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Article

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Regional economic integration in Mercosur: The role of real and financial sectors

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Abstract

This study explores economic interdependence in Mercosur by examining common trends and common cycles among key macro-variables representing both the real and financial sectors of the economy. The serial correlation common features test reveals that the key macroeconomic variables (real output, investment, and intra-regional trade) share common trends in the long run suggesting that macroeconomic interdependence in the Mercosur economies is strong. The exchange rates demonstrate co-movement in the long run as they share a single common trend. These finding suggests that these economies cannot swing away from long-run equilibrium for an extended duration; they will be brought together by their common trends. Similarly, each variable under consideration shares common cycles lending support to the notion of short-run synchronous movement. The trend-cycle decomposition results reveal that the cyclical movements of real output and trade are synchronized with a high degree of positive correlations. Our overall findings thus provide justification and optimism for deeper economic integration among Mercosur countries.

JEL classifications: F15; F42

Keywords: Economic integration; Co-movement; Business cycles; Mercosur; Exchange rates

1. Introduction

Recent decades have witnessed regional economic integration gaining momentum in many parts of the world. Since 1990, there have been more than 14 agreements pertaining to free trade areas and custom unions. By lowering trade barriers and fostering greater mobility of human and physical capital, regional trading arrangements provide many benefits and may contribute to economic growth in member countries. These benefits include reduced transactions costs, lower prices for consumers, more efficient use of resources, scale economies, enhanced competition among firms, greater certainty and investment, technological improvements, and increases in productivity. Regional integration can also lead to deeper assimilation and may complement multilateralism by setting a precedent which other nations will follow (Carbaugh, 2015). Given these potential advantages, it is not surprising that many countries around the world have continued to pursue greater economic integration. On the other hand, regional trade agreements are also discriminatory in that some nations are treated differently than others. Further, they may decrease incentives for nations to pursue multilateral agreements because trade bloc members may not gain additional economies of scale through multilateralism. Finally, as the recent experiences of some members of the European Union such as Greece and Spain have demonstrated, integration is no panacea. The loss of independent monetary and exchange rate policies can pose serious limitations in tackling economic crises. And as is also apparent from the recent exit of the United Kingdom from the European Union, non-economic factors, particularly the role of special interest politics, can be crucial.

The main objective of this paper is to investigate the economic interdependence of the economies of Mercosur (Southern Common Market). Established in 1991 between Argentina, Brazil,

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Paraguay, and Uruguay,[1] Mercosur is one of the largest regional trade blocs in Latin America. The main goal of Mercosur is to eliminate barriers to facilitate the free movement of goods, people, and currency among member countries. The formation of Mercosur was inspired by the success of the European Union and represents a first step toward greater regional integration. The member countries decided to adopt a gradual approach toward deeper integration, starting with a free trade area to an eventual customs union, and from a contractual agreement to a structured international organization (UNCTAD, 2003). Although Mercosur has a long way to go to achieve its goals, member countries have agreed to set up an institutional framework to foster economic policy coordination. In 2000, a high level monitoring body (equivalent to the Economic and Financial Council in the European Union) was created to implement agreements and treaties among member countries with regard to the convergence of public deficit and debt ratios. The process of deeper integration in Mercosur appears to be steadily gaining momentum.

In light of these efforts toward economic integration, this study examines the degree of macroeconomic synchronization (i.e., the co-movement of macroeconomic variables) among the member countries of Mercosur. For this purpose, we make an attempt to identify the number of common trends and common cycles. We also separate permanent and transitory components from the original variables which will allow us to identify the degree of co-movement in the long run and short run, and measure the degree of interdependence among the economies under consideration. For this purpose, we examine key macroeconomic variables in the Mercosur countries—real output, investment, intra-country trade, exchange rate, and interest rate, representing both real and financial sector of the economies. Studies suggest that a high degree of macroeconomic synchronization or business cycle co-movement is a necessary condition for promoting economic cooperation among countries involved in an economic integration process (Christodoulakis et al., 1995; Fiorito and Kollintzas, 1994). If business cycle fluctuations are synchronized, harmonized policies to cope with these cycles across countries can be effective (Sato and Zhang, 2006). Likewise, exchange rate dynamics often remain at the core of monetary policy discussions. In an open economy, the monetary authority needs to respond to exchange rate movements which work as shock absorbers. After the collapse of the Bretton Woods system, monetary authorities in developing countries began to emphasize exchange rate stability and correct exchange rate alignments to improve economic performance.[2] One of the reasons for establishing the European Monetary Union was to promote exchange rate stability among member countries and to encourage trade inside the European Union (Dell'Ariccia, 1999). Acknowledging the importance of exchange rate movements, Basnet et al. (2015) examine exchange rate movements to assess monetary policy coordination in the ASEAN nations. The results of their study lend support for monetary policy coordination between some but not all ASEAN nations. The effect of exchange rates on macroeconomic stability is linked to interest rates and other macroeconomic variables. International shocks are also transmitted through, among other variables, interest rates.

The existence of long-term common trends and short-term common cycles in a set of variables indicates that these variables do not swing for an extended period of time, ultimately move together, and share similar cyclical fluctuations in the short run. We submit that if member countries share synchronous long-term trends and short-term cycles in their key macroeconomic variables, these countries may find it mutually beneficial to strengthen their integration process. Eventually, these countries could potentially even move toward a monetary union, the highest level of economic integration. Such a union would be characterized by, among other features, a common currency, common fiscal and monetary policies, and free mobility of goods, services, labor, and capital. On the other hand, if the impact of a shock is not symmetric across countries seeking deeper integration, harmonized monetary and fiscal policies are unlikely to benefit these countries. That is, non-synchronized movements in macroeconomic variables may indicate weak interdependence which may require different policy prescriptions, and in turn, lower the prospects for integration. Therefore, an examination of the costs and benefits of integration must include a careful and rigorous investigation of the behavior of macroeconomic variables. The common feature analysis has been extensively used in the literature (e.g., Sato and Zhang, 2006; Abu-Qarn and Suleiman, 2008; Castillo Ponce and Ramirez, 2008; Adom et al. 2010; Weber, 2012; Basnet and Sharma, 2013), especially to assess the feasibility of higher levels of policy coordination involving an economic or monetary union. However, Mercosur has been largely exempt from this kind of analysis. Utilizing a variety of methodologies and hypotheses, studies have examined business cycle synchronization (Allegret and Sand-Zantman, 2009), labor market interdependence (Caceres, 2011), and convergence and inequality (Blyde, 2006) in Mercosur. To the best of our knowledge, no study has explicitly analyzed the real and financial sectors of Mercosur countries to explore the possibility of greater economic alliance, particularly from the perspectives of common trends and common cycles. We hope that our findings will provide helpful information as to how favorable the economic conditions are to expedite the process of economic integration in Mercosur. As a corollary, we hope to determine whether these countries require different policy adjustments to internal and external shocks.

The rest of the paper is organized as follows. The next section provides a brief economic background of the four Mercosur countries. Next, we describe the data and methodology used to analyze macroeconomic interdependence and business-cycle synchronization. In the following section we discuss the empir-

[1] Venezuela is a recent member of Mercosur. Even though Venezuela signed the membership agreement with Mercosur in 2006, full membership was not granted until 2012. Therefore, we have opted to include only the founding members in our study.

[2] For details: Ann Krueger, Exchange rate determination, Cambridge University Press 1983.

ical results. The final section summarizes and concludes the paper.

2. Brief economic background[3]

Mercosur is the principal trade bloc in South America. It is the world's fourth largest trading bloc after EU, NAFTA, and ASEAN. Mercosur is home to more than 250 million people and accounts for almost three-fourths of total economic activity in South America. Among the full member states in the bloc, Brazil and Argentina are the largest economies, and Paraguay and Uruguay are the smallest. Brazil, with a gross domestic product of $2.25 trillion in 2013, is the world's seventh largest economy; it has large and well-developed agriculture, manufacturing, and service sectors, and is considered the leading voice in the alliance.

With respect to trade patterns, Brazil is the largest trading partner for all three countries. Despite China's growing presence in the Latin American region, each country in the Mercosur region is critically dependent on Brazil. In terms of the proportion of trade, Brazil and Argentina share a relationship of high mutual interdependence. Argentina's trade with Brazil represented 21.16% of total exports and 26% of total imports in 2013. Brazil's share of trade with Argentina represented 8.1% of exports and 6.87% of imports in 2013. It is interesting to note that Brazil's major trade partners are distributed worldwide, led by the United States and China; none of the Mercosur countries is among Brazil's top five trading partners.

The trade shares of Paraguay and Uruguay with Brazil and Argentina are significantly higher, accounting for approximately 30–55% of total trade during the last 13 years. In 2013, Paraguay's total export and import shares with Argentina and Brazil were 37.65% (7.61 and 30.04%) and 40.57% (14.21 and 26.36%). The same is true for Uruguay; its export and import shares with Argentina and Brazil were 24.32% (5.44 and 18.89%) and 30% (14.23 and 15.77%). It should be noted that there is growing trade reliance between China, Paraguay, and Uruguay as well. For instance, some 28.28% of Paraguay's total imports in 2013 came from China and the corresponding number was 17% for Uruguay.

Fig. 1 shows the percentage shares of total trade (exports plus imports) of each of the four countries in Mercosur. Brazil's trade reliance within Mercosur is low; it is only about 10% for the study period. Paraguay and Uruguay, on the other hand, appear to be highly dependent on the Mercosur region. For instance, between the 2003 and 2005, Paraguay traded more with the Mercosur countries than with the rest of the world. The percentage share has decreased after 2005, due primarily to the growing commercial presence of China in the Central and South American regions.

Fig. 2 shows the annual GDP growth of Mercosur countries and suggests that these countries have shared both good and bad economic times. In the late 1990s and the early 2000s when the region was experiencing economic crises, all countries suffered significant losses, although some were hit harder than others (see Fig. 2). We also observe that all four countries enjoyed high rates of economic growth from 2003 through 2008, followed by a severe contraction during the global financial crisis (GFC) in 2009. The observed growth rates of these countries demonstrates significant similarities in their economic expansions and contractions, suggesting strong economic interdependence. As the leading economy in the alliance, Brazil recorded positive economic growth during the period, with the exception of 2009. After strong growth in 2007 (6.10%) and 2008 (5.17%), Brazil experienced a severe economic contraction in 2009 due to the GFC; the economy recorded a negative 0.33% annual growth. However, Brazil's strong domestic and intra-regional markets proved to be less vulnerable to external crises, which made it one of the first emerging market economies to begin a recovery. In 2010, Brazil recorded the last decade's highest rate of economic growth at 7.53%.

Argentina, with a GDP of $610 billion in 2013, is the second largest economy in the coalition. It is endowed with rich natural resources and has benefitted from its export-oriented agricultural and industrial sectors. In recent years Argentina has experienced record economic growth (see Fig. 2). While all four countries show synchronous movement in their economic growth during the study period, Argentina certainly displays a greater degree of fluctuation, especially during the financial crisis in Brazil, and its own currency crisis period.[4] Argentina's economy contracted by almost 11% in 2002. A huge spike in Fig. 2 corresponds to that period. However, Argentina has had robust growth thereafter (with the exception of the crisis period in 2009).

Paraguay and Uruguay are the bloc's smallest countries, with a population of 6.8 million and 3.4 million in 2013. Being a landlocked country, Paraguay is characterized by re-export of imported consumer goods to neighboring countries. Following the Argentine and Brazilian crises, other countries in the region were also hit hard by speculative attacks and capital outflows. As a consequence, the Paraguayan economy suffered from those episodes in Latin America in the early 2000s. Like Argentina and Brazil, Paraguay's economy also grew rapidly between 2003 and 2008. The GFC in 2009 took a toll on Paraguay's economy as well, causing the annual growth rate to fall by 4% in 2009. Growth, however, resumed at an impressive 13.09% in 2010, the highest growth not only in Mercosur, but in all of South America. Among the Mercosur countries, Paraguay experienced a negative growth of 1.24% in 2012 followed by another leap in 2013 (14%). Despite being the smallest country in the bloc in terms of size, Uruguay has an economy that is significantly larger than

[3] The data in this section were obtained from the World Bank's World Integrated Trade Solution (WITS) database.

[4] In the 1990s, Brazil suffered from record high inflation, ranging from 100% to nearly 3000 percent per year. Brazil's economic situation deteriorated significantly, prompting it to owe almost 46% of GDP to foreign creditors. Fear and uncertainty among investors about the region's largest economy escalated and resulted in massive capital flight. Higher inflation coupled with currency devaluation created a deep financial crisis in Brazil which engulfed the entire region. Argentina also faced massive speculative attacks on its currency from investors, causing its currency to depreciate by 255% in five months (from January 2002 to May 2002). Argentina defaulted on its debt in January 2002.

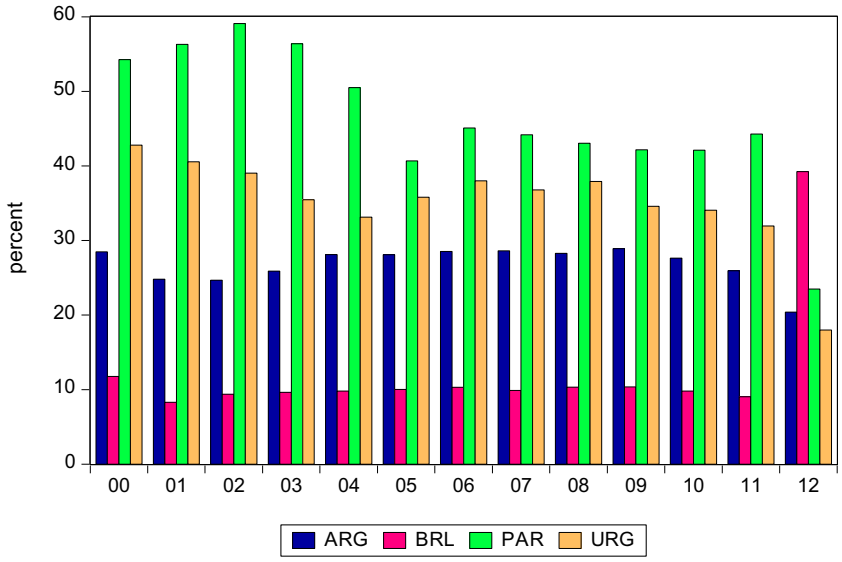

Fig. 1. Total trade in Mercosur.

Source: UN COMTRADE.

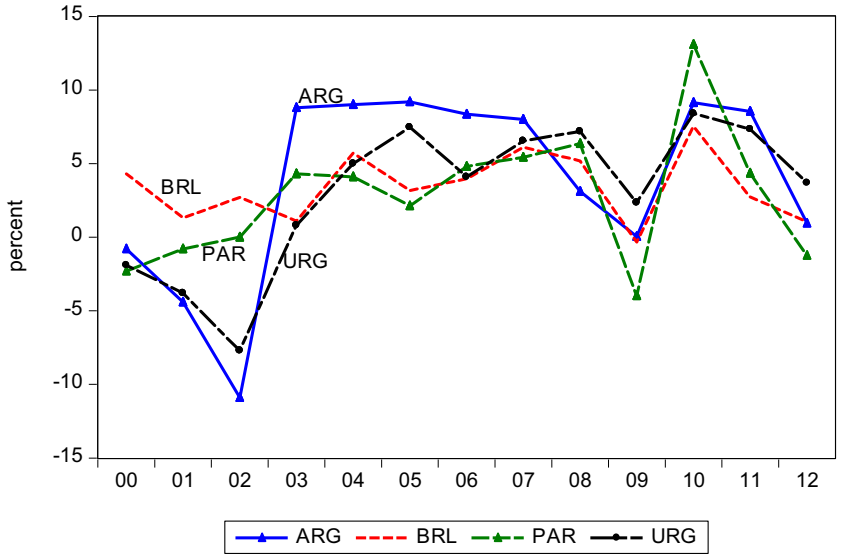

Fig. 2. GDP growth.

Source: World Bank.

that of Paraguay ($56 billion versus $29 billion in 2013). Following the region's crisis, Uruguay grew at an average rate of 8% annually during the period 2004–2008. Even though the GFC slowed down its rapid economic growth, which fell to 2.35% in 2009, it managed to avoid a recession and negative economic growth (see Fig. 2). Uruguay's economic prosperity relies heavily on the economic health of the Mercosur giants Brazil and Argentina. Its total partner share of exports and imports with them is considerable; it was 58.13% in 2012.

The Mercosur countries exhibit great similarities in their inflation rates as well. Among the member countries, Argentina has a long history of hyperinflation. With a few exceptions, it has typically experienced double-digit inflation during the study period, as is evident from Fig. 3. While Brazil, Paraguay, and Uruguay all suffered from relatively high inflation between 2002–2003, inflation remained in single digits thereafter (except for Paraguay in 2008, which was 10.2%). The average inflation rates during the past 13 years in Brazil, Paraguay, and Uruguay were 6.6%, 7.6%, and 8.3%, while it was 13.5% in Argentina.

3. Data and research methodology

Our study is based on quarterly data from 2001 to 2012 on real gross domestic product (RGDP), domestic investment (INVT), intra-Mercosur trade (TRADE), nominal exchange rate (EX), and money market interest rates (INT) for the four member countries of Mercosur. Real gross domestic product is used as a measure of real output and gross capital formation is used as a proxy for domestic investment. The data for these two variables are obtained from the World Bank's *World Development*

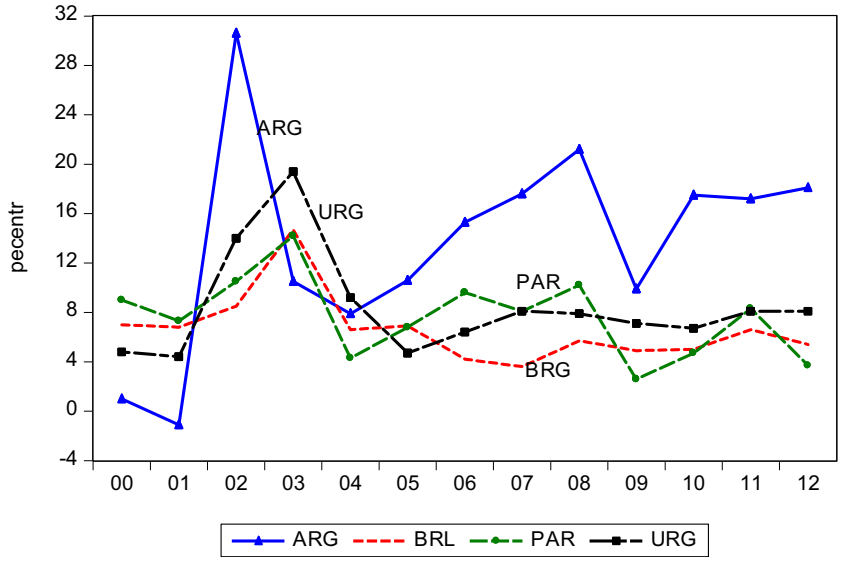

Fig. 3. Inflation.
Note: Inflation for Brazil, Paraguay, and Uruguay is measured by the consumer price index, whereas inflation for Argentina is measured by the annual growth rate of the GDP implicit deflator. Due to lack of data availability through standard data sources, the GDP implicit deflator is used for Argentina, which shows the rate of price changes in the economy as a whole.
Source: World Bank.

Indicators (WDI). Since the present study investigates the extent of macroeconomic interdependence among Mercosur countries, we choose to examine intra-Mercosur trade rather than trade flows in general. Intra-Mercosur trade includes exports plus imports of each country only within Mercosur. For example, Argentina's trade refers to its exports to Brazil, Paraguay, and Uruguay, and its imports from the same three countries. Trade statistics are based on the United Nations Commodity Trade Statistics Database (*UN Comtrade*) and covers all products. Nominal exchange rates, obtained from International Financial Statistics (IFS) are expressed in terms of the domestic currencies per U.S. dollar. For the purpose of interest rates, money market rates are used. All data series except interest rates are normalized in logarithmic forms. The choice of time span is largely driven by the availability of data, especially on intra-Mercosur trade.

3.1. Methodology

The empirical strategy consists of testing for common trends and common cycles. Prior to conducting these tests, all variables are tested for stationarity and their order of integration by employing the Dickey–Fuller test, the Augmented Dickey–Fuller test, the Phillips–Perron (PP) test, and the KPSS. Thereafter, following the Johansen (1988) and Johansen and Juselius (1991) maximum likelihood test, we estimate the following vector autoregressive model:

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + \varepsilon_t \quad (1)$$

where y_t is a (n × 1) vector of each variable (i.e., either real GDP, investment, intra-regional trade, exchange rate, or interest rate) of the countries under consideration; $n = 4$; A_0 is a $(n \times 1)$ vector of constants; A_i, $i = 1, 2, \ldots p$, is a $(n \times n)$ matrix of coefficients to be estimated; p is the selected lag length, and ε_t is the vector of error term which is expected to be serially uncorrelated with zero mean. We then rewrite Eq. (1) in the following Vector Error Correction (VEC) form when all series are I(1):

$$\Delta y_t = A_0 + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \ldots + \Gamma_{p-1} \Delta y_{t-p+1} + \Pi y_{t-p} + \varepsilon_t \quad (2)$$

where $\Delta y_t = y_t - y_{t-1}$ and $\Gamma_i = -\left[I - \sum_{j=i+1}^{p} A_j\right]$, $\Pi = -\left[I - \sum_{i=1}^{p} A_i\right]$ are $n \times n$ matrices of coefficients and contain information about the long-run relationship between the variables. Two likelihood ratio tests used in Johansen (1988) to test the rank of Π matrix are the maximum eigenvalue test statistics, $\lambda_{\max}$, and the trace test statistics, λ_{trace}:

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad (3)$$

$$\lambda_{\max} = -T \ln(1 - \lambda_{r+1}) \quad (4)$$

where λ_i is the estimated value of the characteristic roots (also called eigenvalues) obtained from the estimated Π matrix and T is the number of usable observations. If $0 < \text{rank}\ (\Pi) < n$, the n variables are cointegrated and thus share long-run common trend. The number of common trends is determined by the number of independent cointegrating vectors. Johansen (1988) shows that given an $(n \times 1)$ vector y_t, there can exist $r < n$ linearly independent co-integrating vectors (r), which implies $(n - r)$ common trends.

Vahid and Engle (1993) propose a test for determining the number of common cycles given the presence of common trends. The number of common cycles is determined by the co-feature vectors, which are identified by testing the significance of the canonical correlations between Δy_t and

$W = (\alpha' y_{t-1}, \Delta y_{t-1}, \Delta y_{t-2}, \ldots, \Delta y_{t-p+1})$, where α is a $(n \times r)$ matrix. The test points out that given r linearly independent co-integrating vectors, if a series y_t has common cycles, there can, at most, exist $s = (n - r)$ co-feature vectors that eliminate common cycles. The presence of co-feature vectors represents a form of convergence in the short run. To investigate common cycles, we apply the test suggested by Vahid and Engle (1993) for determining the significance of the smallest canonical correlation:

$$C(k*, s) = -(T - k* - 1)\Sigma \ln(1 - \rho_i^2) \tag{5}$$

where $\rho_i^2 (i = 1,2. . .s)$ are the s smallest squared canonical correlations between Δy_t and $W = (\alpha' y_{t-1}, \Delta y_{t-1}, \Delta y_{t-2}, \ldots, \Delta y_{t-p+1})$, T is the number of observations, and $k*$ is the lag length in the VAR system. Under the null hypothesis, this statistic has a χ^2 distribution with $(nk*s - rs - ns + s^2)$ degrees of freedom. Engle and Issler (1993), however, use the F-test[5] approximation proposed by Rao (1973) to test the significance of canonical correlations. If a system contains s independent co-feature vectors then there are $(n - s)$ common cycles. A dimension of $(n \times s)$ matrix $\tilde{\alpha}$ and of $(n \times r)$ matrix α are referred to as the co-feature and co-integrating vectors, respectively. Vahid and Engle (1993) decompose the permanent (trend) and transitory (cyclical) components of the original series when the sum of co-integrating vectors (r) and the number of co-feature vectors (s) is equal to the total variables (n) i.e., $r + s = n$. They further note that when $r + s = n$ then an $(n \times n)$ matrix $A = \begin{bmatrix} \tilde{\alpha}' \\ \alpha' \end{bmatrix}$ is of full rank and thus A^{-1} exists. The trend and cycle decomposition can be obtained by partitioning the columns of A^{-1} such as $A^{-1} = (\tilde{\alpha}^- | \alpha^-)$, where $\tilde{\alpha}$ and β are the matrices of the dimension of $(n \times s)$ and $(n \times r)$ for co-feature and co-integrating vectors, respectively. Finally, the trend and cyclical components are recovered as follows:

$$y_t = A^{-1} A y_t = \tilde{\alpha}^- \tilde{\alpha}' y_t + \alpha^- \alpha' y_t \tag{6}$$

Eq. (6) is used to decompose the trend-cycle in a series to analyze long-term and short-term co-movement among the exchange rates.

4. Results

The unit root test results, reported in Table 1, suggest that all series are stationary in the first difference. While the ADF and the PP tests fail to reject the null hypothesis of unit roots in the real output of Brazil at the conventional level, the KPSS test rejects the null at the five percent significance level. Therefore, we proceed with our analysis under the assumption that all series are integrated of the first order, denoted as ∼I(1).

[5] Engle and Issler (1993) claim that the F-statistic yields superior results; we present the results of both $\chi 2$ and the F-test.

4.1. Common trend analysis

Johansen's (1988) and Johansen and Juselius's (1991) cointegration test is used to identify the common trend(s) in the Mercosur zone that link macroeconomic variables together in the long run. Keeping the sensitivity of lag in the VAR structure, the present study selects the lag length by utilizing the AIC and LR tests. Both test results are reported in Table 3. Panel A indicates that the appropriate lag length for all models except for the exchange rate is two; a lag length of 3 is identified for the exchange rate. Panel B shows that the LM test assures that the selected lags do not suffer from serial autocorrelation. The results of the cointegration tests are reported in Table 2. From these results, we can safely reject the null hypothesis of no cointegrating vector (r) in real outputs. Both λ_{trace} and $\lambda_{\max}$ statistics indicate the presence of at least two cointegrating vectors in real output. This means that there exist two common trends (i.e., $n - r$: $4 - 2 = 2$) in real outputs. Likewise, the cointegration results indicate that investment and intra-Mercosur trade are also cointegrated in the long run. Investment and trade have one and two cointegrating vectors, implying that these variables share three ($n - r$: $4 - 1 = 3$) and two ($n - r$: $4 - 2 = 2$) common trends in the long run, respectively. The test results show that the λ_{trace} and $\lambda_{\max}$ statistics do not produce conflicting cointegrating vectors.

With regard to the financial sector, the test results denote at least three cointegrating vectors among the four exchange rate series, implying a common trend (i.e., $4 - 3 = 1$). While the existence of one or more cointegrating vectors is sufficient to establish the long run relationship between variables, the $n - 1$ cointegrating vectors ensures a stable long run relationship. Likewise, the null hypothesis of no cointegrating vector is rejected at the 1% significance level for interest rate as well. The test results in Table 2 indicate that there is evidence of at least one cointegrating vector that establishes the long run relationship among interest rates. The results further imply that there are three ($n - r$: $4 - 1 = 3$) common trends, suggesting that the series moves together in the long run. Note that a common trend implies that permanent shocks eventually affect all the countries in the same way (Engle and Issler, 1993) whereas common trends ensure that the series moves together in the long run. The long run synchronous movement among a number of macroeconomic variables often begins with the countries facing similar external conditions. Since the exchange rate series shares a common trend, exchange rate forecasts of one country in Mercosur may be improved by taking the forecasts of other countries into consideration.

Our results suggest, based on the movements of their macroeconomic variables, that the economies of the four Mercosur countries cannot swing for a long period of time, and that they eventually move together. Note that the existence of a long-run relationship does not imply that these countries do not differ in their policy implementation over time. It simply means that any deviation in the short run will be corrected by internal dynamics within the system that corrects the misalignment and pushes these economies back toward the equilibrium path in the long run (Darrat and Al-Shamsi, 2005). To support this conclusion, vari-

Table 1
Unit root tests.

Variables	ADF (first difference)		PP (first difference)		KPSS (first diff)
	Constant	Constant + trend	Constant	Constant + trend	
	Argentine				
RGDP	−3.35**	−3.26*	−3.23**	−3.15*	0.29**
INVT	−3.25**	−3.12	−3.15**	−3.00	0.18**
TRADE	−3.11**	−2.98	−3.13**	−2.93	0.13**
EX	−4.56**	−4.72**	−5.73**	−5.68**	0.11**
INT	−7.49**	−7.42**	−7.49**	−7.42**	0.24**
	Brazil				
RGDP	−2.28	−2.23	−2.28	−2.16	0.18**
INVT	−2.85*	−2.80	−2.98**	−2.85	0.14**
TRADE	−3.05**	−2.89	−3.07**	−2.78	0.13**
EX	−6.29**	−6.24**	−6.21**	−6.15**	0.13**
INT	−4.57**	−4.83**	−3.39**	−3.35	0.22**
	Paraguay				
RGDP	−3.14**	−2.93	−3.19**	−2.97	0.18**
INVT	−4.77**	−4.61**	−3.67**	−3.53**	0.10**
TRADE	−4.08**	−5.00**	−3.97**	−3.86**	0.09**
EX	−4.17**	−4.34**	−5.99**	−6.12**	0.30**
INT	−11.05**	−10.93**	−21.73**	−21.95**	0.25**
	Uruguay				
RGDP	−3.40**	−2.36	−2.70*	−2.27	0.39*
INVT	−3.60**	−4.36**	−3.27**	−3.18*	0.27**
TRADE	−3.14**	−3.74**	−3.16**	−2.90	0.18**
EX	−5.47**	−5.59**	−5.46**	−5.49**	0.27**
INT	−4.85**	−4.81**	−5.97**	−5.92**	0.18**

RGDP is real gross domestic product, INVT is private investment, TRADE is intra-Mercosur trade, EX is nominal exchange rate, and INT is interest rate (money market rate).
* Indicates significance at the 5% level.
** Indicates significance at the 1% level.

Table 2
Cointegration test results.

Variables	Eigenvalues	Null hypothesis	λ-trace	λ-max	Critical values (5%)	
					λ-trace	λ-max
RGDP	0.489	r = 0	57.11*	30.18*	40.17	24.16
	0.311	r ≤ 1	26.93**	16.77**	24.28	17.80
	0.167	r ≤ 2	10.16	8.22	12.32	11.22
	0.042	r ≤ 3	1.94	1.94	4.13	4.13
INVT	0.53	r = 0	72.24*	33.66*	63.87	32.12
	0.36	r ≤ 1	38.58	20.15	42.91	25.82
	0.28	r ≤ 2	18.43	14.72	25.87	19.38
	0.08	r ≤ 3	3.72	3.72	12.52	12.52
TRADE	0.575	r = 0	62.59*	38.48*	40.17	24.15
	0.306	r ≤ 1	24.10**	16.40**	24.27	17.80
	0.143	r ≤ 2	7.69	6.96	12.32	11.22
	0.016	r ≤ 3	0.72	0.73	4.12	4.12
EX	0.57	r = 0	99.40*	43.96*	63.87	32.11
	0.39	r ≤ 1	55.43*	26.40*	42.91	25.82
	0.30	r ≤ 2	29.03*	18.85**	25.87	19.38
	0.17	r ≤ 3	10.17	10.17	12.51	12.51
INT	0.55	r = 0	62.41*	43.35*	40.17	24.15
	0.19	r ≤ 1	19.06	11.34	24.27	17.79
	0.12	r ≤ 2	7.72	7.25	12.32	11.12
	0.01	r ≤ 3	0.46	0.46	4.12	4.12

* Indicates significance at the 1% level.
** Indicates significance at the 5% level.

Table 3
Test statistics for lag length selection and serial autocorrelation.

Panel A: Lag length selection criteria					Panel B: Serial autocorrelation LM test $\chi^2_{(49)}$	
	LR	AIC	SC	HQ	LM test	p-Value
Lags	RGDP					
0	NA	−4.85	−4.70	−4.80	–	–
1	483.92	−16.54	−15.73	−16.24	11.63	0.77
2	52.43[a]	−17.31[a]	−15.85[a]	−16.77	16.97	0.39
3	8.87	−16.87	−14.76	−16.09	8.71	0.93
4	6.03	−16.36	−13.61	−15.34	76.65	0.00
Lags	INVT					
0	NA	−2.72	−2.56	−2.66	–	–
1	417.07	−12.69	−11.88	−12.39	5.97	0.98
2	53.42[a]	−13.49[a]	−12.03[a]	−12.95[a]	15.09	0.52
3	7.99	−13.02	−10.91	−12.24	4.88	0.99
4	5.06	−12.48	−9.72	−11.46	83.04	0.00
Lags	TRADE					
0	NA	−6.36	−6.20	−6.30	–	–
1	477.17	−17.87	−17.06	−17.57	24.76	0.07
2	66.34[a]	−19.04[a]	−17.58[a]	−18.49[a]	19.90	0.22
3	16.02	−18.82	−16.72	−18.04	16.55	0.42
4	23.27	−18.96	−16.20	−17.94	95.55	0.01
Lags	EX					
0	NA	−2.83	−2.68	−2.77	–	–
1	324.85	−9.26	−8.51[a]	−8.97	45.50	0.00
2	40.13	−9.59	−8.23	−9.07	35.05	0.00
3	40.97[a]	−10.04[a]	−8.07	−9.29	15.44	0.49
4	21.34	−10.04	−7.47	−9.06	19.43	0.24
Lags	INT					
0	NA	21.66	21.82	21.72	–	–
1	239.76	16.37	17.18	16.67	14.21	0.58
2	64.25[a]	15.30[a]	16.75[a]	15.84[a]	13.50	0.63
3	13.20	15.60	17.69	16.38	24.36	0.08
4	20.86	15.56	18.29	16.58	35.88	0.00

Autocorrelation LR test H_o: no serial correlation at the selected lag.
[a] Indicates lag order selected by the criterion.

ous hypotheses as they relate to the cointegrating relation (β) and the speed of adjustments (α) are tested. Table 4, Panel A reports the test results on β, which examines whether a particular variable in the model can be excluded from the long-run relationship. In order to establish the individual significance of each variable we conduct the likelihood ratio (LR) test for the null hypothesis that each variable in the model does not contribute to the long-run relationship, i.e., $H_0 = \beta_k = 0$, where, $k = 1, 2. . .4$. The test results (Table 4, Panel A) indicate that all of the variables are significant in the cointegration terms, suggesting an equal contribution in moving the system toward long-run equilibrium. Table 4, Panel B reports the results of the weak exogeneity test. A variable is said to be weakly exogenous with respect to the long-run parameter β if that variable does not respond to the discrepancy from the long-run equilibrium (Enders, 2004). In other words, if the speed of adjustment parameter α_i is zero, the variable in question is weakly exogenous. We test the null hypothesis that each variable in the system is weakly exogenous, i.e., $\alpha_i = 0$, where $i = 1, 2. . .4$. While we reject the null hypothesis for all three variables, we fail to reject the null hypothesis for the investment variable for Uruguay[6] at the conventional level (Table 4, Panel B). Results of all the tests to establish the long-run convergence relationship indicate that macroeconomic variables in Mercosur have a long-run link; they move together in the long run and any short-run deviation from equilibrium tends to be transitory. Note that the more cointegrating vectors there are the more stable the system (Dickey et al., 1991). In other words, it is desirable for an economic system to have $n - 1$ cointegrating vectors which ensures long run stability from as many directions as possible. Standard investment has more common trend than cointegrating vectors, suggesting a relatively less stable long run relationship. It corroborates with the speed of adjustment coefficient for Uruguay (Table 4, Panel B), which indicates that the investment variable for Uruguay is weakly exogenous.

[6] These results are not robust with regard to different lag length. However, for the sake of consistency, we used the lag selected by the AIC and LR tests for all three variables. Further, the test for exclusion of variables rejects the insignificant role of any of the variables under consideration. Therefore, we proceed with our analysis with all four countries.

Table 4
Tests for exclusion of variables from cointegrating vectors and weak exogeneity.

Panel A: Tests for exclusion of variables from CV			Panel B: Tests for weak exogeneity	
	$\chi^2_{(1)}$	p-Value	$\chi^2_{(1)}$	p-Value
Country	RGDP			
ARG	19.68	0.00	20.20	0.00
BRL	14.94	0.00	9.57	0.00
PAR	9.42	0.00	5.40	0.06
URG	9.17	0.01	5.50	0.06
Country	INVT			
ARG	14.54	0.00	10.60	0.00
BRL	8.28	0.01	6.72	0.01
PAR	9.92	0.00	8.83	0.00
URG	6.16	0.04	11.44	0.00
Country	TRADE			
ARG	29.63	0.00	9.31	0.01
BRL	25.76	0.00	6.01	0.04
PAR	29.15	0.00	11.07	0.00
URG	14.03	0.00	2.40	0.30
Country	EX			
ARG	17.51	0.00	18.93	0.00
BRL	6.21	0.10	17.76	0.00
PAR	10.65	0.01	8.00	0.04
URG	7.38	0.06	12.99	0.00
Country	INT			
ARG	5.27	0.02	9.66	0.00
BRL	6.93	0.00	6.56	0.01
PAR	5.91	0.01	2.48	0.11
URG	8.90	0.00	10.68	0.00

4.2. Common cycle analysis

The next step is to identify whether the selected variables in the Mercosur zone have common cycles. The co-feature statistics presented in Table 5 indicate that real output has two co-feature vectors (i.e., $s=2$), implying that the four countries share two common cycles. Note that co-feature rank (vectors) s is the number of statistically zero canonical correlations that ultimately determines the common cycles (n − s: 4 − 2 = 2). In this case, the sum of the dimension of the co-feature vectors (s) and the cointegrating vectors (r) add up to the total number of the series (n) in the system, i.e., $r+s=n$, which allows us to decompose real GDP into its trend and cyclical components. The null hypothesis that the co-feature space (s) has a dimension of four is rejected for investment and trade. The co-feature rank for both variables is two (i.e., $s=2$). This implies that the system of the four intra-trade and investment series possesses two common cycles.

When the financial variables are considered, the test statistics suggest that the exchange rate series in Mercosur has two co-feature vectors (i.e., s = 1), implying that they share two common cycles (i.e., n − s: 4 − 1 = 3). From the p-values of the F-test in Table 5, we cannot uphold the hypothesis that the smallest three canonical correlations are zero for interest rates. However, we conclude that the smaller two are jointly zero, indicating that there are two co-feature vectors in the system of four variables. Thus, the exchange rate and interest rate each share two independent common cycles. Engle and Issler (1993) report that if the cycles are common, then the short-run movements are synchronized, although they may not follow the same path in the long run. On the other hand, if a common (single) cycle is identified, transitory (short-run) shocks affect all countries uniformly. In that case, if a country is, say, in recession, its trading partner is likely to be in a recession as well. The statistical evidence thus points to strong macroeconomic interdependence among the Mercosur countries. Our results are consistent with the findings of Basnet and Sharma (2015), where the authors support policy coordination among the seven largest Latin American countries. The chief implication of our finding is that any policy aimed at enhancing growth in the Mercosur zone through investment and exchange rate stability will be easy to implement as the real and financial sector variables share common trends in the long run, and common cycles in the short run.

In this analysis, the cointegration test results identify one cointegrating vector ($r=1$) while the common cycle test identifies at least two co-feature vectors ($s=2$) for investment. Since $r+s<n$ (i.e., $r=1$, $s=2$ & $n=4$), the special condition is not satisfied for investment. The special condition, i.e., n = r + s, necessary to decompose a series into its trend and cyclical components, is not satisfied by the financial sector variables. Thus, we cannot proceed with trend-cycle decomposition for the exchange rate and interest rate. However, the test results allow us to perform the trend-cycle decomposition for intra-Mercosur trade as the $r+s=n$: $2+2=4$ exists.

Table 5
Test statistics for the number of common cycles.

Null hypothesis	ρ_i^2	df	F-stat	p-Value
	RGDP			
s = 1	0.24	10	0.77	0.65
s = 2	0.52	22	1.14	0.33
s = 3	0.72	36	1.66**	0.03
s = 4	0.87	52	3.37*	0.00
	INVT			
s = 1	0.19	10	0.72	0.69
s = 2	0.32	22	0.94	0.54
s = 3	0.66	36	1.57*	0.04
s = 4	0.64	52	2.27*	0.00
	TRADE			
s = 1	0.23	10	0.91	0.54
s = 2	0.34	22	1.08	0.39
s = 3	0.64	36	1.84*	0.01
s = 4	0.74	52	2.75*	0.00
	EX			
s = 1	0.24	10	1.26	0.28
s = 2	0.46	22	1.32	0.23
s = 3	0.58	36	2.47*	0.00
s = 4	0.69	52	3.04*	0.00
	INT			
s = 1	0.12	10	0.88	0.51
s = 2	0.33	22	1.56	0.11
s = 3	0.59	36	2.66*	0.00
s = 4	0.87	52	5.35*	0.00

* Indicates significance at the 1% level.
** Indicates significance at the 5% level.

Table 6
Correlations among trend and cyclical components of RGDP.

	Panel A: RGDP				Panel B: TRADE			
	ARG	BRL	PAR	URG	ARG	BRL	PAR	URG
ARG	1	0.93	0.96	0.99	1	0.99	0.99	0.99
BRL	0.99	1	0.99	0.90	0.99	1	0.99	0.99
PAR	0.97	0.98	1	0.93	0.87	0.88	1	0.99
URG	0.96	0.98	0.99	1	0.99	0.99	0.90	1

Lower triangular: coefficients of trend components.
Upper triangular: coefficients of cyclical components.

4.3. Dynamic analysis of trend innovation

To further analyze the findings, we present the trend and cyclical components through graphical illustration. The trend innovations of real GDP are plotted in Fig. 4 which displays a greater degree of similarities in their movement. The trend behaviors are quite comparable; they project identical patterns and direction in their long-term movement. We do not observe any asynchronous behavior by any of the four countries during the study period. Since cointegrating vectors are normalized with respect to the largest economy in the group (Brazil), we analyze the trend behavior of the rest of the countries in relation to Brazil. To this end, it is interesting to find a positive and synchronized movement of real GDP of the Mercosur countries. The lower triangular in Table 6, Panel A reports the simple correlation of the trend components of real GDP. The correlation coefficients are positive and highly correlated; the correlation in every instance is 0.93 or greater. We also report the standard deviation of the trend and cyclical components for real GDP and trade. The decomposed series does not indicate considerable cross-country differences in volatility. The standard deviation of trend components of real GDP is less than 1 for all the nations; Table 7 shows that it is 0.52 for the most volatile country (Brazil) and 0.42 for the least volatile country (Argentina). In fact, the discrepancy among real outputs is miniscule.

Table 7
Standard deviation of trend and cyclical components.

	ARG	BRL	PAR	URG
RGDP				
Trend comp.	0.42	0.52	0.43	0.47
Cyclical comp.	0.53	0.44	0.40	0.43
TRADE				
Trend comp.	2.67	2.45	0.93	1.88
Cyclical comp.	2.75	2.51	0.85	1.87

ARG is Argentina, BRL is Brazil, PAR is Paraguay, and URG is Uruguay.

The trend components of trade are plotted in Fig. 6. We notice that the innovations of trade in Mercosur demonstrate a greater degree of synchronous movement and are positively correlated. In the figure we observe some interesting facts. First, while all series show a coinciding expansion and contraction during the study period, the trend behaviors of Argentine and Brazilian trade are extremely synchronized; they show identical dynamics in terms of timing and duration of the movement. Second, the trend innovations of Uruguay and Paraguay do not fluctuate to the same extent as that of Brazil and Argentina. Such response variations may be attributable to the relative size of these economies. The volatility in trend innovations—distinct and comparable for all economies—suggests that all countries suffered from the bad and good economic times over time. The correlation coefficients in Table 6, Panel B, upper triangular reveal that the long-run movement is perfectly correlated (0.99). The trend components of trade appear to be more volatile compared to that of real GDP. The standard deviation of the trend components of trade for the most volatile country (Argentina) is almost three times as great as that of the least volatile country (Paraguay).

4.4. Dynamic analysis of cyclical innovation

Fig. 5 plots the estimation of the cyclical components of real GDP. It is apparent from the figure that the cyclical components display synchronized co-movement during the study period. The cyclical components are obtained by subtracting the trend components from the original series by utilizing Eq. (6) in Section 3. Simple correlations for cyclical components suggest that the short-run behavior of the four countries is highly correlated (Table 6, Panel A, upper triangular). The correlation coefficient is above 0.97 for any pair of countries. The graphical presentation further confirms this strong correlation. As discussed earlier, the two leading economies considered in this study (Argentina and Brazil) experienced a major financial crisis between 1999

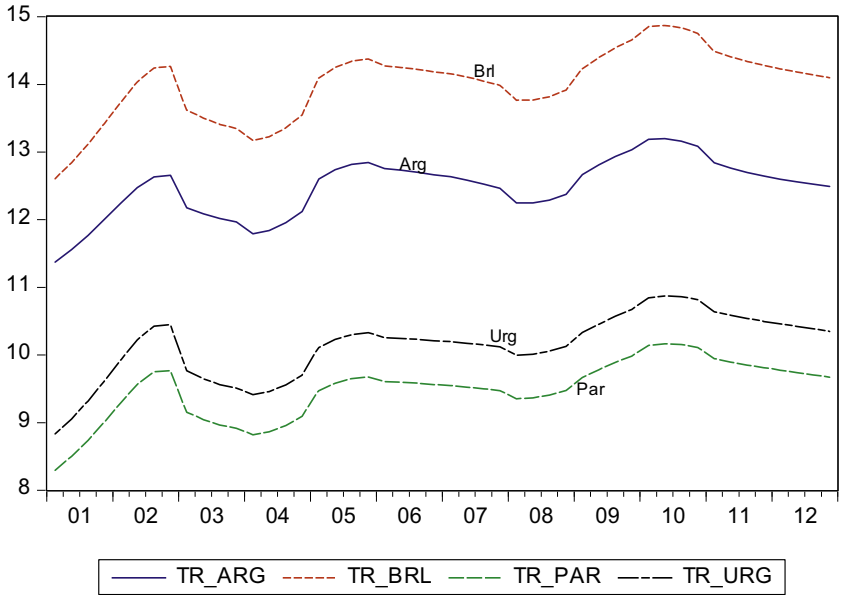

Fig. 4. Trend components of real GDP.

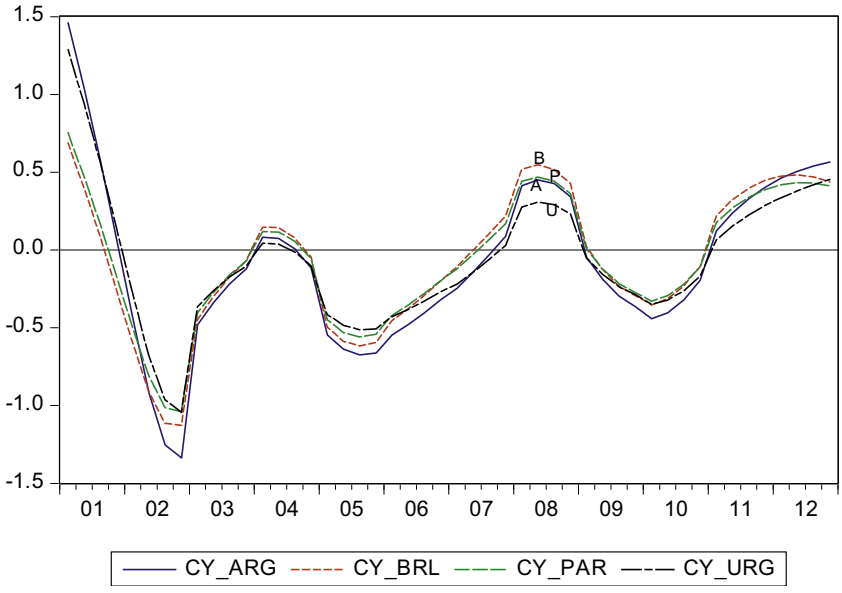

Fig. 5. Cyclical components of real GDP.

and 2002. In Fig. 5, we observe a stark downward movement in the cyclical response of these countries which can be attributed to the financial crisis in Argentina and Brazil. Additionally, the 9/11 attacks on the United States also took place during the same time, which by all accounts had a severe impact on the global economy. Similarly, the world economy went through a severe recession during the study period. The GFC crisis that emerged in 2007 and lasted until 2009 resulted in a severe contraction in economies around the world. The Mercosur countries were not immune to this GFC the impact from which is captured by the negative responses of real output (Fig. 5).

The graphical illustration of the cyclical components of trade is presented in Fig. 7. All four countries demonstrate a strong short-run co-movement during the study period. The graph illustrates that the amplitude of the Paraguayan cyclical movement is less pronounced vis-à-vis the rest of the countries. Again, the correlation is strong among the variables (Table 6, Panel B, lower triangular). The cyclical behavior of trade is strikingly similar to that of real outputs. This observation, however, is not surprising given the close association between trade and the overall health of the economy. We do not find any qualitative differences between the short-run responses of these cycle-generating innovations. All of them capture the economic and financial turmoil mentioned above. The standard deviation among the cyclical components of real outputs is also negligible. The graphical illustration confirms the perfect co-movement among the cyclical components (Fig. 5). Similar to the trend behavior of trade, the test also indicates a greater standard deviation among the

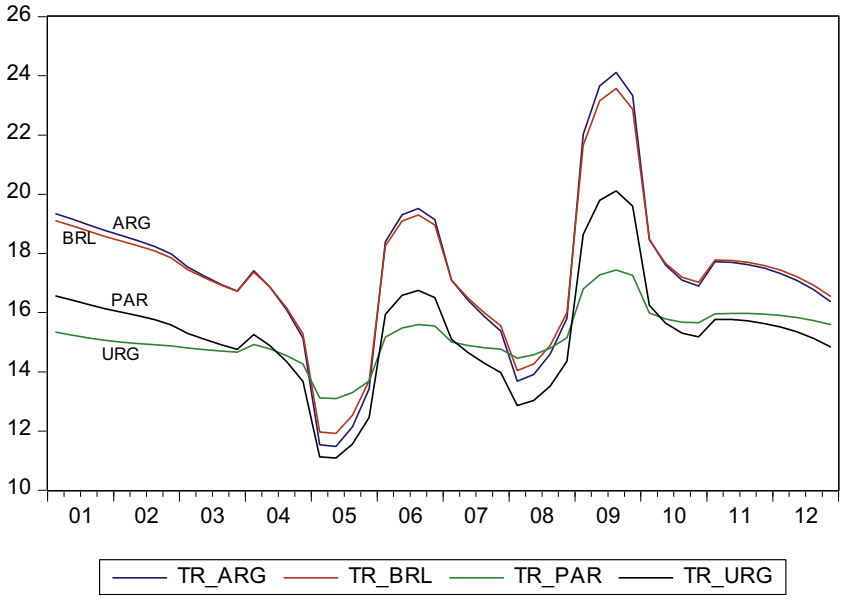

Fig. 6. Trend components of trade.

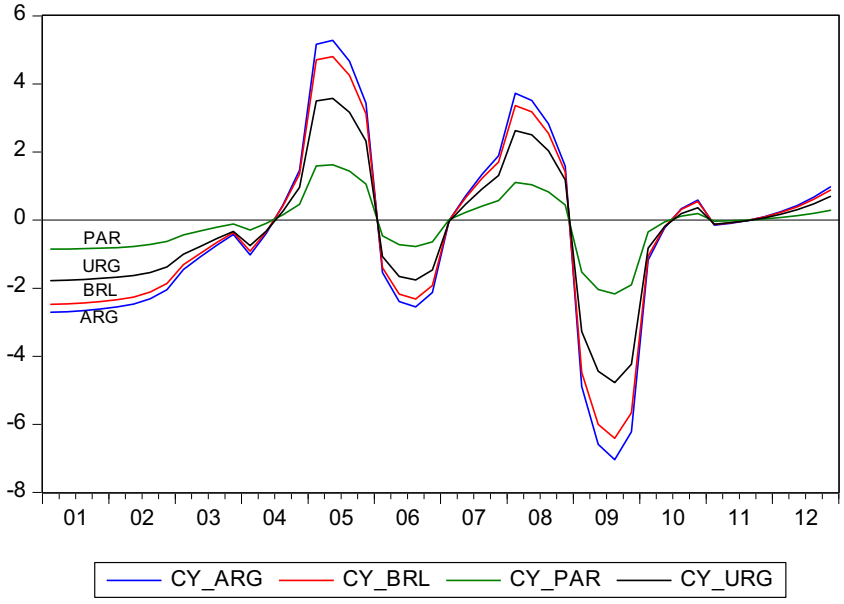

Fig. 7. Cyclical components of trade.

cyclical movement of trade. While they display a strong co-movement, it is evident from Table 7 that the highest volatile cycle (Argentina) is more than three times larger than the least volatile (Paraguay).

4.5. Robustness check

Since trade is one of the important aspects of regional integration, this study further investigates whether there are commonalities in total world trade (exports and imports of all products) of the Mercosur economies. We undertake this examination in an effort to provide an additional robustness check to our analysis. By utilizing Eqs. (1) through (6) discussed in the methodology section, we estimate the commion trend and common cycles in total trade of these countries. Both the λ_{trace} and $\lambda_{\max}$ statistics indicate at least two cointegrating vectors (i.e., $r = 2$) implying that the trade variables share two common trends (i.e., $n - r = 4 - 2 = 2$) in the long term. Similarly, the common cycle test reveals the presence of two co-feature vectors (i.e., $s = 2$) suggesting that trade shares at least two (i.e., $n - s = 4 - 2 = 2$) common cycles in the short term.[7] Therefore, our test results do not indicate any changes in the trajectory of

[7] The detailed test statistics with regard to robustness check of unit root, common trend, and co-feature vectors are not reported in the paper but are available upon request.

the common trends and common cycles between intra-regional trade and total trade.

5. Conclusion

This paper has analyzed some of the common features of key macroeconomic variables (real output, investment, intra-regional trade, exchange rate, and interest rate) representing both the real and financial sectors of the economy in the Mercosur countries. Macroeconomic variables are considered to be instrumental for any prospect of economic or monetary integration. Our test results reveal that the Mercosur countries have common trends; as such, their economies cannot drift away from long-run equilibrium for a prolonged duration. Similarly, each variable under consideration shares two common cycles which affirm the notion that these economies are subject to synchronous cyclical movement in the short run. The test results for individual significance of the variables suggest that the contribution of each variable in establishing long-run convergence is significant. Hence, the findings of this paper provide consistent evidence that with respect to both the real and financial sectors, economic interdependence among the Mercosur countries is strong. In fact, the exchange rates of the four countries share a common trend which augurs that the permanent shocks eventually affect all four countries in the same way. The trend-cycle decomposition results reveal that the cyclical movements of real output and trade are synchronized with a high degree of positive correlations. The policy implication of our findings is thus two-fold. First, any policy devised to enhance economic growth through investment and exchange rate stability would be relatively easy to implement. Second, our results should help policy makers improve their ability to understand and forecast the behavior of macroeconomic variables in the region. This understanding could help the governments of the Mercosur countries to formulate a common defensive mechanism to prevent external shocks.

While our findings offer adequate support for deeper integration such as a common market in Mercosur, a cautionary note on multiple independent common cycles, as is the case in the paper, is in order. It is apparent that short-run cycles are spread through more than a single channel. As such, the governments of these countries will need to enhance policy coordination in a way that can eliminate multiple propagation channels of intra-country shocks.

Despite our efforts to be thorough, there is certainly room for a more wide-ranging analysis. One avenue for further research is the degree of labor-market movement which might provide some important implications for policy. We also believe that a more disaggregated examination across countries, such as at the industry level, might provide more insight into the prospects for deeper regional integration. Finally, the potential, implementation, and long-term success of regional integration also depend a great deal on non-economic considerations such as the role played by special interest politics. The reality is that like international trade, economic integration creates winners and losers; it is not necessarily beneficial for every group or individual. It is therefore important to distinguish between individual and national welfare. Another challenge is that it is difficult to show in practice that gains from such integration more than offset the losses.

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