

How Strong is the Case for Dollarization in Costa Rica?

A Note on the Business Cycle Comovements with the United States

Nannette Lindenberg
Frank Westermann

CESIFO WORKING PAPER NO. 2785

CATEGORY 7: MONETARY POLICY AND INTERNATIONAL FINANCE

SEPTEMBER 2009

An electronic version of the paper may be downloaded

- *from the SSRN website:* www.SSRN.com
- *from the RePEc website:* www.RePEc.org
- *from the CESifo website:* www.CESifo-group.org/wp

How Strong is the Case for Dollarization in Costa Rica?

A Note on the Business Cycle Comovements with the United States

Abstract

We evaluate the proposal for official dollarization in Costa Rica by applying a new approach to measure the business cycle comovements with the United States. While the literature often focuses on the correlation of shocks, we point out that the response of each country to the shocks is also an important aspect of stabilization policy. We analyze whether Costa Rica and the United States share a common synchronized response to shocks, i.e. a common business cycle, using the Engle and Kozicki (1993) and Cubadda (1999, 2007) serial correlation common features tests, in a quarterly GDP data set from 1991 to 2008. Although we find some tendency towards common AR(p) structures and common long run trends, we reject the hypothesis that the two countries share a common business cycle. Based on this evidence, we conclude that official dollarization in Costa Rica would impede the efforts of its stabilization policy, despite the relatively high contemporaneous correlation of shocks.

JEL Code: E32, F36, O54.

Keywords: dollarization, business cycle comovement, serial correlation common feature, Central America, Costa Rica.

Nannette Lindenberg
Institute for Empirical Economic Research
University of Osnabrück
Rolandstrasse 8
49069 Osnabrück
Germany
nannette.lindenberg@uos.de

Frank Westermann
Institute for Empirical Economic Research
University of Osnabrück
Rolandstrasse 8
49069 Osnabrück
Germany
frank.westermann@uos.de

1 Introduction

In Costa Rica both, deposit and credit dollarization, have increased to shares of about 50% over the past decade.¹ The topic of official dollarization has therefore become an important part of the discussion on stabilization policy. Recently, in October 2008, the participant experts of an international seminar², among others several ex presidents of Latin American central banks, agreed on the recommendation that Costa Rica should officially introduce the dollar as *valuta*. Also, ex president of the Costa Rican Central Bank, Eduardo Lizano, argued that only a bill was needed for official dollarization. Furthermore, the issue is discussed regularly by academics in Costa Rica, e.g. in March 2009 during a forum that was organized by the Costa Rican University (UCR)³.

Despite the intense political discussion, there is so far only little empirical evidence on the economic cost (and benefit) of a dollarization policy in Costa Rica and other Latin American countries.⁴ Partly, this may be due to the lack of an easy to use comprehensive empirical framework to address the issue of dollarization and its implications for stabilization policy. Although it is clear that one of the main costs - giving up an individual monetary policy to smooth the business cycle - is reduced substantially when business cycles are synchronized and the correlation of shocks is high, the empirical literature so far has mostly focused on the latter of the two.

In a seminal paper Bayoumi and Eichengreen (1993) have proposed a method to empirically address the issue of optimum currency areas that can also be used for fixed exchange rate regimes or full dollarization. Applying the Blanchard and Quah (1989) procedure to decompose temporary and permanent shocks in a time series, the authors identify demand shocks as the transitory component of GDP. They find that the correlation among the demand shocks is not very high in the European Union and conclude that Europe might not be an optimum currency area (OCA), according to the OCA model of Mundell (1961).⁵ Related trend/cycle decompositions have been used for Costa Rica by Fiess (2007), who focuses on the contemporaneous correlation of shocks in a study on regional business cycle integration.

In our view, this approach provides only incomplete information to policy makers for the following two reasons. On the one hand, it is well known that there may also be permanent demand shocks or temporary supply shocks. It is therefore helpful to also investigate the full time series in growth rates. More importantly, on the other hand, the contemporaneous correlation of the transitory component (or the full time series) may not be sufficient, as a basis for a common monetary policy. Even when the correlation of shocks between

¹See figure A.1 in the appendix.

²The seminar was titled "Reforma monetaria urgente, con o sin el Banco Central" and organized by the Instituto Libertad.

³The topic of the forum, where one of the principal speakers, Dr. Luis Loría Rojas, recommended official dollarization, was "Causas, dimensiones y consecuencias previsibles de la crisis financiera global y su impacto para Costa Rica".

⁴For a theoretical model of a small open economy and the costs of dollarization see Schmitt-Grohe and Uribe (2001); Levy Yeyati and Sturzenegger (2002) give a review of the issue of dollarization; and Mishkin and Savastano (2001) give an overview of monetary policy options for Latin America, including currency boards and dollarization.

⁵An analysis of exchange rate regime choice, based on the correlation of shocks, is also given in Berger, Jensen, and Schjelderup (2001).

two countries is high, the response of each country to a shock - often interpreted as a business cycle - can be very different. When one country reacts to and absorbs the shock more quickly than the other, it is still difficult to implement a common monetary policy.

In order to address this issue, we investigate whether there exist common reactions to a standard shock in Costa Rica and the USA, using the test for common serial correlation that was first developed by Engle and Kozicki (1993) and Vahid and Engle (1993) and later extended by Cubadda (1999, 2007).⁶ The authors show that it is possible to test for common serial correlation (i.e. a common business cycle) by constructing a linear combination of the two time series (that each follow an AR(p)-process) that is free of autocorrelation. If it is feasible to construct such a linear combination, it implies that there exists a common AR(p)-structure, as well as a perfectly collinear response of two time series to a standard shock.

The existence of such a common reaction to shocks would be an ideal precondition for official dollarization. For Costa Rica, however, we will show that this precondition is not met. We find that although in recent years there is some tendency towards common AR(p) structures and towards common long run trends, we reject the hypothesis that Costa Rica and the USA share a common business cycle. Thus, from a perspective of macroeconomic stabilization, Costa Rica appears to be better off not abandoning its - only recently gained⁷- scope of independent monetary policy by officially dollarizing the economy.⁸

The next section contains the data description. In section three, we start by estimating the AR(p)-process of each time series, that best fits the data. We then, after testing for unit roots and cointegration, conduct the test for common feature using both the Engle and Kozicki (1993) two stage least squares procedure and the Cubadda (1999, 2007) GMM approach. Section 4 gives a review of the related literature and the last section concludes.

2 Data

The time series for Costa Rica, quarterly GDP from 1991:1 to 2008:1 in constant prices, seasonally adjusted and in millions of domestic currency, was obtained from the *Latin American and Caribbean Macro Watch* of the *Inter-American Development Bank*. Equivalent data for the USA were retrieved from the *International Financial Statistics* Database of the *International Monetary Fund*. The growth rates of GDP are displayed in figure 1.

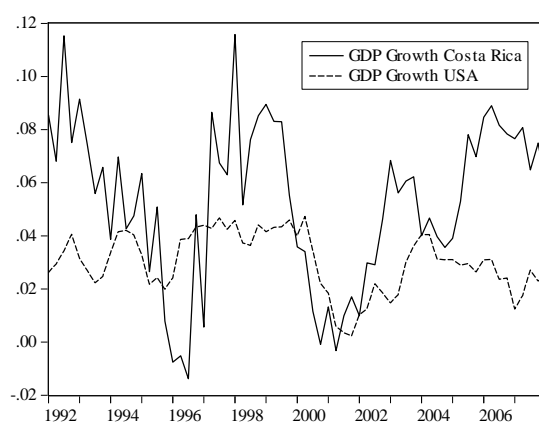
In Costa Rica two stagnation periods stand out: the first in the mid- to late 1990s, a period in which many countries in Latin America experienced financial crisis⁹, and the second the world wide slowdown in

⁶See Urga (2007) for an overview of recent developments in the literature of common features in time series.

⁷In 1984 Costa Rica had implemented a crawling peg system ("minidevaluaciones") that was transformed into a crawling band on October 17, 2006. The exchange rate anchor has been the US\$ (see IMF - Staff Report (2009)).

⁸An optimal monetary and fiscal policy for a small open economy with a flexible exchange rate has recently been proposed by Ball (2009).

⁹Laeven and Valencia (2008) date a systemic banking crisis to 1994 in Costa Rica.

Figure 1: GDP growth rates of Costa Rica and the USA

Note: GDP growth rates of Costa Rica and the USA are displayed.

Source: IADB and IMF (see table A.1 in the appendix).

the beginning of the 21st century. The latter period has also been a time of slow growth in the United States. Over the sample period, it appears that the volatility of output has declined in Costa Rica. The relatively high volatility at the beginning of the sample, however, is not due to remaining seasonal components of the data as the peaks occur very irregularly. Possibly the decline in volatility in the mid-90s can be ascribed to the change in the Central Bank's policy: Until the end of 1995 inflation was only a secondary objective, though from 1996 onwards the main objectives for monetary policy have been price and exchange rate stability.

Table 1: Contemporaneous correlations between the GDP cycles of Central American countries and the USA

Contemporaneous Correlations between the Growth Rates of GDP							
	Belize	Costa Rica	Dominican Republic	El Salvador	Nicaragua	Panama	USA
Belize	1						
Costa Rica	0.050	1					
Dominican Republic	-0.375	0.273	1				
El Salvador	-0.353	0.502	0.245	1			
Nicaragua	-0.067	0.153	-0.032	0.236	1		
Panama	-0.304	0.606	0.415	0.688	0.143	1	
USA	-0.142	0.299	0.052	0.108	0.301	0.218	1

Note: Contemporaneous correlations (in pairwise samples) are displayed for the Central American countries and the USA.

The contemporaneous correlations of the GDP growth rates of Central American countries and the USA

are displayed in table 1. The GDP growth rate of Costa Rica is positively correlated with the GDP growth rates of all other Central American countries and also with the one of the USA. However, the contemporaneous correlation with the latter is with 0.299 relatively small.¹⁰ Still, among Central American countries, only Nicaragua and Panama have likewise high correlations: Nicaragua's contemporaneous correlation with the USA is slightly higher (0.301) and Panama has even a somewhat smaller correlation (0.218). Though, in Nicaragua the issue of dollarization is not relevant due to the political situation in the country, and Panama has already adopted full dollarization in 1904.¹¹

3 Business Cycle Synchronization

3.1 AR(p)-Process

In this section, we conduct our analysis of common business cycles. Although the contemporaneous correlation is not very high, it may still be the case that the two countries respond similarly to shocks. We start by identifying the AR(p)-processes of our GDP data. We estimate AR representations for each variable with the following equation:

$$y_t = \mu + \sum_{i=1}^p \beta_i y_{t-i} + \epsilon_t,$$

with $y_t = \text{GDP}$ at time t , $p = \text{lag parameter}$ and $\epsilon_t = \text{an innovation term}$. We then select the most parsimonious AR(p)-process¹² by identifying the minimum lag length that is needed to remove all autocorrelation from the residuals.

Table 2 shows the identified AR(p)-structures of the American and the Costa Rican GDPs for 10 different sub-samples. Each sample starts at the indicated date and ends in 2008:1. The American GDP is always optimally specified as an AR(1)-process, in all samples. The Costa Rican GDP however, is characterized by different AR(p)-processes depending on the chosen sub-sample. In the two largest sub-samples, starting in the early 1990s, the data is best described by an AR(4)-process; in the following two sub-samples, starting 1994 and 1995, as AR(3); then, in the sub-samples starting 1996 to 1998 as AR(2); and finally, from 1999 onwards, the data follow an AR(1)-process. This finding, can be interpreted as a first indication that the Costa Rican cycle has become more similar to the US cycle in recent years.¹³ In addition, this implicates that synchronized common serial correlation patterns (that we will later interpret as common business cycles)

¹⁰Note that the correlation of the shocks, after fitting an AR(1) process, is somewhat lower in Costa Rica, with a value of 0.094.

¹¹Goldfajn, Olivares, Frankel, and Milesi-Ferretti (2001) analyze the disadvantages and advantages of dollarization on the example of Panama, one of the largest dollarized economies in the world, comparing the country especially with Costa Rica and Argentina to control for idiosyncratic effects.

¹²In order to generate the best condition for finding cyclical comovement, we choose the most parsimonious model. However, using the AIC or SIC criterion to choose the lag length does not change the results qualitatively (see also table 6 where the common feature test is conducted with different lag length).

¹³Note that, the convergence of the Costa Rican GDP data towards an AR(1)-representation is not trivially caused by the simple reduction of the number of observations as the sub-samples become smaller. Conducting the same analysis with rolling windows of each 33 observations, i.e. the first sub-sample is 1992:1 - 2000:1, the second 1993:1 - 2001:1, and so on, yields similar results: only the first two sub-samples are described by different AR(p)-processes (AR(3)); for the remaining sub-samples we get the same results.

Table 2: AR(p) representations of GDP-series

AR(p) - Process										
Q-Statistics (5 respectively 10 lags)										
	1992:1	1993:1	1994:1	1995:1	1996:1	1997:1	1998:1	1999:1	2000:1	2001:1
Costa Rica										
optimal lag length	4	4	3	3	2	2	2	1	1	1
Q(5)	1.072	1.086	5.266	3.932	8.395	8.871	5.666	3.317	3.123	2.201
Q(10)	4.986	5.755	10.920	8.580	13.171	13.996	9.260	11.101	8.527	7.192
USA										
optimal lag length	1	1	1	1	1	1	1	1	1	1
Q(5)	4.272	4.307	3.783	4.029	3.932	3.204	3.563	2.263	1.395	3.645
Q(10)	5.956	5.795	8.133	8.542	7.701	7.710	8.433	6.095	3.702	6.812

Note: AR representations of the process of the time series of national GDP data are reported for different sub-samples, which differ in their starting point. Each sample ends in 2008:1. Under the restriction that the residual is free of autocorrelation, the specification with the smallest number of AR terms is selected. Q-Statistics of 5 and 10 lags are reported beneath.

can only be found in the last three sub-samples (1999 onwards). In the following section, we will test this hypothesis more formally.

3.2 Stationarity

In this section, we test for the stationarity of the time series in those sub-samples, where both, Costa Rica and the USA, follow a common AR(p)-process, using the Augmented-Dickey-Fuller (ADF) test:

$$\Delta y_t = \mu + \gamma y_{t-1} + \sum_{j=1}^p \phi_j \Delta y_{t-j} + \epsilon_t,$$

where Δ is the first difference operator. The lag parameter p is determined by the Akaike information criterion (AIC) and the finite sample critical values from Cheung and Lai (1995) are used.

The results of the ADF test are displayed in table 3. In the first sub-sample, 1999:1 - 2008:1, both series are non stationary in growth rates.¹⁴ Thus, even if they follow both AR(1)-processes, it is not possible to formally test for common cycles, as the test for common serial correlation requires stationarity. However, in the other two sub-samples, starting 2000 and 2001, the American and the Costa Rican GDP are stationary in growth rates and it is possible to test for common cycles in these two sub-samples.

¹⁴Using the SIC criterion does not yield I(1) series either.

Table 3: Results of ADF-test for GDP data

	ADF-Test - t-Statistic					
	1999:1		2000:1		2001:1	
	level	1st diff.	level	1st diff.	level	1st diff.
Costa Rica	1.794	-2.789	2.649	-3.174 **	1.709	-2.947 **
USA	-0.769	-1.926	0.420	-3.244 **	0.551	-3.209 **

Note: ADF-test statistics are reported for three different sub-samples, all ending in 2008:1. For both, GDP data of Costa Rica and the USA, the ADF-test was conducted in level and in logarithmized growth rates. The lag length was selected by the AIC criterion. Critical values of Cheung and Lai (1995) were applied. ** indicate rejection of the existence of both, stochastic and deterministic, trends with a significance of 5%.

3.3 Common Stochastic Trend

As another preliminary exercise, we test for cointegration using the Johansen (1988, 1991) maximum likelihood approach, allowing for an intercept in the cointegrating equations:

$$Y_t = \mu + \sum_{i=1}^{p-1} \Gamma_i Y_{t-i} + \epsilon_t$$

where Y_t is a 2×1 vector of the GDP series, μ is an intercept vector and ϵ_t is a vector of innovation terms.

The canonical correlations between the least squares residuals of the two subsequent regressions are calculated in order to deduce the maximum eigenvalue test statistic:

$$\Delta Y_t = \mu_1 + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \epsilon_{1t}$$

and $Y_{t-p} = \mu_2 + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \epsilon_{2t}$.

The null hypothesis of the maximum eigenvalue statistic claims that there are r , and the alternative hypothesis that there are $r + 1$ cointegrating vectors:

$$\text{Maximum Eigenvalue Statistic} = -T \ln(1 - \lambda_{r+1}).$$

The critical values of Osterwald-Lenum (1992), corrected with the scaling factor of Cheung and Lai (1993) to control for a possible finite-sample bias, are then compared with the calculated test statistics.

The results of the Johansen test are shown in table 4. We find that, except for the 1998 sub-sample, the American and the Costa Rican GDP are cointegrated in all sub-samples from 1996 onwards. Again, this result supports the view that a process of convergence has taken place. In all recent sub-samples, GDP data

Table 4: Results of Johansen cointegration test for GDP of Costa Rica and the USA

Johansen Test (Maximum Eigenvalue Statistic) - Costa Rica and USA										
	1992:1	1993:1	1994:1	1995:1	1996:1	1997:1	1998:1	1999:1	2000:1	2001:1
r=0	13.637	11.376	11.776	10.627	27.849 ***	25.604 ***	15.716	52.122 ***	49.100 ***	49.408 ***
r=1	3.429	3.673	6.020	5.212	8.917	5.257	4.307	7.195	5.973	2.346

Note: Results of testing for cointegration between the GDPs of Costa Rica and the USA are shown for different sub-samples. All samples end in 2008:1. The table contains the Maximum Eigenvalue statistics for $r=0$ and $r=1$. The critical values of Osterwald-Lenum (1992) were scaled with the scaling factor of Cheung and Lai (1993) to adjust for finite samples. *** indicates the rejection of the null hypothesis with a significance of 1%.

of both countries share a common stochastic trend. Thus, in the subsequent analysis of common cycles, an error-correction term will be included in the test for common cycles in both sub-samples (2000 and 2001).

3.4 Common Cycle

We can now analyze whether the US and the Costa Rican GDPs share a common serial correlation pattern in the two sub-samples 2000 - 2008 and 2001 - 2008. We start with the two-stage least squares (TSLS) approach of Engle and Kozicki (1993). The first regression

$$x_t = c + \beta y_t + \epsilon_t \quad (1)$$

is estimated with TSLS, including as instruments all lagged variables of x and y , i.e. x_{t-k} and y_{t-k} for $k = 1, \dots, p$ as well as the lagged error correction terms, ec_{t-k} . $(1, \beta)$ is the normalized common feature vector.

Then, we analyze whether the estimated residual $\hat{\epsilon}_t$ still contains autocorrelation that affects the present values through the same channels as x_t and y_t by estimating the following equation:

$$\hat{\epsilon}_t = c + \sum_{k=1}^p \delta_k x_{t-k} + \sum_{k=1}^p \gamma_k y_{t-k} + \sum_{k=1}^p \phi_k ec_{t-k} + u_t. \quad (2)$$

The null hypothesis is defined as all parameters being not statistically different from zero. If all lagged variables do not explain the estimated residual, the common AR(p)-pattern has been removed in the first regression. H_0 is tested with the F-statistic:

$$F_{k-1, T-k} = \frac{R^2}{1 - R^2} \frac{T - k}{k - 1},$$

where T denotes the number of observations and k refers to the number of restrictions, i.e. the number of

exogenous variables including the constant. R^2 is the R-squared of regression 2. Thus, if the null hypothesis cannot be rejected, evidence in favor of a common cycle is established.

Table 5: Results of serial correlation common feature tests for Costa Rica and the USA

Serial Correlation Common Feature Tests - Costa Rica and USA				
	2000:1		2001:1	
	test statistic	vector	test statistic	vector
TOLS	32.697 ***	0.906 ⁱ	12.626 ***	1.522
GMM	19.772 ***	-0.785	5.451 **	-2.612 ⁱ

Note: Results of the TOLS estimation and GMM estimation of serial correlation common features between the GDP growth rates of Costa Rica and the USA are reported for the sample 2000:1 - 2008:1 and 2001:1 - 2008:1. In the columns *test statistic* F-statistics are reported for the TOLS and X^2 -statistics for the GMM approach. The columns titled *vector* report the coefficient β of the common feature vector. ***, ** indicates the rejection of the null hypothesis with a significance of 1%, 5%; i implies that the coefficient β of the common feature vector is insignificant.

Results of the serial correlation common feature test (with TOLS estimation) are displayed in the first row of table 5. Our results clearly indicate that the null hypothesis of a common cycle is rejected at conventional levels.

Cubadda (1999, 2007) argues that an optimal general method of moments (GMM) estimation is more appropriate than a TOLS estimation for testing for common cycles, due to its relative efficiency. As table 5 shows, our results are also unchanged, when using the optimal GMM test proposed by Cubadda (1999, 2007).

Additionally, as a robustness check, we disregard the question of stationarity and the requirement of common lag structures and conduct the same serial correlation common feature test for all sub-samples including from one to four lags in the estimation equations. Results are reported in table 6 and confirm our previous finding that the series under consideration do not share a common AR(p)-structure.

Graphically our main finding is also confirmed when plotting the autocorrelation functions of the Costa Rican and the US GDP growth rates. A common feature (i.e. common reactions to a standard shock) would also imply a perfect collinearity between the two autocorrelation functions. As figure 2 shows, this is clearly not the case. The US GDP reacts to a shock much faster than the Costa Rican GDP does.

4 Related Literature

Over the last ten years, some authors have given a cautious recommendation for dollarization in Central America. Berg, Borensztein, and Mauro (2002) and Salvatore (2001) both discuss the issue of dollarization

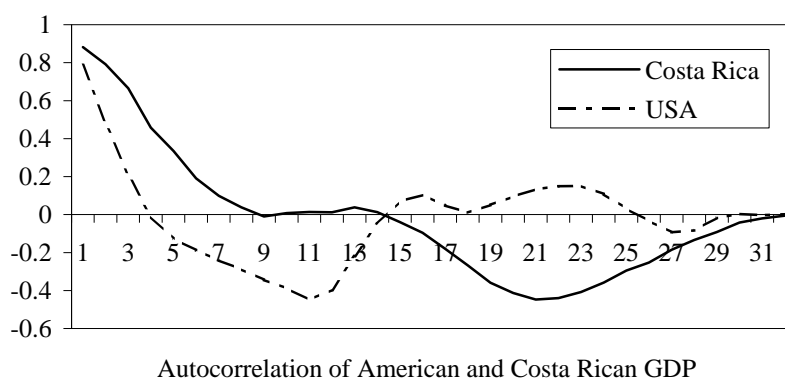
Table 6: Comprehensive serial correlation common feature tests (TSLs)

Serial Correlation Common Feature Tests (TSLs) - Costa Rica and USA									
lags	1992:1		1993:1		1994:1		1995:1		
	F-statistic	vector	F-statistic	vector	F-statistic	vector	F-statistic	vector	
1	14.8504 ***	0.8285	15.5193 ***	0.7112 ⁱ	14.6203 ***	0.7254 ⁱ	14.7326 ***	0.7657 ⁱ	
2	13.5584 ***	0.8222	10.2725 ***	0.7125	9.91173 ***	0.7451	9.85820 ***	0.8290	
3	8.16529 ***	0.7421	7.01634 ***	0.7157	7.01969 ***	0.7751	6.88728 ***	0.7579	
4	13.0250 ***	0.9319	12.1673 ***	0.9126	11.8940 ***	0.9528	11.4703 ***	0.8496	
lags	1996:1		1997:1		1998:1		1999:1		
	F-statistic	vector	F-statistic	vector	F-statistic	vector	F-statistic	vector	
1	14.0395 ***	0.6851 ⁱ	9.26704 ***	1.0723	22.7820 ***	0.9978	33.6471 ***	0.9187	
2	8.50670 ***	0.7682	9.42200 ***	1.1425	13.0782 ***	1.1332	15.9624 ***	0.8214 ⁱ	
3	4.60262 ***	0.8842	5.67469 ***	1.1642	9.39087 ***	1.0393	12.2153 ***	0.6768 ⁱ	
4	8.12200 ***	1.0329	8.15277 ***	1.2606	9.47803 ***	1.0443	12.5931 ***	0.7945 ⁱ	
lags	2000:1		2001:1						
	F-statistic	vector	F-statistic	vector					
1	32.6967 ***	0.9056 ⁱ	12.6264 ***	1.5220					
2	12.2079 ***	1.2102	5.95512 ***	1.1975					
3	6.3466 ***	1.4664	4.08710 ***	0.8351 ⁱ					
4	4.78911 ***	1.4742	5.18653 ***	0.4094 ⁱ					

Note: Results of the TSLs estimation of the serial correlation common features between the GDP cycles of Costa Rica and the USA are reported for all samples, including from 1 to 4 lags in the regression equations. In the first columns F-statistics are reported. The columns titled *vector* report the coefficient β of the common feature vector. *** indicates the rejection of the null hypothesis with a significance of 1%; ⁱ implies that the coefficient β of the common feature vector is insignificant.

in Latin America and conclude that the Central American countries might be good candidates for a fixed exchange rate with the USA. Alesina, Barro, and Tenreyro (2002), who test in a large set of countries whether they should belong to a dollar-, a euro-, or a yen-area, assign the Central American countries clearly to the dollar-area.

A recent study about the costs of dollarization for Central America was conducted in Fiess (2007). Using

Figure 2: Autocorrelation function of growth rates of American and Costa Rican GDP

Note: The Autocorrelation functions of the growth rates of the GDP of Costa Rica and the USA are displayed for the sample 2000:1 - 2008:1.

different filters to identify the cyclical component of GDP, he analyzes business cycle synchronization of Central America and the USA - measured by the contemporaneous correlations between the cycles - and calculates the degree of trade integration in DR-CAFTA with annual GDP data from 1965 - 2005 and monthly data on economic activity from 1995 - 2005. He finds that Costa Rica has the highest business cycle synchronization with the USA of the Central American countries, and that all of them have become more sensitive to developments of the American economy in recent years, an observation that is consistent with our findings. Nevertheless, Fiess (2007) concludes that his evidence does not make a good case for macroeconomic coordination between Central America and the United States.

Also Schmitt-Grohe and Uribe (2001) are sceptical of a policy of dollarization. Focusing on Mexico and using a calibrated general equilibrium model, they conclude that dollarization is the least preferable option among different monetary policy regimes, from a welfare point of view.

Finally, Ahmed (2003) points out that external shocks only play a limited role for business cycle fluctuations. He concludes that fixed exchange rates in Latin America may not be as costly as theory predicts.

The common cycle approach of Vahid and Engle (1993) has also been applied to (annual) output data in Central America in Roache (2008), although not in the context of dollarization. The author analyzes annual real GDP from 1950 to 2006 in a multivariate framework including both Central American countries and the United States. For the purpose of addressing the policy issue of dollarization, the bivariate framework, and the extension of Cubadda (2007), allows us to clearly attribute the common cycle (or the lack of it) to specific individual countries, such as Costa Rica and the US. The multivariate framework is, however, useful for addressing the issue of a potential monetary union among several countries. This has been done for instance by Cheung and Yuen (2005) in the context of a policy debate of a potential currency union in Northeast Asia. Using the approach of Vahid and Engle (1993), the authors reject that China, Japan and Korea form an optimum currency area. In an analysis of the introduction of the Euro as a single currency,

Westermann (1998) reported that Germany, France and Italy share a common business cycle, also applying the Vahid and Engle (1993) procedure.

5 Conclusions

The contribution of this note is to analyze the issue of dollarization by focusing on the business cycle synchronization and its implications for stabilization policy. We emphasize that in addition to the correlation of shocks the reaction of each country to a shock is of high relevance for a common monetary policy. Even if the growth rates of the GDP are highly correlated, the reaction to a shock - that can be interpreted as the business cycle - may differ significantly across countries. We apply the test for common serial correlation to a data set from Costa Rica, where the topic of dollarization has been - and still is - an important part of the discussion on stabilization policy. Although we find some evidence for a convergence process in the last years, with respect to a common autoregressive structure and a common stochastic trend, we can not confirm the existence of a common business cycle between the GDP growth rates of Costa Rica and the USA. This finding is likely to hold also for the other Central American countries, as Costa Rica was the most promising candidate for the analysis of a common serial correlation with the US.¹⁵

We focused on the synchronization of business cycles. For a complete analysis, further research remains to be done. For instance, if other instruments, such as remittances, were important to stabilize the home economy, the costs of a fixed exchange rate would be reduced.¹⁶ Further issues are the degree of capital market integration and the potential for fiscal transfers that play an important role. Finally, it remains an open issue how official dollarization would affect the magnitude of the business cycle in the domestic country itself. All countries that presently consider dollarization, including Costa Rica, already have a relatively high degree of unofficial dollarization. Edwards (2008) considers the degree of dollarization as one of the sources of macroeconomic vulnerability and financial crisis. The potential output cost of currency or twin crisis, that can result from only partial dollarization have been estimated by Hutchison and Noy (2006).¹⁷ Further, Tornell, Westermann, and Martinez (2003) have shown that highly dollarized middle income countries experience pronounced boom-bust cycle episodes. In addition to the classical issue of monetary policy coordination that we focus on, further research would be needed to understand how partial vs. full dollarization affects the link between regular business cycle fluctuations and the vulnerability to financial crisis and pronounced boom-bust cycles.

¹⁵We have also tried to apply the analysis for other Central American countries. However, often the growth rates of the GDP are non stationary or the AR(p)-structure differs from the American equivalent.

¹⁶Freund and Spatafora (2008) show that reductions in transaction costs (e.g. by reducing the exchange rate volatility) increase remittance flows. Thus, one hypothesis to test would be that dollarization leads to an increase in remittances and thus to a stabilization of the domestic economy.

¹⁷The link between dollarization and systemic risk is also explored in Bacha, Holland, and Gonçalves (2009).

References

- Ahmed**, Shaghil (2003). “Sources of economic fluctuations in Latin America and implications for choice of exchange rate regimes.” *Journal of Development Economics*, 72(1):181 – 202.
- Alesina**, Alberto, **Barro**, Robert J., and **Tenreyro**, Silvana (2002). “Optimal Currency Areas.” In “NBER Macroeconomics Annual 2002, Volume 17,” The University of Chicago Press.
- Bacha**, Edmar L., **Holland**, Márcio, and **Gonçalves**, Fernando M. (2009). “Systemic Risk, Dollarization, and Interest Rates in Emerging Markets: A Panel-Based Approach.” *World Bank Economic Review*, 23(1):101–117.
- Ball**, Laurence M. (2009). “Policy Responses to Exchange-Rate Movements.” NBER Working Papers 15173, National Bureau of Economic Research, Inc.
- Bayoumi**, Tamim and **Eichengreen**, Barry (1993). “Shocking Aspects of European Monetary Unification.” In **Torres**, Francisco and **Giaavazzi**, Francesco, eds., “Adjustment and Growth in the European Monetary Union,” chapter 7. Cambridge University Press, pp. 193 – 241.
- Berg**, Andrew, **Borensztein**, Eduardo, and **Mauro**, Paolo (2002). “An evaluation of monetary regime options for Latin America.” *The North American Journal of Economics and Finance*, 13(3):213–235.
- Berger**, Helge, **Jensen**, Henrik, and **Schjelderup**, Guttorm (2001). “To peg or not to peg?: A simple model of exchange rate regime choice in small economies.” *Economics Letters*, 73(2):161–167.
- Blanchard**, Olivier Jean and **Quah**, Danny (1989). “The Dynamic Effects of Aggregate Demand and Supply Disturbances.” *American Economic Review*, 79(4):655–673.
- Cheung**, Yin-Wong and **Lai**, Kon S (1993). “Finite-Sample Sizes of Johansen’s Likelihood Ratio Tests for Cointegration.” *Oxford Bulletin of Economics and Statistics*, 55(3):313–328.
- Cheung**, Yin-Wong and **Lai**, Kon S. (1995). “Lag Order and Critical Values of the Augmented Dickey-Fuller Test.” *Journal of Business & Economic Statistics*, 13(3):277–280.
- Cheung**, Yin-Wong and **Yuen**, Jude (2005). “An Output Perspective on a Northeast Asia Currency Union.” In **Grauwe**, Paul De and **Méltiz**, Jacques, eds., “Prospects for Monetary Unions after the Euro,” MIT Press, Cambridge and London, pp. 289–317.
- Cubadda**, Gianluca (1999). “Common Cycles in Seasonal Non-stationary Time Series.” *Journal of Applied Econometrics*, 14(3):273–291.
- Cubadda**, Gianluca (2007). “A unifying framework for analysing common cyclical features in cointegrated time series.” *Computational Statistics & Data Analysis*, 52(2):896–906.
- Edwards**, Sebastian (2008). “Sequencing of Reforms, Financial Globalization, and Macroeconomic Vulnerability.” NBER Working Papers 14384, National Bureau of Economic Research, Inc.
- Engle**, Robert F. and **Kozicki**, Sharon (1993). “Testing for Common Features.” *Journal of Business & Economic Statistics*

- Economic Statistics*, 11(4):369–380.
- Fiess**, Norbert (2007). “Business Cycle Synchronization and Regional Integration: A Case Study for Central America.” *World Bank Economic Review*, 21(1):49–72.
- Freund**, Caroline and **Spatafora**, Nikola (2008). “Remittances, transaction costs, and informality.” *Journal of Development Economics*, 86(2):356 – 366.
- Goldfajn**, Ilan, **Olivares**, Gino, **Frankel**, Jeffrey, and **Milesi-Ferretti**, Gian Maria (2001). “Full Dollarization: The Case of Panama [with Comments].” *Economía*, 1(2):101–155.
- Hutchison**, Michael M. and **Noy**, Ilan (2006). “Sudden stops and the Mexican wave: Currency crises, capital flow reversals and output loss in emerging markets.” *Journal of Development Economics*, 79(1):225–248.
- IMF - Staff Report** (2009). “Costa Rica.” Country Report 09/134, International Monetary Fund.
- Johansen**, Søren (1988). “Statistical analysis of cointegration vectors.” *Journal of Economic Dynamics and Control*, 12(2-3):231–254.
- Johansen**, Søren (1991). “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models.” *Econometrica*, 59(6):1551–1580.
- Laeven**, Luc and **Valencia**, Fabian (2008). “Systemic Banking Crises: A New Database.” IMF Working Paper 08/224, International Monetary Fund.
- Levy Yeyati**, Eduardo and **Sturzenegger**, Federico (edt.) (2002). *Dollarization: Debates and Policy Alternatives*. MIT Press, Cambridge and London.
- Mishkin**, Frederic S. and **Savastano**, Miguel A. (2001). “Monetary policy strategies for Latin America.” *Journal of Development Economics*, 66(2):415 – 444.
- Mundell**, Robert A. (1961). “A Theory of Optimum Currency Areas.” *The American Economic Review*, 51(4):657–665.
- Osterwald-Lenum**, Michael (1992). “A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics.” *Oxford Bulletin of Economics and Statistics*, 54(3):461–472.
- Roache**, Shaun K. (2008). “Central America’s Regional Trends and U.S. Cycles.” IMF Working Papers 08/50, International Monetary Fund.
- Salvatore**, Dominick (2001). “Which countries in the Americas should dollarize?” *Journal of Policy Modeling*, 23(3):347 – 355.
- Schmitt-Grohe**, Stephanie and **Uribe**, Martin (2001). “Stabilization Policy and the Costs of Dollarization.” *Journal of Money, Credit and Banking*, 33(2):482–509.
- Tornell**, Aaron, **Westermann**, Frank, and **Martinez**, Lorenza (2003). “Liberalization, Growth, and Financial Crises: Lessons from Mexico and the Developing World.” *Brookings Papers on Economic Activity*,

34(2003-2):1–112.

Urga, Giovanni (2007). “Common Features in Economics and Finance: An Overview of Recent Developments.” *Journal of Business & Economic Statistics*, 25:2–11.

Vahid, F and **Engle**, Robert F (1993). “Common Trends and Common Cycles.” *Journal of Applied Econometrics*, 8(4):341–360.

Westermann, Frank (1998). *Three Essays on Market Integration*. Ph.D. thesis, University of California, Santa Cruz.

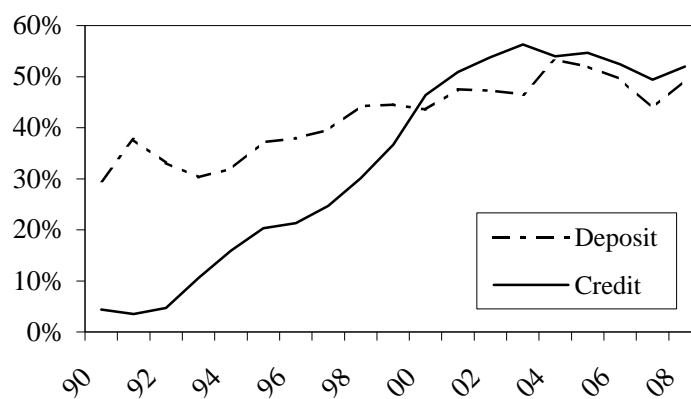
Appendix

Table A.1: Data sources

Data Sources			
Country	Data	Source	Max. Sample
Belize		Latin American and Caribbean	01:1 - 08:4
Costa Rica	GDP, constant prices, seasonally	Macro Watch	91:1 - 08:4
Dominican Republic	adjusted, millions of domestic	Research Department, Inter-	92:1 - 08:4
El Salvador	currency	American Development Bank	90:1 - 08:4
Nicaragua		http://www.iadb.org/res/lmw.cfm	94:1 - 08:1
Panama			96:1 - 08:4
USA	GDP Volume, 2000 reference year (chained), seasonally adjusted, millions of national currency	IFS, 11199B.RZF... International Monetary Fund http://www.imfstatistics.org/imf/	90:1 - 08:4

Note: Data sources and the maximal availability are displayed.

Figure A.1: Unofficial dollarization in Costa Rica



Unofficial Dollarization in Costa Rica

Note: The degree of deposit and credit dollarization (in %- end of period) in Costa Rica are displayed.

Source: Latin American and Caribbean Macro Watch, Inter-American Development Bank

CESifo Working Paper Series

for full list see www.cesifo-group.org/wp

(address: Poschingerstr. 5, 81679 Munich, Germany, office@cesifo.de)

- 2721 Thushyanthan Baskaran and Lars P. Feld, Fiscal Decentralization and Economic Growth in OECD Countries: Is there a Relationship?, July 2009
- 2722 Nadia Fiorino and Roberto Ricciuti, Interest Groups and Government Spending in Italy, 1876-1913, July 2009
- 2723 Andreas Wagener, Tax Competition, Relative Performance and Policy Imitation, July 2009
- 2724 Hans Fehr and Fabian Kindermann, Pension Funding and Individual Accounts in Economies with Life-cyclers and Myopes, July 2009
- 2725 Ernesto Reuben and Arno Riedl, Enforcement of Contribution Norms in Public Good Games with Heterogeneous Populations, July 2009
- 2726 Kurt Schmidheiny and Marius Brülhart, On the Equivalence of Location Choice Models: Conditional Logit, Nested Logit and Poisson, July 2009
- 2727 Bruno S. Frey, A Multiplicity of Approaches to Institutional Analysis. Applications to the Government and the Arts, July 2009
- 2728 Giovanni Villani, A Strategic R&D Investment with Flexible Development Time in Real Option Game Analysis, July 2009
- 2729 Luca Di Corato and Michele Moretto, Investing in Biogas: Timing, Technological Choice and the Value of Flexibility from Inputs Mix, July 2009
- 2730 Gilad D. Aharonovitz, Nathan Skuza and Faysal Fahs, Can Integrity Replace Institutions? Theory and Evidence, July 2009
- 2731 Michele Moretto and Sergio Vergalli, Managing Migration through Conflicting Policies: an Option-theory Perspective, July 2009
- 2732 Volker Nitsch, Fly or Cry: Is Airport Noise Costly?, July 2009
- 2733 Francesco Cinnirella and Joachim Winter, Size Matters! Body Height and Labor Market Discrimination: A Cross-European Analysis, July 2009
- 2734 Samuel Bowles and Sandra Polanía Reyes, Economic Incentives and Social Preferences: A Preference-based Lucas Critique of Public Policy, July 2009
- 2735 Gary Burtless, Lessons of the Financial Crisis for the Design of National Pension Systems, July 2009

- 2736 Helmuth Cremer, Firouz Gahvari and Pierre Pestieau, Fertility, Human Capital Accumulation, and the Pension System, July 2009
- 2737 Hans Jarle Kind and Frank Stähler, Market Shares in Two-Sided Media Industries, July 2009
- 2738 Pamela Campa, Alessandra Casarico and Paola Profeta, Gender Culture and Gender Gap in Employment, August 2009
- 2739 Sebastian Gechert, Supplementary Private Health Insurance in Selected Countries: Lessons for EU Governments?, August 2009
- 2740 Leif Danziger, Endogenous Monopsony and the Perverse Effect of the Minimum Wage in Small Firms, August 2009
- 2741 Yan Dong and John Whalley, A Third Benefit of Joint Non-OPEC Carbon Taxes: Transferring OPEC Monopoly Rent, August 2009
- 2742 Valentina Bosetti, Carlo Carraro and Massimo Tavoni, Climate Change Mitigation Strategies in Fast-Growing Countries: The Benefits of Early Action, August 2009
- 2743 Christina Felfe, The Willingness to Pay for Job Amenities: Evidence from Mothers' Return to Work, August 2009
- 2744 Jörg Franke, Christian Kanzow, Wolfgang Leininger and Alexandra Väh, Effort Maximization in Asymmetric N-Person Contest Games, August 2009
- 2745 Bruno S. Frey and Paolo Pamini, Making World Heritage Truly Global: The Culture Certificate Scheme, August 2009
- 2746 Frank N. Caliendo, Is Social Security behind the Collapse of Personal Saving?, August 2009
- 2747 Caterina Liesegang and Marco Runkel, Corporate Income Taxation of Multinationals and Fiscal Equalization, August 2009
- 2748 Chrysovalantou Milliou and Apostolis Pavlou, Upstream Horizontal Mergers and Efficiency Gains, August 2009
- 2749 Rüdiger Pethig and Christian Wittlich, Interaction of Carbon Reduction and Green Energy Promotion in a Small Fossil-Fuel Importing Economy, August 2009
- 2750 Kai Carstensen, Oliver Hülsewig and Timo Wollmershäuser, Monetary Policy Transmission and House Prices: European Cross-country Evidence, August 2009
- 2751 Olaf Posch, Explaining Output Volatility: The Case of Taxation, August 2009
- 2752 Beatrice Scheubel, Daniel Schunk and Joachim Winter, Don't Raise the Retirement Age! An Experiment on Opposition to Pension Reforms and East-West Differences in Germany, August 2009

- 2753 Daniel G. Arce, Dan Kovenock and Brian Roberson, Suicide Terrorism and the Weakest Link, August 2009
- 2754 Mario Larch and Wolfgang Lechthaler, Comparative Advantage and Skill-Specific Unemployment, August 2009
- 2755 Horst Raff and Nicolas Schmitt, Buyer Power in International Markets, August 2009
- 2756 Seppo Kari, Hanna Karikallio and Jukka Pirttilä, The Impact of Dividend Taxation on Dividends and Investment: New Evidence Based on a Natural Experiment, August 2009
- 2757 Mirco Tonin and Michael Vlassopoulos, Disentangling the Sources of Pro-social Behavior in the Workplace: A Field Experiment, August 2009
- 2758 Nicole Grunewald and Inmaculada Martínez-Zarzoso, Driving Factors of Carbon Dioxide Emissions and the Impact from Kyoto Protocol, August 2009
- 2759 Yu-Fu Chen and Michael Funke, Booms, Recessions and Financial Turmoil: A Fresh Look at Investment Decisions under Cyclical Uncertainty, August 2009
- 2760 Jan-Egbert Sturm and Jakob de Haan, Does Central Bank Communication really Lead to better Forecasts of Policy Decisions? New Evidence Based on a Taylor Rule Model for the ECB, August 2009
- 2761 Larry Karp, Sacrifice, Discounting and Climate Policy: Five Questions, August 2009
- 2762 Marianna Belloc and Samuel Bowles, International Trade, Factor Mobility and the Persistence of Cultural-Institutional Diversity, August 2009
- 2763 Charles Noussair and Fangfang Tan, Voting on Punishment Systems within a Heterogeneous Group, August 2009
- 2764 Birgit Bednar-Friedl and Karl Farmer, Internationally Coordinated Emission Permit Policies: An Option for Withdrawers from the Kyoto Protocol?, August 2009
- 2765 Pierre M. Picard and David E. Wildasin, Labor Market Pooling, Outsourcing and Labor Contracts, August 2009
- 2766 Stefan Voigt and Lorenz Blume, The Economic Effects of Federalism and Decentralization – A Cross-Country Assessment, August 2009
- 2767 David S. Jacks, Christopher M. Meissner and Dennis Novy, Trade Booms, Trade Busts, and Trade Costs, August 2009
- 2768 Mario Jametti and Thomas von Ungern-Sternberg, Hurricane Insurance in Florida, August 2009
- 2769 Alessandro Balestrino, Kind of Black: The Musicians' Labour Market in Italy, August 2009

- 2770 Yosr Abid Fourati and Cathal O'Donoghue, Eliciting Individual Preferences for Pension Reform, August 2009
- 2771 Christian Breuer and Chang Woon Nam, VAT on Intra-Community Trade and Bilateral Micro Revenue Clearing in the EU, August 2009
- 2772 Choudhry Tanveer Shehzad, Jakob De Haan and Bert Scholtens, Growth and Earnings Persistence in Banking Firms: A Dynamic Panel Investigation, August 2009
- 2773 Erdal Yalcin, Uncertain Productivity Growth and the Choice between FDI and Export, August 2009
- 2774 Klaus Abberger, Wolfgang Nierhaus and Shynar Shaikh, Findings of the Signal Approach for Financial Monitoring in Kazakhstan, September 2009
- 2775 Sascha O. Becker, Francesco Cinnirella and Ludger Woessmann, The Trade-off between Fertility and Education: Evidence from before the Demographic Transition, September 2009
- 2776 Thomas Aronsson and Erkki Koskela, Optimal Income Taxation, Outsourcing and Policy Cooperation in a Dynamic Economy, September 2009
- 2777 Joel Slemrod, Old George Orwell Got it Backward: Some Thoughts on Behavioral Tax Economics, September 2009
- 2778 Cagri Seda Kumru and Athanasios C. Thanopoulos, Social Security Reform and Temptation, September 2009
- 2779 Alessandro Buccioli and Roel M. W. J. Beetsma, Inter- and Intra-generational Consequences of Pension Buffer Policy under Demographic, Financial and Economic Shocks, September 2009
- 2780 Eduardo Strube and Marcelo Resende, Complementarity of Innovation Policies in the Brazilian Industry: An Econometric Study, September 2009
- 2781 Henry Tulkens and Vincent van Steenberghe, "Mitigation, Adaptation, Suffering": In Search of the Right Mix in the Face of Climate Change, September 2009
- 2782 Maria L. Loureiro, Anna Sanz-de-Galdeano and Daniela Vuri, Smoking Habits: Like Father, Like Son, Like Mother, Like Daughter, September 2009
- 2783 Momi Dahan, Tehila Kogut and Moshe Shalem, Do Economic Policymakers Practice what they Preach? The Case of Pension Decisions, September 2009
- 2784 Eytan Sheshinski, Uncertain Longevity and Investment in Education, September 2009
- 2785 Nannette Lindenberg and Frank Westermann, How Strong is the Case for Dollarization in Costa Rica? A Note on the Business Cycle Comovements with the United States, September 2009