Currency Substitution And European Monetary Union

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Abstract

Results from cointegration and error-correction models for testing the effects of currency substitution in Greece, Portugal and Spain, in light of their upcoming participation in the European Monetary Union, revealed no significant short- or long-run currency substitution behavior in any country, suggesting that joining the union now would offer them no real benefits, unless significant economic convergence is achieved.

I. Introduction

In the presence of a high degree of currency substitution (CS) national monetary independence is undermined and that, in turn, has important implications for determining the incentive to join a monetary union. Evidence on several western European countries showed that the move toward monetary unification among major industrial countries may be more to offset CS than anything else [e.g., Melvin (1985), European Commission (1990), Girton and Roper (1981) and McKinnon (1995)]. Recently, Von Hagen and Neumann (1994) have found that the strongest demand for a foreign currency appeared to be for the German mark, which explains why Germany is the hegemon within the European Monetary System. Hence, although a common currency between Germany and a few other equally economically strong European countries is a feasible arrangement, the question is whether less industrialized European countries would benefit from such a currency arrangement when they join in.

In this study, we examine three emerging European countries (Greece, Portugal and Spain) with respect to their viability in a single-currency system, as set forth by the Maastricht Treaty criteria of 1994.[1] Contrary to their more advanced partners, these three share similar economic characteristics, like high inflation rates and budget deficits, and possess a less developed financial system. Their central banks had followed an administratively-set interest rate structure and exercised foreign exchange controls but during the last ten years or so their capital markets such as stock exchanges are well under way of development and modernization and a wave of industry deregulations and labor markets flexibility plans has swept these countries. At the time of writing, the inflation and the interest rates criteria have been met by Spain and Portugal but not by Greece, although the progress is fast.

To assess the effects of the presence of currency substitution on the effectiveness of monetary union, we will employ the methodology of an error-correction model through the application of the two-step estimator of cointegrated systems as proposed by Engle and Granger (1987). Within that setting, short- and long-run dynamics are incorporated by imposing (long-run) equilibrium constraints on the short-

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run model. In this way, cointegration permits the separation of long-run dynamic impulses from short-run ones within the context of several variables.

Section II of the paper lays out several methodological issues with respect to the model and presents the empirical results, while section III concludes with some observations and suggestions for future research.

II. Methodology And Results

The literature on CS typically starts with an empirical investigation of a simple money demand for domestic money being a function of income, a domestic and a foreign interest rate, or the opportunity cost of holding foreign money.[2] A common econometric specification [as in Bergstrand and Bundt (1990)] is as follows:

$$ln(m^d_h) = \beta_0 + \beta_1 ln(y_h) + \beta_2 ln(i_h) + \beta_3 ln(i_f) + u_t \quad (1)$$

$$\beta_1 > 0, \ \beta_2 > 0, \ \beta_3 < 0$$

where m^d_h is real domestic money demand, y_h is real national income, i_h the home interest rate, i_f the foreign interest rate, *ln* the natural logarithm and u_t an error term. The expected signs of real income and the domestic interest rate are positive, for obvious reasons. An increase in the domestic real income pushes up the demand for money as units need more money for transaction purposes, while a rise in the home interest rate provides greater incentive for the home currency in lieu of the foreign. The sign of the i_f variable should be negative for an increase in the foreign interest rate induces a decrease in the demand for domestic money in favor of foreign balances. The two interest rates represent the opportunity cost of money demand or the marginal productivity of the home and foreign inputs in the function.

Before estimating [1], two econometric issues need to be addressed. The first concerns the time-series properties of the variables or the existence of stationarity in the series. Further, even if the original individual variables are non-stationary, is a linear combination of them level stationary? Engle and Granger (1987) have shown that if two variables y_t and z_t are integrated in the same order, $I(1)$, then any linear combination of them, $u_t = y_t - az_t$, may be $I(0)$, implying that the error term u_t may be also stationary. Hence, these variables are said to be cointegrated. The authors have demonstrated how a cointegrated system can be represented in an Error-Correction Model (ECM). The second issue involves the dynamic adjustment of the demand for money function and its modeling. If the adjustment process is not instantaneous, then how are changes in incomes and the opportunity cost handled? When the cointegrating regression is estimated, using OLS, the residuals from this regression reflect the cointegrating linear relationship. Then, the ECM is estimated (by imposing a constraint of long-run equilibrium among levels of variables) incorporating the cointegrating regression residuals:

$$\Delta y_t = \gamma + \varphi x_t + \delta u_{t-1} + \upsilon_t \quad (2)$$

where υ_t is white noise, x_t is a vector of I(0) regressors and u_{t-1} represents the deviations from the long-run equilibrium relationship (with $d < 0$). Alternatively [Engle *et al.* (1989)], if the error-correction term u_{t-1} is replaced by lagged values of the two variables then (2) becomes:

$$\Delta y_t = \gamma + \varphi x_t + \lambda y_{t-1} + \xi z_{t-1} + \upsilon_t \quad (3)$$

where estimates of ξ capture the long-run effect of z on y.[3] We intend to experiment with both versions [(2) and (3)] of the ECM, referred to as the *short-run* and the *long-run* models, respectively.

Nominal national money balances (M1) are in billions of domestic currency. To derive the real money supply, m_t, we used the Consumer Price Index. Real national income as measured by the real Gross Domestic Product (1985=100) in billions of national currency. To derive the inflation variable, the Consumer Price

Index was used (1985=100) for the home and the foreign country. The exchange rates were the market rates expressed in domestic currency per German mark. The short-term interest rates were the three-month Treasury bills for all the countries. The foreign rates were Germany's three-month money market rate. All data was taken from IMF's *International Financial Statistics* and from the Bundesbank's *Monthly Bulletin of Statistics*.

To test each variable for its order of integration we propose using the univariate Augmented Dickey-Fuller (ADF).[4] The results (see Table 1) revealed stationarity in the series when expressed in first-differences. Thus, equation [1] represents the cointegrating relationship to be used in the error-correction procedure. Test statistics for cointegration examined were the Cointegrating Regression Durbin-Watson (CRDW), the ADF and the Dickey-Fuller (DF). The findings rejected the null of no-cointegration, albeit based on weak statistical evidence. Table 2 reports the estimates of short-run CS behavior for Greece, Portugal, and Spain. Explanatory variables were the lagged changes in the home and Germany's interest rates, lagged changes in domestic real income, and the lagged changes in real domestic money stock. The long-run equilibrium restriction was imposed on each equation, by embedding the cointegrating regression residuals in this version of the ECM. Since the latter variable reflects deviations from long-run equilibrium, its estimated coefficient is expected to be negative representing a downward pressure on money stock the next period if it is above its equilibrium level. As seen from the findings, however, the coefficient is not statistically significant for Greece or Spain but is for Portugal, although it has the correct sign. In particular, divergences from the long-run equilibrium relationship for the demand for foreign money are not shown to surface in the short-run demand for home money in Greece and Spain. Moreover, the results essentially indicate no dynamic short-run CS behavior given that the coefficients of the lagged domestic and foreign interest rates are statistically insignificant, although they had the correct sign at times. Results from long-run CS patterns (Table 2), in which additional explanatory variables are included, such as lagged levels of the original variables, support the assertion of no evidence of short-run CS behavior for Greece and Spain since the coefficients of the lagged changes in the foreign interest rate have the wrong sign and are insignificant. By contrast, the significance and the correct coefficient signs of the lagged level of the domestic interest rate for Portugal and Spain give evidence of long-run CS behavior, but weak. Further, to make the case a bit stronger for Portugal the coefficient of the lagged level of the foreign interest rate has the anticipated sign and is statistically significant.

III. Conclusions

This paper used Engle and Granger's cointegrating methodology through the estimation of an Error-Correction Model to investigate the issue of long- and short-run Currency Substitution behavior in Greece, Portugal, and Spain. Although empirical evidence supports the proposition of forming a monetary union even in the presence of CS among industrial nations, the issue remains unresolved in the case of less advanced countries. The documentation presented here for the latter reveals that CS behavior is weak at both the short- and the long-run, even though a case can be made for Portugal in the long-run in favor of such conduct. A country may benefit from CS when the stabilization efforts of its government has earned the trust of the private sector, in which case domestic residents will prefer their home currency over the foreign one(s). The above results were anticipated, in one part, because of high inflation rates in these countries and, in the other part, because of the low degree of financial market liberalization, despite the drastic steps to deregulate them in recent years. Therefore, the findings appear to imply that being part of a monetary union offers no net benefits to these countries presently

Table 1
Cointegration Test Results

Statistic	GREECE	PORTUGAL	SPAIN
CRDW	1.098* (0)	1.009* (0)	0.987* (0)
DF	-4.021* (0)	-3.978* (1)	-4.100* (0)
ADF	-4.044* (0)	-4.013* (1)	-4.132* (0)

* significant at the 10% level; number of significant lagged differences in paretheses; CRDW is the Cointegrating Regression Durbin-Watson statistic; (A)DF is the (Augmented) Dickey-Fuller statistic.

Table 2
Short- And Long-Run Currency Substitution Error-Correction Results

Variable	GREECE		PORTUGAL		SPAIN	
	short -run	long -run	short -run	long -run	short -run	long -run
Constant	1.7001*	1.6031	0.0367	-1.2367*	0.7265	6.0165*
	(1.876)	(0.976)	(0.012)	(-2.317)	(1.011)	(2.112)
$\Delta m^h_{(t-1)}$	-0.4567*	-0.5767*	0.7091*	-0.1981**	-0.2368	-0.2368
	(-1.876)	(-2.567)	(1.810)	(-1.710)	(-1.032)	(-1.045)
$\Delta y^h_{(t-1)}$	0.0933**	0.1113*	-0.0608	-0.8908	0.2745	0.2095
	(1.607)	(2.107)	(-0.023)	(-0.333)	(1.307)	(1.567)
$\Delta i^h_{(t-1)}$	0.7404	0.1104	-0.0146	-3.014**	-0.6205	-0.2205
	(0.514)	(0.064)	(-0.005)	(-1.724)	(-1.234)	(-1.334)
$\Delta i^f_{(t-1)}$	-0.4872	-0.8972	-0.6453	-6.1051*	0.2367	0.4897
	(-0.406)	(-0.726)	(-0.186)	(-2.267)	(0.307)	(0.600)
$u_{(t-1)}$	-0.0897	--	-0.4785*	--	-0.1678**	--
	(-0.614)		(-1.978)		(-1.701)	
$m^h_{(t-1)}$	--	-0.0345	--	-0.2085*	--	-0.0398
		(-0.544)		(-1.918)		(-1.091)
$y^h_{(t-1)}$	--	-0.0309**	--	1.5123*	--	-0.0123
		(1.701)		(1.998)		(-0.654)
$i^h_{(t-1)}$	--	0.2789	--	2.3781*	--	0.4231**
		(0.312)		(1.987)		(1.698)
$i^f_{(t-1)}$	--	0.1245	--	-0.3789*	--	0.1123
		(0.253)		(-1.898)		(0.256)
R^2	0.2464	0.2364	0.5134	0.7234	0.2015	0.2215
SEE	0.6631	0.6511	0.1867	0.1456	0.3456	0.4356
DW	1.9878	1.9456	2.0111	1.9867	1.9767	1.9567

Notes: *, ** significant at the 5 and 10 percent levels, respectively; t-ratios in parentheses; (t-1) is one period back; u is the Error-Correction Model's error term.

unless economic convergence with their partners is reached, at least with respect to inflation rates.

IV. Suggestions For Future Research

A natural next step would be to examine the link between currency substitution and the various models that explain the determination of exchange rates such as the monetary (sticky- or flexible-price) or the asset price models. Insights from the inclusion of such behavior into the money demand functions could shed light on how to improve the performance of these structural models, which may justify a reexamination of their assumptions. 🕮

Endnotes

1. The convergence criteria are as follows: (a) annual inflation must be within 1.5% of the best three performing members; (b) long-term interest rates must not exceed 2% of the best three members; (c) the government deficit may not exceed 3.0% of GDP; (d) gross government debt may be no more than 60% of GDP; (e) the currency of the candidate nation must have been in the EMS for at least two years.
2. See Arize (1991) and Marashdeh and Khalil (1993).
3. Accordingly, the lagged value for the money stock can be expressed as a short-term stock-adjustment model and can also be justified by the fact that we use quarterly data. We also included dummy variables in all equations to capture the effect (if any) of the countries' currency inclusion in the European Monetary System on CS behavior (Greece joined in September 1984 but left in 1989, Portugal and Spain in September 1989). None of the dummies were found statistically significant and there was no qualitative change from the results presented in Table 2.
4. We also used the Phillips-Perron procedure, which led us to the same conclusion, but these results are not reported.

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