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# THE IMMEDIATE IMPACT OF EURO ON INTRA-REGIONAL TRADE: AN EVENT STUDY APPROACH

RUHUL SALIM AND SHAHRIAR KABIR*

*Curtin University of Technology*

This article applies the event study approach to assess the immediate impact of Euro on intra-regional trade among the European Union (EU) members. Here, the post-Euro intra-regional trade has been compared with the pre-Euro intra-regional trade, while the implementation of Euro has been considered as the event. The results show that the trade enhancement at the immediate post-event period is 1.2 times of the immediate pre-event period for France, Germany, Italy and Spain, while immediate trade enhancement for all Euro-members is 1.14 times. The estimation has been statistically justified by using the gravity model. This study thus provides the first empirical evidence on the assessment of currency union impact on intra-regional trade by using the alternative method, the event study approach.

*Keywords*: Currency Union, Intra-Regional Trade, Event Study, Trade Deepening
*JEL classification*: R12, F14, C14, C33, F17

## 1. INTRODUCTION

After a long journey of the European cooperation and a successful economic integration the single currency, Euro, was launched in 1999 in the European Union. The European Central Bank (ECB) was established in the same year and it was given total responsibility for the monetary policy throughout the Euro area. In January 2002, twelve of the EU members replaced their national currencies by Euro notes and coins. Euro reduces the cost of intra-regional business and increases competition. Competition and comparability in turn lower the prices. Moreover, the Euro has achieved recognition as an international currency and is used for commercial transactions outside the Euro area. Central banks around the world use the Euro as a reserve currency. Hence, the risk that Euro faces as a currency with regard to business has also reduced. Rose (2000), Glick

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and Rose (2002) and others show the impact of currency union on trade by using the so-called gravity model. These studies measure the impact in general for a number of incidents of common currency formation and dissolution over a long period throughout the world. None of the previous study estimates the impact of any specific currency union. Therefore, the objective of this article is to analyze the immediate impact of Euro on intra-regional trade among the European Union (EU) members by using an alternative method, namely an event study approach, and compare the results with those of a traditional methodology, namely the gravity modeling approach. This approach is easy to apply as it does not require any specific functional form. Whereas the traditional gravity type of modeling requires specification of functional form which may be restrictive in most cases. Therefore, results obtained from gravity model may vary depending on the specification of functional form. There is no such problem in the event study approach. Moreover, the authors know no other study attempts to quantify the impact of Euro by using the event study method. Hence, this article provides first empirical assessment of the introduction of Euro on the intra-regional trade by using this approach.

The rest of the article proceeds as follows. Section 2 reviews the existing literature followed by the analytical framework in Section 3. Section 4 presents the data sources and analyzes the empirical findings. Concluding remarks are given in the final section.

## 2. LITERATURE REVIEW

Regional economic coordination normally begins with the formation of free trade agreements and ends with the adoption of a common currency (Madhur, 2002). The wave of globalization gave rise to a number of preferential trading arrangements throughout the world. The second half of the twentieth century witnessed a major growth of regional economic cooperation and trading arrangements. However, common currency union is unusual and most of the countries have their own currency. In the past, some small countries unilaterally adopt a currency of a large neighboring country. Whereas, members of the European Union adopt a single currency as an ultimate stage of economic integration in order to boost trade and growth of the region. A voluminous literature evolves on the assessment of *ex post* effects of regional free trade arrangements by using the traditional gravity model while there is only a few studies evaluates the impact of currency union and most of these studies are *ex-ante* analysis. For example, Madhur (2002) examines the cost benefit analysis of a prospective ASEAN currency union. According to him, the key economic cost for a currency union is the loss of national autonomy on monetary policy, while the major benefit of Currency union is the reduction of transaction costs in cross-border businesses and eliminating exchange rates volatility across the region. This phenomenon increases the facilities for trade and investment among the nations of the union.

Frankel and Wei (1993) and Frankel and Romer (1999) successfully use the gravity

model to assess the idea of a growing yen bloc and find that the exchange rate volatility has an insignificant effect on international trade. Rose (2000) augments the gravity model by including additional 'conditional variables' and 'monetary variables' to relate cross-country variation in currency arrangements with cross-country variation in international trade. Glick and Rose (2002) combine the time-series and cross-sectional approaches together to figure out the trade response of a country after joining or leaving a currency union, rather than calculating the additional amount of trade possible by common currency members. Using the same data set of Rose (2000) and augmented gravity model Thom and Walsh (2002) shows that pair of countries using common currency experiences huge gains in bilateral trade. However, most of the currency unions they analyzed involving countries that were either small, poor, or both and hence their results should be treated with caution.

It is to be noted here that the standard gravity model has been widely used as an empirical tool to examine trade determinants and potential, however, this method suffers from some serious limitations. Kalirajan (1999) highlighted these limitations in his study while estimating Australia's trade potential with its partners in the Indian Ocean Rim Association for Regional Cooperation (IOR-ARC). Hence, this present paper uses the event study approach to assess the immediate impact of currency union on regional trade in the European Union. In the literature, this method has been used to assess stock price effects caused by unanticipated market events.

## 3. ANALYTICAL FRAMEWORK

### 3.1. Event Study Model of Trade Enhancement

The seminal works of Ashley (1962), Ball and Brown (1968) and Fama *et al*. (1969) lead the foundation of event study approach in accounting, business and applied economics. In the spirit of their research, hundreds of research papers appeared to assess the impact of an event on stock returns or asset prices, or firms' earnings. Examples of an event includes announcement of merger between two entities, stock split, legislative act or regulatory ruling, etc. The methodology is described with the assumption that the historical information is sufficiently capable to estimate the effect of new information. The information is also referred to as event. The event study approach involves several steps usually summarized in the literature (Bowman, 1983; Cambell, 1997; Dasgupta *et al*., 1998; Peterson, 1989; Mackinlay, 1997): (i) Event identification and event window determination; (ii) selection of a sample set of cases which would be analyzed; (iii) prediction of a "normal" outcome during the event window when the event is absent; (iv) evaluation of the cumulative abnormal outcome (event effect) within the event window; (v) test for statistical significance of the cumulative abnormal outcome.

The implementation of Euro is selected as the event of interest, and the event window is defined as five years prior to the event to five years after the event. Though

Dasgupta *et al*. (1998) suggest for inclusion of ten years period before and after the event, this paper includes five periods to emphasize the immediate impact of the event. The event period has been excluded to avoid any biasness (Binder, 1998). The sample set includes the trade deepening (TD) of Euroland by the event of implementation of Euro. Trade deepening would be defined as trade estimated as a percentage of total GDP. Alternatively it can be interpreted as an amount of trade against every dollar of GDP. Unlike previous studies on event study method, this research avoids the step of normal outcome prediction. As this method is widely used to estimate the event impact of stock return, normal and abnormal outcome are the major components for those studies. Instead, this paper focuses on the currency union impact on intra-regional trade. Hence, pre- and post-event trade deepening replaces those two commonly used components to explain the event effect.

The Euroland model for this research consists of four European Union members, namely, France, Germany, Italy and Spain. There are several reasons for selection of these four nations. Firstly, all four members are neighboring countries. They had cross-border trade among them long before the currency union. Secondly, France, Germany and Italy are the leading economic powers in the EU. The effect of the Euro is substantial on these three countries. Finally, selection of a set of four sample countries gives the computational expediency with greater accuracy. In addition, Intra-regional trade between four selected countries (France, Germany, Italy and Spain) is above 50% of total intra-regional trade occurred between 12 Euro members. The estimation is presented in Table 1, which shows that these four selected members provide significant information about Euro-zone.

**Table 1.** Intra-Regional Trade Percentage of Four Selected Members

| Period | Total Intra-Regional Trade among Euro Members (Billion USD) | Total Intra-Regional Trade among 4 Selected Members (Billion USD) | Percentage of Trade by 4 Selected Members |
|---|---|---|---|
| 1994 | 497.4059 | 259.0068 | 52.07% |
| 1995 | 624.8269 | 323.9297 | 51.84% |
| 1996 | 629.9641 | 326.0414 | 51.76% |
| 1997 | 601.9477 | 309.5465 | 51.42% |
| 1998 | 648.5659 | 336.6688 | 51.91% |
| 2000 | 665.0502 | 339.1212 | 50.99% |
| 2001 | 642.9015 | 325.9097 | 50.69% |
| 2002 | 671.8254 | 343.5032 | 51.13% |
| 2003 | 839.8063 | 427.2895 | 50.88% |
| 2004 | 995.8189 | 506.6445 | 50.88% |

*Source*: United Nation Trade Database and authors' calculation.

The estimation begins with cumulative trade deepening (*CTD*) for pre-and post-event period:

$$CTD_i(T_{pre}) = \sum_{t=T1pre}^{T2pre} TD_{itpre}\,, \tag{1}$$

$$CTD_i(Tpost) = \sum_{t=T1post}^{T2post} TD_{itpost}\,. \tag{2}$$

Here, $i(=1,...,6)$ refers to number of country pair; $t_{pre}(=1994-1998)$ pre-event period; $t_{post}(=2000-2004)$ post-event period and $TD$(= Trade deepening) Trade/GDP.

The aggregation across time and event is done by calculating the cumulative average of trade deepening (*CATD*):

$$CATD_i(T_{pre}) = \frac{1}{N}\sum_{i=1}^{N} CTD_i(T_{pre})\,, \tag{3}$$

$$CATD_i(T_{post}) = \frac{1}{N}\sum_{i=1}^{N} CTD_i(T_{post})\,. \tag{4}$$

Here, *N* stands for the number of country pair (6 in this case).

Finally, trade enhancement has been calculated from cumulative average trade deepening (*CATD*) for pre- and post-event period:

$$Trade\ enhancement = \frac{CATDi(Tpost)}{CATDi(Tpre)}. \tag{5}$$

### 3.2. The Gravity Model Specification

The following gravity model has been applied in order to substantiate the findings from the event study method:

$$Y_{ijt} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 DIST_{ij} + \beta_4 CU_t + \beta_5 CB_{ij} + U_{ijt}\,. \tag{6}$$

Here, $Y_{ijt}$ is the trade variable between country *i* and country *j* at time *t* while $GDP_{it}$ ($GDP_{jt}$) is a measure of income of country *i*(*j*) at time *t*. $DIST_{ij}$ is the distance between countries *i* and *j*, $\beta_i$ ($i=1,...,5$) are parameters of the equation, and $U_{ijt}$ is a white noise disturbance term. All variables are in logs, so the estimated coefficients are

interpreted as elasticity. $CU_t$ is a currency union dummy variable. The variable takes on the value of 1 to show the implementation of currency union and 0 otherwise. $CB_{ij}$ is the cross border dummy which is 1 if two countries share the border and 0 otherwise.

The coefficients of standard variables are expected to be as $\beta_1 > 0$, $\beta_2 > 0$ and $\beta_3 < 0$. If the income level of local country ($GDP_{it}$) increases, the purchasing power of local country will increase. Distance causes negative impact on bilateral trade. Besides geographical remoteness, distance refers to "surface" of host markets, level of trade costs and presence of home biasness (Pastore, Ferragina and Giovannetti, 2009). Common currency dummy captures the currency union impact, while cross border dummy captures the impact of communication, information exchangeability and labor mobility.

### 3.3. Panel Estimators

This paper estimates the coefficients using both fixed effect (FE) model and random effect (RE) model. Similar to least square dummy variable (LSDV) model, fixed effect model considers a complex structure of error term ($\nu_{ijt}$), which consists a white noise term ($\varepsilon_{ijt}$), and a dependent term ($\mu_{ijt}$), which depends on the "unobserved country-level effect". Hence we get $\nu_{ijt} = \varepsilon_{ijt} + \mu_{ijt}$; where $\varepsilon_{ijt} \sim IID(0, \alpha_\varepsilon^2)$. Under this assumption, Equation (6) becomes:

$$X_{ijt} = Z_{ij}\beta + \nu_{ijt}. \tag{7}$$

Here, $Z$ represents the matrix of independent variable and $\beta$ represents the vector of coefficients. Though both models eliminate the time-invariant effects, unlike LSDV, FE estimates every bilateral trade by taking the difference of every variable from its mean. Hence, the relation becomes:

$$\left(X_{ijt} - \overline{X}_{ij}\right) = \left(Z_{ijt} - \overline{Z}_{ij}\right)\beta + \left(\varepsilon_{ijt} - \bar{\varepsilon}_{ij}\right). \tag{8}$$

Here, the time invariant dummies are captured by the bilateral constant term. As the model only deals with the change in observations of specific bilateral trade relations, FE is also called within group estimator.

The RE model considers the error terms correlated with random effect. Hence the model becomes:

$$\left(X_{ijt} - \gamma\overline{X}_{ijt}\right) = (1-\gamma)\alpha + \left(Z_{ijt} - \gamma\overline{Z}_{ijt}\right)\beta + \{(1-\gamma)\nu_{ijt} + (\varepsilon_{ijt} - \gamma\bar{\varepsilon}_{ijt})\}. \tag{9}$$

## 4. DATA SOURCES AND EMPIRICAL ANALYSIS

Trade data comes from the United Nation (UN) trade database, while country GDP from the OECD database. Distance between countries is calculated based on the country location provided by the CIA World Fact-book. Data period ranges from 1994 to 2004. Instead of total trade, trade data has been collected as exports and imports. The first concern of this paper involves the calculation of trade deepening. Flow of trade is considered as it moves from reporter country towards partner country. Hence the amount of export and import is divided by the GDP of the reporter country to estimate the export deepening and import deepening. Then export deepening and import deepening is added up to calculate the trade deepening. The result is provided in the Table 2 below:

**Table 2.** Estimation of Trade Deepening (TD)

| Period | Trade deepening (TD) | | | | | |
|---|---|---|---|---|---|---|
| | France-Germany | France-Italy | France-Spain | German-Italy | Germany-Spain | Italy-Spain |
| 1994 | 0.0598 | 0.0333 | 0.0227 | 0.0303 | 0.0115 | 0.0151 |
| 1995 | 0.0648 | 0.0352 | 0.0249 | 0.0318 | 0.0132 | 0.0176 |
| 1996 | 0.0626 | 0.0351 | 0.0269 | 0.0323 | 0.0142 | 0.0173 |
| 1997 | 0.0634 | 0.0373 | 0.0288 | 0.0340 | 0.0159 | 0.0190 |
| 1998 | 0.0671 | 0.0385 | 0.0321 | 0.0352 | 0.0173 | 0.0199 |
| 2000 | 0.0733 | 0.0413 | 0.0385 | 0.0396 | 0.0212 | 0.0235 |
| 2001 | 0.0685 | 0.0392 | 0.0363 | 0.0392 | 0.0205 | 0.0230 |
| 2002 | 0.0671 | 0.0383 | 0.0358 | 0.0366 | 0.0204 | 0.0234 |
| 2003 | 0.0663 | 0.0378 | 0.0364 | 0.0382 | 0.0228 | 0.0231 |
| 2004 | 0.0666 | 0.0376 | 0.0356 | 0.0395 | 0.0245 | 0.0242 |

*Source*: United Nation Trade Database and authors' calculation.

Here, data for 1994 to 1998 provides the pre-event data and 2000 to 2004 provides the post-event data. Table 2 reveals that the trade deepening increases very next year to the event. Then it moves downward for two to three years. In 2004, all the variables show upward turn. These results can be visualized more clearly in the following Figure 1.

In event study approach, post-currency union impact is compared with pre-currency union impact. This paper considers euro-zone as the field of study. For pre-union period, most of the data is provided in local currency, which is converted to US dollar. For post-union period, data is converted to US dollar from Euro. As a result, trade deepening is used instead of total trade to increase data efficiency. As trade deepening is estimated from the ratio of trade over GDP, currency unit is made ineffective; hence competence of data is enhanced. Thus pre- and post-currency union impact is made more comparable. Besides, as event study method used in this paper compares post-currency union impact

with pre-currency union impact, use of US dollar is more convenient than use of Euro.

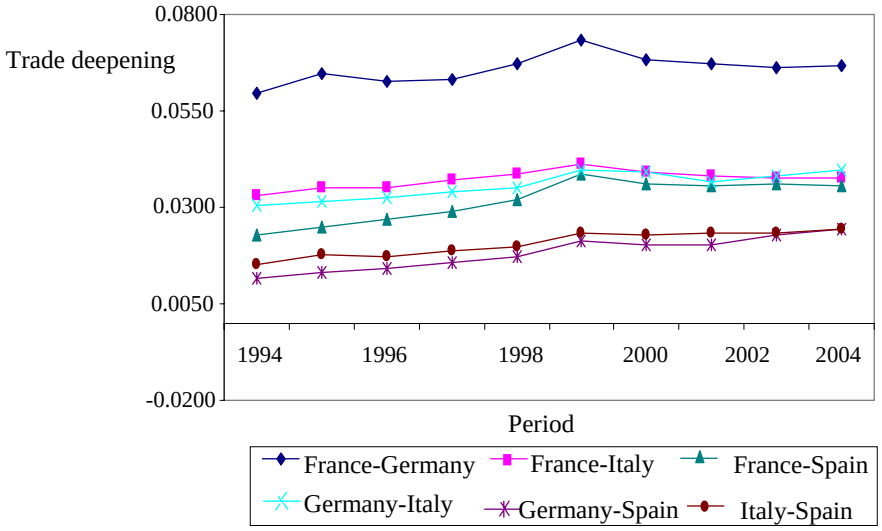


**Figure 1.** Trade Deepening (TD) of Four Euroland Members

From the trade deepening, cumulative trade deepening is calculated for each country-pair for both pre-event and post-event period. Then the cumulative average trade deepening for all country-pairs is calculated for both periods. Comparison between these two cumulative average trade deepening provides the amount of trade enhancement. These trade enhancement results are presented in Table 3 below.

**Table 3.** Estimation of Trade Enhancement

| Periods | | Pre-event | Post-event |
|---|---|---|---|
| Cumulative Trade Deepening (CTD) | France-Germany | 0.3176 | 0.3418 |
| | France-Italy | 0.1793 | 0.1941 |
| | France-Spain | 0.1354 | 0.1825 |
| | German-Italy | 0.1636 | 0.1931 |
| | Germany-Spain | 0.0721 | 0.1093 |
| | Italy- Spain | 0.0889 | 0.1172 |
| Cumulative Average Trade Deepening (CATD) | | 0.1595 | 0.1897 |
| Trade Enhancement | | 1.2 | |

*Source*: Authors' calculation.

The cumulating average trade deepening (CATD) for five years before the implementation of Euro is found to be USD 0.1595 against every dollar of GDP. CATD for five years after the implementation of Euro turns out to be USD 0.1897 against every dollar of GDP. These results provide the amount of trade enhancement of 1.2 which implies that regional trade increases by 1.2 times as a result of the event, *i.e.*, the implementation of a common currency.

An attempt has been taken here to check the robustness of the above findings by using a panel gravity model. The results from the gravity model are presented in Table 4 below.

**Table 4.** Estimates from the Panel Gravity Model

| | Fixed Effects ("within") | Random Effects GLS | Between Estimator |
|---|---|---|---|
| gdp1 | 0.1147 | 0.9430*** | 1.5749** |
| | (0.1434) | (0.1091) | (0.0281) |
| gdp2 | 0.8204*** | 0.6529*** | 0.6711*** |
| | (0.1152) | (0.0454) | (0.0089) |
| dist | — | -0.3871*** | -0.9260** |
| | | (0.1400) | (0.0313) |
| cu | 0.1156*** | 0.1134*** | — |
| | (0.0241) | (0.0386) | |
| cb | — | 0.2263*** | 0.2060** |
| | | (0.0507) | (0.0098) |
| _cons | -2.5933*** | -5.0651*** | -6.1490** |
| | (0.5429) | (0.7836) | (0.1542) |
| $R^2$: within | 0.896 | 0.833 | 0.681 |
| $R^2$: between | 0.806 | 0.974 | 0.988 |
| $R^2$: overall | 0.822 | 0.922 | 0.885 |

*Note*: ***, ** and * denote 1%, 5% and 10% level of significance respectively.

Table 4 shows the estimates of fixed effect, random effect and between estimator models. As this paper deals with the immediate impact of Euro, dataset used here is insufficient for getting successful outcome of the Hausman test; hence both FE and RE are considered to assess the estimates. Though between estimator does not consider time-varying factors, the estimates have been presented for the terms of comparison for significance level. Standard errors are presented in the parentheses. Though distance is

dropped in FE model, major variables are found significant and the signs are as expected in the RE model. Coefficients for GDP are positive for both reporting country and partner country, while coefficient for distance between them is negative. This finding is consistent to the theory that higher GDP increases trade, while higher distance creates resistance. All these coefficients are significant at 1% level (except GDP1 in FE). Both currency union dummy and cross border dummy are found to be significant at 1% level. As the variables are estimated in natural logarithm, the coefficients of variables of both FE and RE model represent the elasticity, i.e. estimated coefficients can be interpreted as percentage change of trade due change in different variable. Fixed effect model significantly interprets the trade impact of partner country's GDP and currency union dummy, while random effect model significantly interprets the trade impact of all considered variables. According to the FE model, 1% change in partner country's GDP would change 0.8204% trade between reporting country and partner country in the same direction, while use of common regional currency by reporting and partner countries would enhance 0.1156% trade among themselves. Estimates of random effect model could be interpreted as follows. Firstly, 1% change in reporting country's GDP would change 0.9430% trade between reporting country and partner country; while 1% change in partner country's GDP would change 0.6529% trade between them. Change in both GDP and trade would occur in same direction. Secondly, 1% change in distance between reporting country and partner country would change 0.3871% trade between reporting country and partner country in the reverse direction. Beside these major variables, dummy variables show some significant impact in the Euro-model. Members sharing a common regional currency trades 0.1134% more than members not sharing a common regional currency. Besides, members sharing a common land border trade 0.2263% more than members not sharing a common land border.

In this paper, major focus of the gravity model is to estimate the impact of Euro on intra-regional trade among four selected EU members, rather than assessing the relation of gravity variables. Both FE and RE models provide significant and almost equal estimation of the common currency dummy variable. Following Rose (2000), impact of Euro on intra-regional trade between France, Germany, Italy and Spain is estimated as $e^{0.1156}$ or 1.1225 from FE estimator and $e^{0.1134}$ or 1.12 from RE estimator. Both values almost coincide with the estimated value of trade enhancement factor using the event study method.

Rose (2000) shows that currency union increases intra-regional trade three times using the cross sectional approach. Glick and Rose (2002) shows that trade doubles when a country pair enters a currency union and halves when they dissolve the union. In both cases, a number of incidents of currency union have been considered for a long period of time. Instead, this paper focuses towards immediate impact of Euro among its member countries. The use of event study methodology provides three observations. Firstly, as the immediate impact, Euro enhances the trade among the member countries. Secondly, the event study methodology shows that the post-Euro intra-regional trade is 1.2 times of pre-Euro intra-regional trade for four selected member countries. Thirdly,

the result of event study method very much similar to the gravity model estimation.

In order to verify the consistency of performance of event study approach, trade enhancement is estimated for all Euro-members using event study approach, and the result is compared to trade enhancement observed through gravity model. Table 5 presents the results of the estimation.

**Table 5.** Estimated Trade Enhancement for All Euro-members

| Period | Cumulative Average Trade Deepening (CATD) | Trade Enhancement Estimated from Event Study Model | Trade Enhancement Estimated from Gravity Model | |
|---|---|---|---|---|
| | | | FE | RE |
| 1994 - 1998 | 0.1229 | 1.14 | 1.11 | 1.09 |
| 2000 - 2004 | 0.1401 | | | |

Taking all Euro members into consideration, event study method estimates that Euro enhances intra-regional trade among all members by 1.14 times after five years of introduction of Euro. While using gravity model, intra-regional trade enhancement is found to be 1.11 times by the fixed effect model and 1.09 times by the random effect model. Hence, estimated trade enhancement from the event study model is consistent with that of obtained from the gravity model.

## 5. CONCLUSIONS

This article estimates the impact of the introduction of Euro on regional trade in the European Union by using the event study approach, a non-parametric approach generally used for the analysis of stock returns for the pre-and post event periods. Similar estimation with gravity model is considered as benchmark for assessment of effectiveness of event study method to measure trade enhancement. The results show that the immediate post-event trade is 1.2 times of the pre-event trade for France, Germany, Italy and Spain; while immediate trade enhancement for all Euro-members is 1.14 times. In general, adoption of Euro enhances intra-regional trade by 1.1 to 1.2 times among the members in five years. These results are consistent with those obtained from the gravity model. This study thus provides the first empirical evidence on the assessment of currency union impact on intra-regional trade by using an alternative method, the event study approach. Hence the event study method can be used as an

alternative and effective methodology for assessing the impact of any specific event of currency union. Successful implementation of this method would open the opportunity for the future common currency members of other regions to quantify their probable trade enhancement to be achieved by implementing currency unions. However, further research may involve in capturing facilitation effect and substitution effect using trade deepening of the event study approach in any currency union.

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*Mailing Address: Ruhul Salim, School of Economics and Finance, Curtin Business School, Curtin University, Perth, WA-6845, Australia. Tel: 61-9266-4577. E-mail: Ruhul.Salim@business.curtin.edu.au.*

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