	11.51059
Norway	Mean	-0.02429	8.736842	5.07375	3.772532	70.03158	89.02548
	St. Dev	0.364983	2.694482	7.573048	2.162239	2.63756	20.32323
S. Korea	Mean	-0.00709	9.052632	5.342544	4.558364	81.57895	97.82247
	St. Dev	0.278112	1.489731	4.032507	3.012792	16.78404	6.626727
Sweden	Mean	0.307719	13.68421	4.394735	2.449132	83.68947	95.46353
	St. Dev	0.31541	1.842481	3.309228	1.600269	5.049411	10.57079
Switzerland	Mean	0.214251	9.105263	4.694773	0.925621	101.6421	97.87987
	St. Dev	0.423563	1.297208	3.055598	1.183504	25.61519	3.690493
UK	Mean	0.608104	12.65789	3.991466	2.788411	54.65789	90.36475
	St. Dev	0.335278	0.688247	2.516158	2.077051	4.654904	11.52174
USA	Mean	0.221206	10.42105	4.165062	2.362763	26.44737	128.7557
	St. Dev	0.303917	0.651135	2.065334	2.245512	3.052935	11.37043

Our basic empirical model is a panel regressions family model[10], estimating a linear equation of the following form:

$$INFp_{\ it}{=}\alpha{+}\beta_1 TRNS_{it} + \beta_2 IR_{it} + \beta_3 GDPg_{it} + \beta_4 OPN_{it} + \beta_5 ULC_{it} + \beta_6 EUDUMMY_{it} + \mu_i + u_{it} \quad (2)$$

where the last two terms are the individual heterogeneity term (μ_i) and the common error term (u_{it}). Following Wooldridge (2003), if the individual heterogeneity is correlated with the regressors, the proper specification is the fixed effects regression. When no autocorrelation is assumed, the random effects specification is preferred. The latter represents country level characteristics that are not explicitly included among the independent variables and can therefore cause omitted variable bias.

[10] When investigating central bank transparency effects, many researchers use a panel regression family model (see among the others Papadamou et al., 2014). In that extend, and as we find no endogeneity, we proceed in estimating our models, using panel regressions. In case of endogeneity, we would use instrumental variables regression or a Panel GMM model (as in the case of Dincer and Eichengreen, 2010). In this way, we are also differentiated from the autoregressive estimation of Van der Cruijsen et al. (2010).

Table 2. Panel Unit root tests.

Variable / ***Test***	***Levin-Lin-Chu p-value***	***Im-Pesaran-Shin p-value***
TRNS	0.0000	0.0305
GDPg	0.0000	
IR	0.0000	0.0000
OPN	0.0000	0.0000
INFp	0.0000	0.0000
ULC	N/A	0.9990

Table 3. Fixed-Effects Regression Results.

INFp	**(2)**	**(3)**	**(4)**
TRNS	-0.093688***	-0.1141346***	-0.0871027***
	(0.000)	(0.000)	(0.000)
GDPg	0.0088799	0.0078814	
	(0.129)	(0.159)	
IR	0.0015785	-0.0090111	
	(0.884)	(0.284)	
OPN	-0.0032335		
	(0.452)		
d.ULC	0.0082295***		
	(0.001)		
EUDUMMY	0.658271***	0.6622488***	
	(0.001)	(0.000)	
α	1.213313***	1.256143***	1.179839***
	(0.000)	(0.000)	(0.000)
Diagnostics			
Adj. R^2	0.1167	0.0996	0.0721
Hausman	16.33[a]**	73.34[a]***	8.82[a]**
	(0.0121)	(0.0000)	(0.0030)
Frees Test	3.605[a]	2.984[a]	3.036[a]
	(0.2838)[b]	(0.2262)[b]	(0.2262)[b]
Pesaran Test	7.270[a]***	8.369[a]***	9.353[a]***
	(0.0000)	(0.0000)	(0.0000)

Notes: p-values in parentheses, [a] critical value, [b] alpha value, ** and *** represent significance at 95% and 99,9% respectively.

3. Empirical results

We first apply unit root tests on all variables of interest (Table 2), where both Im et al. (2003) and Levin et al. (2002) tests conclude in rejecting the null-hypothesis (H0: Panels contain unit roots), except ULC, where there is a unit-root and after first-differencing the variable becomes stationary.

In a second step, we proceed to the estimation of equation (2), and the results are presented in Table 3. It is to notice that we present three different models for robustness checks. Starting from the full model (2), following a model not including variables with a significant effect in the retained results (3) and closing with only transparency as a control variable (4). As can be seen in the lower part of Table 3 by diagnostic tests, the results of the Hausman test for fixed or random effects suggest the fixed effects selection for our basic model. Pesaran (2004) and Frees (1995) tests for cross sectional dependence confirm the existence of dependence of the error terms in our basic model. While, Wooldridge (2003) test demonstrate the appearance of

Table 4a. Prais-Winsten Regression with Corrected Standard Errors Results.

INFp	**(4)**		**(3)**		**(2)**	
TRNS	-.0344185*	-.039278**	-.033211**	.0332627**	-.0350012**	-.0346192**
	(0.053)	(0.020)	(0.029)	(0.028)	(0.023)	(0.021)
GDPg				-.0016805	-.0000703	.0002091
				(0.643)	(0.987)	(0.960)
IR	.		.0136364	.0140904	.0184186	.0185077
			(0.208)	(0.192)	(0.150)	(0.145)
OPN						-.0010946
						(0.220)
d.ULC					.0081187	.0084806
					(0.232)	(0.203)
EUDUMMY		.1572891*	.1976918**	.1980934**	.235527***	.2570031***
		(0.072)	(0.015)	(0.014)	(0.003)	(0.002)
α	.6790423***	.6784586***	.5418985***	.5472755***	.5032021**	.5716035***
	(0.001)	(0.000)	(0.004)	(0.004)	(0.011)	(0.004)
ρ(AR(1)coefficient)	.7901183	.7764514	.7430232	.7388132	.6948972	.6958169
R^2	0.0783	0.1053	0.1072	0.1346	0.1373	0,1478
F-test	F(1, 14)= 29.493 (0.0001)	F(1, 14)= 29.618 (0.0001)	F(1, 14)= 28.925 (0.0001)	F(1, 14)= 30.982 (0.0001)	F(1, 14)= 27.194 (0.0001)	F(1, 14)= 28.388 (0.0001)
m-Wald test	$x^2(15)$=81.28	$x^2(15)$=78.44	$x^2(15)$=48.82	$x^2(15)$=73.29	$x^2(15)$=167.79	$x^2(15)$=152.67
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes: p-values in parentheses, ***, ** and * indicate 10%, 5% and 1% statistical significance, respectively.

Table 4b. Pooled-OLS with Driscoll-Kraay Corrected Standard Errors.

INFp	**(4)**		**(3)**		**(2)**	
TRNS	-.040095***	-.049604***	-.0298163**	-.0292843**	-.023710***	-.023938***
	(0.003)	(0.000)	(0.012)	(0.013)	(0.006)	(0.006)
GDPg				.0071711*	.0064678*	.0065914***
				(0.066)	(0.085)	(0.002)
IR			.0326241*	.0316275*	.0428235***	.0425187*
			(0.059)	(0.061)	(0.002)	(0.074)
OPN						-.0006129
						(0.465)
d.ULC					.0069803	.0073734
					(0.488)	(0.442)
EUDUMMY		.1999105***	.2469986***	.2500727***	.2754309***	.2886835***
		(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
α	.6991431***	.7359158***	.3854995**	.3497699*	.2197829**	.2636303*
	(0.000)	(0.000)	(0.047)	(0.062)	(0.033)	(0.051)
R^2	0.0721	0.1174	0.1812	0.1847	0.2174	0.2191

Notes: p-values in parentheses, ***, ** and * indicate 10%, 5% and 1% statistical significance, respectively

an autocorrelation issue and the modified Wald test show heteroskedasticity in the fixed effects regression model. Due to the heteroskedasticity and autocorrelation problems, we continue our methodology with an autoregressive (AR(1)) model, using Prais-Winsten Panel Corrected Standard Errors and a Pooled-OLS regression, using Driscoll and Kraay (1998) standard errors and results are shown, respectively, in Table 4a and 4b.

For our basic model, the results are highly statistically significant for transparency, unit labour cost and the EU dummy variable. The latter variables have a positive effect on inflation persistence, while transparency is reducing it. The negative relationship between central bank transparency and inflation persistence is justified on the ground that transparency is responsible for a better anchoring of inflation expectations affecting accordingly inflation persistence (Van der

Cruijsen and Demertzis, 2007; Zhang, 2011). Our results come in line with Dincer and Eichengreen (2007), regarding the effects of the variables, although our results are more robust and also, we find a statistically significant effect of more variables, than the previous mentioned research.

In order to measure the robustness of our results, we focus on two stricter models, the first one without trade openness and first differences in unit labour cost and the second one using only transparency as the independent variable:

$$INFp_{it}=\alpha+\beta_1 TRNS_{it}+\beta_2 IR_{it}+\beta_3 GDPg_{it}+\beta_4 EUDUMMY_{it}+\mu_i+u_{it} \quad (3)$$

$$INFp_{it}=\alpha+\beta_1 TRNS_{it}+\mu_i+u_{it} \quad (4)$$

For the first regression, we find that transparency is statistically significant and has a negative impact on inflation persistence for all the panel data regressions employed. The same holds for the EU dummy variable, which has a positive impact on inflation persistence. GDP growth and money-market interest rates have a positive impact on inflation persistence in the Pooled-OLS regression. Openness and the unit labour costs have no effect on inflation persistence. Concerning central bank transparency, we confirm the negative effect on inflation persistence, as in Dincer and Eichengreen (2007) and Van der Cruijsen et Demertzis (2007). In effect, the public adjust their expectations more quickly under more transparent monetary policies, limiting policymakers' willingness to run accommodating policies in order to deal with increased output gaps. Regarding the EUDUMMY, the European Union countries share a common custom policy, however they have asymmetric structural characteristics. In this perspective, economic policy responses to shocks may be diffused with a different speed, resulting in different levels of inflation, enhancing inflation persistence. Concerning the relationship between inflation dynamics and money market rates we find a positive link, which is related to the so called "price puzzle" (Bernanke and Blinder 1992; Sims 1992). In effect, short-term interest rates affect borrowing rates and therefore the cost component to firms. It is not unlikely that the increased costs from higher interest rates precedes the contractionary effect on the demand side from higher rates, although it is not clear whether this is the case. The positive effect of GDP growth on inflation dynamics is reflected in the increase in the demand-side equation of the economy.

4. Conclusion

This paper contributes to the ongoing literature on the determinants of inflation persistence and the importance of highly transparent central banks. The existing literature has shown that transparency is a highly respectable characteristic of central banks with positive contributions to the economy. In our empirical framework, we consider 15 developed economies, with relatively low levels of inflation persistence and increasing levels of transparency. We include control variables widely used by the literature on inflation dynamics, which are not however extensively used in studies related to the relationship between central bank transparency and inflation persistence. Moreover, we expand the time period of the analysis with respect to previous studies. Our results confirm the negative link between central bank transparency and inflation persistence. It is to notice that interest rates have a positive impact on inflation persistence implying the occurrence of the price puzzle. The European Union dummy has a significant positive effect on inflation inertia, due to the different structural characteristics of the economies involved. In the case of the ECB, this result is emphasized by the fact that in a low interest rates environment and since the target of inflation was fulfilled, ECB's monetary policy had no incentive to increase its policy rates and risk missing its target.

Overall, the main policy implication of the paper is that there is a role of monetary policy characteristics on inflation persistence. Central banks dealing with inflation inertia might be in the difficult position to achieve poor results in terms of inflation stabilisation if their monetary policies are not transparent enough. This result holds even if the levels of inflation inertia are relatively low as it is the case for most of the developed countries.

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