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# A NEW VIEW OF THE VOLATILITY OF THE EURO<sup>1</sup>

## UN NUEVO PUNTO DE VISTA ACERCA DE LA VOLATILIDAD DEL EURO

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### ABSTRACT

The euro was officially launched as the national currency of eleven member countries on January 4, 1999 after decades of debate and discussion. [Greece's entry was delayed.] The member countries established the euro for several reasons, such as ease of use for traveling throughout Europe, reduced transactions costs and increased stability in the currency's value. A more stable currency yields enormous economic benefit to the member countries, typically in the forms of lower risk and enhanced investor confidence. Subsequently, an additional ten other countries have conditionally adopted the euro realizing the benefits of doing so.

In this paper, the authors ask if, in fact, the euro has proven to be a stable currency compared to today's most heavily traded currencies. Second, they seek to confirm or refute the charge that the euro is driven by pre-euro German deutschmark values. Lastly, the authors compare the volatility of the euro in its transitional phase to a more recent phase.

Keywords: euro, currency volatility, risk.

### RESUMEN

El euro fue lanzado oficialmente como la moneda nacional de los once países miembros el 4 de enero de 1999, después de décadas de debate y discusión. [La entrada de Grecia se retrasó.] Los países miembros establecieron el euro por varias razones, tales como facilidad de uso para viajar por toda Europa, la reducción de los costos de transacción y el aumento de la estabilidad en el valor de la moneda. Una moneda más estable produjo un enorme beneficio económico para los países miembros, por lo general, en forma de menor riesgo y una mayor confianza de los inversionistas. Posteriormente, otros diez países han adoptado el euro condicionalmente a la obtención de los beneficios de hacerlo.

En este trabajo, los autores preguntan si, de hecho, el euro ha demostrado ser una moneda estable en comparación con otras de las más utilizadas monedas. En segundo lugar, tratan de confirmar o refutar la acusación de que el euro está impulsado por la validez del pre-euro marco alemán. Por último, los autores comparan la volatilidad del euro en su fase de transición con una fase más reciente.

Palabras clave: euro, volatilidad de divisa, riesgo.

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## INTRODUCTION

After years of planning and negotiation, on January 1, 1999, the euro began 'transitional implementation' as the official currency of its eleven 'member' nations. [Greece's initial entry was delayed because of fiscal deficiencies.] The transitional period ended on January 2, 2002, when the euro was officially adopted by those countries. The official adoption of the euro by these member nations was the culmination of years of negotiation and planning by European economic powers.

The euro's roots can be traced back to the Treaty of Rome in 1957. The treaty's purpose was to enhance prosperity among European countries and to strengthen the economic union among them. The Economic and Monetary Union (EMU) was established in the 1970s when European 'common market' countries realized the advantages of a single European currency, particularly in light of how much commerce and trading existed among European nations. The Single European Act (1986) was also a contributing factor to the establishment of the euro.

Meetings and discussions continued to mold the shape of the euro until this 'European Council' signed the Maastricht Treaty in February 1992. Membership in this union required that member countries adhere to the following criteria:

- Budget deficits must not exceed 3% of GDP
- Debt/GDP must not exceed 60%
- Inflation rate must be within 1.5% of the lowest three inflation rates in the 'union'
- Long term interest rates must be within 2% of the lowest three long term interest rates in the 'union'
- There can be no extraordinary nominal exchange rate movements for two years outside of margins the union set. (Schwartz 2004a)

One hypothesis proposes that as the number of euro users grows, the volatility should decline, if for no other reason than numbers. To illustrate the increase in the number of users, a brief identification of member countries' entrance to the union appears in order.

The original members were Austria, Belgium, Finland, France, Holland, Ireland, Italy, Luxembourg, Portugal and Spain. These

countries officially adopted the euro in December of 1998. Greece's entry was delayed because of fiscal issues until June of 2000. Slovenia joined in July of 2006, and Cyprus and Malta joined in July of 2007. As of January 1, 2008, there were 317 million users of the euro, a number which now surpasses those of the US dollar.

But the growth doesn't stop there. Below is the anticipated schedule of remaining countries whose currencies are on track to 'migrate' to the euro

- Slovakia, January 2009;
- Lithuania, January 2010;
- Estonia, January 2011;
- Bulgaria, Poland, the Czech Republic, and Hungary, January 2012; and
- Romania, January 2014

This will bring the total of users to nearly 500 million by the end of the migrations. A referendum in Denmark failed, Sweden's fiscal deficiencies have kept it out and Britain decided against euro adoption.

Since the euro's inception, regulatory oversight responsibility for the euro's stability has resided with the European Central Bank (ECB), an organization somewhat analogous to the Federal Reserve in the U. S. The main difference, according to Trichet (2005) is that the ECB "...has an explicit, quantitative definition of price stability and performs a detailed and explicit cross-check between its economic analysis and detailed monetary analysis" (p. 421). However, the main goal of the ECB is to ensure the stability in the price of the euro. The central theme of this paper is to judge how successful the ECB has been in maintaining the stability of the euro to date.

The advantages of euro price stability include:

- Exchange costs decline
- Exchange rate volatility declines
- Trade is simplified
- Bookkeeping and Accounting is simplified, since no conversions need be done.

There are some disadvantages of a single currency, the two most prominent of which, are related. First, by joining such a union, a country essentially surrenders its fiscal autonomy. Where U. S. Federal Reserve may undertake monetary policy activity to, for example, slow inflation, individual 'euro' countries individually have no



such freedom. Schwartz (2004b) stated that such monetary decisions are made centrally by the ECB whose goal is to benefit the union itself, not individual countries. The second disadvantage is that fiscal problems in larger countries may have negative repercussions in smaller countries, such as Portugal, because they use the same currency. Germany's and France's recessions of the early 2000s arguably had a negative effect on the euro's value, which negatively impacted all member countries.

Though there are drawbacks to a single currency, the benefits for some countries far outweigh the costs. Trichet (2005) noted that ten additional countries, mostly from eastern and southern Europe, are in line to adopt the euro. The new members have witnessed the positive impact euro adoption has yielded to its members, particularly lower trade costs and increases in competition. He also says that the new members will be allowed to officially join when convergence is achieved, trade patterns adequately change and capital and labor flows are sufficient.

To assist in the goal of stability, the member countries established a Stability and Growth Pact (SGP) which set macroeconomic targets. Stability cannot, of course, be guaranteed, but adherence to the targets by member countries can help to ensure fiscal discipline, since violators are penalized. With the establishment of the SGP, two criteria from the Maastricht treaty were retained:

- Budget deficits must not exceed 3% of GDP
- Debt/GDP must not exceed 60%.

However, there are several criticisms of the SGP, stating that the current rules do not lend themselves to stability or that the rules show favoritism.

Tran (2003) pointed out that Germany and France violated the budget deficit rule from 2001-2003 because of recessions and were allowed to break the rule in 2004, raising the ire of smaller countries such as Portugal and Ireland who have, in large measure, abided by the rules. He also feels that more flexibility is needed and that Germany and France wield too much power in the SGP. Large countries criticize SGP, even though the larger countries appear to be the primary offenders of the budget deficit rule.

Despite the criticisms of SGP, the key issue is whether or not the SGP has succeeded in its goal of stability. The answer to this issue is the main point of this paper. Specifically, the key questions posed in this paper are

- Has the euro actually been stable, compared to other currencies since its adoption?
- Is the euro similar in volatility to the German deutschmark from prior periods?
- Has the euro been more or less volatile since the transitional period?

## **HISTORICAL BACKGROUND IN RELATED LITERATURE**

Some of the literature focused on exchange rate volatility over extremely short periods of time, such as either daily or hourly. Since the authors viewed daily or hourly observations, this group of studies resulted in high frequency returns that are characterized in the literature as 'fat tailed' where the preponderance of the observations lies in the extremes values of the distribution.

One of the earliest studies of fat tailed distributions was one by Koedijk and Kool (1992) who discovered the distribution while analyzing returns of seven Eastern European countries' currencies from 1955-1990. Later, Andersen et al. (2000) found that 'fat tails' can be reduced when standardized by certain estimated volatilities. Using different models, these authors suggested methods of forecasting volatility in exchange rates. Forsberg and Bollerslev (2002) found that the distribution of daily returns is about normal when the returns are standardized by realized returns.

Mussa (2005) concluded that the short term volatility of the euro since 1999 is virtually unchanged against the U. S. dollar, compared to the euro's 'legacy' currencies. He attributed the value swings to changes in macroeconomic fundamentals.

Cotter (2005) analyzed very short term exchange returns up until 1999 and found that the euro's volatility was similar (during its transitional phase) to the Japanese yen, British pound, Swiss franc and South African rand, the four currencies used in this analysis. In addition, he found that the probabilities of extreme returns of these groups to be very similar. Of particular interest in this analysis is the strong correlation he discovered between the euro and the German



deutschmark, which appears to confirm the contention that the deutschmark is a dominant driver of euro valuation.

These studies primarily utilized the GARCH (Generalized Autoregressive Conditional Heteroscedasticity) method of calculating the variance of time series data. The GARCH method is particularly effective in the types of analyses mentioned thus far - studies of fat tailed distributions. The statistical process bears mentioning at this juncture, as the authors have deviated, as some others identified below, from this approach to one of analysis of the variances.

Other studies viewed longer terms in the return calculations, as does this analysis. Therefore the statistical processes utilized in the following studies do not typically utilize GARCH. The next group of studies implements a myriad of statistical methods which will not be detailed here. What is important is that the following group of studies views a longer term with the same intent - to identify reasons for currency value fluctuations.

Lobo and Tufte (1998) found that the political affiliation of the President/Congress affected currency volatility and that volatility was more pronounced in election years because of the inherent uncertainty. This uncertainty is not dissimilar to reactions expected in equity markets during those periods.

Detken and Hartmann (2002) attributed euro volatility to the fact that exchange swap trading is significantly less than pre-euro (or legacy) currencies. Part of this phenomenon can be explained by "... the elimination of dollar swaps meant to hedge currency exchange risk between currencies now subsumed by the euro" (p.554).

Two studies indicated that public statements and announcements affected volatility, as investor perceptions changed. First, Jansen and Haan (2005) found that announcements on monetary policy and euro valuation by either the ECB or its officials significantly impacted euro-dollar exchange rate means and volatilities in much the same way that public announcements affect prices of equity securities. Bauwens et al. (2005) corroborated Jansen and Haan's findings also found that scheduled and unscheduled news announcements affected the euro-dollar exchange rate. Where Bauwens et al.'s study differed is their finding that prior to scheduled announcements, volatility was pronounced as

investors' anticipation of these announcement caused uncertainty in currency markets.

Two studies support the contention that the euro may be 'deutschmark driven', an issue the authors explore in Hypothesis 2. Detken and Hartmann (2002) found that [in global spot foreign exchange markets] "... the euro's relative role closely resembles that of the deutschmark before EMU and features a dominant position in spot trading ... in Nordic and several Eastern European countries." A secondary finding of Jansen and Haan (2005) was that the Bundesbank is the center of much media coverage, adding credibility to the theory that the euro could be 'deutschmark domination'.

Black and McMillan (2004) found increased convergence among euro economies because of spillover effects, using a model that captured short and long term volatility movement.

Kitamura (2007) also noted these spillover effects in his current working paper. He found a high positive correlation in the movement of the euro with the Swiss franc and the British pound, two currencies studied herein. He found that any shock in return volatility of the euro similarly affected the two currencies. In addition, any euro news announcements similarly impact the two currencies. He attributed the 'co-movement' to "...the common political and economic backgrounds which the euro countries, the UK and Switzerland share due to their geographic proximity" (p. 10).

He further indicated that, though the correlation of each currency to the euro is high, the Swiss franc's correlation is higher than that of the pound. This co-movement likely explains these countries' preference for fiscal autonomy over euro adoption.

## Hypotheses

Based on the preceding discussion, the following the research hypotheses result:  $H_0$  designates the research hypothesis,  $H_a$  designates the alternative hypothesis.

- |     |  |
|-----|--|
| Ho1 | There is no significant difference in volatility among the euro and the Swiss franc, the South African rand, the British pound and the Japanese yen over the period 1999-2005. |
| Ha1 | There is a significant difference in volatility among the euro and the   |



- Swiss franc, the South African rand, the British pound and the Japanese yen over the period 1999-2005.
- Ho2 There is no significant difference in volatility among the estimated value of the euro and the Swiss franc, the South African rand, the British pound, the Japanese yen and the German deutschmark over the period 1995-1998.
- Ha2 There is no significant difference in volatility among the estimated value of the euro and the Swiss franc, the South African rand, the British pound, the Japanese yen and the German deutschmark over the period 1995-1998.
- Ho3 There is not a significant difference in volatility in the euro between the periods 1999-2001 and 2002-2004.
- Ha3 There is a significant difference in volatility in the euro between the periods 1999-2001 and 2002-2004.
- volatility, the authors propose weekly observations to accommodate the smoothing process. As a result, the exchange rates were captured every Monday in each year analyzed. If financial markets were closed on Monday, Tuesday's data were used.
- The first hypothesis compares the volatility (measured by the standard error and the long term variance) of the euro to the volatility of the Swiss franc, the South African rand, the British pound and the Japanese yen over the period 1999-2005. These currencies are those used by Cotter. Therefore, the results will either confirm or refute the findings of Cotter (2005), who found little difference in volatility, though it must be noted that his data covered a longer time period, ending in 2004. However, one would expect that, as the number of users grows, the volatility of the euro should decline. Given that the time period here is somewhat different, more focused around euro adoption, it would appear that the euro should be more stable than the other 'standalone' currencies, if, for no other reason, the stability inherent in more users.

## RESEARCH METHODOLOGY

The aforementioned studies typically employ rigorous statistical methods and this certainly may be warranted. Cotter's (2005) 'benchmark' is the most recent of several which uses the GARCH method of calculating the variance of time series data. The GARCH method is particularly of value in situations where either the distribution of the data is 'fat tailed' (most of the observations lie in the extreme values) or there is inherent volatility in the data. In addition to Cotter (2005), other recent analyses using the GARCH method are those by Andersen et al. (2000), Forsberg and Bollerslev (2002), and Koedijk and Kool (1992).

The authors propose less frequent observations in measuring volatility in an effort to 'smooth out' fluctuations inherent in such short time increments. Instead of analyzing daily or hourly

The second hypothesis compares the volatility (measured by the standard error and the long term variance) of the deutschmark from 1995-1998 to that of the euro from 1999-2002. The results of this hypothesis will either confirm or refute Cotter's analysis, which found significant similarities in volatilities of the two groups. Detken and Hartmann (2002) also found similar behavior between euro and pre-euro deutschmark valuations. Because the preponderance of the literature finds similarities, it is expected that the euro will show the same behavior as the legacy deutschmark.

There is no known academic precedent set for the third hypothesis which compared the volatility of the euro in the transitional phase to an equal period since (1999- 2001 vs. 2002-2004). As in the first hypothesis, the expectation is that, as the number of users grows, the volatility will decline.

**RESULTS**

## Hypothesis 1

Table 1

	Coefficient	Std Error	Long run avg variance	Z statistic
British Pound	.3411	70.45	1.7455	.0048
South African Rand	2.2826	423.0437	7.0702	.0054
Japanese Yen	53.902	379802	125.612	.00014
Swiss Franc	.406	31.06	1.6871	.0131
Euro	.6071	15.1555	1.467	.0406

The results suggest that the volatility of the euro is not significantly different than the Swiss franc and the British pound. However, the euro is significantly more stable than either the Japanese yen or the South African rand. Considering that, as of 2005, 19.4 % (Trichet, 2005) of the world's population uses the euro, the results are not surprising. Over the period of the study, the euro has garnered the confidence of the

international investment community, as evidenced by the burgeoning number of countries in line to adopt the euro. Not only is this an expected result, but partially corroborates Cotter's results (2005) which were that there was no significant difference in volatility among the euro and the currencies used in this analysis. The null hypothesis cannot be completely accepted in its entirety, and is, therefore, rejected.

## Hypothesis 2

Table 2

	Coefficient	Std Error	Long run avg variance	Z statistic
German Deutschmark	.3473	72.2541	1.7341	.0048
Early Euro	.6831	18.4796	1.433	.037

Somewhat surprisingly, the euro is more stable than the deutschmark over the affected periods, potentially refuting the claim that the deutschmark drives the value of the euro. The results are also inconsistent with findings of Cotter (2005). However, the results appear

somewhat intuitive from the standpoint that the value of the euro is comprised of more countries, implying an inherent level of stability provided by a large number of users. Therefore, the null hypothesis in number 2 cannot be rejected.



Hypothesis 3

Table 3

	Coefficient	Std Error variance	Long run avg	Z statistic
Late Euro	..05603	19.759	1.5235	.0048
Early Euro	.6831	18.4796	1.433	.037

The results from hypothesis 3 suggest little difference in volatility. Though the results suggest that the euro was more stable in early years, the difference in volatility is insignificant. That leads the authors to conclude that the impact thus far of adding additional countries is insignificant. The null hypothesis in 3 is therefore rejected.

**SUMMARY AND IMPLICATIONS**

The purpose of this paper was to explore the volatility of the euro compared to other highly used currencies in the world. Though there is an extensive body of literature on this subject, this study is differentiated from others from several perspectives. First, a simpler statistical approach is proposed. Much previous analysis focused on exchange rate changes for very short periods of time (such as hourly) using GARCH, a statistical approach conducive to analyses of 'fat tailed' distributions or inordinately volatile data. Instead the authors simply view the longer run variance of the data, given that weekly data are less erratic than hourly. Relatedly, the second differentiation of this study is, though they concede that measurement of hourly changes will result in substantial volatility, the authors chose to analyze weekly changes in rates to 'smooth out' that inherent volatility, making the variance analysis approach appropriate.

Though Cotter (2005) compared the euro to the Swiss franc, the South African rand, the British pound and the Japanese yen, there is no known study which analyzes the hypotheses proposed herein, that is comparisons of

- The difference in those currencies' volatilities from 1999-2005
- The difference in estimated value of the euro the German deutschmark and the other four currencies from 1995-1998.

- Volatility in the euro between the periods 1999-2001 and 2002-2004.

The authors discovered a mixed bag of results compared to the existing body of literature of euro's volatility. On the one hand, the results herein suggest that the euro's volatility is essentially similar to some of the world's most utilized currencies and even more stable than others. These results are similar to those in a study done by Cotter (2005), which to date most closely resembles the intent of this paper. On the other, the authors found that the euro tends to be much less volatile than the deutschmark. These results, though inconsistent with Cotter's findings, can be explained by the fact that 19.4% (as of the time of this study) of the world uses the euro, possibly indicating that there should be some innate stability, if for no other reason, number of users. Lastly, the results suggest very little difference in volatility between the transitional and later stages.

**Limitations**

The simpler statistical approach may be considered by some to be a limitation. But the authors submit that, due to the longer term view of volatility, the method used herein is sufficient.

Other currencies could have been used in the comparisons, though Cotter (2005) appeared to pick among the most stable currencies in the world.

**FUTURE RESEARCH**

In future research, constant monitoring of the euro is a likely goal of the ECB, particularly to answer criticisms that

- Germany and France have been allowed 'forgiveness' on fiscal guidelines not offered





- to all member nations
- The rules favor countries with high debt/GDP ratios
- There needs to be more flexibility in fiscal guidelines.

There are currently several countries evaluating the prudence of euro adoption. A recent referendum in Denmark failed. Sweden's status is uncertain, as that country has experienced fiscal deficiencies that currently disqualify it from membership. Britain decided against euro adoption. However, as situations change, all non member euro countries should constantly monitor the relative movement of their own currency against the euro. Therefore, the evaluation of non member countries' benefits will always be a worthy topic of research. The only postscript to this statement is contained in the findings of Kitamura's 2007 working paper. Britain and Switzerland are not likely to adopt the euro because his study found that movements in the euro are highly and positively correlated to movements in these two countries, diminishing their incentives to abandon fiscal autonomy for euro adoption.

Also, other countries are in line to adopt the euro. As of January 2008, there are 317 million users worldwide in 15 member countries. Eight more are scheduled to join by 2014 which could bring total euro users to over 500 million by the time the migrations are complete. As the number of users continues to increase, intuitively, it would appear that, as the number of users continues to swell, stability would also rise, if, for no other reason than the volumes make the euro less susceptible to violent swings in value. Analyzing the changes in volatility over even a longer period of time (now that two more years' data are available) appears worthy of future research efforts.

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