What Variability of Real Exchange Rate Implies about the Success of the Euro

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Abstract

This paper uses real exchange rate variability and the adjustment time for real exchange rate changes to assess the viability of euro zone membership for the 17 European Union countries that adopted the euro. The results support euro zone membership for Austria, Cypress, France, Germany, Italy, Luxembourg, Portugal, Slovakia and Spain. The persistence of real exchange rate changes and slow adjustment times suggest that the viability of euro zone membership for Belgium, The Netherlands, Finland, Malta and Slovenia requires greater integration. The results also indicate that the costs associated with euro zone membership are great for Greece and Ireland, and the viability of membership is in question. The results support the conclusion that Greece and Ireland should consider dropping out of the euro zone. Since Estonia only adopted the euro on January 1, 2011, the time frame is too short to infer any conclusions regarding viability.

Keywords: euro, real exchange rates, monetary union, common currency

1. INTRODUCTION

The European Union (EU) states that its membership is open to any European country that meets its democratic, political and economic criteria. Over the last decade, the EU has successfully expanded its treaty membership from 15 to 27 member countries. The original EU member countries were Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. Joining the EU during 2004 were the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia. The most recent countries joining the EU during 2007 were Bulgaria, and Romania.

As part of the economic and monetary integration, the EU introduced the euro as its common currency for member countries that met specific economic criteria. In 1999, eleven of the fifteen EU countries met the economic criteria and adopted the euro as their national currency. These countries were Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxemburg, the Netherlands, Portugal, and Spain. Greece met the euro qualifications and adopted the euro one year later. Of the EU expansion countries, the countries that have met the economic criteria and adopted the euro are Slovenia in 2007, Cyprus and Malta in 2008, Slovakia in 2009 and Estonia in 2011. In total 17 of the 27 EU member countries have met the economic criteria and adopted the euro as their national currency.[1]

The recent recession and the on-going financial turmoil in Europe have called into question the viability of the euro for the 17 countries. Fiscal uncertainties in Greece, Spain and Portugal have stressed financial markets and in turn have created uncertainty regarding the sustainability of the euro. A question often asked is will the euro survive with all of the member countries or a subset of countries? In the spirit of the methodology proposed by Von Hagen-Neumann (1994), this study provides evidence to answer this question by examining the variability of real exchange rates and the persistence of real exchange rate shocks for the euro countries.

[1] An additional thirty-two countries and territories have unilaterally adopted or directly pegged their national currencies to the euro.

The contributions of this study are to analyze two aspects of real exchange rate shock variability. First, the study compares real exchange rate variability for the euro countries over two time periods using the Newey-West (1987) variance estimator to predict real exchange rate shocks. This approach estimates coefficients in the presence of heteroskedasticity and corrects for autocorrelation so that the error term reflects real exchange rate shocks. Second, the study compares the persistence of real exchange rate changes over the two periods using ARIMA to estimate the coefficients; The AR(1) coefficient reflects the persistence of real exchange rate shocks over time.

2. SURVEY OF LITERATURE

Researchers have been using the variability of real exchange rates to assess the viability of a monetary union for nearly thirty-five years. Vaubel (1976, 1978) was the first to argue that real exchange rate variability is an empirical means to identify whether countries should form a common currency area. He argued that countries should adopt a common currency only if real exchange rate adjustments were small. Meltzer (1986) and Mussa (1986) supported this conclusion by finding that a flexible nominal exchange rate is preferred in the presence of large real exchange rate variability. When real exchange rate variability is large, the costs associated with maintaining the common currency would be too great.

Von Hagen and Neumann (1994) examined real exchange rate variability of several European countries and used the relative magnitude of the real exchange rate variance to assess real exchange rate variability and adjustment. They found that although Austria, Belgium, France, Germany, Luxembourg and the Netherlands were good candidates for a common currency area, Denmark, England and Italy were not good candidates. The high variability of real exchange rates with Germany needed further adjustment before monetary union. More recently, Haug et al (2000) and Kutan and Zhou (2008) examined the fifteen original EU member country real exchange rates and confirmed these results. Further, Kutan and Zhou (2008) found that joining the Eurozone lead to a more stable real exchange rate and faster adjustment of real exchange rate shocks.

This paper contributes to the literature by estimating the real exchange variability and the persistence of real exchange rate shocks for the 17 euro member countries. The variability and adjustment time results are used to identify which countries are viable euro members and which countries are not. The remainder of the paper discusses the data, model and results of the study.

3. DATA AND MODEL

This study examines the variability and sustainability of the euro for the 17 EU member countries that have adopted the euro. The countries included in the study are Austria, Belgium, Cyprus, Estonia, Finland, France, Greece, Germany, Ireland, Italy, Luxembourg, Malta, The Netherlands, Portugal, Spain, Slovakia and Slovenia. The dataset are the monthly harmonized indices of consumer prices (HICP) for each country from January 1999 through November 2011, and where appropriate the nominal exchange rate for each country with the euro. All data was collected from the Eurostat database.

The Germany mark was used as the benchmark currency during the period leading up to the adoption of the euro in 1999. In this spirit, the real exchange rate shocks and adjustment period estimations are for the euro member countries relative to Germany. Let p_{it} be the logarithm of the monthly HICP for country i and let p_{Gt} be the logarithm of the monthly HICP for Germany. For the countries that adopted the euro beginning in 1999, the real exchange rate between country i and Germany is

$$q_{i,Gt} = p_{it} - p_{Gt}$$

where $q_{i,Gt}$ is the real exchange rate for country i currency per Germany at time t. For the countries that joined the euro after January 1999, let s_{it} be the logarithm of the nominal exchange rate between country i and the euro. The real exchange rate between country i and Germany is

$$Q_{i,€t} = p_{it} + s_{it} - p_{Gt}$$

where $Q_{i,€t}$ is the real exchange rate for country i currency per euro at time t.

Given the geographical, cultural, regulatory and economic differences, the HICP includes seasonal conditions that are likely different across the countries. To estimate the real exchange rates shocks, $q_{i,Gt}$ and $Q_{i,€t}$, are regressed on a set of twelve month dummies using the using the Newey-West (1987) variance estimator. This approach estimates coefficients in the presence of heteroskedasticity and corrects for autocorrelation so that the error term, $r^1_{iG,t}$, reflects real exchange rate shocks.

$\Delta Q_{i,€t} = \sum \beta D_m + r^1_{iG,t}$

As suggested by Von Hagen and Neumann, the variability of exchange rate changes may be different over a short-run period (monthly) and a longer-run period (quarterly). They argue that monthly seasonally adjusted real exchange rate changes likely measures short-run variability while the quarterly data measures long-run real exchange rate variability. To measure the long-run variability, the quarterly seasonally adjusted real exchange rate changes is calculated by adding three consecutive non-overlapping changes,

$r^3_{i€,t} = \sum_{m=0,2} \quad r^1_{iG,3t-m}$

To measure relative real exchange rate variability and changes in variability over time, the data are divided into two time periods. The first time period is January 1999 through December 2006. This time period covers the introduction of the euro and period leading up to the Great Recession. The second time period is January 2007 through November 2011. This time period covers the Great Recession and recent financial market turmoil.

4. RESULTS

4.1 Real Exchange Rate Variability results

Table 1 reports the monthly and quarterly seasonally adjusted real exchange rate variability results for the two time periods. Columns 1 and 2 of the monthly and quarterly results report the standard deviation or variability of the real exchange rate shocks. Column 3 of the monthly and quarterly results reports the test statistic for the null hypothesis that adopting the euro does not reduce the variability of real exchange rate shocks. The results in Column 3 report whether or not joining the euro zone has reduced real exchange rate variability. Except for Austria, Belgium, Estonia and Finland, the monthly results reported in Column 3 reject the null hypothesis. Joining the euro zone reduced short-run real exchange rate variability. The quarterly results measuring long-run variability support similar results for all countries with only Austria, Estonia and Finland failing to reject the null hypothesis. These results support the Kutan and Zhou (2008) conclusions that joining a monetary union reduces exchange rate variability for the majority of euro member countries.

For a common currency area to be viable, the variability of real exchange rate shocks should be similar across countries. A small standard deviation suggests stable real exchange rate shocks and a smaller cost for a country that gives up its nominal exchange rate flexibility. The results in Table 1 columns 1 and 2 show a wide range of variability among the countries.

For the period 1999 through 2006, Belgium, Finland and France had the lowest variability and were not significantly different from each other. This suggests that over this time period, Belgium, Finland, France and German experienced stable real exchange rate shocks. The real exchange rate variability for the remaining 13 countries is significantly higher than this core group. Cypress, Italy, Luxembourg, and The Netherlands were 2.5 times more variable than the core group. Estonia, Ireland, Malta, Portugal and Spain were approximately 3.6 times more variable than the core group. Greece, Slovakia and Slovenia were significantly more variable than all of the other countries. A higher variability for Slovakia and Slovenia was not unexpected since they were in transition from communist rule. The variability for Greece was nearly 5 times greater than the core countries suggesting that since joining the euro, the viability of Greece within the euro zone was in question.

For the period 2007 through 2011, Austria, France and The Netherlands had the lowest variability and were not significantly different from each other. Italy, Spain and Portugal were 2 times more variable than the second period core group but not significantly different from the first period core group. This suggests that Austria, France, Germany and The Netherlands experienced stable real exchange rate shocks during the Great Recession and recovery. Although Italy, Spain and Portugal are under fiscal pressure, they too experienced relatively stable real exchange rate shocks supporting the viability of their euro membership. The viability of Estonia, Greece, Ireland and Slovakia as euro zone members is questionable.

Except for France, Italy and Spain, the quarterly results indicate greater real exchange rate variability for the euro zone countries. This suggests that the loss of nominal exchange rate flexibility as an instrument for real exchange rate adjustment is high and the cost of euro membership is large for most countries.

4.2 Persistence of Real Exchange Rate Changes results

To measure the persistence of real shocks, the seasonally adjusted real exchange rate changes are regressed on the AR coefficients. The more economically integrated the economies, the less likely real exchange rate fluctuations will persist over time. A significantly positive autocorrelation coefficient shows that the real exchange rate changes do not tend to revert over time and therefore do not satisfy the conditions to have a viable currency area. A significantly negative autocorrelation coefficient signifies a self-reverting tendency of real exchange rate changes, indicating the convergence of the country's real exchange rate with Germany.

The results find that while Cypress, Finland and Slovenia had significantly negative autocorrelation coefficients during the first period, only Austria showed improving adjustment and a significantly negative autocorrelation during the second period. This suggests that the Austria and German economies were more integrated regionally and that real exchange rate changes did not persist. The results for Portugal, Spain and Slovakia showed improvement in adjustment and a negative autocorrelation coefficient although it was insignificant. Cypress and Italy adjustment time also improved although the coefficients were not negative or significant. France and Luxembourg show no significant change for adjustment.

The Belgium, Finland, Ireland, Malta and Slovenia results indicate a movement in the wrong direction. The adjustment time for real exchange rate shocks were slower during the second time period indicating that real exchange rate changes were more persistent. The Estonia, Greece and The Netherlands results show significantly positive autocorrelation coefficients indicating that the real exchange rate changes do not tend to revert over time. These results suggest greater regional integration is needed for these countries or their viability within the euro zone is in question.

4.3 Implications of the Results

For countries to form a common currency area that will be viable over time real exchange rate shock variability must be low and the adjustment to real exchange rate changes should be fast. High variability and slow adjustment to real exchange rate changes indicate that the countries are not good candidates for a common currency area. Chart 1 combines the previous results and classifies the countries by variability and adjustment time. The chart results indicate that Austria is the only country that meets the criteria of low variability and fast adjustment time. The results suggest that Cypress, France, Italy, Luxembourg, Portugal, Slovakia and Spain together with Austria and Germany form a viable and sustainable euro zone. The persistence of real exchange rate changes and slow adjustment time for The Netherlands, Belgium and Finland indicate that the countries do not satisfy the criteria for a viable common currency area. Since Estonia, Malta and Slovenia only recently joined the euro zone and economic conditions have been weak, it is too early to conclude that their euro zone membership is not viable. If they had not already joined the euro zone, the results suggest that membership would not be advisable at this time. High variability and slow adjustment time suggest that Greece and Ireland should exit the euro zone. The cost associated with relinquishing nominal exchange rate flexibility as an instrument for real exchange rate adjustment between countries is great. Without greater integration, euro zone membership for Greece and Ireland is not viable.

5. Conclusion

This paper estimated the real exchange rate variability and the adjustment time for real exchange rate changes for the 17 European Union euro member countries to assess the viability of the euro. A common currency area is viable as long as the real exchange rate variability is low and adjustment time for real exchange rate changes is fast. Using Germany as the benchmark country, the results support euro zone membership for Austria, Cypress, France, Germany, Italy, Luxembourg, Portugal, Slovakia and Spain. These countries have relatively low real exchange rate variability and a fast or improving adjustment time for real exchange rate shocks. The persistence of real exchange rate changes and slow adjustment times suggest that viability of euro zone membership for Belgium, The Netherlands, Finland, Malta and Slovenia requires greater integration. Without improvements, the persistence of the real exchange rate shocks may lead to distortions in the markets that could be reduced with flexible exchange rate. The results also indicate that the costs associated with euro zone membership are great for Greece and Ireland, and the viability of their membership is in question. The results support the conclusion that Greece and Ireland should consider dropping out of the euro zone. Although the results regarding viability for Estonia are also questionable, since Estonia only adopted the euro on January 1, 2011, the time frame is too short to infer any conclusions regarding viability.

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TABLE 1: Standard deviation and constant covariance test of real exchange rate shocks

Country	Monthly results				Quarterly results		
	1999-2006	2007-2011	Constant covariance t-statistic		1999-2006	2007-2011	Constant covariance t-statistic
Austria	7	7	0.9445		61	65	1.210***
Belgium	11	12	0.8993		11	11	1.101
Cyprus	31	15	4.393***		33	13	6.496***
Estonia	45	39	1.3354		46	41	1.223
Finland	13	14	0.8128		13	13	0.9129
France	11	3	11.219***		11	3	11.894***
Greece	53	26	4.386***		55	23	5.593***
Ireland	47	23	4.234***		49	20	5.751***
Italy	21	7	8.521***		21	6	10.914***
Luxembourg	30	13	5.059***		30	12	6.297***
Malta	44	18	5.905***		340	198	2.948***
The Netherlands	29	4	61.175***		262	48	30.133***
Portugal	37	6	39.038***		333	68	21.129***
Spain	38	8	21.379***		38	7	29.074***
Slovakia	67	55	2.555***		68	47	2.114*
Slovenia	168	16	108.98***		173	19	18.068***

* Reject the null hypothesis at 10 percent
** Reject the null hypothesis at 5 percent
*** Reject the null hypothesis at 1 percent

TABLE 2: First-order autocorrelation of monthly real exchange rate changes

Country	1999-2006		2007-2011	
	Average AR(1) Coefficient	z-test	Average AR(1) Coefficient	z-test
Austria	-.244	-1.01	-.817	-2.79***
Belgium	.481	1.62	.683	3.48***
Cyprus	-.920	-10.3***	.669	1.52
Estonia	.899	6.79***	.906	6.84***
Finland	-.379	-0.42	.562	1.68*
France	.046	0.12	.096	0.31
Greece	.634	2.60***	.883	7.11***
Ireland	.481	0.53	.836	4.31***
Italy	.498	2.07**	.184	0.76
Luxembourg	.588	1.94*	.611	1.87*
Malta	.476	1.32	.675	2.77***
The Netherlands	.865	9.28***	.785	4.53***
Portugal	.843	2.45**	-.141	-0.33
Spain	.941	2.03**	-.104	-0.20
Slovakia	.985	29.57***	-.200	-0.25
Slovenia	-.960	-20.9***	.065	0.04

* Reject the null hypothesis at 10 percent
** Reject the null hypothesis at 5 percent
*** Reject the null hypothesis at 1 percent

Chart 1: Classification of countries based upon variability and adjustment time

Adjustment time	Variability		
	Low	Medium	High
Fast	Austria		
Improving	Italy Portugal Spain	Cypress	Slovakia
No Change	France	Luxembourg	
Slower		Belgium Finland Malta Slovenia	
Slow	The Netherlands		Estonia Greece Ireland