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Testing the dependency theory on small island economies: The case of Cyprus☆

Mehmet Balcilar[a,b], Ali M. Kutan[c], Mehmet E. Yaya[d,*]

[a] Eastern Mediterranean University, Famagusta, Northern Cyprus, via Mersin 10, Turkey
[b] Montpellier Business School, Montpellier, France
[c] Department of Economics and Finance, School of Business, Southern Illinois University Edwardsville, Edwardsville, IL 62026-1102, United States
[d] Department of Economics, Eastern Michigan University, Ypsilanti, MI 48197, United States

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ABSTRACT

This paper empirically tests the validity of dependency theory in the small island setting of Cyprus, to establish whether a periphery/patron relationship exists between each of the island's two economies and their respective mainland partners of Greece and Turkey. Using data for the 1978–2013 period, we first test for the necessary condition, i.e. whether there is a long-run cointegrating relationship in the economic development of the Republic of Cyprus (RC) and Greece, and the Turkish Republic of Northern Cyprus (TRNC) and Turkey. We then test for the sufficient condition, i.e. whether periphery-economy per capita income series to be weakly endogenous, while those of patron economies are weakly exogenous. Our results indicate strong dependency within the periphery/patron economy pairs of the RC/Greece and the TRNC/Turkey. Further, we show that economic growth in the periphery economies is largely driven by that of the patron economies. Using a Markov-switching vector autoregressive (MS-VAR) model of the short-run business cycle, we demonstrate that the RC/Greece and the TRNC/Turkey co-move in the short-run, and that business cycles with each pair are synchronized. The policy implications of these findings are then discussed.

1. Introduction

Santos (1970) defines dependency as "a situation in which the economy of a certain country or group of countries is conditioned by the development and expansion of another economy, to which their own is subjected.". The literature on dependency, summarized in the next section, includes examinations of colonial relationships, in which colonial powers are presented as patrons and their colonies as peripheries or satellites. Kaufman et al. (1975) concur with this perspective, on the grounds that the peripheries (colonies) do not have the necessary resources and know-how to compete in international markets. According to the authors, even industrialization does not reduce the level of dependency between patrons and peripheries. The industrialization of periphery economies makes them still more dependent on patron-economy imports, such as raw materials, capital, or semi-finished goods, rather than non-essential consumer products. More recently, Armstrong and Read (2000) suggest that peripheries tend to concentrate on a few niche-market exports, which exacerbates the dependency problem of periphery economies. Furthermore, periphery economies experience decline in the domestic entrepreneurial activity while multinational corporations replace domestic ones (Kaufman et al. 1975).

There is also large literature on the advantages and disadvantages of being a small island economy. For example, Briguglio (1995) suggests that small island economies face challenges due to remoteness, insularity, and vulnerability to natural disasters, in addition to economic vulnerabilities including size, limited natural resources, constraints to import substitution, dependence on export markets and a narrow product range, limited power to influence prices, and inability to achieve economies of scale. Furthermore, Read (2004) suggests the islandness and globalization through trade have significant impacts on the economic growth of island economies.

In addition to imperialist (colonist vs. colony) relationships, dependency theory is also used to describe the political power of a patron over a periphery that is the result of historical ties between the two. This paper contributes to the literature on dependency theory by

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* Correspondence to: Department of Economics, Eastern Michigan University, 703 Pray Harrold Hall, Ypsilanti, MI 48197, United States.

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examining such periphery/patron relationships between two eastern-Mediterranean pairs with historical ties—the Republic of Cyprus (RC) and Greece, and the Turkish Republic of Northern Cyprus (TRNC) and Turkey. We analyze the possible long-run (co-integration) and short-run (synchronization) relationships within these pairs, with particular focus on specific milestones.[1] Our study is both timely and relevant, with the recent global crisis and problems in the Eurozone providing an excellent setting in which to test dependency theory. Following the accession of the RC to the Eurozone in 2008, each of our economy pairs use a common currency (the Turkish lira in the TRNC/Turkey and the euro in the RC/Greece), making our work a unique case study in dependency theory.

At the macroeconomic level, a periphery/patron relationship implies that common indicators (such as the per capita GDP of each economy) will be driven by a common stochastic trend, and the specific indicators (e.g. per capita GDPs) thus cointegrated. The existence of a periphery/patron relationship is further confirmed if a given macroeconomic indicator of the periphery economy is weakly endogenous and that of the patron economy weakly exogenous. We empirically test these implications by analyzing the co-integration relationship of per capita GDP between the RC/Greece and between the TRNC/Turkey over the 1978–2013 period.

While the RC's accession to the EU and Eurozone might have had an impact on the co-movement of the RC/Greece economy pair, a 2008 European Commission report on the degree, evolution, and determinants of business cycle co-movement in the euro area as a whole found that existing studies were at best inconclusive (European Commission, 2008). This finding is supported by Kappler and Sachs (2012), in their extensive analysis of business-cycle synchronization in the EU.[2] Giannone et al. (2010) show that monetary union did not alter business-cycle characteristics or the co-movement of per capita real GDP. Montoya et al (2008) conclude that, on average, monetary union increased business-cycle synchronization, but that synchronization in some regions remained low or even decreased, indicating a 'national border' effect.

In sum, the vast literature on business-cycle co-movement in the EU does not facilitate easy conclusions on the likely effect of EU integration on the long- and short-run co-movement of the RC/Greece economy pair. Nor can we disentangle the separate EU and global effects with the addition of other variables to our model. However, we do recognize that EU integration should have an effect on the co-movement of the RC/Greece economy pair.

Each economy pair of the TRNC/Turkey and the RC/Greece are historically and closely linked. For more than three centuries, the island was under the control of the Ottoman Empire, during which time Turkish migration resulted in the cohabitation of Turks and Greek Cypriots. In the aftermath of World War I the Ottoman Empire lost control of the island, which became a British colony in 1925, declaring independence in 1960. Turkey and Greece, along with Britain, were established as guarantors of the independence, territorial integrity, and security of Cyprus, under the Treaty of Guarantee. However, Turkish intervention in Cyprus following a Greek-sponsored coup in 1974 led to the island's de facto division, and the closer integration of each side with its respective mainland partner.

The economic integration of each economy pair has since accelerated, with the accession of Greece then the RC to the EU, followed by each joining the Eurozone, and the parallel strengthening of ties between Turkey and the TRNC. (Greece joined the EU in 1981 and adopted the euro in 2001, while the RC joined the EU in 2004 and adopted the euro in 2008. Turkey has been an associate member of the EU since 1963. The TRNC has been under international embargo since the events of 1974, further spurring its economic integration with Turkey.).

We empirically test whether business cycles within each of our periphery/patron economy pairs are driven by a single regime and are synchronized, using Markov-switching vector autoregressive (MS-VAR) models fitted to per capita real GDP series. Our paper contributes to the sizeable literature on the transmission of shocks, contagion, business-cycle synchronization, and convergence between countries. Although there are numerous papers on these issues, no work has investigated the transmission of shocks and business-cycle synchronization between a EU member (Greece) or a candidate country (Turkey) on the periphery economy with which either is associated. To the best of our knowledge, this is the first study to investigate linkages between these patron and periphery economies in the framework of dependency theory.

Our results show that per capita real income of the periphery/patron economy pairs, i.e. the RC/Greece and the TRNC/Turkey are cointegrated, implying that per capita real GDP in the RC and Greece are driven by the same stochastic trend in the long run as in TRNC and Turkey. Furthermore, as dependency theory suggests, we find periphery-economy per capita income series to be weakly endogenous, while those of patron economies are weakly exogenous. Therefore, the RC and TRNC behave as periphery economies of their respective patrons, Greece and Turkey.

In order to examine short-run business-cycle dependency, we estimate bivariate MS-VAR models for the real GDP growth series of patron/periphery pair economies. Our empirical results imply that business cycles in patron and periphery economies follow perfectly synchronized regime-switching processes. Using the multi-chain version of MS-VAR models, our results further show that regime-switching processes in periphery economies depend on regime-switching processes in patron economies, indicating that short-run periphery-economy business cycles also depend on patron-economy business cycles.

The following section describes the economic links between the two island economies of Cyprus and their respective patrons, while Section 3 discusses recent literature on patron/periphery relationships, with particular emphasis on the two economies of Cyprus, Turkey, and Greece. Section 4 presents the data and empirical analysis, and Section 5 concludes with some policy implications of findings.

2. Cyprus: small island economies and links to patrons

For the past century the two main populations of Cyprus, Greek- and Turkish-Cypriots, have been locked in dispute (Okumus et al. 2005). Historically, each group has been closer to its patron of Greece or Turkey than to one another, bound by cultural, religious, and economic ties (Kliot and Mansfield, 1997). Since the de facto division of the island in 1974, the Republic of Cyprus (RC) has controlled the southern 63% of the island, while the Turkish Republic of Northern Cyprus (TRNC) controls the northern 37% (Sonmez and Apostolopoulos, 2000). The economic embargo on the north following Turkey's intervention has, unsurprisingly, resulted in distinctive paths of economic growth in the RC and the TRNC. For example, while the TRNC experienced average growth of 8.5% from 1978 to 2010—0.5% higher than the RC—the volatility of growth in the TRNC was much higher than that in the RC (see Fig. 1). The RC prospered as a result of additional stability, particularly since it joined the European Union (EU) in 2004. Although real GDP growth rates are more volatile in Turkey and the TRNC in the period up to the mid-1990s, growth in both has also been more robust since 2004.[3]

[1] The period of our study includes several important milestones: 1980 – military coup in Turkey; 1981 – Greece joins EU; 1996 – Imia/Kardak military crisis between Greece and Turkey; 2001 – Greece joins Eurozone; 2003 – opening of the Green Line between RC and TRNC; 2004 – RC joins EU; 2008 – RC joins Eurozone; 2004 – rejection of the Annan Plan for reunification of Cyprus; 2009 – Eurozone banking crisis.

[2] See also other references in Kappler and Sachs (2012).

[3] For a recent evaluation of the Turkish and Greek economies, see, among others,

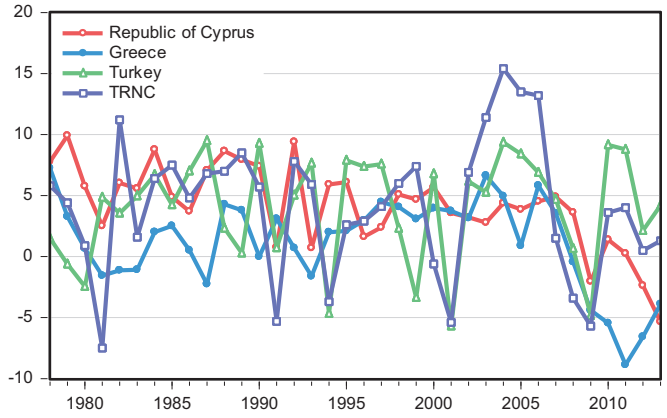

Fig. 1. Real GDP growth rates (1978–2013).*Note*: Figure plots the real GDP growth rates. Real GDPs are in local currency (Euro for Greece and RC; and Turkish Lira for Turkey and TRNC). Real GDPs for Greece and RC are in 2005 constant Euros; and in 1998 constant Turkish Liras for Turkey and TRNC.

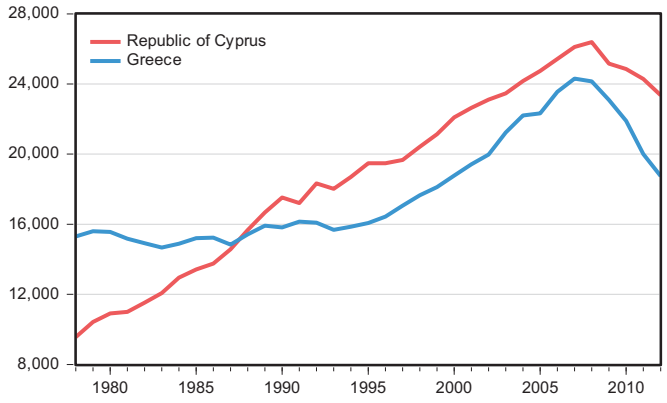

Fig.2. Per capita real GDP in Greece and the Republic of Cyprus (2005 constant Euros). *Note*: Figure plots the real GDP per capita in 2005 constant Euros.

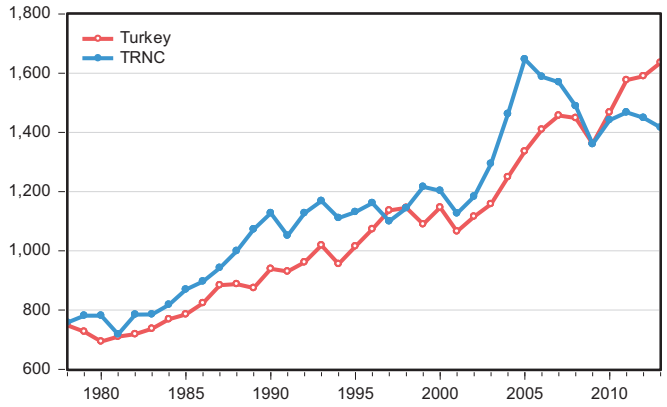

Fig. 3. Per capita real GDP in Turkey and TRNC (1998 Constant Turkish Liras).*Note*: Figure plots the real GDP per capita in 1998 constant Turkish Liras.

However, a comparison of per capita real incomes for the RC/Greece and TRNC/Turkey indicate clear co-movement within and divergence between these economy pairs (see Figs. 2 and 3). In 1978, per capita incomes in the RC/Greece were approximately twice those in the TRNC/Turkey. Per capita incomes in the RC/Greece increased from $4,000 to $26,000 from 1978 to 2012, with discernable co-movement. In fact, until the 2009 Euro crisis, the correlation of per capita incomes between these economies is almost perfectly correlated at 99%. By contrast, there is a clear divergence in the per capita incomes of Turkey and the TRNC, although significant correlation remains. Furthermore, while per capita incomes have increased in Turkey and the TRNC, these economies have failed to close the gap in per capita GDP with Greece and the RC. This can be partly attributed to the international embargo on Turkey[4] and the TRNC following Turkey's intervention in Cyprus in 1974, as well Greece's accession to the EU, followed by that of the RC.

The de facto division of Cyprus following Turkey's intervention in 1974 led to a divergence in the economic growth of the RC and the TRNC. There are several reasons for these radically different growth paths, including ties to patrons (Ioannides and Apostolopoulos, 1999). As shown in Figs. 2 and 3, per capita income levels in Turkey and the TRNC are similar and follow the same trend. RC per capita real GDP surpassed that of Greece from 1988, however the trend has remained analogous.

Figs. 2 and 3 show a clear co-movement within but divergence between economy pairs in terms of per capita real incomes. Per capita incomes in the RC/Greece grew faster than in the TRNC/Turkey until the start of the global recession in 2007, at which point the pattern reverses: per capita incomes of the TRNC/Turkey maintain historical growth rates, while those of the RC/Greece have fallen. This pattern reveals that the RC/Greece and the TRNC/Turkey economy pairs are driven by distinct factors across pairs but by common factors within. That is, while global recession has reversed historical patterns across pairs, the co-movement of patrons and peripheries remains.

These patterns in per capita real incomes are due to distinct factors across the patron/periphery economy pairs, and to dependency (common links) within them. These factors are the international embargo on Turkey and the TRNC, the accession of Greece and the RC to the EU, and the effects of global recession being distinct across but common within the patron/periphery pairs.

As mentioned above, the economic embargo on the TRNC and extensive foreign direct investment (FDI) in the RC had a significant impact on the economic fundamentals of each (Kliot and Mansfield, 1997). FDI figures for all four economies indicate that patrons Greece and Turkey have historically received significantly more FDI than their peripheries (the RC and the TRNC—see Figs. 4 and 5). Indeed, the largest recipient of FDI by far has been Turkey, with $109 billion over the last 33 years, much of that in the last decade. By comparison, Greece has received $39 billion and the RC $17 billion, while the TRNC has received just $4.5 billion, mostly from Turkey. The volatility of FDI flows to all four economies remained fairly low until 2000, increasing significantly over the past decade. The post-1974 divergence of the two economy pairs is marked. However, the 2007 global financial crisis and the 2009 Euro crisis have negatively impacted both periphery economies, particularly that of the RC (see Figs. 1–5).[5]

3. Literature review

There is a large literature on the transmission of shocks, contagion, market integration, business-cycle synchronization, and the nominal and real convergence of economies. For example, Arouri et al. (2011) examined the transmission of volatility shocks in Gulf Cooperation Council (GCC) members. More recently, Aloui and Hkiri (2014) analyzed the co-movement of stock markets in GCC countries. The authors found strengthening dependence between these countries, especially during times of crisis. Hatemi-J and Roca (2011) investi-

(*footnote continued*)
Athanasenas et al. (2013), Tagkalakis (2013), Andiç, et al. (2015), Atiyas and Bakis (2015), Bayar et al. (2015) and Özatay (2016),

[4] Embargos on weapon sales, military aid, and credits were also imposed on Turkey by US from September 19, 1974 to September 26, 1978.

[5] For recent theoretical and empirical studies examining the impact of the global financial crisis and the Greek bailout crisis on domestic economic activity and financial markets, see, among others, Breuss (2010), Kosmidou et al. (2015), Liau (2016) and Wu et al. (2016).

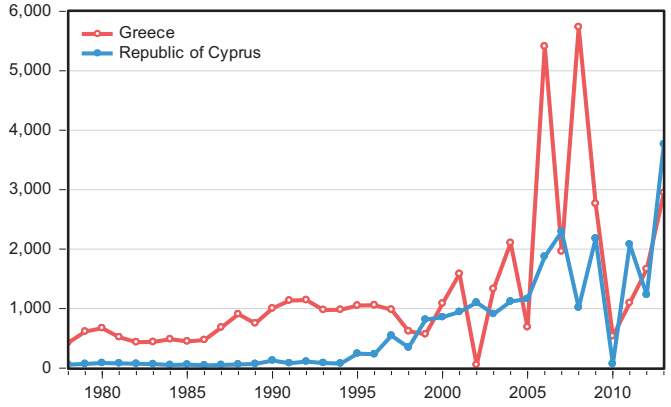

Fig. 4. FDI inflows in Greece and the Republic of Cyprus (million US Dollars, 1978–2013).

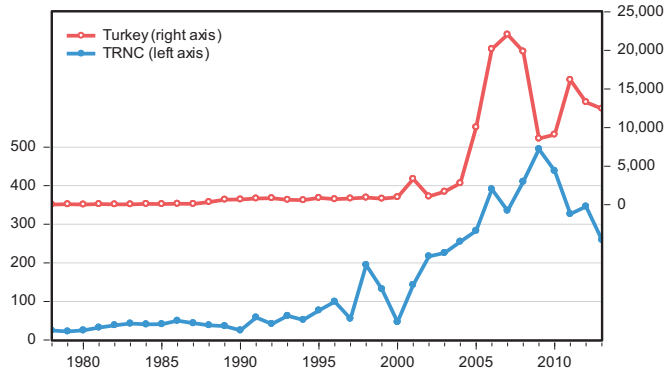

Fig. 5. FDI inflows in Turkey and TRNC (million US Dollars, 1978–2013).

gated the contagion effect in the interaction of the US real estate market with three developed economies. The authors found no contagion effect but a conventional dependency relationship between the developed economies. Changqing et al. (2015) found strong evidence of contagion risk between Chinese and other international stock markets. However, Arouri et al. (2012) found that emerging markets became more integrated as a result of liberalization and reforms. Darvas (2012) and Petrevski et al. (2014) investigated the transmission of euro-area shocks and monetary policy to several periphery economies, while Avdoulas et al. (2016) examined nonlinear dependencies among Eurozone periphery stock markets.

Another thread in the literature has examined business-cycle synchronization. For instance, Lehwald (2012), Antonakakis and Tondl (2014), Christodoulopoulou (2013), Veličkovski and Stojkov (2014), and Anagnostou et al. (2014), among others, studied synchronization between core and new EU members, analyzing the channels that might contribute to synchronization. Dufrénot and Keddad (2014) and Allegret and Essaadi (2011) examined business-cycle synchronization in ASEAN-5 countries, the former using the Markov switching model and the latter coherence study. Dufrénot and Keddad (2014) underscored the importance of regional and international business cycles and their impact on ASEAN-5 business cycles. Allegret and Essaadi (2011) suggested the bilateral trade synchronization is observed in the ASEAN-5 countries. Finally, Kabundi and Loots (2007) examined business-cycle synchronization between South Africa and other Southern African Development Community (SADC) countries, finding strong evidence of synchronization. Akkoyun et al. (2014) examined the synchronization of Turkey's businesscycleswith those of Eurozonemember states and the United States following the 2001 financial crisis in Turkey. They reported that the Turkish economy's business cycles are highly correlated with those of both the EU and the US,and that trade and capital flows are key channels of business-cycle transmission.Kočenda et al. (2006), Lopez and Papell (2012), and Ogrokhina (2015), among others, investigated nominal convergence. Brada and Ali (2001), Brada et al. (2005), Kutan and Yigit (2004, 2005, 2009), Veličkovski and Stojkov (2014), and Cuestas et al. (2015), among others, examined real convergence between core members of EU and their peripheries.

The literature also boasts a wide array of empirical analyses testing dependency theory. These include Kaufman et al. (1975), Sullivan (1983), Gasiorowski (1988), Cashdm (1995), Poirine (1999), Armstrong and Read (2000), Bertram (2004), McElroy and Pearce (2006), Dunn (2011), and McElroy and Parry (2012). For example, Kaufman et al. (1975) analyzed the possible consequences of economic dependency in Latin American countries. The authors examined whether countries with high levels of economic dependency are likely to have low rates of economic growth, an unfavorable balance of trade, or fluctuating economic growth patterns, to present early evidence of the impact of economic dependency on peripheries. Armstrong and Read (2000) examined the economic performance of over 100 sovereign microstates and dependent territories, comparing their economic performance through an analysis of the impact of tourism on gross national income per capita. The authors also considered the relationship between sovereignty and GNP per capita, to reach the striking conclusion that sovereign states have lower GNP per capita than their dependent territories. The authors argued that dependent territories might receive more aid from patrons than microstates. Similarly, Dunn (2011) has shown that politically dependent islands have higher standards of welfare and economic development, mostly due to higher levels of financial aid, FDI, migration and tourism. Bertram (2004) identified two additional factors that influence the economic development and growth rates of Pacific periphery islands that are heavily dependent on their patrons: strength of political connections between the periphery and the patron, and patron per capita GDP. The author found a convergence of incomes between patrons and peripheries, but not between peripheries in the same region. Moreover, he found the convergence is stronger in close political orbits than more distant orbits, such as fully independent island microstates. Poirine (1999) analyzed foreign aid to sovereign small island economies and dependent territories, reporting that island economies receive more aid than others, and that dependent territories receive more than sovereign ones. Bradshaw (1988) examined the Kenyan post-independence experience, using time-series analysis to show that economic dependency does not hinder economic growth if the country receives substantial foreign investment and maintains a strong state.

However, critics maintain that many such studies of microstates and periphery island countries fail to take account of variations in their path of economic development, or of the unique structure of their dependency to a given patron. It has therefore been argued that it is not possible to generalize the findings of these studies to other individual states.

Rather than studying colonial ties, our purpose in this paper is to test dependency theory in the context of political ties, in the context of the two separate economies of the island of Cyprus. Furthermore, the periphery/patron relationship can possibly be best observed during economic crises. Okumus et al. (2005) have examined the 2001 financial crisis in Turkey and its impact on the tourism and hospitality industry in the TRNC. Their results suggest that the TRNC tourism industry failed to foresee the upcoming crisis and was negatively impacted by the decline in tourist arrivals and revenues in post-crisis years. More recently, Boukas and Ziakis (2013) analyzed the impact of the global crisis on the RC, finding that the RC suffered from the global downturn, particularly in the tourism sector. RC tourism revenues and visitor numbers have yet to recover from their 2001 peak, declining due to lack of competitiveness and escalating prices. Furthermore, the authors showed that global crises have a negative impact on the tourism sector of microstates, but more pronounced effects in small island economies such as Cyprus. Yorucu and Ozay (2011) also

analyzed the island's tourism industry, reporting significant co-integration of the tourism industry of the RC/Greece, and of the TRNC/Turkey. Finally, Katircioglu (2009) analyzed the possible cointegration relationship and direction of Granger-causality between economic growth, trade, and tourism in the RC, finding that there is indeed a long-run cointegration relationship among these three variables. Furthermore, economic growth is reported to Granger-cause trade and international tourist arrivals.

Dependency theory can be analyzed using Markov-switching autoregressive (MS-AR) and Markov-switching vector autoregressive (MS-VAR) models to test whether business-cycle patterns in patron economies are directly transmitted to their peripheries. Although the literature has analyzed some of these cointegrating relationships, especially in the tourism and hospitality sector, existing work does not present findings in the context of dependency theory. We therefore believe that our work extends the literature, using the special case of small island economies in the eastern Mediterranean region to present a co-integration relationship of economic development in a periphery/patron framework.

4. Data and empirical analysis

We examine dependency theory using time-series data for the Republic Cyprus (RC), the Turkish Republic of North Cyprus (TRNC), Greece, and Turkey.[6] The sample period covers the years 1978–2013, which is the longest period available for all countries. The variables used in the empirical analysis are real GDP, real GDP growth rate, real GDP per capita, and foreign direct investment (FDI), measured in local-currency units.[7] The data for the RC, Greece, and Turkey are from the World Bank's World Development Indicators database, while that for the TRNC is from the TRNC State Planning Organization. The TRNC State Planning Organization national accounts follow the same standards used in Turkey, which is consistent with the World Bank data. Descriptive statistics for real GDP, real GDP growth, real per capita GDP, and FDI presented in Table 1 indicate the close clustering of per capita real incomes of patron and periphery economies.[8] Real GDP growth rate of patron and periphery economies also cluster for the TRNC/Turkey, however the average growth rate for Greece (1.17%) is significantly lower than that of the RC (4.19%). Although significant differences exist in the FDI series, they seem to follow a similar path (all estimations are based on logarithmic series). The Jarque-Bera normality tests reported in Table 1 reject normality at the 5% level only, for the FDI series of the RC, Greece, and Turkey.[9]

Dependency theory can be empirically tested for the case of the RC/Greece and the TRNC/Turkey using cointegration analysis. Economic integration between the periphery/patron economy pairs implies that the data-generating processes for the observed series pairs should follow the same regime. Business-cycle regime analysis is based on real GDP growth rates. The following section empirically tests the following hypotheses: whether per capita real GDP series are cointegrated; whether business-cycle regimes are synchronized; and whether periphery-economy business-cycle regimes depend on patron-economy business-cycle regimes.

[6] Data for the RC excludes the TRNC region, just as data for the TRNC excludes the RC region.

[7] The local-currency unit for the RC/Greece is the euro, and the Turkish lira for the TRNC/Turkey. We estimate models for the RC/Greece and TRNC/Turkey pairs, thus all model variables are in the same currency unit. We avoid using data in foreign exchange such as US dollars, since this could induce changes in the variables arising from exchange markets that may not relate to the real economy.

[8] FDI is measured as net inflows in current US dollars.

[9] We have a relatively small sample size and normality of the data implies that hypothesis tests based on the finite sample statistics are more reliable as all these tests assume normality.

Table 1
Descriptive statistics.

	Mean	Maximum	Minimum	Std. Dev.	JB	*p*-val. JB
RC						
Per capita GDP	15197.88	21216.24	7687.85	4158.46	2.62	0.27
GDP[a]	10381.15	16689.37	3841.23	4306.66	2.80	0.25
GDP growth	4.19%	9.91%	−5.36%	3.39%	3.04	0.22
FDI[b]	667.53	3765.40	46.32	863.57	31.40	0.00
Greece						
Per capita GDP	14415.94	19545.72	11794.82	2468.83	4.70	0.10
GDP[a]	152761.33	218189.00	116006.00	33535.17	3.75	0.15
GDP growth	1.17%	7.25%	−8.86%	3.72%	4.00	0.14
FDI[b]	1258.98	5733.41	53.06	1235.50	92.53	0.00
TRNC						
Per capita GDP	1145.60	1646.78	717.82	265.40	1.51	0.47
GDP[a]	0.008683	0.015349	0.003895	0.003891	3.57	0.17
GDP growth	4.08%	15.40%	−7.50%	5.60%	0.42	0.81
FDI[b]	15.01	49.50	2.21	14.36	5.61	0.06
Turkey						
Per capita GDP	1073.37	1635.56	693.45	280.71	2.43	0.30
GDP[a]	65764.53	122556.00	30446.36	27559.47	2.64	0.27
GDP growth	3.99%	9.49%	−5.70%	4.36%	3.42	0.18
FDI[b]	4197.92	22047.00	18.00	6620.84	16.55	0.00

Note: Table gives descriptive statistics of various time series for RC, Greece, TRNC, and Turkey. All data are in annual frequency and covers the period 1978–2013. Per capita GDP and GDP are in real local currency units (constant 2005 Euros for Cyprus and Greece and constant 1998 Turkish Liras for TRNC and Turkey). GDP is the real gross domestic product in million local currency unit. FDI is net inflows of foreign direct investment in current million US dollars. GDP growth is the growth rate of the real GDP in local currency unit. JB is the Jarque-Berra test for normal distribution and *p*-val. JB is its *p*-value from Chi-square distribution with 2 degrees of freedom. The data for RC, Greece, and Turkey are obtained from the World Development Indicators database of the World Bank and the TRNC data is obtained from State Planning Organization of the TRNC.

[a] In million local currency (Euros for Cyprus and Greece and Turkish Liras for Turkey and TRNC).

[b] In million US dollars.

4.1. Long-run implications and cointegration analysis

Dependency theory implies that (per capita) macroeconomic variables in the periphery economy are driven by and therefore cointegrated with those of the patron economy.[10] Within the framework of a neoclassical growth model, dependency theory implies that patron and periphery countries with the same rate of technological change should eventually converge at the same level of per capita income. By extension, therefore, a sustained difference in patron and periphery per capita incomes would contradict dependency theory.

One of the most convenient ways of testing the implications of dependency theory is to assume that the long-run level of a macroeconomic variable such as patron-economy per capita real GDP is governed by a random walk with drift, i.e.,

$$\mu_t = \alpha + \mu_{t-1} + \varepsilon_t \tag{1}$$

where α is the drift parameter, and the stochastic component ε_t is independent and identically distributed with 0 mean and constant variance σ^2, $\varepsilon_t \sim iid(0, \sigma^2)$. Any shock to μ_t will permanently change its level, meaning it is well-suited to modelling long-run growth. The RC/Greece and the TRNC/Turkey have historical intra-pair trade links,

[10] Unit root tests show that per capita real GDP series are nonstationary, therefore any long-run relationship between these series requires that they be cointegrated.

Table 2
Unit root test results for the per capita real GDP series.

Country	Level				First Differences			
	H_0: I(1)		H_0: I(0)		H_0: I(1)		H_0: I(0)	
	ADF_τ[a]	ADF_μ[b]	$KPSS_\tau$[c]	$KPSS_\mu$[d]	ADF_τ[a]	ADF_μ[b]	$KPSS_\tau$[c]	$KPSS_\mu$[d]
RC	−0.33	−2.78*	0.23***	0.73**	−5.33***	−3.76***	0.09	0.65**
Greece	−2.72	−0.87	0.16**	0.62**	−3.04	−3.09**	0.11	0.16
TRNC	−1.81	−1.55	0.15**	1.77***	−5.07***	−5.07***	0.05	0.12
Turkey	−2.76	0.55	0.15**	0.76***	−4.35***	−4.30***	0.05	0.09
	DF-GLS$_\tau$[e]	DF-GLS$_\mu$[f]			DF-GLS$_\tau$[e]	DF-GLS$_\mu$[f]		
RC	0.01	0.14			−3.62**	−2.55**		
Greece	−2.75	−1.02			−3.57**	−2.18**		
TRNC	−2.46	−0.30			−5.21***	−5.08***		
Turkey	−2.68	1.17			−6.00***	−5.27***		

* Indicate significance at the 10% levels, respectively. The lag order for the ADF test is selected by the Bayesian Information Criterion (BIC). Bartlett kernel with Newey-West bandwidth selection is used for the KPSS test.
** Indicate significance at the 5% levels, respectively. The lag order for the ADF test is selected by the Bayesian Information Criterion (BIC). Bartlett kernel with Newey-West bandwidth selection is used for the KPSS test.
*** Indicate significance at the 1% levels, respectively. The lag order for the ADF test is selected by the Bayesian Information Criterion (BIC). Bartlett kernel with Newey-West bandwidth selection is used for the KPSS test.
[a] Test allows for a constant and a linear trend; one-sided test of the null hypothesis that the variable has a unit root; 10, 5, 1% critical value equals −3.13, −3.41, −3.97, respectively.
[b] Test allows for a constant; one-sided test of the null hypothesis that the variable has a unit root; 10, 5, 1% significance critical value equals −2.59, −2.88, −3.45, respectively.
[c] Test allows for a constant and a linear trend; one-sided test of the null hypothesis that the variable is stationary; 10, 5, 1% critical values equals 0.11, 0.14, 0.21, respectively.
[d] Test allows for a constant; one-sided test of the null hypothesis that the variable is stationary; 10, 5, 1% critical values equals 0.34, 0.46, 0.73, respectively.
[e] Test allows for a constant and a linear trend; one-sided test of the null hypothesis that the variable has a unit root; 10, 5, 1% critical value equals −2.89, −3.19, −3.77, respectively.
[f] Test allows for a constant; one-sided test of the null hypothesis that the variable has a unit root; 10, 5, 1% significance critical value equals −1.62, −1.95, −2.63, respectively.

particularly since 1974. The periphery economies also each share strong cultural, religious, and political ties to their metropolitan patrons.

In addition both the RC and the TRNC exhibit basic production technology, concentrated in the tourism, trade, and banking sectors. It is reasonable to assume that technology available in their respective patron economies will also be available to periphery economies. Therefore, we can assume that the macroeconomic indicator is driven by the same process in patron and periphery economies. This means, for instance, that the per capita income series of patron and periphery economies would be both integrated of order one and cointegrated, because the process driving these series, μ_t, is itself integrated of order one and common to both economies. One would then expect to find one cointegrating vector and one common stochastic trend for a vector autoregressive (VAR) model of bivariate per capita real GDP series. Indeed, cointegration is a necessary condition for the patron/periphery relationship. The sufficient condition for Greece and Turkey to be patron economies requires that their per capita real GDP should be weakly exogenous and that of the RC and TRNC weakly endogenous.

Neusser (1991) tests for cointegration among income, consumption, investment, and real interest rates, using data for Austria, Canada, Germany, Japan, the UK, and the US. The results are favorable for the US but less favorable for Canada, Germany, and Japan, while the hypothesis of cointegration is rejected for Austria and the UK.

Consider a bivariate VAR model of order p, defined as

$$Z_t = A_0 + \sum_{i=1}^{p} A_i Z_{t-i} + u_t \tag{2}$$

where A_0 is a 2×1 vector of constant terms, A_i, i=1, 2,...,p, are 2×2 coefficient matrices, and u_t is a 2×1 vector of *iid* stochastic error terms with zero mean and covariance matrix Σ, $u_t \sim iid(0, \sum)$.

Let the per capita income levels of patron and periphery economies be denoted by $Y_{M,t}$ and $Y_{P,t}$, respectively, and define Z as $Z=(Y_M, Y_P)'$. If the patron economy is the leading economy, the long-run trend growth in both the patron and periphery economies will be generated by Eq. (1), which is driven by the patron economy. Therefore, we would have nonstationary per capita income series $Y_{M,t}$ and $Y_{P,t}$ in both economies, which are cointegrated and share the same stochastic trend in Eq. (1). Of course, nonstationary $Y_{M,t}$ and $Y_{P,t}$ series would not be expected to converge unless they are cointegrated. Hence, we should be able to find cointegration for $Y_{M,t}$ and $Y_{P,t}$ series, if Greece and Turkey are the respective patron economies of the RC and the TRNC.

Table 1 shows that the average per capita income series of Greece and the RC cluster around €14,000–15,000 (measured in constant 2005 euros), while that of Turkey and the TRNC cluster around TRY1,000–1,100 (measured in constant 1998 Turkish lira). Thus patron/periphery pairs share markedly similar levels of per capita income, a relationship still more clearly observed in Figs. 2 and 3.

Fig. 2 plots per capita real GDP of Greece and the RC. Although RC per capita real GDP has exceeded that of Greece since 1988, the difference between the two has remained under €1,000 in real terms throughout, while rates of growth have followed the same trend. Fig. 3 presents a similar pattern for the per capita income series of the TRNC and Turkey. TRNC per capita income exceeds that of its patron from 1978 to 2010 and is slightly below it between 2010 and 2013. However, the difference never exceeded TRY200 in real terms. Similarly, while the TRNC growth rate has been slightly above that of Turkey, the per capita income difference has only been greater in the last two decades—partly as a result of an increase in net transfers from Turkey to the TRNC, in order to maintain living standards broadly in line with those in the RC.

Before cointegration analysis, we establish the order of integration of the time series. Using the augmented Dickey-Fuller (ADF—Dickey and Fuller, 1979), KPSS (Kwiatkowski et al., 1992), and Dickey-Fuller generalized least squares (DF-GLS) (Elliott et al., 1996) unit root tests, we determine the integration properties of per capita real GDP series of the four economies. Results of the unit root tests are presented in Table 2, for both the levels and first differences of the series. Both the ADF and KPSS tests do not reject the existence of a unit root in the levels, and reject it in the first differences for the per capita real GDP series of all four countries at the 5% significance level. Therefore, we find evidence that the per capita real GDP series are all integrated of order 1, denoted I(1).

Second, we fit the bivariate VAR model given in Eq. (2) to per capita income series of the patron/periphery economy pairs. The order of the VAR model is determined by Bayesian information criterion (BIC). We

Table 3
Cointegration and weak exogeneity tests for per capita real GDP.

Statistic/ Series	H_O	H_1	$[Y_M, Y_P]$: Greece and RC	$[Y_M, Y_P]$: Turkey and TRNC
Eigenvalues (λ)				
$\hat{\lambda}_1$			0.423	0.435
$\hat{\lambda}_2$			0.164	0.133
Trace statistics (λ_{trace})				
	$r = 0$	$r \leq 1$	27.692**	25.701**
	$r = 1$	$r \leq 2$	6.822	5.148
Maximal eigenvalue statistics ($\lambda_{\max}$)				
	$r = 0$	$r = 1$	20.870**	20.553**
	$r = 1$	$r = 2$	6.822	5.148
5% critical values for λ_{trace}				
	$r = 0$	$r \leq 1$	20.262	20.262
	$r = 1$	$r \leq 2$	9.165	9.165
5% critical values for $\lambda_{\max}$				
	$r = 0$	$r = 1$	15.892	15.892
	$r = 1$	$r = 2$	9.165	9.165
H_0:Y_M is weakly exogenous			0.111	1.671
H_0:Y_P is weakly exogenous			22.753***	7.635***
Normalized cointegration vectors				
		Variable		
		Y_P	1.000	1.00
		Y_M	−0.284 (0.330)	−0.732*** (0.119)
p			2	1

Note: Table reports the Johansen trace and maximal eigenvalue tests of cointegration and weak exogeneity tests. Y_M is the logarithm of the per capita real GDP of the motherland economy and Y_P is the per capita real GDP of the periphery economy. p is the order of the VAR model, which is determined by the Bayesian Information Criterion (BIC). Weak exogeneity tests are Wald tests and distributed as Chi-square distribution with 1 degree of freedom. Standard errors of the estimate are given in parentheses. * Denote 10% levels of significance respectively.
** Denote 5% levels of significance respectively.
*** Denote 1% levels of significance respectively.

test for the cointegration of $Y_{M,t}$ and $Y_{P,t}$ using the trace and maximum eigenvalue tests of Johansen (1988) and Johansen and Juseluis (1990). Cointegration test results are presented in Table 3.[11] For the Greek and RC economies, the null hypothesis of no cointegration is rejected at the 5% significance level by both the trace and maximal eigenvalue tests. Similarly, both tests reject the null hypothesis of no cointegration for the per capita GDP series of the Turkish and TRNC economies at the 5% level. In summary, we find evidence that the per capita real GDP series of Greece and the RC are cointegrated, as are those of Turkey and the TRNC. Hence, we obtain evidence in favor of the necessary condition for the existence of a patron/periphery relationship between Greece/the RC and Turkey/the TRNC, supporting dependency theory.[12][13]

The sufficient condition for dependency theory in terms of the patron/periphery relationship can be tested using the weak exogeneity test, performed on the estimated vector error correction model (VECM). The results of weak-exogeneity tests are reported in Table 3. The test results show that the weak exogeneity of Greek per capita real GDP for that of the RC and of Turkey's for the TRNC are not rejected, even at the 10% level. On the other hand, weak exogeneity of the per capita income series of the RC and the TRNC are both rejected at the 1% level. Therefore, we also obtain evidence in favor of the sufficient condition for a patron/periphery relationship between Greece and the RC, and between Turkey and the TRNC. Hence, we have strong support for dependency theory, implying that patron economies determine the per capita GDP of periphery economies.

Table 3 reports long-run normalized cointegration parameter estimates. The data show that a 1% increase in the per capita real GDP of Greece leads to a 0.294% increase in the per capita real GDP of the RC in the long run, while a 1% increase in the per capita real GDP of Turkey leads to a greater (0.782%) increase in that of the TRNC. Thus the estimates further confirm the stronger dependency links between Turkey and the TRNC.

4.2. Short-run implications and regime-switching analysis

Strong ties and a dependency relationship between the RC/Greece and between the TRNC/Turkey also result in periphery-economy business cycles closely following those of patron economies. In order to test this short-run implication, we use two-regime MS-VAR[14] models for the pairs of real GDP growth rates. Let the vector ΔZ denote the real GDP growth rates $(\Delta Y_M, \Delta Y_P)'$, where Y_M and Y_P denote the logarithm of real GDP for the patron and periphery economies, respectively. In the MS-VAR specification, we assume that the regime of the patron economy is denoted by a latent state variable $S_{1,t}$ and that the regime of the periphery economy is denoted by a state variable $S_{2,t}$. The MS-VAR model can then be written as:

$$\Delta Z_t = A_{0,S_t} + \sum_{i=1}^{p} A_{i,S_t} \Delta Z_{t-i} + u_t \tag{3}$$

where A_{0,S_t} is a 2×1 vector of regime dependent constant terms, A_{i,S_t}, i=1,2,...,p, are 2 × 2 regime dependent coefficient matrices, and u_t is a 2×1 vector of *iid* stochastic error terms with zero mean and state dependent covariance matrix Σ_{S_t}, $u_t \sim iid(0, \sum)$. Here, $S_t = (S_{1,t}, S_{2,t})'$ is the state vector taking values in {0,1}. The random state or regime variable S_t, conditional on S_{t-1}, is unobserved, independent of past Z, and assumed to follow a 2-state first order Markov process. In other words, $Pr[S_{k,t} = j | S_{k,t-1} = i] = p_{k,ij}$, k=1,2, i,j=0,1, for all t. For each state variable the transition probabilities $p_{k,ij}$ form a 2×2 transition matrix, $P = [p_{k,ij}]$, i,j=0,1, k=1,2. In this specification, each of the patron and periphery economies follows separate but potentially related regimes. Hence, we assume that

$$\sum_{S_t} = \begin{bmatrix} \sigma_1^2(S_{1,t}) & \rho(S_{1,t}, S_{2,t})\sigma_1(S_{1,t})\sigma_2(S_{2,t}) \\ \rho(S_{1,t}, S_{2,t})\sigma_1(S_{1,t})\sigma_2(S_{2,t}) & \sigma_2^2(S_{2,t}) \end{bmatrix} \tag{4}$$

The specification in Eq. (4) assumes that the variance of the state variable for patron or periphery economy (σ_k^2) depends only on the economies' own state. The parameter $\rho(S_{1,t}, S_{2,t})$ measures the correlation between the patron and periphery economies. The specification

[11] We perform two types of parameter constancy tests: (1) constancy of the VECM parameters and (2) constancy of the transformed eigenvalues. Both tests show that all VECM models we estimate do display parameter constancy. Parameter constancy tests are not reported here to conserve space, but are available from the authors upon request.

[12] Based on the findings of Akkoyun et al. (2014), an anonymous referee has suggested that properties of the TRNC business cycle would be highly correlated with the US and the Eurozone, since the Turkish economy has co-moved with the US and the Eurozone in the post-1987 period. We were not able test cointegration of the TRNC economy with the Eurozone due to insufficient availability of annual data. Cointegration test results for the 1978–2013 period show that the US and TRNC per capita real GDP series are not cointegrated. (These cointegration test are not reported here, given space limitations, but are available from the authors upon request.) The necessary condition for the co-movement of these economies therefore does not hold, most likely due to the isolation of the TRNC economy as a result of sanctions and the weak transmission of global shocks, coming only through the Turkish economy.

[13] An anonymous referee suggested that the RC and TRNC economies can also be considered for the co-movement analysis. Cointegration test results for the 1978–2013 period shows that the RC and TRNC per capita real GDP series are not cointegrated. This result is most likely due to (1) de-facto division of Cyprus in 1974 and almost non-existent economic relationship between the RC and TRNC and (2) the isolation of the TRNC economy from the world since 1974 and only weak transmission of the global macroeconomic shock to the TRNC economy only through its relationship with the Turkish economy. These cointegration test are not reported to save space, but are available from the authors upon request.

[14] The MS-VAR model is intended for short-run business-cycle analysis and specified directly in terms of the growth rates of the real GDP series. The long-run analysis in Section III.A is based on the real per capita GDP series. Clements and Krolzig (2004) show that the VECMs that incorporate long-run impacts are far worse at characterizing the business-cycle characteristics than the short-run VAR models in first differences. Therefore, we estimate an MS-VAR model rather than an MS-VECM.

therefore allows regimes of the patron and periphery economies to be correlated. Following Otranto (2005), the transition probabilities are specified as follows:

$$P(S_{1,t} = i|S_{1,t-1} = i,\ S_{2,t-1}) = \frac{exp(\alpha_{1,i} + \beta_{1,i}S_{2,t-1})}{1 + exp(\alpha_{1,i} + \beta_{1,i}S_{2,t-1})}$$
$$P(S_{2,t} = i|S_{2,t-1} = i,\ S_{1,t-1}) = \frac{exp(\alpha_{2,i} + \beta_{2,i}S_{1,t-1})}{1 + exp(\alpha_{2,i} + \beta_{2,i}S_{1,t-1})} \quad (5)$$

for i=0,2. This specification for the transition probabilities allows the regime of the periphery economy to depend on the regime of the patron economy through parameters$\beta_{2,i}$. For completeness and formal testing, we also allow the regime of the patron economy to potentially depend on the regime of the periphery economy, through parameters$\beta_{1,i}$.

There are four interesting cases that can be statistically tested:

Case 1. H_0:$\beta_{2,0} = \beta_{2,1} = 0$. Under this case, the regime of the patron economy has no influence on the regime of the periphery economy.

Case 2. H_0:$\beta_{1,0} = \beta_{1,1} = 0$. Under this case, the regime of the periphery economy has no influence on the regime of the patron economy.

Case 3. H_0:$\beta_{1,0} = \beta_{1,1} = \beta_{2,0} = \beta_{2,1} = 0$. Under this case, the regimes of the patron and the periphery economies are not interrelated.

Case 4. H_0: $\alpha_{1,0} = \alpha_{2,0}$, $\alpha_{1,0} + \beta_{1,0} + \alpha_{2,1} = 0$, $\alpha_{1,1} + \beta_{2,1} + \alpha_{2,0} = 0$, and $\alpha_{1,1} + \beta_{1,1} = \alpha_{2,1} + \beta_{2,1}$. Under this case, the patron and the periphery economies co-move (see Gallo and Otranto (2008)).

In order to estimate the parameters of the MS model in Eqs. (3)–(5), given that the number of regimes is known, the likelihood is evaluated using the filtering procedure of Hamilton (1990), followed by the smoothing algorithm of Kim (1994). The log-likelihood of the MS model is a function of the parameters in Eqs. (3)–(5) and the transition probabilities $p_{k,ij}$. The estimates are obtained by maximizing the log-likelihood subject to the constraint that the probabilities should be between 0 and 1 and sum to unity.

In order to estimate an MS-VAR model, we first need to establish that the real GDP growth rates of patron and periphery economies do not follow a linear VAR process, but are better characterized by an MS-VAR model. For this purpose, we use likelihood ratio (LR) tests. We report p-values based on both the conventional χ^2 distribution and the approximate upper bound for the significance level of the LR statistic, as derived by Davies (1987). We further supplement the LR test with Akaike information criterion (AIC).[15]

Table 4 shows LR tests of linearity and AIC criteria for linear and two-regime MS-VAR models. LR tests strongly reject the linear VAR model in favor of a two regime MS-VAR model for systems formed by the real GDP growth rates. The linearity is rejected at the 5% significance level, using both the χ^2 distribution and Davies (1987) upper bound p-values. The AIC criteria also select the MS-VAR model over the linear VAR model for each of the two models we consider.

Table 4 also reports the LR tests for the four cases explained above. LR tests reject the null hypotheses given under Cases 1 and 3 at the 1% significance level. Therefore, the null hypotheses that regimes of patron and periphery economies are not interrelated are rejected for both Greece/the RC and Turkey/the TRNC. We also reject the null hypothesis that the regime of the Turkish economy is influenced by the regime of the TRNC economy for the MS-VAR model of real GDP. The same result also holds for the Greek and RC economies.

Finally, Table 4 presents regime inference statistics, which include the ergodic (or average) probability and average duration of a regime. Average probability measures the percentage of observations falling into a certain regime, while duration measures the average length of a certain regime. Both the duration and probability estimates across the Greece/RC and Turkey/TRNC pairs are analogues. This is further evidence that the business-cycle regimes across the periphery and patron economies are analogues. For instance, average probability of the recession regime for Turkey and the TRNC are 0.28 and 0.27, respectively, while the duration of the recession regime is 1.30 and 1.53 years, respectively. Analogue features also exist for the Greek and RC economies.

According to the results presented in Table 4, we fail to reject the null hypothesis that the regime of real GDP growth rate of the periphery economy depends on the regime of the patron economy, for both patron/periphery economy pairs. Moreover, the co-movement of real GDP growth rates in the patron and periphery economies is not

Table 4
Linearity and regime dependence tests.

	$[\Delta Y_M, \Delta Y_P]$: Greece and RC	$[\Delta Y_M, \Delta Y_P]$: Turkey and TRNC
Transition probability matrix for metropolitan economy	$P = \begin{bmatrix} 0.69 & 0.31 \\ 0.39 & 0.61 \end{bmatrix}$	$P = \begin{bmatrix} 0.77 & 0.23 \\ 0.30 & 0.70 \end{bmatrix}$
Transition probability matrix for periphery economy	$P = \begin{bmatrix} 0.76 & 0.24 \\ 0.42 & 0.58 \end{bmatrix}$	$P = \begin{bmatrix} 0.75 & 0.25 \\ 0.34 & 0.66 \end{bmatrix}$
Log L of MS-VAR system	−142.016	−184.240
	−32.466	−34.591
Log L of linear system	−159.202	−197.656
	−44.604	−44.807
AIC of MS-VAR system	10.001	12.014
	2.616	2.741
AIC of linear system	10.130	12.156
	2.918	3.035
LR test of linearity[a]	34.372** (0.001)	26.833** (0.002)
	[0.026]	[0.032]

Regime Statistics				
	Probability			
	Greece	RC	Turkey	TRNC
Expansion regime	0.64	0.69	0.72	0.73
Recession regime	0.36	0.31	0.28	0.27
	Duration			
	Greece	RC	Turkey	TRNC
Expansion regime	4.17	5.28	3.38	4.06
Recession regime	2.59	2.38	1.30	1.52
H_0: Regime of metropolitan economy does not depend on the regime of periphery economy (Case 2)[b]	3.611		3.786	
H_0: Regime of periphery economy does not depend on the regime of metropolitan economy (Case 1)[b]	10.173***		21.905***	
H_0: Regime of the metropolitan and the periphery economies are not interrelated (Case 3)[c]	18.068***		32.708***	
H_0: Time series of metropolitan and periphery economies co-move (Case 4)[c]	6.334		7.003	

Note: Statistics are computed as likelihood ratio tests from the estimates of the MS-VAR model given in Eq. (3). Y_M and Y_P denote the logarithm of real GDP in local currency units (Euro for RC and Greece and Turkish Lira for TRNC and Turkey) respectively. Order of the MS-VAR models, p, is determined using the BIC and 2 for Greece-Cyprus model and 1 for Turkey-TRNC model. * Denote 10% levels of significance respectively.

[a] Test is statistics is computed as a likelihood ratio statistics. Davies (1987) upper bound for p-value is given in square brackets and Chi-square p-value with 10 degrees of freedom is given parentheses.

[b] Test is statistics is a likelihood ratio statistics and distributes as Chi-square with 2 degrees of freedom.

[c] Test is statistics is a likelihood ratio statistics and distributes as Chi-square with 4 degrees of freedom.

** Denote 5% levels of significance respectively.

*** Denote 1% levels of significance respectively.

[15] Psaradakis and Spagnolo (2003) and Krolzig (1997) suggest selecting the number of regimes and type of MS-VAR model using AIC and the Monte Carlo study of Psaradakis and Spagnolo (2003) show that AIC is generally successful in selecting the correct model.

rejected. In summary, the MS-VAR models reveal that regimes of real GDP growth rates in the RC and TRNC economies do depend on the corresponding real GDP growth-rate regimes in Greece and Turkey, respectively.

4.3. Regime synchronization tests

The dependency of regimes across patron and periphery economies for real GDP growth rates raises the issue of potential synchronization of regime-switching behavior across patron and periphery economies. Examining the synchronization of regimes across patron and periphery economies is important because the existence of non-synchronization implies that short-run implications of the patron/periphery relationship are weak. If a particular regime is perfectly synchronized across patron and periphery, then it is also possible to predict the regime of the periphery economy from the regime of the patron economy. Synchronization tests developed by Harding and Pagan (2006) could not reject the perfect synchronization hypothesis for both the Greece/RC and the Turkey/TRNC economy pairs.

In order to apply the multivariate synchronization tests of Harding and Pagan (2006), one should date (classify) the regime of each economy for each period. Our regime classification or dating is based on smoothed probability estimates, which is 1 for regime i if its probability is the maximum.[16] Focusing on the first panel of Table 5, the concordance indices (upper diagonal) are reported to capture the degree of synchronization of the regimes, that is, the fraction of time the economies in the model are in the same regime. Reported values are large for both pairs of series and economies, suggesting both patron/periphery economy pairs spend much of the time in the same regime (recession or recovery). Interestingly, the highest index value (0.92) is observed for the real GDP growth series of Greece and the RC economies. This might be due to both economies being part of the Eurozone. On the other hand, the concordance index value for real GDP growth rate series of Turkey and the TRNC economies is 0.83. All correlation coefficient estimates are statistically significantly and different from zero at the 1% level, according to robust t-statistic. The concordance index and correlation coefficient estimates point to significant synchronization across the Greece/RC and Turkey/TRNC pairs, in terms of real GDP growth rates.

Although a univariate synchronization test provides significant information on how economies move together in various regimes, a multivariate test would be more appropriate (Balcilar and Demirer, 2015). Harding and Pagan (2006) proposed three statistics that are appropriate in our case. The first statistic tests for the necessary condition—that is, the means of the random variables are equal for multivariate synchronization. The second statistic tests for perfect multivariate synchronization—that is, all pairwise correlations are jointly equal to one. The third statistic tests for strong multivariate non-synchronization—that is, all pairwise correlations are jointly equal to zero.

In our case, there is also evidence of serial correlation in the states across economies.[17] For instance, the first order serial correlation coefficients for the regime dummy variables are around at least 0.25–0.53 with cross-autocorrelations reaching 0.83, highlighting the need to use robust variance matrix estimates. We therefore use Newey and West (1987) heteroskedasticity and autocorrelation consistent standard errors with Bartlett weights, to perform the tests reported in Panels C–E of Table 5. Robust t-statistics in Panel B of Table 5 show that the null hypothesis of no synchronization across economies is strongly rejected for the real GDP growth rate series. Given this, we first test for the necessary condition for perfect multivariate synchronization. Results presented in Panel C of Table 5 show a p-value that is equal to or greater than 0.880 for all series and patron/periphery economy pairs, suggesting that the necessary condition for perfect synchronization holds (that is, means of regime dummy variables are equal across patron and periphery economies). Second, we perform the test for strong multivariate non-synchronization based on the null of no synchronization. Again, results are favorable to strong multivariate synchronization, as p-values reported in Panel E of Table 5 are very small (less than 1% level) for all GDP growth rate pairs. Third, the tests do not reject perfect positive multivariate synchronization across both the Greece/RC and Turkey/TRNC economy pairs.

Consequently, there is strong evidence in favor of perfect positive multivariate synchronization across both the Greece/RC and Turkey/TRNC pairs. The patron and periphery economies move in and out of regimes simultaneously. Given the dependency test results presented in Table 4, this result indicates that periphery-economy regimes follow those of their patron economies.

Table 5
Tests for the multivariate synchronization of the regimes across metropolitan and periphery economies.

Panel A: Concordance indices and correlations of regimes across metropolitan and periphery economies

	Greece and RC		Turkey and TRNC	
	Concordance Index	Correlation	Concordance Index	Correlation
Growth rates	0.92	0.83	0.83	0.66

Panel B: Standard and robust t-statistics for the null hypothesis of no correlation of regimes across metropolitan and periphery economies

	Greece and RC		Turkey and TRNC	
	Standard t-statistics	Robust t-statistics	Standard t-statistics	Robust t-statistics
Growth rates	8.93***	9.07***	5.23***	4.66***

Panel C: Tests for the necessary conditions for perfect multivariate synchronization

	Greece and RC		Turkey and TRNC	
	χ^2 statistic	p-value	χ^2 statistic	p-value
Growth rates	0.009	0.924	0.023	0.880

Panel D: Tests for the perfect multivariate synchronization

	Greece and RC		Turkey and TRNC	
	χ^2 statistic	p-value	χ^2 statistic	p-value
Growth rates	0.087	0.768	0.147	0.701

Panel E: Tests for strong multivariate non-synchronization[b]

	Greece and RC		Turkey and TRNC	
	χ^2 statistic	p-value	χ^2 statistic	p-value
Growth rates	6.952***	< 0.01	7.849***	< 0.01

Note: Panel A displays the concordance indices constructed upon phase states for binary regime indicators and analogue of $\Pr(S_{1,t}=S_{2,t})$ advocated in Harding and Pagan (2006), where S_{it} is the regime indicator for country i in period t. These indices have a maximum value of unity when $S_{1,t}=S_{2,t}$ and zero when $S_{1,t}=(1-S_{2,t})$. Panel B shows standard and robust t-statistics, which account for both heteroskedasticity and autocorrelation. Panel C to E reports three synchronization tests computed based on regime indicator dummy variable using smoothed probability estimates. The regime indicator dummy takes a value of 1 for the regime with maximum soothed probability and 0 otherwise. Table reports only tests for regime 0, since the indicator variable for regime 1 is equal to 1 minus the indicator variable for regime 0 and, thus, it has the same test value. *, ** Denote 10 and 5% levels of significance respectively.

*** Denote 1% levels of significance respectively.

[b] p-values are obtained with 2000 Monte Carlo simulations as described in Harding and Pagan (2006).

5. Conclusions and policy implications

The third-largest island in the Mediterranean, Cyprus has been

[16] See Harding and Pagan (2006) for further details.

[17] We did not report the multivariate ACF estimates, but results are available from the authors upon request.

divided in two since 1974, with Greek-Cypriots in the south closely linked to Greece and Turkish-Cypriots in the north similarly close to Turkey. Over the past decades these strong ties have developed into relationships of dependency, such that Greece and Turkey have become the respective metropolitan patrons of the Republic of Cyprus (RC) in the south and of the Turkish Republic of Northern Cyprus (TRNC) in the north. In this study, we have tested the relationship between the economies of Greece and the RC, and between Turkey and the TRNC, within the framework of dependency theory.

Our study presents testable, long-run implications of dependency theory in island economies, using aggregate macroeconomic time series. The existence of strong trade links, as well as an effective monetary union within the economy pairs (since 1974 between Turkey and the TRNC, and since 2008 between Greece and the RC), there are also testable implications in the short-run. In the long run, the necessary condition for a patron/periphery relationship is the cointegration of per capita income levels. The sufficient condition requires that the periphery economies should be weakly endogenous and the patron economies weakly exogenous. We test these implications and find that the data strongly support both for the per capita GDP series, with uniformly strong evidence for the Greece/RC and Turkey/TRNC economy pairs.

The strong dependency of the Greece/RC and Turkey/TRNC economy pairs implies that RC and TRNC business cycles would follow the business-cycle regimes of their respective patron economies, Greece and Turkey. We use MS-VAR models to test these implications. The evidence indicates that the regimes of real GDP growth rates in the periphery economies depend on the regimes of the patron economies. Moreover, the multivariate synchronizations tests indicate strong positive multivariate synchronization between periphery and patron economies. We find strong evidence that long- and short-run economic dynamics in the RC and TRNC are driven by their patrons, supporting dependency theory.

These results supporting dependency theory in a small-island setting have important policy implications. First, the findings imply that the economic development of the island periphery is mainly driven by the level of economic growth in the respective patron economy. Second, the results suggest that besides economic development, small island states also have limited control over their business cycles, which follow those of patron economies. Overall, these results suggest that the island economies' growth rates and economic fluctuations are in the hands of their patron economies. Hence, small-island economies in highly dependent relationships need to design policies to significantly diversify their economies from those of their patron economies. Given the limited resources available to the periphery, however, patron states have to be willing to provide periphery economies with the financial and technical support required to accomplish this. For example, foreign aid to the periphery economies could establish new sectors that are independent of the patron economies. In addition, periphery island economies could develop policies to attract FDI inflows quite different to that going to patron economies.

In terms of regional policy, the EU could design aid and development packages to help the two island economies of Cyprus. In addition, bilateral cooperation between the two sides should focus on developing economic policies aimed at reducing dependency on respective patrons. Such cooperation between the RC and the TRNC would not only result in economies of scale but could also help bring the people of the island closer together, further contributing to the peace and long-run prosperity of the region.

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