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SHORT- AND LONG-RUN LINKAGES BETWEEN EMPLOYMENT GROWTH, INFLATION AND OUTPUT GROWTH: EVIDENCE FROM A LARGE PANEL

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Abstract. This study examines the short- and long-run linkages between employment growth, inflation and output growth applying panel cointegration and causality tests to data for 119 countries over the period 1970–2010. We find evidence of positive Granger causality running from output growth to employment growth in the short run. Employment growth Granger causes output growth with a negative sign in the long run. Inflation Granger causes employment and output growth positively in the short run and negatively in the long run.

Keywords: employment, inflation, output, Granger causality.

JEL Classification: C23, E24, E31, E60.

Introduction

The seminal study by Phillips (1962) stressed the importance for policy-makers of understanding the joint dynamics of employment growth, inflation and output growth in order to improve macroeconomic performance. Whilst numerous papers analyse these variables individually (see, for example, Phillips (1958), Tobin (1997), Targetti (1992), Okun (1981, 1980), Phelps and Zoega (1998), Friedman (1968), Friedman and Schwartz (1971), only a few examine their simultaneous interactions (Scott, McKean 1964), Phelps (1967), Gordon *et al.* (1977), Gordon (1991), Phelps and Zoega (1998), Nickell (1998), Acemoglu and Scott (1994)). As Phillips pointed out (1962), the fact that they are both targets and policy instruments makes knowledge of their relationships even more crucial in order to avoid "overshooting" or "undershooting" of the targeted "equilibrium" values.

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This paper aims to provide new empirical evidence on the linkages between these variables by applying panel VECM techniques and carrying out causality tests in the context of an extensive balanced panel of annual data on prices, employment, and output (in annual percentage changes) from 1970 to 2010 for 119 countries. This is in contrast to earlier papers typically estimating VARs for individual countries or analysing small panels of OECD or EU countries (see Hu 2004; Marelli, Signorelli 2010; Loboguerrero, Panizza 2006; Sill 2011; Lucas, Rapping 1969; Hossain 2005; Arato 2009; Motley 1998). An exception is a previous study by Caporale and Škare (2011) exploring the joint behaviour of employment growth, inflation and output growth in a panel cointegration framework. The present paper expands their analysis by estimating VECM specifications at both panel and individual country level, thereby providing both aggregate and disaggregate evidence; in addition, it also tests for both short- and long-run causality. As in Scott and McKean (1964), it considers a three-variable model, unlike the majority of existing studies that focus instead on the linkages between only two of the variables in question (see Barro 1995; Ewing 1999; Michie, Smith 1997). To preview our results, we find clear evidence of both short- and long-run linkages between the three variables analysed.

The structure of the paper is as follows. Section 1 provides a brief literature review. Section 2 describes the econometric framework and estimation. Section 3 focuses on the Granger causality test results. Section 4 offers some concluding remarks.

1. Literature review

In his famous studies on the UK economy Phillips (1958, 1962) highlighted the importance of analysing the relationships between unemployment, the rate of change of money wage rates and output growth as well. The validity of the unemployment-inflation relationship he detected and its implications for monetary policy were then questioned by Phelps (1967), Phelps and Zoega (1998), Friedman (1968) and Friedman and Schwartz (1971).

Among subsequent studies, Okun (1981) focused on the inflation-unemployment tradeoff faced by policy-makers (see also Tobin 1997, 1987, 1982), whilst Kaldor in Targetti (1992) modelled unemployment as a function of the marginal labour productivity and the associated labour costs (a decrease in marginal labour productivity or an increase in labour costs result in higher unemployment).

Scott and McKean (1964) saw employment and price stability as alternative policy goals (1964). According to Landmann (2004), employment and productivity are strongly and positively correlated over the business cycle in a pro-cyclical way. Marelli and Signorelli (2010) found evidence that high employment growth leads to slower productivity growth in the EU area. Pissarides and Vallanti (2004) reported a positive relationship between TFP growth and employment. Phelps (1994) and Ball and Moffitt (2001) argued that growth has only temporary, short-run effects on employment. Oil shock as found in Çatik and Karaçuka (2012) exert strong influence on inflation dynamics. Inflationary pressures appears to be closely connected with gross average wage dynamics, debt accumulation and consumption growth (Bratu 2012). Linearity and constancy assumption in the augmented Phillips curve model in relation to expected inflation should also be accounted (Šergo *et al.* 2012). The impact of oil shock on prices is studied in Semko (2013) with money – income link examined in Bozoklu (2013) for Turkey.

Barro (2013) presented evidence of the adverse effects of inflation on growth, while Andres and Hernando (1999) found a negative correlation between the two. Bruno and Easterly (1996) found a short- to medium-term negative relationship between inflation and growth but no evidence that discrete inflation jumps harm growth in the long run. Hooker (2002) reported evidence of a backward-looking Phillips' curve for the US, a finding confirmed by Nakov and Pescatori (2010). Only a recent paper by Caporale and Škare (2011) studies the simultaneous relationships between employment growth, inflation and GDP growth in a panel cointegration framework. Similar research exploring scientifically acceptable law of dynamics between output, employment and inflation can be found in Škare (2010).

2. Econometric analysis

We use a balanced panel of annual data on prices, employment, and output (in annual percentage changes) from 1970 to 2010 for 119 countries[1]. These are taken from the USDA International macroeconomic dataset (historical data files) and the Conference board total economy database 2011.

A. Testing for integration (nonstationarity)

As a first step, we check the order of integration of the series using the panel unit root tests developed by Im *et al.* (2003), Pesaran (2004, 2007), Pesaran *et al.* (1999), Pesaran and Smith (1995), Maddala and Wu (1999), Hadri (2000).

Im, Pesaran and Shin (IPS) allow for heterogeneity in ρ_i by adopting the following specification (see also Hurlin, Mignon 2007):

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,y-1} + \sum_{z=1}^{p_i} \beta_{i,z} \Delta y_{i,t-z} + \varepsilon_{i,t}. \quad (1)$$

Maddala, Wu (1999) and Choi (2001) propose a Fisher-type test based on the p-values from the individual unit root tests taking the form (MW):

$$-2\sum_{i=1}^{N}(\ln p_i) \sim \chi^2(2N);$$
$$P_m = \frac{1}{2\sqrt{N}} \sum\nolimits_{i=1}^{N} (-2\ln p_i - 2). \quad (2)$$

[1] The countries included in the panel are the following: Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Bosna & Hercegovina, Brazil, Bulgaria, Burkina Faso, Cambodia, Cameron, Canada, Central African Republic, Chile, China, Colombia, Congo, Democratic Republic of Costa Rica, Cote d'Ivore, Croatia, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Ethiopia, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea South, Kuwait, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mexico, Moldova, Morocco, Mozambique, Myanmar, The Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Pakistan, Peru, The Philippines, Poland, Portugal, Romania, Russia, St.Lucia, Saudi Arabia, Senegal, Serbia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Syria, Taiwan, Tajikistan, Tanzania, Thailand, Trinidad & Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, USA, Uruguay, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia.

Hadri (2000) suggests a different panel unit root test based on the null of stationarity allowing for individual specific variances and correlation patterns. His (H) test takes the form:

$$y_{it} = \delta_{mi} d_{mt} + \varepsilon_{it} . \tag{3}$$

We use Baum's (2001) version of Hadri's test (2000), which is a residual-based Langrange multiplier (LM) test for a unit root in panel data under the null that the observed series are stationary around a deterministic level or a deterministic trend.

The result of the IPS, MW unit root tests are presented in Table 1.

Table 1. Panel unit root tests

Variables	Levels	
	IPS	MW
y	–25.87**	2182**
p	–17.02**	1752**
e	–19.96**	1248**

Notes: Variables in levels, *,** indicate 5%, 1% rejection levels. IPS, MW tests for a unit root. H test of the stationarity null.

IPS and MW (see Table 1) reject the unit root null, whilst the H test (see Table 2) strongly rejects the null of stationarity in the panel for the series in levels but fails to reject for the differenced series.

Table 2. Hadri unit root test

Variables	Levels			First differences		
	(1)	(2)	(3)	(1)	(2)	(3)
y	26.551***	19.476***	14.650***	–12.140	–11.655	20.638
p	20.378***	42.813***	15.095***	–13.102	–8.712	22.979
e	14.703***	38.319***	15.526***	14.703	38.319	15.526

Notes: *,** indicate 5%, 1% rejection levels. Hadri test under the null of stationarity in the model. (1) denotes the homoscedasticity assumption, (2) denotes the heteroscedasticity assumption, (3) denotes the serial correlation assumption.

The ambiguity of the unit root test results arises from the interdependence between the series in the panel. As shown by O'Connell (1998), panel unit root tests over-reject the unit root null in the presence of cross-unit cointegration displaying "false" high power. Breuer *et al.* (2001, 2002) discuss the power of panel unit root test in such a case, pointing out that they have lower power when testing the unit root null as opposed to that of stationarity. Persyn and Westerlund (2008) and Westerlund (2008) show that the empirical failure to reject the unit root null does not definitely establish its presence. Among recent studies, Tatoglu (2011) finds a unit root in both unemployment and GDP for a panel of EU countries; using non-parametric tests, Holl and Kunst (2011) also find evidence of a unit root in unemployment; Narayan, P., Narayan, S. (2010) report the presence of a unit root in inflation in 17 EU countries. Barbieri (2008) recommends to use both the IPS and MW tests for the null of a unit root as well as tests for the null of stationarity (H) in the case of a heterogeneous panel. Hadri and Rao (2008, 2009) using their stationarity test (2008) find that the null of stationarity with a break cannot be rejected for 4 out of 14 variables[2]. Hurlin (2004) found that the unit root hypothesis cannot be rejected when taking into account cross-sectional dependence for most variables including GDP, wages, real wages, the unemployment rate and the money stock.

In our case, since the H test strongly rejects at the 1% level the null of stationarity for the levels and fails to reject it for the first differences under the assumptions of homoscedasticity, heteroscedasticy and serial dependence respectively in the disturbances, we conclude that series in the panel are integrated of order I(1), and then proceed to test for possible long-run relationships using panel cointegration tests.

B. Panel cointegration tests and FMOLS, DOLS estimation

We carry out the Nyblom-Harvey, Fisher-Johansen, Pedroni, Westerlund and Kao cointegration tests. Nyblom and Harvey (2000) test for common stochastic trends in the panel under the null of zero common trends as a proxy for cointegration relationship. Their test takes the form:

$$\zeta_{k,n} = \lambda_{k+1} + \ldots + \lambda_n. \tag{4}$$

The Fisher-based Johansen panel cointegration test (1995, 1988) developed by Maddala and Wu (1999) uses individual cross-section test results as follows:

$$\Delta Y_{i,t} = \Pi_i y_{i,t-1} + \sum_{k=1}^{n} T_k \Delta Y_{i,t-k} + u_{i,t}. \tag{5}$$

Pedroni's (1999, 2004) tests for cointegration are based on the estimated residual in the form:

$$e_{it} = \rho_i e_{it-1} + \sum_{j=1}^{p_i} \psi_{ij} \Delta e_{it-1} + \upsilon_{it}. \tag{6}$$

Kao (1999) develops a similar residual-based panel cointegration test under the null of stationarity of the residuals with homogenous variance of the innovation process ε_{it}:

$$\hat{\varepsilon}_{it} = \rho \hat{\varepsilon}_{it-1} + \sum_{j=1}^{p} \upsilon_j \Delta \hat{\varepsilon}_{it-j} + \nu_{it}. \tag{7}$$

Westerlund (2008) uses an error-correction panel cointegration test for error correction in individual panel member and in the full panel:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i y_{it-1} + \lambda_i' x_{it-1} + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{it-j} + \sum_{j=0}^{p_i} \gamma_{ij} \Delta x_{it-j} + e_{it}. \tag{8}$$

[2] Real GDP, Nominal GDP, Real per capita GDP, Industrial production, Employment, Unemployment rate, GDP deflator, Consumer prices, Wages, Real wages, Money stock, Velocity, Bond yield, Common stock prices.

The panel cointegration test results are presented in Table 3, with the lag length selected on the basis of the Akaike information criterion with individual intercepts and trend.

Table 3. Panel cointegration tests results

	Nyblom-Harvey		Fisher-Johansen		Pedroni		Westerlund		Kao
	F	T	Trace	Max	F	T	F	T	F
y	7.48**	5.96**	1589**	1175**	–30.91**	–35.03**	–18.78**	–24.26**	–13.77**
p	7.48**	5.96**	1317**	1214**	–17.45**	–18.36**	–11.41**	–20.15**	–18.92**
e	6.82**	5.97**	1130**	954**	–39.83**	–48.44**	–13.28**	–19.27**	–12.29**

Notes: Variables in levels, *,** indicate 5%, 1% rejection levels.

It can be seen that all panel cointegration tests strongly reject the null of no cointegration in favour of a long-run relationship between employment growth, inflation and output growth. This holds for both the individual panel units and the full panel.

Following Pedroni (2001), we also apply group-mean panel FMOLS and DOLS methods. The FMOLS estimator takes the form:

$$\hat{\beta}^*_{GFM} = N^{-1}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}(p_{it}-\overline{p}_i)^2\right)^{-1} \times \left(\sum_{t=1}^{T}(p_{it}-\overline{p}_i)s^*_{it} - T\hat{\gamma}_i\right), \tag{9}$$

and the DOLS one

$$\hat{\beta}^*_{GD} = \left[N^{-1}\sum_{i=1}^{N}(\sum_{t=1}^{T} z_{it}z'_{it})^{-1}(\sum_{t=1}^{T} z_{it}\tilde{s}_{it})^{-1}\right]_1 . \tag{10}$$

The results overwhelmingly reject the null of no cointegration (see Table 4) in favour of a long-run relationship, with only a few exceptions (see Table A1).

Table 4. FMOLS and DOLS group-mean panel test results

Panel results	FMOLS	t-stat	DOLS	t-stat
Without time dummies				
Between	0.03	–1589.83**	0.03	–1368.77**
With time dummies				
Between	–0.01	–2722.07**	–0.01	–2141.17**

Notes: Variables in levels, *,** indicate 5%, 1% rejection levels.

C. Model specification

We aim to analyse the relationship between employment growth, inflation and output growth in 119 countries over the period 1970–2010, i.e.:

$$y_{it} = a'_i + a'_t + \hat{a}_{1i}x_{1i,t} + \hat{a}_{2i}x_{2i,t} + \ldots + \hat{a}_{Mi}x_{Mi,t} + \varepsilon_{it}, \tag{11}$$

$$\textit{for } t = 1, \ldots, T; \quad i = 1,\ldots,N; \quad m = 1, \ldots, M,$$

where y_{it} is the annual growth rate of real output in country *i* and year *t*, p_{it} is the annual change of the price level, e_{it} the annual change in the employment level and u_{it} the error term.

Following Pedroni (2004, 1999), we estimate a panel VECM model:

$$\Delta y_{it} = \theta_{1i} + \lambda_{1i} EC_{i,t-1} + \sum_{k=1}^{m} \theta_{11ik} \Delta y_{i,t-k} + \sum_{k=1}^{m} \theta_{12ik} \Delta p_{i,t-k} + \sum_{k=1}^{m} \theta_{13ik} \Delta e_{i,t-k} + u_{1it} \quad (12)$$

and then test for multivariate causality with lag length m (SIC = 2) to examine multivariate causality within the VECM framework using Wald tests (F test) of the null $H_0 : \theta_{12ik}, \theta_{13ik} = 0$, $H_0 : \theta_{22ik}, \theta_{23ik} = 0$, $H_0 : \theta_{31ik}, \theta_{32ik} = 0$ and also of $H_0 : \lambda_{1i}, \lambda_{2i}, \lambda_{3i} = 0$ for all *i* and *k* in (22). Table 5 and A2 display the results of the multivariate Granger causality analysis.

3. Granger causality tests

Table 5 summarises the results of short- and long-run Granger causality tests.

Table 5. Summary of the findings from the Panel Granger Causality Analysis

Dependent variable	Independent variable	Granger causality	
		Short run	Long run
y	*e*	Employment has limited impact on growth in the short run. Increasing employment slowly boosts growth. In the short run there is strong and significant positive Granger causality running from growth to employment. The impact of employment on growth is statistically significant only for very few countries.	There is clear evidence of long-run causality running from employment to output growth in the long run with a negative sign. For most of the countries in the panel Granger causality is unidirectional running from employment growth to output growth.
p	*e*	Inflation positively Granger causes employment in the short run. This confirms the idea that inflation has a beneficial impact on employment in the short run. Increasing employment in turn has a positive effect on output growth in the short run.	We find negative Granger causality running from inflation to employment in the long run, which can be rationalised by arguing that, as inflation uncertainty rises, agents become more risk averse. In 8 countries causality is bidirectional.
y	*p*	For 38 countries we find evidence that inflation Granger causes output growth in the short run and therefore price increases have a positive effect on output growth in the short run.	Price increases in the long run have a negative effect on growth. We find unidirectional causality running from inflation to growth in 81 countries and bidirectional one in 14.

Source: Own calculations.

We test for the presence of both short- and long-run causality as well as for the presence of both (joint Granger causality). To test for the latter we carry out F tests for the joint significance of the lags of the explanatory variables (short-run) and the lagged error correction term (long-run equilibrium)[3].

[3] Specifically, we test if changes in X are a function of past changes in both X and Y $H_0 : \theta_{12ik}, \theta_{13ik} = 0$, $H_0 : \theta_{22ik}$, $\theta_{23ik} = 0$, $H_0 : \theta_{31ik}, \theta_{32ik} = 0$ and whether there is an adjustment process towards the long-run equilibrium ($EC_{i,t-1}$) i.e. $H_0 : \lambda_{1i}, \lambda_{2i}, \lambda_{3i} = 0$.

The null hypothesis that inflation does not Granger cause employment growth cannot be rejected in the short run. However, in the long run it can be rejected with inflation negatively affecting employment growth (causality being unidirectional in most cases). For small open economies, transition and African countries, negative unidirectional Granger causality from inflation to employment growth is detected in the long run (negative long-run effects). Testing for joint Granger causality (short- and long-run) indicates that inflation positively Granger causes employment growth in most cases (in 47 countries at the 1, 5 and 10% level). In the short run inflation has a less significant (positive) impact on employment growth, and only in a few countries (the US, the former Soviet republics and other transition countries). Bidirectional Granger causality between inflation and employment is found for 43 countries in the panel.

The null hypothesis that output growth does not Granger cause employment growth in the short run cannot be rejected in most cases. The Granger causality relation between output growth and employment growth is significant but not as strong as the inflation-output growth one. The results differ across the countries in the panel. Output growth Granger causes employment growth in 30 countries only, whilst in the other cases causality runs in the opposite direction. For output and employment growth, the null hypothesis that output growth does not Granger cause employment growth in the short run is not rejected (at the 1, 5% significance level). Unidirectional causality is found in the long run from employment growth to output growth. The joint Granger causality tests provide evidence of positive effects of employment growth on output growth in both the short and the long run.

The null hypothesis that inflation has no short-run effects on (does not Granger cause) output growth is rejected for a large number of countries in the panel. The evidence suggests that inflation is conducive to growth in the short run but damaging in the long run. In fact, the null of no Granger causality between inflation and output growth is rejected overwhelmingly, the results implying a negative long-run relationship. In most countries causality is unidirectional and runs from inflation to output growth. However, in countries such as Greece, Iceland, Iran, Kyrgyzstan, Latvia, Angola, Armenia, Belarus, Lithuania etc., there is evidence of bidirectional joint Granger causality. It is noteworthy that in countries vulnerable to external shocks, such as Greece and Iceland, both long-run and joint Granger causality between inflation and output growth are stronger.

Overall, one can interpret these results as suggesting that positive growth during moderate inflation periods is likely to offset negative growth rate associated with higher inflation periods. It would be worthwhile to determine the threshold at which the inflation rate starts affecting growth negatively.

The Granger causality analysis for the 119 countries in the panel considered individually produces some interesting results (see Table A2). In particular, past values of GDP appear to predict current price movements both in the short and in the long run. The links between inflation and output growth for a large number of countries in the panel appear to be bidirectional. Price changes therefore also influence output growth movements.

On the whole, causality linkages appear to be quite different in the short run as opposed to the long run. Also, the evidence provides broad support to the existence of dynamic relationships in the Phillips' and Okun's tradition. It would be interesting also to investigate (using Markov Switching procedures) how these respond to changes in the economic environment.

Conclusions

The aim of this study was to examine the relationship between employment growth, inflation and output growth in the tradition of Phillips (1958, 1962) using panel VECM methods and Granger causality tests. The analysis builds on Caporale and Škare (2011), who carry out panel cointegration tests using an extensive panel including 119 countries, in that it estimates individual country models as well and also conducts Granger causality tests (both in the short and long run). The existence of strong linkages is confirmed by our results (especially the FMOLS and DOLS ones), which are informative for policy-makers and offer a number of useful insights. For example, employment growth is found to have a positive impact on output growth in the short run but a negative one in the long run (as output increases at a slower rate than productivity). The link between employment and output growth is clearly positive in the short run, with causality running from the former to the latter in most cases. By contrast, the link becomes negative in the long run.

The inflation-output growth relationship is undoubtedly positive in the short run, i.e. inflation is beneficial to growth. In the long run, instead, price volatility and uncertainty appear to affect output growth adversely. Inflation positively Granger cause employment in the short run, so it can boost employment temporarily. However, in the long run it has damaging effects, leading to lower output and employment growth, and consequently the inflation-employment growth relationship becomes negative. Obviously, changes can occur over time, and one should therefore investigate whether or not that implies that the Phillips curve relationship does not hold any longer; however, this issue is beyond the scope of the present paper and is left for future research.

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APPENDIX

Table A1. Individual group-mean panel FMOLS and DOLS test results

Country	FMOLS	t-stat	DOLS	t-stat	Country	FMOLS	t-stat	DOLS	t-stat
Albania	−0.057380625	−42.42557022**	−0.072636001	−68.06478373**	Cameron	0.138324205	−7.248741844**	0.083104845	−5.076528624**
Algeria	0.06020534	−13.20260957**	0.075671348	−22.14022007**	Canada	−0.073496742	−16.91165692**	−0.070197987	−16.01405999**
Angola	−0.001422647	−468.0710329**	−0.006295554	−434.1721538**	Central African	0.137486927	−11.57752415**	0.162407487	−5.84058899**
Argentina	−0.00364937	−501.3779005**	−0.002511613	−418.1393237**	Chile	−0.017831863	−142.3730712**	−0.065330622	−25.50870471**
Armenia	−0.002606681	−452.1538579**	−0.014093436**	−870.0869574**	China	0.075749366	−7.676229802**	0.248400787	−4.693987256**
Australia	−0.041122906	−21.39527631**	−0.038173413	−24.58222504**	Colombia	0.015520027	−17.14066355**	−0.04694155	−25.31667693**
Austria	0.35644191	−4.817731937**	0.213540251	−7.477514867**	Congo	−0.144046909	−6.508189079**	−0.235311482	−3.416400373**
Azerbaijan	−0.028767068	−155.4299753**	−0.047145726	−151.9919862**	Costa Rica	−0.089209302	−37.64261594**	−0.141657795	−19.33584828**
Bahrain	0.075300296	−8.033479708**	0.203021164	−4.668935421**	Cote d'Ivore	0.240118768	−5.964868814**	0.595801602	−2.296678186**
Bangladesh	0.22580972	−2.043341574**	−0.496324674	−5.266397497**	Croatia	−0.002292627	−1706.311516**	−0.00407086	−1270.002509**
Barbados	−0.062895939	−14.59022109**	0.031060175	−9.066194315**	Cyprus	0.546813337	−1.904209218*	0.444173545	−2.032904112*
Belarus	−0.008929421	−470.8607133**	−0.021246648	−363.2171804**	Czech Republic	−0.185707094	−10.22158854**	0.317887148	−7.515334926**
Belgium	0.320200352	−7.538374504**	0.2482524	−9.732730723**	Denmark	0.210832516	−6.027636479**	0.064754293	−9.988016873**
Bosna & Hercegovina	0.003194231	−330.0240162**	0.002315164	−157.729005**	Ecuador	−0.088127466	−28.39134861**	−0.125014682	−24.20945058**
Brazil	−0.001566846	−865.5866253**	−0.001282049	−959.5310853**	Egypt	0.065261697	−9.506254196**	0.004617532	−9.42320917**
Bulgaria	−0.007774222	−301.0904247**	−0.014390466	−206.5033623**	Estonia	−0.030631552	−14.22970349**	−0.082419229	−10.3381463**
Burkina Faso	−0.088625282	−6.639381276**	0.348337873	−2.479971591*	Ethiopia	−0.073888828	−10.06003118**	0.576147759	−2.224782436*
Cambodia	−0.142028286	−12.21230575**	−0.311701633	−7.229860388**	Finland	0.116032645	−11.45169556**	0.056671842	−34.04334638**
France	0.181321446	−15.960416**	0.138390607	−26.30356184**	Macedonia	−0.001902909	−2789.459954**	−0.00369947	−3684.789241**
Georgia	−0.002905713	−1412.660688**	−0.007707081	−624.0370032**	Madagascar	−0.092476784	−15.0754512**	−0.157805887	−21.84034383**
Germany	0.380301931	−4.395874199**	0.464134894	−4.369820544**	Malawi	−0.015544543	−19.11134859**	−0.003720173	−16.07656039**

Continued Table A1

Country	FMOLS	t-stat	DOLS	t-stat	Country	FMOLS	t-stat	DOLS	t-stat
Ghana	−0.085268853	−46.78102931**	−0.134216472	−51.53194296**	Malaysia	0.238115321	−4.514579246**	0.37839051	−1.687396123*
Greece	−0.132963945	−16.00770568**	−0.212879429	−41.55711312**	Mali	−0.009122609	−6.140787137**	0.402497042	−1.818542437*
Guatemala	0.009735829	−15.40068992**	−0.077157767	−9.249417125**	Malta	0.588768126	−1.576826958	1.602433712	2.128127788*
Hungary	−0.103721886	−14.17306328**	−0.065453443	−14.87783187**	Mexico	−0.050653231	−104.721837**	−0.058648076	−102.3796201**
Iceland	−0.005307369	−42.24138907**	−0.029678854	−49.5908542**	Moldova	−0.020238393	−279.8604668**	−0.034388254	−352.5092762**
India	−0.068805187	−13.31436962**	−0.129484189	−5.211063345**	Morocco	0.349075484	−4.877308424**	0.3083659	−2.729766861**
Indonesia	−0.169566521	−17.86758169**	−0.058164238	−7.885062685**	Mozambique	−0.07427289	−12.05135845**	−0.179176583	−15.09918056**
Iran	−0.097702095	−10.75224262**	−0.304128965	−8.919746322**	Myanmar	−0.043952384	−28.16394434**	−0.001310234	−14.96423145**
Iraq	0.020624886	−14.32467984**	0.106138455	−6.288161986**	Netherlands	−0.028174203	−96.35734955**	−0.078987233	−46.27220634**
Ireland	0.082398753	−15.22209286**	0.071569026	−13.82860539**	New Zealand	0.021457069	−9.062727778**	0.127374305	−4.838277075**
Israel	0.001566751	−161.1080066**	0.004745307	−200.8623492**	Niger	−0.070642189	−19.80955588**	−0.210453	−19.32799624**
Italy	0.151067641	−16.22691918**	0.143575715	−33.6221729**	Nigeria	0.20683674	−7.534387537**	0.240301336	−10.26475899**
Jamaica	0.02310645	−18.37591551**	0.137058862	−10.48306853**	Norway	0.32205903	−1.372409203	−0.150021852	−0.586069392
Japan	0.078734638	−11.98968527**	0.147724573	−10.92969414**	Oman	0.000845698	−12.26585957**	−0.000330758	−7.153691955**
Jordan	0.299311219	−2.93106145**	1.040785597	0.231576715	Pakistan	−0.002204421	−1655.44797**	−0.001972784	−773.3907816**
Kazakhstan	−0.011206661	−419.7236442**	−0.010816444	−329.4859695**	Peru	−0.179970714	−17.75255962**	−0.309330752	−8.269318237**
Kenya	−0.29543753	−12.75174631**	−0.134043986	−10.16236895**	The Philippines	0.000512147	−251.7308545**	−0.008939972	−172.3553194**
Korea South	−0.074727232	−21.37114304**	−0.146945667	−28.26036921**	Poland	0.069836555	−13.63844574**	0.043566343	−26.66500358**
Kuwait	−0.625375837	−5.761353868**	−0.059405749	−1.804974253*	Portugal	−0.044824132	−56.48171099**	−0.062179135	−35.41948156**
Kyrgyzstan	−0.021598124	−308.8241776**	−0.045684939	−206.0442941**	Romania	−0.008122622	−434.5989442**	−0.016953542	−147.9836038**
Latvia	−0.121390946	−51.08330059**	−0.092360086	−17.23029907**	Russia	−0.086291372	−4.433661182**	−0.036495921	−3.620009244**
Lithuania	−0.053540604	−66.46219528**	−0.110176857	−50.02975878**	Senegal	0.000181352	−657.7424642**	0.000680451	−303.1935125**
Luxembourg	−0.02163125	−5.35212181**	0.17004945	−3.927665655**	Serbia	0.235191386	−5.359732931	0.090121338	−3.306893966

End of Table A1

Country	FMOLS	t-stat	DOLS	t-stat	Country	FMOLS	t-stat	DOLS	t-stat
Singapore	–0.318778209	–6.86705384**	–0.931456039	–8.000445084**	USA	–0.003757885	–33.39319108**	–0.015397437	–32.91785013**
Slovakia	0.030948805	–14.45576441**	–0.110818736	–37.33591953**	Uruguay	–0.011026956	–437.6556781**	–0.018528524	–248.1932963**
Slovenia	–0.185355179	–14.41911658**	–0.23869895	–11.6677259**	Uzbekistan	–0.017378221	–21.8306142**	–0.018524507	–17.34711331**
South Africa	0.169716124	–14.765779**	0.096017126	–24.36312143**	Venezuela	–0.138398154	–6.224258209**	–0.949015303	–5.745152029**
Spain	0.085102975	–14.8378029**	0.079035222	–5.82437413**	Vietnam	0.019918204	–12.66929814**	0.337021606	–4.365185897**
Sri Lanka	0.015883086	–32.27834764**	–0.186883783	–20.92148343**	Yemen	0.000587319	–80.2291903**	0.005212134	–81.7164013**
Sudan	0.311491938	–3.280409073**	0.308879212	–4.363465379**					
Sweden	–0.026836309	–6.75576203**	–0.25534842	–6.302107473**					
Switzerland	–0.012387026	–10.24346024**	0.010826025	–6.179370478**					
Syria	–0.071971174	–12.75897363**	0.225382139	–5.821483612**					
Taiwan	–0.022024704	–262.3235027**	–0.037486878	–169.6245442**					
Tajikistan	–0.10755847	–27.97937422**	–0.247327889	–24.75670936**					
Tanzania	0.10386798	–5.502789618**	0.366468953	–2.140000641*					
Thailand	0.148199744	–3.874126428**	0.219763654	–3.926605452**					
Trinidad & Tobag	–0.088566042	–5.594483541**	–0.128745694	–7.201953707**					
Tunisia	–0.029789211	–46.60237129**	–0.019726919	–43.05170968**					
Turkey	–0.010786957	–397.9287593**	–0.017985787	–391.5268229**					
Turkmenistan	–0.034914624	–101.6315664**	–0.045277886	–124.6796497**					
Uganda	–0.004704723	–721.9561358**	–0.012651426	–816.7479262**					
Ukraine	0.495743277	–0.934266645	0.029337504	–0.813246287					
United Arab Emir	–0.039227165	–18.2553765**	–0.033306001	–43.97118573**					
United Kingdom	–0.224261348	–26.54227677**	–0.183969138	–22.23784992**					

**,* indicate significant at 1 and 5% level.

Table A2. Granger Causality Analysis (Wald F-test)

		Albania	Algeria	Angola	Argentina	Armenia	Australia	Austria	Azerbaijan	Bahrain	Bangladesh	Barbados	Belarus	Belgium	BIH	Brazil	Bulgaria	Burkina F.	Cambodia	Cameron	Canada
SR	*y→p*	***11.832***	0.219	***4.072***	0.808	***90.17***	1.625	0.667	2.121	0.465	0.009	0.818	***5.549***	0.517	0.657	1.976	***18.49***	1.764	0.507	0.017	0.519
	p→y	0.429	*2.539*	0.071	0.364	0.131	0.027	1.573	0.969	2.026	0.332	0.713	***11.53***	1.281	1.244	0.394	0.267	**3.998**	1.312	0.327	1.421
	p→e	0.479	0.564	0.463	0.118	0.926	0.031	0.885	***5.408***	1.599	**4.418**	1.697	***9.759***	1.832	2.00	0.108	**4.075**	0.279	0.988	0.186	1.080
	e→p	0.204	2.280	0.092	0.200	0.629	2.201	***5.665***	1.891	***6.186***	1.679	0.049	2.042	0.506	2.131	0.033	***6.109***	0.179	*2.578*	0.464	1.121
	y→e	0.832	1.430	0.535	0.617	0.129	***7.148***	1.200	0.620	0.651	0.183	6.413	0.685	1.818	1.089	0.298	***17.33***	0.949	0.007	0.388	0.192
	evy	0.173	1.370	1.456	0.118	1.168	2.210	*2.539*	0.327	0.673	0.444	0.636	1.011	1.359	2.246	0.068	0.736	1.673	0.937	1.540	0.463
LR	*y→p*	0.026	−0.684	−2.504	0.638	0.361	**2.099**	0.125	**2.077**	0.940	−0.944	1.690	1.520	0.633	−0.347	0.647	0.772	*1.692*	1.629	−0.207	**1.862**
	p→y	***−3.242***	***−2.904***	***−2.631***	***−2.849***	***−2.428***	**−2.655**	**−2.097**	**−2.257**	−1.092	***−4.879***	***−3.594***	***−3.406***	**−2.568**	−1.562	**−2.412**	**−2.431**	**−2.224**	**−1.995**	−0.748	−1.390
	p→e	0.002	1.259	0.679	−1.304	0.535	−1.347	−0.807	−0.539	**2.736**	0.279	**−2.235**	−0.518	−1.598	0.915	−1.132	**−2.786**	0.126	−1.251	1.628	−0.522
	e→p	0.026	−0.684	***−2.504***	0.638	0.361	**2.099**	0.125	**2.077**	0.940	−0.944	1.690	1.520	0.633	−0.347	0.647	0.772	*1.692*	1.629	−0.207	**1.862**
	y→e	0.002	1.259	0.679	−1.304	0.535	−1.347	−0.807	−0.539	**2.736**	0.279	**−2.235**	−0.518	−1.598	0.915	−1.132	**−2.786**	0.126	−1.251	1.628	−0.522
	e→y	***−3.242***	***−2.904***	***−2.631***	***−2.849***	***−2.428***	**−2.655**	**−2.097**	**−2.257**	−1.092	***−4.879***	***−3.594***	***−3.406***	**−2.568**	−1.562	**−2.412**	**−2.431**	**−2.224**	**−1.995**	−0.748	−1.390
JR	*y→p*	1.067	0.593	***3.233***	0.541	***69.81***	1.597	0.603	*2.458*	0.676	0.535	1.037	***4.657***	0.615	0.454	1.510	***12.86***	1.236	1.236	0.047	1.629
	p→y	***6.637***	***4.723***	**2.778**	**3.158**	**2.947**	*2.377*	***6.330***	1.997	1.881	***10.683***	***5.018***	***9.359***	***7.424***	2.020	*2.302*	*2.497*	**4.343**	*2.409*	0.381	**4.107**
	p→e	0.432	0.824	0.652	0.590	0.624	0.684	1.329	***4.670***	**3.415**	**3.486**	**2.493**	***6.613***	1.851	1.415	0.544	***7.401***	0.372	1.229	1.020	1.744
	e→p	0.172	1.649	*2.251*	0.265	0.419	***4.002***	**3.910**	*2.632*	***4.182***	1.401	1.068	**3.504**	0.391	1.491	0.158	***4.810***	1.080	**3.045**	0.331	**3.570**
	y→e	0.603	0.978	0.961	0.619	0.340	***5.241***	0.800	0.465	*2.655*	0.123	**4.321**	0.562	1.313	0.838	0.450	***11.78***	0.533	1.293	1.409	0.167
	e→y	**3.604**	**3.533**	*2.733*	**2.873**	**2.871**	***4.448***	**3.104**	1.928	0.898	***8.989***	**5.409**	**5.727**	*2.738*	*2.296*	2.123	*2.377*	**3.690**	*2.245*	1.254	1.557

Continued Table A2

		Centr.Afr.R	Chile	China	Colombia	Congo	Costa Rica	Cote d'Ivore	Croatia	Cyprus	Czech Rep.	Denmark	Ecuador	Egypt	Estonia	Ethiopia	Finland	France	Georgia	Germany	Ghana
SR	$y \to p$	**4.607**	**3.481**	*2.999*	1.193	1.063	0.320	2.039	*2.384*	0.641	0.633	2.207	0.169	0.468	***11.51***	***7.039***	**5.227**	0.045	2.041	**3.212**	*8.909*
	$p \to y$	0.150	***6.045***	1.282	0.187	0.424	0.326	*3.073*	1.057	0.315	***5.041***	0.673	0.042	0.958	0.521	1.296	*2.713*	*3.023*	1.348	2.059	1.558
	$p \to e$	0.921	0.312	1.225	0.089	0.135	***6.500***	0.359	***4.902***	0.115	1.745	**4.313**	2.278	0.107	*2.879*	0.691	0.699	2.216	0.911	1.380	*2.911*
	$e \to p$	0.426	0.025	0.493	0.932	1.008	*3.058*	*2.623*	***5.490***	0.104	0.894	1.076	2.417	2.138	*3.026*	0.862	0.822	0.016	***19.64***	1.484	1.534
	$y \to e$	1.721	0.953	2.233	0.641	0.592	**3.289**	2.120	***6.974***	0.807	**5.257**	1.957	0.729	0.298	***8.108***	0.629	0.740	0.039	1.064	**4.335**	0.803
	$e \to y$	0.168	1.096	1.161	0.078	0.267	2.151	1.484	1.811	0.471	***10.73***	0.482	0.143	0.073	0.493	0.194	0.239	0.594	*2.694*	2.259	1.334
LR	$y \to p$	**–2.156**	1.065	**–2.443**	***3.649***	1.087	*1.826*	***–2.957***	1.299	0.937	0.666	0.198	0.551	0.564	–1.550	1.386	0.523	1.435	–0.133	1.451	–0.540
	$p \to y$	***–3.218***	***–2.894***	–0.972	***–2.804***	–0.957	***–2.764***	***2.905***	***–3.245***	–1.551	**–2.128**	***–3.120***	***–2.137***	***–3.033***	**–2.142**	***–2.959***	**–2.263**	–1.553	**–2.353**	**–2.416**	**–2.635**
	$p \to e$	–1.167	*–1.680*	**–2.348**	–0.539	**2.268**	***–2.733***	***3.133***	**–1.971**	0.800	**–2.545**	*–1.695*	–1.139	1.349	–0.454	0.780	0.203	–1.372	–1.164	–1.162	1.062
	$e \to p$	**–2.156**	1.065	**–2.443**	***3.649***	1.087	*1.826*	***–2.957***	1.299	0.937	0.666	0.198	0.551	0.564	–1.500	1.386	0.523	1.435	–0.133	1.451	–0.540
	$y \to e$	–1.167	*–1.680*	**–2.348**	–0.539	**2.268**	***–2.733***	***3.133***	**–1.971**	0.800	**–2.545**	*–1.695*	–1.139	1.349	–0.454	0.780	0.203	–1.372	–1.164	–1.162	1.062
	$e \to y$	***–3.218***	***–2.894***	–0.972	***–2.804***	–0.957	***–2.764***	***2.905***	***–3.245***	–1.551	**–2.128**	***–3.120***	***–2.137***	***–3.033***	**–2.142**	***–2.959***	**–2.263**	–1.553	**–2.353**	**–2.416**	**–2.635**
JR	$y \to p$	**3.103**	*2.376*	**4.298**	***5.596***	1.227	1.199	***4.314***	1.707	0.455	0.607	1.915	0.142	0.319	***4.502***	***4.858***	**4.091**	0.822	1.361	2.174	***8.431***
	$p \to y$	**3.743**	***5.335***	*2.366*	**2.904**	0.537	***3.819***	**2.877**	**3.579**	*2.577*	***5.354***	***4.644***	1.564	**4.012**	1.997	**4.416**	**3.063**	***5.705***	***5.805***	***7.640***	**3.825**
	$p \to e$	1.848	0.988	1.890	0.124	1.746	***7.335***	***11.65***	***8.429***	0.374	**3.682**	***5.123***	*2.628*	0.767	0.995	0.665	0.155	**4.338**	1.783	**3.623**	*2.288*
	$e \to p$	1.813	0.414	2.032	***4.835***	0.680	**3.255**	***5.434***	*2.623*	0.352	0.824	0.762	1.625	1.538	***8.048***	1.286	0.703	0.780	***14.09***	**3.566**	1.023
	$y \to e$	1.204	1.041	1.947	0.469	2.147	**3.730**	***5.874***	**3.509**	0.794	***4.833***	1.529	0.634	0.828	***5.663***	0.809	0.609	0.726	1.276	**2.975**	0.715
	$e \to y$	**3.552**	***4.082***	1.355	**2.755**	0.415	***4.237***	**3.583**	**4.321**	1.169	***8.032***	***5.141***	1.550	**3.229**	2.023	**3.034**	1.810	1.386	*2.699*	**4.406**	*2.841*

Continued Table A2

		Greece	Guatemala	Hungary	Iceland	India	Indonesia	Iran	Iraq	Ireland	Israel	Italy	Jamaica	Japan	Jordan	Kazakhstan	Kenya	Korea South	Kuwait	Kyrgyzstan	Latvia
	$y \to p$	0.361	0.228	0.046	**4.959**	0.838	0.964	0.451	1.399	0.260	0.088	**3.383**	**3.301**	*3.086*	1.110	1.138	1.873	*2.724*	*2.646*	***6.349***	**5.246**
	$p \to y$	***5.530***	0.635	0.658	0.478	1.714	1.723	0.663	0.138	1.864	0.577	***7.163***	***7.220***	**5.458**	0.552	0.495	0.233	1.185	1.170	**5.158**	***6.516***
SR	$p \to e$	0.444	0.176	0.164	0.645	0.035	0.678	0.202	0.283	**3.980**	0.015	*2.637*	**3.123**	1.277	***23.72***	***22.70***	0.010	0.030	1.270	***19.50***	***17.05***
	$e \to p$	0.219	0.271	0.250	0.205	0.587	*2.684*	1.394	0.969	0.114	0.948	0.101	0.291	0.111	0.766	1.096	1.256	1.159	1.544	*3.055*	*2.994*
	$y \to e$	0.415	0.051	0.092	1.770	0.157	0.527	**3.213**	1.941	**3.455**	**3.518**	0.520	0.582	0.072	0.102	0.080	1.069	1.276	0.987	*2.936*	*2.676*
	$e \to y$	0.217	*2.435*	**3.108**	1.873	1.327	**3.368**	0.806	0.088	*2.813*	0.329	1.738	1.690	2.195	**4.604**	**4.645**	0.350	0.064	0.624	0.546	0.501
	$y \to p$	**2.484**	-0.277	0.768	1.615	0.209	**2.696**	−1.408	−1.077	0.139	−1.621	−0.019	1.153	0.375	−0.037	−0.142	**2.010**	**2.504**	***3.279***	*1.883*	**2.219**
	$p \to y$	−1.461	**−2.181**	**−2.555**	**−2.696**	***−2.777***	**−2.525**	***−3.936***	***−3.813***	−1.608	−0.430	−0.412	−0.545	−1.507	−1.516	−1.541	*−3.999*	***−4.165***	**−2.503**	**−2.712**	**−2.342**
LR	$p \to e$	0.206	−0.762	−1.551	**−2.242**	0.678	0.460	*−1.667*	−0.039	−1.110	0.128	−0.239	0.150	*−1.718*	0.670	0.515	1.217	1.398	1.463	−0.200	0.100
	$e \to p$	**2.484**	−0.277	0.768	1.615	0.209	**2.696**	−1.408	−1.077	0.139	−1.621	−0.019	1.153	0.375	−0.037	−0.142	**2.010**	**2.504**	***3.279***	*1.883*	**2.219**
	$y \to e$	0.206	-0.762	−1.551	**−2.242**	0.678	0.460	*−1.667*	−0.039	−1.110	0.128	−0.239	0.150	*−1.718*	0.670	0.515	1.217	1.398	1.463	-0.200	0.100
	$e \to y$	−1.461	**−2.181**	**−2.555**	**−2.696**	***−2.777***	**−2.525**	***−3.936***	***−3.813***	−1.608	−0.430	−0.412	−0.545	−1.507	−1.516	−1.541	*−3.999*	***−4.165***	**−2.503**	**−2.712**	**−2.342**
	$y \to p$	**5.005**	0.154	0.325	**3.419**	0.731	*2.674*	**3.285**	0.933	0.176	0.950	*2.371*	**2.919**	*2.429*	0.762	0.769	1.511	*2.264*	**3.781**	**5.068**	**5.688**
	$p \to y$	***5.305***	2.051	*2.665*	**2.891**	**3.861**	**3.448**	***5.498***	***4.939***	*2.645*	0.388	***6.554***	*6.624*	***7.708***	1.396	1.423	***5.455***	***5.910***	2.186	**5.448**	***4.675***
JR	$p \to e$	0.305	0.318	0.934	1.917	0.203	0.598	0.978	0.191	**3.735**	0.015	*2.397*	*2.383*	**3.592**	***16.08***	***15.92***	0.507	0.665	0.727	***13.00***	***12.98***
	$e \to p$	2.087	0.196	1.130	1.278	0.394	***5.135***	1.896	0.967	0.105	1.629	0.067	0.514	0.119	0.766	0.773	*2.224*	**3.024**	***4.634***	**3.526**	**4.083**
	$y \to e$	0.572	0.261	0.874	2.090	0.222	0.351	3.483	1.315	*2.316*	*2.553*	0.603	0.591	1.625	0.161	0.100	0.748	0.911	0.974	1.963	1.951
	$e \to y$	0.778	**2.983**	**3.643**	*2.537*	*2.649*	***5.253***	***5.327***	***4.958***	2.083	0.258	1.301	1.349	2.089	***5.958***	**5.996**	***6.230***	***6.708***	**2.797**	*2.644*	2.011

Continued Table A2

		Lithuania	Luxemb.	Macedonia	Madagascar	Malawi	Malaysia	Mali	Malta	Mexico	Moldova	Morocco	Mozamb.	Myanmar	Netherlands	New Zealand	Niger	Nigeria	Norway	Oman	Pakistan
SR	y→p	***15.07***	***14.14***	***9.065***	0.360	0.520	0.750	0.560	0.380	**4.154**	**4.334**	0.474	0.053	**4.761**	0.627	**3.650**	0.232	0.243	0.412	0.252	1.618
	p→y	1.977	**3.483**	**3.800**	0.378	**3.983**	***5.420***	0.429	0.942	0.598	0.518	0.758	0.434	*2.599*	***7.168***	*2.732*	0.565	0.385	2.218	1.817	1.173
	p→e	***14.40***	***13.74***	0.044	0.445	0.655	0.536	0.642	0.154	0.150	0.170	0.107	0.061	2.001	1.089	1.898	0.225	0.206	0.640	0.503	0.297
	e→p	*2.851*	2.336	0.531	0.241	1.262	0.182	0.524	0.166	0.968	1.750	0.730	0.266	0.019	**3.668**	0.052	0.258	0.251	0.019	0.088	0.744
	y→e	**4.440**	**4.202**	1.127	***8.634***	0.513	0.225	1.675	0.750	*2.675*	**3.285**	0.522	1.178	**3.399**	1.204	**3.095**	0.074	0.021	2.337	2.161	0.543
	e→y	0.468	0.484	**4.767**	1.452	1.481	2.076	2.038	1.338	0.697	1.076	1.601	0.447	2.304	*2.629*	*2.563*	0.521	0.334	*2.979*	*2.453*	1.047
LR	y→p	0.363	0.168	1.167	1.139	–1.490	**–2.599**	0.347	–0.778	**2.169**	**2.077**	–1.198	–0.233	*1.954*	–1.223	1.540	–0.178	–0.189	1.031	0.346	0.122
	p→y	**–2.457**	**–2.044**	***–2.930***	***–4.119***	***–3.477***	**–2.033**	***–3.697***	***–2.926***	**–2.159**	**–2.573**	**–2.249**	**–2.684**	***–4.002***	–1.500	***–4.120***	***–2.893***	**–2.251**	**2.499**	*–1.755*	**–2.271**
	p→e	–0.440	0.348	–0.862	***3.675***	0.736	–0.193	***3.514***	**2.712**	**–2.422**	**–2.392**	**2.471**	1.562	*–1.779*	–0.128	*–1.662*	0.737	*1.813*	–1.292	–1.201	–0.558
	e→p	0.363	0.168	1.167	1.139	–1.490	**–2.599**	0.347	–0.778	**2.169**	**2.077**	–1.198	–0.233	*1.954*	–1.223	1.540	–0.178	–0.189	1.031	0.346	0.122
	y→e	–0.440	0.348	–0.862	***3.675***	0.736	–0.193	***3.514***	**2.712**	**–2.422**	**–2.392**	**2.471**	1.562	*–1.779*	–0.128	*–1.662*	0.737	*1.813*	–1.292	–1.201	–0.558
	e→y	**–2.457**	**–2.044**	***–2.930***	***–4.119***	***–3.477***	**–2.033**	***–3.697***	***–2.926***	**–2.159**	**–2.573**	**–2.249**	**–2.684**	***–4.002***	–1.500	***–4.120***	***–2.893***	**–2.251**	**2.499**	*–1.755*	**–2.271**
JR	y→p	***10.86***	***10.79***	***6.075***	0.645	***3.487***	***5.387***	0.403	0.571	**3.098**	**2.951**	0.523	0.061	**3.362**	*2.444*	**2.791**	0.206	0.207	0.504	0.185	1.101
	p→y	**3.502**	**2.805**	***5.542***	***5.712***	***7.539***	**4.293**	***4.802***	**3.071**	*2.316*	**3.013**	2.030	**2.766**	***11.27***	***4.909***	***11.71***	***3.441***	*2.283*	**4.175**	**2.936**	*2.747*
	p→e	***9.802***	***9.755***	0.299	***4.565***	0.531	0.357	**4.215**	*2.539*	*2.435*	*2.385*	2.083	0.855	1.952	0.816	1.806	0.355	1.286	1.148	1.068	0.275
	e→p	*2.299*	*2.256*	1.134	0.539	1.670	**3.313**	0.355	0.522	*2.495*	*2.354*	0.685	0.216	1.341	0.009	0.856	0.185	0.186	0.485	0.166	0.496
	y→e	**2.973**	**2.942**	0.779	***7.833***	0.352	0.181	***5.448***	**3.627**	**2.998**	**2.495**	***12.51***	***10.23***	*2.356*	1.182	*2.206*	1.051	2.043	1.674	1.590	0.363
	e→y	**2.879**	*2.215*	***5.609***	***6.183***	***5.065***	*2.276*	***4.811***	**3.079**	*2.394*	**3.095**	2.162	**2.906**	***7.443***	*2.225*	***7.808***	**3.228**	2.089	**4.020**	**2.794**	*2.620*

Continued Table A2

		Peru	Philippines	Poland	Portugal	Romania	Russia	St. Lucia	Saudi Arabia	Senegal	Serbia	Singapore	Slovakia	Slovenia	South Africa	Spain	Sri Lanka	Sudan	Sweden	Switzerland	Syria
SR	$y \to p$	1.663	0.388	*2.378*	2.203	2.363	***4.450***	2.160	0.172	1.867	1.804	0.062	0.213	*2.637*	***7.449***	0.148	0.074	*2.496*	1.077	1.008	1.018
	$p \to y$	1.181	**4.018**	***13.96***	***5.452***	*2.507*	*2.613*	0.168	2.031	1.298	0.614	0.536	0.753	*2.536*	1.946	**5.302**	**4.812**	0.184	1.544	1.041	1.156
	$p \to e$	0.246	*2.573*	***9.403***	***7.653***	1.255	2.217	**3.687**	**3.304**	0.063	0.043	0.283	2.173	1.100	**3.997**	0.961	1.159	0.569	0.530	**3.773**	*2.726*
	$e \to p$	0.765	1.689	1.079	1.251	0.652	0.801	0.112	0.142	0.467	0.517	0.126	1.519	*2.479*	*2.388*	*2.651*	*2.699*	***8.717***	***5.671***	***5.697***	*2.497*
	$y \to e$	0.308	**3.138**	***6.959***	***7.942***	0.084	0.136	0.238	0.398	0.191	0.227	1.418	***29.99***	**4.862**	0.593	0.341	0.313	0.227	0.461	0.087	1.472
	$e \to y$	1.369	0.175	0.575	0.756	0.027	1.261	0.442	0.011	1.001	1.190	1.673	0.804	***6.404***	0.271	***9.128***	***7.880***	***10.26***	***9.610***	0.922	0.406
LR	$y \to p$	0.242	**2.409**	0.534	–0.385	0.172	0.715	1.041	0.267	–1.322	–0.809	0.388	–1.161	**–2.421**	0.845	**2.592**	***3.352***	***–3.308***	**–2.532**	–0.355	–1.150
	$p \to y$	**–2.428**	**–2.688**	**–2.070**	***–2.858***	**–2.007**	**–2.632**	**–2.169**	**–2.009**	**–2.598**	***–2.895***	**–2.694**	***–3.210***	***–3.253***	**–2.071**	*–1.648*	**–1.957**	**–2.336**	–0.600	***–4.040***	–0.235
	$p \to e$	0.093	1.128	–1.544	*–1.769*	1.095	–0.141	0.297	0.939	1.523	1.612	–0.085	–1.144	***–3.768***	0.772	*–1.785*	–1.095	–0.655	1.146	0.648	**–2.612**
	$e \to p$	0.242	**2.409**	0.534	–0.385	0.172	0.715	1.041	0.267	–1.322	–0.809	0.388	–1.161	**–2.421**	0.845	**2.592**	***3.352***	***–3.308***	**–2.532**	–0.355	–1.150
	$y \to e$	0.093	1.128	–1.544	*–1.769*	1.095	–0.141	0.297	0.939	1.523	1.612	–0.085	–1.144	***–3.768***	0.772	*–1.785*	–1.095	–0.655	1.146	0.648	**–2.612**
	$e \to y$	**–2.428**	**–2.688**	**–2.070**	***–2.858***	**–2.007**	**–2.632**	**–2.169**	**–2.009**	**–2.598**	***–2.895***	**–2.694**	***–3.210***	***–3.253***	**–2.071**	*–1.648*	**–1.957**	**–2.336**	–0.600	***–4.040***	–0.235
JR	$y \to p$	1.117	**2.765**	1.694	1.641	1.592	1.778	0.725	0.376	**3.023**	*2.574*	0.201	0.567	***9.411***	***6.624***	**2.777**	***4.384***	***4.693***	**3.066**	0.676	1.100
	$p \to y$	**3.014**	**4.209**	***16.06***	***19.02***	***5.409***	***6.721***	**3.860**	**3.593**	**4.088**	***4.715***	**3.633**	**3.857**	***5.258***	**2.891**	***7.274***	***7.863***	**2.929**	1.070	***8.098***	1.186
	$p \to e$	0.178	*2.510*	***10.22***	**2.986**	1.958	1.506	*2.501*	**2.831**	0.868	0.962	0.188	1.879	***8.452***	0.881	**3.079**	*2.296*	0.393	0.695	*2.592*	**5.243**
	$e \to p$	0.511	**4.031**	0.896	0.846	0.434	0.602	0.441	0.100	1.020	0.641	0.154	1.776	**3.771**	1.793	**2.950**	***4.542***	***7.101***	**5.208**	**3.918**	**4.471**
	$y \to e$	0.260	*2.195*	***5.080***	***5.428***	0.489	0.092	0.221	0.491	2.127	*2.231*	1.390	***20.09***	***5.017***	0.396	1.258	0.584	0.282	0.582	0.884	**3.175**
	$e \to y$	**2.884**	*2.449*	1.483	**2.784**	1.412	*2.384*	1.773	1.546	**4.062**	***4.688***	**4.074**	**3.793**	***5.024***	*2.693*	***6.902***	***7.478***	***9.264***	***6.494***	***6.234***	0.533

End of Table A2

		Taiwan	Tajikistan	Tanzania	Thailand	Trin.&Tob.	Tunisia	Turkey	Turkmenistan	Uganda	Ukraine	United A.E.	UK	USA	Uruguay	Uzbekistan	Venezuela	Vietnam	Yemen	Zambia
SR	y→p	2.014	2.236	*2.431*	0.993	*2.476*	*2.512*	1.425	1.168	1.131	0.444	0.225	0.128	0.138	0.162	***14.18***	***12.52***	0.703	0.676	0.074
	p→y	***30.85***	***29.87***	0.592	1.579	1.858	2.020	1.291	0.893	1.377	1.683	0.214	0.224	**3.787**	*2.472*	0.594	0.961	1.339	1.261	**4.715**
	p→e	***11.45***	***10.04***	0.714	0.616	0.817	**3.500**	0.095	0.033	0.022	0.021	1.316	0.795	**4.413**	**3.471**	0.357	0.282	0.087	0.070	*2.853*
	e→p	1.161	1.397	2.209	1.423	0.689	0.635	0.615	0.405	0.082	0.125	0.746	0.769	0.434	0.201	**3.765**	***5.322***	0.198	0.210	1.007
	y→e	**3.284**	**3.382**	**4.175**	0.137	***5.974***	***5.707***	1.615	2.029	0.047	0.466	1.897	1.875	*2.822*	*2.823*	1.804	2.226	0.756	0.649	***8.544***
	e→y	1.816	*2.691*	0.501	2.310	0.209	0.095	0.966	0.728	0.048	0.049	2.114	2.116	0.255	0.298	1.013	0.971	*2.723*	*2.580*	*2.422*
LR	y→p	***2.773***	**2.418**	0.526	−0.795	1.211	1.190	**2.031**	*1.718*	−0.473	−1.239	−0.311	0.081	**2.195**	*1.861*	***3.444***	***4.056***	0.987	1.018	−0.794
	p→y	***−3.177***	***−3.617***	−0.801	−0.864	**−2.007**	**−2.260**	***−3.089***	***−3.310***	−1.047	−0.760	−1.590	−1.440	*−1.994*	**−2.114**	*−1.945*	**−2.379**	−1.037	−1.060	−0.995
	p→e	**−2.458**	**−2.210**	0.808	0.728	**−2.710**	**−2.413**	**2.112**	**2.290**	−0.579	−1.156	**−2.426**	**−2.404**	−1.296	−1.221	0.565	0.211	0.122	−0.257	**2.416**
	e→p	***2.773***	**2.418**	0.526	−0.795	1.211	1.190	**2.031**	*1.718*	−0.473	−1.239	−0.311	0.081	**2.195**	*1.861*	***3.444***	***4.056***	0.987	1.018	−0.794
	y→e	**−2.458**	**−2.210**	0.808	0.728	**−2.710**	**−2.413**	**2.112**	**2.290**	−0.579	−1.156	**−2.426**	**−2.404**	−1.296	−1.221	0.565	0.211	0.122	−0.257	**2.416**
	e→y	***−3.177***	***−3.617***	−0.801	−0.864	**−2.007**	**−2.260**	***−3.089***	***−3.310***	−1.047	−0.760	−1.590	−1.440	*−1.994*	**−2.114**	*−1.945*	**−2.379**	−1.037	−1.060	−0.995
JR	y→p	**3.095**	*2.454*	1.630	1.186	1.856	1.838	1.419	1.026	1.082	1.563	0.150	0.120	*2.233*	1.747	***13.64***	***16.23***	1.071	1.093	0.223
	p→y	***30.03***	***33.02***	0.827	1.395	*2.393*	***5.404***	**3.925**	***4.422***	2.035	1.835	1.003	0.849	***6.087***	***6.321***	1.398	2.032	1.208	1.261	**3.505**
	p→e	***13.18***	***12.43***	0.838	0.560	**2.858**	*2.335*	1.547	1.810	0.186	0.522	*2.516*	*2.480*	***5.226***	***5.136***	0.281	0.188	0.061	0.078	**3.890**
	e→p	**3.806**	**3.130**	1.603	1.053	0.923	0.906	1.930	1.519	0.122	0.561	0.545	0.513	1.872	1.409	***5.201***	***6.869***	0.438	0.458	0.773
	y→e	**2.963**	*2.548*	**3.155**	0.251	***5.294***	***4.672***	1.716	1.982	0.132	0.466	2.039	2.004	1.955	1.884	1.699	1.593	0.509	0.527	***13.09***
	e→y	***5.757***	***6.933***	0.770	1.370	1.379	1.740	**3.929**	***4.428***	0.423	0.249	*2.552*	*2.376*	1.543	1.711	2.019	*2.687*	*2.217*	*2.236*	2.129

Notes: LR = long run Granger causality, SR = short run Granger causality, Joint = strong Granger causality, values in bold/italic indicate significance at the 1%, bold 5% level; coefficients in italic indicate significance at the 10% level.

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