DID THE AUSTRIAN FINANCIAL MARKET BECOME MORE INTEGRATED WITH THE GERMAN MARKET AFTER EU ACCESSION?

1. Introduction

During 1994 the Austrian voters provided a majority of 66% support for the EU membership in a general referendum. Thus, Austria became officially a member of EU on January 1, 1995. The main goal of EU membership has been claimed to be enhanced economic efficiency via increasing returns to scale as a result of complete mobility, of both capital and labor, and a complete access to a larger market. For an overall economic evaluation of Austrian accession to the EU followed by accession to the Economic and Monetary Union (EMU) the interested reader is referred to Mooslechner (2005)[1]. The aim of this paper is to investigate whether the Austrian financial market became more integrated with the German market after joining EU. Previous studies that have examined empirically the issue of financial market integration usually make use of the correlation coefficient between market returns. However, Forbes and Rigobon (2002) have showed that this approach is not reliable if correlation coefficients are conditional on market volatility. Given the importance of the topic of financial integration and the potential doubts on the estimates of correlation, this paper makes use of a new method, which is robust to non-normality and time-varying volatility to reinvestigate the issue. This method, which is based on case-wise bootstrapping, can be used for both estimating the underlying parameters as well as testing the significance of these estimated parameters.

The reminder of the paper proceeds as follows. Section 2 represents the econometric methodology. Section 3 describes the data. The empirical results are provided in Section 4. The last section presents summary and conclusions.

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[1] For a historical evaluation of asset prices in Austria see Frey and Koucher (1999).

2. Methodology

To test whether integration has increased between Austria and Germany, we estimate the following regression equation:

$$R_{AUS,t} = \alpha_1 + \alpha_2 D_t + \beta_1 R_{GER,t} + \beta_2 D_t R_{GER,t} + u_t \tag{1}$$

where

$R_{AUS,t}$ = returns for the Austrian market.

$R_{GER,t}$ = returns for the German market.

D_t = a binary variable that is equal to zero for the period before EU membership and it takes value one for $t \geq 1995{:}\ M1$, which is the period that Austria became an official member of the EU.

u_t = a stochastic error term, which might not be homoscedastic or normally distributed.

A bootstrap method that is robust to the presence of a heteroscedastic and non-normal error term has been suggested by Hatemi-J and Hacker (2005). Since financial data is usually heteroscedastic and non-normal this method will be used to estimate and to test the significance of the estimated coefficients α_1, α_2, β_1 and β_2. It should be pointed out that the intercept coefficient α_1 represents the premium above the average German rate required by Austrian investors to invest in Germany. Thus, the change in the premium due to EU membership is captured by α_2. The null hypothesis for testing a change in premium due to EU membership is:

$$H_0 : \alpha_2 = 0 \tag{2}$$

If the null is rejected it means a change in the premium has occurred. The coefficient β_1 estimates the regression correlation between returns in the two markets and it is a measure of German systematic risk for Austrian investors investing in Germany. The β_2 parameter embodies the change in correlation due to the potential break in the data arising from the EU membership. Thus, the null hypothesis whether Austrian EU membership has resulted in more integration of the Austrian market with the German market is formulated by the following null hypothesis:

$$H_0 : \beta_2 = 0 \tag{3}$$

If the null is rejected it indicates a change in the correlation between the two financial markets.

Equation (1) can be represented in matrix format as the following:

$$Y = BX + u \tag{4}$$

where

$$Y = \begin{bmatrix} R_{AUS,1} \\ R_{AUS,2} \\ \vdots \\ R_{AUS,T} \end{bmatrix} \qquad \text{a } (T \times 1) \text{ vector,}$$

$$X = \begin{bmatrix} 1 & R_{GER,1} & D_1 & D_1 R_{GER,1} \\ 1 & R_{GER,2} & D_2 & D_2 R_{GER,2} \\ \vdots & \vdots & \vdots & \vdots \\ 1 & R_{GER,T} & D_T & D_T R_{GER,T} \end{bmatrix} \qquad \text{a } (T \times 4) \text{ matrix,}$$

and

$$B = [\alpha_1 \quad \alpha_2 \quad \beta_1 \quad \beta_2] \qquad \text{a } (4 \times 1) \text{ vector.}$$

The ordinary least squares (OLS) estimator for the parameter vector can be obtained by estimating the following:

$$\hat{B} = (X'X)^{-1} X'Y . \tag{5}$$

Hatemi-J and Hacker (2005) suggest the subsequent steps in calculating the casewise bootstrap regression coefficients:

1. Resample with replacement Y and X, and denote them Y^* and X^*. That is:
   $Y^*=\{Y_1^*, Y_2^*, \ldots, Y_n^*\}$, $Y_i^* \in Y \forall i$. Where $i=1,\ldots,n$ and n is the bootstrap sample size.
   $X^*=\{X_1^*, X_2^*, \ldots, X_n^*\}$, $X_i^* \in X \forall i$. Where $i=1,\ldots,n$.
2. Calculate the parameter vector by using Y^* and X^* and denote it $\hat{B}_b$.
   $$\hat{B}_b = \left(X^{*\prime} X^* \right)^{-1} X^{*\prime} Y^*$$
3. Repeat steps one and two N times. N is the number of simulations, which is 10000 in our case.
4. Calculate the casewise bootstrap coefficient vector ($\hat{B}^*$) as the following:
   $$\hat{B}^* = \frac{\sum_{j=1}^{N} \hat{B}_b}{N} .$$

The null hypothesis of the significance of each element of $\hat{B}^*$ is tested by using the same case-resampling technique. For example, the $H_0: \alpha_2 = 0$ is tested in the following way. First, we order the calculated values for $\hat{\alpha}_2^*$. The bootstrapped p-value for $\hat{\alpha}_2$ is then obtained as follows. If the estimated median for $\hat{\alpha}_2^*$ undertakes a positive value, the p-value is calculated as the proportion of elements in the bootstrap distribution for $\hat{\alpha}_2^*$ that are negative plus those that are greater than twice the median. If the estimated median for $\hat{\alpha}_2^*$ undertakes a negative value, the p-value is calculated as the proportion of elements in the bootstrap distribution for $\hat{\alpha}_2^*$ that are positive plus the proportion of elements in $\hat{\alpha}_2^*$ that are less than twice the median. The cutoff point of twice the median value of $\hat{\alpha}_2^*$ provides p-values that are comparable to those symmetric two-sided tests in a traditional hypothesis testing according to Hatemi-J and Hacker (2005). The p-value for other coefficients is calculated in a similar way. The simulations are carried out by using a program code in GAUSS produced by Hacker and Hatemi-J (2009), which is available online.

3. The data description

The share price indexes for Austria and Germany are obtained from *International Financial Statistics* of the International Moneraty Fund (CD-ROM). The sample period is 1998:M1-2007:M1. The logarithmic returns for each market are calculated in order to have continuous returns. Tests for unit roots were also conducted. The results, not reported, reveal that each variable is stationary. Furthermore, we tested for normality and ARCH effects. The results showed that each variable is non-normal and ARCH effects exist. Thus, making use of the case-wise bootstrap method seems to be necessary in order to have robust results.

4. The results

The estimation results for risk premium (α) as well as the measure of German systematic risk for Austrian investors investing in Germany (β) are presented in Table 1. These results reveal that the premium is positive but not statistically significant as represented by the estimated value for α_1.

TABLE 1 - *The Results Based on the Case-resampling Bootstrap Method*

Intercept (α_1)	Change in Intercept (α_2)	Slope (β_1)	Change in Slope (β_2)
0.0022	0.0036	0.502	-0.0647
(0.6098)	(0.4437)	(0.0001)*	(0.4681)

Notes:
1. The parameters are also estimated by Hatemi-J and Hacker (2005) case-resampling bootstrap method.
2. The p-values based on the case-wise bootstrap approach are presented in the parentheses.
3. The notation * indicates that the null hypothesis can be rejected at the 1% level of significance.

Since the estimate for the α_2 is not statistically significant then no change in the premium is required by the investors. Before EU membership there is a statistically significant and positive regression correlation between the Austrian and the German markets (see the estimated value for β_1). However, the results do not support the null hypothesis that the Austrian market has become more integrated with the German market due to the Austrian membership in EU that took place in January 1995. This is the case because the change in the regression slope represented by β_2 is not statistically significant. One potential explanation for this finding might be the home-bias hypothesis. According to French and Poterba (1991) as well as Tesar and Werner (1995) the home-bias represents a situation in which the investors hold most of their portfolios in domestic assets although they could accomplish a better mean-variance trade-off if they diversified internationally. It is also possible that the Austrian market was already integrated with the German market even previous to the EU membership to the extent that the investors found optimal.

There are two potential implications of our empirical findings. Since the correlation between the two markets is significant and less than one (and it has not changed because of the EU membership) we could conclude that there are diversification possibilities for the Austrian investors to choose German market as an egg in another basket. This result is also consistent with the empirical findings by Kempa and Nelles (2001). By applying an international capital asset pricing model for fifteen European countries including Austria the authors report that diversification possibilities still exist. It should be mentioned that the exchange rate risk is a relevant issue to take into account when investors consider diversifying internationally. However, since both Germany and Austria use the same currency there is no exchange risk involved. Another implication of our significant correlation finding might be an indication that the Austrian market is not informationally efficient with regard to the neighboring country's financial market.

5. Conclusions

The purpose of this paper has been to empirically investigate whether the Austrian financial market has become more integrated with the German market after the Austrian accession to the EU in 1995. Since the underlying monthly data is non-normal with time varying volatility we utilize a robust method developed recently by Hatemi-J and Hacker (2005). This method is expected to be more accurate compared to other existing methods in the literature because it is insensitive to the presence of non-normality and heteroscedasticity in the error term. It is found that the Austrian market after the EU membership has not become more integrated with the neighboring country. This result might be explained by the home biased hypothesis. Our findings have two financial economic implications. Firstly, the diversification possibilities for the Austrian investors to invest in Germany exist even after the accession to the EU. Secondly, the significant relation between the two markets might indicate that the Austrian market is not informationally efficient with regard to the German financial market. Thus, the opportunity for abnormal returns might exist.

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ABSTRACT

This paper empirically investigates whether the Austrian EU membership in 1995 resulted in more financial integration with Germany. A method recently developed in the literature that is robust to non-normality and time-varying volatility is used. It is found that EU membership has not resulted in more integration between the two markets. Additionally, the correlation between the markets is still positive and statistically significant. The financial economic implications of the empirical findings are explained in the main text.

Keywords: Financial Integration, Austria, Germany, EU

JEL Classifications: C22, F36, G15

RIASSUNTO

Il mercato finanziario austriaco si è integrato maggiormente con quello tedesco dopo l'adesione all'Unione europea?

Questo studio presenta un'analisi empirica sulla questione se l'adesione austriaca all'Unione europea del 1995 si è tramutata in un'integrazione finanziaria maggiore con la Germania. Viene utilizzato un metodo robusto alla non-normalità e alla volatilità *time-varying*. Non vi sono evidenze che l'adesione all'Unione europea si sia tramutata in una maggiore integrazione tra i due mercati. Nel lavoro vengono illustrate le implicazioni economico-finanziarie dei risultati empirici ottenuti.