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Cointegration and Granger Causality tests on Spanish and German Consumer Prices

Anna Saiti
Harokopio University

Abstract

This paper employs cointegration and Granger causality tests to determine a relationship between the Spanish and the German inflation for the sample period 1976:1-1999:4 employing quarterly data. The results suggest that there is a bi-directional causality between German and Spanish inflation for the entire period as well as for the first sub-period. In the second sub-period (1986:1-1999:4) there was a stronger influence of German on Spanish prices in the short run than in the long run. This implies that not only Germany has a substantial influence on Spain, but also Spain's inflation affects Germany in a significant way. Thus, Germany can be considered as an influential country, which plays a significant role in the EU.

Keywords: Inflation; Cointegration; Causality; German Dominance
JEL Classification: C32, E31

1. Introduction.

The member countries of the European Union have not arguably different "inflation culture". The European Central Bank offers "stability regime, to be supplemented with public attitudes towards the goal of price stability in explaining inflation differentials among countries.." (Hayo, 1998:244). 'Thus, the analysis provides the intellectual underpinnings for the Maastricht decision to institute a European central bank which is a close copy of the Bundesbank (political independence, price stability as the sole objective of monetary policy)" (De Grauwe 1996:1094-1095). The possible relationship between inflation rates among the European countries and Germany as the leader in the European Union (EU) has gained momentum.

The top priority of the monetary authorities in the countries of the European Union is to keep inflation down. In particular, countries such as Italy, Spain and Portugal are forced to keep inflation down and it is likely that the

monetary authorities in these countries will follow the same low inflation as the German authorities (De Grauwe 1996). "German Dominance Hypothesis (GDH) claims that the pattern of monetary policy interaction in the EMS is highly restrictive and hierarchical and the scope for independent action by EMS members other than Germany is very limited" (Hagen & Fratianni, 1990: 363). Inflation forecast, inflation uncertainty and other different versions of inflation rate are discussed, based on different econometric methods, by Freeman (1998), Hwang (2001), Hayo (1998), Le Bihan & Sedillot (2000), Svensson (2000), etc, among others.

Consumer price index usually adopted by economists as the fundamental variable for the analysis of inflation because it contains the prices of goods and services. Given that a) price stability is the main target of the member countries and many Central Banks, such as the Spanish one pursuing policies so as to sustain low level of inflation and b) German policy have significant effects on most of the monetary variables of the member countries, the prime focus of this paper was to discover whether German prices, as a measure, affect Spanish consumer prices. The countries included in the sample (Spain and Germany) are currently members of the EU, and were particularly because it may had been interesting to compare "the leading" country, Germany, with one of the "peripheral" countries such as Spain. Spanish economy is smaller in economic size than the German one and has experienced a lot of shocks during the entire sample period, while the disinflation process had begun earlier than its entry in the EU. However, a country that has a different inflation history from the other European countries, "did not behave very differently from the other European economies" (Barros & Garoupa 1996:549). Attention has focused on examining systematically the relationship, using cointegration and error-correction techniques, between the Spanish consumer price index (SCPI) as our measure of inflation and the German consumer price index (GCPI).

The quarterly data we used is taken from the International Financial Statistics. The sample period the period 1976:1-1999:4 has been split up into two sub-periods: a) 1976:1- 1985:4 before the entry of Spain into the European Union and b) 1986:1-1999:4 after Spain became a EU member. The ending point of the sample period 1999:4 was selected because it was the time that both countries had at least some degree of autonomy over domestic monetary policy.

In the Spanish economy the continuous process of inflation reduction and the close attainment of inflation targets had begun early in the '80s and that Spanish CPI experienced a high proportion of variations (76.75%) from

1987 (a year after Spain's participation in the EU) (Alvarez, *et.al.*, 1997; Arrazola and De Hevia, 2002). For that reason, the author chose the most important structural breaking point, that is 1986, so as to divide the sample and to investigate the relationship between Spanish and German prices. It is the most important breaking point since after Spain's participation in the EU the direction of the Spanish economy has changed. Besides, the two important disinflation episodes occurred after 1986 as a result of the adopted monetary target: price stability and low rate of inflation.

2. Cointegration and Causality tests of Spanish and German Inflation.

Our econometric approach, in order to investigate the relationship between German and Spanish consumer prices, begins with Johansen's (1991) method. Johansen's test starts with a Vector Autoregressive model (VAR) model, testing the restrictions imposed by cointegration on the unrestricted VAR involving the series and determines the number of cointegrating vectors (Maddala & In-Moo 1998). We first estimate if there is any cointegrating vector among the variables. The lag length is four. The VARs include seasonal dummies. In particular, we test the long run and the short run causality in the context of cointegrated VAR equations. The estimation of Error Correction Term (ECT) corresponds to the long run disequilibrium. If the ECT is statistically significant and has the correct sign then this is referred to as "weak endogeneity". The size of the coefficient determines the speed with which each variable tends to return to its equilibrium. The Johansen and Juselious method is a dynamic approach that has many advantages compared with the Engle & Granger (1987) technique. It is an advantageous method mainly because it treats all the economic time-series variables as endogenous (Hondroyiannis and Papapetrou, 2002; Stamatopoulos, 1999) and tests for cointegrating vectors between the variables in a Vector Error Correction Model (VECM) framework. The number of cointegrating vectors (r) are chosen in the procedure by LR test and the test statistic for cointegration are the trace test and the maximum eigenvalue test. The existence of this model implies that the variables involved in the analysis are unified. This means that at macro level those variables are co-variate or appear to have macro-trends with a stable rate of development (Stamatopoulos, 1999:139).

Given that Granger causality and cointegration can be considered both in an error correction model, we investigate the Granger causalities

from Spanish to German prices and vice-versa[1]. The idea behind causality tests is that they can provide useful information on short-run behavior of past values of German and Spanish prices for the sample period and the sub-periods employed in the analysis.

An appropriate method by Chow (1960) was employed to investigate whether the estimating single equation was justified to describe the relationship between Spanish and German prices throughout the sample period 1976:1-1999:4 or whether the separate equations for the two proposed sub-periods 1976:1-1985:4 and 1986:1-1999:4, respectively, are more appropriate. Chow tests are for stationary variables and a single break. The estimated model that valued to describe the relationship between the independent variables and the Y over the entire sample period follows a linear regression procedure with k variables and two regimes with observations n and n respectively.

2.1 Unit Root Tests

The present variables have all been tested for stationarity. For all the variables a logarithmic form was preferable. The test procedure for stationarity adopted is the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) test that gives different profiles of stationarity. Although the ADF test has less serious size distortions than the PP test, it is less powerful (Maddala and Kim, 1998). However, both tests support the hypothesis that the first difference is adequate to induce stationarity for all variables in the analysis. The delta Δ in front of the variables indicates the first differences. "We express the relationship in first differences, rather than in levels, accounting for the importance of both hysterisis mechanisms... in the inflation rate." (Dolado, *et.al,* 2000:271). In addition, Andres, *et.al.*, (1999) and Sarantis & Stewart (2001) present the unit root tests in first differences rather than in levels. In our case, the first difference though of the Spanish and German prices do appear to be stationary. Table 1 reports the results for each individual variable.

2.2 Cointegration Analysis and Structural Changes

Table 2 reports the results for the cointegrating vectors. The results from Table 2 reports the determination of the number of cointegrating relation r, subject to assumptions made about the trends in the series. All the tests show

[1] A similar methodology is employed by Stamatopoulos (2001) and Hondroyiannis, *et.al.* (2002) in different topics.

the existence of one cointegrating vector in all sample periods at 1% significance level. Thus, the tests show that the variables are moving in the same direction under the effect of a common trend and support the existence of cointegration at 1% significance level.

According to Chow stability tests (1960) it is possible to reject the stability for the entire period due to the presence of structural changes. The Chow tests provide information and confirm that there are breaking points during the whole period. Four possible breaking points can be considered (Table 3): 1979 the date when the second oil shock occurred at the end of that year and provoked supply shocks in the Spanish economy, 1986 the date when Spain joined the EU, 1993 when the first disinflationary period started and was accompanied by a severe recession and high rate of unemployment and 1997 the second structural break of disinflation, only this time it was associated by accelerated rates of growth and a fall in the unemployment rate. Thus, during the whole period the Spanish economy experienced many structural changes and the Chow tests accept the structural breaks in the equation. Analysis and splitting the sample into two sub-periods, according to the second (most important) break point (1986), are confirmed by using Chow stability tests. Thus, it is evident that the Spanish economy had many structural breaking points and thus it was impossible to split the entire sample into such small sub-periods.

Sample Period 1976:1-1999:4 $LSCPI = 1.21\ LGCPI + Z_1$ (1)
(0.32)

Sample Sub-Period 1976:1-1985:4 $LSCPI = 2.40\ LGCPI + Z_1$ (2)
(0.72)

Sample Sub-Period 1986:1-1999:4 $LSCPI = 1.44\ LGCPI + Z_1$ (3)
(0.28)

Notices from equations 1 to 3 that the variable of German prices is not significant. In all sub-samples, prices appear to have relatively close coefficients. However, with the larger coefficient in the second sub-period, Spanish prices appear to be more closely related to the German ones, "but the closeness of the relationship is not sufficient" (Freeman, 1998:145). Until 1995 the inflation differential of Spain and other European members was positive due to the severe recession in 1992-93 and the devaluation of the peseta. However, in 1996-97 Spanish prices succeeded in falling sharply and approached German prices. Thus, perhaps in the second sub-sample the closeness of the Spanish prices to German is associated with the tightening of monetary policy and the decline in inflation.

2.3 Granger Causality Tests.

For each of the sub-sample, we estimated a VAR, the possible weak and strong exogeneity of the CPI in the cointegration relationships. Spanish prices will be caused in the long run by German prices through the error correction term. Results from the error correction VAR of CPI inflation are reported in Table 4 for all the sub-samples.

The opposite signs of the coefficients on the error correction terms insure stability of the system. Spanish and German consumer prices are strong endogenous in all sub-samples since there is a rejection of null hypothesis (H_0: strong exogenous). Thus, German consumer prices affect the Spanish prices and the causality also follows the opposite direction for the whole sample period (1976:1-1999:4). So Spanish monetary policy depends significantly on German policy. The results from the long-run causality test are similar to those obtained by Camarero & Ordonez (2001). According to them there is "a long-run bi-directional causality between Germany and Spain" Camarero & Ordonez (2001:643). Although the approach is similar to their work, the present paper differs from Camarero & Ordonez (2001) since attempts to test German and Spanish consumer prices, a different version of the German Dominance Hypothesis, by using cointegration analysis. Additionally our paper examines the possible causality for the period 1976-1999, before and after Spain's participation in E.U, using quarterly data.

When Spain became a member of the EU, in 1986, the results from the short-run causality indicate that there is a high degree of dependence on German consumer prices. In the second sub-period (1986:1-1999:4) there is a uni-directional causality from Germany to Spain. In contrast, in the first sub-period (1976:1-1985:4), that was before Spain joined the EU, the country was able to influence German consumer prices.

3. Discussion of the Empirical Evidence.

The dependence of Spain on German prices (after Spain's participation) is more likely to have resulted from a strong commitment to be part of the European Monetary System (EMS) from the start and the adjustment of fiscal policy to the primary goal of disinflation. Although the initial vision of the EMS was to leave the member countries to choose their own rate of inflation and to follow their domestic monetary policy, this vision was rejected since the Bundesbank dominated the EMS (German Dominance Hypothesis). Member-countries' monetary policy was committed to the leadership of the

Bundesbank. Giavazzi and Pagano (1988) stated that regarding inflation target the EMS allowed member countries to "borrow" reputation from the Bundesbank and thus by pegging their exchange rate to the German currency, they could increase their credibility of their own monetary policy. Price adjustment in member countries of the EMS was influenced by the exchange rate mechanism (Sobczak, 1998). Commitment to lower equilibrium inflation rate and the linking of domestic currencies to the Deutsche-mark, reduced the disinflation costs relative to the implementation of independent monetary policies (Von Hagen and Fratianni, 1990). Whenever fiscal policy is not consistent with disinflation target then the exchange rate pegging does not necessarily provide credibility. However, Spanish fiscal policy was consistent with the disinflation target (two disinflation periods during the second sub-period) and thus, the participation of the country in the EMS may have enhanced credibility. Besides, McNelis and Asilis (2002) found that German central bank rates were important for France and Italy but it was more important for Spain. The co-existence of price stability with a flexible labor market, favorable competitiveness and a reduction in interest rates was strongly associated with the effective implementation of monetary and economic policy. Inflation differential narrowed between Spain and the euro-area due to Spain's participation in the EMU.

Von Hagen and Fratianni (1990) tested the German Dominance by estimating a set of equations for eight European Countries (Belgium, Luxemburg, Denmark, France, Ireland, Italy, the Netherlands and the UK). The results showed that German monetary policy is not independently implemented and certainly Germany is not the anchor of monetary policy. Results also demonstrated that German policy has significant impact on Belgian, French and Italian policy and the reverse was also true. More specifically the author claimed that before 1983 Germany was the least dependent member-country and after 1983 this relative independence had been reduced.

Thus, regarding the sub-period (1976:1-1986:4) bi-directional causality can perhaps be attributed to the rejection of German Dominance since Germany was an important leader but certainly not the dominant one, especially before Spain participated in the EU. Of course Von Hagen and Fratianni (1990) have not tested the German Dominance on the Spanish Economy but they did so for the Italian one, an economy that exhibited (and continues to do so) similar characteristics with the Spanish one.

Another possible reason for the results of the first sub-period may be that causality, as implied by economic literature, did not perform as expected through the causality test, perhaps due to "inverse causality". As Hernandez-

Iglesias and Hernandez-Iglesias, (1981) showed that Grangers causality tests and economic theory have certain differences and that further work is required since Granger's causality tests "in general and independence results in particular, far from being uninformative, provide testable restrictions to screen and refute alternative structural relationships" (1981:262).

Moreover, Spanish consumer prices is calculated by using the Laspeyers formulae[2] and it is an index of the welfare level (Abadia, 1986). The same author found that for the period 1976-1984 (the same sample sub-period employed in the present paper) changes in consumer prices were consistent with changes in the welfare distribution of consumers. "Inflationary pressures are mainly caused by distortions in the distribution mechanism" (Ballabriga, *et.al.*, 1993:101). More particularly, the author stated that Spain experienced an evolution with three breaking points in that period. The first breaking point was in 1976-1978, the second sub-period includes 1979 and finally the third was between 1980-1984.

Additionally, Spanish monetary authorities, at least for this particular sub-period, were "driven by" cost-push inflation and that the rapid growth in prices was due to non-monetary origins (Hernandez-Iglesias and Hernandez-Iglesias, 1981). Thus, Spanish rates of growth in consumer prices were not influence by the existence of monetary mechanisms. "Money does not have predictive value to anticipate the rates of inflation...." (Hernandez-Iglesias and Hernandez-Iglesias, 1981:261). If that is true then it can be concluded that Spanish prices are determined by non-monetary mechanisms such as production sectors and export and import price equations.

On the other hand, Stamatopoulos (1999) stated that Herd in 1987 estimated the export and import price equations for eight countries, including Germany in the sample. Results showed that competitive prices explained for the 35% in the variability of export prices. Certainly the stronger the economy under consideration the less the impact of competitive prices on the formation of export prices. However, it was found that competitive prices of "smaller" (less strong economically) countries, such as Spain, seem to work as price makers. As far as the import prices is concerned it was found that only 25% of the their variability can be determined by domestic prices. They are mainly determined by the exchange rate and the production cost. Thus, it

[2] Laspeyers index ignores the composition and the changes in the composition of the consumer's basket of goods. For more information see Abadia, A. (1986). Inflation, Relative Prices and Welfare Redistribution in Spain, 1976-1984. Economics Letters, 20(4), 387-390.

seems that Spanish prices are able to affect the prices of the main importers of Spanish goods and services and vice-versa.

Spanish sales to Euro-area markets (Germany) -markets with different sizes- increased and especially to Germany remained unchanged although there was a slight slowdown on the demand side. In terms of trade, Spain preferred to have partners from the EU instead of the US market (Winters and Chang, 2000). Perhaps the consistency in Spanish sales was attributed to the rise in tourism (service sector), which "translated into a larger influx of tourists from France and Germany" (Annual Report of Banco de Espana, 1998:62). The Spanish market is large enough and in particular, German exports to Spain appeared to remain stable and even gained ground after the country's participation in the EU in 1986 (Casella, 1996). Besides, Spanish exports to the EU is a fact since before 1986, a main obstacle for Spain was the non-tariff barriers for import goods and that obstacle continued to exist, to some degree, even after 1986. Therefore, it is true that Germany and Spain had and continued to have trade relationships and it is tempting to conclude that due to export and import price equations Spain appears to have had an influence on German prices and the reverse.

From the empirical analysis the following conclusions can be drawn:

1. The results imply the Granger endogeneity of both countries' consumer prices employed in the analysis.
2. There is an inter-dependence of the countries considered in the paper. Thus, bi-directional causality is found between Spanish and German prices for the whole sample period and the first sub-period (1976:1-1985:4).
3. After Spain's participation (second sub-period) in the E.U. there was a stronger influence of Germany on Spanish prices in the short run than in the long run. Spanish consumer prices seem to be acting dependently of the second sub-period employed in the estimation. Since Spain remained in the EMS discipline it was not able to gain independence in the implementation of its monetary policy from the Bundesbank.

4. Conclusion

The present paper attempts to identify by using cointegration tests and Granger causality any influence of German consumer prices over Spanish prices for the periods, 1976:1-1999:4, 1976:1-1985:4 and 1986:1-1999:4. The results are favorable to a stable cointegration system. There is a wide

acceptance that German inflation had a substantial influence on the Spanish one. Results indicate the existence of strong Granger causality from German to Spanish inflation for all the sub-periods in the long and short run. However, strong long and short run causality has been identified from Spanish to German inflation (the leading country). Thus, it is reasonable to conclude that although small (from the economic point of view) countries, such as Spain, Portugal, Greece, etc., applied strict disinflationary policies (De Grauwe, 1996) using German strategy, there is an interdependence among countries of the EU.

Since Spanish CPI is an aggregated measure[3] (contains too many components) and the Spanish economy experienced a large number of many structural changes and shocks during the sample period, a longer data series and a more disaggregated analysis is possibly needed to provide more information and to confirm the results of the present study. Moreover, the study of price effects is also required so as to allow us to have a complete picture of the effects of the member countries.

This cross-influence among countries of the EU sometimes even comes from small countries (Camarero & Ordonez, 2001). Germany can be considered as an influential country and plays a significant role in the EU, however, due to monetary and financial integration it is not easy to accept the existence of dependence on German monetary policy.

[3] For more information see Alvarez, L.J, Delrieu, J.C., and Jareno, J. (1997). Restricted Forecasts and Economic Target Monitoring: An Application to the Spanish Consumer Price Index Journal of Policy Modeling, 19(3), 333-349 and Sobczak, N. (1998). Disinflation in Spain: The recent experince. Working Paper No 98/106, IMF.

Table 1. Unit Roots Tests for each individual country

	Augmented Dickey-Fuller				Phillips-Perron					
	Sample Period 1976q1-1999q4				Sample Period 1976q1-1999q4					
	Spain		Germany		Spain			Germany		
Variables	τ_μ	τ_τ	τ_μ	τ_τ	τ_μ	$\tau_{\tau\alpha}$	κ	τ_μ	τ_τ	κ
ΔLSCPI	-4.32	-8.69	-	-	-3.59	-8.60	4			
ΔLGCPI	-	-	-5.92	-6.48				-6.26	-6.87	3
	Sample Period 1976q1-1985q4				Sample Period 1976q1-1985q4					
Variables	τ_μ	τ_τ	τ_μ	τ_τ	τ_μ	$\tau_{\tau\alpha}$	κ	τ_μ	τ_τ	κ
ΔLSCPI	-3.84	-6.24	-	-	-3.61	-6.06	3			
ΔLGCPI	-	-	-3.66	-3.74				-4.19	-4.21	3
	Sample Period 1986q1-1999q4				Sample Period 1986q1-1999q4					
Variables	τ_μ	τ_τ	τ_μ	τ_τ	τ_μ	$\tau_{\tau\alpha}$	κ	τ_μ	τ_τ	κ
ΔLSCPI	-6.10	-9.05	-	-	-6.21	-8.92	3			
ΔLGCPI	-	-	-5.41	-5.36				-5.74	-5.42	3

Note: The estimating equation of first differences that test the null hypothesis of a unit root, using OLS is:

$$\Delta y_t = \alpha + \rho y_{t-1} + \Sigma j_{=1} \beta_j \Delta y_{t-j} + e_t$$

τ_μ is the t-statistic for testing the significance without time trend in the above equation and τ_τ is the t-statistic for testing the significance with time trend included in the equation. The critical values for N= 90 (sample period 1976q1-1999q4) at 1% is –2.89 for τ_μ and –3.45 for τ_τ respectively. For N= 34 (sample period 1976q1-1985q4) at 1% the critical values is –

2.94 for τ_μ and –3.54 for τ_τ respectively. For N= 54 (sample period 1986q1-1999q4) at 1% the critical values –2.91 for τ_μ and –3.49 for τ_τ respectively. It should be noted that the critical values for Dickey Fuller test are obtained from augmented Dickey Fuller statistic. *** denotes that the variable is stationary at 1% level of significance. ** denotes that the variable is stationary at 5% level of significance. * denotes that the variable is stationary at 5% level of significance. The critical values for the PP unit root tests are obtained from MacKinnon k denotes the truncation lag.

Table 2: Testing for Cointegration using Johansen's method

Variables : LSCPI LGCPI VAR = 4 Sample Period: 1976q1-1999q4				
Null Hypothesis	Hypothesis 1	Likehood Ratio	Critical Values	
			1%	5%
r= 0	r=1	37.01**	14.88	12.98
r< 1	r=2	3.42	8.07	6.50
LSCPI = 1.21 LGCPI+ Z_1				

Variables : LSCPI LGCPI VAR = 4 Sample Period: 1976q1-1985q4				
Null Hypothesis	Hypothesis 1	Likehood Ratio	Critical Values	
			1%	5%
r= 0	r=1	26.65**	18.33	16.28
r< 1	r=2	0.02	11.54	9.75
LSCPI = 2.40 LGCPI +Z_1				

Variables : LSCPI LGCPI VAR = 4 Sample Period: 1986Q1-1999Q4				
Null Hypothesis	Hypothesis 1	Likehood Ratio	Critical Values	
			1%	5%
r= 0	r=1	25.18**	18.33	16.28
r< 1	r=2	0.75	11.54	9.75
LSCPI = 1.44 LGCPI+ Z_1				

Note: r denotes cointegrating vectors. To test the null hypothesis of r cointegrating vectors versus the alternative hypothesis is by comparison with the critical values of the Johansen test.

** denotes rejection of null hypothesis at 1% significance level. * denotes rejection of null hypothesis at 5% significance level.

Table 3: Chow stability tests (1960)

Estimating equation lscpi lgcpi using OLS		
Breaking Point	F-statistic	Log Likelihood Ratio
1979	117.60 (0.00)	77.90 (0.00)
1986	238.68 (0.00)	121.33 (0.00)
1993	49.83 (0.000	40.83 (0.00)
1997	15.13 (0.00)	14.33 (0.00)

Note: The probabilities are in parenthesis. The Chow stability test is testing the null hypothesis of parameter constancy against the alternative of a known break point a priori under the assumption of constant variances.

Table 4: Error-correction VAR of CPI inflation of both countries

Right Hand Side Variables 1976q1-1999q4						
Equation	R^2	ΔSCPI	ΔGCPI	ECT	ECT Plus ΔSCPI	ECT Plus ΔGCPI
ΔSCPI	0.82		1.33* (0.72)	37.93** (0.00)		245.48** (0.00)
ΔGCPI	0.47	26.77** (0.00)		1.32 (0.25)	28.39** (0.00)	
Right Hand Side Variables 1976q1-1985q4						
Equation	R^2	ΔSCPI	ΔGCPI	ECT	ECT Plus ΔSCPI	ECT Plus ΔGCPI
ΔSCPI	0.80		2.71 (0.43)	19.74** (0.00)		20.50** (0.00)
ΔGCPI	0.70	19.65** (0.00)		1.44 (0.23)	20.84** (0.00)	
Right Hand Side Variables 1986q1-1999q4						
Equation	R^2	ΔSCPI	ΔGCPI	ECT	ECT Plus ΔSCPI	ECT Plus ΔGCPI
ΔSCPI	0.63		9.96** (0.01)	4.33** (0.03)		11.25** (0.02)
ΔGCPI	0.53	2.09 (0.55)		20.85** (0.00)	21.62** (0.00)	

Note: The Wald test is applied to test the non-causality hypothesis. The statistics reported are distributed as chi-squared distribution with degrees of freedom the number of restrictions. The number in the parentheses is the probability. Asterisks denote the level of significance. ** denotes level of significance 1%.

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