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Price-Money Relationship after Inflation Targeting: Co-integration Test with Structural Breaks for Turkey and Brazil

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ABSTRACT

The inflation targeting (IT) strategy may create structural changes in macroeconomic variables. This study analyzes the effect of the IT strategy on the price-money supply relationship in Turkey and Brazil by Kejriwal–Perron (K–P) cointegration analysis with structural breaks. The analysis aims to determine whether the IT strategy leads to regime shifts in the price index-money supply relationship in Turkey and Brazil. The K–P tests reveal a structural break in the price-money supply relationship as a result of the IT strategy. In both countries, the implementation of this strategy leads to a decrease in the regime coefficients for Turkey while it creates an increase for Brazil. When Turkey and Brazil are compared in terms of money-price relationship after the IT strategy, the study reveals that it has weakened more in Brazil.

Keywords: Monetary Inflation, Inflation Targeting, Kejriwal–Perron Cointegration Analysis, Regime Shifts
JEL Classifications: C32, E51, E52, E58

1. INTRODUCTION

Most economists argue that inflation is a monetary phenomenon. For these economists, the primary duty of the Central Bank is to maintain price stability, which is the main determinant of money supply. As suggested by the Fisher equation, price stability creates stability in the expected returns of international portfolio investments. Thus, price stability has a great deal of importance for open and developing markets together with policies of economic globalization and financial liberalization. There is a variety of choices to be used as an anchor by a central bank to ensure price stability, such as exchange rate, money supply and interest rate and monetary policy regimes shift according to these anchors. Most countries have managed to solve their chronic inflation problem with the inflation targeting (IT) strategy which was used by New Zealand for the first time in 1990. The success of this strategy depends on determining the causes of inflation. Although various reasons for inflation are given in the literature, inflation modeling based on monetary expansion is crucial for monetary policy management. In case of a stable relationship between money supply and inflation, money supply can be regarded as a future indicator of inflation and can provide information for the policy makers (Gungor and Berk, 2006. p. 2083).

Money-growth targeting has been applied in certain countries because of the monetary character of inflation but due to its instability and unreliability it has been left aside (Svensson, 2001. p. 5). Another targeting policy, the exchange rate peg has led to currency crises in various countries and the IT strategy has become the preferred targeting policy. The relative flexibility of the IT strategy facilitates the disinflation process and leads to stable inflation rates (Roger, 2009. p. 4-6). This situation implies that the IT strategy changes the relationship between inflation and its causes.

In order to reveal this relationship, the study deals with Brazil and Turkey, which have similar inflation dynamics and have applied the IT strategy since the end of the 1990s. Turkey experienced a chronic inflation problem between 1970 and 2000. While this problem has various causes, the turning point was the stabilization program of 2000 which is based on exchange rate targeting. This stabilization policy based on the crawling exchange rate peg led to the deepest crisis experienced by the Turkish economy in November 2000-February 2001 and created structural changes in economic policies. After the February 2001 crisis, a managed floating exchange rate system was adopted and a transition program to strengthen Turkish economy was announced on April 11, 2001; the first implicit IT strategy was adopted in 2002

and by 2006, the full-fledged IT strategy was finally adopted. The nominal anchors of the new monetary policy were monetary targeting and IT. This strategy has cured the chronic inflation problem in Turkey to a great extent. While the inflation rate was 30% in 2002, by 2005 it was 7.7% with a target value of 8%. In other words, the IT strategy has created a structural change in the Turkish economy (Akyurek et al., 2011. p. 343).

Brazil is similar to Turkey in terms of inflationary process and pattern. In order to solve the hyperinflation problem, Brazil has also used the disinflation strategy based on a crawling exchange rate peg. This strategy increased the vulnerability of the country to external shocks because of its increased external debt burden and high reliance on the fluctuations of agricultural export and oil import prices. The exchange rate regime was subject to an adjustable band between 1995 and 1999 and created significant problems in maintaining the balance of payments equilibrium. This strategy was terminated as a result of the currency crisis of 1999 triggered by the 1997 Asian crisis and 1998 Russian crisis (Ferreira and Tullio, 2002. p. 143-144; Jawadi et al., 2014. p. 975). By June, 1999 the IT strategy began to be implemented and the real inflation target of 2000 was realized as 6% (Banco Central do Brasil, 2002. p. 47-50; Edwards, 2006. p. 7; De Mello and Moccero, 2011. p. 229-245). By the year 2005, the inflation rate was around 4.5% and in 2007 it was even below this rate, showing the success of the IT strategy. As was so in the Turkish case, the nominal anchor of the Brazilian IT strategy was the monetary aggregates (Banco Central do Brasil, 2006. p. 43-44; Ersel and Özatay, 2008. p. 39; Arestis et al., 2011. p. 135).

The main objective of this article is to determine whether the IT strategy has led to a change in the money supply-price relationship in Turkey and Brazil. In other words, the article analyzes whether a structural break occurs in the money supply-inflation relationship as a result of the IT strategy. For this purpose, the consumer price index and various money supply definitions will be used. The first part of the article provides a literature review of the theoretical and empirical data on the money supply-prices relationship. The next part analyzes the structural breaks in the money supply-inflation relationship in Turkey and Brazil by using the Kejriwal–Perron (K–P) methodology. In the last part, the main findings of the analysis will be discussed. The originality of this study lies in its application of the K–P approach based on the cointegration test with structural breaks. The cointegration test results for both countries reveal a structural break and while the IT strategy weakens the relationship for Turkey, it has a strengthening effect for Brazil. The value of the slope coefficient, i.e. the degree of money-price relationship implies that at a common optimal degree, the inflation rate will be low and stable.

2. THEORETICAL AND EMPIRICAL LITERATURE ON MONETARY INFLATION

The fact that inflation is a monetary phenomenon is one of the essential claims of monetarist economics. Friedman (1963) stated that high money supply will lead to high inflation in the long-term, but there are non-regular relationships between money supply and inflation in the short term. According to Friedman, every major inflation event has been caused by monetary expansion (Friedman, 1968. p. 12). Friedman (1970) implies that inflation occurs when money supply is higher than the product. The relationship between money supply and general price level with reference to the pure quantity theory of money (QTM). There are two implications for QTM: (I) there is a proportional and direct relationship between price level and money supply and (II) in the long run the level of national real income (Y) and the velocity of money (V) are orthogonal to money supply. In the long run, the proportionality suggestion implies that a constant increase in money growth inclines to an equal constant change in the rate of inflation. Orthogonality also suggests implications about the neutrality or super-neutrality of money. The neutrality of money means a permanent increase in the rate of money output and suggests that velocity is unaffected in the long run (De Grauwe and Polan, 2005. p. 240). According to Friedman and the following monetarist economists, money supply is not only the cause of inflation but it is also the cause of cyclical fluctuations in the economy (Friedman and Schwartz, 1982).

Most empirical studies find that the long-run relationship between money growth and inflation is strong in a statistical sense. Studies also show that there is a strong positive correlation between money supply and inflation for low and high inflation countries in the long-term. In other words, these studies claims that inflation is a monetary phenomenon and the data obtained from both least developed countries (LDCs) and DCs supports QTM[1]. In these studies, CPI is generally chosen to represent the price index. However there is no theoretical reasoning about which definition of money to use in the literature. In order to compare the findings, most studies use $M1$, $M2$ and $M2Y$ definitions. The studies also use both multiple variable models and univariate models. In univariate models, inflation and changes in price index are examined[2]. In some of the studies, persistency and policy efficiency are tested with unit root tests with structural breaks[3].

Some studies use the price index, while others use inflation rate as empirical models. While some studies deal with the structural breaks and success of the IT strategy, there is no study about the regime shifts of the money supply-price relationship in the literature. In addition to those mentioned above, most of the studies apply cointegration analysis. The reason for this choice is the fact that the QTM imply that each of money, price and, nominal income, or their linear combination with a coefficient vector is stationary (Özmen, 2003. p. 971). Some studies show that the IT strategy changes the structure of money-price relationship[4].

1 e.g. Brumm (2005), Budina et al. (2006), Chow and Shen (2005), Crowder (1998), Das (2003), De Grauve and Polan (2005), Dwyer and Fisher (2009), El-Shagi and Giesen (2013), Emerson (2006), Feliz and Welch (1997), Fendel and Ruelke (2014), Gerlach and Kong (2005), Gungor and Berk (2006), İvrendi and Güloğlu (2010), Lim and Papi (1997), McCandless and Weber (l995), Özdemir and Saygılı (2009), Xie et al. (2009), İvrendi and Güloğlu (2010).

2 e.g. Çiçek and Akar (2013), Gerlach and Tillmann (2012), Talaş et. al. (2013).

3 e.g. Caporale and Paxton (2013), Chiquiar et al., 2010, Narayan (2014).

4 e.g. Keskek and Orhan (2010), Tas et al. (2013), Talaş et al. (2013).

3. THE REGIME SHIFTS OF THE MONEY SUPPLY-PRICE RELATIONSHIP: EMPIRICAL ANALYSIS

Economic policies may lead to structural changes (or regime shifts) between macroeconomic variables. Appropriate econometric methods need to be used in order to evaluate these structural changes thoroughly. To this end, in this section variables and methodologies will be presented, the compatibility between co-integration tests and structural breaks will be analyzed by variables unit root tests and, finally, by using the Gregory–Hansen (G–H), Arai–Kurozumi (A–K), Bai–Perron and K–P methodologies, the regime shifts in price-money supply relationships in Turkey and Brazil will be determined. Finally, the findings will be evaluated.

3.1. Data, Models and Methodology

Table 1 presents the variables, definitions and time intervals used in the study and their sources.

All variables in Table 1 were applied logarithmic transformation and seasonal decomposition respectively. Seasonal decomposition was carried out by the moving average (additive) method. The series obtained after the procedure are given in Figures 1 and 2. All the variables of money supply and the price index for both countries reveal apparent trends. The graphs show that beginning from 2000, Turkey reveals a significant change in variables of both money supply and price index. Brazil reveals similar tendencies to Turkey and in 2002 a change can be observed in the variables of money supply and price index. The peculiarity of these countries in terms of inflation dynamics is the fact that they are both high-inflation countries.

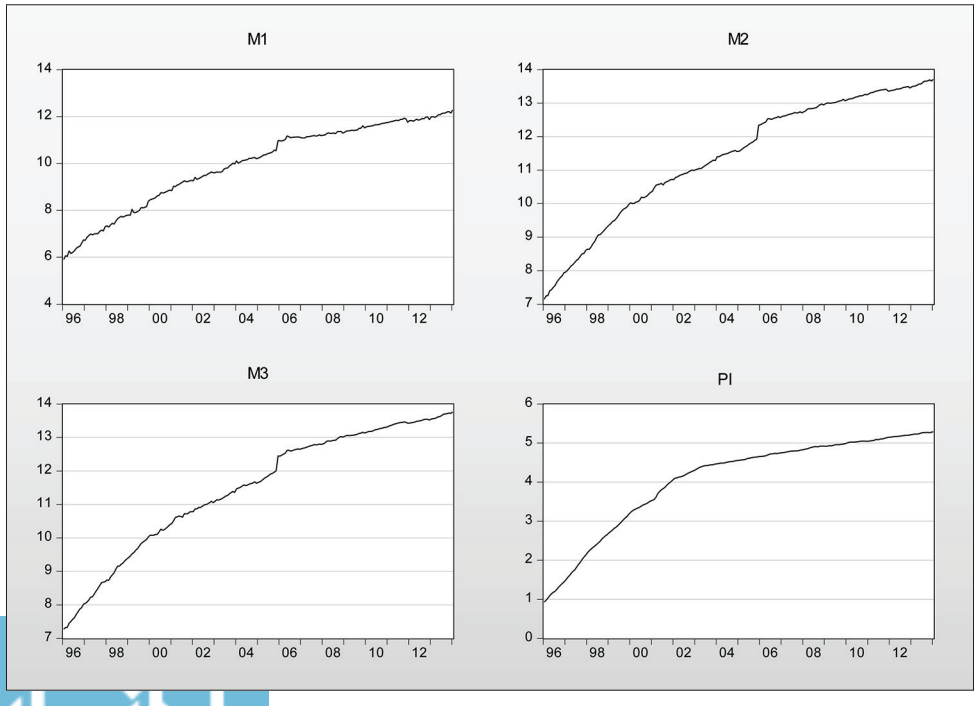
In order to prevent the spurious-regression problem, stationarity tests will be applied for all of the variables. These tests will show whether all variables are suitable for cointegration tests with structural breaks or not. The first stationarity test will be applied to all the variables by intercept with trend models of the augmented Dickey-Fuller test (ADF) (Dickey and Fuller, 1979; 1981). The assumption of the ADF test is that residuals are white noise. Philips–Perron (PP, 1988) test considers the heteroscedasticity problem of the residuals. In order to integrate the structural breaks in the series, the Lagrange multiplier (LM) tests developed by Lee and Strazicich (L–S) (2001; 2003) will be used in unit root tests. This test is based on the LM unit root test suggested by Schmidt and Phillips (1992) and stationarity is tested by breaks in the constant and trend according to Models A and C of Perron (1989).

Table 1: Variables and their sources, definitions and characteristics

Country	Variables	Definition	Sources, time interval and frequencies
Turkey	*PI*	2003=100	IMF-IFS CD-Room 2010,
		CPI: All country	CBRT (http://evds.tcmb.gov.tr/)
			1996:01-2014:01, monthly
	*M*1	National	
	*M*2	currency	
	*M*3		
Brazil	*PI*	2005=100	IMF-IFS CD-Room 2010,
		CPI: All country	Banco Central do Brasil (https://www.bcb.gov.br/)
	*M*1	National	1996:01-2013:12, monthly
	*M*2	currency	
	*M*3		

PI: Price index, CBRT: Central Bank of the Republic of Turkey, CPI: Consumer price index

Figure 1: Price index and money supply in Turkey



After the unit root tests, Bai and –Perron (1998a ;1998b) methodology will be used to determine the structural change between money supply and price in linear regression models. The G–H cointegration test with regime and trend shift model will firstly be applied in order to determine the structural breaks in the money supply-price cointegration relationship. Since the G–H test's (Gregory and Hansen,1996a; 1996b) multiple breaks have a low power for the cointegration relationship, the methodology of Arai and Kurozumi (2007) and Kejriwal and Perron (2008; 2010) will be used. For the coefficient estimates the K–P test will be applied to the money supply-price index relationship for Brazil and Turkey. The common feature of all tests is their ability to determine the breaks in cointegration relationships for unknown dates. The reason for applying the K–P methodology is the fact that cointegration analysis can reveal the long-term relationship between the variables and that the money-prices relationship is stable in the long-run according to the monetarist approach.

Kejriwal and Perron (2008; 2010) presented a new sequential procedure which gives consistent estimation of the number of breaks and obtains the null hypothesis of no structural breaks in a general model which admits both $I(0)$ and $I(1)$ regressors together with multiple breaks. Kejriwal and Perron (2008) developed a procedure that permits one to test the null hypothesis of, say, k changes, versus the alternative hypothesis of $k + 1$ regime shift. Kejriwal (2008) expands the cointegration test with the known or unknown structural change tests presented by A–K to analyze multiple structural breaks under the null of cointegration. This analysis, the time of structural changes in the cointegration relationship, and the coefficients of the regime introduced a methodology that offers internally. In order to test the multiple breaks in the cointegration relationship, test statistics of $SubF_T$, *SEQ* and *UD*max are developed.

3.2. The Unit Root and Co-integration Test Results

The results of the ADF and PP tests given in Table 2 shows that the data are mostly stationary in the first differences. The only exception is the PI variable for Turkey in the ADF and PP tests, which is in the level stationary.

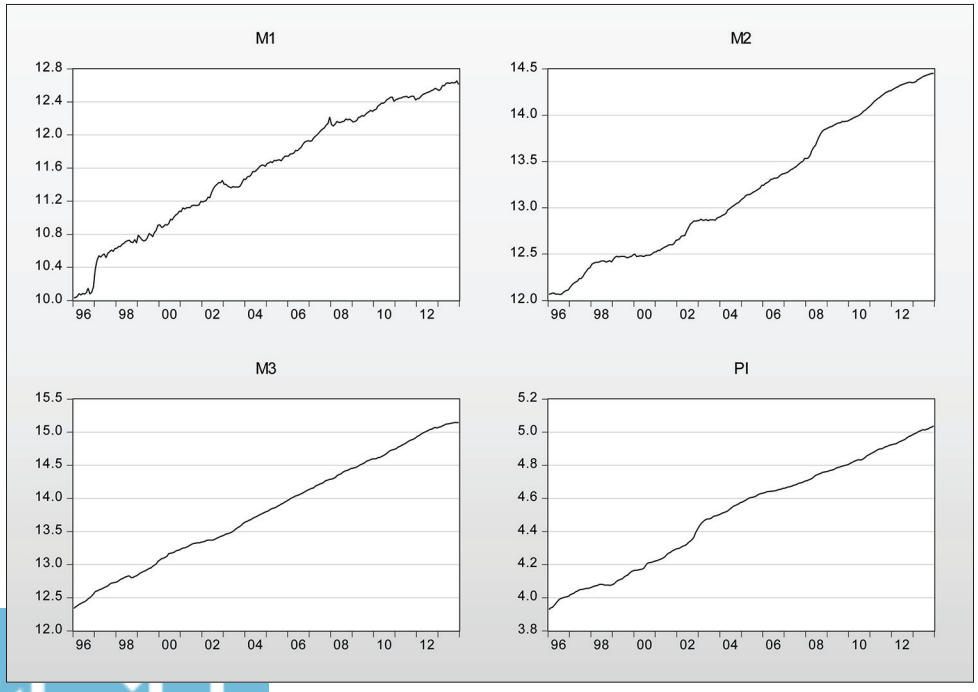
Table 3 presents the L–S test results. The null hypothesis was accepted for both countries and all of the variables. In other words, under the assumption that there are breaks in the series, the results show that they are not stationary in the level. The break dates obtained for the price index in Turkey and Brazil correspond to the periods of IT strategy, while the breaks in money supply correspond to both IT strategy and the 2008 global crisis. When the ADF, P–P, and L–S test results are evaluated together, it is seen that the variables fit for the K–P co-integration test. The unit root test results also show that the policy implementation has an impact on price

Table 2: ADF and PP statistics for testing for a unit root

Variables	ADF tests		PP tests	
	Level	First differences	Level	First differences
Turkey				
*M*1	−1.88 (1)	−20.04 (0)*	−2.26 (4)	−20.44 (2)*
*M*2	−2.45 (0)	−15.45 (0)*	−2.48 (3)	−15.43 (4)*
*M*3	−2.19 (0)	−15.20 (0)*	−2.22 (1)	−15.19 (3)*
PI	−4.36 (1)*	−6.43 (0)*	−4.49 (9)*	−6.29 (1)*
Brazil				
*M*1	−2.31 (0)	−13.27 (0)*	1.34 (9)	−6.70 (3)*
*M*2	−2.00 (3)	−5.16 (2)*	−1.89 (9)	−10.47 (8)*
*M*3	−2.30 (1)	−10.43 (0)*	−2.60 (7)	−10.46 (3)*
PI	−1.56 (1)	−6.77 (0)*	0.95 (7)	−6.08 (2)*

All the series were tested by intercept and trend models. An asterisk (*), two asterisk (**) and number sign (#) respectively that the unit root null is rejected at the 1%, 5% and 10% level, using MacKinnon (1991) critical values. The numbers in parentheses indicate lag lengths for the ADF test and bandwidths for the PP test. ADF: Augmented Dickey-Fuller test, PP: Philips–Perron

Figure 2: Price index and money supply in Brazil



index in the long-run and there is policy efficiency regarding the price index.

3.3. The Structural Break and Co-integration Test Results

In tests on structural breaks, the null hypothesis is that there is no structural break for long-term relationships. The results of this test are given in Table 4. The results show that there are break dates for both Turkey and Brazil for the $PI = f(M1)$ model. All test on the structural breaks show evidence in favor of the presence of breaks.

Tables 5 and 6 give the results of the G–H, A–K and K–P cointegration test results. Table 6 indicates that for the G–H test the break dates for Turkey are 2002, 2004 and 2006 while it is 2002 for Brazil. For Turkey, the G–H test was statistically significant only for the $PI = f(M2)$ model. On the other hand, none of the models were statistically significant for the Brazil G–H tests. There are three breaks for Turkey in the $PI = f(M1)$ model according to the A–K cointegration results. The model is statistically meaningful with 10% significance level. The second and third break dates (1999:11 and 2003:5) correspond to the exchange rate based stabilization program and IT strategy respectively. The A–K test gives similar results for Brazil and with two breaks for the $PI = f(M1)$ model (1998:11 and 2002:8). These dates correspond to the currency crisis of 1999 and the results of the IT strategy. For this model, structural breaks are meaningful with a 10% significance level. No statistical significance was determined for the other models.

Table 3: L–S unit root test results

Country	Variables	Lags	Break dates	Test statistics	Critical *t* values
Turkey	*M*1	6	2002:01 2006:09	−4.90	−5.67
	*M*2	2	1999:03 2008:02	−4.27	−5.74
	*M*3	6	1999:05 2008:02	−2.74	−5.74
	PI	5	1999:01 2003:03	−3.47	−5.59
Brazil	*M*1	5	1997:01 2007:04	−5.44	−5.74
	*M*2	7	2000:04 2005:03	−5.60	−5.74
	*M*3	8	2002:03 2012:01	−4.28	−5.65
	PI	8	2002:07 2006:09	−4.31	−5.67

Critical *t* values are provided for the 5% significance level. These values were taken from Lee and Strazicich (2001; 2003). L–S: Lee–Strazicich

Table 4: Multiple structural break test results with regime and trend shift model (z_t=2, q=0, P=3, h=30, M=3)

Model and country	*SubFT*			*UD* max	*BIC*	*LWZ*
	T					
	1	2	3			
Turkey						
$PI=f(M1)$	15.59	41.56	7.37	41.56	3	3
$PI=f(M2)$	7.94	2.31	3.04	7.94	2	2
$PI=f(M3)$	7.56	2.17	1.18	7.56	3	3
Brazil						
$PI=f(M1)$	6.37	27.65	14.84	27.65	3	3
$PI=f(M2)$	0.94	1.80	3.93	3.93	3	3
$PI=f(M3)$	0.42	0.75	1.37	1.37	3	3

*,**,***,#Respectively that the unit root null is rejected at the 1%, 5% and 10% level, critical values are available on Kejriwal-Perron website, trending case with q_b=1. (q): The number of the I (1) variables, (p): The number of the I (0) variables, the allowed to change across regimes, (h): The minimum number of observations in each segment, (M): The maximum number of breaks, (T): Break number, K–P: Kejriwal–Perron

According to the K–P cointegration results in Table 6, there are three breaks in the A–K cointegration test in the $PI = f(M1)$ model for Turkey. According to this model, slope coefficients decrease for Turkey during the years of the IT strategy. However, the opposite is true for Brazil and other tests also reveal similar results. There is a structural break in 2002 in the money supply-price relationship for Brazil according to K–P, G–H and A–K cointegration tests. The same break took place in Turkey in 2001 and 2003. There are three breaks in Turkey for the $PI = f(M1)$ model. The first regime shift corresponds to the exchange rate based stabilization program of 1999:12. When the estimated coefficients of the first and second regimes are compared, no significant change is observed. The second break corresponds to the implicit IT strategy period of 2003:3. There is a high estimated coefficient slope with the third regime. The third break corresponds to the full-fledged IT strategy of 2005:11.

For the high inflation period, the $M1$–price relationship is almost the same for the K–P test after the IT strategy. The K–P test results are evaluated by regimes as follows. The results for Turkey Model (1) are shown in Table 6. The K–P technique is applied to test for cointegration between the variables. This determines whether a long-term relationship exists between the price index and $M1$, $M2$, $M3$ money supply. According to the $PI = f(M1)$ model and K–P test result, under the three breaks assumption, the money-prices relationship is stronger in Brazil in the first and last regimes. Estimates for different slope coefficients for Brazil and Turkey in the money-price relationship are compatible with the findings of Dwyer and Fisher (2009), De Grauwe and Polan (2005) and Basco et al. (2009). The findings of these studies show that money-price relationship is strong for high-inflation countries while it is weak for the low-inflation ones.

4. CONCLUSIONS

Financial liberalization enabled LDCs to utilize portfolio investments to resolve their external financing requirements. LDCs need to minimize interest rate, exchange rate and inflation risk in order to attract portfolio investments to the domestic markets to reduce the saving gap. For this reason, central banks have determined price stability as the main objective of monetary policy. One of the common strategies of central banks to achieve price stability is IT strategy, which has managed to decrease inflation rates in countries with chronic inflation problems. This situation leads to the hypothesis that the IT strategy creates structural breaks in monetary inflation (i.e., money-price relationship). To evaluate this hypothesis, the econometric analysis method should take structural changes into account. In particular for LDCs which have experienced structural reforms and economic crises such as

Table 5: G–H and A–K cointegration tests results for Turkey and Brazil

Model and country	G–H			A–K								
				One break		Two breaks			Three breaks			
	χ^2_{ar}	Z_α	ADF_t	$\tilde{V}(\hat{\lambda})$	$\hat{\lambda}$	$\tilde{V}(\hat{\lambda})$	$\hat{\lambda}$	$\hat{\lambda}$	$\tilde{V}(\hat{\lambda})$	$\hat{\lambda}$	$\hat{\lambda}$	$\hat{\lambda}$
Turkey												
PI=*f*(*M*1)	−4.92 (2004:7)	−41.35 (2004:1)	−4.53 (2004:1)	0.07	0.08 (1997:4)	0.09	0.08	0.22 (1999:11)	0.11#	0.08	0.22	0.41 (2003:5)
1%	−6.02	−69.37	−6.02	0.44		0.36			0.18			
5%	−5.50	−58.58	−5.50	0.26		0.20			0.11			
10%	−5.24	−53.31	−5.24	0.20		0.14			0.08			
PI=*f*(*M*2)	−4.00 (2002:4)#	−35.38 (2006:1)	−4.35 (2006:1)#	0.09	0.08 (1997:4)	0.10	0.07	0.32 (2001:9)				
1%	−6.02	−69.37	−6.02	0.45		0.27						
5%	−5.50	−58.58	−5.50	0.26		0.15						
10%	−5.24	−53.31	−5.24	0.19		0.11						
PI=*f*(*M*3)	−4.44 (2006:1)	−36.89 (2006:1)	−4.16 (2002:4)	0.08	0.07 (1997:3)	0.06	0.07	0.32 (2001:9)				
1%	−6.02	−69.37	−6.02	0.46		0.27						
5%	−5.50	−58.58	−5.50	0.27		0.15						
10%	−5.24	−53.31	−5.24	0.20		0.11						
Brazil												
PI=*f*(*M*1)	−3.02 (2002:6)	−19.90 (2002:6)	−3.41 (2007:7)	0.09	0.16 (1998:11)	0.10#	0.16	0.36 (2002:8)				
1%	−6.02	−69.37	−6.02	0.45		0.21						
5%	−5.50	−58.58	−5.50	0.26		0.13						
10%	−5.24	−53.31	−5.24	0.19		0.10						
PI=*f*(*M*2)	−2.97 (2002:6)	−18.22 (2002:6)	−3.940 (2002:3)	0.11	0.19 (1999:6)	0.06	0.19	0.37 (2002:9)				
1%	−6.02	−69.37	−6.02	0.36		0.21						
5%	−5.50	−58.58	−5.50	0.21		0.13						
10%	−5.24	−53.31	−5.24	0.15		0.10						
PI=*f*(*M*3)	−4.52 (2002:8)	−40.42 (2002:8)	−4.67 (2002:03)	0.06	0.24 (2000:3)	0.08	0.24	0.36 (2002:7)				
1%	−6.02	−69.37	−6.02	0.34		0.22						
5%	−5.50	−58.58	−5.50	0.20		0.14						
10%	−5.24	−53.31	−5.24	0.14		0.10						

For all series, regime and trend shift were tested according to the model. Numbers in parentheses show the dates of regime shifts in cointegration relationship. *,**,#The breaks are accepted as meaningful at the 1%, 5% and 10% significance levels respectively. Critical values are acquired by simulations using 100 steps and 2500 replications. G–H: Gregory–Hansen, A–K: Arai–Kurozumi

Table 6: K–P cointegration test results for Turkey and Brazil

Model and country	Information criteria and break number		Constants				Slope coefficients				Break date (s)		
			c_1	c_2	c_3	c_4	δ_1	δ_2	δ_3	δ_4	$\hat{\lambda}_1$	$\hat{\lambda}_2$	$\hat{\lambda}_3$
Turkey													
PI=*f*(*M*1)	SEQ	0											
	LWZ	3	−5.14*	−5.49*	1.42*	−0.929	1.005*	1.022*	0.30	0.513	48	87	119
	BIC	3	(0.143)	(0.143)	(0.143)	(0.586)	(0.143)	(0.143)	(0.143)	(0.389)	[1999:12]	[2003:03]	[2005:11]
PI=*f*(*M*2)	SEQ	2	−4.867*	−1.075*	−1.331		0.819*	0.489*	0.485		66	119	
	LWZ	2	(0.142)	(0.120)	(0.369)		(0.158)	(0.144)	(0.349)		[2001:06]	[2005:11]	
	BIC	2											
PI=*f*(*M*3)	SEQ	1	−5.272*	0.485*			0.851	0.344			69		
			(0.168)	(0.168)			(0.117)	(0.133)			[2001:09]		
	LWZ	3	−5.108	−8.420	0.683*	−1.540	0.833*	1.150*	0.333	0.498	56	87	118
	BIC	3	(0.144)	(0.194)	(0.165)	(0.682)	(0.194)	(0.112)	(0.862)	(0.328)	[2000:08]	[2003:03]	[2005:10]
Brazil													
PI=*f*(*M*1)	SEQ	1	0.835*	−0.227			0.306	0.411			80		
			(0.020)	(0.056)			(0.015)	(0.039)			[2002:08]		
	LWZ	3	2.451*	−0.272*	0.582*	−3.515*	0.152*	0.407*	0.343	0.676	35	82	176
	BIC	3	(0.029)	(0.018)	(0.116)	(0.054)	(0.025)	(0.029)	(0.119)	(0.405)	[1998:11]	[2002:10]	[2010:10]
PI=*f*(*M*2)	SEQ	0											
	LWZ	3	0.370*	−2.556*	0.208*	−0.878*	0.299*	0.540*	0.333	0.407	43	82	146
	BIC	3	(0.039)	(0.032)	(0.261)	(0.138)	(0.041)	(0.032)	(0.314)	(0.148)	[1999:7]	[2002:10]	[2008:2]
PI=*f*(*M*3)	SEQ	0											
	LWZ	3	0.415*	−4.728*	−0.340	−0.281	0.286*	0.677*	0.356	0.349*	49	80	124
	BIC	3	(0.021)	(0.022)	(0.110)	(0.120)	(0.027)	(0.016)	(0.330)	(0.049)	[2000:1]	[2002:8]	[2006:4]

The numbers in parentheses are standard errors. The numbers in square parentheses indicate regime shift dates. *The estimated coefficients are statistically significant

Turkey and Brazil, these methods are crucial for determining the success of the implemented policies.

In order to test the above hypothesis, a two-stage strategy was applied. In the first stage, two countries with similar political and economic structures and chronic inflation, namely Turkey and Brazil, were examined with unit root tests. The unit root tests applied in the study show that the variables of money supply and prices are difference-stationary. This situation implies that the variables have a long memory process and that there is policy efficiency. The LS unit root test results show that the break dates coincide with the IT strategies. The fact that all variables are difference-stationary reveals the appropriateness of the K–P cointegration tests for the analysis.

In the second stage, Turkey and Brazil were examined with K–P cointegration tests. The tests show that in both countries there are structural breaks in money supply-price relationship as a result of the IT strategy. The tests show that the money supply-inflation relationship weakens for Turkey and strengthens for Brazil with the IT strategy. This situation implies that there can be a unique coefficient for stable and low inflation and the money supply-prices relationship. After the regime change, the relationship gains persistency and this shows that the IT strategy creates a structural break in the money supply-price relationship. The reason for this situation is that the IT strategy contains various macroeconomic variables in addition to the money supply as a nominal anchor. This situation creates flexibility for disinflation policies which increases their credibility and chances of success. The findings of the study show that the money-price relationship claimed by monetarist economics depends on the IT strategy in terms of long-term stability. After IT, while slope coefficient increased in Brazil, it decreased in Turkey and this means that it constitutes a threshold for inflation stability. Consequently, IT strategy is a successful strategy for monetary policy in developing countries because it causes a structural break in inflation. Therefore, the IT strategy can be applied as a monetary policy strategy to reduce inflation.

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