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Three Essays on International Trade

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By

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Abstract

This doctoral thesis consists of three independent chapters. However, those three chapters discuss a similar big issue, *i.e.* international trade. In depth, they talk about an empirical case of trade in Southeast Asian area (Chapter 1), and Indonesian manufacturing industries (Chapter 2 and 3). Chapter 1 will put its intention in the bilateral trade relationship among ASEAN (Association of Southeast Asian Nation) countries itself and between ASEAN and their major trading partners, Japan and the US. Chapter 2 will do an investigation on the level of efficiency of Indonesian manufacturing industries and study the determinants of export in Indonesian manufacturing. Finally, Chapter 3 observes the decision of doing export in a specific Indonesian manufacturing industry, *i.e.* textile and apparel firms.

In fact, we specifically put our intention on the theme of export. The discussion of it unifies those 3 chapters. However, each chapter has different emphasizes on its export idea. We stress our analysis on the effect of change in real exchange rate, real domestic income, and real domestic cash balance on the real bilateral trade balance in the first chapter, while in the second chapter; we observe the influence of capital intensity, size, export diversification and technical efficiency on the export performance, then for the last but not the least, third chapter will study the decision to export of Indonesian textile apparel firms.

Furthermore, efficiency also obtains our great concern, as we believe that efficiency is one of the important aspects that can positively affect country's export performance (which is stated by self-selection hypothesis), thus country's economy as well. When a firm or industry could achieve a higher level of efficiency, it should be able to enjoy a better export performance or a higher probability of becoming an exporter. More exports could be nearly related to more profit which can be collected by a firm, since export can be used by firm as a way for generating profit. Assuming firms will not do exports if they can not get any profit, then through the accumulation of the exporter's profits, the

country's trade balance and economy will also positively flourish. Efficiency is measured by technical efficiency in the second chapter and by total factor productivity (and labor productivity) in the third chapter. To explain shortly the discussion of the thesis, a concise description about each chapter can be shown as follows.

The first chapter examines the short run and long run effects of real exchange rate, real domestic (foreign) income, and real domestic (foreign) cash balance on the real bilateral trade balance in ASEAN region. Based on quarterly data set 1980q1 to 2007q3, investigations are carried out using VECM method. However, the impulse response functions, the variance decompositions, as well as the OLS are analyzed in order to capture further the dynamic perspective of the research. Expanding our analysis, we do test and analysis for a possibility of the presence of structural break. The Chow test is applied when a structural break with a known break point is considered. While, Zivot and Andrews (1992) unit root test, Gregory and Hansen (1996) cointegration test, and two steps Engle-Granger method are performed when a structural break with an unknown break point is measured. Results show that in the long run: (i) income effect is found to be dominant in determining the change in trade balance, either when a structural break is omitted or allowed; (ii) the cash balance effect do influence the bilateral trade; (iii) the exchange rate effect significantly plays a role only in the period before the regime shift where it is absent in the post regime shift, indicating that the structural break carries a significant impact in removing the positive long run effect of exchange rate on trade balance. With respect to that, the small economy effects are suspected to be present in ASEAN region. Meanwhile, in the short run: (i) the cash balance effect relatively plays a major role in influencing the improvement of trade balance, either when a structural break is omitted or allowed, (ii) compared to cash balance effect, the income effect is present with slightly less difference in contribution; (iii) the exchange rate effect is always observed in all types of analysis and is more discernible when a structural break is omitted, while a J-curve phenomenon is present in minor cases. On the contrary, once a structural break is allowed, we provide lack of evidence for the presence of the phenomenon.

The second chapter examines the technical efficiency of Indonesian manufacturing industry by estimating a stochastic production frontier (SPF) and the constant returns to scale (CRS) output-oriented DEA approach. In addition, this chapter also analyzes the determinants of export performance of the industries using panel analytical model. The results show that the estimated mean technical efficiency of Indonesian manufacturing industries which are found by those approaches are lower than 0.5. It indicates that there is substantial inefficiency problem in the industry. Comparing the scores obtained by SPF and DEA, we identify there are six relatively prominent industries in term of efficiency achievement, namely iron & steel, tobacco, transport equipment, food products, industrial chemicals, and machinery, electric. Our results which correspond to the technical efficiency indicate that the estimated mean technical efficiency in the DEA approach is larger than those obtained from the SPF. Utilizing Fixed Effect Model (FEM), we find that all export determinants, *i.e.* capital intensity (CAP), number of labor (SIZE), diversification (DIV) and technical efficiency (TE) shows the appropriate significant sign. The highest elasticity coefficient is provided by diversification (DIV) variable. With respect to the relationship between efficiency and export performance, we provide evidence for the presence of self-selection hypothesis.

This third chapter is devoted to the examination of factors which influence the decision to export of firms in Indonesian textile and apparel industry. Using a panel of firm-level data and a panel probit model, we test for the role of heterogeneous characteristics of firms in determining firms' probability of exporting. We use two different definitions of firm productivity in our model, *i.e.* TFP and labour productivity. Besides executing the general estimation for whole observations, we execute as well the disaggregated specifications concerning the firm size (middle and large size). Mostly, the main findings in this study are in line with related previous works. In particular, we find that productivity increases the probability of exporting. Likewise, firm characteristics related to size and foreign ownership has a positive influence on the probability of exporting. On the other hand, variables accounting for capital intensity and Java region dummy affect negatively the decision to export. However, in the general estimation results, we find no significant effect of labor quality on our model. Concerning the estimation results of

disaggregated specifications, a consistent finding with the general estimation results is basically provided, except for labor quality variable which is significantly negatively related with exporting in middle-size firms' case. This condition seemingly reflects the actual state of the textile and apparel industry in the developing economy, such as Indonesia. In which, exporters are generally inclined to be more labor intensive, and 'cheap' labors are specifically dominant to be employed among middle firms. Besides, the reason of less competitive in the international market also should be taken into account. Although still showing positive signs, the coefficients of productivity lose their statistical significance when the models are applied for large-sized firms. However, in general, our findings corroborate the self-selection hypothesis.

Keywords: Export, Bilateral trade balance, VECM, J-curve, Structural break, Efficiency, DEA, Stochastic production frontier, Probit, Total factor productivity

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Putu Mahardika A. Saputra

Chapter 1

The Dynamics of Bilateral Trade Balance: The role of exchange rate, income and cash balance (An Empirical Case for ASEAN Countries)

1.1 Introduction

For more than four decades, the Association of Southeast Asian Nations (ASEAN) has been established[1]. So far, it is often classified as a prominent regional association in the world (see Imada, 1993; Severino, 2002; Sen, 2006). With more than 500 million inhabitants, consisting of 10 member states -Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam- and whose a combined GDP around over US$ 1 trillion and total foreign trade of over US$ 1.4 trillion, in general ASEAN has became a potential partner for trading of two major economies in the world, *i.e.* US and Japan (ASEAN Secretariat, 2007).

After Asian financial crisis struck the region in 1997, ASEAN started to maintain intensively two fundamental internal actions in order to accelerate the recovery process and out of the downturn period rapidly. They are: first, doing intensification on trade cooperation among the member states and with other major trading partners (e.g. US, Japan, and EU); and second, doing expansion on financial cooperation among the member states itself, including China, Japan and Korea (Severino, 2002). From the first

[1] ASEAN is initiated on August 8, 1967 through "Bangkok declaration" by five founding countries, *i.e.* Indonesia, Malaysia, the Philippines, Singapore and Thailand. In 1984, Brunei Darussalam joined ASEAN, then in 1995, 1997 and 1999, Vietnam, Lao PDR and Myanmar, and also Cambodia respectively joined.

point, we know that a consistent emphasizing on trade arrangement is still going to be a keyword and is also extremely reasonable since ASEAN has been recognized as: (i) an open organization that should liberalize its intra and inter-regional trade; and (ii) a regional bloc whose economy highly dependent on trade. With respect to the latter, Huang *et al.* (2004) finds that prior to the financial crisis (1996), ASEAN's ratio of exports to GDP has achieved about 46% while the ratio of imports to GDP is around 49%. After crisis (2000), the declining of its GDP which accompanied by the growing of exports performance results in the ratio of exports to GDP increases by 71% while the ratio of import to GDP climbs to 62%. It shows the condition of ASEAN which apparently becomes more trade-dependant, even after the crisis period.

The objective of this paper is to analyze the role of real exchange rates, real income and real cash balance on the bilateral trade balance among selected ASEAN countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand) and between those ASEAN countries and the US and Japan, due to their position as the major ASEAN's trading partners and two major economies in the world. As regarded by Tongzon and Felmingham (1998), study in bilateral trade provides a deeper insight in highlighting particular issues related to trade activity between countries, which usually are not addressed in studies of aggregate trade. Bilateral trade flows tend to respond differently to the factors (*e.g.* real exchange rate, income, and other monetary instruments) which determine aggregate trade flows, *i.e.* those variables may have different impacts on certain country where the impacts depend highly on the characteristics that owned by the country itself or its trading partner.

This paper will concentrate its discussion on ASEAN countries which are heterogeneous in numerous things, not only in cultures things, such as, languages, traditions, and religions but also in other aspects, *e.g.*, the level of development and technology, the structure of economy, relative factor endowments and government policies. By performing particular empirical methods in the sample of heterogeneous countries, this paper expects to find interesting facts and conclusions concerning the determinants of bilateral trade, especially in each country which is analyzed.

To address the paper's objective, a vector error correction model (VECM) is estimated. In this case, VECM treats all variables in the model as potentially endogenous. The model will analyze the impact of all considered variables on bilateral trade flows, both in the short run and long run. Additionally, the impulse response function, variance decomposition and OLS are also utilized to support the results of VECM. In order to expand our analysis, we consider the presence of a structural break. To accommodate that matter, the paper uses two types of structural break tests, namely structural break test with a known break point and structural break test with an unknown break point. Based on these tests, we investigate further whether the conclusions are sensitive to the inclusion or exclusion of a structural break.

The paper finds that in the long run, income effect is found to be dominant in determining the change in trade balance, either when a structural break is omitted or allowed. Bilateral trade appears affected too by the cash balance, and exchange rate movements. However, bilateral trade seems sensitive to bilateral exchange rate adjustments only in the period before the regime shift. The exchange rate effect is absent in the post regime shift. This condition brings us to a suspicion towards the possibility of the significant impact of financial crisis in blurring of the true relationship between real exchange rate and trade balance.

Further, in the short run, the cash balance effect relatively plays a major role in influencing the improvement of trade balance, either when a structural break is omitted or allowed. With slightly less difference in contribution, the income effect also appears. The exchange rate effect is always observed in all type of analysis. When a structural break is omitted, the exchange rate effect is found to be more discernible. Our findings are supportive of the J-curve phenomenon in minor cases, once a structural break is neglected. However, when a structural break is allowed, we provide lack of evidence for the existence of this phenomenon. Overall, we find the exchange rate effect is sensitive to the presence of a structural break, while income and cash balance effect are less sensitive to the structural break.

The paper will be structured as follows. Section 2 discusses some principal facts around ASEAN trade. Section 3 provides the empirical methodology. While, in section 4, presents the empirical results, section 5 deals with the summary of main empirical findings, and finally section 6 concludes the paper.

1.2 Some principal facts around ASEAN trade

Two indicators which often used for explaining global trade and describing the importance of trade in the economy are the ratio of trade in goods to GDP and the ratio of trade in services to GDP. Trade in goods consist of all merchandise which are exported and imported by a country, while trade in services has a same meaning but it involves some different sectors, such as transport, travel, finance, insurance, royalties, construction, communication and cultural services (World Bank, 2006).

As seen in Table 1, the importance of trade in the economies of the region (as indicated by the ratio of trade in goods and trade in services to GDP) is quite varying for all considered periods. Singapore, one of the most open economies in the world could be expected to be superior to other economies in the region. It is verified by its ratio of trade in goods to GDP which has reached over 200%, ranging from about 277% to 368% and its ratio of trade in services to GDP which has achieved more than 50% ranging between 58% and 90%. The trades in goods/GDP ratios of other ASEAN countries move far lower than that of Singapore. The story seems still to be the same for the ratio of trade in services to GDP.

As a group, as indicated by Figure 1 and 2, the distributions of ASEAN trade are relatively concentrated in its own area. On average, during 1996-2005, intra-ASEAN trade accounted for more than 23% of export and 22% of import. Data show that intra-ASEAN trade is of growing importance, particularly for the import. Intra-ASEAN import shows a gradual increase in share during 1996-2005, except for 2001, where the figure drops slightly to 21.9%. Generally, intra-ASEAN import grows from 18.4% of total in

1996 to 24.8% of total in 2005. In term of export, intra-ASEAN export always displays an increasing figure since 2001, though prior to that period, its distribution inclines to fluctuate.

Table 1. The importance of trade in ASEAN economies

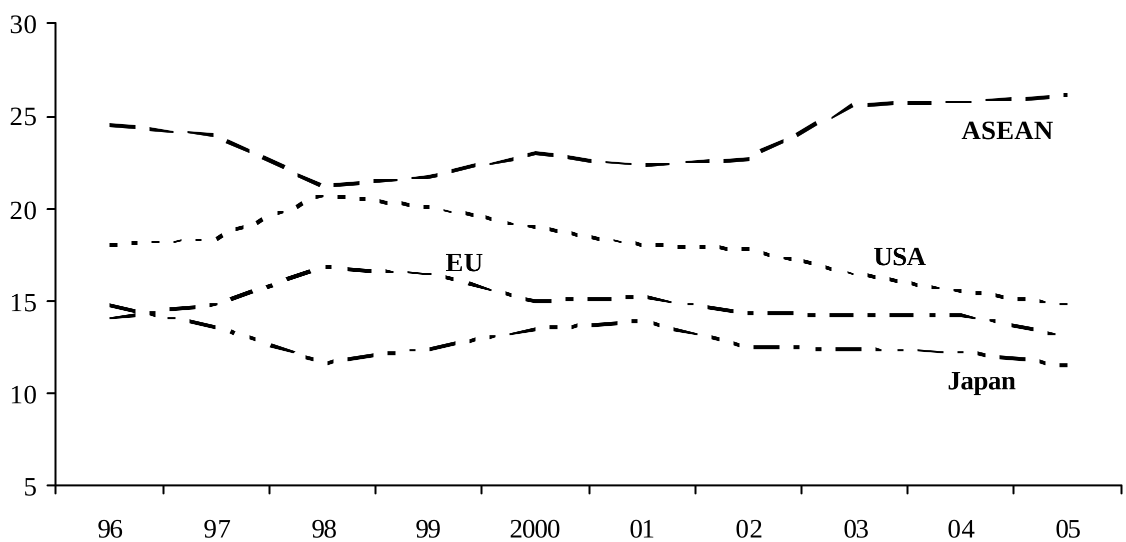
Country	**Trade in goods as a share of GDP (%)**					**Trade in services as a share of GDP (%)**		
	1990	2001	2003	2004	2005	1990	2004	2005
Cambodia	22.4	91.7	80.5	122.2	109.9	5.7	25.3	28.1
Indonesia	41.5	60.1	44.9	49.4	54.2	7.5	17.9	12.8
Lao PDR	30.5	50.4	42.5	35.4	43.6	5.8	*na*	*na*
Malaysia	133.4	184.0	174.8	195.9	196.1	21.2	29.9	31.9
Philippines	47.7	88.9	94.3	97.0	89.5	11.3	11.2	10.4
Singapore	309.5	277.6	297.8	321.5	368.0	58.1	76.6	90.4
Thailand	65.7	110.9	109.4	119.2	129.3	14.9	26.1	27.3
Vietnam	79.7	93.6	115.0	125.4	129.9	*na*	19.0	18.0

Source: *World Development Indicators*, 2003; 2005; 2006 and 2007, World Bank.
Notes: (1) Data are not available for Brunei Darussalam and Myanmar. (2) *na* means “not available”.

After ASEAN itself, developed countries are the next most significant trade partners of ASEAN. Three of them, namely the US, Japan and EU are noted as the countries whose contribution always dominate ASEAN’s export and import activities. Their contributions during 1996-2005 reach more than 11% each for both trade activities. The most dominant market for ASEAN merchandises is the US, which accounted for around 18% of total in 1996 and around 15% of total in 2005. It is followed by Japan which contributes 15% of total in 1996 and 12% of total in 2005. Meanwhile, as a group -EU market- gives its share around 14.8% on average during 1996-2005. Actually, the EU’s contribution has surpassed the Japan’s since 1997, reflecting the increasing of the importance of developed countries in Europe as the outlet for ASEAN total exports.

Developed countries are the most important import suppliers for ASEAN as well. During those periods, instead of the US, Japan places itself as the most significant key player in ASEAN market after the ASEAN countries. Even, for 1996 and 1997, the contribution of Japan is higher than ASEAN’s. In 1996, over 21% of ASEAN imports are originated from Japan, followed by the US and EU with a similar share of around 15% each. Figure 2 presents a different tendency of contribution of intra-ASEAN imports and other three countries (the US, Japan, EU) to total ASEAN's imports. The former tends to increase gradually during the period, and conversely, the latter inclines to decrease. Perhaps due to the deteriorating of purchasing power that encountered by ASEAN countries or due to the particular trade policy (trade agreement), for instance –in 2005-, the imports from Japan, the US and EU decline to about 14%, 11% and 13% of total, respectively. Figure 1 and 2 also describe that the import distributions of ASEAN countries match their export distributions, where similarly, they put the heaviest dependence on intra-ASEAN trading partners and then on two individual major countries, *i.e.* the US and Japan as their other trading partners.

Figure 1. Distribution of ASEAN exports by major destination (%), 1996-2005



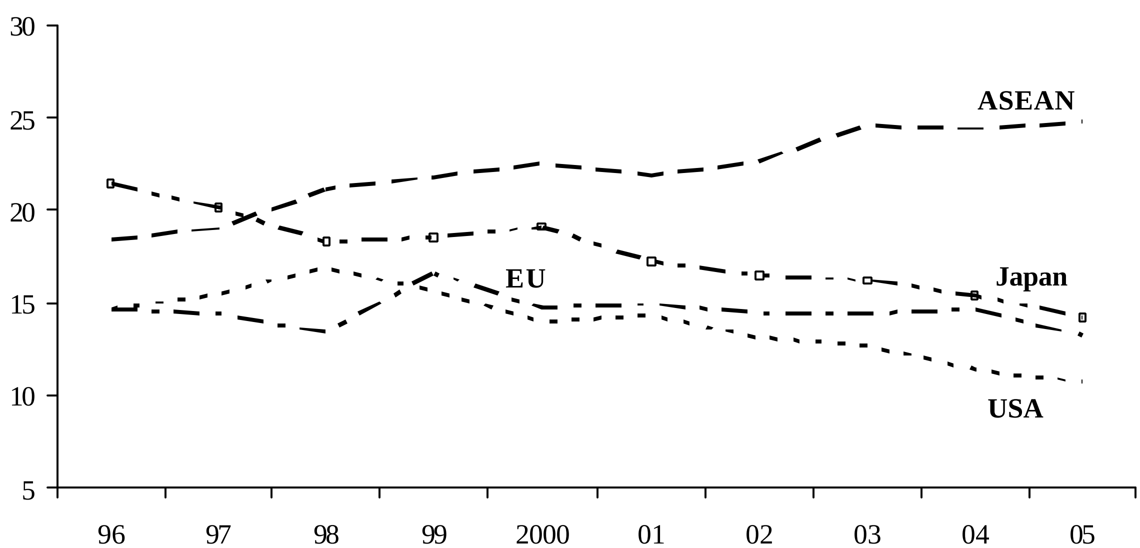
Source: *Direction of Trade Statistics Yearbook*, 2003 and 2006, IMF.

1.3 Empirical methodology

1.3.1 Model specification

The bilateral trade balance model used is developed on the idea of Rose and Yellen (1989), Rose (1991) and Tongzon and Felmingham (1998). This paper adopts a trade balance model that relies on a standard two-country model as applied by the first two papers. However, significantly this paper also follows the work of Tongzon and Felmingham which puts the inclusion of real cash balance variable in the determination of bilateral trade flows.

Figure 2. Distribution of ASEAN imports by major destination (%), 1996-2005



Source: *Direction of Trade Statistics Yearbook*, 2003 and 2006, IMF.

As a starting point, let the paper applies two-country imperfect-substitutes model which assumes that exports and imports are imperfect substitutes for domestic goods (see Goldstein and Khan, 1985; Lindert, 1986; Rose and Yellen, 1989). On the demand side, the standard Marshallian functions which are derived from the consumer utility function are modified with the addition of real cash balance effects. That modification is based on the work of Miles (1979) who argues that an increase of domestic real cash balance would stimulate domestic aggregate demand and increase expenditure on domestic and foreign products. This argument has been tested empirically by Bahmani-Oskooee and Malixi (1992) who have found the effect of real cash balance on import demand, notably among LDCs and by Tongzon and Felmingham (1998) who have confirmed the real cash balance effects on the bilateral trade among Australia, USA, Japan and Singapore. In this term, they justify the inclusion of the variable in our bilateral trade model. The following expressions will clarify more those points. It will be started by the equations which represent the import demand at domestic and a foreign country.

$$M = M\left(p_m, y, h\right) = -a_1 p_m + a_2 y + a_3 h \quad \text{...(1)}$$

$$M^* = M^*\left(p_m^*, y^*, h^*\right) = -a_1^* p_m^* + a_2^* y^* + a_3^* h^* \quad \text{..(2)}$$

Equation (1) and (2) describe the function of import quantity demanded by domestic and foreign country respectively. The demand for import by domestic country (M) depends negatively on the relative price of imported goods (p_m) and positively on real income (y) and real cash balance (h) while in the similar way, the demand for import by foreign country (M^*) depends negatively on the foreign country's relative import price (p^*_m) and positively on foreign real income (y^*) and foreign real cash balance (h^*).

On the supply side, each country's supply of exportables (X and X^*) is assumed to depend positively only on their relative price of exportables (p_x and p^*_x) as shown by Equation (3) and (4)[2].

$$X = X\left(p_x\right) = b_1 p_x \quad \text{..(3)}$$

[2] In this case, the paper applies the argument of Bahmani-Oskooee and Kantipong (2001), Rose (1991) and Singh (2002). Their statement assumes perfect competition, in spite of there are some models of imperfect competition in supply as referred by Rose and Yellen (1989) can be utilized to get the reduced form equation.

$$X^* = X^*\left(p_x^*\right) = b_1^* p_x^* \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

In the case of domestic country's relative price, both cases, *i.e.* the relative price of imported goods (p_m) and the relative price of exportables (p_x) are always measured in domestic currency. We know that the domestic country's relative import price (p_m) is the product of the real exchange rate (q) and the foreign country's relative export price (p^*_x).

$$p_m = e \cdot \frac{P_x^*}{P} = \left(e \cdot \frac{P^*}{P}\right) \cdot \left(\frac{P_x^*}{P^*}\right) = q.p_x^* \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where e is the nominal or spot exchange rate where it expresses the domestic price of foreign currency and q is the real exchange rate which is defined as $q = e.p^*/p$. Meanwhile, the domestic country's relative export price (p_x) is identified as the result of the multiplication of foreign country's relative import price (p^*_m) and the real exchange rate (q).

$$p_m^* = \frac{1}{e} \cdot \frac{P_x}{P^*} = \left(\frac{1}{e} \cdot \frac{P}{P^*}\right) \cdot \left(\frac{P_x}{P}\right) = \frac{p_x}{q} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Due to the relative prices, then one can equilibrate supply and demand at domestic and foreign country as presented by (7).

$$X = M^*; X^* = M \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

The real trade balance (in terms of domestic currency), *TB*, is by definition expressed as the difference between the real value of export from domestic country to foreign country and the real value of import from foreign country by domestic country.

$$TB = p_x.M^* - q.p_x^*.M \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

Equation (1) to (6) are all structural equations that can be solved together with the equilibrium conditions in (7) for the volumes and relative prices of domestic's export and import. Through substituting those expressions into Equation (8), then we can find

$$TB = \left[\left(\frac{a_1^* y^* q}{b_1 q + a_2^*}\right) + \left(\frac{a_3^* h^* q}{b_1 q + a_2^*}\right)\right]\left[\left(a_1^* y^* + a_3^* h^* - \left(\frac{a_2^* a_1^* y^*}{b_1 q + a_2^*}\right) - \left(\frac{a_2^* a_3^* h^*}{b_1 q + a_2^*}\right)\right)\right]$$
$$- \left[\left(\frac{a_1 yq}{b_1^* + a_2 q}\right) + \left(\frac{a_3 hq}{b_1^* + a_2 q}\right)\right]\left[a_1 y + a_3 h - \left(\frac{a_2 a_1 yq}{b_1^* + a_2 q}\right) - \left(\frac{a_2 a_3 hq}{b_1^* + a_2 q}\right)\right] \quad \text{……..……(9)}$$

Now Equation (9) may be rewritten

$$TB = \left[\frac{q^2 b_1\left[(y^*)^2 (a_1^*)^2 + (h^*)^2 (a_3^*)^2\right] + 2\left[y^* h^* q^2 a_3^* a_1^* b_1\right]}{(b_1 q + a_2^*)^2}\right]$$
$$- \left[\frac{q b_1^*\left[y^2 (a_1)^2 + h^2 (a_3)^2\right] + 2\left[yhq a_3 a_1 b_1^*\right]}{(b_1^* + a_2 q)^2}\right] \quad \text{……………………………………………...(10)}$$

which can be simplified into reduced-form specification as

$$TB = TB\left(q, y, y^*, h, h^*\right) \quad \text{…………………………………………………………………(11)}$$

where, trade balance (TB) is expressed as a function of real exchange rate (q), the domestic (foreign) country's real income (y, y^*) and the domestic (foreign) country's real cash balance (h, h^*). According to Equation (10), TB will improve if y^* and h^* increase or if y and h decrease, but the influence of q still seems ambiguous.

However, there is a conventional wisdom which says that a country's trade balance TB will improve (in the long run) when the real exchange rate q increases. The argument is derived from the Marshall-Lerner condition, where it states that all else equal, the trade balance will be positively affected by a real depreciation if export and import volumes are sufficiently elastic with respect to the real exchange rate, *i.e.* the absolute value of the sum of the price elasticities for export and import must exceed unity (Isard, 1995; Krugman and Obstfeld, 2003)[3]. Assuming this condition holds, we believe that a currency depreciation will eventually lead to an improvement in the country's trade balance.

Additionally, the literature also considers the role of time path in the relationship between the real exchange rate and trade balance. It distinguishes the time path into short and long run. Hence, after a real depreciation happens, an initial deterioration in *TB* occurs before an improvement is realized. This well-known phenomenon is called the J-curve effect. J-curve effect shows a condition where a country's trade balance worsens suddenly after a real depreciation and improves only after a certain period of time. This effect is attributed to a lagged adjustment of quantities to changes in relative prices (Junz and Rhomberg, 1973; Pikoulakis, 1995). Basically, a real depreciation of domestic currency raises the competitiveness of prices for the domestic country's products which then can stimulate export and reduces domestic import demand, thereby the trade balance improves. A real depreciation makes domestic products relatively cheaper than foreign products since prices of export products are sticky in sellers' currencies. When p_x and p^*_x are assumed to be fixed in Equation (8) and there is only a small immediate impact on the quantity of export (M^*) and import (M), then we can find that the value of exports (p_xM^*) increases only in a small amount, while the value of imports (qp^*_xM) increases significantly. This situation results in a deterioration of trade balance in the short run. However, as time goes by for the long run, the increased price of imports brings the quantity of domestic import demand falls and due to the price elasticity of domestic export is larger in the long run than in the short run, the volume and value of domestic exports rise sufficiently to improve the trade balance so that the effect of the depreciation is cumulatively positive (Rose and Yellen, 1989; Tongzon and Felmingham, 1998; Wilson and Tat, 2001). Due to the importance of the issue, this paper decides to investigate the J-curve effect in its analysis in association with the investigation of the impact of q (the exchange rate) on *TB* (trade balance).

[3] The exchange rate improves the bilateral trade balance if only in case $E_x + E_m - 1 > 0$, which in turn requires $E_x + E_m > 1$. This is a term which is known as Marshall-Lerner condition. So, when the real trade balance (*TB*) is initially zero, a real depreciation in domestic currency will lead to a *TB* surplus if the sum of E_x and E_m is greater than one (Baek, 2007; Krugman and Obstfeld, 2003).

Regarding the model used, this paper starts by forming Equation (11) into a log-linear standard model and then modifies a VECM specification for the real bilateral trade balance (*TB*) conditional on the real exchange rate (*q*), real domestic (home country) income (*y*), real foreign income (y^*), real cash balance of the home country (*h*), and real cash balance of the foreign country (h^*). The model will be estimated in order to identify the dynamic bilateral trade relationship among selected ASEAN countries (Indonesia, Malaysia, Singapore, Thailand, and the Philippines) and between ASEAN countries and the US and Japan. The following vector error correction model (VECM) is designed for each country[4]:

$$\Delta V_t = q_0 + dgV_{t-k} + \sum_{i=1}^{k-1} l_i \Delta V_{t-i} + u_t \quad \text{……………………………………………………(12)}$$

where, V_t is the vector of endogenous variables (i.e. *TB*, *q*, *y*, y^*, *h* and h^*); ΔV_t is the vector of those endogenous variables in difference; q_0 is (n x 1) vector of intercept terms; d is the adjustment coefficient matrix which reflects the error correction mechanism; while the long-run equilibrium relationship between the variables are captured by the cointegrating term gV_{t-k}; and l_i is the (n x n) matrix which catches the short-run dynamics among variables with *k-1* number of lags; finally u_t is an (n x 1) vector of white noise error terms. In addition, *i* and *k* stand for the lag order and the maximum number of the lag length, respectively. Generally, one can conclude dgV_{t-k} as the error-correction components and $\sum_{i=1}^{k-1} l_i \Delta V_{t-i}$ as the vector autoregressive components in difference form.

This paper will only concentrate its analysis in variables relationship as shown by Equation (11), where all variables are expressed in natural logarithm. Real bilateral trade balance (*TB*) is measured as the ratio of the bilateral export value from domestic country to foreign country over the bilateral import value from foreign country by domestic country. There are two reasons why the study defines *TB* as a ratio of export over import:

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[4] Further theoretical exp lanation about VECM can be found, for instance at Enders (2004).

First, according to Bahmani-Oskooee (1991), the ratio is insensitive to the units of measurement of export and import, whether they are measured in domestic country's currency or foreign currency. Second, the ratio allows one to take natural logarithm of trade balance and then get the growth rates (Brada *et al.*, 1997). Hitherto, many empirical papers in the area of the bilateral trade balance have used that ratio in their investigation, such as Arize (1996), Guptar-Kapoor and Ramakrishnan (1999), Weliwita and Tsujii (2000), Bahmani-Oskooee and Goswami (2003) and Bahmani-Oskooee and Bolhasani (2008).

After performing Equation (12), we expect the effect of domestic real income (y) to the real bilateral trade balance (TB) is negative. While, since an increase in foreign income (y^*) improves TB, so their relationship should be positive[5]. Due to an increase in h^*, which traditionally means there is an increase of foreign country's ability to import, brings an increase in TB then the positive sign is expected for their relationship. For h (domestic country's real cash balance), the paper expects it to have an inverse relationship with TB.

As described in ($q = e.p^*/p$); q is specified as the domestic currency price of the foreign currency. It indicates that a positive change in q implies a real depreciation of the domestic currency. If this variable gives a positive impact to TB, then one can says that the exchange rate effect is present. Marshall-Lerner condition will be satisfied, if the effect persists in the long run. Besides that, the paper will investigate deeper on the interpretation of the relationship between q and TB. That is related to an argument which is called the J-curve effect. The effect will be verified by the paper, if initially, real exchange rate (q) gives a negative impact to TB and then followed by positive impact

[5] However, the relation between y and TB is still possible to be positive if: (i) increase in y is due to an increase in the production of import-substitute goods which cause the reporting country would import less, yielding an improvement in its trade balance and (ii) supply becomes the driving force in determining exports and imports (Bahmani-Oskooee and Ratha, 2004; Onofowora, 2003). By the same token, y^* could also carry a negative coefficients if the increase in y^* is due to an increase in the production of substitutes for reporting country's goods which cause reporting country may export less, resulting in a deterioration of its trade balance.

after some particular periods[6]. In term of VECM specification, this paper also utilizes the impulse response functions for observing J-curve effect in each country.

Technically, we propose some steps in estimating Equation (12). As the first step, we do the determination of lag length for each case by employing Akaike Information Criterion (AIC) as suggested by Onafowora (2003). Then, due to the importance of the property of stationarity in a time series variable, we do the second step, *i.e.* the test for stationarity and unit roots of each variable by performing the Augmented Dickey-Fuller (ADF) test. A time series variable is called stationary if it possesses a finite mean, variance and autocovariance function which are all independent of time. Testing of unit root involves the testing of order of integration of the series. The series is said to be integrated of order *d* if it requires differencing *d* times in order to achieve stationarity. So, a series X_t is said to be integrated of order one, $X_t \sim I(1)$, if its level series, X_t, is nonstationary but its first-differenced series (ΔX_t) is stationary, $\Delta X_t \sim I(0)$. Using the Augmented Dickey-Fuller test methodology, our fundamental regression equation to test unit root is:

$$\Delta y_t = a_0 + a_1 y_{t-1} + \sum_{i=2}^{k} b_i \Delta y_{t-i+1} + e_t \quad \text{...(13)}$$

Above equation adds an intercept term to the pure random walk model which constitutes another version of the ADF test. The null hypothesis of unit root fails to be rejected if $a_1 = 0$. If the null hypothesis $a_1 = 0$ is rejected, the series is stationary.

After finding which series are nonstationary (in level) and have same order of integration, we test whether the linear combination of the series is stationary, *i.e.* they are cointegrated. Cointegration test is a test for equilibrium between nonstationary variables which have same order of integration. It becomes important since nonstationary variables may bring a possibility of the existence of the long-run relationship among variables in the vector auto-regression system (Engle and Granger, 1987).

[6] Krugman and Obstfeld (2000), for instance, give a thorough explanation about the argument of J-curve effect

To accommodate the cointegration test for this paper, as the third stage, we perform the Johansen test. Johansen (1991) introduces two likelihood ratio test statistics for testing the hypothesis of r cointegrating vectors. They are broadly known as the trace statistic and the maximum eigenvalue statistic (l_{max}). The first statistic tests the null hypothesis $r = r_0$ against the alternative $r > r_0$ for $r_0 = (0, 1, \ldots, p)$. Where, if the null hypothesis of at most r_0 cointegrating vectors is true, then there should be $p - r_0$ eigenvalues which are not statistically different from zero. While, the latter tests the null hypothesis $r = r_0$ against the alternative $r = r_0 + 1$. In this case, if the null hypothesis is true, then we can expect that $r_0 + 1$ eigenvalues are not statistically different from zero. Actually, the intuition of those tests is that since cointegrating relationships are connected with nonzero eigenvalues, thus testing the null hypothesis of r cointegrating vectors is alike to testing how many of the largest ordered eigenvalues are significantly different from zero (see Yousefi and Wirjanto, 2003).

In general, if the results conclude the absence of cointegrating vectors between the variables, it means that there is no long-run relationship among them. Conversely, if co-integration exists, then the long-run relationship among variables appears in the case and it can be presumed that a dynamic specification of the error correction mechanism is appropriate (Engle and Granger, 2000). For the last step, the paper executes the VECM in order to examine the short and long-run relationship of the model. Additionally, the impulse response function and variance decomposition are applied for complementing the dynamic perspective of the paper.

However, in order to expand our analysis, we investigate the short-run relationship between the trade balance and other considered variables for the bilateral cases which are excluded from the execution of VECM by using OLS. OLS is still employed based on Equation (11), in which all variables are treated at their appropriate integration order and optimum lag length. Furthermore, the presence of a structural break also becomes our consideration. To accommodate that matter, the paper uses two types of structural break tests, namely structural break test with a known break point and structural break test with an unknown break point.

1.3.2 Data source

To carry out the empirical work, quarterly data for the first quarter of 1980 to the third quarter of 2007 (1980q1-2007q3) are used[7]. Data are collected from *Direction of Trade Statistics* (DOTS) of IMF and *International Financial Statistics* (IFS) of IMF. The real bilateral trade balance (*TB*) is measured as a ratio of merchandise *f.o.b.* exports to merchandise *c.i.f.* imports multiplied by 100. Since *DOTS*-IMF only covered 2003q1-2007q3 Singapore's export-import data to and from Indonesia, then the paper will only used that series for the case without doing any techniques of data mining.

Due to the absence of quarterly GDP data in most countries during the research periods (1980q1-2007q3), following Wilson and Tat (2001), Bahmani-Oskooee and Goswami (2003) and Bahmani-Oskooee and Ratha (2004), this paper uses industrial production index (for Malaysia, Japan and the US) and manufacturing production index (for Indonesia, Philippines, and Singapore) as a proxy for the real domestic (foreign) income. All with index numbers (2000=100). Note that, since those two indexes are not available for Thailand, then this paper uses quarterly data of nominal GDP for that country but with a shorter research period (1993q1-2007q3)[8]. Thailand's quarterly nominal GDP series was deflated by its CPI (2000=100) to express it in real terms. It then was expressed as an index with 2000=100.

Home country's real cash balance (*h*), following Bahmani-Oskooee (1985) and Tongzon and Felmingham (1998), is obtained by adding currency outside banks (*IFS*, 14a) and commercial banks reserves (*IFS*, 20) and then deflated by the country's CPI (*IFS*, 64). An

[7] Note that for all Thailand cases and Singapore-Indonesia case, this paper uses quarterly data for 1993q1-2007q3 and 2003q1-2007q3 respectively.
[8] *IFS*-IMF data source only provides Thailand's nominal GDP data from 1993q1 to 2007q3. Manufacturing production index data are used if a country does not have industrial production index data. For consistency, the paper uses industrial production index for Japan and the US.

equivalent procedure (as shown by *h*) is used to generate the foreign country's real cash balance (h^*) based on their respective data.

The bilateral real exchange rate (*q*) is computed by multiplying the spot or market exchange rate –*e* (*IFS*, rf) by the ratio of foreign price to the domestic price level and then multiplied by 100. Price level will be proxied by the CPI (*IFS*, 64). Note that, since the IMF provides all exchange rates in relation to the US dollar, then a conversion adjustment in relation to other currencies -outside the US dollar- are needed. If the bilateral exchange rate want to be generated against the Malaysian Ringgit, then domestic currency value of the Ringgit can be measured as the ratio of the domestic currency exchange rate against the US dollar to the Ringgit rate against the US dollar. Further explanation about data and variables used are summarized in Table 2. All variables are in natural logarithm form.

Table 2. Variables, definitions and data sources

Variable	Definition	Source
TB	The real bilateral trade balance. It is measured as a ratio of merchandise f.o.b. exports to merchandise c.i.f. imports multiplied by 100. Singapore-Indonesia case (but not Indonesia-Singapore) used data from 2003q1 to 2007q3.	DoTS (Direction of Trade Statistic), IMF, various years
$y(y^*)$	The domestic (foreign) country's real domestic income. Following Wilson and Tat (2001), Bahmani-Oskooee and Goswami (2003) and Bahmani-Oskooee and Ratha (2004), this paper uses industrial production index (for Malaysia, Japan and the US) and manufacturing production index (for Indonesia, Philippines, and Singapore) instead of real GDP. Since those two indexes are not available for Thailand, then this paper uses quarterly data of nominal GDP for the country with a shorter research period (1993q1-2007q3).	IFS (International Financial Statistics), IMF, various years
$h(h^*)$	Domestic (foreign) country's real cash balance. Following Bahmani-Oskooee (1985) and Tongzon and Felmingham (1998), they are obtained by adding currency outside banks (*IFS*, 14a) and commercial banks reserves (*IFS*, 20) and then deflated by the country's CPI (*IFS*, 64).	IFS (International Financial Statistics), IMF, various years
q	The real bilateral exchange rate; it is computed by multiplying the spot or market exchange rate –*e* (*IFS*, rf) by the ratio of foreign price -foreign country's CPI (*IFS*, 64) to the domestic price level -home country's CPI (*IFS*, 64) and then multiplied by 100.	IFS (International Financial Statistics), IMF, various years

1.4 Empirical results

As the first step, this paper determines the lag length of each bilateral case by using Akaike Information Criterion (AIC). In order to get the optimum lag length, following Moura and Da Silva (2005), we estimate a vector auto regression (VAR) for the variables in levels, where it imposes a maximum of six lags on each variable and employs AIC to select the optimum lag length[9]. The results are reported in Table 3.

Table 3. The optimum lag length based on AIC for each country case

Trading partner	**Case**				
	Indonesia	Malaysia	Philippines	Singapore	Thailand
Indonesia (Ina)	-	1	5	1	6
Malaysia (Mal)	1	-	5	3	6
Philippines (Philip)	5	5	-	5	6
Singapore (Sing)	5	6	6	-	6
Thailand (Thai)	6	6	6	6	-
Japan (Jap)	6	6	6	6	6
The US (the US)	6	6	5	6	6

For the next step, we test for stochastic trends in the autoregressive representation of each individual time series using the augmented Dickey - Fuller (ADF) test. Through ADF, we check the variables for unit roots to examine their order of integration, since cointegration requires the variables to be integrated in the same order. For this test, intercept terms in the test regression are included.

According to Table 4, the ADF test finds two individual time series are stationary in level [I(0)], namely (i) the trade balance (*TB*) between Indonesia and Malaysia, and (ii) the trade balance between Malaysia and Indonesia. For the majority of remaining series, the ADF tests provide a strong indication of unit roots, in which they are [I(1)] processes in their respective bilateral case. However, there are exceptions to these ten series which are

[9] Due to the limitation of data availability, the paper imposed a maximum of one lag on each variable for Singapore-Indonesia series.

stationary in second differences [I(2)], namely *y* data for Thailand and the US (in Thailand-US case), *h* data for Indonesia, Malaysia and Philippine (when they do trade with Thailand), *q* data for Malaysia-Thailand, Singapore-Indonesia, Thailand-Malaysia, Thailand-the US, and *TB* data for Singapore-Thailand.

Table 4. Summary results of unit root tests

Case	Integration order	Variable					
		TB_t	y_t	y_t^*	h_t	h_t^*	q_t
Indonesia-Malaysia	*I(0)*	*-3.74**	-1.53	-0.91	-0.39	-1.56	-2.62
	I(1)	-	*-9.47**	*-7.77**	*-14.11**	*-5.76**	*-6.97**
Indonesia-Philippines	*I(0)*	-2.68	-1.43	-2.03	-0.27	-0.17	-1.68
	I(1)	*-4.98**	*-3.90**	*-4.50**	*-3.96**	*-3.05**	*-5.21**
Indonesia-Singapore	*I(0)*	-0.96	-1.43	0.51	-0.27	-1.85	-1.96
	I(1)	*-4.25**	*-3.90**	*-5.62**	*-3.96**	*-4.47**	*-5.60**
Indonesia-Thailand	*I(0)*	-2.58	-1.83	-0.39	-1.47	-1.89	-1.60
	I(1)	*-4.02**	*-3.41**	-2.10	-2.62	*-3.85**	*-3.36**
	I(2)	-	-	*-3.61**	*-3.76**	-	-
Indonesia-Japan	*I(0)*	-1.96	-1.59	-1.50	0.10	-1.04	-2.13
	I(1)	*-5.09**	*-3.77**	*-3.82**	*-3.52**	*-4.52**	*-4.25**
Indonesia-the US	*I(0)*	-1.48	-1.59	-0.04	0.10	-0.97	-1.97
	I(1)	*-4.59**	*-3.77**	*-4.70**	*-3.52**	*-4.65**	*-4.74**
Malaysia-Indonesia	*I(0)*	*-4.55**	-0.91	-1.53	-1.56	-0.39	-2.62
	I(1)	-	*-7.77**	*-9.47**	*-5.76**	*-14.11**	*-6.97**
Malaysia-Philippines	*I(0)*	-2.01	-1.11	-2.03	-1.57	-0.17	-1.20
	I(1)	*-6.60**	*-5.06**	*-4.50**	*-3.74**	*-3.05**	*-4.00**
Malaysia-Singapore	*I(0)*	-2.60	-1.08	0.63	-1.68	-2.34	-1.07
	I(1)	*-4.33**	*-4.09**	*-4.40**	*-3.40**	*-5.15**	*-3.97**
Malaysia-Thailand	*I(0)*	-2.80	-1.28	-0.39	-1.76	-1.89	-1.96
	I(1)	*-3.04**	*-3.76**	-2.10	-2.63	-3.85*	-2.56
	I(2)	-	-	*-3.61**	*-4.72**	-	*-3.72**
Malaysia-Japan	*I(0)*	-1.57	-1.08	-1.50	-1.68	-1.04	-1.91
	I(1)	*-3.24**	*-4.09**	*-3.82**	*-3.40**	*-4.52**	*-3.85**
Malaysia-the US	*I(0)*	-1.55	-1.08	-0.04	-1.68	-0.97	-1.19
	I(1)	*-4.98**	*-4.09**	*-4.70**	*-3.40**	*-4.65**	*-3.70**
Philippines-Indonesia	*I(0)*	-3.15	-2.03	-1.43	-0.17	0.27	-1.68
	I(1)	*-6.01***	*-4.50**	*-3.90**	*-3.05**	*-3.96**	*-5.21**
Philippines-Malaysia	*I(0)*	-1.59	-2.03	-1.11	-0.17	-1.57	-1.20
	I(1)	*-6.95**	*-4.50**	*-5.06**	*-3.05**	*-3.74**	*-4.00**
Philippines-Singapore	*I(0)*	-2.64	-2.16	0.63	-0.17	-2.34	-2.63
	I(1)	*-5.44**	*-4.30**	*-4.40**	*-2.85****	*-5.15**	*-5.33**

Table 4. (Continued)

Case	Integration order	Variable					
		TB_t	y_t	y_t^*	h_t	h_t^*	q_t
Philippines-Thailand	*I(0)*	-1.76	-1.75	-0.39	0.48	-1.89	-1.87
	I(1)	*-3.07**	*-3.03**	-2.10	-1.37	*-3.85**	*-3.02**
	I(2)	-	-	*-3.61**	*-4.61**	-	-
Philippines-Japan	*I(0)*	-1.86	-2.16	-1.50	-0.17	-1.04	-2.38
	I(1)	*-4.02**	*-4.30**	*-3.82**	*-2.85****	*-4.52**	*-4.44**
Philippines-the US	*I(0)*	-2.23	-2.03	0.18	-0.17	-0.91	-1.97
	I(1)	*-4.39**	*-4.50**	*-3.76**	*-3.05**	*-3.80**	*-4.33**
Singapore-Indonesia	*I(0)*	-2.83	-1.10	-3.07	1.91	-1.72	-1.32
	I(1)	*-3.32**	*-3.86**	*-5.18***	*-3.57**	*-4.41**	-2.60
	I(2)	-	-	-	-	-	*-3.97**
Singapore-Malaysia	*I(0)*	-1.72	0.49	-1.02	-1.81	-1.50	-1.29
	I(1)	*-5.04**	*-4.02**	*-4.98**	*-5.18**	*-3.97**	*-5.05**
Singapore-Philippines	*I(0)*	-1.79	0.51	-2.03	-1.85	-0.17	-2.62
	I(1)	*-5.46**	*-5.62**	*-4.50**	*-4.47**	*-3.05**	*-5.51**
Singapore-Thailand	*I(0)*	-0.21	0.61	-0.39	0.14	-1.89	-1.74
	I(1)	-2.19	*-3.45**	-2.10	*-4.01**	*-3.85**	*-2.77****
	I(2)	*-5.34**	-	*-3.61**	-	-	-
Singapore-Japan	*I(0)*	-0.24	0.63	-1.50	-2.34	-1.04	-2.74
	I(1)	*-5.20**	*-4.40**	*-3.82**	*-5.15**	*-4.52**	*-3.83**
Singapore-the US	*I(0)*	-1.88	0.63	-0.04	-2.34	-0.97	-1.92
	I(1)	*-4.57**	*-4.40**	*-4.70**	*-5.15**	*-4.65**	*-2.68****
Thailand-Indonesia	*I(0)*	-3.47	-0.39	-1.83	-1.89	-1.47	-1.60
	I(1)	*-5.60***	-2.10	*-3.41**	*-3.85**	*-2.62*	*-3.36**
	I(2)	-	*-3.61**	-	-	*-3.76**	-
Thailand-Malaysia	*I(0)*	-2.72	-0.39	-1.28	-1.89	-1.76	-1.96
	I(1)	*-3.52**	-2.10	*-3.76**	*-3.85**	*-2.63*	-2.56
	I(2)	-	*-3.61**	-	-	*-4.72**	*-3.72**
Thailand-Philippines	*I(0)*	-2.87	-0.39	-1.75	-1.89	0.48	-1.87
	I(1)	*-3.65**	-2.10	*-3.03**	*-3.85**	-1.37	*-3.02**
	I(2)	-	*-3.61**	-	-	*-4.61**	-
Thailand-Singapore	*I(0)*	-0.57	-0.39	0.61	-1.89	0.14	-1.74
	I(1)	*-3.51**	-2.10	*-3.45**	*-3.85**	*-4.01**	*-2.77****
	I(2)	-	*-3.61**	-	-	-	-
Thailand-Japan	*I(0)*	-2.07	-0.39	0.25	-1.89	-1.44	-1.19
	I(1)	*-3.50**	-2.10	*-3.04**	*-3.85**	*-3.11**	*-2.66****
	I(2)	-	*-3.61**	-	-	-	-
Thailand-the US	*I(0)*	-1.52	-0.39	-1.34	-1.89	-1.21	-1.56
	I(1)	*-3.47**	-2.10	-2.32	*-3.85**	*-3.24**	-2.32
	I(2)	-	*-3.61**	*-4.47**	-	-	*-3.84**

Notes: (1) All variables in natural logarithm form. (2) These tests are carried out over the period 1980q1 to 2007q3 except for all Thailand cases which are carried out over 1993q1 to 2007q3 and Singapore-Indonesia case which are carried out over 2003q1 to 2007q3. (3) This paper tests the null hypothesis of a unit root in levels and also in first differences and second differences of variables. (4) *, ** and *** mean to reject the null hypothesis at 5%, 1% and 10% level, respectively.

Since some series are integrated of different order and we have considerable evidence that the majority of the series are getting stationary in first differences [I(1)], hence this paper only consider to identify the long-run relationships among variables for each bilateral case which are stationary at [I(1)]. All bilateral cases which posses variables that get stationary in second differences [I(2)] are excluded from the cointegration test.

Table 5. Summary results of Johansen cointegration tests

Case	(r)	Eigenvalues	The statistic value of		The *p*-value of	
			Trace	l_{max}	Trace	l_{max}
Indonesia-Philippines	*r*=0	0.244	87.684	29.317	0.158	0.470
	r=1	0.231	58.367	27.603	0.289	0.232
	r=2	0.154	30.764	17.612	0.679	0.528
	r=3	0.062	13.152	6.704	0.884	0.965
	r=4	0.047	6.448	5.022	0.643	0.739
	r=5	0.013	1.426	1.426	0.232	0.232
Indonesia-Singapore	*r*=0	0.398	*137.009***	*53.319***	0.000	0.001
	r=1	0.274	*83.689***	*33.662****	0.002	0.053
	r=2	0.235	*50.027**	*28.136**	0.031	0.043
	r=3	0.123	21.891	13.827	0.305	0.379
	r=4	0.068	8.064	7.426	0.459	0.440
	r=5	0.006	0.637	0.637	0.425	0.425
Indonesia-Japan	*r*=0	0.303	*114.386***	*37.570****	0.001	0.093
	r=1	0.244	*76.817**	29.120	0.012	0.167
	r=2	0.178	*47.697****	20.325	0.052	0.319
	r=3	0.168	*27.371****	*19.089****	0.093	0.094
	r=4	0.069	8.282	7.410	0.436	0.442
	r=5	0.008	0.872	0.872	0.351	0.351
Indonesia-the US	*r*=0	0.316	*123.022***	*39.427****	0.000	0.059
	r=1	0.282	*83.595***	*34.505**	0.003	0.042
	r=2	0.187	*49.090**	21.476	0.038	0.249
	r=3	0.142	*27.614****	15.937	0.088	0.229
	r=4	0.075	11.677	8.114	0.173	0.367
	r=5	0.034	*3.563****	*3.563****	0.059	0.059
Malaysia-Philippines	*r*=0	0.326	*104.313**	*41.357**	0.011	0.036
	r=1	0.219	62.957	25.953	0.156	0.324
	r=2	0.159	37.004	18.190	0.347	0.480
	r=3	0.093	18.814	10.242	0.506	0.722
	r=4	0.056	8.573	5.998	0.406	0.614
	r=5	0.024	2.575	2.575	0.109	0.109
Malaysia-Singapore	*r*=0	0.285	*105.238**	34.880	0.010	0.172
	r=1	0.251	*70.358**	30.107	0.045	0.132
	r=2	0.173	40.251	19.748	0.214	0.359
	r=3	0.138	20.502	15.421	0.389	0.261
	r=4	0.047	5.081	4.972	0.800	0.745
	r=5	0.001	0.109	0.109	0.741	0.741

Table 5. (Continued)

Case	(r)	Eigenvalues	The statistic value of: Trace	The statistic value of: l_{max}	The *p*-value of: Trace	The *p*-value of: l_{max}
Malaysia-Japan	*r*=0	0.309	*118.733***	*38.422****	0.001	0.076
	r=1	0.245	*80.311***	29.161	0.006	0.165
	r=2	0.219	*51.151**	*25.675****	0.024	0.086
	r=3	0.107	25.475	11.756	0.145	0.572
	r=4	0.099	*13.719****	10.879	0.091	0.160
	r=5	0.027	*2.840****	*2.840****	0.092	0.092
Malaysia-the US	*r*=0	0.345	*140.455***	*43.951**	0.000	0.018
	r=1	0.314	*96.503***	*39.166**	0.000	0.011
	r=2	0.233	*57.337***	*27.524****	0.005	0.051
	r=3	0.116	*29.813**	12.837	0.049	0.467
	r=4	0.083	*16.976**	9.056	0.030	0.282
	r=5	0.073	*7.921***	*7.921***	0.005	0.005
Philippines-Indonesia	*r*=0	0.252	76.318	30.440	0.495	0.396
	r=1	0.177	45.878	20.407	0.802	0.728
	r=2	0.105	25.471	11.622	0.905	0.947
	r=3	0.064	13.850	6.936	0.849	0.956
	r=4	0.040	6.913	4.284	0.588	0.828
	r=5	0.025	2.630	2.629	0.105	0.105
Philippines-Malaysia	*r*=0	0.257	*94.950****	31.221	0.057	0.347
	r=1	0.224	63.729	26.636	0.139	0.283
	r=2	0.138	37.093	15.560	0.343	0.703
	r=3	0.120	21.533	13.438	0.325	0.413
	r=4	0.044	8.095	4.732	0.455	0.775
	r=5	0.032	*3.363****	*3.363****	0.067	0.067
Philippines-Singapore	*r*=0	0.266	*98.278**	32.129	0.033	0.296
	r=1	0.211	*66.149****	24.616	0.095	0.412
	r=2	0.177	41.533	20.199	0.172	0.328
	r=3	0.117	21.335	12.902	0.337	0.461
	r=4	0.061	8.432	6.581	0.420	0.540
	r=5	0.018	1.852	1.852	0.174	0.174
Philippines-Japan	*r*=0	0.345	*118.052***	*44.025**	0.001	0.017
	r=1	0.282	*74.028**	*34.525**	0.022	0.042
	r=2	0.156	39.503	17.616	0.241	0.527
	r=3	0.109	21.887	12.046	0.305	0.543
	r=4	0.059	9.842	6.336	0.293	0.571
	r=5	0.033	*3.506****	*3.506****	0.061	0.061
Philippines-the US	*r*=0	0.289	*108.926***	35.761	0.005	0.142
	r=1	0.253	*73.165**	30.583	0.026	0.118
	r=2	0.153	42.581	17.380	0.143	0.548
	r=3	0.128	25.202	14.403	0.154	0.333
	r=4	0.060	10.799	6.457	0.224	0.555
	r=5	0.041	*4.342**	*4.342**	0.037	0.037
Singapore-Malaysia	*r*=0	0.223	79.808	27.014	0.371	0.632
	r=1	0.209	52.795	25.131	0.514	0.376
	r=2	0.104	27.663	11.787	0.828	0.941
	r=3	0.074	15.876	8.266	0.721	0.887
	r=4	0.068	7.611	7.581	0.508	0.423
	r=5	0.0003	0.030	0.030	0.862	0.862
Singapore-Philippines	*r*=0	0.280	*92.176****	34.505	0.086	0.182
	r=1	0.218	57.671	25.794	0.314	0.333
	r=2	0.137	31.877	15.522	0.619	0.706

Table 5. (Continued)

Case	(r)	Eigenvalues	The statistic value of		The *p*-value of	
			Trace	l_{max}	Trace	l_{max}
	r=3	0.106	16.355	11.821	0.687	0.566
	r=4	0.041	4.534	4.388	0.856	0.816
	r=5	0.001	0.146	0.146	0.702	0.702
Singapore-Japan	r=0	0.358	121.814^{**}	46.059^{*}	0.000	0.010
	r=1	0.235	75.754^{*}	27.832	0.016	0.221
	r=2	0.188	47.922^{*}	21.698	0.049	0.236
	r=3	0.159	26.224	17.996	0.122	0.130
	r=4	0.061	8.229	6.502	0.441	0.550
	r=5	0.016	1.727	1.727	0.189	0.189
Singapore-the US	r=0	0.472	169.842^{**}	66.378^{**}	0.000	0.000
	r=1	0.340	103.464^{**}	43.191^{**}	0.000	0.003
	r=2	0.242	60.273^{**}	28.864^{*}	0.002	0.034
	r=3	0.168	31.409^{*}	19.153^{***}	0.032	0.093
	r=4	0.106	12.256	11.614	0.145	0.126
	r=5	0.006	0.642	0.642	0.423	0.423

Notes: (1) r denotes the number of cointegrating vector. (2) *, ** and *** denote rejection of null hypothesis at 5%, 1% and 10% level, respectively.

So as the consequence, the paper cannot conduct cointegration test in the bilateral case of: (i) Indonesia-Malaysia, (ii) Indonesia-Thailand, (iii) Malaysia-Indonesia, (iv) Malaysia-Thailand, (v) Philippines-Thailand, (vi) Singapore-Indonesia, (vii) Singapore-Thailand, (viii) Thailand-Indonesia, (ix) Thailand-Malaysia, (x) Thailand-Philippines, (xi) Thailand-Singapore, (xii) Thailand-Japan, and (xiii) Thailand-the US.

This paper uses Johansen cointegration test to find out the possibility of long run relationship among the variables in each case. In applying the test, the optimum lag length employed can be different for every case. They are chosen according to the minimum AIC as reported by Table 3. Using the procedure proposed by McKinnon *et al.* (1999), the *p*-values of trace and the maximum eigenvalue test results are reported in Table 5.

Based on the computed *p*-values, we reject the null hypothesis of no cointegration (r=0) in 9 out of 17 cases. Those 9 cases have at least one cointegrating relationship among the variables, hence as a result; we only can apply VECM in those bilateral cases. They are: (i) Indonesia-Singapore; (ii) Indonesia-Japan; (iii) Indonesia-the US; (iv) Malaysia-

Philippines; (v) Malaysia-Japan; (vi) Malaysia-the US; (vii) Philippines-Japan; (viii) Singapore-Japan; and (ix) Singapore-the US.

The last step constructs the VECM which will estimate the long run and the short run relationship between the trade balance and other variables of interest. However, in order to expand our analysis, we investigate also the short-run relationship between the trade balance and other considered variables for the cases which are excluded from the execution of VECM by using OLS. For that purpose, all variables will be estimated based on Equation (11) at their appropriate integration order and optimum lag length.

1.4.1 The long run relationship

Since the results of Johansen cointegration test show various numbers of cointegrating vectors in the bilateral cases which reject the null hypothesis, this suggests that the long run relationship is not unique. With respect to that, following Singh (2004), we decide to use the first cointegrating vector as the most likely vector in our not unique long run analysis due to it provides the maximal eigenvalue statistics in the test[10]. So, hereafter we consistently hold the idea when applying Johansen cointegration test.

In Table 6, the estimated coefficients of the first cointegrating vector (g) are normalized with respect to the coefficient of the $Ln\ TB$. Among all of bilateral cases which are reported, only the case of Indonesia-Singapore and Indonesia-Japan indicate an expected positive long run relationship between the real exchange rate (q) and the real bilateral trade balance (TB). With a long run elasticity of 1.81 and 4.44, respectively, they provide strong empirical support to the theoretically predicted real depreciation improves the trade balance in the long run. Marshall-Lerner condition holds in those bilateral cases. On the contrary, for other bilateral cases, this paper fails to find such a relationship. However, the case of Singapore-the US still shows an expected positive sign though it is statistically insignificant.

[10] See only the cases which reject the null hypothesis of no cointegration in Table 5.

Table 6. Long run relationship of the variables: Estimation of VECM

Case	Type of coef.	TB_t	y_t	y_t^*	h_t	h_t^*	q_t	Const.
Indonesia-Sing.	g	1.0	-0.889^{***} (-1.820)	0.766 (1.372)	0.121 (0.769)	1.249^{***} (1.801)	-1.807^{**} (-6.541)	11.250
Indonesia-Japan	g	1.0	4.997^{**} (2.815)	13.473^{***} (1.959)	-5.999^{**} (-3.881)	14.752^{**} (3.499)	-4.440^{*} (-2.501)	20.638
Indonesia-the US	g	1.0	0.935^{**} (4.094)	-10.483^{**} (-4.591)	0.073 (0.234)	4.030^{*} (2.600)	1.382^{**} (4.161)	11.139
Malaysia-Philip.	g	1.0	-36.649 (-1.589)	20.503 (1.160)	-18.008^{**} (-3.331)	12.310 (1.062)	81.920^{**} (3.998)	-8.983
Malaysia-Japan	g	1.0	-22.443 (-1.474)	-45.348^{***} (-1.896)	-3.395 (-0.901)	10.058 (0.736)	57.924^{**} (5.317)	264.36
Malaysia-the US	g	1.0	-0.502^{***} (-1.928)	0.983 (1.135)	0.234 (1.661)	-1.960^{**} (-2.926)	1.993^{**} (3.090)	-16.86
Philip.-Japan	g	1.0	-0.169 (-0.220)	-12.173^{**} (-3.161)	2.050 (1.628)	-2.957^{**} (-2.889)	8.299^{**} (5.183)	56.976
Sing.-Japan	g	1.0	-0.513 (-1.259)	-2.235^{**} (-3.105)	1.425^{**} (2.867)	-0.875^{**} (-4.079)	0.744^{**} (2.694)	0.560
Sing.-the US	g	1.0	3.461^{**} (7.188)	-1.756^{***} (-1.846)	-3.842^{**} (-10.091)	-0.551 (-0.932)	-0.028 (-0.086)	8.803

Notes: (1) g coefficients are estimated cointegrating coefficients which are normalized on Ln TB. (2) The *t*-statistics are reported in the parenthesis. (3) *, ** and *** denote rejection of null hypothesis at 5%, 1% and 10% level, respectively.

The long run coefficients of real domestic income (y) for Indonesia-Japan (-4.997), Indonesia-the US (-0.935) and Singapore-the US (-3.461) are each significant at 1% level and this evidence suggests that the real domestic income (y) contributes significantly towards the deterioration in real trade balance (TB). At the same time, foreign real income (y^*) is correctly signed and has a significant (positive) impact on the real trade balance for 5 bilateral cases, i.e. Indonesia-the US (10.483), Malaysia-Japan (45.348), Philippines-Japan (12.173), Singapore-Japan (2.235), and Singapore-the US (1.756). However, we find two positive significant coefficients of y for Indonesia-Singapore and Malaysia-the US, implying the possibility of the existence of import-substitution effect in those cases.

Home real cash balance (h) displays the correct sign for 5 bilateral cases too but is significant only for Singapore-Japan case. Meanwhile, the estimated long run foreign real cash balance (h^*) carries the expected positive sign in 4 bilateral cases, where three of them are statistically significant. Those are the bilateral case of Malaysia-the US (1.960), Philippines-Japan (2.957), Singapore-Japan (0.875), and Singapore-the US (0.551).

Through those 9 cases, we discover some issues related to the long run analysis. First, we find that the income effect seems more dominant and consistent than the import-substitution effect. The evidence shows that Indonesia and Singapore exports to the US have increased because of the US income effect. Also, for Malaysia, Philippines, and Singapore exports to Japan seem have been affected favorably by the Japan income effect. The import-substitution effect, however, is present in the trade between Indonesia-Singapore and Malaysia-the US as displayed by the positive coefficients for Indonesia and Malaysia income. In such a case, as reporting country income increases, imports from trading partners decrease due to an increase in the production of import-substitution goods, yielding an improvement in the reporting country trade balance.

Second, the income effects play a major role in determining the trade balances since their coefficients are relatively greater than other variables' coefficients and they appear in relatively more bilateral cases. Third, the cash balance effects play a minor role in influencing the trade balance since their coefficients show the smallest figure in relative meaning. The effect consistently appears only for Singapore-Japan case. Although, for Malaysia-the US and Philippines-Japan, the coefficient sign of home (h) and foreign (h^*) cash balance's are correctly signed but only the coefficients of the latter are statistically significant, implying the effect of cash balance only driven by the foreign cash balance.

Fourth, the results provide evidence for the exchange rate effect in our bilateral cases. The long run effects of real exchange rate on trade balance are presented significantly positive in the trade between Indonesia and Singapore and Japan, indicating the Marshall-Lerner condition holds in those 2 cases. It suggests that a real depreciation improves the trade balance eventually. However, in all other cases, the coefficients of q are wrongly signed.

1.4.2 The short run relationship and the speed of adjustment

In this part, the paper will deal with the influence of all considered variables on the short run behavior of bilateral trade balance. In addition, we analyze the speed of adjustment coefficients which indicate the speed of movement of trade balance over time toward its long run equilibrium levels. The explanations will not only focus on 9 bilateral cases which have been investigated by VECM, but also cover all remaining bilateral cases which are considered by the study. We use OLS in analyzing the latter.

The results of VECM estimation for the short run relationship are reported in Table 7. Changes in the value of Indonesia's bilateral trade balance with Singapore are affected by the lagged four period value of the domestic real income ($\Delta y_{(t-4)}$). Domestic real income (*y*) seems always be a variable which brings a significant positive impact to the Indonesia-Singapore real trade balance in both types of relationship long run and short run. It strengthens a possibility that the import-substitution effect exists for the case. Yet, another possibility also could happen, *i.e.* the reporting country's exports are not driven by the demand factor but determined by the supply factor. Onafowora (2003) notes that supply can also be a main determining factor of exports and imports when higher exports are originated from the utilization of domestic surplus which are carried by a condition where increases in domestic output surpass increases in domestic consumption.

The import-substitution effects are found in the bilateral trade for Indonesia, Malaysia, and Singapore with respect to the US. In addition, the effects also appear in the case of Malaysia-Japan and Philippines-Japan. Meanwhile, the income effect can be seen in Malaysia-Philippines. In this case, the Philippines income carries the expected positive sign and it is statistically significant at the 10% level of significance, indicating that the Malaysian export to Philippines have increased in the short run due to the Philippines income effect.

However, we also note that both income and import-substitution effect exist simultaneously in the case of Philippines-Japan and Singapore-the US. For the former case, both y (lagged two, four, and five periods) and y^* (lagged four periods) carry a positive sign which means that they contribute favorably towards the improvement in trade balance. In this case, as Philippines income increases, imports from Japan decline due to an increase in the production of import-substitute goods. Beside that, Philippines exports to Japan have increased too because of the Japanese income effect. Here, the income effect contributes a greater impact than the import-substitution effect towards the improvement in trade balance (see the magnitudes for lagged four periods). For the latter case, both y (lagged three, five, and six periods) and y^* (lagged three and six periods) display a negative sign which means that they contribute unfavorably towards the change in trade balance. This condition happens due to the increase in US income (y^*) is originated from an increase in the production of substitutes for Singapore's goods which in turn cause Singapore may export less. In addition, due to the Singapore income effect, Singapore may import more, yielding in a deterioration of its trade balance. So, in Singapore-the US case, it is found that the import-substitution effect contributes a greater impact than the income effect towards the deterioration in trade balance (see the magnitudes for lagged three and six periods).

From above analysis, the findings indicate that in the short run relationship, the import-substitution effect seems more dominant than the income effect. The situation is quite different with the situation when the analysis is performed for the long run relationship. At long run analysis, the income effect is found as the most influential effect which determines the trade balance.

The short run coefficients of domestic real cash balance (*h*) are reported significant and correctly signed (negative) for Indonesia-the US (lagged two and three periods), Malaysia-Philippines (lagged five periods), Malaysia-Japan (lagged one and five periods), and Singapore-Japan (lagged two and three periods). Interestingly for Singapore-Japan, *h* carries consistent expected sign and is statistically significant in both short run and long run relationship. It suggests that the real cash balance effect is strongly present in that bilateral case.

Meanwhile, the short run coefficients of foreign real cash balance (h^*) displays the correct sign (positive) and are significant at 10% level or better for Indonesia-the US (lagged two, three, and five periods), Malaysia-Philippines (lagged two and four periods), Malaysia-Japan (lagged five and six periods), Malaysia-the US (lagged three periods), Philippines-Japan (lagged two, four, and five periods), and Singapore-the US (lagged six periods). The real cash balance effects are found robust in the case of Indonesia-the US, Malaysia-Philippines, and Malaysia-Japan since for those cases, both h and h^* simultaneously carry the expected sign and are statistically significance. This suggests that a rise in reporting country (trading partner) cash balance -h (h^*) leads to an increase in domestic (trading partner) demand for trading partner imports (domestic exports), thereby worsening (improving) the trade balance.

So far, in the short run, the income effect plays a less influential role than the cash balance effect in determining the trade balances since the income effect presences in relatively less bilateral cases and the cash balance effect displays more consistent appropriate sign on the variables. However, the magnitudes of the variables which are related to those two effects seem are not so significantly different in figure.

The estimated short run coefficients for the exchange rate (q) are found negative and significantly different from zero in two cases, *i.e*. Indonesia-Singapore (lagged one, three, and four periods), and Singapore-Japan (lagged two periods). The negative sign of the short run coefficient of the exchange rate determines a possibility for the existence of the J-curve effect. The J-curve phenomenon would be consistent if an initially negative sign which occur in the short run followed by a positive sign in the long run. For our cases, the J-curve effect is present in the trade between Indonesia and Singapore (see Table 6 and 7). This finding indicates that when a real devaluation happens; Indonesia shows an initial short run worsening bilateral trade balance with Singapore which is then followed by a long run improvement of it. In short run, a deterioration of Indonesia's bilateral trade with Singapore is evident in response to one, three and four period lag of the real exchange rate.

Table 7. Short run relationship of the variables and the speed of adjustment coefficients: Estimation of VECM

Variable	Case and coefficients(1)								
	Ina-Sing	**Ina-Jap**	**Ina-US**	**Mal-Phil**	**Mal-Jap**	**Mal-US**	**Phil-Jap**	**Sing-Jap**	**Sing- US**
$\Delta TB_{(t-1)}$	0.050	-0.310*	-0.357**	-0.703**	-0.310*	-0.230***	-0.367**	-0.510**	-0.733**
	(0.400)	(-2.558)	(-2.717)	(-7.271)	(-2.624)	(-1.677)	(-3.151)	(-3.453)	(-5.171)
$\Delta TB_{(t-2)}$	0.051	-0.082	-0.156	-0.490**	-0.153	-0.142	-0.172	-0.239	-0.341*
	(0.419)	(-0.756)	(-1.144)	(-4.247)	(-1.282)	(-0.934)	(-1.358)	(-1.576)	(-2.172)
$\Delta TB_{(t-3)}$	0.073	0.021	-0.287*	-0.345**	0.079	0.196	-0.338*	-0.323*	-0.312***
	(0.631)	(0.208)	(-2.236)	(-2.943)	(0.631)	(1.244)	(-2.625)	(-2.197)	(-1.905)
$\Delta TB_{(t-4)}$	-0.033	-0.177***	-0.203	-0.255*	0.044	0.035	-0.275*	-0.271***	-0.084
	(-0.307)	(-1.779)	(-1.566)	(-2.230)	(0.352)	(0.208)	(-2.170)	(-1.958)	(-0.553)
$\Delta TB_{(t-5)}$	-0.095	-0.142	-0.043	-0.237*	0.033	0.229	-0.245***	-0.124	0.070
	(-0.954)	(-1.408)	(-0.363)	(-2.491)	(0.287)	(1.392)	(-1.831)	(-0.957)	(0.490)
$\Delta TB_{(t-6)}$	-	-0.030	0.041	-	-0.231*	-0.144	-0.065	0.035	0.041
	-	(-0.318)	(0.387)	-	(-2.025)	(-0.968)	(-0.512)	(0.309)	(0.384)
$\Delta y_{(t-1)}$	-0.024	-0.229	0.588	-1.261	0.180	0.710*	0.271	0.017	0.055
	(-0.050)	(-0.699)	(1.320)	(-1.665)	(0.830)	(2.079)	(1.025)	(0.056)	(0.156)
$\Delta y_{(t-2)}$	0.636	0.182	-0.449	0.853	-0.310	-0.213	0.491***	-0.217	-0.491
	(1.357)	(0.545)	(-1.080)	(1.127)	(-1.462)	(-0.683)	(1.704)	(-0.689)	(-1.405)
$\Delta y_{(t-3)}$	0.202	-0.309	0.090	0.967243	-0.063	0.082	0.440	0.076	-0.577***
	(0.443)	(-0.864)	(0.213)	(1.228)	(-0.296)	(0.269)	(1.557)	(0.240)	(-1.817)
$\Delta y_{(t-4)}$	1.009*	-0.155	0.216	-0.601	0.136	0.140	0.653*	0.475	0.115
	(2.234)	(-0.446)	(0.526)	(-0.745)	(0.641)	(0.469)	(2.303)	(1.484)	(0.384)
$\Delta y_{(t-5)}$	0.555	-0.059	-0.256	0.085	0.408*	-0.122	0.523***	0.141	-0.617*
	(1.168)	(-0.185)	(-0.641)	(0.107)	(1.913)	(-0.424)	(1.760)	(0.479)	(-2.303)
$\Delta y_{(t-6)}$	-	0.442	0.476	-	0.125	-0.044	0.442	-0.048	-0.616*
	-	(1.379)	(1.124)	-	(0.577)	(-0.152)	(1.651)	(-0.172)	(-2.194)
$\Delta y^*_{(t-1)}$	-0.720	-0.804	3.073	1.132***	-1.121	1.481	0.516	1.327***	1.653
	(-1.184)	(-0.682)	(1.043)	(1.784)	(-1.606)	(0.887)	(0.524)	(1.709)	(1.315)
$\Delta y^*_{(t-2)}$	-0.686	0.416	1.687783	-0.516	0.910	-2.569	0.184	-0.429	2.129
	(-1.339)	(0.354)	(0.600)	(-0.802)	(1.367)	(-1.498)	(0.193)	(-0.543)	(1.649)
$\Delta y^*_{(t-3)}$	0.726	1.271	-6.125*	-0.009	-1.146*	-1.755	-0.216	-1.635*	-2.347***
	(1.485)	(1.308)	(-2.158)	(-0.012)	(-2.027)	(-0.994)	(-0.275)	(-2.402)	(-1.855)
$\Delta y^*_{(t-4)}$	0.136	-1.170	-2.680	0.055	-0.574	2.086	1.547***	0.652	0.490
	(0.255)	(-1.156)	(-0.900)	(0.079)	(-1.010)	(1.361)	(1.925)	(0.978)	(0.460)
$\Delta y^*_{(t-5)}$	0.057	-0.901	2.339	0.295	-0.138	-0.924	-1.292	0.391	-0.056
	(0.093)	(-0.789)	(0.883)	(0.438)	(-0.217)	(-0.589)	(-1.374)	(0.558)	(-0.049)
$\Delta y^*_{(t-6)}$	-	1.024	-0.284	-	-0.837	0.189	-0.986	-0.277	-1.992***
	-	(0.885)	(-0.118)	-	(-1.327)	(0.144)	(-1.005)	(-0.400)	(-1.893)
$\Delta h_{(t-1)}$	0.142	-0.166	-0.168	0.778*	-0.197***	0.153	0.168	-0.249	0.197
	(0.530)	(-0.990)	(-0.714)	(2.113)	(-1.722)	(0.806)	(1.217)	(-0.736)	(0.619)
$\Delta h_{(t-2)}$	-0.124	-0.091	-0.469***	-0.146	-0.033	0.109	0.102	-0.679***	0.185
	(-0.410)	(-0.493)	(-1.856)	(-0.398)	(-0.288)	(0.555)	(0.655)	(-1.872)	(0.566)

Table 7. (Continued)

Variable	Case and coefficients[(1)]								
	Ina-Sing	**Ina-Jap**	**Ina-US**	**Mal-Phil**	**Mal-Jap**	**Mal-US**	**Phil-Jap**	**Sing-Jap**	**Sing- US**
$\Delta h_{(t-3)}$	-0.129	0.029	-0.514***	-0.217	0.145	-0.261	-0.010	-1.045**	0.067
	(-0.426)	(0.155)	(-1.837)	(-0.574)	(1.228)	(-1.300)	(-0.074)	(-2.845)	(0.206)
$\Delta h_{(t-4)}$	-0.291	0.422*	-0.308	-0.020	0.084	0.196	-0.051	-0.285	0.592***
	(-1.078)	(2.402)	(-1.133)	(-0.053)	(0.710)	(1.099)	(-0.356)	(-0.774)	(1.873)
$\Delta h_{(t-5)}$	0.167	0.341*	-0.112	-0.698***	-0.239*	-0.082	-0.023	-0.353	0.309
	(1.625)	(2.041)	(-0.476)	(-1.802)	(-2.132)	(-0.465)	(-0.142)	(-1.012)	(1.046)
$\Delta h_{(t-6)}$	-	0.120***	0.060	-	-0.113	-0.086	0.126	0.069	0.176
	-	(1.678)	(0.536)	-	(-0.958)	(-0.493)	(0.894)	(0.181)	(0.578)
$\Delta h^*_{(t-1)}$	-0.131	0.088	0.658	0.525	0.206	-0.401	0.205	0.065	0.335
	(-0.171)	(0.299)	(0.632)	(1.602)	(1.079)	(-0.638)	(0.822)	(0.291)	(0.615)
$\Delta h^*_{(t-2)}$	0.207	-0.268	2.242*	0.731*	-0.247	0.145	0.523*	0.172	-0.214
	(0.254)	(-0.885)	(2.178)	(2.428)	(-1.281)	(0.214)	(2.050)	(0.802)	(-0.399)
$\Delta h^*_{(t-3)}$	0.062	0.172	2.834*	0.399	-0.040	1.064***	0.370	0.103	0.747
	(0.075)	(0.599)	(2.607)	(1.401)	(-0.211)	(1.833)	(1.489)	(0.527)	(1.311)
$\Delta h^*_{(t-4)}$	1.308	0.204	0.649	0.628*	0.178	0.487	0.748**	-0.051	0.585
	(1.641)	(0.668)	(0.666)	(2.132)	(0.887)	(0.847)	(2.813)	(-0.225)	(1.080)
$\Delta h^*_{(t-5)}$	0.300	0.520	2.042*	-0.012	0.520*	0.072	0.584***	0.277	0.256
	(0.389)	(1.489)	(2.084)	(-0.039)	(2.448)	(0.121)	(1.979)	(1.171)	(0.519)
$\Delta h^*_{(t-6)}$	-	0.036	1.224	-	0.401*	-0.293	-0.069	0.040	0.923*
	-	(0.107)	(1.271)	-	(2.060)	(-0.505)	(-0.242)	(0.171)	(2.097)
$\Delta q_{(t-1)}$	-0.990**	-0.055	0.196	-0.128	0.247	-0.087	0.571*	-0.458	0.795
	(-2.739)	(-0.292)	(0.790)	(-0.128)	(1.111)	(-0.159)	(2.116)	(-1.605)	(1.517)
$\Delta q_{(t-2)}$	-0.478	0.096	1.203**	0.923	-0.058	1.537**	0.336	-0.518***	0.221
	(-1.252)	(0.498)	(4.372)	(0.898)	(-0.229)	(2.666)	(1.189)	(-1.711)	(0.453)
$\Delta q_{(t-3)}$	-0.753***	-0.196	-0.051	-1.103	0.282	0.068	0.648*	-0.271	0.749
	(-1.975)	(-0.972)	(-0.162)	(-1.080)	(1.151)	(0.111)	(2.513)	(-0.878)	(1.547)
$\Delta q_{(t-4)}$	-0.734***	0.200	0.011	0.465	0.241	0.365	0.289	0.061	-0.464
	(-1.937)	(1.048)	(0.040)	(0.456)	(0.954)	(0.553)	(1.072)	(0.207)	(-0.921)
$\Delta q_{(t-5)}$	-0.336	0.374***	0.972**	-1.157	0.380***	0.580	0.390	-0.064	0.174
	(-0.908)	(1.961)	(3.370)	(-1.145)	(1.670)	(0.881)	(1.612)	(-0.211)	(0.332)
$\Delta q_{(t-6)}$	-	-0.096	0.221	-	-0.071	0.019	0.322	-0.074	0.280
	-	(-0.512)	(0.737)	-	(-0.301)	(0.032)	(1.303)	(-0.265)	(0.522)
Const.	-0.030	-0.043	-0.021	-0.084	-0.012	-0.014	-0.115**	0.034	-0.006
	(-0.445)	(-1.217)	(-0.432)	(-1.511)	(-0.840)	(-0.518)	(-3.311)	(1.474)	(-0.239)
d	-0.649**	-0.002	-0.254*	-0.012*	-0.007**	-0.166	-0.074**	0.025	0.053
	(-4.973)	(-0.136)	(-2.551)	(-2.426)	(-3.121)	(-1.583)	(-3.941)	(0.342)	(0.741)
Diagnostics:									
R^2	0.453	0.481	0.571	0.609	0.594	0.538	0.495	0.522	0.637
Serial Correlation									
LM (6)	39.415	43.422	42.419	37.093	28.037	19.985	44.232	39.989	32.167
p-value	0.320	0.185	0.214	0.418	0.826	0.986	0.163	0.298	0.652

Table 7. (Continued)

Variable	Case and coefficients[1]								
	Ina-Sing	**Ina-Jap**	**Ina-US**	**Mal-Phil**	**Mal-Jap**	**Mal-US**	**Phil-Jap**	**Sing-Jap**	**Sing-US**
HET									
χ^2	54.995	65.130	68.581	75.632	66.436	78.271	74.591	70.173	81.332
p-value	0.724	0.760	0.656	0.114	0.722	0.345	0.459	0.605	0.262
[*d.f.*]	[62]	[74]	[74]	[62]	[74]	[74]	[74]	[74]	[74]

Notes: (1) Only those variables which are stated statistically significant are included, except for the speed of adjustment coefficients (d). (2) Dependent variable is real bilateral trade balance (ΔTB_t). (3) All variables are in natural logarithm form. (4) d reflects the speed of adjustment coefficients. (5) The t-statistics are reported in the parenthesis. (6) *, ** and *** denote rejection of null hypothesis at 5%, 1% and 10% level, respectively. (7) Ina=Indonesia, Mal=Malaysia, Phil=Philippines, Sing=Singapore, Jap=Japan, and US=the US. (8) [*d.f.*] denotes the degree of freedom. (9) Serial correlation test with H_0: no serial correlation. (10) HET (Heteroskedasticity Test) with White Heteroskedasticity *no cross terms* method where H_0: no heteroskedasticity.

For some other bilateral cases, the estimated exchange rates coefficients are reported positively signed and have a significant impact on the trade balance. In this short run relationship, the exchange rate effect appears in most bilateral cases and we find that the effect are more frequently observed than in the long run relationship.

Looking at the speed of adjustment coefficients (d), their sizes imply a particular adjustment information to a deviation from the long run equilibrium. Four out of nine coefficients of the speed of adjustment are statistically insignificant, while the remaining five coefficients of d carry theoretically predicted negative signs and are statistically significant. In Indonesia-Singapore bilateral case, the coefficient suggests a quite rapid speed of adjustment, where nearly 65% of the disequilibrium is eliminated in each quarter. For Indonesia-the US case, we can see that about 25% of disequilibrium corrected each quarter by changes in the trade balance. In other bilateral cases, *i.e.* Malaysia-Philippines, Malaysia-Japan and Philippines-Japan, those coefficients are fairly small in size. It implies that they characterize a slow adjustment to the disequilibrium. Those coefficients suggest about 1.2%, 0.7% and 7.4% of disequilibrium is eliminated in one quarter for each case respectively.

Table 7 also includes a brief description of diagnostic tests. As can be seen, the null hypothesis of no serial autocorrelation and no heteroskedasticity are not rejected. The coefficients of determination (R^2) in 9 bilateral cases vary in value from 0.453 to 0.637.

1.4.3 The estimation results of OLS

In order to expand its analysis, this paper turns to model short run effect employing OLS regression to other 21 bilateral cases which are excluded from the execution of VECM (due to their variables are integrated of different order and the absence of cointegrating relationship among their variables). The OLS regression analyzes the short run relationship between bilateral trade balance (*TB*) and its determinant variables. All variables use the same equation (11) at the appropriate integration order and optimum lag length. The results are reported in Table 8. Each case is estimated and irrelevant explanatory variables which do not play significance role are not presented here (for reasons of brevity).

In this analysis, we exclude 2 bilateral cases from our further analysis, *i.e.* Singapore-Indonesia and Thailand-Indonesia since they do not have statistically significance explanatory variable at all in their respective model. The diagnostics checking of models are employed using LM, ARCH and RESET tests. The LM test will check the residual serial correlation, ARCH will tests the heterocedasticity problem and RESET test will check the functional misspecification.

Inspecting the OLS estimates reported in Table 8, we find that the domestic real income (y) carries a statistically significant impact on the real trade balance (*TB*) in 12 bilateral cases, however it is correctly signed (negative) only in 8 cases, namely Malaysia-Singapore, Malaysia-Thailand, Philippines-Indonesia, Philippines-Thailand, Philippines-the US, Singapore-Philippines, Thailand-Philippines and Thailand-Japan. Foreign real income (y^*) displays a significant correct sign (positive) for around 7 bilateral cases. Those are Indonesia's bilateral cases with Malaysia and Philippines, Philippines' bilateral cases with Thailand and the US, Thailand's bilateral cases with Philippines and the US and Malaysia-Thailand bilateral case. If we investigate the income effect in all mentioned cases, then consistently, it can be found in 9 bilateral cases. This condition is better than the condition of our previous short run analysis (with VECM), where here, the income effect appears more obvious.

Next, the import-substitution effect exists in 8 bilateral cases, implying the effect seems to have substantially contributed towards the change in trade balance. This finding reinforces the results of our short run analysis with VECM. It is apparent that there is evidence concerning the domination of the import-substitution effect in some cases (Indonesia-Thailand, Philippines-Malaysia, Philippines-Singapore, Singapore-Thailand, and Thailand-Malaysia). As can be seen, in those cases, the import-substitution effect looks to be a predominant significant factor contributing to the improvement (deterioration) in trade balance.

The coefficient of domestic real cash balance (h) is statistically significant in 7 cases, *i.e.* Malaysia-Singapore, Malaysia-Thailand, Philippines-Singapore, Thailand-Malaysia, Thailand-Philippines, Thailand-Japan and Thailand-the US. But only in 3 out of those 7 cases, the coefficient indicates an expected correct sign (negative). The Thailand-Philippines bilateral case shows a consistent negative relationship between h and the dependent variable (TB). While 2 other cases, Malaysia-Thailand and Philippines-Singapore display a bit different fact. For each of them, an inappropriate positive sign of h (at lag 2) turns into negative at a six period lag of h, implying a deterioration of bilateral trade balance (TB) is evident in response to a six period lag of the domestic real cash balance (h).

Although the effect of foreign real cash balance (h^*) on TB is statistically significant in 12 bilateral cases (indicating that h^* is influential in determining the bilateral trade balance), in fact the coefficient is correctly signed only in 5 cases (Thailand-Singapore, Thailand-Philippines, Singapore-Philippines, Philippines-Thailand, Malaysia-Thailand). For Thailand-Singapore case, the appropriate positive coefficient appears at lag 2, 4 and 6. The contemporaneous values of foreign real cash balance (h^*) influences TB positively in two cases, i.e. Thailand-Philippines and Singapore-Philippines. For Philippines and Malaysia trade with Thailand, an inappropriate negative sign appears at lag 1 but turn positive thereafter.

Concentrating on the impact of h and h^* toward TB, we gather that the cash balance effect is consistently present (has theoretically expected sign) in 3 bilateral cases, namely: Singapore-Philippines, Thailand-Philippines, and Thailand-Singapore.

Table 8. Short run relationship of the variables: Estimation of OLS model

Case	Significant explanatory variables and the diagnostics					
Indonesia-Malaysia	$\Delta TB_{(t-1)}$	Δy^*_t	$\Delta y^*_{(t-1)}$	*Const.*		
	0.487^{**}	1.676^{***}	-1.989^{*}	2.428^{**}		
	(5.429)	(1.887)	(-2.199)	(5.559)		
Diagnostics	R^2	*LM(1)*	*ARCH(1)*	*RESET*		
	0.298	18.897	0.489	8.884		
		[0.00]	[0.484]	[0.004]		
Indonesia-Philippines	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-4)}$	$\Delta y_{(t-2)}$	Δy^*_t	$\Delta y^*_{(t-4)}$	$\Delta h^*_{(t-5)}$
	-0.542^{**}	-0.382^{**}	2.196^{***}	3.815^{**}	3.196^{*}	-1.420^{*}
	(-4.365)	(-2.760)	(1.886)	(2.867)	(2.319)	(-2.182)
Diagnostics	R^2	*LM(5)*	*ARCH(5)*	*RESET*		
	0.487	7.484	3.219	0.054		
		[0.187]	[0.666]	[0.816]		
Indonesia-Thailand	$\Delta TB_{(t-2)}$	$\Delta_2 y^*_{(t-1)}$				
	-0.878^{*}	-10.64^{***}				
	(-2.631)	(-1.955)				
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*		
	0.882	26.367	12.494	0.005		
		[0.000]	[0.052]	[0.947]		
Malaysia-Indonesia	$\Delta TB_{(t-1)}$	*Const.*				
	0.451^{**}	2.365^{**}				
	(5.015)	(6.102)				
Diagnostics	R^2	*LM(1)*	*ARCH(1)*	*RESET*		
	0.246	5.530	5.150	4.732		
		[0.019]	[0.023]	[0.032]		
Malaysia-Singapore	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-4)}$	$\Delta y_{(t-5)}$	$\Delta h_{(t-5)}$		
	-0.456^{**}	0.349^{*}	-0.602^{**}	0.264^{***}		
	(-2.889)	(2.044)	(-2.746)	(1.720)		
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*		
	0.529	7.937	6.600	1.212		
		[0.243]	[0.359]	[0.275]		

Table 8. (Continued)

Case	Significant explanatory variables and the diagnostics						
Malaysia-Thailand	$\Delta TB_{(t-2)}$	$\Delta TB_{(t-5)}$	$\Delta TB_{(t-6)}$	Δy_{t}	$\Delta y_{(t-4)}$	$\Delta_2 y^*_{t}$	$\Delta_2 y^*_{(t-4)}$
	0.527^{*}	-0.593^{***}	-0.614^{*}	-2.071^{***}	-2.865^{**}	-3.130^{*}	5.213^{*}
	(2.347)	(-1.951)	(-2.583)	(-1.861)	(-3.385)	(-2.862)	(3.035)
	$\Delta_2 y^*_{(t-5)}$	$\Delta_2 h_{(t-2)}$	$\Delta_2 h_{(t-6)}$	$\Delta h^*_{(t-1)}$	$\Delta h^*_{(t-3)}$		
	5.116^{**}	1.204^{*}	-0.517^{*}	-1.611^{*}	1.018^{***}		
	(3.418)	(2.285)	(-2.691)	(-3.158)	(1.929)		
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*			
	0.936	9.323	9.816	1.041			
		[0.156]	[0.133]	[0.337]			
Philippines-Indonesia	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-2)}$	$\Delta TB_{(t-5)}$	$\Delta y_{(t-2)}$	$\Delta h^*_{(t-5)}$		
	-0.244^{*}	-0.345^{**}	-0.247^{*}	-2.536^{*}	-0.374^{***}		
	(-2.185)	(-2.870)	(-2.194)	(-2.306)	(-1.732)		
Diagnostics	R^2	*LM(5)*	*ARCH(5)*	*RESET*			
	0.396	4.562	2.012	0.157			
		[0.472]	[0.847]	[0.693]			
Philippines-Malaysia	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-2)}$	$\Delta TB_{(t-3)}$	$\Delta y^*_{(t-3)}$	Δh^*_{t}	$\Delta q_{(t-1)}$	$\Delta q_{(t-3)}$
	-0.346^{**}	-0.239^{***}	-0.347^{**}	-1.835^{*}	-0.828^{*}	1.959^{***}	-2.303^{*}
	(-2.799)	(-1.831)	(-3.025)	(-2.393)	(-2.136)	(1.790)	(-2.104)
Diagnostics	R^2	*LM(5)*	*ARCH(5)*	*RESET*			
	0.522	5.984	2.732	0.407			
		[0.308]	[0.741]	[0.525]			
Philippines-Singapore	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-4)}$	$\Delta TB_{(t-5)}$	$\Delta y_{(t-1)}$	$\Delta y_{(t-2)}$	$\Delta h_{(t-2)}$	$\Delta h_{(t-6)}$
	-0.208^{***}	-0.244^{***}	-0.267^{***}	1.361^{***}	1.453^{***}	0.934^{*}	-0.72^{***}
	(-1.672)	(-1.812)	(-1.954)	(1.757)	(1.828)	(2.165)	(-1.888)
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*			
	0.413	24.476	15.054	0.146			
		[0.000]	[0.020]	[0.703]			
Philippines-Thailand	$\Delta TB_{(t-2)}$	$\Delta TB_{(t-4)}$	$\Delta TB_{(t-6)}$	$\Delta y_{(t-5)}$	$\Delta_2 y^*_{t}$	$\Delta_2 y^*_{(t-1)}$	$\Delta_2 y^*_{(t-2)}$
	-0.366^{***}	-0.461^{***}	-0.402^{*}	-2.967^{*}	8.070^{*}	11.035^{*}	15.889^{*}
	(-2.082)	(-2.175)	(-2.805)	(-2.531)	(3.080)	(2.350)	(2.741)
	$\Delta_2 y^*_{(t-3)}$	$\Delta_2 y^*_{(t-4)}$	$\Delta h^*_{(t-1)}$	$\Delta h^*_{(t-4)}$	$\Delta h^*_{(t-5)}$		
	9.888^{***}	12.143^{***}	-1.245^{***}	1.126^{***}	1.988^{**}		
	(1.845)	(1.836)	(-2.011)	(2.045)	(3.519)		
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*			
	0.940	15.647	9.406	2.747			
		[0.016]	[0.152]	[0.136]			
Philippines-the US	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-2)}$	$\Delta y_{(t-2)}$	Δy^*_{t}	$\Delta y^*_{(t-2)}$	$\Delta h^*_{(t-2)}$	
	-0.420^{**}	-0.395^{**}	-0.512^{*}	3.815^{*}	3.232^{***}	-1.180^{*}	
	(-3.485)	(-3.061)	(-2.260)	(2.517)	(1.898)	(-2.258)	
Diagnostics	R^2	*LM(5)*	*ARCH(5)*	*RESET*			
	0.545	10.531	2.879	1.607			
		[0.062]	[0.719]	[0.209]			

Table 8. (Continued)

Case	Significant explanatory variables and the diagnostics						
Singapore-Malaysia	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-2)}$	$\Delta q_{(t-2)}$				
	-0.389**	-0.383**	-0.902***				
	(-3.554)	(-3.615)	(-1.914)				
Diagnostics	R^2	*LM(3)*	*ARCH(3)*	*RESET*			
	0.428	9.514	5.538	0.047			
		[0.023]	[0.136]	[0.828]			
Singapore-Philippines	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-2)}$	$\Delta TB_{(t-4)}$	Δy_t	$\Delta y^*_{(t-4)}$	Δh^*_t	
	-0.408**	-0.261*	-0.335**	-1.425*	-0.994***	0.713*	
	(-3.375)	(-2.182)	(-2.655)	(-2.068)	(-1.742]	(2.492)	
Diagnostics	R^2	*LM(5)*	*ARCH(5)*	*RESET*			
	0.558	9.871	9.572	0.026			
		[0.079]	[0.088]	[0.872]			
Singapore-Thailand	$\Delta_2 TB_{(t-1)}$	$\Delta_2 TB_{(t-2)}$	$\Delta_2 TB_{(t-3)}$	$\Delta_2 TB_{(t-4)}$	$\Delta_2 TB_{(t-5)}$	Δy_t	
	-1.597**	-1.568*	-1.295***	-1.090***	-0.802***	0.807***	
	(-4.836)	(-2.707)	(-2.022)	(-2.058)	(-1.945)	(1.842)	
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*			
	0.947	26.252	2.105	0.010			
		[0.000]	[0.910]	[0.922]			
Thailand-Malaysia	$\Delta TB_{(t-5)}$	$\Delta y^*_{(t-1)}$	$\Delta y^*_{(t-3)}$	$\Delta h_{(t-1)}$	$\Delta h_{(t-4)}$	$\Delta h_{(t-5)}$	$\Delta h^*_{(t-3)}$
	-0.394***	-5.059*	-5.250*	2.425*	1.520***	1.265***	2.406*
	(-1.907)	(-2.732)	(-3.145)	(2.614)	(1.983)	(2.190)	(2.284)
	$\Delta h^*_{(t-4)}$	$\Delta_2 q_t$	$\Delta_2 q_{(t-4)}$				
	-1.722***	2.590*	-5.145*				
	(-2.090)	(2.542)	(-2.767)				
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*			
	0.945	49.409	0.826	11.340			
		[0.000]	[0.991]	[0.010]			
Thailand-Philippines	$\Delta TB_{(t-1)}$	$\Delta_2 y_{(t-1)}$	$\Delta y^*_{(t-4)}$	$\Delta h_{(t-4)}$	$\Delta h_{(t-5)}$	$\Delta_2 h^*_t$	$\Delta q_{(t-2)}$
	-0.662***	-6.205***	1.999***	-1.657**	-1.866*	1.114*	2.016***
	(-2.221)	(-1.967)	(2.097)	(-3.362)	(-3.229)	(2.639)	(2.028)
	$\Delta q_{(t-6)}$						
	2.872**						
	(3.518)						
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*			
	0.943	30.855	3.988	3.416			
		[0.000]	[0.678]	[0.102]			
Thailand-Singapore	$\Delta TB_{(t-1)}$	$\Delta TB_{(t-2)}$	$\Delta TB_{(t-5)}$	$\Delta_2 y_{(t-2)}$	Δy^*_t	$\Delta h^*_{(t-2)}$	$\Delta h^*_{(t-4)}$
	-0.631*	-0.707***	-0.807***	6.234***	-1.448***	1.856***	2.091*
	(-2.331)	(-1.906)	(-2.116)	(2.129)	(-2.218)	(1.899)	(2.306)
	$\Delta h^*_{(t-6)}$	$\Delta q_{(t-1)}$	$\Delta q_{(t-3)}$				
	1.596***	1.701***	2.801***				
	(2.023)	(1.897)	(1.844)				

Table 8. (Continued)

Case	Significant explanatory variables and the diagnostics					
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*		
	0.882	39.622	9.823	1.645		
		[0.000]	[0.132]	[0.236]		
Thailand-Japan	$\Delta_2 y_{(t-6)}$	$\Delta h_{(t-2)}$	$\Delta h^*_{(t-2)}$			
	-1.737***	1.072*	-0.789*			
	(-2.120)	(2.682)	(-2.263)			
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*		
	0.853	32.420	4.006	0.239		
		[0.000]	[0.676]	[0.638]		
Thailand-the US	$\Delta_2 y^*_t$	$\Delta_2 y^*_{(t-4)}$	$\Delta_2 y^*_{(t-6)}$	$\Delta h_{(t-3)}$	$\Delta h^*_{(t-1)}$	$\Delta h^*_{(t-5)}$
	9.529***	5.563***	-8.225**	1.085*	3.450*	-2.946*
	(1.987)	(1.939)	(-3.813)	(2.404)	(2.764)	(-2.665)
Diagnostics	R^2	*LM(6)*	*ARCH(6)*	*RESET*		
	0.973	39.595	19.378	0.580		
		[0.000]	[0.004]	[0.468]		

Notes: (1) Only those variables which are stated statistically significant are included. (2) All variables are in natural logarithm form. (3) The *t*-statistics are reported in the parenthesis and *p*-values are reported in the square bracket. (4) *, ** and *** denote rejection of null hypothesis at 5%, 1% and 10% level, respectively. (5) LM is serial correlation test, where H_0: no serial correlation. (6) ARCH is Autoregressive Conditional Heteroskedasticity test, where the null hypothesis is no ARCH structure in the residuals. (7) RESET is the Regression Specification Error Test, where the null hypothesis is that there is no misspecification in the functional form. In RESET, the number of fitted terms is 1.

In comparison with our previous analysis for income variables (y and y^*), cash balance effect is found plays a less influential role than the income effect in determining the trade balance. This result is analogous to the result of long run analysis. Finally, the real exchange rate (q) shows a positive relationship with trade balance in 4 bilateral cases (Philippines-Malaysia, Thailand-Malaysia, Thailand-Philippines, and Thailand-Singapore). Almost all q's coefficients in those cases are correctly signed, indicating that a real depreciation improves the trade balance. Nevertheless, only in the bilateral case of Thailand-Philippines and Thailand-Singapore, we obtain a consistent positive relationship between q and *TB*. For Philippines and Thailand trade with Malaysia, our findings indicate the inconsistency of coefficient sign of q. It displays a positive value in earlier quarter but further followed by negative value as the lag length increases. From the result, we can judge that the exchange rate effect appears in our OLS short run model.

As a summary, most of our findings for OLS regression reinforce the results which are obtained by the VECM long run analysis. Both of them simultaneously define the income effect as the most influential significant factor which determines the trade balance. They also corroborate the existence of exchange rate effect in the trade balance model. However, the former provides more evidence for the existence of cash balance effect than the latter.

In the VECM short run analysis, the cash balance effect is noted surpassing the real income effect due to the former exists in relatively more bilateral cases and displays more consistent appropriate sign on the variables. Hence, in this type of analysis, trade balance tends to be more sensitive to the cash balance effect than the income effect.

In addition, the exchange rate effect is present in most bilateral cases of VECM short run analysis. Inspecting all types of our analysis above (long run, VECM short run, and OLS short run), the exchange rate effect always plays a significant role in determining the trade balance. The evidence of J-curve phenomenon is found in the case of Indonesia-Singapore. Most of the estimated short run coefficients of *q* provide lack of support for the phenomenon.

1.4.4 Dynamic relationships: the impulse response function and variance decomposition

In this part, by using the impulse response functions and variance decompositions, we discuss the dynamic relationships within the system. As have been done for VECM, for this analysis, we put as well our concentration only in 9 bilateral cases which rejected the null hypothesis of no cointegration [r=0] (see 1.4.1 and 1.4.2).

1.4.4.1 Impulse response functions (IRFs)

An impulse response function measures the time profile of the innovations or shocks effect at a given point in time on the current and future values of variables in a system of equations. Impulse response function is strongly related to the vector moving average which is represented by the parameters of the error terms. Those parameters are called impact multipliers and they measure the instantaneous response of a given dependent variable to one unit change in an innovation or a shock. If these impact multipliers are considered over time, they are called impulse response functions and when they are plotted against time, the behavior of a given dependent variable in the dynamic system is represented in response to various innovations or shocks (Johnston and Dinardo, 1997; Enders, 2004).

This study focuses on the effect of changes of the domestic real income (y), foreign real income (y^*), domestic real cash balance (h), foreign real cash balance (h^*) and real exchange rate (q) on bilateral trade balance (TB). Figures 3 until 6 summarize the impulse response function for those impacts within 9 bilateral cases.

1.4.4.1.1 Indonesia's IRF

Let us start from Figures 3. The impacts of all variables of interest are observed for Indonesia on its bilateral trade with Singapore, Japan and the US. Following a real depreciation, Indonesia's bilateral trade balance with Singapore displays an initial short run improvement (see Figure 3.A). Within around 4 quarters of a real depreciation in the exchange rate, Indonesia's trade balance improves 0.07 percent. It was followed by a worsening in the trade balance and then by an improvement after 6 quarters. Generally, it is observed that Indonesia's trade balance with respect to Singapore reacts positively to real depreciation both in the short run and long run. This pattern provides evidence for a Marshall-Lerner condition, reinforcing our previous finding in section 1.4.1.

The impulse response function for Indonesia-Singapore shows that an increase in Indonesia's income (y) leads to an increase in the bilateral trade balance, while an increase in Singapore's income (y^*) initially leads to a decline in the bilateral trade balance which then followed by an increase of TB after 3 quarters. This finding supports our previous long run finding, where the import-substitution effect appears in the case.

The effect seems consistently influence the trade balances, particularly through real domestic income (y), where as Indonesia income increases, imports from Singapore decline due to an increase in the production of import-substitute goods.

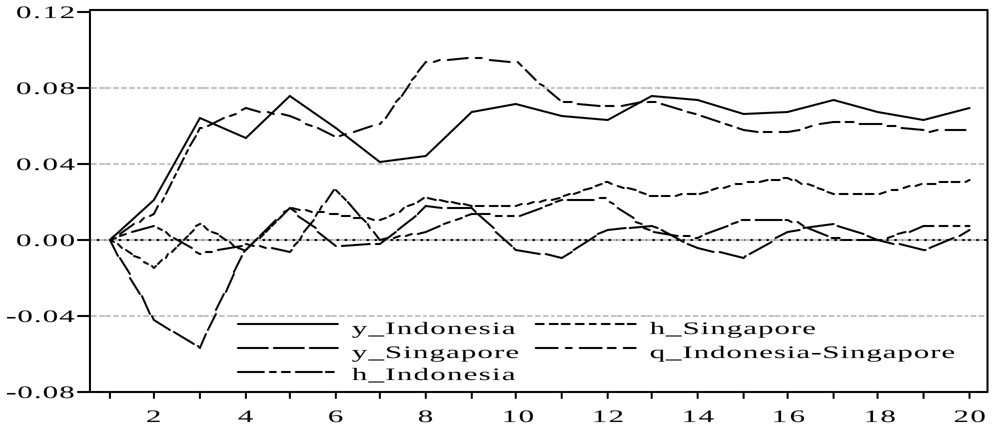
Further, an increase in Indonesia's real cash balance (h) leads to an increase in the bilateral trade balance. The initial deterioration in the Indonesia-Singapore real trade balance is about 0.01 percent for a one standard deviation shock in Singapore's real cash balance (h^*). The deterioration lasts for about 2 quarters, and then beyond that quarter, we find a significant improvement of *TB* (as the bilateral trade balance achieves a new long run equilibrium level which is higher than the initial value). The last fact displays the existence of cash balance effect for this bilateral case in the long run, as is indicated previously by our finding in Table 6.

Figure 3.B shows an initial deterioration in Indonesia's bilateral trade balance with Japan, following a one standard deviation shock to the real exchange rate (q). The first deterioration lasts for 2 quarters, after which the trade balance improves before worsening again becomes lower than the initial value. When the time surpasses 4 quarters, real trade balance reaches an improvement till around 0.05 percent. This was again followed by a worsening value and then by a gradual improvement after 12 quarters. The presence of a negative short run effect of a real depreciation on this bilateral case is supportive of the J-curve phenomenon. The findings also observe the presence of a Marshall-Lerner condition for the case eventually.

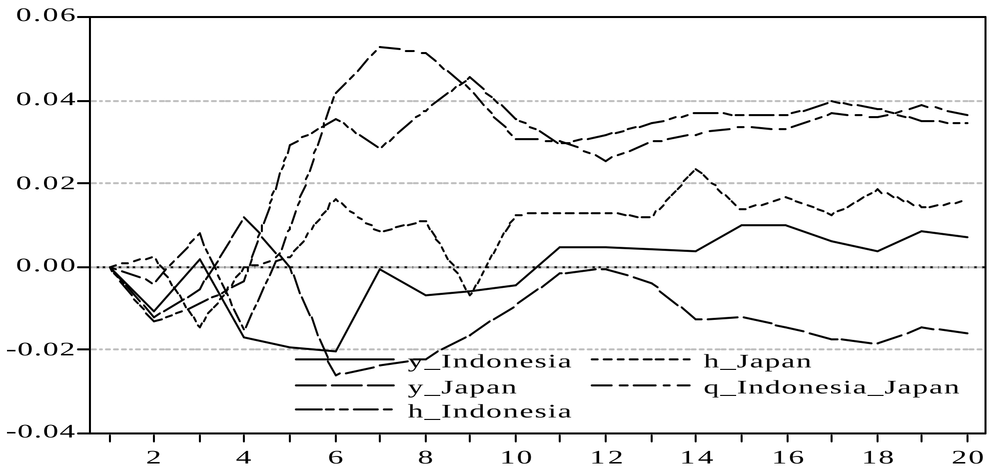
The figure exhibits that a positive shock to Indonesia's real income (y) produces a decline in the Indonesia's bilateral trade with Japan. However, beyond 10 quarters there is an improvement as the trade balance settles to a new long run equilibrium level which is only slightly higher than the initial value. On the other side, rising Japan's real income (y^*) eventually correspond to declining the bilateral trade balance. As is observable from our previous analysis, this finding clarifies about the existence of import-substitution effect in this bilateral case.

Figure 3. Impulse response functions for the Indonesia's bilateral trade balance

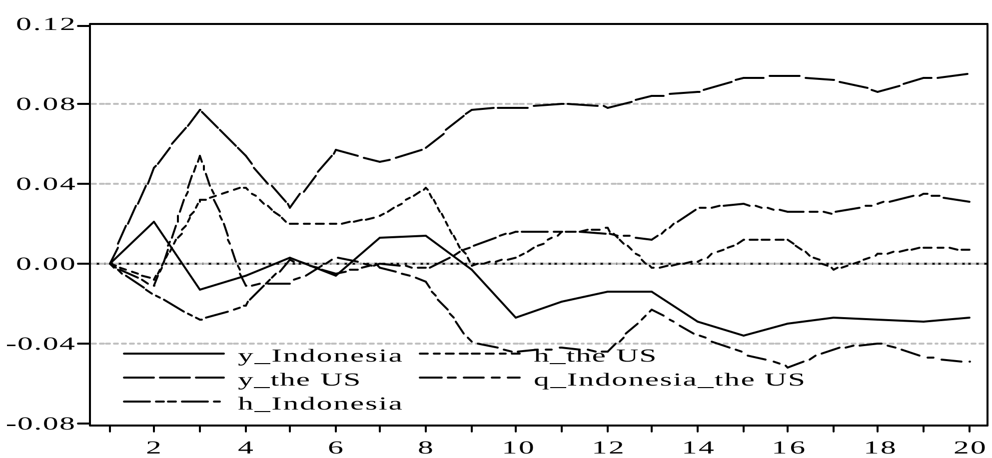
A. Indonesia-Singapore



B. Indonesia-Japan



C. Indonesia-the US



A positive shock to Indonesia's real cash balance (*h*) and Japan's real cash balance (h^*) initially produce a decline and an increase in the Indonesia-Japan trade balance, respectively. Yet after 4 quarters, *h* displays a consistent different effect to the bilateral trade balance, *i.e.* rising Indonesia's real cash balance correspond to rising bilateral trade balance. The same condition is shown also by h^* where its pattern tends to fluctuate after 13 quarters. Nevertheless, for some initial extents, the cash balance effect seems exist in this case.

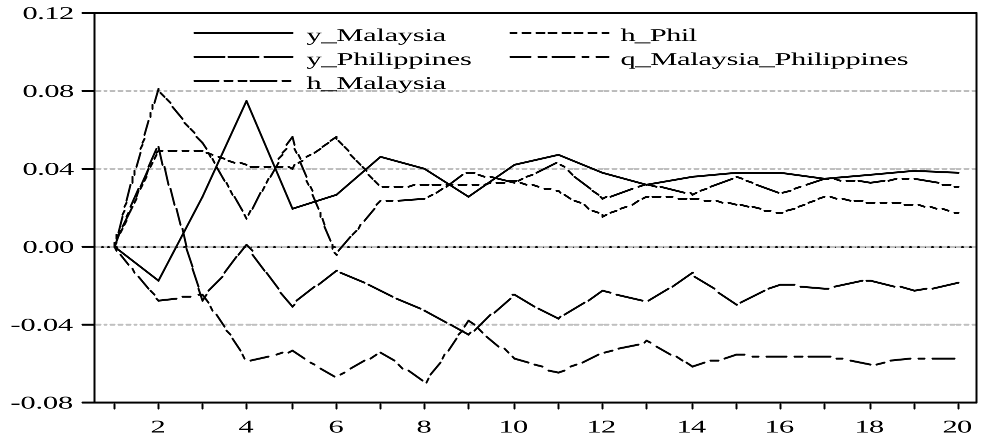
In figure 3.C, our findings suggest that a J-curve effect does not exist in Indonesia-the US case, since the impulse response function reveals that rising real exchange rate (*q*) eventually correspond to declining their bilateral trade balance. This condition strengthens our previous VECM finding. However, analogous to short run VECM analysis, the effect of exchange rate still observed by the pattern in the initial period. Furthermore, a positive innovation to Indonesia's real income (*y*) and the US' real income (y^*) produce a decline and an increase in the Indonesia-the US bilateral trade balance, respectively. These results are expected as more Indonesian real income, it increases the Indonesian ability to import, which in turn deteriorates the Indonesia's trade balance with the US and increased the US' real income leads to more US' import which brings an increase in Indonesia-US trade balance. It is discernible that income effect is present in the case of Indonesia-the US, reinforcing the result of our long run analysis (section 4.1). On the contrary, we find no evidence for the cash balance effect in the case, as the pattern of a positive shock of *h* and h^* to the trade balance do not provide a tendency for it.

1.4.4.1.2 Malaysia's IRF

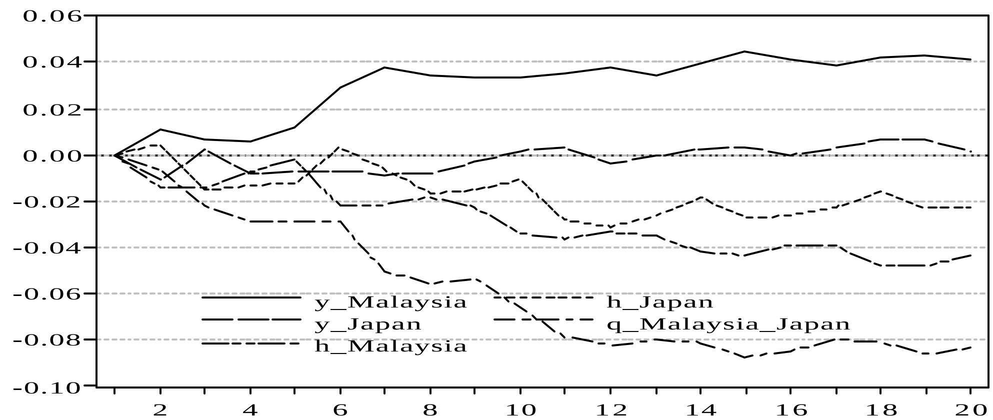
The impulse response functions which are pictured in Figure 4 reveal that increases in real exchange rate (*q*) eventually lead to reductions in the bilateral trade balance for all three Malaysia's bilateral cases (Malaysia-Philippines, Malaysia-Japan and Malaysia-the US). The negative long run effect of a real depreciation on bilateral trade balance in respective case is not supportive of the J-curve hypothesis.

Figure 4. Impulse response functions for the Malaysia's bilateral trade balance

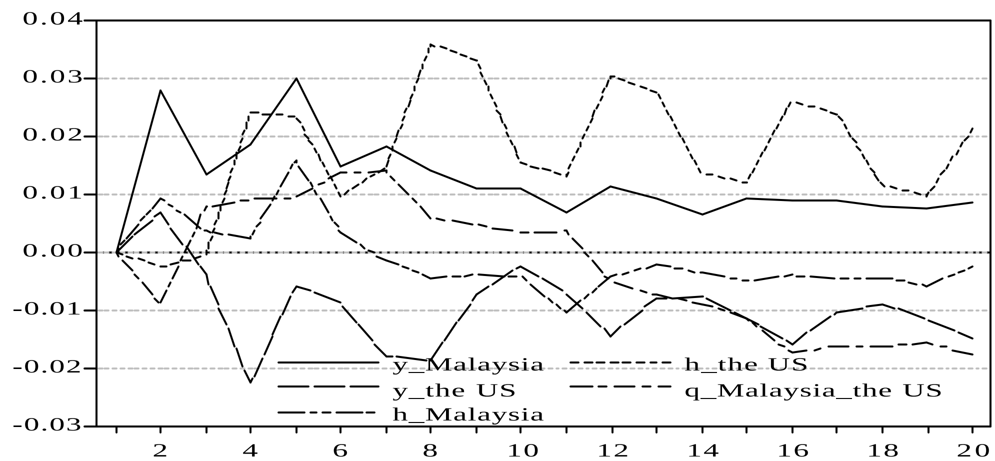
A. Malaysia-Philippines



B. Malaysia-Japan



C. Malaysia-the US



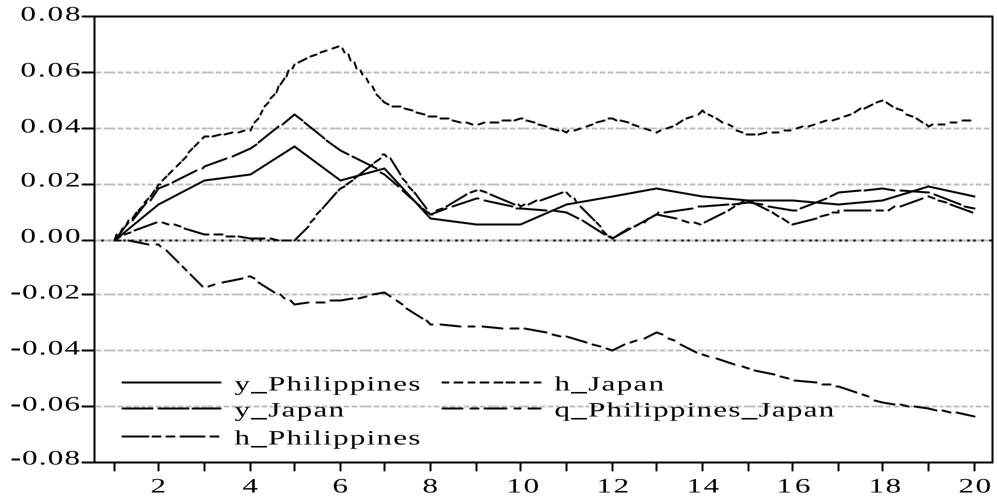
So, these results strengthen our finding in 1.4.2. It is also observed that increases in Malaysia's real income (*y*) lead to increases in the bilateral trade balance on all cases. This is not a surprising result since we have observed the same finding about the presence of import-substitution effect for these 3 cases in previous analysis. While, only in Malaysia-Japan bilateral case a positive innovation to foreign real income (y^*) produces an increase in the bilateral trade balance, indicating income effect is present in the case.

Figure 4 also shows that in the case of Malaysia-Japan and Malaysia-the US, trade balance reacts negatively to Malaysia's real cash balance (*h*), where a positive innovation to Malaysia's real cash balance results in less trade balance. In the case of Malaysia-Philippines and Malaysia-the US, we can see that trade balance reacts positively to foreign real cash balance (h^*), *i.e.* rising foreign real cash balance eventually correspond to rising bilateral trade balance. It suggests that the cash balance effect is seems consistently present in the trade between Malaysia and the US.

1.4.4.1.3 The Philippines' IRF

The response of Philippines-Japan's bilateral trade balance to an innovation in other variables is shown in Figure 5. The impulse response function shows that a shock to real exchange rate (*q*) results a decline in Philippines's bilateral trade balance with Japan, indicating the absence of J-curve phenomenon in the case. This result is similar to the previous finding in sub section 1.4.2. Further, we find that increases in Philippines' real income (*y*), Japan's real income (y^*), Philippines' real cash balance (*h*) and Japan's real cash balance (h^*) lead to increases in the bilateral trade balance. Through the findings which related to variables y^* and h^*, we confirm the existence of income and cash balance effect in Philippines-Japan case. As shown before by VECM analysis, these two effects are clearly present in the short run and long run. The effects have been observed since the VECM provide evidence for positive influence of Japan's income and cash balance on the improvement of trade balance.

Figure 5. Impulse response functions for the Philippines-Japan bilateral trade balance



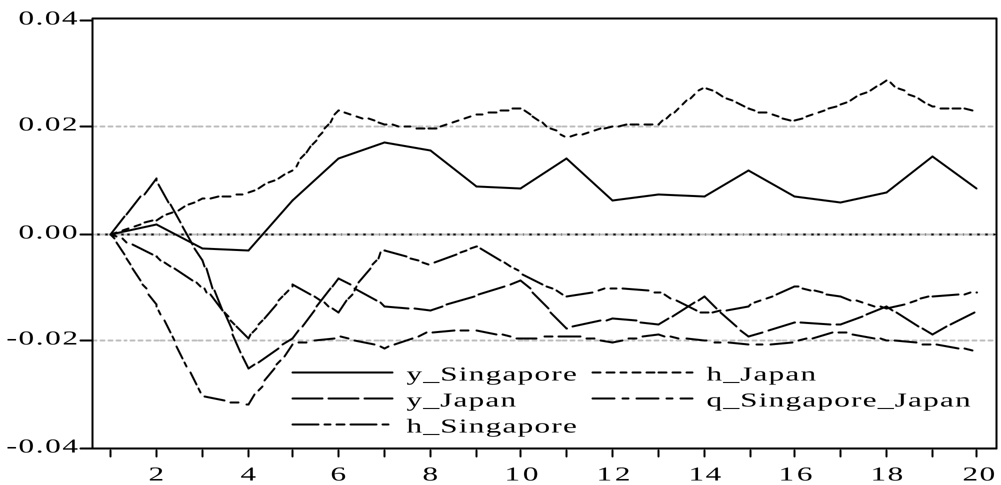
1.4.4.1.4 Singapore's IRF

Figure 6 shows the impulse response functions for the Singapore's bilateral trade balance with Japan and the US. In those 2 cases, we fail to find the J-curve effect. However, in the case of Singapore-the US, Marshall-Lerner condition still hold since the bilateral trade balance improves given a positive innovation in real exchange rate (q).

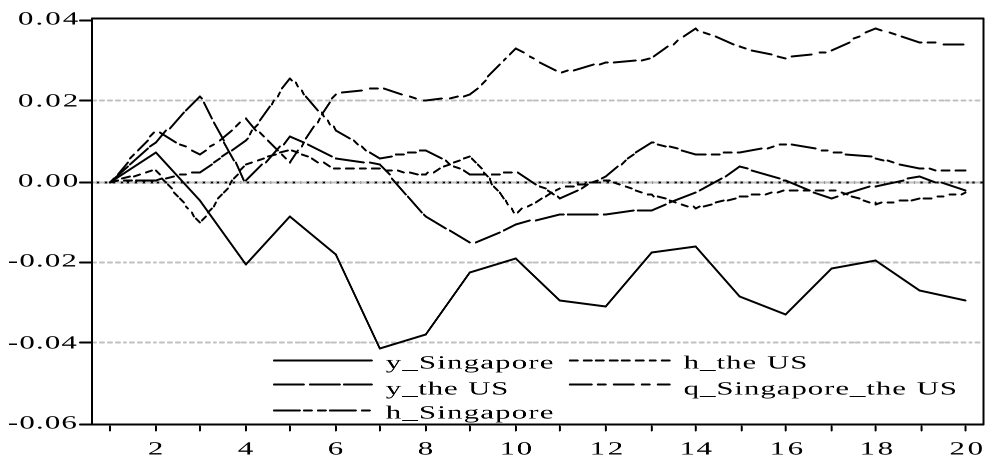
Meanwhile, Singapore's trade balance only reacts negatively to Singapore's real cash balance (h) in the case of Singapore-Japan. Finally, in the same bilateral case, we also find that a positive shock to foreign real cash balance (h^*) produces an increase in the bilateral trade balance. These two facts indicate that the cash balance effect is consistent appears in the trade between Singapore and Japan.

Figure 6. Impulse response functions for the Singapore's bilateral trade balance

A. Singapore-Japan



B. Singapore-the US



1.4.4.2 Variance decomposition

Variance decomposition analysis provides some information about the relative importance of innovations of all variables within the system to the percentage of forecast variance in one variable of the system. In this analysis, the percentage of forecast variance of a dependent variable will be explained by its own innovation and other considered variables innovations.

Table 9 displays the results of the variance decompositions of bilateral trade balance (*TB*) for 9 bilateral cases during 20 periods in average value. The results for Indonesia-Singapore bilateral case indicate that the significant source of variation in the bilateral trade balance forecast error is its own innovation with an average of 53.76%. The real exchange rate (*q*) explains about an average of 22.42% of the variation in the bilateral trade balance. The domestic real income (*y*) explains about an average of 17.88% of the variation in the *TB*. While, the foreign real income (y^*), domestic real cash balance (*h*) and foreign real cash balance (h^*) explains an average of 0.74%, 1.60%, and 3.60% respectively. Generally, the results suggest that the exchange rate and domestic real income have more dominant contributions than the foreign real income, domestic and foreign real cash balance to the variations in Indonesia-Singapore's bilateral trade balance.

Table 9. Variance decompositions of the bilateral trade balance (*TB*) for 9 bilateral cases: in average value

Case	Variable					
	TB_t	y_t	y_t^*	h_t	h_t^*	q_t
Indonesia-Singapore	53.758	17.884	0.736	1.602	3.599	22.421
Indonesia-Japan	81.210	1.142	1.821	6.898	1.056	7.873
Indonesia-the US	54.343	1.946	31.035	2.159	3.862	6.655
Malaysia-Philippines	70.264	5.183	3.242	6.808	5.351	9.152
Malaysia-Japan	59.261	7.440	0.693	5.678	2.649	24.280
Malaysia-the US	77.778	7.020	3.223	1.065	8.843	2.072
Philippines-Japan	62.585	3.760	5.965	1.500	19.325	6.866
Singapore-Japan	61.799	2.805	7.025	3.659	9.179	15.532
Singapore-the US	70.555	12.007	3.188	2.746	0.859	10.645

Notes: *TB*=bilateral trade balance; *y*=domestic real income; y^*=foreign real income; *h*=domestic real cash balance; h^*=foreign real cash balance; *q*=real exchange rate

In two other Indonesia's cases, we can see that the most important innovations that affect the variation of bilateral trade balance are still its own innovations with an average of 81.21% and 54.34% for the case of Indonesia-Japan and Indonesia-the US respectively. While, compared to Indonesia-Singapore case, the real exchange rate innovations in these two Indonesian cases have less important contribution to the variations in bilateral trade balance (7.87% and 6.66%). Among all of three Indonesian cases, the foreign real income (y^*) displays its most meaningful contribution (31.04%) to the variation of the forecast error of *TB* in the case of Indonesia-the US.

Similar conditions exist in Malaysian bilateral cases, where the variance decomposition results indicate that current performance of bilateral trade balance depends largely upon their past performance. Only in Malaysia-Japan case, the innovations of real exchange rate (*q*) seem to give a bit another dominant contribution (24.28%) in explaining the variation of *TB*. Still relatively the same, the results of the variance decomposition of the bilateral trade balance in Philippine-Japan shows that on average 62.59% of the variation in the forecast error for *TB* can be explained by its own innovation. However, contrary to other cases, for this case we find that the foreign real cash balance (h^*) has a relative significant contribution to the variations in the bilateral trade balance (19.33%).

For Singapore's bilateral cases, Table 9 shows the innovations of *TB* explains about 61.80% and 70.56% on average of the variations of the forecast error in the bilateral trade balance. For those cases, the effect of real exchange rate (*q*) innovations to the variations of *TB* are more than 10%, *i.e.* with an average of 15.53% and 10.65% for the forecast horizon in Singapore-Japan bilateral case and Singapore-the US bilateral case respectively. In Singapore-the US case, the domestic real income (*y*) carries a relative significant contribution to the variations of *TB*, in which on average about 12% of *TB*'s variations are attributable to the innovations of domestic real income (*y*).

In general, we find the innovation of *q* gives a relative dominant contribution to the variation in *TB* (if the innovations of *TB* itself are neglected). Additionally, a slight domination of income variables' innovations on cash balance variables' innovations also found in explaining the variation of trade balance.

1.4.5 Is there a structural break?

In the preceding sub section, we have discussed the dynamics relationship between *TB* and its determinants without taking into account the presence of structural break. In this sub section, we try to employ several alternative methods which allow us to include a structural break in the analysis. Doing analysis on the structural break will give us at least two significant things (Narayan, 2006). First, due to the structural break almost always can be associated with the influential events, so it can assist us to studying the reactions of particular variables to the events. Second, it provides us an opportunity in obtaining some more thorough information about the behavior of our variables. Related to that thought, precisely, this sub section deals with two points, *i.e.* whether a structural break exists in our bilateral cases and whether the structural break contributes to the new facts which might change our previous findings.

Time series analyses usually utilize a long time period variable. Such a characteristic gives a greater possibility for the variable in covering a particular time period which contains some influential events, like unexpected policy changes, big shocks or great depression. The exclusion of those events in the analysis might cause models with constant coefficients will provide poor results (Maddala and Kim, 1996). In our model sense, the series seem could be cointegrated, where a linear combination of the nonstationary variables is stationary, but the cointegrating vector may have shifted at some point of time giving a nonconstancy of estimated parameter in the models.

Briefly, we have discussed about the devastating financial crisis which hit ASEAN countries in 1997. It is the worst shock which brings a widespread effect to the region since the establishment of ASEAN in 1967. Many actions have been implemented in order to respond its impact. From financial restructuring, such as doing guarantee system for letters of credit, banks recapitalization and debt renegotiation until social reforms, like taking into account the need to protect the poor and other vulnerable groups in the affected societies (Severino, 2002). From this point of view, it might reasonable if we take the period of 1997q3 (the period when the crisis begins to hit) as the potential break point of structural break for the region.

However, we employ two types of technique in determining the break point of structural break. First, we simply choose a break point (*i.e.* 1997q3) then divide the data into sub-samples. The sub-samples represent the data which each exists before and after the event. This technique has been used by Sheng and Tu (2000) for examining the linkage among the stock markets of 12 Asia-Pacific countries, before and during the period of the Asian financial crisis. Solomon and Ruiz (2006) also utilized the technique for detecting the existence of price puzzle in Colombia, before and during inflation targeting period. Following Solomon and Ruiz (2006), this paper includes the Chow break point test which will inform us about the presence of structural break in each bilateral case. The limitation of the technique is that it clearly prejudges the point of the sampling break, where some serious consequences might influence the result (Gerlach *et al.*, 2006).

Second, instead of using technique which involves prejudging the break point, we apply a technique which accommodates a structural break without predetermining the break point. In this case, we do test for a unit root in the series using a method which developed by Zivot and Andrews (1992), and then perform the cointegration test which proposed by Gregory and Hansen (1996). Those two methods endogenize the break point in the underlying series rather than treat it as exogenous.

1.4.5.1 Structural break with a known break point

To examine the relationship of the variables among the bilateral cases (before and after the financial crisis), we divide the data into two groups: (i) 1980q1-1997q2 as the period before the financial crisis, and (ii) 1997q3-2007q3 as the period after the financial crisis. All procedures after the Chow break point test are analogous to the procedures that we have in the case of full sample. However, the different thing is that the procedures will be performed in the area of sub-sample.

Due to in the full sample (1980q1-2007q3), we found that some series of our bilateral cases are integrated of different order and some bilateral cases also have no cointegrating relationship among their variables, then in order to examine whether there is a structural break in each case, OLS regressions will be utilized for the stability checking instead of VAR or VECM. We apply the same procedure as presented by Binswanger (2004). The estimated OLS equations are:

$$TB_t = a + \sum_{i=0}^{k} b_i y_{t-i} + \sum_{i=0}^{k} c_i y^*_{t-i} + \sum_{i=0}^{k} d_i h_{t-i} + \sum_{i=0}^{k} e_i h^*_{t-i} + \sum_{i=0}^{k} f_i q_{t-i} + e_t \quad \text{……………...…… (14)}$$

where TB_t stands for the bilateral trade balance at time t, and y_{t-i} (y^*_{t-i}), h_{t-i} (h^*_{t-i}), q_{t-i} stand for domestic (foreign) country's real income, domestic (foreign) country's real cash balance and the real exchange rate at time $t-i$, respectively. The subscript i and k denote the lag length and the maximum amount of the lag length. As shown by Table 3 previously, the maximum amount of lag length varies in each case.

For the Chow test, we exploit Equation (13) separately for two sub-samples and the entire sample, and then check whether there are significant differences among their equation. A structural break in the bilateral case will be indicated by an existence of that significant difference. Specifically, the Chow test will compare the residual sum of squares from a regression which uses the full or entire sample (restricted case) with the residual sum of squares from separate equations which use the sub-samples (unrestricted case). For comparing the restricted and unrestricted residual sum of squares, the Chow test utilizes the F-statistic which is formulated as:

$$F_{(k,T-2k)} = \frac{(RSS_r - RSS_{ur})/k}{RSS_{ur}/(T-2k)} \quad \text{…………………………………….……………….... (15)}$$

where RSS_r is the restricted residual sum of squares, RSS_{ur} is the unrestricted residual sum of squares which is obtained by adding the residual sum of squares of two sub-samples, k

is the number of parameters in the equation, T is the total number of observations, and the degree of freedom of F distribution is denoted by (k), (T - $2k$).

We apply the Chow test using 1997q3 as the break point. Table 10 reports the results of the test, where it suggests a structural break for 17 out of 29 bilateral cases which are considered (with 10% level of significance). Every country has at least a structural break for their bilateral cases. The Philippines experiences the structural break in all their bilateral cases except when they do trade with Singapore. The presence of structural break is obvious when Thailand becomes a trading partner for other countries. Astonishingly, all countries except the Philippines do not provide evidence for a structural break when they do trade with the US. On the other hand, we find almost all cases show the presence of a structural break when they do trade with Japan, except for Singapore-Japan. As the most developed country in the region, it is unsurprising that Singapore exhibits the lack of evidences for a structural break on their cases. Conversely, the first country which hit by the crisis in the region, *i.e.* Thailand looks seriously facing problems of parameter instability on their bilateral equations due to the financial crisis.

Those conditions strongly justify us to examine further the impact of the presence of structural break on our previous full sample analysis (when the structural break is neglected). The risk of combining the pre and post crisis period possibly will blur the true relationship between bilateral trade balance and its regressors. So, dividing our full sample into two sub-samples (before and after crisis) will allow us to observe the particular behavior of bilateral trade balance regarding the growing trend in the normal period and the declining phase in the crisis period.

Our main focus here is detecting the impact of structural break on the reactions of variables to the event, consequently, investigation will only involves 17 bilateral cases which are suggested by the Chow test. Analogous to prior procedures, VECM will be applied for these 17 cases.

Table 10. The Chow test and the optimum lag length based on AIC for each country case before (1980q1-1997q2) and after crisis (1997q3-2007q3)

Trading partner	**Period**	**Reporting country**				
		Indonesia	Malaysia	Philippines	Singapore	Thailand
Indonesia						
Chow test (p-value)	1997q3	-	0.846	*0.025*	-	*0.000*
Lag length	Before crisis		1	6	-	1
	After crisis		5	5	1	5
Malaysia						
Chow test (p-value)	1997q3	*0.052*	-	*0.058*	0.446	*0.000*
Lag length	Before crisis	1		1	6	1
	After crisis	5		5	5	5
Philippines						
Chow test (p-value)	1997q3	0.274	0.558	-	0.249	*0.000*
Lag length	Before crisis	6	6		6	1
	After crisis	5	5		5	5
Singapore						
Chow test (p-value)	1997q3	*0.024*	*0.015*	0.301	-	0.214
Lag length	Before crisis	6	6	6		1
	After crisis	5	5	5		5
Thailand						
Chow test (p-value)	1997q3	*0.000*	*0.000*	*0.000*	*0.007*	-
Lag length	Before crisis	1	1	1	1	
	After crisis	5	5	5	5	
Japan						
Chow test (p-value)	1997q3	*0.000*	*0.071*	*0.018*	0.298	*0.000*
Lag length	Before crisis	6	6	6	6	1
	After crisis	5	5	5	5	5
The US						
Chow test (p-value)	1997q3	0.467	0.412	*0.000*	0.135	0.107
Lag length	Before crisis	6	6	5	6	1
	After crisis	5	5	5	5	5

Notes: (1) For Chow test, the full sample ranged from 1980q1 to 2007q3 except for all Thailand bilateral cases which ranged from 1993q1 to 2007q3. In the bilateral case of Singapore-Indonesia, we unable to do the test since its sample only ranged from 2003q1 to 2007q3. (2) For the determination of optimum lag length, due to the limitation of sample period data, we use lag 1 for Thailand's case before the period of crisis (1993q1 to 1997q2). We unable to determine the optimum lag length of Singapore-Indonesia's bilateral case in the period before the crisis due to the unavailability of the data. However, for that bilateral case, we still able to use lag 1 for the period after the crisis (2003q1-2007q3). (3) In the Chow test, we use 10% level of significance of the *F*-test. It tests the null hypothesis of no sub-sample instability can be rejected for the third quarter in 1997 (1997q3). (4) Italic number means that the test rejects the null hypothesis.

We apply the ADF test where intercepts terms in the test regression are included. By minimizing AIC, the optimum lag length of each bilateral case is selected for its corresponding sample period, *i.e.* before and after crisis (see Table 10). The results from the ADF test, as presented by Table 11 suggest that at 90% confidence interval or better, only in 7 bilateral cases, the tests do not reject the null hypothesis that the series of each bilateral case contain a unit root. They are, (i) Indonesia-Malaysia, (ii) Indonesia-Thailand, (iii) Indonesia-Japan, (iv) Philippines-Indonesia, (v) Philippines-Japan, (vi) Philippines-the US, and (vii) Thailand-Indonesia. It is consistently shown that the series of those 7 cases are integrated of order one, that is [I(1)], for the period of before crisis. Since there is no bilateral case has series which are integrated in the same order after the period of crisis (1997q3-2007q3), then the absence of any cointegrational relationship among variables for respective case is verified in the period.

Table 11. Summary results of unit root tests in structural break analysis: before and after the crisis

Case	Integration order	Variable					
		TB_t	y_t	y_t^*	h_t	h_t^*	q_t
Before the crisis							
Indonesia-Malaysia	***I(1)***	**-10.102****	**-7.333****	**-6.192****	**-11.833****	**-4.951****	**-5.979****
Indonesia-Singapore	*I(0)*	-3.840**	-	-	-	-	-
	I(1)	-	-3.775**	-3.303*	-3.065*	-5.102**	-3.666**
Indonesia-Thailand	***I(1)***	**-4.466****	**-4.261****	**-3.916***	**-3.756***	**-4.748****	**-5.593****
Indonesia-Japan	***I(1)***	**-4.510****	**-3.775****	**-2.836*****	**-3.065***	**-3.081***	**-3.211***
Malaysia-Singapore	*I(1)*	-4.588 **	-2.848***	-3.303 *	-	-5.102 **	-2.767 ***
	I(2)	-	-	-	-4.296**	-	-
Malaysia-Thailand	*I(0)*	-	-	-	-3.405*	-	-2.815***
	I(1)	-3.844*	-9.578**	-3.916*	-	-4.748**	-
Malaysia-Japan	*I(1)*	-	2.848***	-2.836***	-	-3.081*	-2.691***
	I(2)	5.143**	-	-	-4.296**	-	-
Philippines-Indonesia	***I(1)***	**-3.812****	**-3.592****	**-3.775****	**-2.782*****	**-3.065***	**-3.872****
Philippines-Malaysia	*I(0)*	-2.783***	-	-	-	-	-
	I(1)	-	-5.704**	-6.192**	-8.944**	-4.951**	-5.738**
Philippines-Thailand	*I(0)*	-	-	-	-3.700*	-	-
	I(1)	-4.232 **	-3.966**	-3.916*	-	-4.748**	-3.821*
Philippines-Japan	***I(1)***	**-3.015****	**-3.592****	**-2.836*****	**-2.782*****	**-3.081***	**-3.275***
Philippines-the US	***I(1)***	**-3.704****	**-3.726****	**-3.127***	**-3.086***	**-2.859*****	**-3.286***
Singapore-Thailand	*I(1)*	-3.220*	-4.285**	-3.916*	-4.183**	-4.748**	-
	I(2)	-	-	-	-	-	-3.236*
Thailand-Indonesia	***I(1)***	**-4.282****	**-3.916***	**-4.261****	**-4.748****	**-3.756***	**-5.593****
Thailand-Malaysia	*I(0)*	-3.029***	-	-	-	-3.405*	-2.815***
	I(1)	-	-3.916*	-9.578**	-4.748**	-	-

Table 11. (Continued)

Case	Integration order	Variable					
		TB_t	y_t	y_t^*	h_t	h_t^*	q_t
Thailand-Philippines	*I(0)*	-	-	-	-	-3.700^{*}	-
	I(1)	-3.012^{***}	-3.916^{*}	-3.966^{**}	-4.748^{**}	-	-3.821^{*}
Thailand-Japan	*I(0)*	-3.296^{*}	-	-	-	-	-
	I(1)	-	-3.916^{*}	-3.680^{*}	-4.748^{**}	-4.284^{**}	-2.923^{***}
After the crisis							
Indonesia-Malaysia	*I(1)*	-	-	-4.706^{**}	-	-2.616^{***}	-3.636^{**}
	I(2)	-3.654^{**}	-3.354^{*}	-	-2.993^{*}	-	-
Indonesia-Singapore	*I(1)*	-	-	-3.646^{**}	-	3.007^{*}	-3.565^{*}
	I(2)	-4.121^{**}	-3.354^{*}	-	-2.993^{*}	-	-
Indonesia-Thailand	*I(1)*	-4.838^{**}	-	-	-	-3.447^{*}	-3.757^{**}
	I(2)	-	-3.354^{*}	-3.056^{*}	-2.993^{*}	-	-
Indonesia-Japan	*I(0)*	-2.770^{***}	-	-	-	-	-
	I(1)	-	-	-3.699^{**}	-	-	-3.176^{*}
	I(2)	-	-3.354^{*}	-	-2.993^{*}	3.771^{**}	-
Malaysia-Singapore	*I(0)*	-	-	-	-	-	-3.592^{*}
	I(1)	-	4.706^{**}	-3.646^{**}	-2.616^{***}	-3.007^{*}	-
	I(2)	*a*	-	-	-	-	-
Malaysia-Thailand	*I(0)*	-2.677^{***}	-	-	-	-	-
	I(1)	-	-4.706^{**}	-	-2.616^{***}	-3.447^{*}	-
	I(2)	-	-	-3.056^{*}	-	-	-4.131^{**}
Malaysia-Japan	*I(1)*	-4.139^{**}	-4.706^{**}	-3.699^{**}	-2.616^{***}	-	-
	I(2)	-	-	-	-	-3.771^{**}	-3.746^{**}
Philippines-Indonesia	*I(1)*	-3.295^{*}	-2.997^{*}	-	-	-	-3.157^{*}
	I(2)	-	-	-3.354^{*}	-3.227^{*}	-2.993^{*}	-
Philippines-Malaysia	*I(0)*	-2.803^{***}	-	-	-	-	-
	I(1)	-	-2.997^{*}	-4.706^{**}	-	-2.616^{***}	-
	I(2)	-	-	-	-3.227^{*}	-	-3.186^{*}
Philippines-Thailand	*I(1)*	-	-2.997^{*}	-	-	-3.447^{*}	-
	I(2)	-3.282^{*}	-	-3.056^{*}	-3.227^{*}	-	-4.434^{**}
Philippines-Japan	*I(1)*	-3.122^{*}	-2.997^{*}	-3.699^{**}	-	-	-
	I(2)	-	-	-	-3.227^{*}	-3.771^{**}	-3.507^{*}
Philippines-the US	*I(0)*	-	-	-	-	-	-3.318^{*}
	I(1)	-5.264^{**}	-2.997^{*}	-	-	-	-
	I(2)	-	-	-3.118^{*}	3.227^{*}	-3.790^{**}	-
Singapore-Thailand	*I(0)*	-	-	-	-	-	-2.942^{*}
	I(1)	-2.763^{***}	-3.646^{**}	-	-3.007^{*}	-3.447^{*}	-
	I(2)	-	-	-3.056^{*}	-	-	-
Thailand-Indonesia	*I(0)*	-3.094^{*}	-	-	-	-	-
	I(1)	-	-	-	-3.447^{*}	-	-2.989^{*}
	I(2)	-	-3.056^{*}	-3.354^{*}	-	-2.993^{*}	-
Thailand-Malaysia	*I(0)*	-4.997^{**}	-	-	-	-	-
	I(1)	-	-	-4.706^{**}	-3.447^{*}	-2.616^{***}	-
	I(2)	-	-3.056^{*}	-	-	-	-4.131^{**}

Table 11. (Continued)

Case	Integration order	Variable					
		TB_t	y_t	y_t^*	h_t	h_t^*	q_t
Thailand-Philippines	*I(1)*	-3.339*	-	-2.997*	-3.447*	-	-
	I(2)	-	-3.056*	-	-	-3.227*	-4.434**
Thailand-Japan	*I(0)*	-4.272**	-	-	-	-	-
	I(1)	-	-	-3.699**	-3.447*	-	-2.989*
	I(2)	-	-3.056*	-	-	-3.771**	-

Notes: (1) *I[n]* denotes order of integration. (2) These tests are carried out over the period 1980q1 to 2007q3 except for all Thailand cases which are carried out over 1993q1 to 2007q3. (3) This paper tests the null hypothesis of a unit root in levels and also in first differences and second differences of variables. (4) *, ** and *** mean to reject the null hypothesis at 5%, 1% and 10% level, respectively. (5) *a* means that the series is nonstationary until in second differences.

As a consequence of the findings, we only can check for the presence of cointegration between variables for 7 bilateral cases before the period of crisis. Table 12 reports the results at 95% confidence interval. Both l_{trace} and $l_{\max}$ tests show that at least one cointegrational relationship exists in the bilateral cases, except for the case of Indonesia-Malaysia which provide no evidence of any cointegrational relationship among its variables.

Looking at our results for the cointegration test (as is observable from Table 12) and our previous results concerning long run structure when the structural break is omitted (see Table 6), it is interesting to find that there are 2 similar bilateral cases which are consistent to show a cointegrational relationship. They are the bilateral case of Indonesia and Philippines with respect to Japan. This might represent the key role of Japanese market for ASEAN exports.

The long run estimates of the balance of trade in the pre-crisis model are presented in Table 13. The coefficients for the natural log of the real exchange rate (q) are correctly signed (positive) in all bilateral cases, implying a favorable long run impact of real depreciation on the trade balance before the period of crisis. This is consistent with Marshal-Lerner condition. However, the significant relationships between q and TB are found only for Indonesia-Thailand, Indonesia-Japan, and Philippine-the US case.

Compared to our previous results on full sample model (which neglects the structural break); in this pre-crisis model, we find a better portrait concerning the exchange rate effect. In which, the exchange rate effect becomes more dominant and carries more theoretically predicted correct signs, implying the significant impact of financial crisis in blurring of the true relationship between real exchange rate and trade balance.

The estimated long run coefficients of domestic real income (y) are all negatively signed and statistically significant at the 5% level or better, indicating that changes in trade balance are affected unfavorably by changes in real domestic income (y). Meanwhile, foreign real income (y^*) displays the correct sign (positive) for 4 cases and statistically significant in 3 cases, namely: Indonesia-Japan, Philippines-Indonesia, and Thailand-Indonesia. This suggests that the traditional argument relating to y^* is still observed in the pre-crisis period.

Additionally, a consistent income (y and y^*) effect appears in the case of Indonesia-Japan, Philippines-Indonesia and Thailand-Indonesia. Compared to our previous full sample long run finding, this pre-crisis finding shows a better fact in explaining the long run role of income effect on the change in trade balance. We find the income effect presences for more bilateral cases, and the magnitude of the effect becomes relatively stronger in latter finding.

A small evidence of import-substitution effect is detected in Indonesia-Thailand case. The y^* presents a negative sign in their bilateral equation which means that y^* contributes unfavorably towards the change in trade balance. In this case, as Thailand income increases, imports from Indonesia decline due to the increase in Thailand income (y^*) is originated from an increase in the production of substitutes for Indonesia-made goods which in turn cause Indonesia may export less.

Table 12. Summary results of Johansen cointegration tests in structural break analysis

Case	(r)	Eigenvalues	The statistic value of		The critical value of	
			Trace	λ_{max}	Trace*)	λ_{max} *)
Indonesia-Malaysia	*r*=0	0.480	92.614	*44.499*	94.15	39.37
	r=1	0.292	48.115	23.460	68.52	33.46
	r=2	0.177	24.655	13.260	47.21	27.07
	r=3	0.114	11.395	8.256	29.68	20.97
	r=4	0.044	3.139	3.061	15.41	14.07
	r=5	0.001	0.078	0.078	3.76	3.76
Indonesia-Thailand	*r*=0	0.983	*138.862*	*69.263*	94.15	39.37
	r=1	0.871	*69.599*	*34.809*	68.52	33.46
	r=2	0.655	34.789	18.073	47.21	27.07
	r=3	0.465	16.716	10.636	29.68	20.97
	r=4	0.245	6.080	4.777	15.41	14.07
	r=5	0.074	1.303	1.303	3.76	3.76
Indonesia-Japan	*r*=0	0.668	*190.304*	*69.429*	94.15	39.37
	r=1	0.522	*120.876*	*46.562*	68.52	33.46
	r=2	0.479	*74.313*	*41.062*	47.21	27.07
	r=3	0.292	*33.251*	*21.793*	29.68	20.97
	r=4	0.144	11.459	9.768	15.41	14.07
	r=5	0.026	1.690	1.690	3.76	3.76
Philippines-Indonesia	*r*=0	0.663	*180.845*	*68.443*	94.15	39.37
	r=1	0.556	*112.402*	*51.139*	68.52	33.46
	r=2	0.382	*61.262*	*30.276*	47.21	27.07
	r=3	0.225	*30.986*	16.033	29.68	20.97
	r=4	0.199	14.953	13.999	15.41	14.07
	r=5	0.015	0.954	0.954	3.76	3.76
Philippines-Japan	*r*=0	0.709	*207.172*	*77.673*	94.15	39.37
	r=1	0.589	*129.499*	*56.092*	68.52	33.46
	r=2	0.410	*73.407*	*33.189*	47.21	27.07
	r=3	0.300	*40.218*	*22.491*	29.68	20.97
	r=4	0.180	*17.727*	12.500	15.41	14.07
	r=5	0.080	*5.227*	5.227	3.76	3.76
Philippines-the US	*r*=0	0.581	*130.895*	*55.605*	94.15	39.37
	r=1	0.308	*75.290*	23.570	68.52	33.46
	r=2	0.293	*51.720*	22.213	47.21	27.07
	r=3	0.240	29.506	17.595	29.68	20.97
	r=4	0.158	11.911	10.997	15.41	14.07
	r=5	0.014	0.914	0.914	3.76	3.76
Thailand-Indonesia	*r*=0	0.930	*100.636*	*45.188*	94.15	39.37
	r=1	0.820	55.448	29.112	68.52	33.46
	r=2	0.525	26.336	12.655	47.21	27.07
	r=3	0.440	13.680	9.865	29.68	20.97
	r=4	0.178	3.815	3.339	15.41	14.07
	r=5	0.028	0.476	0.476	3.76	3.76

Notes: (1) *r* denotes the number of cointegrating vector. (2) *) denotes 5% critical value. (3) Italic number means that the test rejects the null hypothesis at 5% level. (4) Due to the problem of the limitation of data availability and the degree of freedom, we use lag 0 instead of 1 for Indonesia-Thailand, Thailand-Indonesia, and Thailand-the US case. All series in those bilateral cases are stationary in first difference with lag 0 as well.

Domestic real cash balance (*h*) is correctly signed and has a significant (negative) impact on the trade balance only for Philippines-Japan. Foreign real cash balance (h^*) performs a bit better than *h*, since its coefficient also influential in determining the Philippines-Indonesia trade balance. Nevertheless, the real cash balance effect consistently appears for Philippines-Japan case. As reported by full sample long run analysis, this finding supports too a minor influential role of cash balance effect in determining the trade balance.

Table 13. Long run relationship of the variables: Estimation of VECM in structural break analysis

Case	Variables						
	TB_t	y_t	y_t^*	h_t	h_t^*	q_t	Const.
Indonesia-Thailand	1.000	*1.439***	*2.120***	*-3.979***	*9.544***	*-7.882***	82.06
		(6.055)	(3.100)	(-16.803)	(16.173)	(-3.875)	
Indonesia-Japan	1.000	*13.538***	*-14.751****	*-11.791***	*28.256***	*-5.785***	188.38
		(4.841)	(-1.801)	(-5.327)	(3.795)	(-4.282)	
Philippines-Indonesia	1.000	*8.908***	*-8.664***	*-2.663***	*-2.131**	-1.730	15.97
		(6.669)	(-8.797)	(-3.966)	(-2.342)	(-0.735)	
Philippines-Japan	1.000	*2.200***	1.671	*2.645***	*-9.428**	-0.851	-30.63
		(5.182)	(0.627)	(3.145)	(-2.761)	(-1.576)	
Philippines-the US	1.000	*0.323**	-1.384	*-0.274**	0.338	*-1.081***	3.51
		(2.085)	(-1.436)	(-2.171)	(0.634)	(-5.891)	
Thailand-Indonesia	1.000	*10.010***	*-3.587***	*-35.513***	*12.969***	-3.563	-116.17
		(3.168)	(-3.268)	(-13.028)	(11.856)	(-0.379)	

Notes: (1) The *t*-statistics are reported in the parenthesis. (2) *, ** and *** denote rejection of null hypothesis at 5%, 1%, and 10% level, respectively

Based on the long run analysis results above, finally, we can draw some key issues concerning the structural break analysis. First, the Chow test provides evidence for a structural break in 17 out of 29 bilateral cases of interest. Second, having established the unit root and cointegration test, we find 6 bilateral cases in the pre-crisis period which are applicable for VECM approach. Third, due to our unit root test in post-crisis period has verified that the variables of 17 bilateral cases are not integrated of the same order; as a result, the cointegration test cannot be done for the concerned period. It implies that there is no evidence of any cointegrational relationship for all bilateral cases variables after the period of crisis (1997q3-2007q3). Hence, the structural break analysis deals only with the condition during pre-crisis period.

Fourth, in the long run, the income effects seem play a major role in determining the trade balance, while a small evidence is provided for the import-substitution effect. This circumstance corroborates our previous finding in sub section 1.4.1. However, compared to our previous full sample long run finding, this pre-crisis finding shows a better fact in explaining the long run role of income effect on the change in trade balance. Fifth, the cash balance effects play the most minor role in influencing the trade balance since the effect is present in relatively less bilateral cases. This also strengthens our previous results, as presented by sub section 1.4.1.

Sixth, the exchange rate effect actually appears in all bilateral cases which are considered in VECM analysis. The coefficients for exchange rate (q) carries the expected positive sign for all those bilateral cases, implying a favorable long run impact of real depreciation on the trade balance before the period of crisis. Although, the coefficients are found statistically significant only in the case of Indonesia-Thailand, Indonesia-Japan, and Philippine-the US, but compared to our previous finding in full sample model which neglects the structural break, this pre-crisis finding displays a better portrait in explaining the exchange rate effect. The condition brings us to a suspicion towards the possibility of the significant impact of financial crisis in blurring of the true relationship between real exchange rate and trade balance.

On the other hand, for the short run relationship, we allow trade balances respond to changes in the past value of our regressors. The coefficient estimates reported in Table 14 based on the VECM. The estimated coefficients of the error correction terms (d) are all negatively signed and carry the theoretically predictive signs implying that real trade balance should rise over time toward its long run equilibrium levels. However, only two of them are significant. Examining the case which provides evidence for a structural break, we find the estimated short run coefficients of domestic real income (y) are mostly negatively signed in the bilateral case of Indonesia-Japan, Philippines-Indonesia and

Philippines-the US. By solely considering the majority of *y*'s short run and long run coefficient signs for those three bilateral cases in the pre-crisis period, a consistent contribution of domestic real income (*y*) towards the deterioration in trade balance (*TB*) can be suggested. However, the short run coefficient of *y* is statistically significant only in the case of Philippines-Indonesia (lagged two periods).

For foreign real income (y^*), again, its coefficient is correctly signed and significant only in the case of Philippines-Indonesia (lagged six periods). Combining the results by considering the long run coefficients for *y* and y^* of the case as shown by Table 13 (where y and y^* carry the expected negative and positive sign respectively and are statistically significant), we may conclude that the real income effect seems strongly presence for Philippines-Indonesia case. Although not too robust, in fact Indonesia-Japan and Philippines-the US also confirm for a possibility of real income effect. In addition, a small evidence of import-substitution effect appears on the case of Philippines-Japan in the short run, indicating an increase of Japan income has an unfavorable impact on the Indonesian trade balance.

The short run coefficients of domestic real cash balance (*h*) are reported significant and correctly signed for Indonesia-Japan (lagged one period) and Philippines-the US (lagged two and three periods). Nevertheless as is observable from Table 13, we find no significant long run impacts of *h* on *TB* for their cases, means that the cash balance effect for these 2 reporting countries only exists in the short run. Meanwhile, the short run coefficients of foreign real cash balance (h^*) are significant at 10% level and positively signed for Philippines-the US (lagged three and four periods). In this case, we obtain the cash balance effects are consistently present in the case of Philippine-the US.

The results for real exchange rate (*q*) show that the effects of *q* on *TB* are significant and correctly signed in two cases, namely Indonesia-Japan (lagged one period) and Philippines-the US (lagged one and four periods). As far as J-curve effects are concerned, those two bilateral cases provide evidence for the presence of a J-curve where in the short run, their exchange rate coefficient has negative value followed by positive value later in the long run (see Table 13). Actually, the coefficient cycle from negative in the short run to positive in the long run are presented too by Philippines-Indonesia and Philippines-Japan. Yet, those coefficients are all statistically insignificant.

Table 14. Short run relationship of the variables and the speed of adjustment coefficients: Estimation of VECM in structural break analysis

Variable	Case and coefficients (1)					
	Ina-Thai	Ina-Jap	Phil-Ina	Phil-Jap	Phil-US	Thai-Ina
$\Delta TB_{(t-1)}$	-	-0.474*	-0.350	-0.100	-0.306	-
	-	(-2.272)	(-1.100)	(-0.459)	(-1.699)	-
$\Delta TB_{(t-2)}$	-	-0.425	-0.163	0.184	-0.282	-
	-	(-1.636)	(-0.520)	(0.803)	(-1.502)	-
$\Delta TB_{(t-3)}$	-	-0.224	-0.116	0.187	-0.060	-
	-	(-1.041)	(-0.420)	(0.781)	(-0.316)	-
$\Delta TB_{(t-4)}$	-	-0.468*	-0.189	0.167	0.027	-
	-	(-2.559)	(-0.755)	(0.697)	(0.154)	-
$\Delta TB_{(t-5)}$	-	-0.191	-0.240	-0.026	0.054	-
	-	(-1.194)	(-1.183)	(-0.102)	(0.350)	-
$\Delta TB_{(t-6)}$	-	-0.165	-0.117	0.221	-	-
	-	(-1.106)	(-0.519)	(0.891)	-	-
$\Delta y_{(t-1)}$	-	-0.123	-2.627	0.787	-0.186	-
	-	(-0.208)	(-0.991)	(1.511)	(-0.657)	-
$\Delta y_{(t-2)}$	-	-0.265	-4.837***	0.231	-0.453	-
	-	(-0.480)	(-1.983)	(0.472)	(-1.682)	-
$\Delta y_{(t-3)}$	-	-0.239	-3.105	0.058	-0.074	-
	-	(-0.461)	(-1.162)	(0.123)	(-0.239)	-
$\Delta y_{(t-4)}$	-	0.082	2.181	0.518	-0.155	-
	-	(0.163)	(0.795)	(1.139)	(-0.496)	-
$\Delta y_{(t-5)}$	-	-0.384	0.376	0.190	-0.267	-
	-	(-0.758)	(0.154)	(0.407)	(-0.861)	-
$\Delta y_{(t-6)}$	-	-0.094	-0.509	-0.006	-	-
	-	(-0.168)	(-0.256)	(-0.013)	-	-
$\Delta y^*_{(t-1)}$	-	4.985***	-1.813	2.248	0.473	-
	-	(1.884)	(-0.802)	(1.056)	(0.212)	-
$\Delta y^*_{(t-2)}$	-	0.296	-0.945	-0.807	6.890*	-
	-	(0.103)	(-0.424)	(-0.425)	(2.695)	-
$\Delta y^*_{(t-3)}$	-	1.912	1.181	1.250	-3.301***	-
	-	(0.981)	(0.459)	(0.691)	(-1.705)	-
$\Delta y^*_{(t-4)}$	-	1.686	-1.324	1.599	0.298	-
	-	(0.885)	(-0.572)	(1.020)	(0.188)	-

Table 14. (Continued)

Variable	Case and coefficients[(1)]					
	Ina-Thai	**Ina-Jap**	**Phil-Ina**	**Phil-Jap**	**Phil-US**	**Thai-Ina**
$\Delta y^*_{(t-5)}$	-	-5.418*	-1.400	-3.899***	-1.136	-
	-	(-2.766)	(-0.633)	(-2.029)	(-0.709)	-
$\Delta y^*_{(t-6)}$	-	2.606	4.117***	0.016	-	-
	-	(1.043)	(1.755)	(0.007)	-	-
$\Delta h_{(t-1)}$	-	-0.869***	-0.532	0.622***	-0.116	-
	-	(-2.032)	(-0.476)	(1.794)	(-0.743)	-
$\Delta h_{(t-2)}$	-	-0.211	0.664	0.358	-0.408*	-
	-	(-0.581)	(0.554)	(1.052)	(-2.298)	-
$\Delta h_{(t-3)}$	-	-0.636	1.722***	0.198	-0.461**	-
	-	(-1.533)	(1.818)	(0.608)	(-2.850)	-
$\Delta h_{(t-4)}$	-	-0.209	1.408	-0.031	-0.130	-
	-	(-0.557)	(1.456)	(-0.105)	(-0.797)	-
$\Delta h_{(t-5)}$	-	-0.307	1.569	-0.158	-0.083	-
	-	(-0.885)	(1.325)	(-0.549)	(-0.550)	-
$\Delta h_{(t-6)}$	-	-0.044	1.181	0.161	-	-
	-	(-0.391)	(1.147)	(0.714)	-	-
$\Delta h^*_{(t-1)}$	-	-0.195	-0.197	-2.046	-0.835	-
	-	(-0.142)	(-0.150)	(-1.640)	(-1.087)	-
$\Delta h^*_{(t-2)}$	-	-1.467	-0.126	0.202	0.374	-
	-	(-1.190)	(-0.094)	(0.153)	(0.524)	-
$\Delta h^*_{(t-3)}$	-	-0.831	-0.903	-1.654	1.511*	-
	-	(-0.873)	(-0.636)	(-1.351)	(2.300)	-
$\Delta h^*_{(t-4)}$	-	-1.090	-0.771	-0.112	1.519*	-
	-	(-0.884)	(-0.550)	(-0.101)	(2.097)	-
$\Delta h^*_{(t-5)}$	-	0.851	0.062	0.859	0.327	-
	-	(0.531)	(0.051)	(0.581)	(0.476)	-
$\Delta h^*_{(t-6)}$	-	0.077	-0.195	-1.950	-	-
	-	(0.055)	(-0.640)	(-1.387)	-	-
$\Delta q_{(t-1)}$	-	-1.367*	-2.535	-0.253	-1.485***	-
	-	(-2.464)	(-1.256)	(-0.649)	(-2.011)	-
$\Delta q_{(t-2)}$	-	-0.033	-0.776	-0.324	-0.260	-
	-	(-0.058)	(-0.400)	(-0.770)	(-0.457)	-
$\Delta q_{(t-3)}$	-	-0.721	0.508	0.166	-0.431	-
	-	(-1.334)	(0.204)	(0.401)	(-0.691)	-
$\Delta q_{(t-4)}$	-	-0.534	1.544	-0.608	-0.975***	-
	-	(-1.029)	(0.673)	(-1.505)	(-1.820)	-
$\Delta q_{(t-5)}$	-	0.311	0.104	0.206	-0.019	-
	-	(0.615)	(0.049)	(0.572)	(-0.034)	-
$\Delta q_{(t-6)}$	-	-0.153	-3.106	-0.066	-	-
	-	(-0.332)	(-1.485)	(-0.190)	-	-
Const.	-0.028	0.104	0.262	-0.022	0.020	0.022
	(-0.304)	(1.206)	(0.801)	(-0.384)	(0.652)	(0.146)
d	-0.520*	-0.036	-0.164	-0.198	-0.689**	-0.193
	(-2.936)	(-1.161)	(-0.620)	(-1.423)	(-2.910)	(-1.463)

Table 14. (Continued)

Variable	Case and coefficients[1]					
	Ina-Thai	**Ina-Jap**	**Phil-Ina**	**Phil-Jap**	**Phil-US**	**Thai-Ina**
Diagnostics:						
R^2	0.365	0.700	0.639	0.630	0.692	0.125
Serial Correlation						
LM (6)	30.673	30.091	40.133	46.325	32.848	37.940
p-value	0.720	0.745	0.292	0.116	0.619	0.381

Notes: (1) Dependent variable is real bilateral trade balance (ΔTB_t). (2) d reflects the speed of adjustment coefficients. (3) The *t*-statistics are reported in the parenthesis. (4) *, ** and *** denote rejection of null hypothesis at 5%, 1%, and 10% level, respectively. (5) Ina=Indonesia, Mal=Malaysia, Sing=Singapore, Phil=Philippines, Thai=Thailand, Jap=Japan, and US=the US. (6) [*d.f.*] denotes the degree of freedom. (7) Serial correlation test with H_0: no serial correlation. (8) Due to the problem of the limitation of data availability and the degree of freedom, we use lag 0 instead of 1 for Indonesia-Thailand, Thailand-Indonesia, and Thailand-the US case.

The short run income and cash balance effect in the pre-crisis period appear on the same number of bilateral case. However, if we consider the magnitude of these 2 effects, then income effect still looks stronger relatively than the cash balance effect. Regarding the short run import-substitution effect, we find a minor evidence for its presence before the period of crisis

In contrast to our previous short run finding (full sample), in which, it shows about the minor role of income effect in determining the trade balance, even less important than the import-substitution effect (see Table 7); here, our short run findings for pre-crisis period display a relatively much better magnitude of the income effect in the trade balance equation. It is clearly discernible that the magnitude of income effect is more robust than the cash balance or import-substitution effect. Our short run findings for pre-crisis period support the findings of previous OLS short run analysis. These analyses simultaneously admit a significant role of income effect which exceeds the cash balance and import-substitution effect in determining the trade balance.

1.4.5.2 Structural break with an unknown break point

In this section, instead of doing prejudge on selecting a break point time (as have been done in preceding part), the analysis will endogenize the choice of a break point through the estimation of a break point using sequential methods. We utilize Zivot and Andrews (1992) method for the unit root test and Gregory and Hansen (1996) method for cointegration test. Through these methods, the problem of selecting a subjective break point can be avoided.

1.4.5.2.1 Zivot and Andrews (1992) unit root test

According to Perron (1989), the ADF test is biased in favor of the null hypothesis in the existence of a structural break which is not accounted for in the data series. The results of the ADF test may be invalid due to the false acceptance of the unit root null hypothesis, when in fact it should do the rejection. Employing Zivot and Andrews method, we test all series in the full sample and accommodate a structural break without predetermining the break point time, avoiding the risk of incorrect time period selection.

Zivot and Andrews (1992) introduce a unit root testing procedure that allows for the presence of a structural break in the data series, in which the break point of structural change is firmly estimated, instead of assumed as exogenous (see Jayanthakumaran *et. al*, 2007). The Zivot and Andrews test (ZA) consists of three different models, namely model A, B and C. In each model, the null hypothesis of a unit root that excludes any structural break is tested against the alternative hypothesis of a trend stationary process with possible structural break occurring at an unknown point in time. Model A permits the break occurs in the intercept. Model B considers the possibility of a change in the slope while Model C accommodates possible breaks in both intercept and slope.

Because of a consistency reason relating to our previous ADF model, then only ZA unit root test for structural break in the intercept (Model A) will be considered. Therefore, following the notation of ZA, the model which accommodates the possibility of a break in the intercept that we use for checking a unit root is:

$$\Delta y_t = m + qDU_t(l) + bt + ay_{t-1} + \sum_{j=1}^{k} c_j \Delta y_{t-j} + e_t \quad \text{..} (16)$$

Equation (16) looks analogous to the ADF unit root test regression equation with the inclusion of a dummy variable DU_t. This DU_t is a break dummy variable capturing a shift in the intercept. It is defined as:

$$DU_t = \begin{cases} 1 & if \quad t > T.l \\ 0 & otherwise \end{cases}$$

where k is the number of lags determined for each possible break point by one of the information criteria[11], T is the sample size, and l is the break fraction which ranges from *2/T* to *(T-1)/T*. This range corresponds to the ‘trimming region’ of the sample where we search for the minimum t-statistic. Such interval of a sample actually can be chosen subjectively. For above range, the trimming region should be within (*0.001T*, *0.999T*). However, in this model, we assume the ‘trimming region’ to be within (*0,15T*, *0.85T*) as suggested by Zivot and Andrews (1992). So, suppose a break is empirically located at point *0.30T* (positioned between *0.15T* and *0.85T*); this means that the point will divide the sample of size T into two regimes where one from $t = 1$ to $t = 0.30T$, and another from $t = 0.30T + 1$ to $t = T$. Further, the break fraction (l) can be defined as *Tb/T*, where *Tb* is the time of break. Equation (16) will be sequentially estimated and since our objective is to select the break point which provides the least support to the null hypothesis of unit root, then l is chosen to minimize the one-sided t-statistic of the a .

[11] For consistency with the reporting of our previous ADF test; in this model, the optimal k is determined by AIC

Table 15 shows that using ZA test in the full sample; we find 30 data series appear to be stationary in levels. Only one series is suggested by the two unit root tests (ADF test and ZA test) consistently rejects the unit root hypothesis, *i.e. TB* data for Malaysia-Indonesia. As to the previous data series which the ADF test deems nonstationary, 29 are found to be stationary under ZA test. Although not all the nonstationary conclusions of our previous ADF test are overturned by ZA test, those 29 overturning cases do signify the importance of considering structural break when performing unit root tests.

Table 15. Summary results of Zivot-Andrews unit root tests

Case	Variable	Test statistic	Lags	Break date
Indonesia-Malaysia	TB_t	-4.311	2	1996q1
	y_t	-3.475	3	1998q1
	y_t^*	-5.387**	1	1987q3
	h_t	-5.502**	2	1998q1
	h_t^*	-4.390	2	1998q1
	q_t	-3.811	3	2002q2
Indonesia-Philippines	TB_t	-3.759	1	2002q2
	y_t^*	-2.903	1	1987q3
	h_t^*	-3.110	3	1986q4
	q_t	-4.535	0	2001q3
Indonesia-Singapore	TB_t	-3.301	2	2003q2
	y_t^*	-3.155	3	1987q2
	h_t^*	-4.673	3	1998q3
	q_t	-3.633	3	2002q2
Indonesia-Thailand	TB_t	-5.463**	0	1998q2
	y_t	-3.255	2	1999q1
	y_t^*	-5.291*	2	1998q1
	h_t	-3.339	2	1997q4
	h_t^*	-3.543	2	2001q3
	q_t	-5.942**	1	1997q4
Indonesia-the Japan	TB_t	-5.573**	1	1998q1
	y_t^*	-2.773	3	1997q4
	h_t^*	-2.065	3	1999q4
	q_t	-2.916	3	1985q4
Indonesia-the US	TB_t	-4.278	3	1988q2
	y_t^*	-3.451	2	1996q2
	h_t^*	-3.678	3	1993q3
	q_t	-3.005	3	2002q2
Malaysia-Indonesia	TB_t	-5.513**	2	1987q1
	q_t	-3.811	3	2002q2

Table 15. (Continued)

Case	Variable	Test statistic	Lags	Break date
Malaysia-Philippines	TB_t	-3.395	3	1986q1
	q_t	-3.452	0	2000q1
Malaysia-Singapore	TB_t	-2.568	3	1997q3
	q_t	-3.000	2	1988q4
Malaysia-Thailand	TB_t	-4.878*	0	1996q2
	y_t	-3.861	1	2001q1
	h_t	-6.100**	2	1998q3
	q_t	-4.286	2	2000q3
Malaysia-Japan	TB_t	-3.639	2	1988q1
	q_t	-4.569	3	1985q4
Malaysia-the US	TB_t	-4.895*	2	1989q4
	q_t	-4.676	1	1997q3
Philippines-Indonesia	TB_t	-4.910*	0	2002q1
	q_t	-4.535	0	2001q3
Philippines-Malaysia	TB_t	-3.976	3	1996q2
	q_t	-3.452	0	2000q1
Philippines-Singapore	TB_t	-4.737	0	1987q1
	q_t	-3.373	1	1985q4
Philippines-Thailand	TB_t	-6.092**	0	1999q3
	y_t	-4.696	0	1995q2
	h_t	-1.829	1	2005q2
	q_t	-3.620	1	1995q3
Philippines-Japan	TB_t	-3.241	1	1989q1
	q_t	-4.182	1	1985q4
Philippines-the US	TB_t	-3.573	3	2001q1
	q_t	-3.033	1	1997q3
Singapore-Indonesia	TB_t	-5.780**	1	2006q1
	y_t	-4.822*	0	2005q3
	y_t^*	-6.824**	1	2005q4
	h_t	-3.896	1	2006q4
	h_t^*	-5.684**	0	2004q3
	q_t	-6.101**	1	2005q4
Singapore-Malaysia	TB_t	-6.474**	2	1994q1
	q_t	-3.000	2	1988q4
Singapore-Philippines	TB_t	-3.910	2	1987q1
	q_t	-3.373	1	1985q4
Singapore-Thailand	TB_t	-4.243	2	1996q4
	y_t	-5.271*	0	2001q1
	h_t	-7.669**	0	1998q3
	q_t	-6.450**	1	1997q3
Singapore-Japan	TB_t	-3.559	3	1986q1
	q_t	-4.764	1	1985q4

Table 15. (Continued)

Case	Variable	Test statistic	Lags	Break date
Singapore-the US	TB_t	-2.440	3	2003q1
	q_t	-3.534	1	1997q3
Thailand-Indonesia	TB_t	-5.373**	0	1998q2
	q_t	-5.942**	1	1997q4
Thailand-Malaysia	TB_t	-6.341**	0	1997q1
	q_t	-4.286*	2	2000q3
Thailand-Philippines	TB_t	-7.046**	0	1996q1
	q_t	-3.620	1	1995q3
Thailand-Singapore	TB_t	-7.011**	0	2005q1
	q_t	-6.450**	1	1997q3
Thailand-Japan	TB_t	-5.419**	0	1997q3
	y_t^*	-3.323	0	1998q2
	h_t^*	-2.164	2	2005q2
	q_t	-3.682	1	1997q3
Thailand-the US	TB_t	-4.407	2	1997q3
	y_t^*	-4.169	2	2001q1
	h_t^*	-3.683	1	2005q2
	q_t	-5.264*	1	1997q3

Notes: (1) These tests are carried out over the period 1980q1 to 2007q3 except for all Thailand cases which are carried out over 1993q1 to 2007q3 and Singapore-Indonesia case which are carried out over 2003q1 to 2007q3. (2) *, and ** mean to reject the null hypothesis at 5%, and 1%, respectively. (3) Critical values are 5%: -4.80 and 1%: -5.34 (Zivot and Andrews, 1992).

The results identify that for most Indonesia, Malaysia, Singapore, and Thailand series, the structural breaks tend to appear during the period 1996-1998. As has been highlighted before, the period is strongly associated with the shocks of Asian financial crisis. In addition for Indonesia case, breaks in 1998 clearly also correspond to the political chaos caused by the reformation movements which eventually overthrew Indonesian president Soeharto. While for Philippines, breaks occur in around 1985-1987 and 2000-2001; it is most likely that the break in 1985-1987 is related to the presence of a political instability in Philippine, where the people power did the EDSA (Epifanio de los Santos Avenue) revolution in 1986 which toppled President Marcos, whereas the latter tends to be a result of the second -EDSA- people power revolution that overthrew Philippine president Joseph Estrada.

Having confirmed that all nonstationary series are integrated with order one [I(1)], the result of ZA tests report a less number of bilateral cases which can be included in the cointegration test than the ADF tests. Instead of 17 (as considered previously by ADF test), only 6 bilateral cases are suggested by ZA test to continue with the cointegration test (namely Philippines-Singapore, Philippines-Japan, Philippines-the US, Singapore-Philippines, Singapore-Japan, and Singapore-the US). The interesting fact is that those 6 bilateral cases are concluded as well to be integrated in the same order [I(1)] under prior ADF test.

1.4.5.2.2 Gregory and Hansen (1996) cointegration test

In order to identify the existence of a structural break in the cointegrating relationship, this paper follows a procedure proposed by Gregory and Hansen (1996). The Gregory and Hansen (GH) test introduces the idea of testing cointegration under the framework of residual-based test, in which the cointegrating vector is allowed to change at a single unknown break point (see Gregory and Hansen, 1996; Goyal *et. al*, 2004; Voronkova, 2004; Kasman and Ayhan, 2008). According to GH, failing to account for a structural break in the model may lead one who utilizes the conventional cointegration test not to reject the null hypothesis of no cointegration when in fact the cointegrating relationship exists during the period, indicates that the conventional test is biased and can not accommodate a shift in the cointegrating vector.

Specifically, the idea of GH test comes from the concept of residual based test for cointegration which is initially developed by Engle and Granger (1987). To clarify, say we have simple standard model:

$$y_t = ax_t + e_t \quad \text{(17)}$$

Suppose y_t and x_t are I[1], if e_t is nonstationary, then $y_t - ax_t$ is not a cointegrating relationship, suggesting a unit root test of e_t is a test for the cointegration relationship in

y_t. The standard ADF test can be employed to test whether e_t has a unit root. Under the residual-based technique, the ADF is exploited to test for the null hypothesis of the residual has a unit root and hence no cointegration versus the alternative of the residual is stationary and hence variables of interest are cointegrated.

GH develop further the residual based cointegration test above by considering the influence of a structural break in their model. GH cointegration test is designed to test the null hypothesis of no cointegration against the alternative hypotheses of cointegration subject to one shift in the cointegrating vector at an unknown break point. They suggest three models: (i) level shift, (ii) level and trend shift, and (iii) regime shift. Similar to Zivot and Andrews unit root test, GH cointegration test also assumes that the break point is unknown and will be selected endogenously. The three models of GH test can be specified as follow:

$y_t = m + qDU_{tl} + ax_t + e_t,$ ($t = 1, \ldots, T$) ………………………….. (18)

$y_t = m + qDU_{tl} + ax_t + b_t + e_t,$ ($t = 1, \ldots, T$) ……………………….…. (19)

$y_t = m + qDU_{tl} + a_1 x_t + a_2 x_t DU_{tl} + e_t,$ ($t = 1, \ldots, T$) ………………..…………. (20)

where Equation (18) shows the 'level shift' model (*C*), Equation (19) and (20) represent the 'level shift with trend' (*C/T*) and 'regime shift' (*C/S*) model, respectively. The scalar dependent variable is denoted by y_t, x_t is an *m*-dimensional vector of independent variables, e_t is an error term, l is the break fraction which constitutes an unknown parameter ranging from 0 to 1, DU_{tl} is a dummy variable which is defined as: $DU_{tl} = 1$ if $t > [T. l]$ and $DU_{tl} = 0$ if $t = [T. l]$, T is the sample size, and $T. l = Tb$ in which Tb is the breaking point.

As shown by Equation (18) to (20), the 'level shift' or *C* model is a simple case which allows an intercept to shift. Here, parameters μ and ($q + \mu$) denote the intercept before and after the break at *Tb*, while a are the parameters of the cointegrating vector which are held constant. The second model is *C/T* model which include a time trend into the *C* model where *ß* denotes the slope of time trend. The 'regime shift' or *C/S* model is also an analogous regression, but it allows a shift in both intercept and the cointegrating vector parameters. In this model, μ and (q + μ) are as in the *C* model, while a_1 is the cointegrating slope coefficients before the break, and $(a_1 + a_2)$ is the slope coefficients after the break.

In order to check for the presence of unit roots in the residuals, we employ the standard ADF residual test statistic for each model. This test statistic is computed by regressing Δe_{tl} upon e_{t-1l} and Δe_{t-1l}, …., Δe_{t-kl} for some appropriate chosen lag truncation *k*. The ADF statistic will be described by the *t*-statistic of the reggessor e_{t-1l}, where:

$$ADF(l) = tstat(e_{t-1l}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (21)$$

The GH test will select the break point which provides the smallest values of the above statistics since the smallest values of the test statistics carry the least support for the null hypothesis of a unit root in the residuals. Gregory and Hansen (1996) define the smallest ADF statistic as ADF*. Since we cannot use the standard critical values, we follow the approximate asymptotic critical values for ADF* which are provided by Gregory and Hansen. Similar to Zivot and Andrews test, in this case, we assume the unknown break point to be in the (0.15*T*, 0.85*T*) interval of a sample of size *T*.

We apply the GH test to our 6 bilateral cases which are detected by Zivot and Andrews test to have unit root and to be integrated in the same order. Table 16 reports the results of the GH test. Considering the test statistic of ADF*, the test supports the relationship of cointegration between the trade balance (*TB*) and other 5 variables of interest (*i.e.* y, y^*, h, h^*, and q) in all 6 bilateral cases. The estimated break dates mostly vary across different statistics, however they seem provide a similar tendency for the period range as is displayed before in the ZA test. They occur in the period of 1985-1987, 1996-1998, and 2000-2001.

Table 16. Summary results of Gregory and Hansen cointegration tests

Case	Model	Test Statistic	Break fraction	Break date
Philippines-Singapore	*C*	-7.146**	0.288	1987q4
	C/T	-7.685**	0.279	1987q3
	C/S	-8.599**	0.270	1987q2
Philippines-Japan	*C*	-5.914*	0.324	1988q4
	C/T	-5.890*	0.324	1988q4
	C/S	-6.915*	0.568	1995q3
Philippines-the US	*C*	-6.818**	0.784	2001q3
	C/T	-6.785**	0.784	2001q3
	C/S	-6.711*	0.829	2002q4
Singapore-Philippines	*C*	-7.524**	0.270	1987q2
	C/T	-7.806**	0.162	1984q2
	C/S	-9.803**	0.261	1987q1
Singapore-Japan	*C*	-6.617**	0.180	1984q4
	C/T	-8.052**	0.324	1988q4
	C/S	-7.743**	0.532	1994q3
Singapore-the US	*C*	-6.612**	0.153	1984q1
	C/T	-6.890**	0.604	1996q3
	C/S	-10.328**	0.252	1987q2

Notes: (1) *, and ** mean to reject the null hypothesis at 5%, and 1%, respectively. (2) Critical values are 5%: -5.56 (*C* model), -5.83 (*C/T* model), -6.41 (*C/S* model), and 1%: -6.05 (*C* model), -6.36 (*C/T* model), -6.92 (*C/S* model) [Gregory and Hansen, 1996].

If we look at back to our full sample analysis for Johansen cointegration test (see Table 5), and compare them to the results of Gregory and Hansen cointegration test, then we discover several different conclusions. In GH test, we find that: (i) there are 6 instead of 9 bilateral cases in favor of the existence of a long run cointegrating relationship between those variables of interest, (ii) six bilateral cases (*i.e.* Indonesia-Singapore, Indonesia-Japan, Indonesia-the US, Malaysia-Philippines, Malaysia-Japan, Malaysia-the US) which are previously identified by Johansen cointegration test to provide evidence of rejecting the null hypothesis; have been overturned by GH test. In other words, with the break included, the latter test finds that the null hypotesis of non cointegration of those cases fail to be rejected, (iii) three bilateral cases (*i.e.* Philippines-Singapore, Philippines-the

US, and Singapore-Philippines) provide significant evidence in favor of a cointegration relation allowing for structural break, where previously those cases failed to be identified by Johansen test to support the hypothesis of cointegration. This suggests that it is very important to consider structural break in the cointegrating vector since standard cointegration test probably can be biased if structural breaks are neglected where they are indeed presence. Nevertheless, both Johansen and Gregory and Hansen's procedures still provide evidence of cointegration relation in three similar bilateral cases, namely Philippines-Japan, Singapore-Japan, and Singapore-the US.

1.4.5.2.3 The long run relationship: in presence of a structural break

Since the null hypothesis of no cointegration is rejected by all the three models (*C*, *C/T*, *C/S*), we need to determine further which model actually that should be decided as the most acceptable model for our long run and short run analysis. In order to do that, we adopt a procedure which is applied by Golinelli and Orsi (2000). They apply two steps Engle-Granger (1987) method (EG) after doing GH test, and utilize the first step of EG for selecting the best model[12]. Particularly, the most acceptable model is decided after doing comparison for all models' performance in their respective cointegrating equation. Therefore, following Golinelli and Orsi (2000), we apply OLS for Equation (18) to (20) in the first step of EG method. The results are given in Table 17. From the estimates, the cointegrated model *C/S* seems to be the most acceptable. In this model, significant estimated coefficients are more frequently observed than in *C* or *C/T* model. The coefficient's values of the model are more relatively plausible too. To make this analysis become easier to be followed, the cointegrating vector estimated by GH tests using the *C/*S model for each bilateral case can be rewritten as:

[12] The EG method consists of two steps. In the first step, the presence of a cointegrating relationship between considered variables will be tested. If we find the evidence of a cointegrating relationship in the model then a corresponding error correction model should exist for the short run and will be estimated in step 2 (Vogelvang, 2005).

(1) Philippine-Singapore.

$$TB_t = 29.845 - 13.437DU_{tl} + 5.480y_t - 1.418y_t^* - 0.281h_t - 7.606h_t^* - 0.515q_t$$
$$- 3.441y_t DU_{tl} + 0.816y_t^* DU_{tl} + 0.797h_t DU_{tl} + 4.684h_t^* DU_{tl} - 0.672qDU_{tl} \quad \ldots\ldots (22)$$

(2) Philippine-Japan.

$$TB_t = -5.871 + 3.667DU_{tl} - 0.875y_t + 3.079y_t^* - 0.494h_t - 0.165h_t^* + 0.407q_t$$
$$+ 1.467y_t DU_{tl} - 2.129y_t^* DU_{tl} + 0.469h_t DU_{tl} + 0.247h_t^* DU_{tl} + 0.110qDU_{tl} \quad \ldots\ldots (23)$$

(3) Philippine-the US.

$$TB_t = 1.249 + 36.546DU_{tl} + 0.139y_t + 0.433y_t^* + 0.050h_t - 0.559h_t^* + 0.546q_t$$
$$- 0.186y_t DU_{tl} - 4.267y_t^* DU_{tl} - 0.415h_t DU_{tl} - 0.342h_t^* DU_{tl} - 3.945qDU_{tl} \quad \ldots\ldots (24)$$

(4) Singapore-Philippine.

$$TB_t = -6.081 + 9.798DU_{tl} + 1.575y_t - 3.311y_t^* + 3.366h_t + 0.703h_t^* - 0.032q_t$$
$$- 2.216y_t DU_{tl} + 2.450y_t^* DU_{tl} - 1.717h_t DU_{tl} - 0.883h_t^* DU_{tl} - 0.348qDU_{tl} \quad \ldots\ldots (25)$$

(5) Singapore-Japan.

$$TB_t = 0.406 + 6.188DU_{tl} - 0.439y_t + 1.181y_t^* - 0.116h_t - 0.178h_t^* - 0.261q_t$$
$$+ 0.877y_t DU_{tl} - 2.350y_t^* DU_{tl} + 0.312h_t DU_{tl} + 0.662h_t^* DU_{tl} - 0.307qDU_{tl} \quad \ldots\ldots (26)$$

(6) Singapore-the US.

$$TB_t = -12.714 + 24.992DU_{tl} + 0.412y_t + 2.580y_t^* + 0.568h_t - 0.344h_t^* + 0.687q_t$$
$$- 0.501y_t DU_{tl} - 2.540y_t^* DU_{tl} - 1.748h_t DU_{tl} + 1.462h_t^* DU_{tl} - 1.298qDU_{tl} \quad \ldots. (27)$$

At Equation (22), both the intercept and the intercept at the time of regime shift are significant. With the 1% level of significance, both the coefficients of y before and at the time of regime shift are also significant. Domestic real income's (y) coefficient before the regime shift is 5.480, while change of y at the time of regime shift is -3.441. This implies that domestic income elasticity decreases after regime shift and it takes a different path. Despite the influence of y on TB declines at the time of regime shift but TB is still positively related to y, hence as a result, this is not consistent with our income effect expectation. Here, the coefficient provides evidence for the presence of import-substitution effect in the long run. On the other hand, the estimated long run coefficients of y^* and q do not contribute to the change of TB during the two regimes since their coefficients are insignificant. Although the impacts of real cash balance variables are found to be significant after the regime shift but they are wrongly signed, means that they fail to denote the real cash balance effect during the period.

According to Equation (23), income effects are present in both regimes. It can be seen from the existence of the expected negative and positive signs of y and y^*, respectively, in pre and post regime shift. Yet, we also find that y is wrongly signed after the regime shift, indicating the import-substitution effect appears in the period as well. Nevertheless, for this case, income effect is still noted by the estimation result to posses a stronger impact than the import-substitution effect in determining the change of trade balance. The real cash balance effects are confirmed in both regimes since the estimated long run coefficients of h carry the expected negative sign and are statistically significant at the 10% level of significance. The long run exchange rate effect is found to be significant only in the period before the regime shift, implies that Marshall-Lerner condition is observed in that period.

Table 17. Cointegrating equations for *C*, *C/T*, and *C/S* model

Case	Model	Regressor												
		Int.	**Trend**	y_t	y_t^*	h_t	h_t^*	q	DU_t	$y_t.\ DU_t$	$y_t^*.\ DU_t$	$h_t.\ DU_t$	$h_t^*.\ DU_t$	$q.\ DU_t$
Philip.-Sing.	*C*	18.019**		2.673**	-1.134**	-0.103	-2.916**	-1.273*	-1.139**					
	C/T	15.742**	-0.014	2.980**	-0.779	0.009	-2.942**	-1.063***	-1.347**					
	C/S	29.845**		5.480**	-1.418	-0.281	-7.606**	-0.515	-13.437***	-3.441**	0.816	0.797***	4.684**	-0.672
Philip.-Japan	*C*	-1.917		-0.352**	1.929**	-0.301**	1.018**	-0.240*	-0.674**					
	C/T	-1.873	0.004	-0.482*	1.973**	-0.316**	0.926**	-0.194	-0.646**					
	C/S	-5.871***		-0.875**	3.079**	-0.494**	-0.165	0.407*	3.667	1.467**	-2.129*	0.469***	0.247	0.110
Philip.-the US	*C*	0.985		0.070	0.405	0.095	-0.304	0.616**	-0.510**					
	C/T	-0.702	-0.008	0.227	0.741***	0.103	-0.264	0.617**	-0.425**					
	C/S	1.249		0.139***	0.433	0.050	-0.559***	0.546**	36.546***	-0.186	-4.267	-0.415	-0.342	-3.945*
Sing.-Philip.	*C*	3.683*		0.356	-1.512**	1.071*	0.302	-0.249	0.770**					
	C/T	1.212	-0.028**	-0.093	-0.073	1.296*	0.758**	-0.347	-0.526**					
	C/S	-6.081		1.575*	-3.311**	3.366**	0.703**	-0.032	9.798***	-2.216*	2.450**	-1.717	-0.883*	-0.348
Sing.-Japan	*C*	8.759**		0.260*	-0.497*	-0.670**	0.782**	-0.907**	0.309**					
	C/T	6.338**	0.017**	-0.315**	0.477*	-0.782**	0.391**	-0.577**	-0.172**					
	C/S	0.406		-0.439**	1.181**	-0.116	-0.178	-0.261**	6.188**	0.877**	-2.350**	0.312	0.662*	-0.307
Sing.-the US	*C*	4.624**		-0.210	-0.004	-0.068	0.191	0.107	0.495**					
	C/T	-12.993**	-0.021**	-0.450*	2.015**	1.197**	0.315	1.127**	-0.355**					
	C/S	-12.714**		0.412	2.580**	0.568*	-0.344	0.687	24.992**	-0.501***	-2.540**	-1.748**	1.462**	-1.298***

Notes: (1) *, ** and *** denote rejection of null hypothesis at 5%, 1% and 10% level, respectively. (2) Phil=Philippines, and Sing=Singapore.

Further, at the period before the regime shift, the estimated long run domestic real income (*y*) in Equation (24) is wrongly signed but has a significant impact on *TB*. It suggests that the import-substitution effect is present in the case, so, as Philippines income increases, imports from the US decline due to an increase in the production of substitutes for the US-made goods. The estimated long run exchange rate (*q*) carries a positive sign and is statistically significant in the pre regime shift, implies that the Marshall-Lerner condition holds in the concerned period. However, since the exchange rate coefficient before the regime shift is 0.546 and the coefficient of *q* decreases drastically become -3.945 (significant at the 5% level of significance) at the time of regime shift, hence we find *q* is no longer positively related to *TB*, thus the Marshall-Lerner condition fails to be verified for the period after the regime shift.

At the pre regime shift [see Equation (25) to (27)], the estimated long run coefficients of real income (*y* and y^*) are all (except the coefficient of *y* in Singapore-the US case) significant at the 5% level or better. The income effects presence in Equation (26) and (27). However, for Equation (25), both coefficients are wrongly signed, indicating that the import-substitution effect is observed instead of income effect. On the other hand, at the time of regime shift, the coefficients of *y* in Equation (25) and (27) provide evidence for the income effect. The variable's impact on *TB* changes during the two regimes since the income elasticity decreases drastically for Singapore-Philippine case (it declines more than 1.575, therefore when the regime shift, its value becomes negative) and the variable's coefficient turns to be significant and has an appropriate sign for Singapore-the US case.

In addition, looking at the Equation (26) at the post regime shift, we find that the existence of income effect fails to be observed. Real cash balance effect seems more dominant after the regime shift. While, the estimated long run coefficients of exchange rate (*q*) are not significant in most cases. Although they are significant, they are wrongly signed. In these last 3 equations, it can be concluded that the income effect plays a dominant role in determining the change of *TB* in which it is followed by the importance of real cash balance effect.

1.4.5.2.4 The short run relationship: in presence of a structural break

In this part, we shall do a discussion on the short run analysis. The analysis will be done by utilizing the second step of Engle-Granger (EG) method. We use the residuals from *C/S* model to estimate the short run dynamic equation for the bilateral trade balance with the error correction model (ECM). Technically, the equation of interest will be estimated with OLS in which trade balance (*TB*) is regressed on its lagged values, the lagged values of other considered variables and the one period lagged residuals from the cointegrating vector of Gregory-Hansen *C/S* model (*ECT*). The error correction model for the bilateral trade balance can be specified as (see Olivo and Miller, 2000; Chaudhuri and Rao, 2004):

$$\Delta TB_t = y + \sum_{i=1}^{k} g_{11i}\Delta TB_{t-i} + \sum_{i=1}^{k} g_{12i}\Delta y_{t-i} + \sum_{i=1}^{k} g_{13i}\Delta y^*{}_{t-i} + \sum_{i=1}^{k} g_{14i}\Delta h_{t-i} + \sum_{i=1}^{k} g_{15i}\Delta h^*{}_{t-i} + \sum_{i=1}^{k} g_{16i}\Delta q_{t-i} + rECT_{t-1} + u_t \quad \text{...} \quad (28)$$

where Δ is the difference operator, k is selected lag length, ECT_{t-1} is the one period lagged of error correction term, and u_t is white noise disturbance term. From Equation (28), the short run dynamics is provided by the lagged values of the difference terms, while the short run deviations of series from their long run equilibrium path is denoted by the error correction term (*ECT*). In determining the lag length, we start with a maximum of six lags and use AIC as a criteria to select the appropriate numbers of lags. For the relationship between *TB* and other variables of interest, the AIC favor the ECM with four lags in all Philippines' cases (Philippines-Singapore, Philippines-Japan, Philippines-the US, and Singapore-Philippines), then with five lags in Singapore-Japan case, and with six lags in Singapore-the US case.

Considering that each regressand in Table 18, is cast in first different, the empirical results suggest that the statistical fit of each model to the data is satisfactory, as indicated by the values of R^2, which range from a low of 0.382 to a high of 0.698. In addition, the F-test in each case is statistically significant, indicates that we have an explanation of bilateral trade adjustment. Also, each estimated model fulfills the conditions of serial noncorrelation, and homoskedasticity.

Having provided evidence, we can make the following observations regarding the obtained estimates: First, the error correction term's coefficient is statistically significant in each of the six cases and carries the expected negative sign. These findings reinforce the validity of an equilibrium relationship among the variables in each cointegrating equation. Bilateral trade balances should raise over time toward their long run equilibrium levels. From Table 18, the coefficients suggest a quite rapid speed of adjustment, in which 33% to nearly 78% of the disequilibrium is eliminated in one quarter.

Table 18. Short run relationship of the variables and the speed of adjustment coefficients: Regression results for ECM

Variable	Case and coefficients[1]					
	Phil-Sing	**Phil-Japan**	**Phil-the US**	**Sing-Phil**	**Sing-Japan**	**Sing-the US**
$\Delta TB_{(t-1)}$	0.119	-0.013	-0.186	0.131	-0.010	-0.149
	(0.89)	(-0.11)	(-1.23)	(0.82)	(-0.06)	(-0.87)
$\Delta TB_{(t-2)}$	0.164	0.169	-0.206	0.110	0.132	0.044
	(1.40)	(1.35)	(-1.41)	(0.80)	(0.92)	(0.32)
$\Delta TB_{(t-3)}$	0.181	0.041	-0.040	0.227***	-0.018	-0.060
	(1.58)	(0.33)	(-0.32)	(1.88)	(-0.14)	(-0.49)
$\Delta TB_{(t-4)}$	0.057	0.071	0.068	-0.144	-0.121	0.038
	(0.52)	(0.63)	(0.64)	(-1.33)	(-1.04)	(0.34)
$\Delta TB_{(t-5)}$	-	-	-	-	0.003	0.075
					(0.03)	(0.67)
$\Delta TB_{(t-6)}$	-	-	-	-	-	0.015
						(0.16)
$\Delta y_{(t-1)}$	0.302	0.199	0.086	1.027***	-0.137	0.278
	(0.50)	(0.87)	(0.41)	(1.80)	(-0.61)	(1.22)
$\Delta y_{(t-2)}$	0.517	0.266	-0.445*	0.092	-0.363	-0.189
	(0.86)	(1.12)	(-2.04)	(0.18)	(-1.60)	(-0.83)
$\Delta y_{(t-3)}$	-0.001	0.066	-0.052	0.345	-0.073	-0.331
	(-0.00)	(0.26)	(-0.23)	(0.62)	(-0.33)	(-1.47)
$\Delta y_{(t-4)}$	-0.115	0.260	0.143	-0.836	0.349	0.282
	(-0.19)	(1.09)	(0.64)	(-1.42)	(1.56)	(1.15)

Table 18. (Continued)

Variable	Case and coefficients[1]					
	Phil-Sing	**Phil-Japan**	**Phil-the US**	**Sing-Phil**	**Sing-Japan**	**Sing-the US**
$\Delta y_{(t-5)}$	-	-	-	-	0.225 (0.96)	-0.370 (-1.52)
$\Delta y_{(t-6)}$	-	-	-	-	-	-0.512^{*} (-2.03)
$\Delta y^{*}_{(t-1)}$	-0.539 (-0.77)	0.370 (0.52)	-0.100 (-0.07)	-0.440 (-0.90)	1.771^{**} (2.92)	1.101 (1.06)
$\Delta y^{*}_{(t-2)}$	0.024 (0.04)	0.289 (0.43)	2.237 (1.65)	0.251 (0.51)	-0.378 (-0.66)	1.713 (1.56)
$\Delta y^{*}_{(t-3)}$	-0.497 (-0.71)	-0.765 (-1.14)	-0.398 (-0.31)	0.046 (0.09)	-0.918^{***} (-1.70)	-2.071^{***} (-1.93)
$\Delta y^{*}_{(t-4)}$	0.331 (0.46)	0.841 (1.18)	0.953 (0.86)	-0.631 (-1.35)	-0.079 (-0.14)	0.187 (0.19)
$\Delta y^{*}_{(t-5)}$	-	-	-	-	0.108 (0.21)	-0.132 (-0.13)
$\Delta y^{*}_{(t-6)}$	-	-	-	-	-	-1.680^{***} (-1.76)
$\Delta h_{(t-1)}$	0.221 (0.78)	0.128 (1.04)	0.034 (0.03)	0.426 (0.57)	0.052 (0.20)	0.456 (1.63)
$\Delta h_{(t-2)}$	0.426 (1.40)	0.213 (1.62)	0.012 (0.11)	0.447 (0.64)	-0.353 (-1.19)	0.302 (1.01)
$\Delta h_{(t-3)}$	-0.170 (-0.55)	-0.024 (-0.19)	-0.029 (-0.26)	0.481 (0.70)	-0.660^{*} (-2.24)	0.049 (0.17)
$\Delta h_{(t-4)}$	-0.203 (-0.70)	-0.117 (-1.07)	0.002 (0.02)	-0.235 (-0.37)	-0.150 (-0.51)	0.459 (1.58)
$\Delta h_{(t-5)}$	-	-	-	-	-0.365 (-1.41)	0.248 (0.92)
$\Delta h_{(t-6)}$	-	-	-	-	-	0.194 (0.70)
$\Delta h^{*}_{(t-1)}$	0.336 (0.35)	0.176 (0.80)	-0.378 (-0.83)	-0.665^{**} (-2.68)	-0.200 (-1.06)	-0.080 (-0.17)
$\Delta h^{*}_{(t-2)}$	-0.101 (-0.11)	0.189 (0.84)	-0.561 (-1.17)	-0.333 (-1.34)	-0.083 (-0.48)	-0.602 (-1.41)
$\Delta h^{*}_{(t-3)}$	-0.270 (-0.31)	0.192 (0.89)	0.532 (1.06)	0.077 (0.31)	-0.102 (-0.62)	0.323 (0.81)
$\Delta h^{*}_{(t-4)}$	-0.017 (-0.02)	0.448^{*} (2.02)	0.928^{***} (1.93)	0.391 (1.65)	-0.127 (-0.70)	0.363 (0.91)
$\Delta ?h^{*}_{(t-5)}$	-	-	-	-	0.240 (1.32)	0.059 (0.14)
$\Delta h^{*}_{(t-6)}$	-	-	-	-	-	0.788^{*} (2.03)

Table 18. (Continued)

Variable	Case and coefficients (1)					
	Phil-Sing	**Phil-Japan**	**Phil-the US**	**Sing-Phil**	**Sing-Japan**	**Sing-the US**
$\Delta q_{(t-1)}$	1.382	0.142	-0.042	0.559	-0.208	1.042*
	(1.54)	(0.67)	(-0.13)	(0.81)	(-0.86)	(2.17)
$\Delta q_{(t-2)}$	-0.923	-0.267	-0.010	-0.558	-0.261	0.407
	(-1.03)	(-1.20)	(-0.03)	(-0.79)	(-1.09)	(0.91)
$\Delta q_{(t-3)}$	1.887*	0.180	0.043	0.987	-0.183	0.854***
	(2.10)	(0.82)	(0.12)	(1.39)	(-0.78)	(1.93)
$\Delta q_{(t-4)}$	0.616	-0.113	0.066	0.856	0.207	-0.292
	(0.65)	(-0.53)	(0.20)	(1.14)	(0.86)	(-0.64)
$\Delta q_{(t-5)}$	-	-	-	-	0.049	0.115
					(0.21)	(0.24)
$\Delta q_{(t-6)}$	-	-	-	-	-	0.248
						(0.53)
Const.	-0.022	-0.038***	-0.013	0.002	0.029***	-0.012
	(-0.42)	(-1.85)	(-0.61)	(0.04)	(1.69)	(-0.54)
ECT	-0.562**	-0.370**	-0.331*	-0.752**	-0.697**	-0.776**
	(-4.04)	(-3.18)	(-2.34)	(-4.10)	(-3.94)	(-3.73)
Diagnostics:						
R^2	0.382	0.3925	0.497	0.528	0.618	0.698
F	1.97	2.07	3.16	3.58	3.81	4.12
[*d.f*]	[25, 80]	[25, 80]	[25, 80]	[25, 80]	[31, 73]	[37, 66]
DW	1.902	2.116	2.005	2.005	2.003	2.131
LM						
c^2 (6)	35.601	46.878	30.497	43.134	35.658	29.508
p-value	0.487	0.106	0.727	0.193	0.485	0.769
HET						
c^2 (1)	3.79	0.09	0.42	1.41	0.98	2.12
p-value	0.052	0.768	0.517	0.235	0.322	0.145

Notes: (1) Dependent variable is real bilateral trade balance (ΔTB_t). (2) *ECT* reflects the speed of adjustment coefficients. (3) The *t*-statistics are reported in the parenthesis. (4) *, ** and *** denote rejection of null hypothesis at 5%, 1%, and 10% level, respectively. (5) Phil=Philippines, and Sing=Singapore. (6) [*d.f.*] denotes the degree of freedom. (7) DW tests first-order residual autocorrelation. (8) LM denotes Lagrange-multiplier test for autocorrelation in the residuals of models with H_0: no autocorrelation at lag order. (9). HET is the Breusch-Pagan test for heteroskedasticity with H_0: homoskedasticity.

Second, we verify the existence of real income effect in minor cases. A similar condition also prevails for the import-substitution effect; however as can be seen, its impact seems a bit bigger than the income effect. Third, real cash balance (h and h^*) make a rather relatively more discernible contribution towards the improvement in trade balance than the real income (y and y^*) and the exchange rate (q). Four, only in the case of Singapore-the US, we find the coefficients of q are significant. These coefficients have a positive sign, implies that the exchange rate effect is observed. In general, when a structural break is considered, our findings provide lack of evidence for a J-curve phenomenon since the estimated short run coefficients of the exchange rate never carry the predicted significant negative sign.

1.5 Summary of main empirical findings

This section summarizes the main findings of our analysis which technically utilizes some different methods. In general, the use of the methods is separated based on the issue of the existence of a structural break. When our analysis omits the structural break, we investigate the dynamics of bilateral trade balance by using VECM and OLS method. Then, when the analysis allows for a structural break, we apply the Chow test and VECM (for the structural break case with a known break point), and Zivot-Andrews test, Gregory-Hansen test, and two steps Engle-Granger ECM method (for the structural break case with an unknown break point).

In the case of a structural break is omitted, by using VECM, we remark that for the long run: (i) the income effect is found to be the most dominant effect which determines the change in trade balance; (ii) the cash balance and exchange rate effect contribute in determining the trade balance but they seem play a minor role. Meanwhile, for the short run: (i) because of the effect significantly appears in relatively more bilateral cases with more appropriate sign on the variables, the cash balance effect is found to be dominant in the short run analysis; (ii) income effect only plays a less influential role, even if is compared to the import-substitution effect. In this type of analysis, trade balance tends to be more sensitive to the cash balance effect than the income effect; (iii) the exchange rate effects are present in more cases (compared to the long run); (iv) the evidence of J-curve phenomenon is provided, although it is found only in one bilateral case, namely Indonesia-Singapore. On the other hand, employing OLS method for the other bilateral cases in the short run, we find that: (i) analogous to the VECM long run results, the income effect is defined to be the most influential factor which determines the trade balance; (ii) the cash balance and exchange rate effect are exist.

Depending only on the interpretations of variable's significance, sign, and magnitude when applying VECM sometimes are problematic. Many studies which use VECM as a method usually also include other non slope interpretation techniques, such as impulse response functions (IRF) and variance decompositions for prediction purposes (Stock and Watson, 2001). Both techniques are useful for complementing the VECM's slope interpretation, in which the impulse response functions reveals the effect of a one standard deviation change in the current explanatory variables on the current and future values of the dependent variable, while variance decompositions provide information on the percentage of variation in the forecast error of a variable which is explained by its own and other variables innovations.

Our IRF's findings mostly reinforce our VECM long run and short run findings. Using variance decomposition analysis and considering only the explanatory variables' innovations, we find that the most meaningful innovations which affect the variation of trade balance are the innovation of exchange rate (q). Although, the results show that the effect of real income and real cash balance are relatively smaller, but they still important in explaining the performance of trade balance.

In the case when a structural break is allowed, we introduce two types of structural break analysis, *i.e.* structural break analysis with a known break point and structural break analysis with an unknown break point. For the former, we pick a break point subjectively based on the most remarkable event in the ASEAN region, namely financial crisis at the third quarter of 1997 and for the latter we apply a technique which accommodates a structural break without predetermining the break point.

The Chow test is considered in the analysis of structural break with a known break point. Through this test, we want to confirm about the presence of structural break in each bilateral case. When a bilateral case provides evidence for a structural break, we apply

VECM and all its procedures on that case for both periods, period before the crisis and period after the crisis. As shown by the results, we find that there is no evidence for any cointegrational relationship among the variables for all bilateral cases after the period of crisis. Consequently, for this type of structural break analysis, we just consider the use of VECM in the period before the crisis. Regarding the long run findings of the period, our reported results present that: (i) the income effects seem play a major role in determining the trade balance, while small evidence is provided for the import-substitution effect. This fact corroborates our previous findings in VECM (long run) which neglects the structural break; (ii) the cash balance effects play the most minor role in influencing the trade balance since the effect is present in relatively less bilateral cases. This also strengthens our previous results; (iii) compared to our previous findings in full sample model which neglects the structural break, the pre-crisis findings display a better portrait in explaining the exchange rate effect. The condition brings us to a suspicion towards the possibility of the significant impact of financial crisis in blurring of the true relationship between real exchange rate and trade balance.

For the short run relationship, we highlight some points, *i.e.*: (i) in contrast to our previous short run finding (full sample) which indicate income effect only plays a minor role in determining the trade balance; our short run findings for pre-crisis period display a relatively much better magnitude of the income effect in the trade balance equation. It is clearly discernible that the magnitude of income effect is more robust than the cash balance or import-substitution effect. These analyses simultaneously admit a significant role of income effect which exceeds the cash balance and import-substitution effect in determining the trade balance; (ii) as far as J-curve phenomenon are concerned, the bilateral case of Indonesia-Japan and Philippines-the US provide evidence for the presence of a J-curve since their exchange rate coefficient's sign changes from negative in the short run to positive in the long run. Previously, we verify the J-curve phenomenon as well, but in this case, the phenomenon seems become more discernible.

Looking at the findings of the long run analysis of structural break with an unknown break point, we find that: (i) income effects are relatively dominant in influencing the change of trade balance at both regimes, pre and post regime shift; (ii) cash balance effects are present at both regimes in which the effect seems become more discernible at the period after the regime shift; (iii) compared to other effects, the contribution of exchange rate effects to the change in trade balance are relatively low. The effect appears at the pre regime shift, but it is absent at the post regime shift. So, this paper does not suggest the Marshall-Lerner condition for the region at the period after the crisis.

Further, in considering the short run analysis of structural break with an unknown break point, our results suggest that: (i) unlike the long run analysis before, the most dominant effect in this analysis is cash balance effect; (ii) with slightly less difference in contribution (compared to the cash balance effect), the income effect is present in the short run as well; (iii) the exchange rate shows a significant impact to the improvement of trade balance in the case of Singapore-the US. Despite that is just a minor fact but it still imply the existence of exchange rate effect; (iv) there is lack of evidence for a J-curve phenomenon in the region since none of the estimated short run coefficients of the exchange rate carry the predicted significant negative sign.

1.6 Conclusion

The objective of this paper is to analyze the dynamics of bilateral trade balance in ASEAN region. In order to realize the objective, we investigate the role of exchange rate, income and cash balance on the change of trade balance. Our analysis includes the bilateral trade cases among selected ASEAN countries (Indonesia, Malaysia, Singapore, Thailand, and Philippines) and between those ASEAN countries and their major trading partners, *i.e.* the US and Japan. In the investigation of the effects of all considered variables on the bilateral trade balance, a vector error correction model (VECM) is specified. Besides that, the impulse response functions as well as the variance decompositions are employed to complement the dynamic perspective of VECM. In order to expand its analysis, this paper also investigates the short run relationship between bilateral trade balance and its regressors by using OLS for other bilateral cases which are excluded from the execution of VECM.

Motivated by the interest for knowing whether the standard conclusions are sensitive to the inclusion of a structural break; this study considers in using some additional methods which can accommodate the existence of structural break in the analysis. To test for a structural break, the tests are classified under the categories of structural break test with a known break point and structural break test with an unknown break point. Based on the results of these tests, further analyses which are related to the dynamics of bilateral trade under the inclusion of a structural break will be carried out.

In accordance with the structural break test with a known break point, we simply choose Asian financial crisis event which occurs at the third quarter of 1997 as a reasonable break point. The Chow test and VECM method are applied in this analysis. Meanwhile, for the structural break test with an unknown break point, instead of using technique which involves prejudging the break point, we employ a technique which accommodates a structural break without predetermining the break point. Hence, Zivot and Andrews (1992) unit root test, Gregory and Hansen (1996) cointegration test, and two step Engle-Granger method are performed in the analysis.

Based on the results obtained, this paper suggests some interesting points. In the long run, income effect is found to be dominant in determining the change in trade balance. The facts consistently appear in all type of analysis; either omitting or allowing for a structural break. The cash balance and exchange rate affect the bilateral trade, although their roles are relatively lower than income effect. When a structural break is taken into account, we find no evidence for the existence of exchange rate effect in the post regime shift. In other words, exchange rate effect significantly plays a role only in the period before the regime shift. The structural break is shown to carry a significant impact in removing the positive long run effect of exchange rate on trade balance. This condition may be attributed to a small economy effect, where usually a small economy inclines to use foreign currency in trading, avoiding the uncertainty of their domestic currency fluctuation.

As a group of small open economies, mostly foreign trades (exports and imports) of ASEAN countries are invoiced in foreign currency. Consequently, the effect of real depreciation is hedged and the trade balance remains unaffected. The small economy effect seems stronger in the post regime shift since we find no evidence for the exchange rate effect in the period. In addition, compared to our findings in full sample model which neglects a structural break, the findings of the pre-crisis period seem to exhibit a better portrait in explaining the exchange rate effect. This circumstance strengthens our suspicion towards the possibility of the significant impact of financial crisis in blurring of the true relationship between real exchange rate and trade balance.

For the short run, the cash balance effect relatively plays a major role in influencing the improvement of trade balance in the condition of omitting and allowing for a structural break. The exchange rate effect is observed in both type of analysis as well. The effect is more discernible when a structural break is omitted, while J-curve phenomenon is verified in minor cases. However, when a structural break is allowed, we provide lack of evidence for the presence of J-curve phenomenon. Finally, exchange rate effect seems sensitive to the presence of a structural break, while income and cash balance effects are found to be relatively less sensitive to the structural break.

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Chapter 2

Technical Efficiency and Export Performance in Indonesian Manufacturing: Evidence from Sector-Level Data

2.1 Introduction

There are two aims of this paper: first, examining the technical efficiency of Indonesian manufacturing industries using data envelopment analysis (DEA) and a stochastic production frontier (SPF) and comparing the performance of the two techniques in predicting technical efficiency; second, analyzing empirically the determinants of the export performance of Indonesian manufacturing industries, in particular, we would try to investigate whether better performers within Indonesian manufacturing industry tend to export more.

In economics literature, the performance of an economic unit is connected closely to the concept of economic efficiency. This concept divides the efficiency definition into two components, namely technical efficiency and allocative efficiency (Forsund and Sarafoglou, 2000). According to Kalirajan and Shand (1999), technical efficiency is defined as the capacity and willingness of an economic unit to produce the maximum possible output from a given set of inputs and a technology, while allocative efficiency is known as the ability and willingness of an economic unit to equate its specific marginal value product with its marginal cost.

The locus of technically efficient input-output combinations is exhibited by the points on the potential production frontier (Pitt and Lee, 1981). Technical inefficiency appears when actual output generated by a given set of mix input is less than the maximum possible (Fan, 1999). There are two approaches to estimating technical efficiency, non-parametric and parametric. Data envelopment analysis (DEA) is a non-parametric approach which is based on a linear programming technique, while the stochastic production frontier (SPF) is a parametric approach which uses a parametric function. Some important characteristics among two of them often introduced by the literature, such as, the strength of the SPF which includes the stochastic noise into the model, and the advantage of the DEA which is able to accommodate multiple output and does not impose explicit functional form on the data.

Given the different characteristics of the two approaches, then it is interesting to compare the empirical performance of those two approaches using the same data set. To tackle that objective, we employ the DEA approach proposed by Charnes, Chooper, and Rhodes (CCR) which assumes the production function is operated in constant return to scale (CRS) and SPF approach which is based on the work of Battese and Coelli (1992) and Battese and Coelli (1995).

Another prominent issue which is related to manufacturing industry is the export activities. Exporting can accommodate firm's interests in expansion. Through exporting, firm can create a link with the world economy and enlarge their markets, also take benefit from economies of scale and technology transfer (Pack, 1993; Girma *et al.*, 2004). In this regard, exporting becomes a firm's rational choice, besides establishing subsidiaries in the host country. Export success also leads to a significant impact for attracting higher quantity and quality of FDI into the country and thus can generate additional growth impetus.

If we recall the general concept of export activity, there are two things which should be considered on it, namely the external demand conditions, and the supply response in terms of establishing, and maintaining competitiveness in the external markets (Bhavani and Tendulkar, 2001). With respect to the former, the study of Nurkse (in Love, 1984) in 1959 has emphasized the significance influence of external demand on LDCs exports.

Nurkse finds the external demand for LDCs exports are unfavorable by historical standards. Both LDCs' commodities, *i.e.* traditional primary products and light manufacturing goods are commonly found facing several classic problems in the trade market, such as low price, low income elasticity of demand, and the growth of output in developed country markets for the former, and the difficulties of reaching a minimum level of efficiency, and adverse developed country commercial policies for the latter.

Later, Nurkse's argument is challenged by the study of Kravis (1970). Arguing that the external demand is actually not the matter of the case, Kravis provides evidence for slight growth rates of primary product trade relative to the past. Despite the results are seemingly not too robust, but still it cannot be said that the developed countries have failed to provide growing markets for primary products. He argues that the stagnation of LCDs' export is primarily triggered by the internal supply constraints rather than external demand conditions. Obviously, export success depends on domestic rather than external factors. In manufacturing sectors, Panoutsopoulos (in Bhavani and Tendulkar, 2001) through his study during 1970-1987 reinforces the thought of Kravis where he notes that "although the growth rate of apparent consumption in volume terms in the major industrial nations was low, the percentage share of imports –especially from the developing countries- still increased over time given the tendency of relocation of the corresponding manufacturing industries away from the developed countries, where labor costs had been rising". In short, in line with Kravis' argument, Panoutsopoulos believes that external demand for manufacturing commodities, although not increasing very fast; actually it does not represent a pivotal constraint for developing countries manufacturing export.

Hitherto, there has been a growing body of empirical research focusing on the investigation of the link between internal supply factors and the ability to compete of industry or firm in the export market. It is not so surprising, given the importance of internal supply factors and export performance in the country's development process. Usually, internal supply factors are defined into various specific factors of industry or firm, such as efficiency, product differentiation, size, and technology. Therefore, they are also often translated as firm-industry specifics or firm-industry characteristics.

According to studies which have been established, the discussion of internal supply factors can be classified into two main conceptual approaches (Wakelin, 1998). They are: (i) 'neo-endowment' approach which considers the importance of factor endowments in determining firms or industries' potential competitiveness, and (ii) 'technology-based' approach which believes in the potential competitiveness is originated from the quality of firms' products or services.

Neo-endowment idea describes about the factor-based advantages, such as labor and capital. Those advantages are pointed out to contribute some significant gains to the industry if the industry has either a natural monopoly of these factors or is located in a particular region where a factor is abundant. Some common determinants of export performance which are usually incorporated in this kind of approach are capital intensity, human capital intensity, and firm size. At least there are four studies which have explored the influence of what one may argue as extra-endowment factors. The study by Berry (in Aw and Hwang, 1995) shows that exports of manufactured goods is inclined to emanate from relatively large firm. In addition, Sterlacchini (1999) makes a conclusion about the positive relationship between the firms' capital stock and the export propensity of Italian firms. Furthermore, Bleaney and Wakelin (1999) who examine the influence of firm-industry characteristics on export performance in UK emphasize that firms with higher average wages, lower unit labor costs, and higher capital intensity tend to have higher exports. They also found a positive relationship between the size of the firm and the propensity to export. Reinforcing those findings, Roper and Love (2001) also point out the importance for being part of multi-plant group which has higher export propensity instead becomes a part of single-plant business in the UK.

On the other hand, technology-based approach emphasizes its definition on the great significance of technology and knowledge deepening. Specifically, it highlights the industry's achievements and investments in new technology implementation or new innovation process which is related to new products or services establishment. Many empirical studies have supported this approach through providing evidence for a positive relationship between technology or innovation process and export performance. Using comparable plant-level surveys in UK and Germany, Roper and Love (2001) report the scale of plants' innovation activity is positively related to export probability and export propensity for both countries. However, there is evidence that the nature of this relation varies between two countries. In UK, both factors (i.e. being a product innovator, and the volume and success of plants' innovation activities) are positively related to the probability and propensity to export. While in Germany, only being a product innovator factor has a positive impact on plants' export probability and propensity, otherwise the scale of plants' R&D and innovation activities show a negative effect on export probability. Still working in Germany firms' data, Lachenmaier and Wobmann (2004) investigate how innovation during the preceding year affects the export share at the end of that year. Their results support the prediction, in which innovation is a driving force for industrialized countries exports. Furthermore, Kumar and Pradhan (2003) observe some determinants of export competitiveness in Indian manufacturing firms. In this study, they discover the critical role of firm's own innovative activities (expressed by R&D intensity) in fostering the export competitiveness. The condition is more discernible, particularly in high technology and medium technology industries. Then, for Sweden manufacturing firms, both R&D expenditures and investment in skilled labor have a positive impact on export intensity. The impact seems better for firms which join together in the multi-firm groups since the access to parent group allows firm to enjoy a possibility for learning new technology and product innovation (Braunerhjelm, 1996).

However, since export success not only depends on what input country has domestically abundant, but also depends on what input country is able to defray cheaper -lower per unit costs, hence the notion of efficiency is supposed to be considered by this paper as well. Available studies provide some valuable insights into the pivotal role of efficiency, where they introduce a fact that only firms with higher efficiency will therefore be possible exporters, and be able to survive in the highly competitive export market. International market will only favor the more efficient firms since mostly firms are always forced to produce a cheaper high quality product. Hence, for firms which have a relatively less efficiency level will incline to be forced by the mechanism to exit from the market (Clerides *et al*., 1998; Bernard and Jensen, 1999; Delgado *et al*., 2002). In order to analyze the determinants of the export performance of Indonesian manufacturing industries, we utilize a panel analytical model. The main data are drawn from the UNIDO (1990-2001).

The rest of the paper is structured as follows. Section 2 summarizes the empirical methodology which is used in the study and reviews some descriptive analyses. Section 3 explains the empirical results. Finally, section 4 will draw the conclusions of the study.

2.2 Empirical methodology and descriptions

2.2.1 Technical efficiency measurement using DEA

DEA determines the relative technical efficiency of an economic unit as the ratio between total weighted output and total weighted input. An optimization model is run for each economic unit to find the weights which will accord it the best possible efficiency rating such that the same weights satisfy a set of normalization constraints for the entire group of observed units. The constant return to scale (CRS) output-oriented DEA model for each economic unit is given by (Cooper *et al*.,2000):

(LP_o) *max*

$$q = u_1 y_{1o} + ... + u_s y_{so}$$

s.t.

$$v_1 x_{1o} + ... + v_m x_{mo} = 1$$

$$u_1 y_{1j} + ... + u_s y_{sj} \le v_1 x_{1j} + ... + v_m x_{mj}$$

$$(j = 1, 2, \ldots, n)$$

$$v_1, v_2, ..., v_m \ge 0$$

$$u_1, u_2, ..., u_s \ge 0$$

where: $Unit_o$=observed manufacturing industry, $Unit_j$=other industries in manufacturing industry, n=number of manufacturing industries which are assessed in the analysis, m=number of inputs employed by the industry, s=number of outputs produced by the industry, X_{1j}=input 1 which is employed by industry j, Y_{1j}=output 1 which produced by industry j, v_1=the weight of input 1, v_m=the weight of input m, u_1=the weight of output 1, u_s=the weight of output s, X_{1o}=input 1 which employed by observed industry, Y_{1o}=output 1 which is produced by observed industry, q=the optimized value which shows the manufacturing industry's technical efficiency level.

The model refers to method proposed by Charnes, Chooper, and Rhodes –CCR- (1978) which assumes the production function is operated in constant return to scale (CRS) condition. Following Farrell's (1957) idea in measure orientation, this study will utilize the output-oriented measure where its focus is consistently only on the proportional maximal movement of the economic unit in augmenting its outputs with a given set of inputs. In short, the term of output-oriented technical efficiency measure can be translated as "by how much can output quantities be proportionally augmented without changing the input quantities employed?" (Coelli, 1996).

Regarding the efficiency calculation process, we utilize single output variable, namely *output value* (Y_1) of Indonesian manufacturing industries, and two input variables, namely *the number of employees* (X_1), and *the capital stock* (X_2). DEAP 2.1 computer program from CEPA written in Fortran (Lahey F77LEM/32) is utilized to operate the linear programming. The scale of relative technical efficiency lies on 0 to 1. The best unit or the most efficient unit will be scored as 1 or 100% and otherwise, a unit will be defined as inefficient if its score is less than 1. The difference in scores gives an idea of the scope of plausible improvement.

2.2.2 Technical efficiency measurement using SPF

The stochastic production frontier (SPF) is a parametric approach which is developed by Aigner *et al*. (1977). Unlike DEA, SPF accounts for random factors (such as strikes, natural disasters, war, luck etc.). The production frontier in DEA is deterministic; therefore any deviations from the potential production frontier are related to inefficiency. In an SPF, the production frontier function is sensitive to the random shocks since a random error term is included to the production frontier. Contrary to DEA, deviation from the potential production frontier in SPF might not be entirely under the control of the economic unit (firm or industry). SPF model allows for the influence random factors which may increase inefficiency (Bigsten *et al.*, 1999). However, only deviations caused by controllable factors can be attributed to inefficiency (Coelli *et al.*, 1998).

The SPF model used in this study is based on the Battese and Coelli (1992) and Battese and Coelli (1995) approaches. Basically, both of them use a similar general stochastic production frontier model as given by Equation (1). However, the difference is the latter incorporates a model for technical inefficiency effects in a SPF.

$$\ln y_{it} = f(x_{it}; b) + v_{it} - u_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where y_{it} denotes the output of the i-th sample industry in the t-th year of observation; x_{it} is a (1 x k) vector of functions of input quantities –labor and capital stock (in natural logarithm)- used by the i-th industry in the t-th year of observation; b is a (k x 1) vector of parameters to be estimated; v_{it} refers to independent identically distributed random variables $N(0, s_v^2)$ which measure errors and random shocks (such as natural disasters, strike, and unpredicted variation in inputs) and independent of the u_{it}; finally, u_{it} is non-negative random variable which is attributed to technical inefficiency in production. Implying the fact that output must lie on or below the frontier, u_{it} follows one sided distribution.

Our first SPF model (hereafter SPF1) follows Battese and Coelli (1992) approach where u_{it} is assumed to be *i.i.d* as truncations at zero of the normal distribution with mean, m, and variance, s_u^2, which are permitted to vary systematically with time. While, as suggested by the work of Battese and Coelli (1995), in the second SPF model (hereafter

SPF2), we assume u_{it} to be independently distributed and truncated (at zero) normally with variance s_u^2, and the mean $m_{it} = dZ_{it}$, where m_{it} stands for a linear combination of the inefficiency variable. In both models, the disturbances v_{it} and u_{it} capture the deviations of the production frontier. Further, the inefficiency model follows a form which can be specified as:

$$u_{it} = d_0 + dZ_{it} + w_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where d denotes the vector of parameter; Z_{it} is a vector of the determinants of the efficiency level, and w_{it} is the error term. After doing parameterization on the variance terms by replacing s_v^2 and s_u^2 with $s_v^2 + s_u^2 = s^2$ and $s_u^2 / (s_v^2 + s_u^2) = g$, the technical efficiency of the i-th sample industry in the t-th year of observation, denoted by TE_{it}, can be defined as (Battese and Coelli, 1993; Coelli *et al*., 1998):

$$TE_{it} = \exp(-u_{it}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

As a result, we can calculate the frontier production for the i-th industry in the t-th year of observation by defining a ratio between actual production and the technical efficiency estimate (Sharma *et al*., 1997). For estimating the frontier efficiency model, as shown by Equation (1), and the inefficiency model, as presented by Equation (2), this study will employ the maximum-likelihood method as suggested in Battese and Coelli (1992, 1995).

However, a significant difference has to be taken into consideration concerning all considered efficiency models above. That is, the DEA approach is proposed for cross-sectional data, whereas the SPF is proposed for the analysis of panel data[13]. Hence, in order to accommodate and address the objective of the paper in a proper way, we also consider the calculation of technical efficiency scores using a cross-sectional Battese and Coelli (1995) model (herewith SPF2A). The SPF2A model has the same characteristic as

[13] Panel data have substantial differences compared to cross-sectional data. In this context, panel data allow for the simultaneous investigation of technical change and technical efficiency change over time (Coelli, *et al*, 1998).

the SPF2 model, except for the definition of data which are used (*i.e.* cross-sectional). The stochastic frontier production function for SPF2A model can be defined as:

$$\ln y_i = f(x_i; b) + v_i - u_i \quad \ldots\ldots (4)$$

and the technical inefficiency effects are defined by:

$$u_i = d_0 + dZ_i + w_i \quad \ldots\ldots (5)$$

where y_i denotes the output of the *i*-th sample industry (i=1, 2, …., *n*); x_i is a (1 x *k*) vector of functions of input quantities –labor and capital stock (in natural logarithm)- used by the *i*-th industry; b is a (*k* x 1) vector of parameters to be estimated; v_i is the random error which are assumed to be *i.i.d*; and u_i is non-negative random variable which is attributed to technical inefficiency in production.

To tackle all those three SPF model estimation processes, we use a special computer program for stochastic frontier called FRONTIER 4.1, which is developed by Coelli (1996). FRONTIER 4.1 is a program which accommodates the estimation of maximum-likelihood model using a three-step procedure in obtaining the maximum-likelihood estimates of the parameters of a stochastic frontier production function.

With respect to the technical efficiency calculation; in the frontier efficiency model, we define the natural logarithm of *output value* of Indonesian manufacturing industries (Y_1) as the dependent variable, and natural logarithm of the *number of employees* (X_1), and natural logarithm of the *capital stock* (X_2) as the explanatory variables, respectively. While for the inefficiency model, two explanatory variables are considered, namely the natural logarithm of *value added* (Z_1) which is used as a proxy for size, and *year* (Z_2) which describes the year of observation.

2.2.3 Export determinants: model specification and variables

Analysis of the determinants of industries' exports performance will be described in term of internal domestic supply factors or industry characteristics. Our export function will be estimated by panel analytic model, which allow us to capture both at the same time, the relevant relationship among variables over time and the unobserved (unit of observation) individual effects of the model. There are three types of panel analytic models, namely the constant coefficients model or standard pooled regression model, the fixed effects model (FEM), and the random effects model (REM). The first model is appropriate if we certain on the existence of constant coefficients referring to both intercepts and slopes on the model. FEM would be a better choice when we are interested in estimating specific case between an ex ante predetermined selection of groups, while REM may be more powerful if we are willing to estimate a typical case among a randomly drawn sample of groups from a larger population (Egger, 2000).

Since our samples involve the typical data among Indonesian manufacturing industries, it seems that the most appropriate model for the case is FEM. However, to make sure such a priori point of view is correct in the statistical sense and in order to find the best panel analytic model for our analysis, we also carefully perform some specific tests. First, we perform *F*-test to decide whether to use constant coefficients model or FEM. Second, we use LM (Breusch-Pagan) test to decide between constant coefficients model and REM. Third, we apply the Hausman specification test for selecting whether FEM or REM should be used.

Technically, the export performance function for Indonesian manufacturing industries can be specified as:

$$EI_{it} = f(CAP_{it}, SIZE_{it}, DIV_{it}, TE_{it},) \quad (6)$$

where EI_{it} is real value of export intensity (ratio of exports to output) taken to represent the export performance for industry *i* in Indonesian manufacturing industry at time *t*;

CAP_{it} is the capital intensity of Indonesian manufacturing industries which is captured by the capital to labor ratio; $SIZE_{it}$ denotes a proxy for scale economies (measured by the number of labors); DIV_{it} is export diversification, which is measured by the Gini-Hirschman coefficient following Osuntogun *et al*. (1997):

$$DIV_{it} = \sqrt{\sum_{i=1}^{m} \left(XP_{it} / \sum_{i=1}^{m} XP_{it} \right)^2}$$

where XP_{it} is export value of given manufacturing industry or manufacturing commodity at time t and m is the number of manufacturing industries which produce different export commodities. *DIV* is an indirect measure of diversification, or a direct measure of concentration. The index is based on the ratio of the value of each exported commodity produced by each industry to total manufacturing exports, in which its value is ranged from zero to one. *DIV* gives the highest value of 1 if total exports are comprised of only one commodity. When a country has diversified its export, or number of manufacturing industries with export activity (m) increases, the *DIV* index will take a smaller value and tend to zero; and TE_{it} is level of technical efficiency for industry i in Indonesian manufacturing industry at time t.

The coefficients of *CAP*, *SIZE* and *TE* are expected to be positive, while, *DIV* is expected to be negative. Due to *DIV* reflects an inverse measure of diversification, as the consequence, its sign is considered to be negative, showing an idea that diversification can expand the total manufacturing export. Industry size is generally expected to have a significant positive influence on export performance since larger industries have more resources for market expansion and have bigger chance to achieve scale economies which useful for reducing the initial cost barriers (Kumar and Pradhan, 2003). The export markets tend to have tougher condition than domestic market and therefore afford exporter industry less opportunity for inefficient operation. So, if an industry wants to expand their market through exporting, then it has to become more efficient every time, as suggested by Arnold and Hussinger (2004) and Blalock and Gertler (2004) who state that more efficient or productive industries are more likely to export.

2.2.4 The Indonesian context

Although much research has been conducted to investigate the influence of internal supply factors on export performance, only a few have put their concern in Indonesian manufacturing industries. One of them is Dijk (2002) who analyzes the export performance of Indonesian firms from 28 industries (based on 3-digits ISIC level). Dijk classifies the industries into four types, namely supplier dominated, scale intensive, science based, and specialized suppliers, in order to capture the sectoral patterns. To estimate the relationship between export and its determinants, he employs two kinds of model, *i.e.* Tobit and Generalized Linear model. Through his results, Dijk provides evidence for the presence of significant impact of the explanatory variables (such as age, foreign ownership, relative size, and square of relative size) on export. Dijk considers too the industry concentration variable which is proxied by Hirschman-Herfindahl index. This index is reported to have a significant negative sign in supplier dominated industry type and a significant positive sign in scale intensive and science based industry type.

On the other hand, Sjoholm and Takii (2003) investigate the export decision of Indonesian manufacturing sector using firm level panel data during 1990-2000. Utilizing General Method of Moments (GMM) model in estimating the decision to export, they emphasize the importance of FDI (via foreign firms) in bringing a higher degree of flexibility in the economy. Foreign firms provide significant roles in assisting host country in the industrialization process, and stimulating country's export performance since they have relatively more ability to export than the domestic firms. In Indonesia, foreign-owned firms are about 19 percent more likely to start export than purely domestically-owned firms. In addition, there is clear evidence for a significant positive relationship between size, capital intensity, labor productivity and export decision, but no relationship is captured between white-collar labor ratio and export decision. Regarding the effect of ownership, the study summarizes that foreign ownership is important for export, as are size, capital intensity and labor productivity.

2.2.5 Data source

The data used in this study are compiled from the UNIDO database. There are 23 Indonesian manufacturing industries (3-digits ISIC groups) with 74 sub-industries (4-digit ISIC groups) chosen for this study during 1990 to 2001 (see Table 1 for the descriptions of the 23 industries and their International Standard Industrial Classification –ISIC- numbers). Since all data in 1990-1997 are recorded in ISIC-Rev.2 and all the 1998-2001 data are defined as ISIC-Rev.3, we apply the combination of ISIC-Rev.2 and ISIC-Rev.3 definition. Several modifications are employed among industries within these sources of data, in order to adjust the existence of industrial classifications difference. All basic points can be seen at Table A1 of the Appendix and Table 2, which summarizes data sources and detailed information about the variables, and shows the descriptive statistics for the variables used in the analysis, respectively.

Some raw data series, namely output of the manufacturing industries, gross fixed capital formation and exports value are measured in monetary unit (Million US$), while number of employees will be expressed in person. Based on original sources, all series of output, gross fixed capital formation and exports value are expressed at the current prices. To convert all of those series to the constant price based on year 1995, we then utilize the data of GDP deflators and CPI (Consumer Price Index) from the IFS-IMF (International Financial Statistic) database and WDI-World Bank (World Development Indicators).

Due to the lack of information about the capital stock data for Indonesian manufacturing industries in 4-digits ISIC level, hence following Hu and Kao (2005) and Liao *et al.* (2007), the standard perpetual inventory method (PIM) is used for constructing the capital stock under a uniform 4% depreciation rate with 1990 as the benchmark. The formula of PIM is:

$$K_{i,t} = K_{i,t-1}(1-\Phi) + I_{i,t} \quad \text{(7)}$$

where, $K_{i,t}$ is capital stock of industry i at period t, $I_{i,t}$ is gross fixed capital formation of industry i at period t, and Φ is depreciation rate. The initial capital stock is obtained by assuming that the growth rate of capital formation in the first five years series is representative of the growth of capital formation before the beginning of the series. It is given by (Young, 1995):

$$K_{i,0} = \sum_{t=0}^{\infty} I_{i,-t-1}(1-\Phi)^{t} = \sum_{t=0}^{\infty} I_{i,0}(1+g_i)^{-t-1}(1-\Phi)^{t} = I_{i,0}/(g_i+\Phi) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

where $I_{i,0}$ denotes the first year of gross fixed capital formation data, Φ is the depreciation rate, and g_i is the average growth of gross fixed capital formation series in the first five years. Here, we assume that no net capital stock exists prior to 1990.

Table 1. Manufacturing industries based on 3-digits ISIC groups and the technology category

Categories of tech.	3-digits sectors	Categories of Tech.	3-digits sectors
0	311-Food Products	1	352-Other Chemicals
0	313-Beverages	1	355-Rubber Products
0	314-Tobacco	1	356-Plastic Products
0	321-Textiles	1	371-Iron and Steel
0	322-Wearing Apparel	1	372-Non-Ferrous Metal
0	323-Leather Products	1	381-Fabricated Metal Products
0	324-Footwear	2	382-Machinery, except Electric
0	331-Wood Products	2	383-Machinery, Electric
0	332-Furniture	2	384-Transport Equipment
0	341-Paper & Products	2	385-Professional & Scientific Equipment
0	342-Printing & Publishing	2	390-Other Manufactured Products
1	351-Industrial Chemicals		

Notes: Categories of technology; 0=*traditional*, 1=*basic*, 2=*high-tech* (based on Liao *et al*. 2007)

2.3 Empirical results

2.3.1 DEA results

Our findings provide the individual score of technical efficiency for every industry on a yearly basis. Based on that, we compute as well the yearly mean of technical efficiency for the manufacturing sector as a whole. Table A2 of the Appendix illustrates the entire sector's score and the yearly mean. The mean technical efficiencies for the industries of interest during 1990-2001 are ranged from 0.423 to 0.572. They show a mixed pattern over time, where a steady upward movement seems to appear only in the period 1996-1999. In 1996, the value was about 0.426, which rose to about 0.465 in 1997 and to 0.572 in 1999. On the contrary, after 1999, the mean efficiency registers a sharp decline until 0.423 in 2001.

Table 2. Descriptive statistics for variables used in the analysis

Variable	Obs.	Mean	SD	Median	Minimum	Maximum
Output	276	2453.2	2596.4	1561.4	39.662	14937.347
Labor	276	152241.2	156735.1	99734.0	3319	657464
Capital stock	276	3121.6	4655.6	1381.9	0.6308	22377.0449
Export intensity	240	0.3273	0.2593	0.2481	0.0105	0.9828
Capital intensity	276	0.0071	0.0633	0.0017	0.00000950	1.0492
Diversification	240	0.8299	0.1661	0.8271	0.4970	1
Technical efficiency	276	0.4871	0.2686	0.4215	0.0660	1

Looking at the annually efficiency score of each industry, only 6 out of the 23 have experienced significant improvements in technical efficiency. Those industries are: tobacco, other chemical, iron and steel, machinery (except electric), machinery (electric), and transport equipment. Of these, tobacco, iron and steel, machinery (except electric), and transport equipment gained the most. Tobacco, iron and steel, and transport equipment are found too as the efficient units which have the most optimum output-oriented technical efficiency scores, that is, 1.0. Three of the industries, *i.e.* leather products, rubber products, and plastic products have gained marginally and maintained an increase efficiency level during the sample period while two other industries, namely textiles, and paper and products show a relative stable level of efficiency. The majority amounts of industries (12 industries) have experienced deterioration in technical efficiency. Of these industries, beverages, and professional and scientific equipment are registered as the industries which experience the sharpest decline in the level of technical efficiency.

2.3.2 SPF results

To begin the analysis, several testing of null hypotheses will be discussed for the SPF model with panel data which assume that data are available for a sample of *n* industries over *t* time periods. Concerning the SPF1 model, we do three particular tests. First, doing test for the null hypothesis which states that there are no technical inefficiency effects in the model. This is expressed by H_0: $g = 0$. Second and third, applying test for the null hypothesis that technical inefficiency effects have half-normal distribution and are time invariant, which are defined by H_0: $m = 0$ and H_0: $h = 0$, respectively.

Next, for the specifications of SPF2 model, we do test for the statistical significance of the inefficiency component u_{it} in the error term, the null hypothesis is H_0: $g = d_1 = d_2 = 0$. Here, if the null hypothesis is true, the inefficiency component has zero mean and variance, implying that the error term contains only the random component v_{it}. In other words, it means that the stochastic frontier model is not significantly different from the average production model, with no output deviations due to inefficiency (Movshuk, 2004).

As shown in Table 3, the first formal test of null hypothesis associated with SPF1 model (H_0: $g = 0$), which specifies that the Indonesian manufacturing industries are fully technically efficient, is rejected by the data. Similarly, the null hypotheses H_0: $m = 0$ and

H_0: $h = 0$, that the technical inefficiency effects have half-normal distribution and are time invariant, are also rejected. In the test of the statistical significance of the inefficiency effect in the disturbance term for the SPF2 model, the LR test statistics was found to be 829.980, far in excess of the critical value 8.761. It implies that the null hypothesis of no technical inefficiency effects in Indonesian manufacturing industries is rejected.

Looking at the estimates for the parameters for both SPF model presented in Table 4, all of them have the expected signs. These estimated coefficients are also highly significant. The estimates of the variance parameter, g, are also significantly different from zero (0.767 and 0.999 for SPF1 and SPF2 model, respectively; see Panel (c) of the Table), indicating that the inefficiency effects are significant in determining the level and variability of industries output (for SPF1 model) and the inefficiency component u_{it} is very important in the variation of the error term (for SPF2 model). Technical inefficiency effects is confirmed to rise over time in SPF1 since the estimate for the h is negative (-0.094). Results of estimating the inefficiency model are presented in Panel (b) of Table 4. In the specification of SPF2 model, parameter estimates d_1 and d_2 for value added (Z_1) and time (Z_2) are negative and positive, respectively, implying that technical inefficiency is lower in the industries which produce higher value added and inefficiency is increasing over time.

Table 3. Hypothesis tests of the stochastic production frontier model

Null hypothesis	Log likelihood	Test statistic l	Critical value	Decision
a. SPF1 model				
$H_0: g = 0$	-202.685	308.829	2.706	Reject H_0
$H_0: h = 0$	-277.860	158.478	5.138	Reject H_0
$H_0: m = 0$	-191.624	330.950	5.138	Reject H_0
b. SPF2 model				
$H_0: g = d_1 = d_2 = 0$	57.891	829.980	8.761	Reject H_0

Notes: The critical values ($a = 0.05$) are obtained from Table 1 of Kodde and Palm (1986).

The technical efficiency scores of the Indonesian manufacturing industries under three different SPF models are presented in Table A3, A4, and A5 of Appendix. Due to the large enough number of scores involved, we summarize the frequency distribution of the scores in Table 5. For SPF1 model, the majority of manufacturing industries show predicted technical efficiencies less than 0.5 in all considered years. Nevertheless, some of them can reach scores greater than 0.5 but none of them is identified as fully efficient. The estimated mean technical efficiency is 0.327, which indicates that there is substantial inefficiency problem in the Indonesian manufacturing industry. For SPF2 model, the condition seems worse. The number of industries whose technical efficiency scores smaller than 0.5 are registered increase. In addition, the estimated mean technical efficiency also deteriorates (becoming to only 0.178). However, in the SPF2A model which uses cross-sectional data, we find the estimated mean technical efficiency of the industry is 0.410. Although, it is not comparable with the mean of previous two SPF models which use panel data, that figure seems relatively far better. The number of industries which reach efficiency scores more than 0.5 are also relatively bigger for the SPF2A. These findings imply that the model specification in estimating technical efficiency has a significant relation on the technical efficiency scores.

Next, looking at the annually efficiency score of each industry obtained by SPF1 model, we find some industries predominate relatively during the period. Those industries are: iron & steel, industrial chemicals, transport equipment, non-ferrous metal, machinery, electric, and tobacco. On the other hand, from SPF2 model, several industries are identified to show a relative stable of efficiencies level, namely food products, textiles, transport equipment, tobacco, wood products, and machinery, electric. For SPF2A model, the most prominent industries are food products, tobacco, transport equipment, iron & steel, industrial chemicals, and machinery, electric (see Table A3, A4 and A5 of Appendix).

Table 4. Maximum-likelihood estimates for parameters of the stochastic production frontier and inefficiency models

Variable	Parameter	SPF1 model		SPF2 model	
		Estimate	t-ratio	Estimate	t-ratio
a. Frontier efficiency model					
Constant	b_0	-0.652	-0.787	8.426	90.255
Labor (X_1)	b_1	0.709	7.650	0.034	2.326
Capital (X_2)	b_2	0.150	3.208	0.088	7.684
b. Inefficiency model					
Constant	d_0	-	-	7.628	55.119
Value added (Z_1)	d_1	-	-	-0.898	-67.307
Year (Z_2)	d_2	-	-	0.027	6.676
c. Variance parameters					
	s^2	0.895	7.230	0.037	20.360
	g	0.767	28.842	0.999	62.742
	h	-0.094	-6.914		
	m	1.657	6.394	-	-

2.3.3 Comparing the results

As have been explained above, since DEA uses cross-sectional data, so it is not comparable with SPF1, SPF2 models which use panel data. However, to do a comparison between the two approaches, we utilize the findings of SPF2A model as the representative of cross-sectional SPF approach.

A summary of the average technical efficiency of 6 most efficient industries for all considered models is listed in Table 6. Comparing two models for cross-sectional data (DEA and SPF2A), we find that both models almost define the same picture about 6 most efficient industries in the result. Those 6 industries are food products (311), tobacco (314), industrial chemicals (351), iron & steel (371), machinery, electric (383), transport equipment (384). In average, tobacco is constantly performs better than other industries during the period of analysis. Iron & steel, and transport equipment were trailing right behind it in terms of average technical efficiency over the 10 year period. Three other industries, *i.e.* food products, industrial chemicals, and machinery, electric follow with relatively less average scores.

Based on the level of technology applied by the industry, those 6 most efficient industries represent each considered category (see Table 1), namely traditional (tobacco and food products), basic (iron & steel and industrial chemicals), and high-tech (transport equipment and machinery, electric). Summarizing all the results, there is no domination of certain category of technology for Indonesian manufacturing industries in term of technical efficiency achievement. However, there is a fact that traditional and basic industries show a relatively better performance than the high-tech industries.

It should be noted that firms in Indonesian tobacco industry get considerable advantage from the positive growth of cigarette industry during 1998-2000. Domestic sales have risen and exports have slight soared, as firms work to provide higher quality products for their increasing numbers of smokers at home and abroad. According to GAPPRI (the association of Indonesian cigarette producers), the cigarette production during 1998-2000 always shows a positive evolution which in 1998 and 2000 can reach around 196.2 billion and 232.5 billion pieces, respectively. The firms in the industry also get a benefit from higher local contents for their input.

Other two efficient industries on the list (iron & steel, and industrial chemicals) incline to have significant market power as a monopoly or a dominant firm in Indonesian domestic markets. Until now, the biggest Indonesian iron and steel firm - PT. Krakatau Steel- still holds the majority of domestic production and domestic market for the iron and steel commodities. The industrial chemicals industry also takes benefit from the existence of significant market power since most of the basic industrial chemicals, fertilizers and pesticides firms are owned by the government, where in some extents, they get privileges for selling and distributing the products. Another efficient industry, *i.e.* transport equipment, seems to get a positive significant impact on their output production because of the positive evolution of domestic automotive and aircraft industry during the period.

Using SPF approach for panel data, almost similar general picture is provided. In the two models which are used, namely SPF1 and SPF2, we identify the same 6 most efficient industries in Indonesian manufacturing (as defined by DEA and SPF2A). However, in the panel model, iron & steel seems to be the most efficient industry for Indonesian manufacturing, and then followed by transport equipment and food products for the second and the third.

Table 5. The mean and frequency distributions of efficiency scores from SPF and DEA approach (1990-2001)

Year	TE (DEA)			TE (SPF1)			TE (SPF2)			TE (SPF2 A)		
	Mean	**< 0.50**	**0.50-1.0**	**Mean**	**< 0.50**	**0.50-1.0**	**Mean**	**< 0.50**	**0.50-1.0**	**Mean**	**< 0.50**	**0.50-1.0**
1990	0.502	12[a]	11 (4*)	0.494	15	8	0.191	22	1	0.316	16	7
1991	0.520	14	9 (3*)	0.463	15	8	0.193	22	1	0.455	16	7
1992	0.512	13	10 (4*)	0.431	17	6	0.217	22	1	0.303	18	5
1993	0.463	14	9 (2*)	0.400	18	5	0.235	22	1	0.362	18	5
1994	0.464	15	8 (3*)	0.369	18	5	0.239	21	2	0.436	14	9
1995	0.480	14	9 (2*)	0.338	19	4	0.261	20	3	0.341	17	6
1996	0.426	17	6 (2*)	0.308	20	3	0.289	19	4	0.419	15	8
1997	0.465	15	8 (2*)	0.278	20	3	0.210	21	2	0.354	16	7
1998	0.548	10	13 (2*)	0.250	20	3	0.063	23	0	0.467	15	8
1999	0.572	10	13 (2*)	0.223	20	3	0.075	23	0	0.467	15	8
2000	0.470	14	9 (2*)	0.198	22	1	0.086	23	0	0.559	10	13
2001	0.423	16	7 (3*)	0.175	22	1	0.073	23	0	0.436	14	9
Overall												
Mean	0.487			0.327			0.178			0.410		
SD	0.269			0.106			0.081			0.075		
Min.	0.066			0.175			0.063			0.303		
Max.	1.000			0.494			0.289			0.559		

Notes: [a] denotes the number of industries; * indicates the number of industries which are fully efficient (the technical efficiency score of the industry is 1.0); TE (DEA)=technical efficiency is calculated using DEA approach; TE (SPF1)=technical efficiency is computed based on SPF approach which developed by Battese and Coelli (1992); TE (SPF2)=technical efficiency is calculated based on SPF approach which developed by Battese and Coelli (1995).

Table 6. Average technical efficiency of 6 most efficient industries: 1990-2001

Ranking	Average technical efficiency					
	Cross-sectional data			Panel data		
	DEA	**SPF2A**	***Overall***	**SPF1**	**SPF2**	***Overall***
1	0.997	0.936	0.880	0.823	0.558	0.532
	(371)[a]	(311)	(314)	(371)	(311)	(371)
2	0.991	0.769	0.847	0.616	0.409	0.473
	(314)	(314)	(371)	(351)	(321)	(384)
3	0.846	0.760	0.803	0.608	0.337	0.461
	(384)	(384)	(384)	(384)	(384)	(311)
4	0.767	0.697	0.723	0.487	0.311	0.432
	(351)	(371)	(311)	(372)	(314)	(351)
5	0.684	0.667	0.717	0.447	0.287	0.359
	(372)	(351)	(351)	(383)	(331)	(383)
6	0.647	0.629	0.638	0.394	0.270	0.352
	(383)	(383)	(383)	(314)	(383)	(314)

Notes: *Overall* describes the average technical efficiency for both models in cross-sectional or panel; [a] denotes the industry classification; 311=food products; 314=tobacco; 351=industrial chemicals; 371=iron & steel; 383=machinery, electric; 384=transport equipment.

Back to Table 5, the mean technical efficiency under the DEA approach (0.487) is higher than which is estimated under the SPF approach (0.410 for SPF2A). Besides that, the DEA efficiency measures show a significantly higher variability than the SPF measures. In term of final conclusion, our results are parallel with the findings of Kalaitzandonakes and Dunn (1995) who compare technical efficiency approaches relative to DEA and stochastic production frontiers in Guatemalan corn producers. Similar to this study, their work identifies a significantly higher score of mean technical efficiency under DEA than under the stochastic production frontier.

2.3.4 The determinants of export performance

In this part, we focus on the analysis of the determinants of Indonesian manufacturing export and estimate their panel data based on Equation (4). Regarding the explanatory variable, *i.e.* technical efficiency –TE-, the data of technical efficiency scores from DEA are used instead of SPF to proxy the efficiency level of Indonesian manufacturing industries.

As explained before, in order to get the most appropriate panel model, this study performs several specific tests. Table 7 presents the results of the Hausman specification test for FEM versus REM. In addition, both the *F*-test and LM (Breusch-Pagan) test are executed as well for checking the appropriateness of constant coefficients model. As expected, the tests clearly support the FEM estimator in this context. For Hausman test, the orthogonality between the individual effects and all regressors assumption fails, with only the FEM remaining consistent. F-test and LM test also indicate that constant coefficients model is inappropriate.

Table 7. Specific tests for choosing the best panel model

Test	Result			
FEM versus Constant coefficient model (*F*-test)	F(22, 213)	= 26.60	Prob > F	= 0.0000
REM versus Constant coefficient model (LM test)	chi2(1)	= 383.08	Prob > chi2	= 0.0000
REM versus FEM (Hausman test)	chi2(4)	= 17.31	Prob > chi2	= 0.0017

Notes: FEM=Fixed Effect Model; REM=Random Effect Model

As the FEM appears to be the appropriate choice, then its coefficients and the standard errors can be written as:

$$\hat{EI} = -.630 + .037 \ln CAP + .099 \ln SIZE - .273 \ln DIV + .091 \ln TE$$
$$(.460) \quad (.020) \quad (.036) \quad (.128) \quad (.033)$$

We find that all the signs of the slope coefficients of the model are fit with our previous expectation. All estimated coefficients are significant at the 5 per cent level (except for *lnCAP* at 10 per cent), revealing that they are statistically different from zero and do have significant influence to the change of export performance. Starting with the impact of capital intensity (*CAP*) and industry size (*SIZE*), the estimated equation suggests that an industry with more capital intensive will incline to export more intensively and an industry with a bigger size is more likely to exhibit better export performance. Taking into account the elasticity of those two variables, we verify that on an average, one per cent increase in capital intensity and industry size lead to 11.3 and 30.2 per cent rise in the export performance, respectively.

Actually, the relationship between exports diversification (*DIV*) and export performance has been postulated to be positive. Yet, due to our diversification variable is an indirect measure of diversification (or a direct measure of concentration), then a significant negative sign of *DIV* is exactly consistent with our expectation before. The estimation result clarifies that more diversified an industry, it will likely to exhibit better export performance. The elasticity coefficient of the variable indicates that on an average, one per cent decrease in the concentration gives rise to 83.4 per cent hike in the export performance.

As has been considered by many studies, the most important and interesting matter that we want to know in this context is the impact of efficiency to the export performance. From our finding, efficiency (*TE*) shows a positive impact on the exports performance. Its elasticity coefficient is 27.8, indicating that at an average level; one per cent rise in the efficiency produces 27.8 per cent improvement in the export performance. It seems that this study support the self-selection hypothesis prediction. This implies the condition of more efficient firms self-select to enter the export market or high industry efficiency increases the probability of becoming an exporter.

2.4 Conclusion

This study analyzes the technical efficiency and the determinants of export performance of Indonesian manufacturing industries. Our results which correspond to the technical efficiency indicate that the estimated mean technical efficiency in the DEA approach is larger than those obtained from the SPF. Nevertheless, those two approaches give a similar conclusion about the low level of the estimated mean technical efficiency of Indonesian manufacturing industries. In addition, we identify there are six relatively prominent industries in term of efficiency achievement in the Indonesian manufacturing sector, namely iron & steel, tobacco, transport equipment, food products, industrial chemicals, and machinery, electric. Through SPF2 model, we find that value added positively affects efficiency in the industries. However, inefficiency is verified to have a rising tendency over time. On the other hand, using panel analytic model, *i.e.* Fixed Effect Model (FEM), we find all export determinants which are considered, namely capital intensity (*CAP*), number of labor (*SIZE*), diversification (*DIV*) and technical efficiency (*TE*) shows the appropriate significant sign as have been expected before. The highest elasticity coefficient is provided by diversification (DIV) variable. In this study, we also provide evidence for the presence of self-selection hypothesis.

Appendix

Table A1. Variables, definitions and data sources

Variable	Definition	Source
I. The technical efficiency model (DEA, and SPF)		
a. DEA model		
Y_1	Output value of manufacturing industry in Mn US$ at 1995 constant price.	ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI (various years)
X_1	Number of employees of the industry (person).	ISIC Rev.2 & Rev.3, UNIDO (2004)
X_2	The capital stock used by the manufacturing industry in Mn US$ at 1995 constant price.	Calculated using PIM based on ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI database (various years)
b. SPF model		
b.1. Frontier efficiency model		
Y_1	The natural logarithm of output value of manufacturing industry.	ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI (various years)
X_1	The natural logarithm of number of employees of the industry.	ISIC Rev.2 & Rev.3, UNIDO (2004)
X_2	The natural logarithm of capital stock which used by the manufacturing industry.	Calculated using PIM based on ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI database (various years)
b.2. Inefficiency model		
Z_1	The natural logarithm of value added. Following Hossain and Karunaratne (2004), it is used as a proxy for size.	ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI (various years)
Z_2	It describes the year of observation.	-
II. The export model		
EI	The export intensity (ratio of total exports to total output) .	ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI (various years)
CAP	Capital intensity (ratio of total capital to total labor).	ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI (various years)
SIZE	Industry size. It is proxied by total labors.	ISIC Rev.2 & Rev.3, UNIDO (2004)
DIV	The diversification of export. It is measured by Gini-Hirschman index.	ISIC Rev.2 & Rev.3, UNIDO (2004), IFS, and WDI (various years)
TE	Technical efficiency level of the manufacturing industry which is measured by DEA model.	The DEA model calculation results

Notes: IFS=International Financial Statistics, WDI=World Development Indicator, and UNIDO=UNIDO Industrial Statistics Database.

Table A2. Indonesian manufacturing industries: Technical efficiency scores using DEA model (1990-2001)

ISIC (3-digits)	Industry	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
311	Food products	0.403	0.473	0.514	0.686	0.478	0.56	0.46	0.486	0.675	0.565	0.377	0.43
313	Beverages	1	0.769	0.656	0.557	0.63	0.58	0.44	0.53	0.422	0.421	0.203	0.113
314	Tobacco	0.896	1	1	1	1	1	1	1	1	1	1	1
321	Textiles	0.11	0.138	0.162	0.132	0.163	0.158	0.142	0.168	0.249	0.347	0.178	0.175
322	Wearing apparels	0.523	0.411	0.437	0.464	0.36	0.429	0.41	0.398	0.506	0.59	0.574	0.382
323	Leather products	0.109	0.164	0.173	0.16	0.152	0.166	0.136	0.21	0.232	0.24	0.137	0.266
324	Footwear	0.554	0.247	0.313	0.378	0.362	0.391	0.323	0.338	0.45	0.352	0.36	0.161
331	Wood products	0.188	0.313	0.295	0.302	0.302	0.3	0.248	0.322	0.069	0.088	0.066	0.12
332	Furniture	0.307	0.364	0.411	0.412	0.413	0.438	0.456	0.543	0.911	0.539	0.394	0.306
341	Paper & products	0.331	0.359	0.335	0.264	0.296	0.264	0.233	0.259	0.26	0.344	0.544	0.399
342	Printing & publishing	0.184	0.277	0.27	0.293	0.303	0.334	0.311	0.305	0.678	0.834	0.495	0.149
351	Industrial chemicals	1	0.971	1	0.759	0.58	0.499	0.498	0.681	0.885	0.961	0.726	0.638
352	Other chemical	0.405	0.581	0.462	0.513	0.54	0.532	0.403	0.453	0.527	0.678	0.371	0.638
355	Rubber products	0.128	0.181	0.239	0.176	0.196	0.242	0.237	0.228	0.468	0.483	0.289	0.288
356	Plastic products	0.176	0.289	0.459	0.317	0.312	0.414	0.34	0.302	0.391	0.437	0.375	0.251
371	Iron & steel	1	1	1	1	1	1	1	1	1	1	0.967	1
372	Non-ferrous metal	0.967	0.791	1	0.515	0.686	0.609	0.519	0.635	0.637	0.763	0.69	0.395
381	Fabricated metal products	0.626	0.587	0.587	0.48	0.482	0.553	0.517	0.487	0.53	0.584	0.571	0.321
382	Machinery, except electric	0.176	0.27	0.236	0.23	0.255	0.257	0.246	0.315	0.332	0.254	0.198	0.77
383	Machinery, electric	0.351	0.48	0.584	0.527	0.559	0.76	0.665	0.778	0.819	0.877	0.768	0.595
384	Transport equipment	0.606	0.908	0.72	0.788	1	0.995	0.743	0.737	0.695	0.96	1	1
385	Professional & scientific equip.	1	1	0.508	0.307	0.236	0.263	0.258	0.262	0.516	0.57	0.266	0.146
390	Other manufactures products	0.513	0.392	0.406	0.4	0.374	0.285	0.202	0.254	0.346	0.28	0.266	0.193
	Mean	***0.502***	***0.520***	***0.512***	***0.463***	***0.464***	***0.480***	***0.426***	***0.465***	***0.548***	***0.572***	***0.470***	***0.423***

Table A3. Indonesian manufacturing industries: Technical efficiency scores using SPF1 model (1990-2001)

ISIC (3-digits)	Industry	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
311	Food products	0.546	0.515	0.482	0.449	0.415	0.380	0.346	0.312	0.278	0.245	0.214	0.184
313	Beverages	0.425	0.391	0.356	0.322	0.288	0.254	0.222	0.192	0.163	0.136	0.112	0.090
314	Tobacco	0.574	0.543	0.512	0.479	0.446	0.412	0.377	0.343	0.309	0.275	0.242	0.211
321	Textiles	0.435	0.401	0.366	0.332	0.298	0.264	0.232	0.201	0.171	0.144	0.119	0.097
322	Wearing apparels	0.365	0.331	0.297	0.263	0.231	0.200	0.170	0.143	0.118	0.096	0.076	0.059
323	Leather products	0.320	0.285	0.252	0.220	0.190	0.161	0.134	0.110	0.089	0.070	0.054	0.040
324	Footwear	0.346	0.311	0.277	0.244	0.213	0.183	0.154	0.129	0.105	0.084	0.066	0.050
331	Wood products	0.351	0.317	0.283	0.250	0.218	0.188	0.159	0.133	0.109	0.087	0.069	0.053
332	Furniture	0.319	0.285	0.251	0.219	0.189	0.160	0.134	0.110	0.088	0.070	0.053	0.040
341	Paper & products	0.530	0.498	0.465	0.431	0.397	0.363	0.328	0.294	0.261	0.229	0.198	0.169
342	Printing & publishing	0.431	0.396	0.362	0.327	0.293	0.260	0.227	0.197	0.168	0.141	0.116	0.094
351	Industrial chemicals	0.754	0.733	0.711	0.688	0.663	0.637	0.609	0.581	0.551	0.520	0.488	0.455
352	Other chemical	0.563	0.532	0.500	0.467	0.433	0.399	0.365	0.330	0.296	0.263	0.231	0.200
355	Rubber products	0.452	0.418	0.383	0.349	0.314	0.280	0.247	0.216	0.185	0.157	0.131	0.107
356	Plastic products	0.397	0.363	0.328	0.294	0.261	0.228	0.197	0.168	0.141	0.116	0.094	0.075
371	Iron & steel	0.894	0.884	0.873	0.862	0.850	0.836	0.822	0.807	0.790	0.773	0.754	0.734
372	Non-ferrous metal	0.654	0.627	0.599	0.570	0.539	0.508	0.475	0.442	0.408	0.373	0.339	0.305
381	Fabricated metal products	0.486	0.453	0.419	0.384	0.350	0.315	0.281	0.248	0.217	0.186	0.158	0.132
382	Machinery, except electric	0.463	0.429	0.395	0.360	0.326	0.292	0.258	0.226	0.195	0.166	0.140	0.115
383	Machinery, electric	0.621	0.593	0.563	0.532	0.500	0.467	0.434	0.400	0.365	0.331	0.297	0.264
384	Transport equipment	0.748	0.727	0.704	0.680	0.655	0.629	0.601	0.572	0.542	0.510	0.478	0.445
385	Professional & scientific equip.	0.367	0.333	0.299	0.265	0.233	0.201	0.172	0.145	0.120	0.097	0.077	0.060
390	Other manufactures products	0.313	0.279	0.246	0.214	0.184	0.155	0.129	0.106	0.085	0.066	0.051	0.038
	Mean	***0.494***	***0.463***	***0.431***	***0.400***	***0.369***	***0.338***	***0.308***	***0.278***	***0.250***	***0.223***	***0.198***	***0.175***

Table A4. Indonesian manufacturing industries: Technical efficiency scores using SPF2 model (1990-2001)

ISIC (3-digits)	Industry	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
311	Food products	0.608	0.588	0.703	0.992	0.683	0.764	0.820	0.579	0.220	0.237	0.267	0.229
313	Beverages	0.044	0.042	0.051	0.051	0.063	0.066	0.068	0.056	0.010	0.011	0.012	0.009
314	Tobacco	0.413	0.349	0.389	0.416	0.424	0.434	0.453	0.280	0.106	0.147	0.139	0.176
321	Textiles	0.387	0.440	0.499	0.489	0.613	0.606	0.649	0.514	0.157	0.221	0.201	0.129
322	Wearing apparels	0.182	0.170	0.234	0.302	0.216	0.220	0.250	0.156	0.063	0.098	0.091	0.077
323	Leather products	0.018	0.029	0.028	0.027	0.024	0.026	0.028	0.032	0.008	0.007	0.007	0.011
324	Footwear	0.062	0.077	0.139	0.205	0.197	0.187	0.199	0.126	0.053	0.056	0.054	0.037
331	Wood products	0.408	0.443	0.439	0.452	0.455	0.426	0.420	0.342	0.011	0.014	0.013	0.023
332	Furniture	0.048	0.065	0.066	0.076	0.077	0.083	0.089	0.066	0.042	0.035	0.031	0.033
341	Paper & products	0.138	0.160	0.170	0.150	0.180	0.210	0.243	0.187	0.056	0.065	0.124	0.117
342	Printing & publishing	0.065	0.064	0.067	0.074	0.080	0.094	0.114	0.072	0.040	0.050	0.048	0.010
351	Industrial chemicals	0.308	0.300	0.337	0.278	0.294	0.289	0.388	0.318	0.113	0.126	0.123	0.114
352	Other chemical	0.209	0.241	0.208	0.250	0.275	0.277	0.285	0.248	0.062	0.082	0.080	0.098
355	Rubber products	0.186	0.163	0.205	0.148	0.168	0.206	0.238	0.079	0.067	0.069	0.071	0.052
356	Plastic products	0.097	0.111	0.179	0.138	0.144	0.188	0.202	0.119	0.037	0.051	0.058	0.039
371	Iron & steel	0.322	0.267	0.236	0.303	0.327	0.363	0.449	0.305	0.069	0.071	0.075	0.100
372	Non-ferrous metal	0.097	0.083	0.101	0.066	0.094	0.102	0.105	0.086	0.030	0.035	0.035	0.018
381	Fabricated metal products	0.186	0.172	0.218	0.200	0.210	0.240	0.301	0.192	0.048	0.060	0.087	0.042
382	Machinery, except electric	0.062	0.082	0.067	0.078	0.089	0.107	0.123	0.106	0.022	0.017	0.023	0.104
383	Machinery, electric	0.177	0.183	0.263	0.261	0.312	0.441	0.523	0.459	0.125	0.157	0.227	0.114
384	Transport equipment	0.326	0.368	0.323	0.379	0.511	0.598	0.611	0.429	0.076	0.101	0.197	0.130
385	Professional & scientific equip.	0.007	0.008	0.017	0.013	0.015	0.021	0.031	0.025	0.011	0.013	0.010	0.004
390	Other manufactures products	0.032	0.034	0.051	0.059	0.056	0.055	0.054	0.042	0.014	0.013	0.015	0.012
	Mean	***0.191***	***0.193***	***0.217***	***0.235***	***0.239***	***0.261***	***0.289***	***0.210***	***0.063***	***0.075***	***0.086***	***0.073***

Table A5. Indonesian manufacturing industries: Technical efficiency scores using SPF2A model (1990-2001)

ISIC (3-digits)	Industry	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
311	Food products	0.999	0.810	0.913	0.999	0.999	0.960	0.975	0.993	0.863	0.863	0.960	0.899
313	Beverages	0.073	0.251	0.084	0.160	0.178	0.096	0.140	0.093	0.209	0.209	0.138	0.086
314	Tobacco	0.670	0.826	0.558	0.636	0.816	0.602	0.692	0.484	0.999	0.999	0.946	0.999
321	Textiles	0.652	0.476	0.615	0.439	0.778	0.712	0.693	0.875	0.407	0.407	0.913	0.476
322	Wearing apparels	0.291	0.361	0.324	0.370	0.376	0.299	0.349	0.272	0.520	0.520	0.719	0.365
323	Leather products	0.031	0.128	0.044	0.077	0.065	0.038	0.056	0.053	0.130	0.130	0.079	0.111
324	Footwear	0.100	0.195	0.197	0.286	0.357	0.254	0.286	0.219	0.455	0.455	0.473	0.195
331	Wood products	0.678	0.628	0.570	0.493	0.675	0.533	0.518	0.586	0.070	0.070	0.107	0.144
332	Furniture	0.078	0.208	0.100	0.138	0.171	0.121	0.152	0.115	0.582	0.582	0.302	0.219
341	Paper & products	0.240	0.340	0.233	0.259	0.313	0.256	0.337	0.306	0.246	0.246	0.779	0.681
342	Printing & publishing	0.109	0.220	0.101	0.167	0.181	0.130	0.195	0.121	0.465	0.465	0.542	0.088
351	Industrial chemicals	0.513	0.930	0.500	0.573	0.606	0.380	0.618	0.523	0.843	0.843	0.907	0.766
352	Other chemical	0.348	0.615	0.299	0.435	0.536	0.367	0.434	0.416	0.463	0.463	0.689	0.638
355	Rubber products	0.311	0.321	0.281	0.234	0.300	0.266	0.348	0.128	0.445	0.445	0.519	0.313
356	Plastic products	0.161	0.276	0.259	0.232	0.277	0.253	0.303	0.203	0.320	0.320	0.495	0.233
371	Iron & steel	0.544	0.999	0.360	0.765	0.761	0.491	0.819	0.500	0.776	0.776	0.667	0.904
372	Non-ferrous metal	0.167	0.458	0.165	0.233	0.265	0.145	0.221	0.141	0.426	0.426	0.372	0.166
381	Fabricated metal products	0.306	0.466	0.314	0.339	0.410	0.324	0.454	0.325	0.424	0.424	0.764	0.275
382	Machinery, except electric	0.106	0.271	0.101	0.185	0.201	0.143	0.214	0.176	0.244	0.244	0.236	0.682
383	Machinery, electric	0.296	0.495	0.378	0.446	0.582	0.583	0.761	0.779	0.786	0.786	0.968	0.692
384	Transport equipment	0.542	0.914	0.463	0.659	0.987	0.787	0.905	0.720	0.614	0.614	0.972	0.940
385	Professional & scientific equip.	0.012	0.119	0.030	0.061	0.050	0.032	0.069	0.041	0.243	0.243	0.143	0.049
390	Other manufactures products	0.052	0.154	0.080	0.128	0.136	0.078	0.096	0.070	0.214	0.214	0.178	0.101
	Mean	***0.316***	***0.455***	***0.303***	***0.362***	***0.436***	***0.341***	***0.419***	***0.354***	***0.467***	***0.467***	***0.559***	***0.436***

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Chapter 3

The Decision to Export:
Firm-Level Evidence from Indonesian Textile and Apparel Industry

3.1 Introduction

This paper aims to examine the role of firm characteristics, measured by productivity, size, labor quality, capital intensity, and foreign ownership, as the determinant of decision to export for Indonesian textile and apparel manufacturing firms. In addition, the role of other specific effects such as industry, time, and region specific effects are also considered by employing the dummies. Using firm-level survey data from 2002 to 2005 which are drawn from the Republic of Indonesia's *Badan Pusat Statistik* (hereafter, *BPS*) -the Central Bureau of Statistics-, a random effects probit model is estimated for providing us a proper explanation about the empirical relationship among the variables of interest.

The expected main contribution of this paper to the existing literature is twofold: first, broadening the use of firm characteristics in the analysis of export decision; second, by exploiting a panel survey data of Indonesian textile and apparel industry, we offer a thorough clarification about the character of textile and apparel firm which may be useful in the formulation of Indonesian export policy.

The influence of firm characteristics is critically highlighted in this work, since we believe that such characteristics have significant points in explaining firm's export decision. Firms are dissimilar in many aspects and can behave differently in their operations, even when they encounter the same government policies or involve in the same industry classification. Those situations do not only occur in firm's domestic scope activities, but also in their international activities, such as exporting. Firms may act in different way and take different decision to participate in export market, depending on their specific conditions. Many countries' firm-level data give a fact that just a small portion of firms are interested in export market, while the majority persistently serve the domestic markets only. Based on previous sense, the characteristics of firm are often suspected to be the cause of such a tendency. So, it is imperative to observe the contribution of firm-specific characteristics in affecting firm's behavior and capability in entering the international markets. Incorporating the firm characteristics into trade model is also useful for interpreting better the model and helps the policy makers in formulating deeper their trade strategies, where the different among firms are certainly considered.

Past empirical studies related to this discussion have been carried out almost exclusively with firm-level data from various countries. There is a wide range of firm characteristics which are commonly used in those studies, *e.g.* firm's productivity, size, age, labor quality, input intensity, product innovation, ownership, R&D intensity, or advertising intensity. Those measures are usually found to have positive effects on firm's decision to export. It is clearly reported, for example, by Roberts and Tybout (1997) in Colombian firms' case during 1981 to 1989, where size, age and corporation ownership is positively found to affect the decision to export of a firm; by Bernard and Jensen (2004) who find that size, labor quality and product innovation significantly contribute to the probability of exporting in US manufacturing sector in the period of 1984 to 1992; by Manez *et al* (2004) who confirm a positive and significant influence of age, size, productivity, corporation, foreign ownership, R&D and advertising intensity on the probability of exporting in Spanish manufacturing firms during the 1990s; by Arnold and Hussinger (2005) in German manufacturing firms investigation during 1992 to 2000, where they verify the positive effects of size, R&D intensity, product innovation and skills on export decision; and by Ozler *et al* (2009) who analyze the export decision of Turkish manufacturing firms from 1990 to 2001 and find the firm characteristics such as size, wage, input intensity, skill and female employee share significantly contribute a positive impact.

Productivity is widely known as one of the most important measures of firm characteristics in determining the export decision. With respect to the issue, nowadays, there are two frequently important discussed findings in the empirical literature. The first finding puts forward the learning effect associated to exporting (which is known as learning-by-exporting hypothesis). The advocates of this finding believe that export activities increase the productivity of the firm through firm's learning process on knowledge, technology, and operational system in international markets (see *e.g.*, Aw and Hwang, 1995; Tybout and Westbrook, 1995; Blalock and Gertler, 2004). This view appears to be eminent in the management and policy literatures, since the benefits of learning process due to getting involved in exporting are inclined to be strongly related to managerial and technological gains (Arnold and Hussinger, 2005).

The second set of findings comes with a further empirical study which allows for the inclusion of self-selection hypothesis. Given the existence of large fixed costs in serving foreign markets, this hypothesis states that only the more productive firms are profitably able to export. Firm needs to gain enough profit in order to compensate for the costs which have been sacrificed. Such costs will hinder less productive firm from entering export markets, otherwise, more productive firms will self-select to enter the foreign market. Beside that, competition also could be tougher at the international market, hence it brings a condition where only the most productive firms can do well abroad (see *e.g.*, Aw *et al.*, 1998; Clerides *et al.*, 1998; Bernard and Jensen, 1999; Girma *et al.*, 2004).

In this paper, firm characteristics will be measured by several variables which are adjusted to the availability of the data. Those considered firm characteristics are productivity, size, labor quality, input intensity and foreign ownership. Productivity will be measured by using two indicators, *i.e.* TFP (total factor productivity) and labor productivity (value added per labor). As a productivity measure, TFP is more preferred than labor productivity in most studies. However, due to the reason of comparison, we include both of them into the analysis and observe them through a separate probit model. Other characteristics are measured by standard indicators, *i.e.* size by firm's total capital, labor quality by average wage, input intensity by capital intensity and foreign ownership by total capital owned by foreigners. Since productivity is often classified as the most important characteristic of firms which influences the decision to export, so we try to estimate its proxy, *i.e.* TFP in a more precise way. By utilizing a semi-parametric model for the production function following Levinshon and Petrin (2003) approach, we control for the simultaneity bias which may exist due to the possible correlation between the error term and the regressors in the productivity estimation.

Subsequently, we also model the exporting decision of two sub-samples disaggregated by firm size. Since all of our data only consider for firms with 20 or more workers, we exclude the analysis of the small firms which has less than 20 workers. Therefore, only large and middle firms will be taken into account. Large firms are defined as firms which have more than 100 workers, while middle firms are identified as firms which have more than 20 but less than 100 workers

From the results of the whole sample; productivity, size and foreign ownership are reported to contribute a positive and significant effect on the probability of exporting. It indicates that the paper support the self-selection hypothesis, where more productive firms will more likely to be involved in serving foreign markets. On the contrary, capital intensity and the region specific effect (Java region) are significantly negatively related with exporting. While, labor quality does not have a significant effect. There is no significant different impact of using TFP or labor productivity in measuring productivity. Almost identical conclusions are given by both of them. From the models which are disaggregated by firm size, we find that labour quality is critical for middle-sized firm to export.

Many studies have been discussed the Indonesian export activities, such as Blalock and Gertler (2004), Siregar and Rajan (2004), Wengel and Rodriguez (2006), and Hossain

(2009). However, none of them analyze specifically the decision to export using firm-level data in the Indonesian textile and apparel industry. So far, to the best of our knowledge, this paper is the first attempt to measure the effect of firm characteristics, controlling simultaneously for the potential presence of time, industry and region specific effects on the Indonesian textile and apparel firm's decision to export.

The rest of the paper is organized as follows. Section 2 is devoted to the empirical methodology. It reviews the estimating equation which is used in the study, explains the construction of the considered variables and summarizes the descriptive statistics, including data description and some comparisons of exporters and non-exporters. In Section 3, the empirical results are reported and discussed. Finally, section 4 will draw the conclusions of the study.

3.2 Empirical methodology

3.2.1 The estimating equation

In order to estimate the decision to export (*Exp*), we employ an empirical random effects probit model in which export behavior depends on variety of observed firm-specific characteristics, region, time, and industry dummies:

$$\Pr(Exp=1) = f(Prod_{it}, Size_{it}, LabQua_{it}, CapInt_{it}, Own_{it}, RDum_{it}, IDum_{it}, TDum_{it})$$

In the estimations, we try to account for as many firm characteristics as possible for which we have data, so as to have better estimates for the dependent variable. The firm characteristics which are included on the right-hand side are productivity (*Prod*), firm size (*Size*), the labor quality (*LabQua*), the capital intensity (*CapInt*), and foreign ownership (*Own*). We also include the dummy for the region (*RDum*), the industry (*IDum*) and the year of observation (*TDum*). The region dummy is used to capture region-specific characteristics. The industry dummies control for unobservable characteristics of the markets where firms compete, *e.g.* the technology level of the firm, market concentration, or other firm behaviors, while time (the year of observation) dummies are utilized to capture the exogenous factors shown by time-specific factors.

This paper applies two different specifications of the above equation. First, we take our whole sample as a general investigation (the estimation results are reported by Table 6 and 7). In a second glance, we look only at the sub-sample of firms disaggregated by firm size (middle and large), in which all the results of this specification are shown in Table 8 and 9.

3.2.2 Variable construction

The dependent variable in the model is a binary variable, indicating the export status (1 for exporter and 0 for non-exporter). Firm characteristics and other specific dummies which have a potential influence on the export decision will be constructed as follows.

3.2.2.1 Productivity

We start with the productivity variable. To measure the productivity, besides using labor productivity (value added per worker), this paper also utilizes total factor productivity (TFP). TFP is actually preferred in most studies, since it measures productivity in more accurate way. TFP can be measured through some approaches, such as through parametric estimation by using OLS, and through semi-parametric estimation by using Olley and Pakes (1996) or Levinsohn and Petrin (2003) approach.

OLS approach estimates the production function coefficients by assuming input choices are exogenous. However, input choices tend to be endogenous. For instance, the number of labors owned and the amount of materials bought by a firm may depend on unobserved managerial skill, which is part of TFP known to the firm but not to the researcher. Such a condition leads us to the problem of simultaneity, where the input choices and productivity (TFP) are correlated. This may cause biased estimates in the OLS estimation and due to this problem, OLS estimation is often criticized.

Later, this simultaneity bias has been corrected by some recent approaches; among others, the semi-parametric approaches which are proposed by Olley and Pakes (1996) and Levinsohn and Petrin (2003). They show the conditions to solve the simultaneity problem by suggesting the utilization of particular proxy for productivity in the production function. Olley and Pakes (1996) develop an estimator which employs investment as a proxy for productivity, while Levinsohn and Petrin (2003) introduce an estimator which uses intermediate inputs as proxies for productivity.

In term of proxy using, Levinsohn and Petrin (2003) modify the work of Olley and Pakes (1996). The former recommend the use of intermediate inputs rather than investment, because intermediate inputs may respond more smoothly to productivity shocks, while investment is very lumpy in responding the shocks due to the presence of substantial adjustment costs. Besides, the availability of data on investment is not as good as the intermediate inputs.

Because of above reasons, in order to calculate the TFP at the firm level, we implement a semi-parametric estimation technique proposed by Levinsohn and Petrin (2003). This approach uses intermediate inputs of the firm as a proxy for unobserved productivity shocks, and then produces coefficient estimates which are robust to the presence of simultaneity bias. Levinsohn and Petrin's (2003) approach consists of two stages, where in the first stage, OLS will be employed to estimate the coefficient of freely variable input, and in the second stage, a consistent non parametric approximation and GMM approach will be used to identify the coefficient of state variable input.

The first stage of Levinsohn and Petrin (2003) is started with a Cobb-Douglas production function[14]:

$$va_{it} = b_L L_{it} + b_K K_{it} + w_{it} + e_{it} \quad \ldots\ldots \quad (1)$$

[14] A specific program written in STATA by Petrin *et al*. (2004) is used for executing the Levinsohn and Petrin (2003) approach.

where i designates a firm and t designates a year, va_{it} is considered as the value added, L_{it} is freely variable input labor, K_{it} is state variable capital (all in logarithms), w_{it} is productivity known to the firm (which can affect the firm's choice of freely variable inputs), e_{it} is a mean-zero shock uncorrelated with input choices and unknown to the firm (or error which does not affect the firm's choice of inputs). w_{it} is a state variable which impact the firm's decision rules and similar to e_{it}, it is also unknown to the researcher.

The estimation procedure utilizes intermediate input M_{it} (in our case is material) –an observable firm characteristic- to proxy for the unobservable firm productivity. Demand for our intermediate input M_{it} is assumed to depend on the state variables –capital K_{it} and firm productivity w_{it}-:

$$M_{it} = M_{it}(K_{it}, w_{it}) \quad \text{……………………………...………………………………} (2)$$

This intermediate input function is assumed to monotonically increasing in productivity w_{it}, conditional on capital K_{it}[15]. Thus, it can be inverted to express the unobserved productivity w_{it} as a function of observables capital K_{it} and intermediate input M_{it}: $w_{it} = w_{it}(K_{it}, M_{it})$. Putting this expression for productivity into Eq. (1) results in the first stage semi-parametric equation:

$$va_{it} = b_L L_{it} + g_{it}(K_{it}, M_{it}) + e_{it} \quad \text{………………………………………………….... } (3)$$

where $g_{it}(K_{it}, M_{it}) = b_K K_{it} + w_{it}(K_{it}, M_{it})$. Eq. (3) is estimated by OLS, approximating the unknown function $g(\cdot)$ by a third-degree polynomial on (K_{it}, M_{it}). Because the error

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[15] It seems a reasonable assumption; (for given the stock of capital at time t) the higher productivity level attained by the firm will lead to the higher of materials usage, since the firm will produce more than another firm which has the same stock of capital but with lower productivity.

term e_{it} is uncorrelated with the inputs, estimation of the equation provides unbiased estimates of b_L.

In the second stage, the capital coefficient b_K is estimated by as follows. First, we use the first stage estimate for $g(\cdot)$ to identify an estimate for $w_{it}(b_K)$ as $w_{it}(b_K) = g_{it}(\cdot) - b_K K_{it}$. Second, utilizing those values, we regress non-parametrically $w_{it}(b_K)$ on $w_{it-1}(b_K)$ in order to find the predicted values which are consistent for approximating $E[w_{it}|w_{it-1}]$. Considering that innovations in productivity conditional on last year's productivity, *i.e* $m_{it} = w_{it} - E[w_{it}|w_{it-1}]$, where the productivity innovations m_{it} are orthogonal to all information available at time *t-1* and together with e_{it} in Eq. (3), can be used to construct the orthogonality conditions, so we can write the residual of the production function as:

$$e_{it} + m_{it} = va_{it} - b_L L_{it} - b_K K_{it} - E[w_{it}|w_{it-1}] \quad \text{……………………………………..……...(4)}$$

The consistent estimate for capital coefficient can be defined as the solution to (Petrin *et al*, 2004):

$$\underset{b_K}{Min} \sum_t \left(va_{it} - b_L L_{it} + b_K K_{it} - E[w_{it}|w_{it-1}]\right)^2 \quad \text{……………………..………...………… (5)}$$

The standard errors are obtained by the bootstrap. Following Hiep and Ohta (2007), after having all the coefficients, TFP levels can be obtained by using:

$$TFP = \hat{w}_{it} = \exp(va_{it} - \hat{b}_L L_{it} - \hat{b}_K K_{it}) \quad \text{……………………………………..………. (6)}$$

Value added will be expressed as output of a firm. The freely variable input in this approach is labor where it is represented by the number of total labors. The state variable input is capital which is proxied by the net-book value of firm's machinery and equipment, while total purchases of raw materials and intermediate goods are employed to proxy for the unobservable firm productivity. All the variables in the estimation are in logarithmic forms and the number of bootstrap replication which is used is 200.

3.2.2.2 Size

Size is the next important characteristic of firm which is mostly considered by many studies. Larger firms are believed to gain benefits from their size through economies of scale in production and larger demand. Larger firms tend to have higher ability in mobilizing their resources and to have more ability to absorb the risks. Therefore, they can adapt faster and easier to the conditions of foreign markets. It is universally received that size firm is positively related to firm export decision. With respect to that, this paper utilizes firm's capital as a proxy for firm size.

3.2.2.3 Labor quality

Another firm-specific which is considered by the paper is labor quality. If exported goods are assumed to have higher quality than non exported goods. It will be expected that the quality of the labor is positively related to the decision to export, since highly skilled labors can be considered as a signal of quality. There are two types of proxy which are usually suggested by the literature for this factor, *i.e.* the ratio of skilled labors to total labors and the average wage. Since our data availability do not support for the calculation of the former, so we choose the latter as a proxy of labor quality. In which, it is defined as the total labor wages divided by total labors.

3.2.2.4 Capital intensity

Input intensity is supposed to be included in our model, as input intensity is the typical determinant of export in the standard H-O factor proportion trade theory. Here, input intensity means capital intensity which is expressed as the ratio between capital and total number of labors.

3.2.2.5 Foreign ownership

We also consider the effect of ownership of firms on firm's decision in exporting. Foreign-owned firms are usually more powerful than the domestic firms in term of global market penetration. It is reasonable since foreign ownership (through foreign alliances) probably can assist a firm in entering the foreign markets by doing knowledge sharing about export experiences or trade prospects in international markets (Wignaraja, 2002). We characterize a firm has foreign ownership (the dummy variable takes value 1) if at least 20 per cent of the firm total capital are foreign owned (Blalock and Gertler, 2004). If foreign ownership's aim is using the host country as the center of its productive motive, a positive relationship is expected between foreign ownership and exporting decision, but if its aim is supplying the host country and doing penetration into host country market, then a negative relationship is expected.

3.2.2.6 Region, Industry and time specific effect

Table 1. Variables definition

Variabel	Definition
Exporter	= 1 if exporter, and = 0 otherwise
TFP	Total factor productivity
Labor productivity	Value added per labor
Size	Proxied by total capital (total net-book value of machinery and equipment)
Labor quality	Proxied by average wage (total labor wages divided by total labors)
Capital intensity	Ratio of capital to total labors.
Foreign ownership	Dummy variable which takes value 1 if at least 20% of total capital owned by foreigners, and = 0 otherwise
Region	Dummy variable which takes value 1 if firm is located at Java island (the most principal Indonesian island), and = 0 otherwise
Year dummies	Dummy variables that take value 1 for the corresponding year
Industries dummies	Dummy variables for 20 textile and apparel industries of the 5-digit ISIC

Region dummies, industry dummies and time dummies are all considered in the right hand side of estimation equation, to represent the regional, industrial and time specific effects which are encountered by the firms. Dummy variable for region specific effect will take value 1 if firm resides in Java Island. The island represents the most principal island in Indonesia. Table 1 explains the definition and construction of all variables of interest.

3.2.3 Descriptive statistics

3.2.3.1 Data description

The main data are drawn from an annual manufacturing survey which is conducted by the Republic of Indonesia's Central Bureau of Statistic –*Badan Pusat Statistik*- (BPS). All datasets are collected by BPS through the *Survei Tahunan Perusahaan Industri Pengolahan* (SI) which is done annually since 1975. The survey is designed for all manufacturing firms with 20 or more workers, covering all firms in 5-digit ISIC. With respect to the disaggregated (based on firm size) specification, we exclude the analysis of small-sized firms which have less than 20 workers since our data only consider for firms with 20 or more workers. Therefore, only large and middle firms will be taken into account. Large firms are defined as firms which have more than 100 workers, while middle firms are identified as firms which have more than 20 but less than 100 workers (Tomiura, 2007).

Regarding this study, our analysis will focus only in the scope of Indonesian textile and apparel industry or Indonesian manufacturing firms whose industrial classification starts from 32111 to 32290. Table A1 of the Appendix lists those 20 considered industries. After controlling for missing data and outliers (such as doing cleaning process for non-reporting firm identity number, capital, and export data), the remaining size of our unbalanced panel data set contains about 3193 observations which spans from 2002 to 2005. We adjust all variables of interest to express values in real 1990 terms. The deflators are based on *Indeks Harga Perdagangan Besar* (IHPB), wholesale price index (WPI), and *Indeks Harga Konsumen* (IHK), consumer price index (CPI), which are obtained from BPS. WPI is used for all variables of interest, except wage which uses CPI.

Table 2. Number of firms in each industry: 2002-2005

Industry	2002	2003	2004	2005	Total
32111	56	48	48	49	201
32112	3	3	3	5	14
32113	2	12	14	16	44
32114	118	105	99	134	456
32115	30	38	26	42	136
32116	17	14	18	12	61
32117	52	61	53	88	254
32121	32	33	32	33	130
32122	2	2	2	1	7
32123	2	1	1	1	5
32129	1	1	0	0	2
32130	46	48	69	57	220
32140	7	6	8	4	25
32151	3	2	1	1	7
32152	4	4	3	2	13
32160	10	5	5	5	25
32190	27	32	41	32	132
32210	359	319	330	316	1324
32220	8	8	6	4	26
32290	28	31	24	28	111
Total	807	773	783	830	3193

A short description about the data is shown in Table 2 and Table 3. The total numbers of firms for each industry from 2002 to 2005 are reported in Table 2, while the average number of workers, the percentage of exporting firms and the exports-sales ratios are summarized in Table 3.

There are fluctuate number of firms in the Indonesian textile and apparel industry during 2002-2005. In 2002, the number of firms reaches 807, then decreases to 783 in 2004 and rises significantly to 830, in 2005, a time when around 38 per cent of the firms are in the wearing apparel -textile made- industry (32210). Averagely, the largest number of workers per firm, as well as the amount of firm's output is dominated by spinning mills industry (32111) and the manufacture of wearing apparel -leather or fur made- industry (32220). In addition, approximately 41 per cent of the total firms are exporters; where a minor firm of other sacks industry (32129) is not participating in the export market. The average export-sales ratio ranged from 0.016 in the gunny bags industry (32123) to 0.685 in the manufacture of rope and twine industry (32151).

Table 3. The average value of some variables in each industry: 2002-2005

Industry	Number of workers (Log)	Output (Log)	Exporter (per cent)	Export-sales ratio
32111	6.407	17.259	55.721	0.362
32112	4.462	15.253	35.714	0.336
32113	5.788	16.648	68.182	0.318
32114	5.571	15.445	46.053	0.340
32115	5.447	15.831	32.353	0.349
32116	5.420	15.701	45.902	0.377
32117	3.377	11.283	14.567	0.318
32121	4.529	14.048	43.846	0.398
32122	4.457	14.369	28.571	0.040
32123	6.015	15.339	20.000	0.016
32129	5.984	15.927	0	0
32130	5.321	15.332	56.818	0.535
32140	5.106	15.266	60.000	0.383
32151	5.268	15.483	57.143	0.685
32152	5.570	15.357	46.154	0.111
32160	3.908	12.833	24.000	0.041
32190	4.368	13.696	32.576	0.293
32210	4.897	14.180	45.921	0.524
32220	6.362	16.163	53.846	0.309
32290	4.742	14.246	54.054	0.589
Overall	5.150	14.983	41.071	0.316

Notes: The exports-sales ratio is the average among exporters

3.2.3.2 Comparisons of exporters versus non-exporters

Table 4 summarizes descriptive statistics comparing exporters with non-exporters in two different points of time (2002 and 2005). Several essential things can be drawn from the table. First, exporters are on average larger than non-exporters. This fact is consistently shown by some measures, such as the number of workers, output value, capital, and value added, in line with the established finding (*e.g.* Aw and Hwang, 1995; Blalock and Gertler, 2004). The size disparity looks remarkable in output value.

Table 4. Comparisons of exporters versus non-exporters: 2002 and 2005

Variable	**Exporters**		**Non-exporters**	
	Mean	**Std. dev**	**Mean**	**Std. dev**
2002				
Output value	16.013	2.198	13.631	2.397
No. of labor	5.950	1.427	4.472	1.397
Capital	12.530	2.792	10.217	3.145
Value added	14.883	2.189	12.667	2.238
TFP	10.299	1.401	9.177	1.400
Labor productivity	8.933	1.237	8.195	1.237
Labor quality	8.043	0.794	7.545	0.902
Capital intensity	6.580	2.247	5.745	2.405
Foreign ownership	0.260	0.439	0.062	0.242
Region	0.859	0.354	0.898	0.303
No. of firms	(309)		(500)	
2005				
Output value	16.146	2.252	13.626	2.478
No. of labor	5.982	1.411	4.444	1.429
Capital	12.320	3.034	9.860	3.362
Value added	14.808	2.067	12.639	2.234
TFP	10.216	1.257	9.188	1.338
Labor productivity	8.826	1.097	8.195	1.171
Labor quality	8.981	0.761	8.269	1.035
Capital intensity	6.339	2.471	5.416	2.584
Foreign ownership	0.232	0.423	0.067	0.250
Region	0.866	0.342	0.930	0.256
No. of firms	(247)		(585)	

Notes: All variables are in logarithmic forms, except for the dummies (foreign ownership and region) and number of firms; Statistics are arranged for the first and last year the firm entered the panel during 2002-2005.

Second, exporters tend to be more productive than non-exporters, supporting previous research (*e.g.* Bernard and Jensen, 1995; Tomiura, 2007). Two measures which are considered by this paper (*i.e.* TFP and labor productivity) have consistently given a similar tendency for year 2002 and 2005. The disparity in productivity may be partly correlated to high capital intensity of exporters. The relative capital intensiveness of the exporters has been quoted by many previous results, such as Aw and Hwang (1995), Bernard and Jensen (1995) and Wakelin (1998).

Third, exporters tend to have more qualified labor than non-exporters, corroborating the results of Arnold and Hussinger (2005). We use average wages as the proxy of the quality of labor, where we assume that the labor quality is positively related to the wage (see Arnold and Hussinger, 2005; Hiep and Ohta, 2007). In our case, exporting firms incline to pay higher average wages, suggesting an extended use of skilled labor among exporters.

Fourth, exporters are more likely to involve foreign capital on their firm ownership. In this matter, the gap between the group of exporters and non-exporters is reported more than threefold in the year 2002 and 2005. Comparing the location where those two groups are positioned, we find that Java Island has more non-exporting firms than exporting firms.

3.2.3.3 Frequency of exporters and non-exporters firms

Table 5 categorizes 3193 firms according to their participation in export market. This table also disaggregates firms based on their size. Firms with more than 20 but less than 100 workers are classified as middle-sized firms, while firms with more than 100 workers are large-sized firms. Some points emerge from the table.

First, the percentage of non-exporter firms is higher than the exporters. On average, about 11% of the surveyed firms export their products, while around 14% of the firms are defined as non-exporters during 2002-2005. Second, the share of exporters is higher among larger firms than among middle firms. Third, in 2004, both firm types (middle and large) are seemingly so attracted by the export market. Probably, the condition is partly attributable to the euphoria of the phasing out of the MFA (Multi Fiber Arrangement). Fourth, although a bit fluctuated, the number of middle firms increases during the period. On the other hand, the number of large firms tends to decline over time.

Table 5. Percentages of exporters and non-exporters firms

	Middle firms				Large firms			
	2002	**2003**	**2004**	**2005**	**2002**	**2003**	**2004**	**2005**
Exporter	1.816	0.720	9.051	1.535	7.830	5.262	11.682	6.170
Non-exporters	9.709	9.959	2.286	11.463	5.919	8.268	1.503	6.827
Total	11.525	10.680	11.337	12.997	13.749	13.530	13.185	12.997

	Total firms (Middle + Large)					
	2002	**2003**	**2004**	**2005**	**Total**	**Mean**
Exporter	9.646	5.982	20.733	7.704	44.065	11.016
Non-exporters	15.628	18.227	3.790	18.290	55.935	13.984

Notes: All percentages are relative to all 3193 firms; Middle firms are those with more than 20 but less than 100 workers, while large firms have more than 100 workers.

3.3 Empirical results

Table 6 reports the general results of our analysis. Using the entire data, Probit models are estimated. Two different definitions of the variable of productivity are introduced. First, we use TFP to represent the productivity of the firm (see the first column of Table 6). Second, instead of TFP, we utilize labor productivity in the second column.

As can be shown, we find that with higher TFP level, textile and apparel firms in Indonesia incline to self-select into the export market (see column 1). This confirms some existing evidences (*e.g.* Roberts and Tybout, 1997; Bernard and Jensen, 2004; etc). Another variable which contribute a significant effect on the export decision is, as expected, firm size. The coefficient is positive and different from zero at a confidence level of 99 per cent, implying that larger firms are significantly more likely to be exporters. This finding in line with several related previous works, such as Bernard and Jensen (2004) and Arnold and Hussinger (2005). However, with regards the coefficient of variable which proxies for labor quality, although its coefficient is positive in both columns, it is not statistically significant in the decision to export. The condition appears may be due to the characteristic of the industry inclines to be more labor intensive. In which, it tends to put less focus on the quality improvement of the labor. The study of Manez *et al* (2004) provides the same result as what we find here.

Table 6. Decision to export: Probit estimation results

Variable	**(1)**			**(2)**		
	Probit coefficient	S.E.	Marginal effect	Probit coefficient	S.E.	Marginal effect
TFP	0.093***	0.053	0.035	-	-	-
Labor productivity	-	-	-	0.093***	0.053	0.035
Size	0.553**	0.048	0.211	0.580**	0.044	0.222
Labor quality	0.024	0.073	0.009	0.024	0.073	0.009
Capital intensity	-0.566**	0.054	-0.216	-0.599**	0.050	-0.229
Foreign ownership	0.689**	0.158	0.269	0.689**	0.158	0.269
Region	-1.359**	0.175	-0.490	-1.359**	0.175	-0.490
Year dummies	included			included		
Industries dummies	included			included		
Log Likelihood:						
Intercept only	-1376.435			-1376.435		
Full	-1315.476			-1315.475		
McFadden's R^2	0.044			0.044		
Fraction of correct prediction	78.83%			78.86%		
Observations	3193			3193		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors; Marginal effect is evaluated at the mean value of each independent variable, where principally, it is given by

$$\frac{\partial[\Pr(y_{it}=1|x_{it})]}{\partial x_{jit}} = \frac{\partial\left[\Phi(x'_{it}b)\right]}{\partial x_{jit}} = f(x'_{it}b)\,b_j$$

Subsequently, capital intensity and region dummy are found to affect significantly the export participations. The relation between those variables and decision to export is negative. Firms with more labor (more labor intensive) will tend to have higher probability to export and firms located in the Java Island are significantly less likely to export. Concerning the latter result, the following points are worth noting. First, it can be related to the fact that most non-exporting firms which are heavily serve for domestic market are indeed located in Java (see the fact in Table 4). Since Java is the most principal island of Indonesia and becomes the largest single market domestically (in term of population and income), so it makes sense if firms incline to concentrate their concern in this area compared than doing exporting. With the support of a relatively better distribution infrastructure, residing in Java makes firms become easier in maintaining their majority customers and managing their potential domestic buyers. Second, probably, cost considerations respecting the selection of firm location still become the main concern of exporter firms. Indeed, if it is compared to other potential regions in Indonesia, Java is still a costly place for the exporters. This circumstance may motivate exporters tend to locate their firm outside of Java whose land and other inputs price or rents are still relatively cheaper.

Foreign ownership has a positive impact on the probability of exporting. This may suggest that the objective of foreign investors is using Indonesia as a productive platform to supply textile commodities for the foreign markets. Its coefficient is significant at 1 per cent level, corroborating the facts which previously found by Abdel-Malek (1974), Manez *et al* (2004) and Hiep and Ohta (2007). Looking at other specific effects, we have no statistical evidence for the dummies which capture the industry difference. For time dummies, we see that there are more chances for firms to export in year 2004.

In column 2, we replace TFP with labor productivity as a proxy for firm productivity. The principal findings are consistent with our first results which are reported in column 1. All coefficient signs and significance are virtually unchanged (except for the time dummies). Consequently, the use of labor productivity does not affect much our previous conclusion. To evaluate the goodness of fit of the model, this paper compares the actual and predicted patterns of the decision to export (shown by fraction of correct predictions). From both models which are considered, the fitness of each model is near the same. Those models predict around 78.8% of the individual trajectories correctly.

Because of the inherent difficulty in interpreting the parameters produced by probit model and in order to measure correctly the importance of all our right-hand-side variables, we report the marginal effect of our model as well. The marginal effects are evaluated at the mean values of each independent variable. The main findings from the marginal effect computation can be summarized as follows. First, the variables of TFP (model 1) and labor productivity (model 2) are positively associated with the decision to export. A 1% increase in the TFP and labor productivity level raise the probability of becoming an exporter by about 0.035 percentage points. Second, the influences of size and capital intensity seem slightly higher for model 2 than model 1. Third, our dummies, *i.e.* foreign ownership, regional, and year of observation, individually give a different effect towards the export decision. Owning the foreign share has the strong enough positive impact (0.269) on being exporters among firms. On the other hand, locating the firm in Java Island makes firms are very unlikely to be an exporter. This region dummy has the largest negative effect (0.490) among all other explanatory variables. Positive effect of time dummies only can be reported by year 2004 in model 1. In that year, chance for firms to export can raise until 0.777 percentage points.

We also generate another scenario for our first specification by eliminating the labor quality variable from the model (see Table 7) due to the lack of significance and the suspicion that labor quality is likely to be correlated with labor productivity. Technically, we repeat the estimation which excludes the labor quality from the set of regressors. The conclusion is qualitatively very similar to the previous one (reported in Table 6), with generally more robust coefficient estimates. Again, productivity (either measured by TFP or labor productivity) significantly increase the decision to export, as do firm size and foreign ownership. In addition, both capital intensity and regional dummy negatively and significantly affect the decision to export. As far as the other specific controls are concerned, industry dummies generally still give no significant impact to probability in exporting (except for manufacture of finished yarn, manufacture of carpets and rugs, and other manufacture of wearing apparel in the case of labor productivity as a proxy for productivity), while time dummies lose its positive effect on firm's export decision. From the goodness of fit of the model, we find that the fraction of correct predictions rises to 78.92% (see also Table A2 and A3 in the Appendix for complete results).

Table 7. Decision to export: Probit estimation results (labor quality is dropped)

Variable	**(1)**			**(2)**		
	Probit coefficient	S.E.	Marginal effect	Probit coefficient	S.E.	Marginal effect
TFP	0.100*	0.048	0.038	-	-	-
Labor productivity	-	-	-	0.100*	0.048	0.038
Size	0.554**	0.048	0.212	0.584**	0.043	0.223
Capital intensity	-0.566**	0.054	-0.216	-0.601**	0.050	-0.230
Foreign ownership	0.692**	0.157	0.271	0.692**	0.157	0.271
Region	-1.358**	0.175	-0.490	-1.358**	0.175	-0.490
Year dummies	included			included		
Industries dummies	included			included		
Log Likelihood:						
Intercept only	-1376.555			-1376.555		
Full	-1315.529			-1315.529		
McFadden's R^2	0.044			0.044		
Fraction of correct prediction	78.92%			78.92%		
Observations	3193			3193		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors.

Looking deeper on the influence of all variable of interest toward decision to export, Table 8 reports the probit estimation results from two groups which are disaggregated by firm size. The noteworthy findings are as follows.

First, there is no significant different from the use of TFP or labor productivity in our disaggregated estimation results. Similar conclusion can be drawn from the first two columns (column 1 and 2) -for middle firm cases- and the last two columns (column 3 and 4) -for large firm cases-. All coefficient signs and significance in both firm sizes are virtually unchanged. However, unlike the middle firms; in large firms, there is no statistically significant evidence for firms with higher productivity will self-select into serving the export market. The presence of self-selection hypothesis is evident only for the middle firms, where in their case; the achievement of higher productivity is correlated with higher exporting probability.

Second, the effect of labor quality on exporting is evident only among middle firms. The influence of average wage (a proxy for labor quality) is negative in both estimation specifications and statistically significant at 10 per cent level. Actually, among the large firms, we find the signs of the variable turning to be positive; however both of them are insignificant. This fact brings us to a conclusion that exporting activity among middle firms in the Indonesian textile and apparel industry are significantly correlated with the using of 'cheap' labor. Another argument also makes sense, when the increase of labor quality happens (means that the wage of their labors also increases averagely), it makes middle firms with limited capital or equity suffer from paying extra costs in doing export, so as a result; they just sell their products to serve the domestic markets in order to keep their margin at least unchanged. This condition shows that the Indonesian textile middle firms are clearly not so competitive in the international market. Finally, the estimates for other variables are consistent with our previous results (Table 6). For all firm sizes; capital intensity and the dummy of Java region reduce exporting probability, while size and foreign ownership increase the decision to export.

Third, the effect of time dummies is only positively and significantly affects the firm's export decision in the case of middle-sized firms, while the industrial effect is no significant in both cases (middle and large firm).

From the computation result of marginal effects, we find that holding other regressors at their mean, a 1% increase in productivity (see TFP for model 1 and Labor productivity for model 2) is associated with an increase of 0.036 percentage points in the probability of becoming exporter among firms which are classified as middle-sized firm. The marginal effects of size variable are larger at the case of large firms than middle firms. Labor quality only has significant effect among middle firms (-0.035). Foreign ownership has the largest positive effect (0.229 for middle firms and 0.210 for large firms) among all other explanatory variables. It implies that with slight increase in the percentage of foreign ownership, firms will be attracted on being exporter. With regards to the goodness of fit measure, the results indicate that the fraction of correct prediction for middle firm case (87.82%) is higher than large firm case (71.65%).

Afterward, some noteworthy facts are found when labor quality is dropped from the set of our regressors (as reported by Table 9). First, for middle firm case; while the statistical significance of TFP and the positive effect of time dummies vanish, all the other results remain the same as in the previous specification (see Table 8). Second, in this specification, time dummies tend to react positively in large firm case. In which, we find that in the year 2002 and 2004, firms have higher probability in exporting. Third, since labor quality becomes one of the key variables in explaining the decision to export for middle firms, the elimination of labor quality variable in that relevant case seemingly is not beneficial for the power of our estimation results (see also Table A4 and A5 in the Appendix for complete results).

Table 8. Estimations disaggregated by firm-specific: middle and large firms

Variable	**Middle firms**						**Large firms**					
	(1)			**(2)**			**(3)**			**(4)**		
	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect
TFP	0.174*	0.081	0.036	-	-	-	0.049	0.070	0.017	-	-	-
Labor productivity	-	-	-	0.174*	0.081	0.036	-	-	-	0.049	0.070	0.017
Size	0.595**	0.151	0.122	0.646**	0.150	0.132	0.547**	0.087	0.192	0.562**	0.083	0.197
Labor quality	-0.170***	0.096	-0.035	-0.170***	0.096	-0.035	0.173	0.113	0.061	0.173	0.113	0.061
Capital intensity	-0.596**	0.156	-0.122	-0.656**	0.155	-0.134	-0.544**	0.092	-0.191	-0.561**	0.088	-0.197
Foreign ownership	0.790*	0.390	0.229	0.790*	0.390	0.229	0.678**	0.189	0.210	0.678**	0.189	0.210
Region	-1.371**	0.181	-0.412	-1.371**	0.181	-0.412	-1.282**	0.351	-0.286	-1.282**	0.351	-0.286
Year dummies	included			Included			included			included		
Industries dummies	included			Included			included			included		
Log Likelihood:												
Intercept only	-470.443			-470.443			-844.692			-844.692		
Full	-459.515			-459.515			-806.329			-806.328		
McFadden's R^2	0.023			0.023			0.045			0.045		
Fraction of correct prediction	87.82%			87.82%			71.65%			71.65%		
Observations	1486			1486			1707			1707		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors.

Table 9. Estimations disaggregated by firm-specific: middle and large firms (labor quality is dropped)

Variable	**Middle firms**						**Large firms**					
	(1)			**(2)**			**(3)**			**(4)**		
	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect
TFP	0.097	0.069	0.020	-	-	-	0.082	0.067	0.029	-	-	-
Labor productivity	-	-	-	0.097	0.069	0.020	-	-	-	0.082	0.067	0.029
Size	0.579**	0.151	0.118	0.607**	0.148	0.124	0.544**	0.087	0.191	0.568**	0.083	0.199
Capital intensity	-0.593**	0.156	-0.121	-0.627**	0.154	-0.128	-0.535**	0.092	-0.187	-0.563**	0.088	-0.198
Foreign ownership	0.789*	0.389	0.229	0.789*	0.389	0.229	0.715**	0.188	0.220	0.715**	0.188	0.220
Region	-1.361**	0.181	-0.409	-1.361**	0.181	-0.409	-1.214**	0.348	-0.279	-1.214**	0.348	-0.279
Year dummies	included			Included			included			included		
Industries dummies	included			Included			included			included		
Log Likelihood:												
Intercept only	-472.465			-472.465			-846.267			-846.267		
Full	-461.091			-461.091			-807.490			-807.490		
McFadden's R^2	0.024			0.024			0.046			0.046		
Fraction of correct prediction	87.82%			87.82%			71.59%			71.59%		
Observations	1486			1486			1707			1707		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors.

Among all other explanatory factors, locating firm in Java Island (see the region dummy) gives the largest negative marginal effect on export decision (-0.412 for middle firms and -0.286 for large firms). The negative effect seems smaller for large firms, indicates that establishing firm in Java will provide the middle-sized firms a relative greater extent to be less likely to export than large firms. In addition, capital intensity brings a strong enough negative impact on export decision among both firm sizes, where the negative effect of this variable is larger for large firms relative to middle firms (around -0.12 for middle firms and around -0.19 for large firms). It could be either due to the fact of the labor intensiveness level condition in both groups or to the weakening of the effect of the capital-labor ratio among large firms by rich human capital of their labors (which can not be controlled by the paper due to data limitation).

3.4 Conclusion

In this paper, empirical evidence concerning the decision to export in Indonesian textile and apparel firms is provided. The results of this paper show that firm characteristics are important determinants for exporting decision. Mostly, the main findings in this study are in line with related previous works. In particular, we find that productivity increases the probability of exporting. Likewise, firm characteristics related to size and foreign ownership has a positive influence on the probability of exporting. On the other hand, variables accounting for capital intensity and Java region dummy affect negatively the decision to export. However, in the general estimation results, we find no significant effect of labor quality on our model. Concerning the estimation results of disaggregated specifications, a consistent finding with the general estimation results is basically provided, except for labor quality variable which is significantly negatively related with exporting in middle-size firms' case. This condition seemingly reflects the actual state of the textile and apparel industry in the developing economy, such as Indonesia. In which, exporters are generally inclined to be more labor intensive, and 'cheap' labors are specifically dominant to be employed among middle firms. Besides, the reason of less competitive in the international market also should be taken into account. Although still showing positive signs, the coefficients of productivity lose their statistical significance when the models are applied for large-sized firms.

Appendix.

Table A1. Description of the considered industry (5-digit ISIC code)

Industry	Description
32111	Spinning mills
32112	Manufacture of threads
32113	Manufacture of finished yarn
32114	Weaving mills except gunny and other sacks
32115	Textile finishing
32116	Textile printing
32117	Batik printing
32121	Manufacture of made-up textile articles except wearing apparels
32122	Sanitary textiles articles
32123	Gunny bags
32129	Other sacks
32130	Knitting mills
32140	Manufacture of carpets and rugs
32151	Manufacture of rope and twine
32152	Articles from rope
32160	Manufacture of kapok
32190	Manufactures of textiles not elsewhere classified
32210	Manufacture of wearing apparel (from textile)
32220	Manufacture of wearing apparel (from leather or fur)
32290	Other manufacture of wearing apparel (from textile, leather or fur)

Table A2. Decision to export: Probit estimation results

Variable	(1)			(2)		
	Probit coefficient	S.E.	Marginal effect	Probit coefficient	S.E.	Marginal effect
TFP	*0.093******	*0.053*	*0.035*	-	-	-
Labor productivity	-	-	-	*0.093******	*0.053*	*0.035*
Size	*0.553***	*0.048*	*0.211*	*0.580***	*0.044*	*0.222*
Labor quality	0.024	0.073	0.009	*0.024*	*0.073*	*0.009*
Capital intensity	*-0.566***	*0.054*	*-0.216*	*-0.599***	*0.050*	*-0.229*
Foreign ownership	*0.689***	*0.158*	*0.269*	*0.689***	*0.158*	*0.269*
Java region	*-1.359***	*0.175*	*-0.490*	*-1.359***	*0.175*	*-0.490*
Year 2002	*- dropped due to collinearity -*			*-2.600***	*0.153*	*-0.629*
Year 2003	*-0.921***	*0.109*	*-0.311*	*-3.521***	*0.171*	*-0.710*
Year 2004	*2.600***	*0.153*	*0.777*	*- dropped due to collinearity -*		
Year 2005	*-0.381***	*0.122*	*-0.140*	*-2.980***	*0.142*	*-0.679*
Spinning mills	8.040	2724.46	0.788	8.040	2724.58	0.788
Manufacture of threads	8.084	2724.46	0.629	8.084	2724.58	0.629
Manufacture of finished yarn	8.977	2724.46	0.662	8.977	2724.58	0.662
Weaving mills except gunny and other sacks	8.010	2724.46	0.925	8.010	2724.58	0.925
Textile finishing	7.643	2724.46	0.732	7.643	2724.58	0.732
Textile printing	7.671	2724.46	0.670	7.671	2724.58	0.670
Batik printing	7.415	2724.46	0.812	7.415	2724.58	0.812
Manufacture of made-up textile articles except wearing apparels	8.494	2724.46	0.739	8.494	2724.58	0.739
Sanitary textiles articles	7.724	2724.46	0.622	7.724	2724.58	0.622
Gunny bags	6.292	2724.46	0.619	6.292	2724.58	0.619
Other sacks	*- dropped due to collinearity -*			*- dropped due to collinearity -*		
Knitting mills	8.459	2724.46	0.810	8.459	2724.58	0.810
Manufacture of carpets and rugs	8.992	2724.46	0.642	8.993	2724.58	0.642
Manufacture of rope and twine	8.108	2724.46	0.622	8.108	2724.58	0.622
Articles from rope	7.840	2724.46	0.628	7.840	2724.58	0.628
Manufacture of kapok	7.837	2724.46	0.639	7.837	2724.58	0.639
Manufactures of textiles not elsewhere classified	7.631	2724.46	0.729	7.631	2724.58	0.729
Manufacture of wearing apparel (from textile)	8.283	2724.46	0.999	8.283	2724.58	0.999
Manufacture of wearing apparel (from leather or fur)	8.054	2724.46	0.640	8.054	2724.58	0.640
Other manufacture of wearing apparel (from textile, leather or fur)	8.958	2724.46	0.727	8.958	2724.58	0.727
Log Likelihood:						
Intercept only	-1376.435			-1376.435		
Full	-1315.476			-1315.475		
McFadden's R^2	0.044			0.044		
Fraction of correct prediction	78.83%			78.86%		
Observations	3193			3193		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors.

Table A3. Decision to export: Probit estimation results (labor quality is dropped)

Variable	(1)			(2)		
	Probit coefficient	S.E.	Marginal effect	Probit coefficient	S.E.	Marginal effect
TFP	0.100*	0.048	0.038	-	-	-
Labor productivity	-	-	-	0.100*	0.048	0.038
Size	0.554**	0.048	0.212	0.584**	0.043	0.223
Capital intensity	-0.566**	0.054	-0.216	-0.601**	0.050	-0.230
Foreign ownership	0.692**	0.157	0.271	0.692**	0.157	0.271
Java region	-1.358**	0.175	-0.490	-1.358**	0.175	-0.490
Year 2002	-2.622**	0.136	-0.632	-2.622**	0.136	-0.632
Year 2003	-3.542**	0.158	-0.712	-3.542**	0.158	-0.712
Year 2004	- dropped due to collinearity -			- dropped due to collinearity -		
Year 2005	-2.982**	0.142	-0.678	-2.982**	0.142	-0.679
Spinning mills	8.073	2737.79	0.789	1.740	1.435	0.566
Manufacture of threads	8.117	2737.79	0.629	1.784	1.600	0.549
Manufacture of finished yarn	9.010	2737.79	0.662	2.677***	1.473	0.620
Weaving mills except gunny and other sacks	8.040	2737.79	0.925	1.707	1.429	0.583
Textile finishing	7.676	2737.79	0.732	1.343	1.441	0.476
Textile printing	7.703	2737.79	0.670	1.370	1.462	0.479
Batik printing	7.436	2737.79	0.812	1.103	1.442	0.413
Manufacture of made-up textile articles except wearing apparels	8.527	2737.79	0.739	2.194	1.444	0.614
Sanitary textiles articles	7.765	2737.80	0.622	1.432	1.773	0.489
Gunny bags	6.333	2737.80	0.619	- dropped due to collinearity -		
Other sacks	- dropped due to collinearity -			-6.333	2737.82	-0.386
Knitting mills	8.495	2737.79	0.810	2.161	1.436	0.628
Manufacture of carpets and rugs	9.035	2737.79	0.642	2.702***	1.550	0.615
Manufacture of rope and twine	8.143	2737.80	0.622	1.810	1.687	0.552
Articles from rope	7.879	2737.79	0.628	1.546	1.587	0.511
Manufacture of kapok	7.863	2737.79	0.639	1.530	1.531	0.510
Manufactures of textiles not elsewhere classified	7.662	2737.79	0.729	1.329	1.443	0.473
Manufacture of wearing apparel (from textile)	8.315	2737.79	0.999	1.982	1.426	0.675
Manufacture of wearing apparel (from leather or fur)	8.087	2737.79	0.640	1.754	1.534	0.547
Other manufacture of wearing apparel (from textile, leather or fur)	8.993	2737.79	0.728	2.660***	1.447	0.639
Log Likelihood:						
Intercept only	-1376.555			-1376.555		
Full	-1315.529			-1315.529		
McFadden's R^2	0.044			0.044		
Fraction of correct prediction	78.92%			78.92%		
Observations	3193			3193		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors.

Table A4. Estimations disaggregated by firm-specific: middle and large firms

Variable	Middle firms						Large firms					
	(1)			(2)			(3)			(4)		
	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect
TFP	0.174*	0.081	0.036	-	-	-	0.049	0.070	0.017	-	-	-
Labor productivity	-	-	-	0.174*	0.081	0.036	-	-	-	0.049	0.070	0.017
Size	0.595**	0.151	0.122	0.646**	0.150	0.132	0.547**	0.087	0.192	0.562**	0.083	0.197
Labor quality	-0.170***	0.096	-0.035	-0.170***	0.096	-0.035	0.173	0.113	0.061	0.173	0.113	0.061
Capital intensity	-0.596**	0.156	-0.122	-0.656**	0.155	-0.134	-0.544**	0.092	-0.191	-0.561**	0.088	-0.197
Foreign ownership	0.790*	0.390	0.229	0.790*	0.390	0.229	0.678**	0.189	0.210	0.678**	0.189	0.210
Region	-1.371**	0.181	-0.412	-1.371**	0.181	-0.412	-1.282**	0.351	-0.286	-1.282**	0.351	-0.286
Year 2002	0.732**	0.190	0.182	0.732**	0.190	0.182	-1.840**	0.205	-0.641	-1.840**	0.205	-0.641
Year 2003	- dropped due to collinearity -			- dropped due to collinearity -			-2.923**	0.221	-0.847	-2.923**	0.221	-0.847
Year 2004	3.901**	0.262	0.946	3.901**	0.262	0.946	- dropped due to collinearity -			- dropped due to collinearity -		
Year 2005	0.762**	0.211	0.186	0.762**	0.211	0.186	-2.529**	0.187	-0.789	-2.529	0.187	-0.789
Spinning mills	6.842	8249.86	0.891	-4.147	9051.85	-0.134	8.077	1396.63	0.641	8.077	1396.62	0.641
Manufacture of threads	4.853	8249.86	0.881	-6.136	9051.85	-0.131	8.693	1396.63	0.316	8.693	1396.62	0.316
Manufacture of finished yarn	5.272	8249.86	0.883	-5.717	9051.85	-0.131	9.386	1396.63	0.376	9.386	1396.62	0.376
Weaving mills except gunny and other sacks	5.656	8249.86	0.962	-5.333	9051.85	-0.285	8.033	1396.63	0.807	8.033	1396.62	0.807
Textile finishing	4.525	8249.86	0.900	-6.464	9051.85	-0.165	7.994	1396.63	0.473	7.994	1396.62	0.473
Textile printing	4.094	8249.86	0.885	-6.895	9051.85	-0.144	8.069	1396.63	0.376	8.069	1396.62	0.376
Batik printing	4.672	8249.86	0.968	-6.317	9051.85	-0.438	9.097	1396.63	0.342	9.097	1396.62	0.342
Manufacture of made-up textile articles except wearing apparels	5.637	8249.86	0.922	-5.352	9051.85	-0.182	8.964	1396.63	0.425	8.964		0.425
Sanitary textiles articles	5.164	8249.86	0.879	-5.825	9051.85	-0.127	7.786	1396.63	0.310	7.788	1396.62	0.310
Gunny bags	- dropped due to collinearity -			- dropped due to collinearity -			6.285	1396.63	0.312	6.285	1396.62	0.312
Other sacks	- dropped due to collinearity -			- dropped due to collinearity -			- dropped due to collinearity -			- dropped due to collinearity -		
Knitting mills	5.494	8249.86	0.925	-5.495	9.917	-0.191	8.798	1396.63	0.592	8.798	1396.62	0.592
Manufacture of carpets and rugs	5.828	8249.86	0.885	-5.161	9051.85	-0.132	9.917	1396.63	0.335	9.917	1396.62	0.335

Table A4. (Cont.)

Variable	Middle firms						Large firms					
	(1)			(2)			(3)			(4)		
	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit Coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect
Manufacture of rope and twine	10.989	12247.3	0.878	*- dropped due to collinearity -*			8.145	1396.63	0.315	8.146	1396.62	0.316
Articles from rope	5.730	8249.86	0.878	-5.259	9051.85	-0.126	7.862	1396.63	0.322	7.862	1396.62	0.322
Manufacture of kapok	5.503	8249.86	0.893	-5.486	9051.85	-0.143	-0.553	2493.07	-0.212	-0.553	1396.62	-0.212
Manufactures of textiles not elsewhere classified	4.770	8249.86	0.920	-6.219	9051.85	-0.203	7.980	1396.63	0.399	7.980	1396.62	0.399
Manufacture of wearing apparel (from textile)	5.895	8249.86	0.981	-5.094	9051.85	-0.875	8.340	1396.63	0.996	8.340	1396.62	0.996
Manufacture of wearing apparel (from leather or fur)	*- dropped due to collinearity -*			-10.989	12247.18	-0.127	8.288	1396.63	0.347	8.288	1396.62	0.347
Other manufacture of wearing apparel (from textile, leather or fur)	6.089	8249.86	0.913	-4.900	9051.85	-0.161	9.488	1396.63	0.433	9.489	1396.62	0.433
Log Likelihood:												
Intercept only	-470.443			-470.443			-844.692			-844.692		
Full	-459.515			-459.515			-806.329			-806.328		
McFadden's R^2	0.023			0.023			0.045			0.045		
Fraction of correct prediction	87.82%			87.82%			71.65%			71.65%		
Observations	1486			1486			1707			1707		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors.

Table A5. Estimations disaggregated by firm-specific: middle and large firms (labor quality is dropped)

Variable	Middle firms						Large firms					
	(1)			(2)			(3)			(4)		
	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect	Probit coef.	S.E.	Marginal effect
TFP	0.097	0.069	0.020	-	-	-	0.082	0.067	0.029	-	-	-
Labor productivity	-	-	-	0.097	0.069	0.020	-	-	-	0.082	0.067	0.029
Size	*0.579***	*0.151*	*0.118*	*0.607***	*0.148*	*0.124*	*0.544***	*0.087*	*0.191*	*0.568***	*0.083*	*0.199*
Capital intensity	*-0.593***	*0.156*	*-0.121*	*-0.627***	*0.154*	*-0.128*	*-0.535***	*0.092*	*-0.187*	*-0.563***	*0.088*	*-0.198*
Foreign ownership	*0.789**	*0.389*	*0.229*	*0.789**	*0.389*	*0.229*	*0.715***	*0.188*	*0.220*	*0.715***	*0.188*	*0.220*
Region	*-1.361***	*0.181*	*-0.409*	*-1.361***	*0.181*	*-0.409*	*-1.214***	*0.348*	*-0.279*	*-1.214***	*0.348*	*-0.279*
Year 2002	*-3.010***	*0.199*	*-0.341*	*0.726***	*0.190*	*0.180*	*0.527***	*0.135*	*0.171*	*0.527***	*0.135*	*0.171*
Year 2003	*-3.736***	*0.239*	*-0.383*	*- dropped due to collinearity -*			*-0.542***	*0.136*	*-0.199*	*-0.542***	*0.136*	*-0.199*
Year 2004	*- dropped due to collinearity -*			*3.736***	*0.239*	*0.933*	*2.537***	*0.186*	*0.539*	*2.537***	*0.186*	*0.539*
Year 2005	*-3.117***	*0.198*	*-0.388*	*0.619***	*0.194*	*0.147*	*- dropped due to collinearity -*			*- dropped due to collinearity -*		
Spinning mills	6.863	8594.45	0.891	-4.036	9436.42	-0.134	8.486	1433.65	0.658	8.519	1545.48	0.659
Manufacture of threads	4.965	8594.45	0.881	-5.934	9436.42	-0.131	9.106	1433.65	0.317	9.140	1545.48	0.317
Manufacture of finished yarn	5.428	8594.45	0.883	-5.471	9436.42	-0.131	9.821	1433.65	0.379	9.855	1545.48	0.380
Weaving mills except gunny and other sacks	5.724	8594.45	0.963	-5.175	9436.42	-0.280	8.419	1433.65	0.824	8.452	1545.48	0.826
Textile finishing	4.590	8594.45	0.900	-6.309	9436.42	-0.164	8.394	1433.65	0.482	8.428	1545.48	0.482
Textile printing	4.212	8594.45	0.886	-6.687	9436.42	-0.143	8.479	1433.65	0.380	8.513	1545.48	0.381
Batik printing	4.792	8594.45	0.970	-6.108	9436.42	-0.425	9.419	1433.65	0.343	9.452	1545.48	0.343
Manufacture of made-up textile articles except wearing apparels	5.699	8594.45	0.922	-5.200	9436.42	-0.180	9.362	1433.65	0.431	9.395	1545.48	0.432
Sanitary textiles articles	5.207	8594.45	0.879	-5.692	9436.42	-0.127	8.285	1433.65	0.310	8.319	1545.48	0.311
Gunny bags	*- dropped due to collinearity -*			*- dropped due to collinearity -*			6.745	1433.65	0.313	6.779	1545.48	0.313
Other sacks	*- dropped due to collinearity -*			*- dropped due to collinearity -*			0.149	2074.54	0.050	0.183	2153.34	0.061
Knitting mills	5.529	8594.45	0.925	-5.370	9436.42	-0.189	9.212	1433.65	0.606	9.245	1545.48	0.607

Table A5. (Cont.)

Variable	Middle firms (1) Probit coef.	(1) S.E.	(1) Marginal effect	(2) Probit coef.	(2) S.E.	(2) Marginal effect	Large firms (3) Probit coef.	(3) S.E.	(3) Marginal effect	(4) Probit coef.	(4) S.E.	(4) Marginal effect
Manufacture of carpets and rugs	5.812	8594.45	0.885	-5.087	9436.42	-0.132	10.344	1433.65	0.336	10.378	1545.48	0.336
Manufacture of rope and twine	10.899	12763.8	0.878	*- dropped due to collinearity -*			8.564	1433.65	0.316	8.597	1545.48	0.316
Articles from rope	5.766	8594.45	0.878	-5.134	9436.42	-0.126	8.322	1433.65	0.323	8.355	1545.48	0.323
Manufacture of kapok	5.612	8594.45	0.894	-5.287	9436.42	-0.142	*- dropped due to collinearity -*			*- dropped due to collinearity -*		
Manufactures of textiles not elsewhere classified	4.845	8594.45	0.920	-6.055	9436.42	-0.201	8.348	1433.65	0.404	8.382	1545.48	0.404
Manufacture of wearing apparel (from textile)	5.951	8594.45	0.982	-4.949	9436.42	-0.861	8.742	1433.65	0.998	8.775	1545.48	0.998
Manufacture of wearing apparel (from leather or fur)	*- dropped due to collinearity -*			-10.899	12763.7	-0.127	8.675	1433.65	0.350	8.709	1545.48	0.350
Other manufacture of wearing apparel (from textile, leather or fur)	6.132	8594.45	0.913	-4.767	9436.42	-0.160	9.896	1433.65	0.439	9.929	1545.48	0.439
Log Likelihood:												
Intercept only	-472.465			-472.465			-846.267			-846.267		
Full	-461.091			-461.091			-807.490			-807.490		
McFadden's R^2	0.024			0.024			0.046			0.046		
Fraction of correct prediction	87.82%			87.82%			71.59%			71.59%		
Observations	1486			1486			1707			1707		

Notes: *, **, and *** indicate significance at the 5%, 1% and 10% respectively; S.E. means standard errors.

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