Trade efficiency and economic development: evidence from a cross country comparison

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FULL TITLE

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Abstract

Economic theory suggests that development is enhanced through income growth, which is driven through increased trade. However, the empirical evidence of such a relationship most of the times is proved to be weak. In this study we try to determine the factors influencing this relationship by measuring "trade efficiency". Using the Data Envelopment Analysis (DEA) window method for a sample of 16 OECD countries, we obtained the efficiency scores and the optimal output levels for the inefficient countries for a time period of five years under consideration. Results drawn from the broadly used ratio analysis were also compared to the results derived from the DEA model. Our empirical findings show that "trade efficient" countries have clear characteristics like low exchange rates for exports, low R&D intensity, high value intra industry trade and positive impact of net trade on their GDP.

Running Head: Trade efficiency and economic development

1. Introduction

The origins of the theoretical literature about trade and economic development are absolute and comparative advantage, as well as the Hecksher-Ohlin model and their followers. Although some models find that growth can affect patterns of international trade, there is no clear evidence about the causal relation between these variables. Empirical literature relating trade and growth has been dedicated to assess the pattern of trade policy on growth, basically trying to find a causal relationship between openness and growth, or more specially, if trade causes growth (McCombie and Thirlwall 1994; Blecker 1992; Edwards 1992, 1998; Frankel and Romer 1999; Grosman and Helpman 1990; Harrison 1996; Harrison and Hanson 1999; Rodriguez and Rodrik 1999).

Some authors try to demonstrate that open economies tend to converge faster to steady state growth than the closed ones (Edwards, 1992, 1998; Krueger, 1997; Ben-David and Kimhi, 2000). Others have found that openness can prevent economic growth due to the harmful effects on infant industries or due to the balance-of-payments constraint in a demand-led approach. Empirical evidence in several countries, mainly in developing ones, seems to support these studies (McCombie and Thirlwall, 1999). Still others are sceptical about the power of openness in pushing up economic growth even using similar methodology with those who advocate the benefits of opening up to growth (Rodriguez and Rodrik, 1999; Rodrik, 1999; Harrison and Hanson, 1999).

Thus although the relationship between trade and growth has been made in several theoretical and empirical studies the association between them is difficult to be established. The growth literature leads to problems such as the endogeneity of the variables whereas empirical policy literature has been proved to be weak in trying to make a clear correlation between openness and growth.

Taking these problems into consideration this study examines empirically the relationship between trade and growth by measuring trade efficiency in terms of its contribution to growth and establishing the major components derived from several development and trade governmental policies. Using data from the manufacturing sector of 16 OECD countries the proposed model compares their trade policies by analysing efficiency in terms of contribution to GDP. Moreover, it extracts the major factors influencing trade efficiency and suggests policies for their maximisation.

This is obtained by using the Data Envelopment Analysis (hereafter DEA) window method in order to compare trade efficiency for the period from 1996 to 2000. For this reason the paper uses for the first time in this type of formulation a number of ratios. Namely we use and construct indicators for the Research and Development intensity of each country in terms of production, the value added shares from the manufacturing sector relative to the total economy, the intra industry trade, the net trade to GDP and the exchange rates for exports.

The proposed model, using chronically these five factors in an input-output framework, determines the trade efficiency of each country in terms of its contribution to economic development. From the analysis we obtained the efficiency scores and the optimal output (ratios) levels for inefficient countries for all the five years under consideration. The results drawn from the broadly used ratio analysis were also compared to the results derived from the DEA window model.

The paper is organized as follows. Section 2 presents a review of the existing literature. In section 3 the technique adopted both in its theoretical and mathematical formulation is presented. Section 4 discusses the ratios used in the formulation of the proposed model. In section 5 the empirical findings of our study are presented. The final section concludes the paper discussing the derived results and the implied policy implications.

2. Literature review

In general, three are the main factors distinguishing trade theory: a) Comparative advantage; b) Resources availability and c) Increasing returns to scale technology and imperfect competition (Krugman and Obstfeld, 2000). More often these factors are hard to be distinguished and separated as they are interrelated. For instance, Antweiler and Trefler (2002) emphasise the fact that if there is a large scale production and market power then there is the possibility to be used for development of efficient technologies and therefore comparative advantage may lead to market power and economies of scale and via versa. Chui *et al.* (2002) highlight the importance of trade and growth as trade policies may be derived from their growth performances. Comparative advantage is the fundamental "ingredient" of markets' trade ability and countries' manufacturing trade structure. Engelbrecht (1998) investigating the impact of R&D intensity on trade performance in the Australian manufacturing sector has found that despite the increase in business R&D expenditure by Australian government in order to increase technological capability, there wasn't any direct impact on its trade performance.

Other studies emphasise the fact that theoretical growth theories are focusing more on the relationship of trade policies and growth, rather than the relationship between trade volumes and growth (Yanikkaya 2003). There are considerable differences between these two especially when other factors such as geographical location, country size and income are taken into account (Rodriguez and Rodrik, 2001). Yanikkaya (2003) using two types of openness measures finds that growth effects of trade with developed countries are not considerably different from trade with developing countries.

Furthermore, other studies in order to investigate the impact of trade on economic development have focused their investigation on the prices of tradable goods. Bhallam and Lau (1992) have noticed that relative prices of tradable goods relative to international prices have a positive effect on GDP growth. Barro (1991) found that prices of investment goods in relation to international prices influence GDP growth per capita while Dollar (1991) found that prices on traded goods have the same impact on GDP.

Finally, there is significant support for studies investigating China linking trade openness, Foreign Direct Investment (FDI), economic development and trade performance (among others, Liu *et al.* 1997; Chuang *et al.*, 2004; Choi 2004). Yao (2006) examines the effects of exports and FDI on economic performance of China finding that export promotion and adoption of world technology and business practices may be proved useful for other developing countries. Moreover Liu *et al.* (2002) investigating the causal link between, inward foreign direct investment, economic growth and trade in China found that there is a reinforcement of FDI, economic growth and trade as a result of China's "open door" trade and investment policy.

Additionally Cuardos *et al.* (2004) using exports, domestic output, inward FDI and foreign income, confirm the applicability of the export-led growth hypothesis in the economies under examination (Mexico and Argentina). The effects of trade liberalisation on the technical efficiency have been examined also by Hossain and Karunarante (2004) using a Cobb-Douglas production frontier to assess Bangladesh manufacturing sector's technical efficiency. They show that the increase of improvement in technical efficiency is due to the regime's external trade policies. Moreover, the majority of export-oriented industries had a high degree of technical efficiency due to a "competitive push", which leads to an economic development of the whole industry.

As has been written there are different ways that trade may or may not influence and stimulate economic development. However, trade policies play a major role on taking advantage of such effects and therefore give an initiative to investigate on more depth taking into account parameters which influence countries' economic development.

3. The Technique

In this study we propose the application of Data Envelopment Analysis window method, which facilitates the comparison of trade efficiency for a sample of 16 OECD countries with the simultaneous use of multiple criteria. In this way trade efficiency for each country is determined. The comparison of relative efficiency of all countries is carried out, relying on the derived efficiency ratio for every country as the solution of a mathematical model. The higher a country's efficiency ratio in relation to the corresponding ratio of another country the higher is the efficiency of that country.

We may think of DEA as measuring the technical efficiency of a given country by calculating an efficiency ratio equal to a weighted sum of outputs over a weighted sum of inputs. For each country (hereafter DMU or Decision Making Unit) these weights are derived by solving an optimization problem which involves the maximization of the efficiency ratio for that country subject to the constraint that the equivalent ratios for every country in the set is less than or equal to 1.

That is DEA seeks to determine which of the 16 DMUs determine an envelopment surface or efficient frontier. DMUs lying on the surface are deemed efficient while DMUs that do not lie on the frontier are termed inefficient and the analysis provides a measure of their relative efficiency. The solution of the model dictates the solution of 16 (the number of countries) linear programming problems, one for each DMU. It provides us with an efficiency measure for each DMU and shows by how much each of a DMU's ratios should be improved if it were to perform at the same level as the best performing countries in the sample. In this way we extract an efficiency ratio for each country, which shows us by how much the ratios of each country could be improved in order to reach the same level of efficiency with that of the most efficient country in the sample.

The fundamental feature of DEA is that technical efficiency score of each DMU depends on the performance of the sample of which it forms a part. This means that DEA produces relative rather than absolute measures of technical efficiency for each DMU under consideration. DEA evaluates a DMU as technically efficient if it has the best ratio of any output to any input and this shows the significance of the outputs/inputs taken under consideration.

3.1 DEA models (CRS vs VRS)

Under the restriction of constant returns to scale (CRS), Charnes *et al*. (1978) specify the linear programming problem representing the fitting of an efficient production surface to the data. An extension permitting variable returns to scale (VRS) is provided by Banker *et al*. (1984). The latter assumption requires an additional constraint on the solution compared with the constant returns to scale case and the resulting efficiency estimate will be greater than that obtained under constant returns to scale. Thus where the methods yield different values the index obtained under variable returns takes account of scale related effects and therefore represents *pure technical efficiency* alone whereas the constant returns to scale measure represents *overall technical efficiency* in which pure technical and *scale efficiency* are combined. Banker *et al*. (1984) show that the index of overall efficiency is equal to the product of the scale and pure technical efficiency indices. Hence, an index of scale efficiency can be obtained by manipulating the DEA results obtained under the assumption of constant and variable returns.

3.2 Advantages and limitations of DEA methodology

DEA modelling can incorporate multiple inputs and outputs. To calculate technical efficiency it only requires information on output and input. This makes it particularly suitable for analysing the efficiency of trade policies. Possible sources of inefficiency can be determined as well as efficiency levels. The technique gives the ability to decompose economic inefficiency into technical and allocative inefficiency. Furthermore, allows technical inefficiency to be decomposed into scale effects. By identifying the 'peers' for the countries which are not observed efficient DEA provides a set of potential benchmarks that the policy makers of the countries can look for ways of improving the effect of their trade policies on economic development.

However some major disadvantages when using this technique must be observed. First, having a deterministic nature DEA produces results that are particularly sensitive to measurement error. If one country's inputs are understated or its outputs overstated then that country can distort the shape of the frontier and reduce the efficiency scores of nearby countries. Second, it only measures efficiency relative to best practice within the particular sample. Thus, it is not meaningful to compare the scores between two different studies because differences in best practice between the samples are unknown. Third, DEA scores are sensitive to input and output specification and the size of the sample. There are different rules as to what the minimum number of countries in the sample should be. One such rule is that the number of DMUs in the sample should be at least three times greater than the sum of the number of outputs and inputs included in the specification (Nunamaker, 1985). Despite the limitations, DEA is a useful tool evaluating the effect of trade policies on economic development.

3.3 The proposed model

Consider N DMUs (in our case 16 OECD countries), each producing m products using n inputs. Efficiency is measured as:

$$f_k = \sum_{i=1}^{m} b_{ik} y_{ik} / \sum_{j=1}^{n} c_{jk} x_{jk} \quad (1)$$

Where y_{ik} (>0) is the amount of output i by the kth DMU, x_{jk} (>0) is the amount of input j used by the kth DMUs, b_{ik} and c_{jk} are the weights (or multipliers) for the output and the input respectively. The efficiency ratio (1) is maximised subject to the constraints:

$$\sum_{i=1}^{m} b_{ik} y_{ik} / \sum_{j=1}^{n} c_{jk} x_{jk} \leq 1 \quad \text{for} \quad k = 1,\ldots, N \tag{2}$$

and
$$b_{ik}, c_{jk} \geq 0 \tag{3}$$

According to the first inequality the efficiency ratios cannot exceed one while according to the second the weights are positive and are determined by DEA in such a way as each DMU maximises its own efficiency ratio.

The problem can be formulated as an ordinary linear program. That is:

$$\text{Maximize} \quad f_k = \sum_{i=1}^{m} \left(\frac{1}{\sum_i c_{ik} x_{il}} b_{ik} \right) y_{ik} \tag{4}$$

subject to
$$\sum_{i=1}^{m} \left(\frac{1}{\sum_i c_{ik} x_{il}} b_{ik} \right) y_{ik} - \sum_{j=1}^{n} \left(\frac{1}{\sum_j c_{jk} x_{jl}} c_{jk} \right) x_{jl} \leq 0 \tag{5}$$

$$\sum_{j=1}^{n} \left(\frac{1}{\sum_j c_{jk} x_{jl}} b_{ik} \right) x_{jk} = 1 \tag{6}$$

and
$$\left(\frac{1}{\sum_i c_{ik} x_{il}} b_{ik} \right) \geq 0, \left(\frac{1}{\sum_j c_{jk} x_{jl}} c_{jk} \right) \geq 0 \tag{7}$$

The envelopment problem is formulated as a "non-Archimedean infinitesimal" and it can be expressed as:

$$\text{Minimize} \quad \theta_k - \tau \left(\sum_{i=1}^{m} s_{lk}^{+} + \sum_{j=1}^{n} s_{jk}^{-} \right) \tag{8}$$

subject to
$$\sum_{l}^{N} \lambda_{kl} y_{il} - y_{il} - s_{lk}^{+} = 0 \qquad i = 1,\ldots m \tag{9}$$

$$\theta_k x_{jk} - \sum_{l}^{N} \lambda_{kl} x_{jl} - s_{jk}^{-} = 0 \qquad j = 1,\ldots n \tag{10}$$

$$\lambda_{kl}, s_{lk}^{+}, s_{jk}^{-} \geq 0 \qquad (11)$$

In the linear programming duality theory the optimal value of θ_k (the overall technical efficiency) equals the optimal value of f_k (θ_k lies between zero and one). In (8) τ represents the lower bound for the weights and ensures that the optimal solutions are at finite non-zero external points and that the optimal solutions are at finite non – zero extremal points. It also ensures that the optimal value of f_k is not affected by the slack in input j.

Technical efficiency is achieved only when θ_k=1 (ensuring that DMUs is on the frontier) and $S_{lk}^{+} = S_{jk}^{-} = 0$ (excluding external points). An inefficient DMU can become efficient by adjusting outputs and inputs as follows:

$$y_{lk}^{*} = y_{lk} + s_{lk}^{+} \qquad (12)$$

and

$$x_{jk}^{*} = \theta_k x_{jk} - s_{jk}^{-}. \qquad (13)$$

Figure 1 about here

The problem in (8) through (11) assumes constant returns to scale (CRS). Figure 1 illustrates the approach using one output and one input. The frontier OF is the solution of the formulated problem in (8)-(11). Countries on the frontier have an efficiency score of one. Countries located inside the frontier have an efficiency score of less than one. For example country s located at point W is inefficient and the overall technical efficiency is measured by the ratio ML/MW.

The overall technical efficiency can be broken into pure technical and scale efficiency. To do that we solve the above linear programming problem with the additional restriction that

$$\sum_{l}^{N} \lambda_{lk} = 1 \qquad (14)$$

which allows for variable returns to scale (VRS). In Figure 1 the VRS case is represented by the straight line segment BC where the points at the line AB are weekly efficient. The pure technical efficiency of country s located at point W is given by the ratio MI/MW= κ_s. The degree of scale efficiency is computed as $\zeta_s = \theta_s / \kappa_s$. By construction κ_s exceeds θ_s. If the value of ζ_s is one the country is scale efficient. If scale inefficiency exists it can be due to either increasing or decreasing returns to scale (IRS or DRS). To differentiate IRS from DRS we solve again the same linear programming problem with the additional restriction of

$$\sum_{l}^{N} \lambda_{lk} \leq 1 \qquad (15)$$

which allows for non-increasing returns to scale (NIRS). In Figure 1, this case is represented by the OBCD frontier. For country s located at point W the efficiency is given by $\phi_s = ML/MW$, which also equals θ_s. By construction $\varphi_s \geq \theta_s$ and $\varphi_s \leq \kappa_s$ if $\varphi_s = \kappa_s$ and scale inefficiency exists then it is due to decreasing returns to scale. If $\kappa_s \neq \varphi_s$ then the scale inefficiency is due to increasing returns to scale (Halkos and Salamouris, 2004).

The DEA model illustrated above has been introduced by Charnes *et al.* (1978); however a variation of this model will be used based on moving averages introduced by Charnes *et al.* (1985).The use of this variation is due to its ability to handle multiple outputs and inputs and their efficiencies over time (Charnes et al. 1994). Asmid *et al.* (2004), highlight the fact that there are no technical changes within each of the windows because all DMUs in each window are measured (compared) against each other and suggest that in order for the results to be credible a narrow window width must be used. Adopting the formalization by Asmid *et al.* (2004) consider the N DMU's (n=1,…,N) observed for T periods (t=1,…,T) using r inputs and s outputs. So this will create a sample of N x T observations where an observation n in period t (DMU_t^n) has an r dimensional input vector

$x_t^n = \left(x_{1t}^n, x_{2t}^n, ..., x_{rt}^n,\right)'$ and an s dimensional output vector $y_t^n = \left(y_{1t}^n, y_{2t}^n, ..., y_{st}^n,\right)'$.

Then a window k_w with k x w observations is denoted starting at time k, $1 \le k \le T$ with width w, $1 \le w \le T-k$. So the matrix of inputs is given as:

$$X_{kw} = \left(x_k^1, x_k^2, ..., x_k^N, x_{k+1}^1, x_{k+1}^2, ..., x_{k+1}^N, x_{k+w}^1, x_{k+w}^2, ..., x_{k+w}^N\right)$$

and the matrix of outputs will be:

$$y_{kw} = \left(y_k^1, y_k^2, ..., y_k^N, y_{k+1}^1, y_{k+1}^2, ..., y_{k+1}^N, y_{k+w}^1, y_{k+w}^2, ..., y_{k+w}^N\right)$$

The DEA window problem for $DMU_t^{'}$ under the CRS assumption is given by solving the linear program illustrated below:

$$\begin{aligned} &\max_{\theta,\lambda} -\theta \\ &s.t. \\ &-X_{kw}\lambda + \theta x_t^{'} \ge 0 \\ &Y_{kw}\lambda - y_t^{'} \ge 0 \\ &\lambda_n \ge 0, (n = 1, ..., N * w) \end{aligned} \quad (16)$$

4. Data

Using data for 16 OECD countries (Table 1) from "Bilateral Trade Database"[1] and for a time span of five years (1996-2000)[2] a number of ratios were constructed and are used in our empirical analysis.

Table 1 about here

Specifically, the first ratio is an indicator showing the R&D intensity of each country in terms of production (**RDIP**). That is:

$$RDIP^k = \frac{ANBERD^k}{PROD^k} * 100 \quad (17)$$

[1] http://www.oecd.org/document/48/0,2340,en_2649_201185_33762800_1_1_1_1,00.html

[2] This period was fully covered in the database with no missing values.

Where ***ANBERD*** and ***PROD*** are business enterprise Research and Development and production at current prices respectively. For each country this indicator expresses the R&D expenditures by the total manufacturing sector relative to the production. This ratio was constructed in order to approach the concern of a country to deal with technological developments and the speed with which the country adapts them.

The second ratio shows the value added shares from manufacturing sector relative to the total economy (**VASH)**. That is

$$VASH_i = \left[\frac{VALU_i^K}{VALU_{total}^K}\right] * 100 \qquad (18)$$

Where **VALU** is the value added at current prices. For a given country, this indicator shows the value added contributed by manufacturing sector relative to total value added for all industries. The valuation of value added differs among countries and may therefore influence the interpretation of this indicator. Value added is measured at basic prices for all countries except JAPAN and the USA, which are used in producer or market prices.

The third indicator shows the intra industry trade (**IIT**). This aspect of the structure of international trade has not received much attention in the existing trade performance literature. In our construction it is expressed as:

$$IIT_{tot.manuf.}^k = \left[1 - \frac{\sum_i \left|\left(EXPO_i^k - IMPO_i^k\right)\right|}{\sum_i \left|\left(EXPO_i^k + IMPO_i^k\right)\right|}\right] * 100 \qquad (19)$$

where **EXPO** and **IMPO** are the total exports and imports of goods at current prices. Intra industry trade is the value of total trade remaining after subtraction of the absolute value of net exports and imports of manufacturing industry. For comparison between countries this measure is expressed as a percentage of manufacturing industry's combined exports and imports. This index ranges from 0 to 100. If a country exports and imports roughly equal quantities of certain products the **IIT** index is high. If trade is mainly one-way (whether exporting or importing) the **IIT** index is low.

Furthermore, the ratio **NTGDP** has been constructed in order to indicate the contribution of net trade to GDP of each country. That is:

$$NTGDP = [(Exports\ of\ commodities - Imports\ of\ commodities)/\ GDP] * 100 \qquad (20)$$

Finally, an indicator of the exchange rate for exports for each country (dollars per local currency) **EXCR** has been used.

Figure 2 about here

5. Empirical Results

Using a conventional ratio analysis as presented graphically in Figure 2a-f different conclusions can be derived looking at the countries from six different measurement perspectives. Looking at Figure 2a and in the case of Great Britain we observe an increase of its exchange rate for exports over the five years with its prices of the exchange rate significantly higher compared to the other countries.

Quite different is the performance of the *EXCR* of Ireland compared to Spain and Belgium. In our study the exchange rate for exports is a “key” determinant of trade efficiency; higher trading performances are influenced by the exchange rate policies of the countries under investigation. A consistency between exchange rates and trade policy helps to implement successfully structural economic reforms and foster economic development of the countries (Richaud *et al.,* 2000).

Guerrieri and Meliciani (2005) emphasize the importance of manufacturing base of a country as a key determinant affecting trading performance. Country’s ability to develop a dynamic economy is linked to the structure of its manufacturing sector. In that respect Ireland, Finland, Belgium and Germany have higher index prices (Figure 2b) in terms of the value added contributed by their manufacturing sectors relative to the total value added for all their industries. Finally, Norway appears to have the lowest value added shares compared to the other countries.

Sharma (2004) emphasizes the fact that structural changes of manufacturing sector and trade liberalization policies have a major impact on countries' total intra-industry trade. Figure 2c illustrates the intra industry trade of manufacturing for each country over the years. Australia and Japan have the lowest performance in terms of exports and imports at current prices. The highest price is observed for Belgium, France, Great Britain, the Netherlands and Spain. Moderate trade performance has been noticed for the USA, Canada, Denmark and Sweden.

The policies aiming to support R&D in order to change the countries' manufacturing trade structure have broadly analyzed by many authors providing unclear results. Among others Engelbrecht (1998) emphasizes the fact that trade and economic development policy makers must be skeptical about the interrelation between R&D expenditure, R&D supporting policies and trade performance. Moreover looking at figure 2d the performance of countries in terms of their R&D expenditure over the five years time period can be observed. We notice that Sweden, Japan and the USA have a significant higher performance in terms of R&D expenditure compared to the other countries. A medium performance is observed for Germany, France, Finland and Great Britain. The lowest performance has been noticed for Spain and Italy. Figure 1e indicates the net trade of commodities as a percentage of GDP. Observing the performance of countries we realize that Finland, Norway, Sweden and the Netherlands have the highest contribution to their GDP from trade whereas Australia, Great Britain and the USA have a negative contribution. In the case of Norway the first 4 years present a tremendous increase of trade as its economy was based mainly on exports while an even greater reduction for net trade performance for the last year under consideration can be noticed.

Finally all the above conventional analysis must be viewed and compared along with the last graph illustrated in figure 1f in order to have a clear view of trade efficiency and its impact on economic development for the countries examined. Looking at Figure 1f we observe that the two countries with the highest GDP rates are the USA and Japan. These are the countries, which have the lowest impact of trade on their GDP (figure 1e), which in turn raises the question between economic development, trade policies and trade efficiency.

Using conventional ratio analysis shows us the performance of the countries under review but from (in our case) six different angles. However it is difficult to have a clear view of countries' trade contribution to economic development even though the observations through the ratios give us detailed insights of the factors that affect trade efficiency. In order to overcome the problem of "multiple views" we use DEA modeling to observe trade efficiency in terms of a number of inputs and outputs, which will provide us with a unified and simultaneous picture of trade efficiency among the countries considered.

Focusing our interest on changes in efficiency over time DEA window analysis is used for analysis purposes. In such a case moving average analogue is applied. DMUs in each period are treated as if they were different DMUs. A DMU's performance in a particular period is contrasted with its performance in other periods in addition to the performance of the other DMUs.

In our case the DMUs are the OECD countries (n=16) over five years period (p=5) and we proceed our analysis by using a three –year (w=3) window. Each DMU (country) is represented as if it was a different DMU for each of the three years in the first window (Years 1, 2 and 3). An analysis of the 48 (nw = 3 x 16) DMUs is taking place. The window is then moved one period by replacing Year 1 with Year 4 and an analysis is performed on the second three year set (Years 2, 3 and 4) of these 48 DMUs. The process continues moving the window one period and concluding with the final (third) analysis of 48 DMUs for the last three years (Years 3, 4 and 5). This procedure implies p-w+1 separate analyses, where each analysis examines n*w DMUs.

Table 2a illustrates the results of the analysis in the form of overall efficiency and pure technical efficiency while Table 2b presents the scale efficiency scores for the performance of the 16 OECD countries considering the VASH, RDIP and EXCR as inputs and the IIT and NTGDP ratios as outputs. The underlying framework of the window analysis is illustrated on this table. For the first window Australia (AUS) is represented in the constrains of the DEA model as if it was a different DMU in the years 1, 2 and 3. Therefore, when Australia is evaluated for its Year 1 efficiency, its own performance data for Year 2 and Year 3 are included in the constraint sets along with similar performance data of the other OECD countries for Years 1, 2 and 3. Concluding the results of the first window analysis include all the 48 efficiency scores under the column headings for Years 1 to 3 in the first row of each OECD country.

Table 2a-b about here

Scale efficiency scores are calculated by dividing overall efficiency by pure efficiency as can be found in Coelli *et al.* (2001). If the overall efficiency and pure technical efficiency of a DMU (country) are equal then the scale efficiency is 1. If however the DMU has lower overall efficiency compared to pure technical efficiency its scale efficiency will be below 1 (Thanassoulis, 2001). A lower overall efficiency score compared to pure technical efficiency score suggests that a country is efficient in trade terms in the former case and less efficient when we control for scale size (in trade terms). This means that scale operation does impact the trade efficiency of the country. Therefore, the larger the divergence between overall and pure technical efficiency scores the lower the value of scale efficiency (in trade terms) and the more adverse the impact of scale size on trade efficiency. Scale scores results are presented in Table 2b. As it can be observed for instance Canada has a low pure technical efficiency score in year 5 of 0.8594 or 85.94% and relatively high scale efficiency (0.964 or 96.4%). This means that the overall trade inefficiency of that country in the overall efficiency model (0.8292 or 82.92%) is attributed mainly to inefficient trade policies and comparative disadvantages. The same holds also for other countries such as Denmark, Japan and Norway.

On the other hand if a country has an optimal pure technical efficiency score (100) and low scale efficiency score this may imply that the trade overall inefficiency is attributed to comparative disadvantages conditions. Australia may be viewed as an example of this case where it has an optimal pure technical efficiency (year 5) and a relative scale efficiency score of 0.71. Finally our results show that Australia and Norway display increasing returns to scale while Belgium, Italy, the Netherlands, and Spain exhibit constant returns to scale and the rest of the countries decreasing returns to scale.

Table 3 decomposes overall average efficiency scores for each country in each window clarifying trends of trade efficiencies over the years. Similarly, pure technical efficiency has been decomposed. Countries can be distinguished into three different groups: countries with an overall efficiency over 90% (Group 1), with an overall efficiency between 80% and 90% (Group 2) and with overall trade efficiency below 80% (Group 3). The first group includes Belgium, France, Italy, the Netherlands, Norway, and Spain. It is worth mentioning that in the cases of Belgium and France we observe a tendency of decrease over the three windows of 1.01% and 0.4% respectively whereas for the other countries of the group there is an increasing trend of overall trade efficiency. Group 2 consists of Canada, Denmark, Great Britain and the USA. From these countries only Canada indicates a decrease on its efficiency (0.19%) over the three windows, whereas the USA has the highest increase of 4.35%. Finally the third group includes Australia, Finland, Germany, Ireland, Japan, and

Sweden. All the countries forming the third group have an increase in their overall trade efficiency with the highest increase observed in Japan (12.3%) and the lowest for Sweden (0.82%). However it is worthy mentioning that Finland and Ireland although they have low overall efficiency scores they have extremely high scores of pure technical efficiency. Antweiler and Trefler (2002) and Chui *et al.* (2002) emphasize the fact that large scale production and market power can be used for development of efficient technologies and comparative advantage. In that sense Finland and Ireland are trading only goods and/or services which are specialized on producing them and therefore have a comparative advantage in comparison with other countries.

Table 3 about here

Table 4 corroborates the results shown in table 3 by reporting rankings, means and variances across all windows, the greatest differences by window and by year. It illustrates the relative stability of each country's overall trade efficiency results and its further indication of the trade efficiency and stability of Spain. Given the fact that Spain reports an overall efficiency (in trade terms), no variability is a strong indication of healthy and strong trade performance. Stability in performance is further observed by the greatest difference scores being the lowest whether measured by window (GDW) or by year (GDY). Moreover, Belgium has the second best performance with an overall mean efficiency of 99.49 and with a variance of 1.1. Observing Italy we notice that even though is fourth in terms of its trade efficiency (with a mean of 97.28) it seems that it hasn't a stable performance with a variance of its efficiency of 24.9 and with a greatest window difference of 15.1. Table 4 indicates also a low trade performance for Sweden, Australia, Germany, Finland, Ireland and Japan. Generally, the most consistent trade performers are Spain, Belgium and the Netherlands with very high trade efficiency means and low variances.

Table 4 about here

Table 5 provides us with the rankings of all the countries according to highest scores obtained from conventional ratio and window analyses. Furthermore, looking at the rankings according to the value added shares from manufacturing sector relative to the total economy of the countries (VASH) we realize that Ireland and Finland have the highest performances even though when looking at the window analysis ranking they are in the 14th (Finland) and 15th place (Ireland). The fact that they are so high in the ranking of VASH explains the fact that they have so high scores in terms of pure technical efficiency (Table 3).

Looking at the rankings for R&D expenditures by the total manufacturing sector relative to the total economy (RDIP) we realize that Japan lies on the 3rd place compared to the trade efficiency ranking which has the worst trade performance. Countries which are the last in the ranking of RDIP ratio are the most trade efficient according in the DEA window analysis (Spain)[3].

In the same lines, when we observe the exchange rate for exports for each country we realize that countries with higher exchange rates are the ones which are in the lower places of our DEA ranking and therefore they are less trade efficient compared to Belgium and Spain, which have the lowest average exchange rate prices for exports.

Table 5 about here

Figure 3 provide us with essential information comparing overall efficiency and ratios. More analytically we realize graphically that countries which are more trade efficient have, as expected, lower exchange rates for exports. Moreover countries with lower research and development expenditure are more trade efficient. This is justified by the fact that most of the

[3] An economic interpretation may rely on that a country has to decide if it will be a technological leader or a technological follower. The former case requires the involvement in expensive R & D activities. This may lead to new inventions through patents or even to nowhere. On the other hand the technological follower has to search for access to the technology developed by the leader. This may be achieved either by developing a similar version but having to bear a lower R & D cost compared to the leader or by licensing the new technology from the leader (Blake, 1993).

goods which are tradable are agricultural products. Furthermore high technology goods and services are costly to be traded due to tariffs and taxes which are imposed from the importing countries. As expected countries with higher value of IIT are trade efficient.

Figure 3 about here

These results are supported by the derived targeted values presented in table 6. These values are obtained for the trade inefficient countries in order to become efficient. It is noticeable that the targeted values for VASH and RDIP ratios require moderate changes for inefficient countries in order to become trade efficient. On the other hand looking at the targeted values for EXCR these are quite high. Taking Japan as an example we realize that in order for Japan to become trade efficient it has to reduce its exchange rates for exports (probably making its commodities more competitive), increasing significantly the intra industry trade and enhancing policies for trade to contribute to the country's growth. A similar picture is valid in the case of Australia, Canada and Great Britain while Germany, Ireland and Italy have to reduce their exchange rates for exports, increasing their IIT ratio.

Table 6 about here

6. Conclusions and Policy Implications

In this study we performed an application of DEA window analysis in order to compare international trade efficiency by using conventional ratio measures in the suggested model and for the time period 1996–2000. The efficiency scores and the optimal ratio levels for inefficient countries for all the five years of the study were obtained. Results drawn from the broadly used ratio analysis were also compared to the results derived from the DEA window model. The advantage of using DEA compared to economic ratios is that DEA provides us with an overall objective numerical score, ranking, and efficiency potential improvement targets for each one of the inefficient units.

The results of our study support the empirical findings of Richard *et al.* (2000) emphasizing the consistency of countries' exchange rate policy and their trade efficiency. Furthermore trade efficiency is also associated with structural changes in the manufacturing sector and trade liberalization policies. This is also supported by Sharma (2004). In terms of the importance of the value added by the manufacturing sector and its affect to trade efficiency our empirical results find support in the study of Guerriere and Meliciani (2005). Additionally our results indicate that R&D intensity have no major effect on trade efficiency supporting Engelbrecht's (1998) view. This implies that there is no obvious link between trade performance and R&D supporting policies.

According to our findings trade efficient countries have the following clear characteristics:

- Low exchange rates. As expected looking at the exchange rate for exports for each country we realize that countries with higher exchange rates are the ones, which are in the lower places of our DEA ranking and therefore they are less trade efficient.
- Low R&D intensity. Countries with low ranking according to their RDIP ratio are the most trade efficient in the DEA window analysis.
- High value intra industry trade. This is emphasising the liberalization policies of a country and its contribution to trade efficiency.
- The combination of the above mentioned factors has positive effect on the contribution of net trade to GDP of each country.
- Countries with high ranking according to their VASH ratio have high scores in terms of pure technical efficiency.
- Scale operation does affect the trade efficiency of the country. The larger the divergence between overall and pure technical efficiency scores the lower the

value of scale efficiency (in trade terms) and the more adverse the impact of scale size on trade efficiency.

Although our study does not support directly trade's contribution to economic development it seems that trade contributes to the reform of manufacturing structure and market openness, which in turn causes growth. In that respect our study of trade efficiency comes along with the view of causal relationship between openness and growth as has been expressed by several of scholars (McCombie and Thirlwall 1994; Blecker 1992; Edwards 1992, 1998; Frankel and Romer 1999; Grosman and Helpman 1990; Harrison 1996; Harrison and Hanson 1999; Rodriguez and Rodrik 1999).

Institutional change and infrastructure modernization agendas are complex and priorities differ across countries. Therefore trade contribution to economic development may vary from country to country according to the factors affecting the key elements distinguish trade theory as has been expressed by Krugman and Obstfeld (2000). For instance the cost of moving goods across international borders is now as important as tariffs in determining the cost of landed goods. The ability of countries to deliver goods and services in time and at low costs is a key determinant of trade efficiency and its contribution to countries' economic development. Finally the historical and institutional context of each country must be taken into account along side with the micro- and macro-economic aspects to growth and with their interrelations with trade.

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Figure 1: DEA output-input frontier

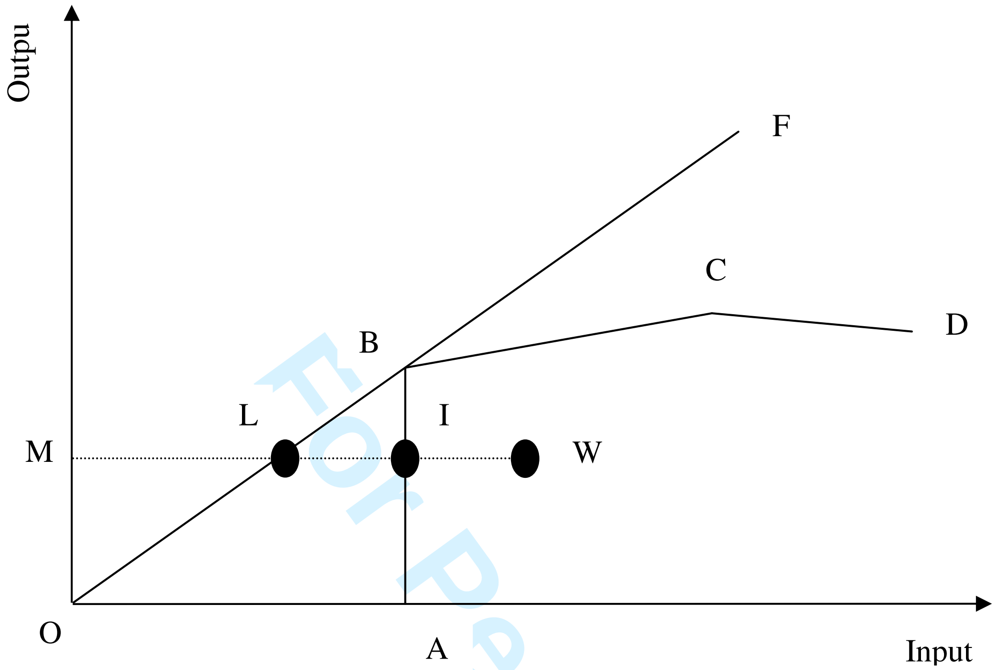

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Table 1: Description and variable codes.

Code	Country Name	Code	Country Name	Variables	Variable name
AUS	Australia	***ITA***	Italy	***IIT***	Intra Industry Trade
BEL	Belgium	***JPN***	Japan	***VASH***	Value Added Shares
CAN	Canada	***NLD***	Netherland	***RDIP***	R&D Intensity
DEN	Denmark	***NOR***	Norway	***EXCR***	Excange rates for exports
FIN	Finland	***ESP***	Spain		
FRA	France	***SWE***	Sweden	***NTGDP***	Net trade of total goods and services as a percentage of GDP
DEU	Deutschland	***GBR***	Great Britain		
IRL	Ireland	***USA***	United States		

Figure 2: (a) Exchange rate for e xports; (b) Value added shares; (c) Intra Industry Trade; (d) R&D Intensity; (e) NTGDP; (f) GDP.

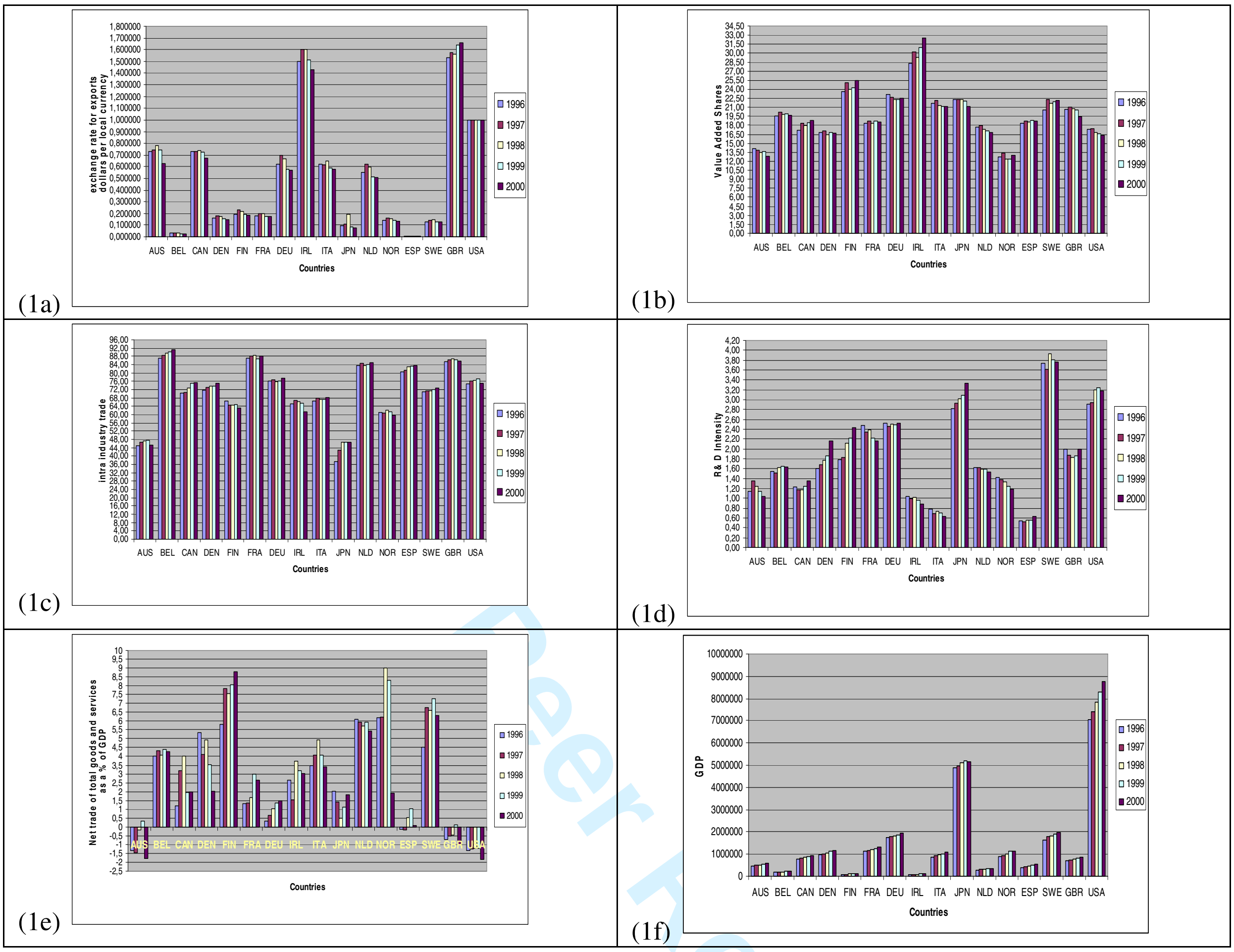

Table 2 (a): Window Analysis; Overall Efficiency, Pure Technical Efficiency.

	Overall Efficiency					*Pure Technichal Efficiency*				
DMUs/Years	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*
AUS	65,579	67,711	71,333			65,624	68,04	71,419		
		67,711	71,333	72,355			67,714	71,334	72,496	
			69,651	70,692	71,067			71,177	72,493	100
BEL	100	100	100			100	100	100		
		98,572	99,929	100			100	99,977	100	
			96,981	100	100			97,9	100	100
CAN	86,21	81,49	85,636			87,063	84,571	90,636		
		81,49	85,636	86,447			83,633	89,602	88,283	
			84,913	85,017	82,917			89,602	87,018	85,937
DEN	87,248	86,614	90,678			90,545	90,158	93,457		
		86,609	90,667	89,695			89,848	93,158	91,03	
			90,176	88,848	91,486			92,295	90,419	92,927
FIN	58,583	66,817	58,373			87,056	95,285	94,007		
		66,139	57,768	65,333			95,277	93,9	96,921	
			57,768	65,333	70,44			93,872	96,894	99,442
FRA	96,759	94,97	97,637			98,874	99,175	100		
		94,959	97,626	95,599			99,04	100	98,576	
			97,146	94,754	96,32			100	97,514	98,922
DEU	65,296	67,39	67,666			85,109	85,946	84,83		
		67,39	67,666	67,82			85,371	84,263	84,664	
			67,657	67,813	68,061			83,019	83,415	84,691
IRL	58,723	53,521	64,938			79,51	78,108	85,895		
		51,242	64,144	62,625			77,677	84,975	82,89	
			64,144	62,593	63,288			84,975	82,89	79,192
ITA	84,819	100	100			90,816	100	100		
		99,061	100	95,867			100	100	95,924	
			100	95,855	100			100	95,865	100
JPN	33,422	38,176	41,741			42,741	47,876	52,267		
		38,176	41,741	42,038			47,556	51,918	51,948	
			41,736	42,033	43,508			51,151	51,182	50,889
NLD	96,065	96,27	98,307			100	100	100		
		96,27	98,307	99,984			100	98,923	100	
			95,96	97,7	100			98,829	100	100
NOR	96,121	91,231	100			100	92,027	100		
		91,231	100	100			91,97	100	100	
			100	100	93,24			100	100	93,565
ESP	100	100	100			100	100	100		
		100	100	100			100	100	100	
			100	100	100			100	100	100
SWE	72,94	69,763	69,107			84,995	96,422	95,565		
		68,074	69,082	77,055			95,745	94,892	99,145	
			68,035	77,055	68,452			94,752	99,014	94,508
GBR	83,228	83,688	85,226			95,442	96,624	96,865		
		83,688	85,226	85,586			95,978	96,217	95,92	
			83,136	83,404	87,425			94,797	94,504	94,267
USA	85,457	86,658	90,121			88,684	89,968	93,269		
		86,658	90,121	92,038			89,202	92,161	94,031	
			90,11	92,026	91,499			90,142	92,026	91,5

Table 2 (b): Window Analysis; Scale Efficiency.

DMUs/Years	Scale Efficiency Year 1	Year 2	Year 3	Year 4	Year 5
AUS	0,999 (DRS)	0,995 (DRS)	0,998 (DRS)		
		1 (CRS)	1 (CRS)	0,998 (DRS)	
			0,978 (IRS)	0,975 (IRS)	0,710 (IRS)
BEL	1 (CRS)	1 (CRS)	1 (CRS)		
		0,985 (IRS)	1 (CRS)	1 (CRS)	
			0,990 (DRS)	1 (CRS)	1 (CRS)
CAN	0,990 (DRS)	0,963 (DRS)	0,944 (DRS)		
		0,974 (DRS)	0,955 (DRS)	0,979 (DRS)	
			0,947 (DRS)	0,977 (DRS)	0,964 (DRS)
DEN	0,963 (DRS)	0,960 (DRS)	0,970 (DRS)		
		0,963 (DRS)	0,973 (DRS)	0,985 (DRS)	
			0,977 (DRS)	0,982 (DRS)	0,984 (DRS)
FIN	0,672 (DRS)	0,701 (DRS)	0,620 (DRS)		
		0,694 (DRS)	0,615 (DRS)	0,674 (DRS)	
			0,615 (DRS)	0,674 (DRS)	0,708 (DRS)
FRA	0,978 (DRS)	0,957 (DRS)	0,976 (DRS)		
		0,958 (DRS)	0,976 (DRS)	0,969 (DRS)	
			0,971 (DRS)	0,971 (DRS)	0,973 (DRS)
DEU	0,767 (DRS)	0,784 (DRS)	0,797 (DRS)		
		0,789 (DRS)	0,803 (DRS)	0,801 (DRS)	
			0,814 (DRS)	0,812 (DRS)	0,803 (DRS)
IRL	0,738 (DRS)	0,685 (DRS)	0,756 (DRS)		
		0,659 (DRS)	0,754 (DRS)	0,755 (DRS)	
			0,754 (DRS)	0,755 (DRS)	0,799 (DRS)
ITA	0,933 (DRS)	1 (CRS)	1 (CRS)		
		0,990 (IRS)	1 (CRS)	0,999 (IRS)	
			1 (CRS)	1 (CRS)	1 (CRS)
JPN	0,781 (DRS)	0,797 (DRS)	0,798 (DRS)		
		0,802 (DRS)	0,803 (DRS)	0,809 (DRS)	
			0,815 (DRS)	0,821 (DRS)	0,854 (DRS)
NLD	0,960 (DRS)	0,962 (DRS)	0,983 (DRS)		
		0,962 (DRS)	0,993 (DRS)	1 (CRS)	
			0,970 (DRS)	0,977 (DRS)	1 (CRS)
NOR	0,961 (IRS)	0,991 (DRS)	1 (CRS)		
		0,991 (DRS)	1 (CRS)	1 (CRS)	
			1 (CRS)	1 (CRS)	0,996 (IRS)
ESP	1 (CRS)	1 (CRS)	1 (CRS)		
		1 (CRS)	1 (CRS)	1 (CRS)	
			1 (CRS)	1 (CRS)	1 (CRS)
SWE	0,858 (DRS)	0,723 (DRS)	0,723 (DRS)		
		0,710 (DRS)	0,728 (DRS)	0,777 (DRS)	
			0,718 (DRS)	0,778 (DRS)	0,724 (DRS)
GBR	0,872 (DRS)	0,866 (DRS)	0,879 (DRS)		
		0,871 (DRS)	0,885 (DRS)	0,892 (DRS)	
			0,876 (DRS)	0,882 (DRS)	0,927 (DRS)
USA	0,963 (DRS)	0,963 (DRS)	0,966 (DRS)		
		0,971 (DRS)	0,977 (DRS)	0,978 (DRS)	
			1 (CRS)	1 (CRS)	1 (CRS)

Table 3: Average efficiency scores for each country in each window

DMUs/ windows' averages	Overall efficiency				Pure Technical Efficiency			
	window 1	window 2	window 3	% Difference w1-w3	window 1	window 2	window 3	% Difference w1-w3
AUS	68,21	70,47	70,47	3,32	68,36	70,51	81,22	18,82
BEL	100,00	99,50	98,99	-1,01	100,00	99,99	99,30	-0,70
CAN	84,45	84,52	84,28	-0,19	87,42	87,17	87,52	0,11
DEN	88,18	88,99	90,17	2,26	91,39	91,35	91,88	0,54
FIN	61,26	63,08	64,51	5,32	92,12	95,37	96,74	5,02
FRA	96,46	96,06	96,07	-0,40	99,35	99,21	98,81	-0,54
DEU	66,78	67,63	67,84	1,59	85,30	84,77	83,71	-1,86
IRL	59,06	59,34	63,34	7,25	81,17	81,85	82,35	1,46
ITA	94,94	98,31	98,62	3,87	96,94	98,64	98,62	1,74
JPN	37,78	40,65	42,43	12,30	47,63	50,47	51,07	7,24
NLD	96,88	98,19	97,89	1,04	100,00	99,64	99,61	-0,39
NOR	95,78	97,08	97,75	2,05	97,34	97,32	97,86	0,53
ESP	100,00	100,00	100,00	0,00	100,00	100,00	100,00	0,00
SWE	70,60	71,40	71,18	0,82	92,33	96,59	96,09	4,08
GBR	84,05	84,83	84,66	0,72	96,31	96,04	94,52	-1,86
USA	87,41	89,61	91,21	4,35	90,64	91,80	91,22	0,64

Table 4: Window analysis –Rankings, means, variances, greatest difference within window (GDW) and greatest difference in the same year but different window (GDY)

DMUs	*GDW*	*GDY*	*Mean*	*Variance*	*Ranking*
ESP	0	0	100	0	1
BEL	3,019	2,948	99,498	1,11131875	2
NLD	2,3	2,347	97,6514444	2,62662003	3
ITA	15,181	0,939	97,2891111	24,9333661	4
NOR	8,769	0	96,8692222	15,7898797	5
FRA	2,667	0,845	96,1966667	1,353155	6
USA	3,463	0,012	89,4097778	6,29850244	7
DEN	4,058	0,847	89,1134444	3,50342853	8
GBR	4,021	2,182	84,5118889	2,09828561	9
CAN	-4,72	1,43	84,4173333	3,787293	10
SWE	9,02	1,689	71,0625556	13,7114723	11
AUS	3,622	1,682	69,7146667	5,016313	12
DEU	2,094	0,009	67,4176667	0,67695725	13
FIN	-8,444	0,678	62,9504444	23,288344	14
IRL	12,902	2,279	60,5797778	25,0549984	15
JPN	4,754	0,005	40,2856667	9,85725525	16

Table 5: Rankings and average values according to the ratios used and the DEA window analysis.

VASH /Rank	DMUs	Average value of Years 95-00	RDIP/ Rank	DMUs	Average value of Years 95-00	NTGDP/ Rank	DMUs	Average value of Years 95-00
1	*IRL*	30,2443289	1	*SWE*	3,76734542	*1*	*FIN*	7,616704
2	*FIN*	24,4871573	2	*USA*	3,09521077	*2*	*NOR*	6,325158
3	*DEU*	22,5550636	3	*JPN*	3,0364985	*3*	*SWE*	6,28069
4	*JPN*	21,9856671	4	*DEU*	2,5006202	*4*	*NLD*	5,827938
5	*SWE*	21,6603509	5	*FRA*	2,3152444	*5*	*BEL*	4,213006
6	*ITA*	21,49262	6	*FIN*	2,07312906	*6*	*ITA*	3,988228
7	*GBR*	20,5156603	7	*GBR*	1,90891696	*7*	*DEN*	3,977936
8	*BEL*	19,7921173	8	*DEN*	1,81608936	*8*	*IRL*	2,82598
9	*ESP*	18,6007695	9	*BEL*	1,59154751	*9*	*CAN*	2,473358
10	*FRA*	18,4975284	10	*NLD*	1,58890337	*10*	*FRA*	2,00105
11	*CAN*	18,1106355	11	*NOR*	1,31297721	*11*	*JPN*	1,37107
12	*NLD*	17,3460502	12	*CAN*	1,23108328	*12*	*DEU*	0,974004
13	*USA*	16,8977581	13	*AUS*	1,18116865	*13*	*ESP*	0,252354
14	*DEN*	16,7656618	14	*IRL*	0,97939034	*14*	*GBR*	-0,5001392
15	*AUS*	13,5770863	15	*ITA*	0,70466916	*15*	*AUS*	-0,881146
16	*NOR*	12,7616214	16	*ESP*	0,55962193	*16*	*USA*	-1,36823
EXCR /Rank	**DMUs**	**Average value of Years 95-00**	**IIT/ Rank**	**DMUs**	**Average value of Years 95-00**	**Window Analysis Rank**	**DMUs**	**Averages scores/ window analysis**
1	*GBR*	1,593832	1	*BEL*	89,2362129	1	*ESP*	100
2	*IRL*	1,529264	2	*FRA*	87,7038911	2	*BEL*	99,498
3	*USA*	1	3	*GBR*	86,1009596	3	*NLD*	97,65144444
4	*AUS*	0,725403	4	*NLD*	84,1171103	4	*ITA*	97,28911111
5	*CAN*	0,7181632	5	*ESP*	82,3567296	5	*NOR*	96,86922222
6	*DEU*	0,6256474	6	*DEU*	76,4748752	6	*FRA*	96,19666667
7	*ITA*	0,609308	7	*USA*	75,919439	7	*USA*	89,40977778
8	*NLD*	0,5563836	8	*DEN*	73,4269361	8	*DEN*	89,11344444
9	*FIN*	0,2040604	9	*CAN*	72,8600179	9	*GBR*	84,51188889
10	*FRA*	0,1836148	10	*SWE*	71,6184693	10	*CAN*	84,41733333
11	*DEN*	0,162012	11	*ITA*	67,428486	11	*SWE*	71,06255556
12	*NOR*	0,145913	12	*IRL*	64,9667409	12	*AUS*	69,71466667
13	*SWE*	0,1353584	13	*FIN*	64,6119426	13	*DEU*	67,41766667
14	*JPN*	0,11200894	14	*NOR*	61,022402	14	*FIN*	62,95044444
15	*BEL*	0,0302406	15	*AUS*	46,3137573	15	*IRL*	60,57977778
16	*ESP*	0,0073672	16	*JPN*	44,0572182	16	*JPN*	40,28566667

Figure 3: Overall efficiency versus VASH; RDIP; EXCR; IIT; NTGDP and GDP

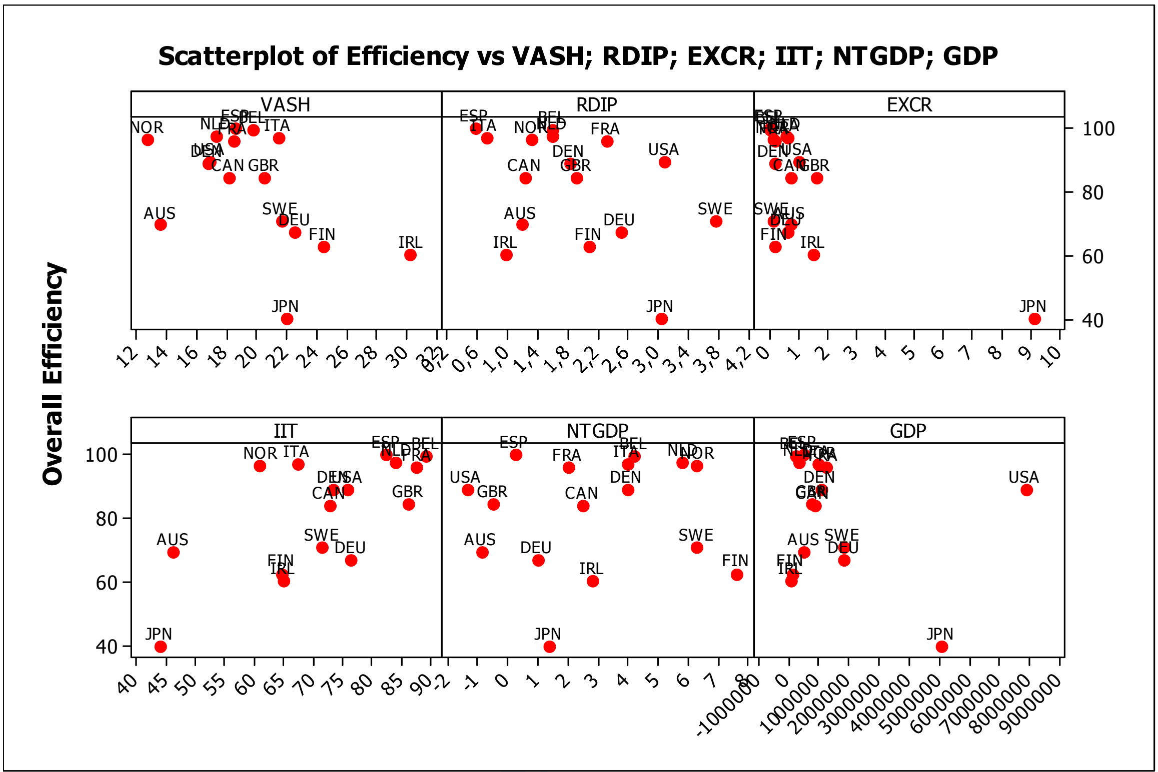

Table 6: Targeted values for the trade inefficient countries to become trade efficient

Dmus/ratios	VASH	RDIP	EXCR	IIT	NTGDP
AUS	12,9000	1,0318	0,6282	45,2704	-1,8017
(targeted)	***12,8980***	***1,0313***	***0,3166***	***63,6522***	***3,3598***
BEL	19,6071	1,6294	0,0276	91,3616	4,2639
(targeted)	***19,6071***	***1,6294***	***0,0276***	***91,3616***	***4,2639***
CAN	18,7393	1,3475	0,6742	75,5266	2,0036
(targeted)	***18,7362***	***1,3478***	***0,3808***	***90,9671***	***4,0349***
DEN	16,6914	2,1607	0,1496	75,1113	2,0172
(targeted)	***16,6926***	***1,4218***	***0,1524***	***79,4656***	***4,0882***
FIN	25,4403	2,4296	0,1874	62,9306	8,8126
(targeted)	***25,4423***	***2,1561***	***0,1914***	***120,5730***	***6,0826***
FRA	18,5611	2,1580	0,1698	88,0536	2,6523
(targeted)	***17,1893***	***1,2474***	***0,3551***	***83,5652***	***3,7629***
DEU	22,5416	2,5200	0,5694	77,3750	1,4948
(targeted)	***24,0527***	***1,0068***	***0,1085***	***109,5830***	***1,1127***
IRL	32,4701	0,8916	1,4285	61,3953	3,0235
(targeted)	***26,1745***	***0,8977***	***0,0140***	***117,2800***	***0,0982***
ITA	21,2019	0,6300	0,5761	68,1938	3,4049
(targeted)	***18,4952***	***0,6343***	***0,0099***	***82,8715***	***0,0694***
JPN	21,1880	3,3273	7,6639	46,4932	1,8352
(targeted)	***21,1852***	***1,9259***	***0,6420***	***106,8580***	***6,8226***
NLD	16,8322	1,5316	0,5051	84,8929	5,4151
(targeted)	***16,8322***	***1,5316***	***0,5051***	***84,8929***	***5,4151***
NOR	13,0402	1,1802	0,1326	59,7283	1,8959
(targeted)	***13,0410***	***1,1151***	***0,1349***	***62,2946***	***3,2517***
ESP	18,6643	0,6356	0,0067	83,6107	0,0672
(targeted)	***18,6643***	***0,6356***	***0,0067***	***83,6107***	***0,0672***
SWE	22,1579	3,7589	0,1259	72,7133	6,2853
(targeted)	***22,1603***	***1,8678***	***0,1292***	***104,5160***	***5,1610***
GBR	19,4651	1,9974	1,6570	85,8265	-0,9904
(targeted)	***19,4626***	***1,7693***	***0,5898***	***98,1685***	***6,2678***
USA	16,3013	3,1813	1,0000	75,2260	-1,8286
(targeted)	***16,2991***	***1,4817***	***0,4939***	***82,2121***	***5,2490***