Price level co-movements within Preferential Trade Agreements (PTAs)

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Abstract

This paper tests for a common stochastic trend among the price levels of a PTA's member countries by testing for cointegration among these price levels. This paper uses the trace statistic test to examine if a cointegrating vector exists for the price indices of signatories to a PTA. The cointegrating vector is a series of coefficients, not all 0, such that a linear combination of these coefficients and the (presumably non-stationary) price levels of the member countries results in a mean-zero, stationary series. The trace statistic test requires estimating a Vector-Error Correction Model (VECM) on the vector of price levels for the member countries (proxied here with the log of the CPI for each country as measured in the IMF's International Financial Statistics). A VECM is a Vector Auto Regression (VAR) where time-t differences in a vector of variables are a function of lagged differences of the variables as well as the time t-1 levels.

Finding a cointegrating vector for the price levels of the countries in the PTA implies that these price levels grow together. However, this finding alone does not indicate that cointegration is a feature unique to PTAs. A country adhering to one or more PTAs may inherently be an exceptionally open country whose price level is affected easily by other countries, whether or not the other countries and the country in question belong to an PTA. A control group is required to test whether or not the price dynamics in PTA members possess distinguishing characteristics.

The next part of the paper provides such a control group. Whereas the first part of the paper tests directly for cointegration by examining the PTA as a whole (multilateral analysis), the second part tests for cointegration among all country pairs that comprise the PTA (bilateral analysis). This conceptualization permits the creation of a control group. If the treatment group consists of an PTA defined by a series of country pairs where both countries belong to the PTA, then consider the following to be a control group for any given PTA: the set of all country pairs where exactly one country belongs to the PTA in question and exactly one country does not belong to the PTA in question. Call this last set of pairs a "partial" or

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"pseudo" PTA. Comparing the share of country pairs exhibiting cointegration in the true PTA with the share of country pairs exhibiting cointegration in the pseudo PTA provides a control group against which to gauge the extent of cointegration within the PTA as "high" or not.

1 Introduction

An expectation on the part of policymakers negotiating regional or preferential trade agreements (referred to henceforth as PTAs) is that the reduction of trade barriers between and/or among countries should increase competition and improve consumer welfare and productive efficiency. These improvements occur through reducing the distortions between the free-on-board price and the cost-plus-insurance-and-freight price. Following the reduction of barriers and the resulting re-alignment of prices in countries covered by the PTA, one should expect that agents will favor goods and services provided by other members of the agreement over non-PTA sources. This paper asks if this re-alignment results in the price levels of signatories to a particular PTA displaying a common pattern of movement. This pattern can be interpreted as evidence for increased economic integration among the PTA's members. In particular, are countries that sign a PTA more integrated among themselves than are they with countries outside their PTA? Do countries that sign a PTA develop a common stochastic trend in their price levels?

Other papers have tested individual or selected PTAs for the presence of cointegration in their members' price levels. The contribution of this paper will be 1) to test for cointegration in all PTAs listed with the WTO and 2) to provide a control group for each PTA in order to determine whether or not the extent of integration within the PTA is sufficiently large to indicate that the price level of any country within the PTA is more integrated with the price levels of the PTA's other countries than is it with any countries outside the PTA. This paper borrows an approach from previous work focusing on currency unions, among which there often exists a high level of trade (Whitten

(2014a)). That paper shows that member countries' price levels (the treatment group) move together in ways unlike those of countries outside currency unions (the control group). This paper extends the analysis to other regimes associated with high levels of trade: PTAs.

The results of this paper show that member countries of several PTAs do possess a cointegrating vector among themselves for price levels, though several major PTAs (ECOWAS and CARICOM) do not. The bilateral analysis shows that the frequencies of cointegrationg and Granger Causality among the country pairs that belong to the same PTA are higher than are they among countries not in a PTA. Most PTAs that lack an area-wide cointegrating vector possess low rates of pairwise cointegration. A few lack an area-wide cointegrating vector but have a high rate of pairwise cointegration.

Given the above-mentioned results, the following questions arise. Does adherence to the PTA cause a change in the stochastic process driving the price levels and exchange rates in a country? Or, do countries that adhere to PTAs at a given moment in time tend, at the time of adherence, to be more open to movements in price levels and exchange rates originating in other countries regardless of economic relationships with other countries? Bilateral analysis of PTAs, conceptualizing the PTA as an assemblage of all possible pairs made from the PTAs member countries, provides answers to these questions. The bilateral analysis first compares the rate of cointegration among the country pairs within a PTA with the rate of cointegration for all country pairs not in any PTA. This comparison shows that the frequency of cointegration within a PTA is generally higher than is it for country pairs not in any PTA. The second portion of the bilateral analysis creates an additional control group by constructing for each PTA a "partial" PTA for pairwise analysis. This "partial" PTA consists of all country pairs where exactly one country belongs to the PTA in question and the other country does not. The pairs of countries examined in this pairwise analysis show that rates of cointegration in the true PTAs are

higher than are the rates of cointegration in the "partial" PTAs for only about half of the PTAs. That is to say, nearly half of all PTAs demonstrate frequencies of cointegration that are *lower* than are the rates in the control group. Hence, joining the PTA appears not to cause any change in the data-generating process for price levels. The earlier results demonstrating cointegration within a PTA suggest that the joining a PTA does not cause cointegration but that countries adhere to a PTA at a moment when the countries are particularly open to outside economic influences.

Although no paper has yet comprehensively examined the universe of PTAs for the presence of cointegrated price levels or examined if this phenomenon were unique to PTA member countries, several papers have examined individual PTAs. Lee (2010) tests for cointegration in 7 PTAs and finds that the price levels in the member countries of all 7 PTAs, proxied through the CPI, exhibit cointegration. Lee concludes that adhering to the PTAs "fosters" price convergence, suggesting a causal note. Mohanty et al. (1998) use cointegration techniques to test for the law of one price (LOOP) in agricultural goods in two large members of Mercosur, Argentina and Brazil. The authors establish the prices of soybeans are cointegrated in Argentina and Brazil, suggesting economic integration brought about through membership in Mercosur. However, the Argentine wheat price is more closely-linked with the world price of wheat than with the Brazilian price of wheat. Mohanty et al. (1998) conclude that country-specific economic policies can override any economic integration brought about through a PTA. Viju et al. (2006) also test the prices of individual agricultural goods for cointegration but for member countries of the present-day European Union. The authors find that the Austrian and German prices of some goods are cointegrate both before and after Austria's accession to the EU in 1995. However, the authors conclude that this integration has deepened following Austria's adherence to the EU. Two other countries, Finland and Sweden, also joined in the EU in 1995. The authors do not find that cointegration exists among these 3 countries following

their membership in the EU.

The organization of this paper is as follows. Section 2 describes the methodology and data used in this paper. Section 3 shows results when looking at the countries within a currency union, one union at a time. Section 4 presents a disaggregated analysis that looks at individual pairs of countries within a currency union as well as pairs where one country belongs to a given currency union and the other country does not.

2 Methodology & Data

The contribution of this paper is to provide a single framework for comparing and contrasting the extent of integration through price dynamics across the set of PTAs. If countries within a currency union display behavior similar to that of a single country, then prices across the PTA should follow a consistent growth trajectory over time, despite any intermittent, idiosyncratic shocks. In the long-run for a PTA with n countries, there should exist a vector of coefficients $(\beta_0, \beta_1, \ldots, \beta_n)$ such that, on average:

$$\beta_0 + \beta_1 p_1 + \ldots + \beta_n p_n = 0 \tag{1}$$

where p_i represents the log of the price level. Phrased differently, equation 1 implies that a cointegrating vector should exist such that a linear combination of the price levels is stationary over time regardless of the dynamic behavior of any individual country's price level. This paper uses the Johansen (1995) methodology to test for a cointegrating vector in the log of the Consumer Price Indices (CPIs) of the member countries which will serve as proxies for the true price levels. This approach uses Maximum Likelihood Estimation with a Gaussian distribution in order to estimate the following equation:

$$\begin{bmatrix} \Delta p_{1t} \\ \vdots \\ \Delta p_{nt} \end{bmatrix} = \pi_0 + \alpha\beta' \begin{bmatrix} p_{1t-1} \\ \vdots \\ p_{nt-1} \end{bmatrix} + \sum_{i=2}^{l} \pi_i \begin{bmatrix} \Delta p_{1t-i} \\ \vdots \\ \Delta p_{nt-i} \end{bmatrix} + \epsilon_t \tag{2}$$

where l is the lag-length of the system, $\alpha\beta'$ is an $n \times n$ matrix consisting of 2 $n \times r$ matrices (where r represents the number of cointegrating vectors) and the remaining π_i are $n \times 3$ matrices. The matrix β contains the cointegrating vectors, the parameters of interest. The Johansen procedure normalizes one coefficient in each cointegrating vector to 1. I will refer to this coefficient as β_1 throughout this paper. The procedure may normalize other coefficients to 0.

The intuition behind this test is as follows. The price level of any individual county likely exhibits unit-root or near-unit root behavior. If a group of countries is well-integrated (owing to the presence of a PTA, for example), then as a group, the price levels of the member countries should move together. How can we reconcile the random walk behavior at the country-level with a common pattern of movement at the wider, PTA-level? Intuitively, if the price level of one country in the PTA moves "far" from the price levels of the other member countries, the price levels of all countries should adjust over time to maintain "balanced" levels in the long-run. Phrased differently, the reconciliation implies that if the value of one country's price level deviates from a long-run level in one period, then the change in the price level for the other countries will respond to that deviated level. Hence, time-t growth in variables is sensitive to time t-1 levels. This sensitivity across variables implies that there exist linear dependencies in the matrix of coefficients for the levels of variables in the VECM. The trace test exploits these dependencies by summing transformations of the Eigenroots of the estimated coefficient matrix from the VECM for the levels of the variables. The linear dependencies

imply that the matrix should be of less-than-full rank, meaning that some Eigenroots are 0. Under a Gaussian distribution on the error terms, tabulated critical values exist for determining whether or not the matrix is of full rank. If the matrix is not of full rank, then cointegration exists and the matrix's rows contain the cointegrating vector(s).

Specifying the lag length has serious implications for detecting the presence of cointegration, as noted by Reimers (1992) and Boswijk and Franses (1992). Rapach and Wohar (2002) and Baharumshah et al. (2010) address this concern by estimating a vector auto regression (VAR) in levels at differing lag lengths, computing an information criterion for each lag length, and choosing the optimal lag length implied by the information criterion as the lag length for the VECM.

This paper uses a similar approach. First, I use the `varsoc` command in Stata to estimate VARs on the data for lag lengths varying from 1 to 5. 5 is the maximum number used by Rapach and Wohar (2002) whose data, like the data in this paper, are measured at quarterly frequencies. Second, I choose the lag length that minimizes the Schwarz's Bayesian Information Criterion (SBIC). Though Baharumshah et al. (2010) use the Akaike Information Criterion (AIC), I use the SBIC as Stata (2005) cites Lütkepohl (2005) in stating that "the SBIC or the HQIC provides consistent estimates of the true lag order," while "minimizing the AIC ... will overestimate the true lag order with positive probability, even with an infinite sample size."[1] Based on the lag length implied by the SBIC, I test for cointegrating vectors using the `vecrank` command in Stata and estimate equation 2 with the lag-length implied by the SBIC and with r cointegrating vectors implied by the results from the `vecrank` test.

How can we infer from the estimates of β whether or not the price levels of currency union countries are well-integrated? If a PTA has 2 countries and is perfectly integrated, then the price level of one country should respond to any given long-run trend in the

[1] Accessed online at `http://www.stata.com/manuals13/tsvarsoc.pdf`, p. 3

price level of the other country with a trend of equal rate and direction. Hence, the cointegrating vector for this PTA should be $(1, -1)$.

If a PTA has more than 2 countries, it is not clear what values of the coefficients would imply a high degree, let alone perfect, integration of price levels. Given that price levels generally rise over time, a stationary combination of price levels should include positive as well as negative coefficients. However, it is not clear which or even how many coefficients should be positive or negative. Therefore, I test each coefficient of the cointegrating vector against a null hypothesis of $\beta = -1$ as well as $\beta = 1$. These tests serve as benchmarks against which to gauge the responsiveness of the price levels in member countries. Coefficients that are significantly different from 0 but insignificantly different from -1 collectively counteract the (presumably upward) long-run trend of p_1.[2] Coefficients that are significantly different from 0 but insignificantly different from 1 enhance the (presumably upward) long-run trend of p_1. I emphasize the significant difference from 0 because relying merely on a failure to reject a null of $\beta = 1$ or $\beta = -1$ would not rule out cases where a large standard error would admit 0 as a possible value for the coefficient.

Studying the extent to which price levels within a PTA move together requires as long of a panel of price data as is possible. However, there exists a tradeoff between length of data for a particular country and the number of countries in a given trade area for which data are available. This problem is exacerbated by entries and exits into PTAs, further reducing the time-span over which data for all countries might be available. Consequently, I perform multiple cointegration tests for each PTA, changing the composition of the countries included and the time period examined, in order to check the robustness of the results. First, I test for cointegration on the entire dataset available, given a PTA's current composition. For each subsequent cointegration test, I

[2]Recall that β_1 is normalized to 1.

drop one country at a time, the country with the fewest number of observations, so as to check the sensitivity of the results and to obtain a longer sample period of data. The longer sample period should improve the power of the test, facilitating a rejection of the null hypothesis of no cointegration. The cost of this tradeoff is that removing a country may remove a price level that plays a key role in identifying a common stochastic trend throughout the PTA.

One can also lengthen the sample period artificially by increasing the frequency of the observations (quarterly versus yearly or monthly versus quarterly) so as to increase the number of observations, the degrees of freedom, and the power of the test. However, the higher the frequency of the data, the more likely that high-frequency noise might infect the data and obscure the existence of a cointegrating vector. Given these trade-offs, I use the CPI measured at quarterly frequencies and published in the IMF's International Financial Statistics database, 1948-2014. Identification of currency union membership comes from Glick and Rose (2002) with updates from IMF Staff Reports. A list of PTA member countries is at the end of this paper.

3 PTA-wide investigation

Results for the PTA-wide investigation of cointegration are found in tables 1 through 15. Table 1 lists the PTAs for which no cointegrating vector exists. Just over half of all of the PTAs lack a common stochastic trend in their price levels. Among such PTAs are several well-known and well-established economic areas such as CARICOM in the Caribbean and ECOWAS in western Africa.

The PTAs that possess a cointegrating vector include those consisting solely of developed economies, developing economies, as well as a mixture of both types of economies. The APTA (see table 2) has a cointegrating vector that is robust to a slight change in the time period examined. However, the initial time period examined requires imposing

0 coefficients on two countries (Bangladesh and South Korea). Looking at the countries with non-zero coefficients shows that Sri Lanka has a coefficient significantly different from 0 and insignificantly different from -1. Laos has a small, positive coefficient that is significant. Hence, price level growth in India and Laos offset price level growth in Sri Lanka.

The results for ASEAN also impose several coefficients to be 0 (see table 3). Additionally, 3 countries (the Philippines, Singapore, and Vietnam) have coefficients that are insignificant. Two countries, Malaysia and Thailand, appear to have the largest importance in governing price stability in the PTA. Both of their coefficients are significant and large in absolute value (27 and 25), compared to Indonesia's fixed coefficient of 1.

Results for the CACM (see table 4) also rely on a small number of countries. Honduras is omitted and 0s are imposed on Guatemala and Nicaragua in order to find a cointegrating vector. Interestingly, the coefficient for El Salvador is significant but twice as large in magnitude as is the fixed coefficient of 1 for Costa Rica. The inflation rate calculated from the CPI in El Salvador has been, on average, 80% of the inflation rate in Costa Rica since the early 1960s, according to data from the World Bank's *World Development Indicators*. Hence, it is not surprising that El Salvador's coefficient should be larger, amplifying the lower inflation rate, in order to achieve a stable combination of price levels across the PTA.

The cointegrating vector for the CEMAC does not impose any 0s on its members, though the coefficient for Chad is insignificantly different from 0 (see table 5). The members of this PTA also belong to a long-standing currency union that previous work has shown to be well-integrated in its price levels as well as in intraunion trade in certain types of goods (Whitten (2014a) and Whitten (2014b)).

The CIS demonstrates a common stochastic trend in the price levels of its member countries, a trend that is robust to the removal of one member, the Kyrgyz Republic (see

table 6). As was the case with ASEAN, several coefficients are set equal to 0. Ukraine's coefficient is significantly different from 0 and insignificantly different from 1. Russia's coefficients is significantly different from 0 and insignificantly different from -1. Hence, it seems that price level growth in Russia and Ukraine just offset each other. A smaller PTA containing some CIS members (Kazakhstan, the Kyrgyz Republic, and Russia) also possesses a cointegrating vector (see table 7).

A common stochastic trend drives inflation in the ECO and is robust to changes in the time-frame examined (2005-2013 versus 1995-2013; see table 8). However, four of the six coefficients for the 2005-2013 time period are imposed to be 0. In the 1995-2013 time period, by contrast, three out of the four countries examined possess non-0 coefficients.

The GCC has a cointegrating vector where most coefficients differ significantly from 0 (see table 9). A rough estimate by observation suggests that they all differ significantly from each other, too, suggesting that no country sees its prices respond in a magnitude similar to that of price movement in any other country.

Two important PTAs in the Americas, NAFTA and MERCOSUR, both have a cointegrating vector (see tables 10 and 11). The sum of the Canada and Mexico coefficients is approximately 1.2, just the opposite of the US coefficient. The MERCOSUR cointegrating vector, however, is effectively just a cointegrating vector between Brazil and Uruguay as both Argentina and Paraguay must be omitted.

The PICTA has a cointegrating vector over a relatively long timespan (the mid-1990s until the present). However, four of the six coefficients for the full sample are set to 0 (see table 12). In contrast, a PTA in existence for a much longer length of time and consisting of the same countries as well as others, the SPARTECA, imposes no 0 coefficients on any countries (see table 14).

The member countries of the SACU share a common stochastic trend in their price levels (see table 13). Of the five countries considered in the full sample, one coefficient is

imposed equal to 0 and one coefficient is insignificantly different from 0.

Another important PTA in Africa, the UEMOA, also has a cointegrating vector. The membership of this PTA overlaps with the UEMOA monetary union, one of the two parts of the CFA zone in Africa. Given that previous work has found this particular CFA zone to be well-integrated on many fronts, it is not surprising that the associated PTA has a cointegrating vector (see Masson and Pattillo (2005), Gulde and Tsangarides (2008), Whitten (2013), Whitten (2014b), and Whitten (2014a)).

The estimates in this section imply that within a given PTA, countries attain stable inflation dynamics when some members have positive coefficients (by normalization or otherwise) that amplify growth in the price level while the negative coefficients on the price levels of other countries work against that effect. Therefore, it seems that countries adhering to a common PTA have price levels that move together. However, there are three key limitations to this conclusion. First, there are several cases where countries must be dropped in order to compute a cointegrating vector in a given time period. Therefore, the results may not be generalizable to the entire PTA. Second, although these results demonstrate that the price levels of countries within a PTA move together, the results do not say that this comovement is unique to PTA countries, occurs more frequently among countries in a PTA than among countries not in a PTA, or is a consequence of PTA membership. Third, several well-established economic areas lack a cointegrating vector in their price levels entirely.

To address some of these limitations, the next section will examine cointegration on a bilateral basis. Instead of looking at a PTA directly as a single entity, the bilateral analysis permits examining the PTA as a set of country pairs. As the bilateral analysis requires the availability of data for just 2 countries instead of more than 2 countries (the requirement for the multilateral analysis), it permits analyzing the price levels over longer periods of time. The examination takes place for pairs of countries that belong to a PTA

as well as for pairs of countries not in a PTA in order to serve as a control group for country pairs in PTAs. The bilateral analysis also invites naturally the inclusion of the exchange rate between the 2 countries. The exchange rate may serve as the means by which one price level responds to movement in another price level. Though this possibility also exists in the multilateral setting, it is not clear how to introduce an exchange rate in order to account for this channel.

The next section follows a methodology similar to the methodology used by Berkowitz et al. (1998) of conducting cointegration tests on country pairs followed by Granger causality tests on those pairs. To understand if a given country has a particular influence on the price movements of another country within the union, I conduct the Granger causality tests on the price levels in country pairs. This provides an extra dimension for understanding price dynamics across countries.

4 Bilateral Investigation

Results from the bilateral analysis are reported in tables 16 and 17 with more detail presented in tables 18 and 19.[3]

In general, country pairs within a PTA are cointegrated to a higher extent than are country pairs otuside PTAs. The frequencey of cointegration for countyr pairs not in PTAs is 14.45%. Only 2 PTAs (CAN and EAC) have rates of cointegration lower than the frequency for country pairs not in a PTA. Of the remaining PTAs, only 4 (ASEAN, COMESA, LAIA, and PTN) have rates of pairwise cointegration above the average for country pairs outside PTAs but below 50%. Hence, more than half of all country pairs in 18 out of 26 PTAs possess a common stochastic component for their exchange rates

[3]Note that owing to space constraints, results for members of the European Community as well as for individual countries that have signed agreements with the EC (and, by extension, each member of the EC/EU) are excluded. They are available separately upon request.

and price levels.

The results in table 16 reflect to a limited extent the multilateral results found in the first half of the table. PTAs with low frequencies of cointegration on a pairwise basis (CAN, COMESA, EAC, LAIA) figure in the list of PTAs possessing no zone-wide cointegrating vector (see table 1). However, several unions with a high frequency of country-pair cointegrating vectors also lack a PTA-wide cointegrating vector (SAFTA, ECOWAS, EFTA, TPSEP). 70% of the country pairs in CACM are cointegrated. PTA-wide, a cointegrating vector for the zone exists only when one country (Honduras) is dropped and two other countries (Guatemala and Nicaragua) have coefficients of 0 imposed on the vector.

The results for Granger Causality reflect causation between price level movements in any one country to any other country. In general, Granger Causality occurs more frequently for country pairs within the same PTA than for a pair not in a PTA. However, Granger Causality is more common than is cointegration for country pairs not in a PTA. For example, the country pair of the US and Canada would count as 2, distinct country pairs as the US CPI could Granger cause the Canadian CPI and/or vice versa. Rates of Granger Causality are weakly and positively related to the rates of cointegration. The correlation between the 2^{nd} and 3^{rd} columns of table 16 is 0.498. This number merely reflects how "similar" are the two columns of numbers and does not imply any statistical relationship between the columns. Four PTAs (CEMAC, COMESA, EAC, NAFTA) have rates of Granger Causality lower than the rate for country pairs not in a PTA. One PTA (PAFTA) has a frequency of Granger Causality nearly equal (25%), to the frequency for country pairs not in a PTA.

Based on table 16, countries adhering to a common PTA tend to possess characteristics of unified markets (price co-movement and responsiveness) to a larger extent than do countries not in a PTA. Are these results evidence that countries forming a PTA are truly

more integrated amongst themselves than are they with other countries? Alternatively, do countries that join PTAs possess a greater level of openness such that price levels in these countries respond to external sources more readily than do countries not in PTAs, regardless of any international accords? Hence, on metric suggests a high level of market integration while another metric does not.

To answer the question raised at the end of the last paragraph, table 17 calculates rates of cointegration and Granger Causality for "partial" PTAs. These "partial" PTAs serve as control groups in order to gague whether the behavior found in earlier results is unique to this particular grouping of countries or if the countries in the PTA are susceptible to shifts in the price level from any other group of countries. For a given PTA, a partial PTA consists of all country pairs where exactly one country belongs to the PTA in question and exactly one PTA does *not* belong to the PTA in question. Such a country pair may count for two different partial PTAs. For example, the Canada - Thailand pair appears in the partial NAFTA PTA (since Canada belongs to NAFTA while Thailand does not) as well as the partial ASEAN PTA (since Thailand belongs to ASEAN while Canada does not).

The results in table 17 show that nearly half of all PTAs have rates of cointegration or Granger Causality that are as high or higher for the "partial" PTAs as are they for the actual PTAs. For example, the frequency of cointegration for the CAFTA is 55% while the frequency for the "partial" CAFTA is 55.98%. The frequency of cointegration for COMESA is merely 31.11% while the frequency for the "partial" COMESA is a much larger 57.42%. In some instances, the frequency for the true PTA is noticeably higher than is it for the "partial" PTA. For example, the frequency for SPARTEC is 82.41% while for the "partial" SPARTECA, the frequency is 59.45%. The frequency for the TPSEP is 100% while the frequency for the "partial" TPSEP is 58.62%. Similar results hold for Granger Causality.

Hence, membership in a PTA appears not to cause greater economic unity or market integration of its members beyond that level found in countries ordinarily. Therefore, if countries join PTAs, it is likely that the countries do so because they happen to be sufficiently open to outside economic forces so as to warrant formalizing economic relationships with trading partners.

5 Conclusion

Joining a PTA can present an economy with significant economic changes and opportunities. The lowering of trade barriers among a group of countries can remove price distortions for households and firms. Following the removal of these distortions, one might wonder if the evolution in prices across the countries within a PTA develops a common pattern.

This paper tests that hypothesis by examining the extent of cointegrated price movements for countries in PTAs. The results from the multilateral analysis in this paper show that several PTAs possess a cointegrating vectors for their exchange rates and price levels. These vectors imply that a long-run, stable relationship exists for the PTAs in question, suggesting that these groups of countries function as well-integrated markets. However, it is not clear *a priori* if joining the PTA causes the integration or if the countries that join PTAs happen to be particularly open to the effect of price movements in any countries (inside or outside the PTA in question).

A disaggregated, bilateral analysis provides further detail as well as a control group against which to analyze extent of cointegration found in the multilateral results. The share of country pairs in a given PTA possess a frequency of cointegration and Granger causality that is higher than the frequency found in country pairs not belonging to the same PTA. However, results for "partial" PTAs (for a given PTA, the set of country pairs where exactly one country in the pair belongs to the PTA in question while the

other country in the pair does not) suggest that the high rates of cointegration and Granger Causality are not a result of the PTA directly. The results instead suggest that when countries join a PTA, they are already more responsive to outside influences for determining their price levels and exchange rates.

Appendix 1: PTAs and their composition

Asia Pacific Trade Agreement (APTA 1976-)

Bangladesh;
China (2009-);
India;
Korea, Republic of;
Lao People's Democratic Republic;
Sri Lanka

ASEAN PTA(1992-)

Brunei Darussalam
Cambodia
China (2004-)
Indonesia
Lao People's Democratic Republic
Malaysia
Myanmar
Philippines
Singapore
Thailand
Vietnam

Central American Common Market (CACM 1962-)

Costa Rica
El Salvador
Guatemala
Honduras
Nicaragua

Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR 2006-)

Costa Rica;
Dominican Republic;
El Salvador;
Guatemala;
Honduras;

Nicaragua;
United States of America

Andean Community (CAN) (1962-)

Bolivia, Plurinational State of
Colombia
Ecuador
Peru
Venezuela, Bolivarian Republic of

Caribbean Community and Common Market (CARICOM 1974-)

Antigua and Barbuda
Bahamas (1984-)
Barbados
Belize
Dominica
Grenada
Guyana
Haiti (2003-)
Jamaica
Montserrat
aint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Suriname
Trinidad and Tobago (2001-)

Central European Free Trade Agreement (CEFTA 2006-)

Albania;
Bosnia and Herzegovina;
Bulgaria;
Croatia;
Moldova, Republic of;
Montenegro;
Romania;
Serbia;
The former Yugoslav Republic of Macedonia;

UNMIK/Kosovo

Economic and Monetary Community of Central Africa (CEMAC 1999-)

Cameroon;
Central African Republic;
Chad;
Congo;
Equatorial Guinea;
Gabon

Common Economic Zone (CEZ 2004-)

Belarus;
Kazakhstan;
Russian Federation;
Ukraine

Common Market for Eastern and Southern Africa (COMESA 2000-)

Burundi; (2004-)
Comoros;
DR Congo;
Djibouti;
Egypt;
Eritrea;
Ethiopia;
Kenya;
Libyan Arab Jamahiriya;
Madagascar;
Malawi;
Mauritius;
Rwanda; (2004-)
Seychelles;
Sudan;
Swaziland;
Uganda;
Zambia;

Zimbabwe.

East African Community (EAC 2001-)

Kenya;
Tanzania;
Uganda

Eurasian Economic Community (EAEC 1998-)

Belarus;
Kazakhstan;
Kyrgyz Republic;
Russian Federation;
Tajikistan

Economic Cooperation Organization (ECO 1992-)

Afghanistan;
Azerbaijan;
Islamic Republic of Iran;
Kazakhstan;
Kyrgyz Republic;
Pakistan;
Tajikistan;
Turkey;
Turkmenistan;
Uzbekistan.

Economic Community of West African States (ECOWAS 1993-)

Benin;
Burkina Faso;
Cabo Verde;
Côte d'Ivoire;
Ghana;
Guinea;
Guinea-Bissau;
Liberia, Republic of;
Mali;

Niger;
Nigeria;
Senegal;
Sierra Leone;
The Gambia;
Togo

Gulf Cooperation Council (GCC 2003-)

Bahrain
Kuwait
Oman
Qatar
Saudia Arabia
United Arab Emirates

European Free Trade Association (EFTA)

Austria (1960-1995)
Denmark (19601-1972)
Norway
Portugal (1960-1985)
Sweden (1960-1995)
Switzerland
United Kingdom (1960-1972)
Iceland (1970-)
Finland (1986-1995)
Lichtenstein (1991-)
Spain (1979-)
Turkey (1992-)
Czech Republic (1992-)
Slovakia (1993-)
Israel (1993-)
Poland (1992-)
Romania (1992-)
Hungary (1992-)
Bulgaria (1992-)
Estonia (1995-)
Latvia (1995-)
Lithuania (1995-)
Slovenia (1995-)
Morocco (2000-)

West Bank & Gaza (2000-)
Macedonia (2001-)
Mexico (2002-)
Chile (2005-)
Croatia (2002-)
Egypt (2008-)
Jordan (2002-)
South Korea (2006-)
Lebanon (2007-)
Singapore (2003-)
Tunisia (2005-)

Latin American Integration Association (LAIA 1981-)

Argentina
Venezuela
Bolivia
Brazil
Chile
Colombia
Cuba
Ecuador
Mexico
Paraguay
Peru
Uruguay

Melanesian Spearhead Group (MSG 1994-)

Fiji
Papua New Guinea
Solomon Islands
Vanuatu

Southern Common Market (MERCOSUR 1992-)

Argentina
Brazil
Paraguay
Uruguay

(NAFTA)

Canada (1994-)
Mexico (1994-)
United States of America (1994-)

Pan-Arab Free Trade Area (PAFTA 1998-)

Bahrain, Kingdom of
Egypt
Iraq
Jordan
Kuwait, the State of
Lebanese Republic
Libya
Morocco
Oman
Qatar
Saudi Arabia, Kingdom of
Sudan
Syrian Arab Republic
Tunisia
United Arab Emirates
Yemen

Pacific Island Countries Trade Agreement (PICTA 2003-)

Federated States of Micronesia
Fiji
Kiribati
Papua New Guinea
Solomon Islands
Tonga
Vanuatu
Western Samoa

Protocol on Trade Negotiations (PTN 1973-)

Bangladesh;
Brazil;
Chile;

Egypt;
Israel;
Korea, Republic of;
Mexico;
Pakistan;
Paraguay;
Peru;
Philippines;
Romania (1973-2000);
Tunisia;
Turkey;
Uruguay;

Southern African Customs Union (SACU 2004-)

Botswana
Lesotho
Namibia
South Africa
Swaziland

South African Development Corporation (SADC 2000-)

DR Congo (2006-);
Madagascar (2006-)
Seychelles (2000-2004)
Angola;
Botswana;
Lesotho;
Malawi;
Mauritius;
Mozambique;
Namibia;
South Africa;
Swaziland;
Tanzania;
Zambia;
Zimbabwe

South Asian Preferential Trade Arrangement (SAFTA 1996-)

Bangladesh
Bhutan
India
Maldives
Nepal
Pakistan
Sri Lanka

SPARTECA (1981-)

Australia
Cook Islands
Fiji
Kiribati
Marshall Islands
Micronesia, Federated States of
Nauru
New Zealand
Niue
Papua New Guinea
Samoa
Solomon Islands
Tonga
Tuvalu
Vanuatu

Trans-Pacific Strategic Economic Partnership (TPSEP)

Brunei (2007-)
Chile (2007-)
New Zealand (2006-)
Singapore (2006-)

WAEMU (1994-)

Benin
Burkina Faso
Côte d'Ivoire
Mali

Niger
Senegal
Togo

Tables

Table 1: PTAs with no cointegrating vectors

CAN	CARICOM
CEFTA	CEZ
COMESA	EAC
ECOWAS	EFTA
GSTP	LAIA
MSG	PAFTA
SAFTA	TPSEP
PTN	

Table 2: Cointegrating vectors for the APTA

	1994q1 - 2014q1					1993q2 - 2014q1				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Bangladesh	0.0									
India	1.0					1.0				
South Korea	0.0					0.0				
Laos	0.11	0.053	2.098	-16.9	21.097					
Sri Lanka	-1.047	0.103	-10.131	-19.802	-0.459	-1.216	0.116	-10.45	-19.034	-1.857

Table 3: Cointegrating vectors for the ASEAN

	1995q2 - 2014q1				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Indonesia	1.0				
Cambodia	0.0				
Laos	0.0				
Myanmar	0.0				
Malaysia	27.547	6.999	3.94	3.793	4.079
Philippines	0.099	3.594	0.03	-0.251	0.306
Singapore	-3.068	3.589	-0.85	-1.133	-0.576
Thailand	-25.473	3.325	-7.66	-7.961	-7.359
Vietnam	1.026	1.146	0.9	0.023	1.768

Table 4: Cointegrating vectors for the CACM

	1999q2 - 2014q2				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Costa Rica	1.0				
Guatemala	0.0				
Honduras					
Nicaragua	0.0				
El Salvador	-2.668	0.06	-44.196	-60.763	-27.63

Table 5: Cointegrating vectors for the CEMAC

	1999q2 - 2014q1				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Central African Republic	1.0				
Cameroon	-0.78	0.3	-2.6	-5.927	0.734
Congo, Republic of	0.446	0.135	3.3	-4.093	10.685
Gabon	-1.246	0.252	-4.94	-8.91	-0.976
Chad	-0.159	0.091	-1.74	-12.701	9.214

Table 6: Cointegrating vectors for the CIS

	1996q2 - 2013q4					1995q3 - 2013q4				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Armenia	0.0					0.0				
Georgia	1.0					1.0				
Kazakhstan	0.0					-0.237	0.166	-1.42	-7.435	4.587
Kyrgyz Republic	0.0									
Moldova	0.0					-1.039	0.168	-6.19	-12.14	-0.235
Russia	-1.171	0.248	-4.73	-8.762	-0.69	0.519	0.099	5.26	-4.871	15.389
Ukraine	0.959	0.333	2.88	-0.123	5.881	-0.059	0.123	-0.48	-8.617	7.659

Table 7: Cointegrating vectors for the EAEC

	1998q2 - 2013q4				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Kazakhstan	1.0				
Kyrgyz Republic	-0.514	0.14	-3.67	-10.815	3.471
Russia	-0.451	0.093	-4.84	-15.555	5.881

Table 8: Cointegrating vectors for the ECO

	2005q2 - 2013q4					1995q2 - 2013q4				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Afghanistan	0.0									
Iran	1.0					1.0				
Kazakhstan	0.0					0.0				
Kyrgyz Republic	0.0									
Pakistan	0.0					-0.675	0.216	-3.13	-7.768	1.508
Turkey	-1.953	0.122	-15.96	-24.138	-7.789	-0.805	0.067	-12.005	-26.914	2.904

Table 9: Cointegrating vectors for the GCC

	2004q3 - 2014q2					2003q2 - 2014q2				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Bahrain	0.0									
Kuwait	1.0					1.0				
Oman	-0.573	0.129	-4.45	-12.212	3.31					
Qatar	-0.157	0.032	-4.93	-36.374	26.521	-0.437	0.037	-11.91	-39.197	15.375
Saudi Arabia	-0.323	0.1	-3.22	-13.194	6.744	-0.576	0.047	-12.28	-33.611	9.047

Table 10: Cointegrating vectors for the MERCOSUR

	1992q3 - 2014q2				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Argentina					
Brazil	1.0				
Paraguay					
Uruguay	-0.679	0.346	-1.97	-4.858	0.928

Table 11: Cointegrating vectors for the NAFTA

	1994q4 - 2014q2				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Canada	1.0				
Mexico	0.262	0.04	6.47	-18.222	31.169
USA	-1.201	0.111	-10.85	-19.876	-1.818

Table 12: Cointegrating vectors for the PICTA

	1996q2 - 2013q4					1995q3 - 2013q4				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Fiji	1.0									
Papua New Guina	0.0					-0.666	0.378	-1.76	-4.401	0.884
Solomon Islands	0.0									
Tonga	0.0					-1.176	0.371	-3.17	-5.86	-0.473
Vanuatu	0.0					-2.208	1.052	-2.1	-3.048	-1.147
Western Samoa	-2.148	0.24	-8.93	-13.091	-4.774	2.368	0.442	5.36	3.095	7.619

Table 13: Cointegrating vectors for the SACU

	2005q2 - 2013q4					2004q2 - 2014q1				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Botswana	1.0					1.0				
Lesotho	0.0					0.0				
Namibia	-14.903	2.448	-6.09	-6.497	-5.68	-10.664	1.785	-5.97	-6.534	-5.414
Swaziland	2.445	1.973	1.24	0.733	1.746					
South Africa	11.071	2.618	4.23	3.847	4.61	9.561	1.815	5.27	4.717	5.819

Table 14: Cointegrating vectors for the SPARTECA

	1981q2 - 1998q4				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Australia	1.0				
Fiji	0.299	0.279	1.07	-2.513	4.661
New Zealand	0.038	0.137	-7.56	-14.836	-0.275
Papua New Guinea	0.498	0.16	3.11	-3.132	9.343
Solomon Islands	-0.707	0.166	-4.25	-10.255	1.757
Tonga	0.069	0.123	0.56	-7.573	8.687
Vanuatu	0.673	0.245	2.75	-1.332	6.822
Western Samoa	0.252	0.119	2.12	-6.291	10.526

Table 15: Cointegrating vectors for the UEMOA

	1997q2 - 2014q2				
	$\hat{\beta}$	Standard Error	Z-score for $H_0 : \beta = 0$	Z-score for $H_0 : \beta = 1$	Z-score for $H_0 : \beta = -1$
Benin	0.0				
Burkina Faso	0.0				
Cote d'Ivoire	1.0				
Guinea-Bissau	1.058	0.669	1.58	0.087	3.075
Mali	4.902	1.257	3.9	3.104	4.695
Niger	3.311	1.434	2.31	1.611	3.006
Senegal	-0.777	1.336	-0.58	-1.33	0.167
Togo	-8.521	0.997	-8.54	-9.546	-7.54

Table 16: Frequencies of cointegration and Granger Causality within PTAs

PTA	Cointegration	Granger Causality
APTA	55.56	77.78
ASEAN	46.67	36.67
CACM	70.00	45.00
CAFTA	55.00	32.50
CAN	10.00	30.00
CEFTA	51.85	42.59
CEMAC	40.00	20.00
CIS	65.00	52.50
COMESA	31.11	20.00
EAC	00.00	00.00
EAEC	66.67	50.00
EC	54.33	35.46
ECO	64.29	42.86
ECOWAS	63.74	55.49
EFTA	61.03	47.89
GCC	100.00	50.00
GSTP	58.41	37.70
LAIA	23.08	40.38
NAFTA	100.00	16.67
PAFTA	50.00	25.00
PTN	41.98	31.68
SADC	65.52	37.93
SAFTA	82.35	64.71
SPARTECA	82.14	48.21
TPSEP	100.00	50.00
Country pairs not in a PTA	14.45	23.60

Table 17: "Partial" PTAs: 1 country in the named PTA, one country outside the named PTA

PTA	Cointegration	Granger Causality
APTA	60.18	48.48
ASEAN	52.68	35.13
CACM	57.49	43.56
CAFTA	55.98	41.90
CAN	52.04	36.68
CARICOM	73.58	29.25
CEFTA	58.71	37.98
CEMAC	54.12	34.34
CIS	58.04	51.30
COMESA	57.42	37.98
EAC	63.15	41.45
EAEC	60.18	49.84
EC	58.54	40.73
ECO	58.40	47.15
ECOWAS	60.67	48.09
EFTA	56.96	47.63
GCC	75.00	42.85
GSTP	55.50	42.98
LAIA	56.45	37.5
NAFTA	57.14	36.55
PAFTA	55.82	32.03
PTN	53.87	37.61
SADC	63.31	42.67
SAFTA	42.10	37.28
SPARTECA	59.45	39.25
TPSEP	58.62	34.48

Table 18: Cointegration and Granger causality results

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
APTA	India - Sri Lanka						$\longleftrightarrow$
APTA	Lao People's Democratic Republic - Sri Lanka	1.182	46.332	-1.263	-24.397	-1.078	$\longleftrightarrow$
APTA	India - Bangladesh						$\longleftrightarrow$
APTA	Korea, Republic of - Sri Lanka	0.0		-0.5	-16.907	-16.907	None
APTA	Korea, Republic of - India	-2.427	-3.301	0.596	1.194	-3.462	$\longleftrightarrow$
APTA	Lao People's Democratic Republic - Bangladesh	1.19	65.599	-1.732	-31.194	-7.544	$\longleftrightarrow$
APTA	Lao People's Democratic Republic - Korea, Republic of						$\longleftrightarrow$
APTA	Lao People's Democratic Republic - India	1.17	57.893	-1.36	-23.668	-2.524	$\longleftrightarrow$
ASEAN	Malaysia - Lao People's Democratic Republic						$\longrightarrow$
ASEAN	Singapore - Lao People's Democratic Republic	1.941	8.317	-1.035	-51.468	3.676	$\longrightarrow$
ASEAN	Thailand - Brunei Darussalam	-0.462	-2.811	1.828	3.17	2.422	None
ASEAN	Malaysia - Brunei Darussalam						$\longrightarrow$
ASEAN	Thailand - Singapore	1.173	8.66	-0.823	-3.03	1.037	$\longrightarrow$
ASEAN	Malaysia - Indonesia	1.569	2.991	-1.123	-8.621	0.857	$\longrightarrow$
ASEAN	Vietnam - Philippines	1.627	14.371	-2.478	-14.157	-3.397	$\longleftrightarrow$
ASEAN	Philippines - Lao People's Democratic Republic	1.336	9.939	-0.981	-27.037	2.192	$\longrightarrow$
ASEAN	Thailand - Philippines	6.779	5.676	-4.817	-6.693	9.772	$\longrightarrow$
ASEAN	Thailand - Cambodia						$\longrightarrow$
ASEAN	Singapore - Philippines	2.489	2.085	-2.139	-5.762	0.477	$\longrightarrow$
ASEAN	Vietnam - Thailand	1.529	6.728	-3.277	-5.804	-3.19	$\longleftarrow$
ASEAN	Vietnam - Lao People's Democratic Republic	1.227	32.332	-1.063	-66.008	3.08	$\longrightarrow$
ASEAN	Philippines - Myanmar	-46.329	-3.803	10.325	3.049	0.55	$\longleftarrow$
ASEAN	Singapore - Malaysia	0.394	1.537	-1.164	-7.201	-2.271	$\longleftrightarrow$
ASEAN	Philippines - Malaysia	12.993	4.778	-23.692	-4.284	0.492	$\longleftrightarrow$
ASEAN	Thailand - Indonesia	0.333	0.83	-0.779	-6.019	-1.04	$\longrightarrow$
ASEAN	Vietnam - Cambodia	0.99	13.629	-1.159	-11.514	-1.062	$\longleftrightarrow$
ASEAN	Thailand - Malaysia	8.249	5.13	-10.57	-5.252	0.819	$\longrightarrow$
ASEAN	Lao People's Democratic Republic - Cambodia	1.111	44.58	-1.525	-19.349	-4.116	$\longleftrightarrow$
ASEAN	Vietnam - Singapore	0.123	1.017	1.873	3.833	4.05	None
ASEAN	Malaysia - Cambodia						$\longleftarrow$

Continued on next page

* The arrow's direction indicates which country's price level Granger causes the other country's price level. $\longleftrightarrow$ indicates bicausality.

Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
ASEAN	Indonesia - Cambodia						⟵
ASEAN	Indonesia - Brunei Darussalam						⟵
ASEAN	Philippines - Cambodia	3.763	9.91	-3.081	-9.351	1.471	⟷
ASEAN	Thailand - Lao People's Democratic Republic	1.978	13.173	-1.088	-42.263	5.276	⟶
ASEAN	Lao People's Democratic Republic - Indonesia						⟵
ASEAN	Vietnam - Malaysia						⟶
ASEAN	Vietnam - Indonesia	1.066	6.397	-1.282	-10.977	-0.863	⟵
CACM	Guatemala - Costa Rica	1.564	1.425	-1.755	-2.446	-0.792	⟶
CACM	Nicaragua - Honduras			0.733	13.36	13.36	None
CACM	Honduras - Guatemala			0.079	1.574	1.574	⟵
CACM	Guatemala - El Salvador	0.098	1.342	0.105	1.486	1.522	⟷
CACM	Nicaragua - El Salvador						⟶
CACM	Honduras - El Salvador			0.234	6.612	6.612	⟵
CACM	Nicaragua - Costa Rica	0.442	0.687	-0.855	-1.534	-0.833	⟶
CACM	Honduras - Costa Rica						⟶
CACM	El Salvador - Costa Rica	5.16	7.198	-2.361	-8.682	4.623	⟵
CAFTA	Dominican Republic - Costa Rica	2.579	9.262	-1.601	-6.657	2.524	⟵
CAFTA	Honduras - El Salvador			0.234	6.612	6.612	⟵
CAFTA	El Salvador - Dominican Republic						⟵
CAFTA	Honduras - United States	-1.769	-6.334	6.164	6.543	6.246	⟶
CAFTA	Honduras - Guatemala			0.079	1.574	1.574	⟵
CAFTA	Guatemala - El Salvador	0.098	1.342	0.105	1.486	1.522	⟷
CAFTA	Nicaragua - El Salvador						⟶
CAFTA	Nicaragua - Honduras			0.733	13.36	13.36	None
CAFTA	El Salvador - Costa Rica	5.16	7.198	-2.361	-8.682	4.623	⟵
CAFTA	Honduras - Costa Rica						⟶
CAFTA	Guatemala - Costa Rica	1.564	1.425	-1.755	-2.446	-0.792	⟶
CAFTA	Nicaragua - United States	-0.57	-2.108	4.063	3.918	4.64	None
CAFTA	Guatemala - United States	6.862	5.7	-16.766	-5.466	3.298	⟵
CAFTA	Nicaragua - Costa Rica	0.442	0.687	-0.855	-1.534	-0.833	⟶
CAN	Peru - Bolivia						⟷

* The arrow's direction indicates which country's price level Granger causes the other country's price level. ⟷ indicates bicausality.

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
CAN	Colombia - Bolivia						⟵
CEFTA	Slovak Republic - Portugal						⟶
CEFTA	Romania - Bulgaria						⟶
CEFTA	Slovak Republic - Czech Republic			-0.75	-6.191	-6.191	None
CEFTA	Romania - Hungary			-0.823	-3.33	-3.33	⟵
CEFTA	Hungary - Portugal						⟶
CEFTA	Slovenia - Slovak Republic						⟵
CEFTA	Hungary - Czech Republic						⟶
CEFTA	Hungary - Slovak Republic						⟶
CEFTA	Croatia - Portugal	-1.273	-4.481	1.769	4.411	1.076	⟵
CEFTA	Slovenia - Portugal	1.373	2.69	-2.938	-3.185	-3.105	None
CEFTA	Slovenia - Hungary						⟵
CEFTA	Slovenia - Czech Republic	11.964	1.848	-4.514	-0.468	-0.07	None
CEFTA	Romania - Slovak Republic						⟶
CEFTA	Romania - Czech Republic	0.606	5.074	0.183	0.249	1.149	⟶
CEFTA	Romania - Slovenia	0.952	2.818	-4.019	-2.691	-3.506	None
CEFTA	Croatia - Hungary	-0.732	-1.33	0.041	0.125	-1.33	⟵
CEFTA	Czech Republic - Bulgaria			-1.085	-23.27	-23.27	⟷
CEFTA	Slovenia - Croatia			-0.209	-2.286	-2.286	⟷
CEFTA	Czech Republic - Portugal	-4.185	-2.6	1.852	0.899	0.883	⟷
CEFTA	Hungary - Bulgaria						⟶
CEFTA	Croatia - Bulgaria	1.451	7.702	-0.765	-7.673	2.738	⟵
CEFTA	Croatia - Czech Republic	-49.543	-5.482	56.913	5.517	-0.044	⟶
CEFTA	Slovenia - Bulgaria			-0.114	-2.35	-2.35	⟷
CIS	Ukraine - Armenia, Republic of						⟷
CIS	Ukraine - Russian Federation						⟵
CIS	Kazakhstan - Armenia, Republic of						⟷
CIS	Russian Federation - Kyrgyz Republic						⟶
CIS	Ukraine - Kazakhstan	0.045	0.17	0.451	1.258	1.142	⟵
CIS	Russian Federation - Georgia	0.989	8.678	-0.926	-3.475	0.196	None
CIS	Moldova - Kyrgyz Republic	0.624	6.933	-0.757	-7.053	-0.749	⟶

* The arrow's direction indicates which country's price level Granger causes the other country's price level. ⟷ indicates bicausality.

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
CIS	Ukraine - Georgia	1.938	12.615	-2.14	-7.967	-0.594	$\longleftarrow$
CIS	Moldova - Kazakhstan	0.884	12.119	-1.035	-10.392	-0.954	None
CIS	Ukraine - Kyrgyz Republic	0.683	3.192	-0.402	-1.557	0.772	$\longrightarrow$
CIS	Moldova - Armenia, Republic of						$\longleftrightarrow$
CIS	Moldova - Georgia	1.25	20.152	-1.473	-13.589	-1.422	$\longleftarrow$
CIS	Kyrgyz Republic - Armenia, Republic of	17.4	5.671	-32.936	-5.059	0.538	$\longleftarrow$
CIS	Russian Federation - Armenia, Republic of	0.0		1.167	2.647	2.647	$\longleftrightarrow$
CIS	Russian Federation - Moldova						$\longrightarrow$
CIS	Ukraine - Moldova	1.733	14.039	-1.418	-11.48	1.449	$\longleftarrow$
CIS	Russian Federation - Kazakhstan	0.0		0.075	0.384	0.384	$\longrightarrow$
CIS	Kyrgyz Republic - Georgia	-2.381	-2.647	3.349	2.524	-8.582	$\longleftarrow$
CIS	Georgia - Armenia, Republic of	1.148	8.306	-1.022	-4.934	0.433	$\longrightarrow$
COMESA	Rwanda - Kenya	5.278	5.486	-3.609	-5.3	4.929	$\longleftarrow$
COMESA	Sudan - Malawi	0.0		-1.494	-9.96	-9.96	$\longleftrightarrow$
COMESA	Mauritius - Malawi	2.663	7.095	-2.253	-11.302	0.96	$\longrightarrow$
COMESA	Malawi - Kenya	3.151	8.963	-2.271	-6.662	1.926	$\longleftarrow$
COMESA	Kenya - Burundi						$\longrightarrow$
COMESA	Malawi - Djibouti	1.979	13.665	-2.637	-7.234	-1.612	$\longleftarrow$
COMESA	Mauritius - Burundi						$\longrightarrow$
COMESA	Madagascar - Burundi			-0.293	-5.292	-5.292	$\longrightarrow$
COMESA	Mauritius - Djibouti	1.196	4.489	-1.383	-3.684	-0.419	$\longrightarrow$
COMESA	Rwanda - Djibouti			2.725	8.687	8.687	$\longleftarrow$
COMESA	Kenya - Djibouti	-1.079	-4.1	3.076	4.473	3.375	None
COMESA	Zambia - Burundi	3.5	2.518	-2.32	-1.873	-1.567	None
COMESA	Sudan - Egypt	0.0		0.441	0.938	0.938	$\longleftarrow$
COMESA	Zambia - Djibouti	0.535	2.807	1.013	1.836	2.798	None
COMESA	Rwanda - Egypt						$\longleftarrow$
COMESA	Zambia - Rwanda						$\longrightarrow$
COMESA	Sudan - Burundi						$\longleftarrow$
COMESA	Rwanda - Mauritius	25.167	5.409	-31.936	-4.963	0.14	$\longleftarrow$
COMESA	Malawi - Burundi	1.911	72.437	-1.373	-55.159	10.752	$\longleftrightarrow$

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0: \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0: \beta_2 = 0$	Z-score for $H_0: \beta_1 + \beta_2 = 0$	Granger Causality*
EAEC	Russian Federation - Kazakhstan	0.0		0.075	0.384	0.384	$\longrightarrow$
EAEC	Kyrgyz Republic - Kazakhstan	0.622	3.125	-0.639	-2.915	-0.051	$\longleftarrow$
EAEC	Russian Federation - Kyrgyz Republic						$\longrightarrow$
ECO	Afghanistan, Islamic Republic of - Iran, Islamic Republic of	0.645	2.203	-0.819	-6.161	-0.496	None
ECO	Kyrgyz Republic - Afghanistan, Islamic Republic of	1.482	15.438	-1.796	-14.236	-1.579	$\longleftrightarrow$
ECO	Pakistan - Afghanistan, Islamic Republic of	1.206	10.655	-1.082	-6.495	0.507	$\longleftrightarrow$
ECO	Kyrgyz Republic - Pakistan	1.312	11.769	-1.418	-10.248	-0.48	$\longleftarrow$
ECO	Kazakhstan - Iran, Islamic Republic of	-130.174	-7.353	72.524	7.287	0.18	$\longleftarrow$
ECO	Pakistan - Iran, Islamic Republic of						$\longleftarrow$
ECO	Kyrgyz Republic - Kazakhstan	0.622	3.125	-0.639	-2.915	-0.051	$\longleftarrow$
ECO	Kyrgyz Republic - Turkey	0.122	0.391	-0.087	-0.597	0.091	$\longrightarrow$
ECO	Iran, Islamic Republic of - Turkey						$\longleftrightarrow$
ECO	Kazakhstan - Afghanistan, Islamic Republic of	1.857	10.721	-2.015	-10.259	-0.52	$\longrightarrow$
ECO	Kazakhstan - Turkey			0.712	3.264	3.264	None
ECOWAS	Burkina Faso - Guinea-Bissau			0.148	2.236	2.236	$\longleftrightarrow$
ECOWAS	Niger - Guinea	-1.69	-1.899	-0.532	-3.259	-2.823	$\longleftarrow$
ECOWAS	Nigeria - Gambia, The	17.377	8.545	-30.693	-7.015	1.238	$\longleftarrow$
ECOWAS	Guinea-Bissau - Benin			-0.096	-0.84	-0.84	$\longleftrightarrow$
ECOWAS	Nigeria - Guinea-Bissau			3.23	11.282	11.282	$\longleftrightarrow$
ECOWAS	Burkina Faso - Cabo Verde	0.0		0.006	0.165	0.165	$\longrightarrow$
ECOWAS	Burkina Faso - Guinea	-1.437	-1.413	-0.565	-2.881	-2.382	None
ECOWAS	Niger - Cabo Verde	0.0		0.016	0.42	0.42	$\longleftarrow$
ECOWAS	Nigeria - Benin						$\longleftarrow$
ECOWAS	Senegal - Liberia						$\longleftrightarrow$
ECOWAS	Niger - Guinea-Bissau			0.154	2.604	2.604	$\longleftrightarrow$
ECOWAS	Senegal - Nigeria	27.866	5.134	-6.335	-6.886	-6.479	$\longleftrightarrow$
ECOWAS	Togo - Nigeria						$\longleftrightarrow$
ECOWAS	Togo - Guinea			-0.709	-21.505	-21.505	$\longleftarrow$
ECOWAS	Togo - Liberia						$\longleftarrow$
ECOWAS	Liberia - Cote d'Ivoire	5.057	6.441	-14.377	-5.521	14.121	$\longleftrightarrow$
ECOWAS	Mali - Cabo Verde			0.006	0.165	0.165	$\longleftarrow$

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
ECOWAS	Niger - Gambia, The	3.693	9.904	-3.043	-18.023	1.532	$\longleftrightarrow$
ECOWAS	Senegal - Gambia, The	4.513	11.249	-3.066	-21.131	3.319	$\longleftrightarrow$
ECOWAS	Nigeria - Niger			18.387	6.384	6.384	$\longrightarrow$
ECOWAS	Senegal - Guinea-Bissau			-0.046	-0.744	-0.744	$\longrightarrow$
ECOWAS	Burkina Faso - Nigeria	20.524	3.648	-6.752	-5.309	-1.926	$\longrightarrow$
ECOWAS	Guinea-Bissau - Gambia, The			-1.635	-8.062	-8.062	$\longleftrightarrow$
ECOWAS	Cote d'Ivoire - Guinea-Bissau			0.267	3.991	3.991	$\longleftrightarrow$
ECOWAS	Burkina Faso - Liberia	1.817	1.931	-1.191	-4.024	0.905	None
ECOWAS	Guinea - Guinea-Bissau	0.55	2.227	1.605	1.395	2.502	$\longrightarrow$
ECOWAS	Nigeria - Cabo Verde						$\longleftarrow$
ECOWAS	Burkina Faso - Sierra Leone	0.101	0.3	-0.578	-7.166	-1.294	None
ECOWAS	Sierra Leone - Liberia	1.692	10.954	-2.071	-9.59	-1.242	$\longleftrightarrow$
ECOWAS	Mali - Guinea-Bissau			-0.074	-1.012	-1.012	$\longrightarrow$
ECOWAS	Gambia, The - Benin	3.282	15.327	-3.141	-8.836	0.333	$\longleftrightarrow$
ECOWAS	Togo - Cabo Verde			-0.012	-0.434	-0.434	$\longrightarrow$
ECOWAS	Liberia - Gambia, The	1.799	8.516	-3.031	-9.308	-3.05	$\longleftrightarrow$
ECOWAS	Mali - Guinea	-0.089	-0.084	-0.847	-3.974	-1.108	$\longleftarrow$
ECOWAS	Sierra Leone - Cabo Verde	0.528	3.201	0.133	0.199	1.068	None
ECOWAS	Nigeria - Cote d'Ivoire			9.449	6.888	6.888	$\longleftarrow$
ECOWAS	Nigeria - Mali	3.481	2.154	-2.496	-0.323	-0.066	$\longrightarrow$
ECOWAS	Gambia, The - Cabo Verde	2.515	20.633	-2.319	-9.371	0.627	$\longleftrightarrow$
ECOWAS	Burkina Faso - Gambia, The	3.755	9.822	-3.255	-17.545	1.157	$\longleftrightarrow$
ECOWAS	Mali - Liberia						$\longrightarrow$
ECOWAS	Cote d'Ivoire - Cabo Verde	-0.081	-0.642	0.095	0.681	0.059	$\longrightarrow$
ECOWAS	Guinea-Bissau - Cabo Verde			-0.188	-1.03	-1.03	$\longleftarrow$
ECOWAS	Sierra Leone - Guinea			-0.211	-6.469	-6.469	None
ECOWAS	Senegal - Guinea	-57.105	-4.164	7.002	3.2	1.196	$\longleftrightarrow$
ECOWAS	Togo - Gambia, The	3.599	12.531	-3.225	-23.678	1.073	$\longleftrightarrow$
ECOWAS	Senegal - Cabo Verde	0.276	2.194	-0.258	-2.685	0.093	$\longrightarrow$
ECOWAS	Benin - Cabo Verde			-0.008	-0.243	-0.243	$\longrightarrow$
ECOWAS	Nigeria - Liberia	1.07	4.16	-1.318	-4.378	-0.614	$\longrightarrow$

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
ECOWAS	Mali - Gambia, The	3.059	9.089	-2.793	-18.436	0.675	$\longleftrightarrow$
ECOWAS	Sierra Leone - Benin						$\longrightarrow$
ECOWAS	Cote d'Ivoire - Gambia, The	4.957	8.474	-3.986	-12.537	1.782	$\longleftrightarrow$
ECOWAS	Liberia - Benin	2.233	7.597	-4.4	-5.353	-3.382	$\longleftrightarrow$
ECOWAS	Togo - Guinea-Bissau	0.0		0.-0	179.-0	179.$\longleftrightarrow$	
EFTA	Bulgaria - Switzerland			-11.716	-1.315	-1.315	$\longleftrightarrow$
EFTA	Slovenia - Mexico	-6.305	-6.127	3.377	4.868	-9.289	$\longleftrightarrow$
EFTA	Spain - Sweden	-0.002	-0.004	-1.325	-2.07	-2.58	None
EFTA	Slovenia - Jordan			-0.139	-1.222	-1.222	$\longrightarrow$
EFTA	Estonia - Iceland	4.725	8.185	-4.295	-9.548	0.811	$\longleftrightarrow$
EFTA	Croatia - Bulgaria	1.451	7.702	-0.765	-7.673	2.738	$\longleftarrow$
EFTA	Czech Republic - Spain	-3.705	-2.949	1.277	0.787	2.469	$\longrightarrow$
EFTA	Romania - Turkey						$\longrightarrow$
EFTA	Latvia - Jordan	-0.689	-4.108	0.473	2.451	-0.725	$\longrightarrow$
EFTA	Slovak Republic - Israel	-1.968	-3.402	-0.477	-0.503	-5.197	None
EFTA	Macedonia, FYR - Latvia	26.467	1.564	-20.633	-2.833	-0.028	None
EFTA	Hungary - Estonia	-2.878	-4.471	3.424	4.279	1.248	$\longrightarrow$
EFTA	Latvia - Spain						$\longleftrightarrow$
EFTA	Hungary - Morocco	51.421	5.2	-137.119	-4.942	0.17	$\longleftrightarrow$
EFTA	Estonia - Norway	-5.359	-4.725	11.46	4.522	-3.096	$\longleftrightarrow$
EFTA	Romania - Estonia	0.069	0.373	0.199	0.288	0.408	$\longleftarrow$
EFTA	Estonia - Jordan			-0.281	-2.573	-2.573	$\longrightarrow$
EFTA	Poland - Singapore						$\longleftrightarrow$
EFTA	Norway - Austria	0.471	3.239	-0.244	-1.14	0.763	None
EFTA	Slovak Republic - Norway	2.39	4.059	-5.193	-3.111	-8.455	None
EFTA	Slovak Republic - Mexico						$\longleftrightarrow$
EFTA	Macedonia, FYR - Lithuania	0.122	1.395	-0.052	-0.909	0.52	None
EFTA	Sweden - Norway	-0.681	-2.133	0.852	2.614	0.391	$\longleftrightarrow$
EFTA	Korea, Republic of - Switzerland						$\longleftrightarrow$
EFTA	Slovenia - Latvia						$\longleftrightarrow$
EFTA	Finland - Austria	3.789	4.631	-3.166	-4.222	1.765	$\longrightarrow$

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PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
EFTA	Poland - Iceland	-3.063	-7.004	-0.339	-1.039	-5.791	None
EFTA	Czech Republic - Norway	6.558	2.854	-6.14	-1.415	-0.033	$\longrightarrow$
EFTA	Estonia - Turkey			0.62	2.731	2.731	None
EFTA	Turkey - Switzerland						$\longrightarrow$
EFTA	Slovenia - Bulgaria			-0.114	-2.35	-2.35	$\longleftrightarrow$
EFTA	Hungary - Mexico	0.0		-0.464	-2.433	-2.433	$\longleftrightarrow$
EFTA	Slovak Republic - Turkey						$\longleftarrow$
EFTA	Hungary - Latvia						$\longrightarrow$
EFTA	Slovak Republic - Czech Republic			-0.75	-6.191	-6.191	None
EFTA	Estonia - Spain	-0.027	-4.311	0.037	3.861	0.639	$\longleftarrow$
EFTA	Croatia - Czech Republic	-49.543	-5.482	56.913	5.517	-0.044	$\longrightarrow$
EFTA	Czech Republic - Bulgaria			-1.085	-23.27	-23.27	$\longleftrightarrow$
EFTA	Lithuania - Jordan						$\longrightarrow$
EFTA	Poland - Mexico	6.694	6.295	-5.464	-7.347	5.193	$\longleftrightarrow$
EFTA	Czech Republic - Singapore	-2.938	-5.897	2.906	6.466	-0.062	None
EFTA	Latvia - Israel	3.505	7.173	-8.901	-9.788	-9.719	$\longleftrightarrow$
EFTA	Romania - Slovenia	0.952	2.818	-4.019	-2.691	-3.506	None
EFTA	Lithuania - Morocco	0.272	1.387	-0.762	-1.955	-1.119	$\longrightarrow$
EFTA	Israel - Spain	-4.41	-4.677	3.408	3.335	-5.02	$\longleftrightarrow$
EFTA	Poland - Estonia			-0.002	-0.043	-0.043	$\longleftrightarrow$
EFTA	Slovenia - Singapore						$\longrightarrow$
EFTA	Singapore - Jordan	-0.527	-2.47	-0.355	-3.062	-3.136	None
EFTA	Hungary - Turkey			0.246	1.987	1.987	$\longleftarrow$
EFTA	Finland - Sweden	-11.532	-3.339	13.843	4.542	-0.164	$\longleftrightarrow$
EFTA	Latvia - Mexico						$\longleftarrow$
EFTA	Turkey - Finland	1.041	38.809	-0.272	-0.521	1.469	$\longrightarrow$
EFTA	Slovenia - Turkey						$\longleftrightarrow$
EFTA	Latvia - Bulgaria	1.468	19.047	-1.092	-46.311	3.835	$\longleftrightarrow$
EFTA	Hungary - Spain	0.0		-0.347	-1.401	-1.401	$\longrightarrow$
EFTA	Croatia - Estonia						$\longleftrightarrow$
EFTA	Czech Republic - Turkey			-0.777	-43.778	-43.778	None

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
EFTA	Singapore - Norway	-0.429	-1.377	-0.638	-1.344	-2.138	None
EFTA	Romania - Israel	-0.198	-0.688	2.609	1.304	2.012	None
EFTA	Latvia - Singapore						⟵
EFTA	Lithuania - Israel	0.0		-17.717	-6.135	-6.135	⟷
EFTA	Poland - Slovak Republic						⟷
EFTA	Estonia - Bulgaria			-0.033	-0.332	-0.332	⟷
EFTA	Singapore - Turkey	-2.152	-3.565	-0.234	-1.11	-4.194	None
EFTA	Lithuania - Mexico	-2.206	-2.246	1.648	1.639	-11.481	⟷
EFTA	Poland - Jordan	1.693	1.333	-1.164	-1.644	2.542	⟶
EFTA	Macedonia, FYR - Czech Republic	-4.069	-5.266	4.874	6.322	2.216	⟶
EFTA	Estonia - Mexico	-11.719	-5.141	11.981	4.927	-0.042	⟶
EFTA	Singapore - Spain	-1.207	-1.6	-0.89	-0.983	-5.799	⟷
EFTA	Romania - Iceland	1.289	14.256	-1.812	-4.378	-1.14	⟵
EFTA	Bulgaria - Jordan	-0.378	-0.892	0.075	0.168	-0.608	None
EFTA	Croatia - Latvia	0.11	0.145	0.198	0.529	0.532	⟵
EFTA	Czech Republic - Iceland	-29.355	-5.116	7.891	2.161	0.873	⟷
EFTA	Poland - Bulgaria						⟷
EFTA	Romania - Czech Republic	0.606	5.074	0.183	0.249	1.149	⟶
EFTA	Latvia - Switzerland						⟶
EFTA	Latvia - Czech Republic	0.0		1.611	6.366	6.366	⟶
EFTA	Turkey - Norway	1.038	28.068	-0.029	-0.05	1.74	None
EFTA	Estonia - Singapore						⟶
EFTA	Korea, Republic of - Iceland						⟶
EFTA	Czech Republic - Jordan	0.0		-0.549	-4.066	-4.066	⟶
EFTA	Korea, Republic of - Jordan	-11.033	-4.183	6.301	4.169	1.294	None
EFTA	Slovenia - Spain	0.705	9.809	-0.676	-5.415	0.161	⟵
EFTA	Iceland - Finland						⟵
EFTA	Hungary - Iceland	-2.109	-4.471	-0.661	-1.044	-4.274	None
EFTA	Lithuania - Turkey			0.232	1.377	1.377	⟷
EFTA	Spain - Austria	-1.368	-3.824	1.428	2.127	0.108	None
EFTA	Switzerland - Austria						⟶

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PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
EFTA	Latvia - Estonia			0.391	6.798	6.798	$\longrightarrow$
EFTA	Romania - Slovak Republic						$\longrightarrow$
EFTA	Bulgaria - Turkey			0.675	8.762	8.762	$\longrightarrow$
EFTA	Bulgaria - Israel						$\longleftarrow$
EFTA	Slovenia - Hungary						$\longleftarrow$
EFTA	Hungary - Slovak Republic						$\longrightarrow$
EFTA	Bulgaria - Iceland			-1.864	-1.524	-1.524	$\longleftrightarrow$
EFTA	Lithuania - Singapore						$\longleftarrow$
EFTA	Bulgaria - Norway	0.948	67.886	-2.285	-11.231	-6.288	$\longleftarrow$
EFTA	Lithuania - Czech Republic			0.839	4.479	4.479	$\longleftrightarrow$
EFTA	Macedonia, FYR - Hungary						$\longleftarrow$
EFTA	Hungary - Jordan	-0.041	-0.044	0.236	0.265	1.074	$\longrightarrow$
EFTA	Slovenia - Czech Republic	11.964	1.848	-4.514	-0.468	-0.07	None
EFTA	Hungary - Israel						$\longleftrightarrow$
EFTA	Estonia - Czech Republic						$\longrightarrow$
EFTA	Romania - Singapore	3.668	3.378	-2.201	-0.961	-1.112	None
EFTA	Latvia - Turkey	0.0		-4.064	-9.054	-9.054	$\longleftrightarrow$
EFTA	Singapore - Israel						$\longleftarrow$
EFTA	Romania - Morocco			-1.439	-0.842	-0.842	None
EFTA	Turkey - Sweden			-19.248	-4.345	-4.345	$\longrightarrow$
EFTA	Estonia - Switzerland	1.542	5.583	-6.29	-4.178	-4.846	$\longleftarrow$
EFTA	Estonia - Israel	-82.993	-5.598	176.995	6.945	-0.133	$\longleftrightarrow$
EFTA	Macedonia, FYR - Estonia	0.581	3.847	-0.317	-3.579	1.242	$\longleftrightarrow$
EFTA	Romania - Mexico	20.796	3.859	-21.09	-2.464	0.004	$\longleftarrow$
EFTA	Korea, Republic of - Spain			0.299	0.513	0.513	$\longleftrightarrow$
EFTA	Slovak Republic - Switzerland						$\longrightarrow$
EFTA	Spain - Portugal	-1.377	-0.568	5.799	3.487	-1.189	$\longrightarrow$
EFTA	Slovenia - Lithuania	0.0		-0.738	-2.533	-2.533	$\longrightarrow$
EFTA	Portugal - Switzerland						$\longleftarrow$
EFTA	Israel - Iceland	-3.572	-4.05	0.286	0.535	-5.178	None
EFTA	Slovenia - Switzerland						$\longleftarrow$

* The arrow's direction indicates which country's price level Granger causes the other country's price level. $\longleftrightarrow$ indicates bicausality.

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
EFTA	Romania - Bulgaria						$\longrightarrow$
EFTA	Slovak Republic - Morocco						$\longleftarrow$
EFTA	Romania - Poland						$\longleftarrow$
EFTA	Singapore - Switzerland						$\longleftarrow$
EFTA	Croatia - Lithuania						$\longleftarrow$
EFTA	Finland - Switzerland	1.178	3.361	-1.051	-2.137	0.25	$\longleftrightarrow$
EFTA	Poland - Hungary						$\longleftrightarrow$
EFTA	Poland - Israel			3.651	8.69	8.69	$\longleftarrow$
EFTA	Turkey - Iceland			-6.662	-6.853	-6.853	$\longrightarrow$
EFTA	Lithuania - Norway	1.265	6.032	-2.438	-6.723	-2.733	$\longleftarrow$
EFTA	Romania - Lithuania	0.366	2.944	-0.065	-0.11	0.501	$\longleftrightarrow$
EFTA	Lithuania - Spain						$\longleftarrow$
EFTA	Lithuania - Hungary						$\longleftarrow$
EFTA	Slovenia - Croatia			-0.209	-2.286	-2.286	$\longleftrightarrow$
EFTA	Romania - Spain	0.0		-4.631	-2.097	-2.097	$\longleftarrow$
EFTA	Romania - Switzerland	0.659	9.508	-1.963	-0.966	-0.697	None
EFTA	Bulgaria - Spain			-2.183	-0.904	-0.904	$\longleftarrow$
EFTA	Lithuania - Bulgaria			-0.336	-5.054	-5.054	$\longleftrightarrow$
EFTA	Israel - Norway	-8.888	-4.022	7.919	2.074	0.098	None
EFTA	Lithuania - Iceland	10.281	5.321	-6.824	-6.006	-3.109	$\longleftarrow$
EFTA	Spain - Finland			-0.649	-4.975	-4.975	None
EFTA	Switzerland - Denmark	1.211	2.508	-1.338	-4.901	-0.257	$\longleftrightarrow$
EFTA	Lithuania - Estonia	0.0		0.551	3.25	3.25	$\longleftrightarrow$
EFTA	Turkey - Austria			-6.156	-2.75	-2.75	$\longrightarrow$
EFTA	Poland - Turkey						$\longrightarrow$
EFTA	Hungary - Singapore	-0.129	-0.283	2.203	2.872	3.79	$\longleftrightarrow$
EFTA	Croatia - Singapore						$\longleftarrow$
EFTA	Iceland - Sweden	2.435	6.21	-6.589	-6.27	-6.343	$\longleftrightarrow$
EFTA	Sweden - Austria	0.579	5.111	-0.089	-0.523	2.005	$\longrightarrow$
EFTA	Slovenia - Iceland	2.539	9.703	-2.027	-8.519	1.325	$\longrightarrow$
EFTA	Slovak Republic - Iceland	1.729	9.206	-2.538	-11.687	-2.449	$\longrightarrow$

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* The arrow's direction indicates which country's price level Granger causes the other country's price level. $\longleftrightarrow$ indicates bicausality.

Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
EFTA	Poland - Czech Republic						$\longrightarrow$
EFTA	Romania - Latvia	0.361	2.387	-0.575	-1.083	-0.382	$\longrightarrow$
EFTA	Macedonia, FYR - Slovenia						$\longleftrightarrow$
EFTA	Macedonia, FYR - Bulgaria	-0.011	-0.339	0.02	1.398	0.21	$\longleftrightarrow$
EFTA	Poland - Norway	3.625	14.206	-2.899	-3.033	0.937	$\longleftarrow$
EFTA	Portugal - Sweden	0.44	2.712	0.279	0.94	1.978	None
EFTA	Czech Republic - Mexico	-35.104	-6.922	20.667	6.469	0.605	$\longleftrightarrow$
EFTA	Hungary - Bulgaria						$\longrightarrow$
EFTA	Hungary - Switzerland						$\longrightarrow$
EFTA	Czech Republic - Israel			-9.555	-10.572	-10.572	$\longrightarrow$
EFTA	Romania - Hungary			-0.823	-3.33	-3.33	$\longleftarrow$
EFTA	Switzerland - Sweden						$\longrightarrow$
EFTA	Romania - Macedonia, FYR	0.682	10.573	-1.328	-2.48	-1.187	None
EFTA	Slovenia - Slovak Republic						$\longleftarrow$
EFTA	Slovenia - Norway	1.293	4.758	-0.974	-1.493	0.552	None
EFTA	Romania - Norway	0.259	1.408	-0.091	-0.041	0.095	None
EFTA	Portugal - Austria	2.215	8.144	-5.72	-8.172	-5.835	$\longleftarrow$
EFTA	Poland - Latvia			-0.301	-3.698	-3.698	$\longleftrightarrow$
EFTA	Hungary - Czech Republic						$\longrightarrow$
EFTA	Poland - Lithuania			0.016	0.151	0.151	$\longleftarrow$
EFTA	Latvia - Iceland	8.778	5.084	-8.051	-4.997	-0.347	$\longleftrightarrow$
EFTA	Slovak Republic - Spain	1.295	2.863	-2.219	-2.403	-1.652	$\longrightarrow$
EFTA	Czech Republic - Morocco	9.047	5.065	-14.643	-5.977	1.264	$\longleftrightarrow$
EFTA	Croatia - Hungary	-0.732	-1.33	0.041	0.125	-1.33	$\longleftarrow$
EFTA	Poland - Switzerland	5.081	9.829	-11.117	-4.147	-5.669	$\longleftrightarrow$
EFTA	Czech Republic - Switzerland	22.928	4.14	-66.295	-2.773	0.2	$\longleftrightarrow$
EFTA	Hungary - Norway	2.048	6.805	-2.772	-2.231	-0.876	None
EFTA	Israel - Switzerland	-10.365	-4.375	23.42	2.296	-0.405	$\longleftarrow$
EFTA	Slovenia - Estonia						$\longleftarrow$
EFTA	Portugal - Iceland	-54.64	-3.627	9.47	0.906	0.168	$\longrightarrow$
EFTA	Portugal - Norway	1.706	14.45	-2.402	-10.292	-2.347	$\longleftrightarrow$

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
EFTA	Turkey - Spain			-44.677	-6.794	-6.794	$\longrightarrow$
GCC	Kuwait - Bahrain, Kingdom of	-0.756	-5.562	1.333	4.704	1.68	$\longleftrightarrow$
GCC	Oman - Kuwait	-0.044	-0.189	0.157	0.698	0.319	None
GCC	Saudi Arabia - Kuwait	1.034	4.049	-0.977	-3.954	0.15	$\longleftarrow$
GCC	Qatar - Kuwait	0.0		0.189	5.716	5.716	$\longrightarrow$
LAIA	Brazil - Bolivia						$\longrightarrow$
LAIA	Colombia - Bolivia						$\longleftarrow$
LAIA	Paraguay - Colombia	0.548	3.266	-0.445	-2.838	0.377	$\longrightarrow$
LAIA	Chile - Bolivia	0.0		-0.064	-0.624	-0.624	None
LAIA	Colombia - Brazil	1.792	23.318	-1.056	-104.633	8.624	$\longleftarrow$
LAIA	Mexico - Colombia						$\longleftrightarrow$
LAIA	Mexico - Bolivia						$\longleftrightarrow$
LAIA	Venezuela, Republica Bolivariana de - Mexico	14.447	10.0	-83.368	-9.471	4.553	None
LAIA	Venezuela, Republica Bolivariana de - Chile			-1.473	-0.425	-0.425	$\longrightarrow$
LAIA	Paraguay - Bolivia						$\longleftarrow$
LAIA	Uruguay - Bolivia						$\longleftrightarrow$
LAIA	Peru - Bolivia						$\longleftrightarrow$
LAIA	Uruguay - Colombia						$\longleftrightarrow$
NAFTA	Mexico - Canada			2.955	10.932	10.932	None
NAFTA	Canada - United States	-1.55	-0.486	0.084	0.032	0.137	None
NAFTA	Mexico - United States			0.888	4.402	4.402	$\longleftarrow$
PAFTA	Egypt - Saudi Arabia						$\longleftarrow$
PAFTA	Qatar - Iraq	0.168	7.825	-0.031	-3.444	4.553	None
PAFTA	Libya - Bahrain, Kingdom of						$\longleftrightarrow$
PAFTA	Sudan - Egypt	0.0		0.441	0.938	0.938	$\longleftarrow$
PAFTA	Egypt - Oman						$\longrightarrow$
PAFTA	Libya - Iraq			-0.022	-0.727	-0.727	None
PAFTA	Tunisia - Iraq	0.532	2.571	0.443	2.751	3.208	None
PAFTA	Tunisia - Morocco						$\longrightarrow$
PAFTA	Libya - Oman	3.877	2.707	-4.87	-3.218	0.972	$\longleftrightarrow$
PAFTA	Saudi Arabia - Iraq	-0.136	-1.163	0.103	0.969	-0.165	$\longrightarrow$

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
PAFTA	Libya - Jordan	1.504	1.596	-1.805	-2.199	-0.723	⟵
PAFTA	Sudan - Saudi Arabia	0.679	5.074	-0.632	-1.375	0.097	⟷
PAFTA	Tunisia - Sudan	0.0		-0.281	-2.575	-2.575	⟶
PAFTA	Iraq - Bahrain, Kingdom of	0.031	0.597	0.022	0.159	0.3	None
PAFTA	Tunisia - Qatar	1.013	10.772	-0.333	-5.287	4.618	None
PAFTA	Sudan - Syrian Arab Republic			-1.723	-4.865	-4.865	⟷
PAFTA	Sudan - Yemen, Republic of	2.731	8.776	-2.701	-8.846	0.07	⟶
PAFTA	Libya - Egypt	8.265	3.287	-5.236	-4.506	-2.094	⟵
PAFTA	Libya - Qatar	0.02	0.341	-0.133	-2.679	-1.1	None
PAFTA	Tunisia - Yemen, Republic of						⟶
PAFTA	Tunisia - Oman	0.333	1.013	0.125	0.394	1.032	None
PAFTA	Libya - Yemen, Republic of	1.979	2.678	-1.026	-3.627	1.417	⟵
PAFTA	Morocco - Oman			-0.328	-3.169	-3.169	None
PAFTA	Morocco - Egypt	0.0		-0.476	-6.128	-6.128	⟵
PAFTA	Morocco - Jordan						⟵
PAFTA	Sudan - Oman	0.737	3.416	-1.379	-2.403	-1.159	⟶
PAFTA	Jordan - Iraq	-0.148	-1.775	0.174	2.071	0.172	⟶
PAFTA	Oman - Iraq						⟶
PAFTA	Syrian Arab Republic - Iraq			-0.471	-11.68	-11.68	None
PAFTA	Tunisia - Libya	1.734	1.65	-0.294	-0.325	4.567	⟶
PAFTA	Yemen, Republic of - Iraq	0.019	0.098	-0.516	-1.161	-1.027	⟶
PAFTA	Libya - Syrian Arab Republic	-1.512	-2.658	0.303	0.972	-2.132	⟶
PAFTA	Sudan - Libya	5.011	3.795	-6.153	-1.789	0.368	⟶
PAFTA	Morocco - Qatar	1.336	4.069	-0.617	-6.158	1.96	⟵
PAFTA	Egypt - Syrian Arab Republic	-0.194	-0.311	-0.63	-0.831	-1.707	None
PAFTA	Libya - Saudi Arabia	19.424	4.105	-26.549	-5.045	0.195	⟵
PAFTA	Tunisia - Saudi Arabia	1.82	6.04	-0.756	-2.176	2.35	⟶
PAFTA	Morocco - Saudi Arabia	3.766	4.9	-1.338	-3.06	4.029	⟶
PAFTA	Tunisia - Bahrain, Kingdom of	3.865	5.248	-6.219	-4.667	-16.123	⟶
PAFTA	Sudan - Iraq			-0.301	-0.707	-0.707	None
PAFTA	Sudan - Morocco			1.447	1.018	1.018	⟵

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
PTN	Pakistan - Turkey	1.01	6.335	-0.936	-30.03	0.408	⟵
PTN	Egypt - Chile	0.0		2.81	52.487	52.487	None
PTN	Peru - Brazil	-0.922	-2.476	0.361	1.341	-1.267	⟵
PTN	Paraguay - Mexico	-0.969	-3.06	0.049	0.294	-2.424	None
PTN	Tunisia - Bangladesh						⟵
PTN	Israel - Uruguay						⟵
PTN	Chile - Turkey	-0.137	-0.12	-1.192	-2.857	-2.177	None
PTN	Pakistan - Bangladesh						⟶
PTN	Uruguay - Peru						⟵
PTN	Egypt - Turkey	8.393	4.41	-3.331	-6.308	11.077	⟶
PTN	Egypt - Mexico						⟵
PTN	Bangladesh - Mexico			-0.039	-0.345	-0.345	⟶
PTN	Tunisia - Korea, Republic of	-13.851	-3.743	16.612	4.66	-0.146	None
PTN	Peru - Chile			-0.762			None
PTN	Philippines - Korea, Republic of						⟶
PTN	Tunisia - Brazil	1.003	1.488	-0.837	-21.086	0.245	None
PTN	Serbia, Republic of - Tunisia						⟵
PTN	Romania - Bangladesh	0.587	7.057	2.231	3.104	4.113	⟶
PTN	Pakistan - Uruguay						⟵
PTN	Bangladesh - Turkey	0.962	4.995	-1.19	-29.485	-1.038	⟶
PTN	Romania - Korea, Republic of	-0.722	-0.481	0.414	0.02	0.008	None
PTN	Peru - Turkey			0.72	7.564	7.564	⟵
PTN	Bangladesh - Egypt						⟵
PTN	Uruguay - Turkey						⟷
PTN	Bangladesh - Uruguay	3.651	14.73	-3.123	-20.791	1.614	⟶
PTN	Egypt - Paraguay	3.674	4.26	-3.406	-5.079	0.703	⟶
PTN	Serbia, Republic of - Israel	0.147	0.698	2.756	3.104	3.915	None
PTN	Bangladesh - Brazil	6.11	11.712	-6.323	-25.029	-0.367	⟶
PTN	Romania - Tunisia	0.107	0.168	-1.106	-0.106	0.487	None
PTN	Korea, Republic of - Peru			-0.896	-110.163	-110.163	None
PTN	Tunisia - Uruguay	-27.768	-3.136	8.967	4.541	1.045	⟵

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
PTN	Israel - Mexico						$\longleftrightarrow$
PTN	Israel - Peru						$\longrightarrow$
PTN	Pakistan - Israel	0.997	21.348	-0.927	-77.449	1.205	$\longleftrightarrow$
PTN	Pakistan - Korea, Republic of	0.0		2.111	8.645	8.645	$\longleftarrow$
PTN	Korea, Republic of - Turkey						$\longleftarrow$
PTN	Tunisia - Turkey			-0.766	-45.337	-45.337	$\longrightarrow$
PTN	Bangladesh - Paraguay						$\longrightarrow$
PTN	Tunisia - Philippines	9.241	6.207	-6.921	-7.232	-6.048	$\longleftrightarrow$
PTN	Philippines - Israel						$\longleftrightarrow$
PTN	Tunisia - Chile						$\longrightarrow$
PTN	Romania - Turkey						$\longrightarrow$
PTN	Paraguay - Brazil	1.046	7.811	-0.962	-54.444	0.574	$\longleftarrow$
PTN	Uruguay - Mexico	-1.105	-3.025	1.347	3.005	0.494	$\longleftarrow$
PTN	Romania - Israel	-0.198	-0.688	2.609	1.304	2.012	None
PTN	Philippines - Chile	0.0		-1.533	-4.725	-4.725	None
PTN	Philippines - Egypt						$\longrightarrow$
PTN	Philippines - Paraguay	2.208	15.977	-1.874	-20.993	1.647	$\longleftrightarrow$
PTN	Peru - Mexico	0.845	30.604	-0.746	-10.438	1.036	$\longleftarrow$
PTN	Tunisia - Israel						$\longleftarrow$
PTN	Peru - Paraguay						$\longrightarrow$
PTN	Tunisia - Paraguay	7.092	6.459	-3.789	-9.318	5.298	$\longrightarrow$
PTN	Korea, Republic of - Uruguay						$\longleftarrow$
PTN	Mexico - Chile						$\longrightarrow$
PTN	Philippines - Peru	0.909	6.175	-0.94	-50.016	-0.195	None
PTN	Tunisia - Pakistan	-0.262	-0.866	-0.347	-2.494	-1.701	$\longleftarrow$
PTN	Paraguay - Chile	3.683	5.177	-6.299	-4.603	-14.773	$\longrightarrow$
PTN	Romania - Peru	0.839	13.989	-0.337	-0.774	1.12	$\longrightarrow$
PTN	Tunisia - Egypt						$\longleftrightarrow$
PTN	Egypt - Israel						$\longleftarrow$
PTN	Philippines - Uruguay						$\longrightarrow$
PTN	Korea, Republic of - Israel	0.691	1.069	-1.383	-10.165	-1.105	None

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
PTN	Romania - Egypt			-11.307	-5.232	-5.232	None
PTN	Tunisia - Peru	0.0		-0.038	-0.427	-0.427	$\longleftrightarrow$
PTN	Philippines - Brazil						$\longleftarrow$
PTN	Egypt - Uruguay	0.76	1.161	-1.074	-5.042	-0.528	$\longleftarrow$
PTN	Uruguay - Brazil						$\longleftrightarrow$
PTN	Serbia, Republic of - Pakistan	0.823	3.449	-0.775	-3.555	0.135	$\longrightarrow$
PTN	Bangladesh - Peru	-10.34	-7.781	26.837	12.383	-8.849	$\longrightarrow$
PTN	Pakistan - Paraguay	1.813	9.485	-1.354	-12.723	1.782	None
PTN	Israel - Paraguay						$\longrightarrow$
PTN	Mexico - Turkey						$\longleftarrow$
PTN	Tunisia - Mexico	3.68	3.476	-2.334	-6.017	2.029	$\longleftarrow$
PTN	Egypt - Brazil						$\longleftrightarrow$
PTN	Uruguay - Paraguay	0.0		-1.875	-2.728	-2.728	$\longrightarrow$
PTN	Serbia, Republic of - Mexico	-1.043	-1.085	2.05	0.939	-0.981	$\longleftarrow$
PTN	Paraguay - Turkey	3.848	4.596	-2.053	-6.887	2.802	$\longleftrightarrow$
PTN	Pakistan - Brazil						$\longleftarrow$
PTN	Bangladesh - Israel	0.563	3.336	0.633	2.044	3.124	None
PTN	Mexico - Brazil	0.145	0.241	-0.538	-3.552	-0.674	$\longleftarrow$
PTN	Romania - Philippines			1.407	1.513	1.513	$\longrightarrow$
PTN	Philippines - Pakistan	0.679	8.616	-0.883	-9.969	-1.325	$\longrightarrow$
PTN	Philippines - Mexico						$\longleftarrow$
PTN	Brazil - Turkey	1.218	37.059	-1.613	-17.904	-3.365	None
PTN	Serbia, Republic of - Korea, Republic of						$\longrightarrow$
PTN	Philippines - Turkey						$\longleftrightarrow$
SADC	Tanzania - Madagascar	-0.16	-0.9	0.372	1.738	0.67	$\longleftrightarrow$
SADC	Tanzania - Botswana						$\longleftarrow$
SADC	Tanzania - Swaziland						$\longleftrightarrow$
SADC	Zambia - Tanzania	0.026	0.202	0.48	2.592	1.858	None
SADC	Madagascar - Lesotho	3.706	4.193	-5.616	-4.807	-231.633	$\longleftrightarrow$
SADC	Swaziland - Mauritius	30.592	5.741	-35.775	-5.638	0.094	$\longleftarrow$
SADC	Tanzania - Seychelles	1.253	35.961	3.029	48.349	45.839	None

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
SADC	Swaziland - Mozambique	2.874	5.965	-2.605	-7.422	0.538	$\longleftarrow$
SADC	Malawi - South Africa	2.629	14.367	-3.336	-9.646	-1.749	$\longleftrightarrow$
SADC	Seychelles - Lesotho			3.018	7.77	7.77	None
SADC	Mozambique - Mauritius	0.397	1.009	0.047	0.072	0.828	None
SADC	Namibia - Mozambique			0.143	0.888	0.888	$\longleftrightarrow$
SADC	Mozambique - Malawi	2.044	1.842	-1.815	-1.922	-11.504	$\longleftrightarrow$
SADC	Mauritius - Lesotho	-12.52	-5.227	10.233	5.182	0.466	$\longrightarrow$
SADC	Seychelles - Mauritius			0.414	0.965	0.965	None
SADC	Seychelles - Malawi			-1.563	-103.314	-103.314	None
SADC	Tanzania - Mozambique	0.19	0.781	-0.177	-0.97	0.039	$\longleftrightarrow$
SADC	Botswana - South Africa						$\longleftarrow$
SADC	Namibia - Botswana	3.01	10.424	-2.599	-12.502	1.089	$\longleftarrow$
SADC	Tanzania - Namibia	0.173	0.182	-0.331	-0.248	0.717	$\longleftarrow$
SADC	Malawi - Lesotho	4.674	5.054	-6.43	-4.429	6.061	None
SADC	Seychelles - South Africa			-54.436	-6.33	-6.33	None
SADC	Tanzania - Malawi						$\longleftarrow$
SADC	Tanzania - South Africa	-6.876	-4.709	10.138	5.078	-1.419	$\longleftarrow$
SADC	Mauritius - South Africa	5.473	7.3	-5.407	-7.276	0.168	$\longrightarrow$
SADC	Swaziland - Botswana	3.673	11.122	-3.359	-12.358	0.741	$\longleftarrow$
SADC	Zambia - Botswana	2.452	3.322	-1.881	-1.708	2.157	$\longrightarrow$
SADC	Swaziland - Malawi	3.792	10.491	-3.227	-13.916	1.319	$\longrightarrow$
SADC	Zambia - Swaziland	49.383	2.082	-38.9	-0.887	-0.005	None
SADC	Mozambique - South Africa	2.09	7.852	-2.643	-6.126	-1.171	$\longleftrightarrow$
SADC	Lesotho - Botswana	4.11	6.187	-3.784	-6.795	0.658	$\longleftrightarrow$
SADC	Mozambique - Lesotho	6.57	6.945	-8.124	-6.405	10.387	$\longrightarrow$
SADC	Namibia - Malawi	2.516	7.017	-2.122	-9.308	0.927	$\longrightarrow$
SADC	Mozambique - Madagascar	-4.08	-3.845	3.882	4.111	-29.071	None
SADC	Zambia - Namibia			0.057	0.519	0.519	None
SADC	Zambia - Mozambique						$\longrightarrow$
SADC	Malawi - Botswana	3.74	8.945	-4.147	-7.759	-0.799	$\longleftrightarrow$
SADC	Zambia - Lesotho						$\longrightarrow$

* The arrow's direction indicates which country's price level Granger causes the other country's price level. $\longleftrightarrow$ indicates bicausality.

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
SADC	Mozambique - Botswana	3.58	8.168	-3.765	-7.645	-0.369	$\longleftrightarrow$
SADC	Seychelles - Mozambique			-2.168	-18.82	-18.82	$\longrightarrow$
SADC	Zambia - South Africa			-0.383	-1.853	-1.853	$\longrightarrow$
SAFTA	Pakistan - India	-4.34	-5.416	5.683	5.965	5.72	$\longleftrightarrow$
SAFTA	Nepal - Sri Lanka	0.942	5.532	-0.988	-8.441	-0.184	$\longleftrightarrow$
SAFTA	Nepal - India	-1.796	-4.459	1.797	4.445	0.002	None
SAFTA	Pakistan - Sri Lanka						$\longleftarrow$
SAFTA	Nepal - Bangladesh	3.486	8.971	-3.811	-9.605	-0.68	$\longleftarrow$
SAFTA	Maldives - India	0.482	1.639	-0.518	-2.038	-0.091	$\longleftarrow$
SAFTA	Sri Lanka - Bhutan	0.508	6.061	-0.621	-4.865	-0.593	$\longleftarrow$
SAFTA	Pakistan - Maldives			0.635	7.16	7.16	$\longrightarrow$
SAFTA	Nepal - Maldives	0.707	2.78	-0.707	-2.451	-0.001	$\longleftrightarrow$
SAFTA	Pakistan - Bhutan	1.219	10.523	-1.454	-7.312	-0.875	$\longleftarrow$
SAFTA	Maldives - Bhutan	0.878	2.361	-1.114	-2.686	-0.49	$\longleftarrow$
SAFTA	Bhutan - Bangladesh						$\longleftrightarrow$
SAFTA	Pakistan - Nepal	-2.476	-3.422	3.401	3.685	2.903	$\longleftrightarrow$
SAFTA	Nepal - Bhutan	-0.101	-2.734	0.1	2.161	-0.008	$\longleftarrow$
SAFTA	Maldives - Sri Lanka	0.692	9.519	-0.629	-10.82	0.509	$\longleftarrow$
SAFTA	Maldives - Bangladesh	0.982	3.538	-0.86	-3.003	0.302	$\longleftarrow$
SPARTECA	Fiji - Australia						$\longleftarrow$
SPARTECA	New Zealand - Australia			-0.064	-0.867	-0.867	$\longrightarrow$
SPARTECA	Samoa - Vanuatu	-15.722	-2.358	12.307	1.425	0.035	$\longleftarrow$
SPARTECA	Samoa - Australia	-1.88	-2.82	1.584	1.813	-0.759	$\longleftarrow$
SPARTECA	Vanuatu - Solomon Islands	-1.011	-1.333	-0.573	-1.967	-2.577	None
SPARTECA	Papua New Guinea - Fiji	1.587	13.833	-2.17	-10.479	-2.113	$\longleftrightarrow$
SPARTECA	Tonga - Australia			1.421	14.006	14.006	$\longleftarrow$
SPARTECA	Papua New Guinea - Vanuatu			11.308	4.444	4.444	$\longleftarrow$
SPARTECA	Tonga - New Zealand	0.511	2.789	0.362	1.084	2.168	None
SPARTECA	Solomon Islands - Australia	-0.171	-0.411	4.226	3.87	6.547	None
SPARTECA	Papua New Guinea - Australia			3.638	11.718	11.718	$\longleftrightarrow$
SPARTECA	Tonga - Papua New Guinea	0.802	4.86	-1.103	-7.912	-1.158	$\longrightarrow$

* The arrow's direction indicates which country's price level Granger causes the other country's price level. $\longleftrightarrow$ indicates bicausality.

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Table 18 – continued from previous page

PTA	Country Pair (country 1 & country 2)	$\hat{\beta}_1$	Z-score for $H_0 : \beta_1 = 0$	$\hat{\beta}_2$	Z-score for $H_0 : \beta_2 = 0$	Z-score for $H_0 : \beta_1 + \beta_2 = 0$	Granger Causality*
SPARTECA	Tonga - Solomon Islands	2.978	3.096	-2.754	-4.318	0.578	$\longrightarrow$
SPARTECA	Samoa - Papua New Guinea			-0.423	-2.167	-2.167	$\longleftrightarrow$
SPARTECA	Tonga - Samoa	0.766	1.675	-1.606	-3.359	-1.655	$\longrightarrow$
SPARTECA	Tonga - Vanuatu			1.231	7.916	7.916	$\longleftrightarrow$
SPARTECA	Samoa - Fiji	0.0		-0.272	-2.321	-2.321	$\longleftrightarrow$
SPARTECA	Fiji - New Zealand	0.0		1.663	7.345	7.345	$\longleftarrow$
SPARTECA	Tonga - Fiji	1.605	9.197	-2.481	-9.325	-2.51	$\longleftrightarrow$
SPARTECA	Vanuatu - Australia	3.554	2.513	-2.119	-1.481	-1.219	$\longleftarrow$
SPARTECA	Fiji - Solomon Islands						$\longrightarrow$
SPARTECA	Samoa - Solomon Islands	4.742	3.871	-2.829	-3.65	12.087	$\longrightarrow$
SPARTECA	Papua New Guinea - New Zealand	4.241	2.53	-15.524	-4.13	2.073	None
SPARTECA	Samoa - New Zealand	-2.322	-1.863	0.266	0.197	3.04	None
SPARTECA	Papua New Guinea - Solomon Islands	2.228	10.777	-1.956	-12.061	0.899	$\longleftarrow$
SPARTECA	Vanuatu - New Zealand						$\longleftarrow$
TPSEP	Singapore - New Zealand	4.161	4.994	-6.046	-5.233	-18.729	$\longleftarrow$
TPSEP	Brunei Darussalam - New Zealand	-66.661	-6.841	26.755	6.409	0.6	$\longleftarrow$
TPSEP	Singapore - Chile			-1.916	-7.461	-7.461	None
TPSEP	Brunei Darussalam - Chile			-0.19	-7.519	-7.519	$\longleftrightarrow$
TPSEP	Chile - New Zealand			8.536	4.988	4.988	$\longrightarrow$

Table 19: Pairs lacking both Cointegration and Granger causality

Currency Union	**Country Pair**
APTA	Sri Lanka - Bangladesh
ASEAN	Thailand - Myanmar
ASEAN	Philippines - Brunei Darussalam
ASEAN	Vietnam - Brunei Darussalam
ASEAN	Malaysia - Myanmar
ASEAN	Vietnam - Myanmar
ASEAN	Singapore - Myanmar
ASEAN	Myanmar - Brunei Darussalam
ASEAN	Cambodia - Myanmar
ASEAN	Lao People's Democratic Republic - Brunei Darussalam
ASEAN	Cambodia - Brunei Darussalam
ASEAN	Singapore - Indonesia
ASEAN	Indonesia - Myanmar
ASEAN	Philippines - Indonesia
ASEAN	Lao People's Democratic Republic - Myanmar
ASEAN	Singapore - Cambodia
CACM	Nicaragua - Guatemala
CAFTA	Guatemala - Dominican Republic
CAFTA	Nicaragua - Dominican Republic
CAFTA	Honduras - Dominican Republic
CAFTA	Costa Rica - United States
CAFTA	Nicaragua - Guatemala
CAFTA	Dominican Republic - United States
CAN	Venezuela, Republica Bolivariana de - Peru
CAN	Peru - Colombia
CAN	Venezuela, Republica Bolivariana de - Bolivia
CAN	Venezuela, Republica Bolivariana de - Colombia
CEFTA	Croatia - Slovak Republic
CEFTA	Romania - Portugal
CEFTA	Slovak Republic - Bulgaria
CEFTA	Romania - Croatia
CIS	Kazakhstan - Georgia
COMESA	Mauritius - Madagascar
COMESA	Zambia - Egypt
COMESA	Zambia - Mauritius
COMESA	Sudan - Rwanda
COMESA	Sudan - Mauritius
COMESA	Sudan - Madagascar
COMESA	Kenya - Egypt

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Currency Union	Country Pair
COMESA	Zambia - Madagascar
COMESA	Zambia - Sudan
COMESA	Rwanda - Madagascar
COMESA	Malawi - Madagascar
COMESA	Burundi - Egypt
COMESA	Sudan - Kenya
COMESA	Madagascar - Kenya
COMESA	Zambia - Malawi
COMESA	Burundi - Djibouti
COMESA	Zambia - Kenya
COMESA	Madagascar - Egypt
COMESA	Mauritius - Kenya
COMESA	Mauritius - Egypt
COMESA	Malawi - Egypt
COMESA	Madagascar - Djibouti
COMESA	Rwanda - Burundi
COMESA	Djibouti - Egypt
COMESA	Rwanda - Malawi
COMESA	Sudan - Djibouti
EAC	Uganda - Tanzania
EAC	Tanzania - Kenya
EAC	Uganda - Kenya
ECO	Kazakhstan - Pakistan
ECO	Kyrgyz Republic - Iran, Islamic Republic of
ECO	Afghanistan, Islamic Republic of - Turkey
ECOWAS	Sierra Leone - Cote d'Ivoire
ECOWAS	Sierra Leone - Nigeria
ECOWAS	Togo - Sierra Leone
ECOWAS	Guinea - Gambia, The
ECOWAS	Niger - Liberia
ECOWAS	Liberia - Guinea
ECOWAS	Sierra Leone - Senegal
ECOWAS	Sierra Leone - Mali
ECOWAS	Liberia - Cabo Verde
ECOWAS	Sierra Leone - Gambia, The
ECOWAS	Guinea - Benin
ECOWAS	Sierra Leone - Niger
ECOWAS	Liberia - Guinea-Bissau
ECOWAS	Cote d'Ivoire - Guinea
ECOWAS	Guinea - Cabo Verde

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Currency Union	Country Pair
ECOWAS	Nigeria - Guinea
ECOWAS	Sierra Leone - Guinea-Bissau
EFTA	Iceland - Austria
EFTA	Slovenia - Israel
EFTA	Bulgaria - Tunisia
EFTA	Poland - Macedonia, FYR
EFTA	Estonia - Morocco
EFTA	Poland - Slovenia
EFTA	Finland - Norway
EFTA	Poland - Croatia
EFTA	Poland - Spain
EFTA	Slovak Republic - Jordan
EFTA	Latvia - Norway
EFTA	Bulgaria - Singapore
EFTA	Lithuania - Latvia
EFTA	Bulgaria - Mexico
EFTA	Poland - Morocco
EFTA	Slovenia - Morocco
EFTA	Croatia - Slovak Republic
EFTA	Latvia - Morocco
EFTA	Slovak Republic - Bulgaria
EFTA	Lithuania - Switzerland
EFTA	Romania - Croatia
EFTA	Macedonia, FYR - Slovak Republic
EFTA	Slovak Republic - Singapore
EFTA	Switzerland - Norway
EFTA	Lithuania - Slovak Republic
EFTA	Singapore - Iceland
EFTA	Korea, Republic of - Norway
EFTA	Latvia - Slovak Republic
EFTA	Romania - Jordan
EFTA	Bulgaria - Morocco
EFTA	Estonia - Slovak Republic
LAIA	Venezuela, Republica Bolivariana de - Paraguay
LAIA	Venezuela, Republica Bolivariana de - Brazil
LAIA	Venezuela, Republica Bolivariana de - Uruguay
LAIA	Peru - Colombia
LAIA	Colombia - Chile
PAFTA	Morocco - Syrian Arab Republic
PAFTA	Sudan - Qatar

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Currency Union	Country Pair
PAFTA	Yemen, Republic of - Bahrain, Kingdom of
PAFTA	Sudan - Bahrain, Kingdom of
PAFTA	Sudan - Jordan
PAFTA	Yemen, Republic of - Qatar
PAFTA	Yemen, Republic of - Saudi Arabia
PAFTA	Morocco - Yemen, Republic of
PAFTA	Egypt - Qatar
PAFTA	Morocco - Iraq
PAFTA	Morocco - Libya
PAFTA	Yemen, Republic of - Jordan
PAFTA	Egypt - Bahrain, Kingdom of
PAFTA	Tunisia - Jordan
PAFTA	Yemen, Republic of - Oman
PAFTA	Yemen, Republic of - Egypt
PAFTA	Morocco - Bahrain, Kingdom of
PAFTA	Yemen, Republic of - Syrian Arab Republic
PAFTA	Egypt - Jordan
PAFTA	Egypt - Iraq
PTN	Serbia, Republic of - Peru
PTN	Romania - Pakistan
PTN	Israel - Brazil
PTN	Serbia, Republic of - Philippines
PTN	Israel - Turkey
PTN	Philippines - Bangladesh
PTN	Korea, Republic of - Chile
PTN	Serbia, Republic of - Turkey
PTN	Israel - Chile
PTN	Korea, Republic of - Paraguay
PTN	Korea, Republic of - Brazil
PTN	Uruguay - Chile
PTN	Serbia, Republic of - Bangladesh
PTN	Serbia, Republic of - Egypt
PTN	Korea, Republic of - Egypt
PTN	Serbia, Republic of - Brazil
PTN	Korea, Republic of - Bangladesh
PTN	Pakistan - Egypt
PTN	Romania - Uruguay
PTN	Chile - Brazil
PTN	Egypt - Peru
PTN	Pakistan - Peru

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Currency Union	Country Pair
PTN	Bangladesh - Chile
PTN	Romania - Brazil
PTN	Romania - Paraguay
PTN	Korea, Republic of - Mexico
PTN	Serbia, Republic of - Paraguay
PTN	Serbia, Republic of - Chile
PTN	Pakistan - Chile
PTN	Pakistan - Mexico
PTN	Serbia, Republic of - Uruguay
SADC	Tanzania - Lesotho
SADC	Tanzania - Mauritius
SADC	Seychelles - Botswana
SADC	Mauritius - Botswana
SADC	Namibia - Mauritius
SADC	Madagascar - Botswana
SADC	Namibia - Madagascar
SADC	Swaziland - Madagascar
SADC	Madagascar - South Africa
SADC	Swaziland - Seychelles
SADC	Zambia - Seychelles
SPARTECA	Vanuatu - Fiji
SPARTECA	Solomon Islands - New Zealand

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