Mutual Recognition Agreements and Trade Diversion: Consequences for Developing Nations

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October, 2006
This version: April, 2007

Abstract

This paper presents a baseline model that illustrates the implications of Mutual Recognition Agreements (MRAs) for excluded nations. The model shows that MRAs can harm third country exports because of a trade-diversion effect. We use highly disaggregated trade data from developed and developing nations to test whether or not MRAs have a negative effect on exports from excluded nations. In particular, we focus on the impact of a North-North MRA on the South. We find empirical evidence in support of the model; the MRA between the EU and the USA has harmed exports from Canada and the group of developing countries included in the study.

JEL Classification: F13, O12
Keywords: trade policy, economic development.

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1 Introduction

Mutual Recognition Agreements (MRAs) are a fairly new element in the world trading system. An increasing number of MRAs have been negotiated in recent years, and new product categories are being added every day to existing ones. As a result they are becoming an important part of the framework by which international trade and domestic regulation are jointly governed.

Trade liberalization through MRAs is likely to continue in the coming years, and it will almost surely be confined to developed nations. This type of preferential trade liberalization of standards and testing procedures between developed nations may have large implications for excluded countries; particularly in the third world. As in Baldwin (2000), we argue that the proliferation of MRAs without some form of international discipline could easily end up in a two-tier world trading system in which developed nations enjoy preferential access.

A review of the scarce literature on MRAs from a trade policy perspective suggests that economists have not paid enough attention to the topic. Maskus et al. (2000) surveys the literature dealing with methodological issues surrounding product standards and technical barriers to trade. They conclude that "these types of arrangements (MRAs) have proliferated with little empirical analysis on the costs and benefits of alternative policy options." In one of the few empirical investigations, Chen and Mattoo (2004) use aggregated data to find that MRAs are trade promoting instruments unless they contain restrictive rules of origin.

To the best of our knowledge no study has focused on the discriminatory aspects of MRAs, and their implications for excluded nations. Trade liberalization through MRAs is an area in international economics in which an actual need for more theoretical and empirical work exists because the nature of the trade-offs involved in this type of preferential liberalization is still not well understood. The purpose of the paper is to shed light on the implications of MRAs for excluded nations. We aim to contribute on the policy dimension with a couple of simple ideas that can help developing nations overcome the adverse effects of MRAs.

We view protection as the outcome of a game in which countries cannot perfectly evaluate other countries' testing procedures. Imperfect information is key to understanding regulatory protectionism. We use a model of

Cournot competition to show that MRAs can harm third country exports because of a trade-diversion effect. Our empirical work is an improvement on previous studies both in terms of data and methodology. We use highly disaggregated data that allows us to finely identify the impact of MRAs on trade in specific product categories. Our methodology and specification allows us to isolate the effect of MRAs from other factors affecting trade.

We organized the paper as follows: Section 2 provides an overview of MRAs, Section 3 develops a simple formal model of trade between developed, and developing countries that crystalizes the logic behind MRAs. We use the model to discuss the implications of MRAs for excluded countries. In Section 4 we turn to the empirical analysis. We test the predictions of the model using highly disaggregated bilateral trade data from the EU and some of its main trading partners. In Section 5 we discuss from a policy perspective some of the solutions that could be adopted to prevent the exclusion of developing countries from MRAs. We conclude in Section 6 summarizing the main findings of the paper, and providing some avenues for future research.

2 Mutual Recognition Agreements: an overview

MRAs are bilateral trade agreements that lay down the conditions under which its members recognize one another's designated Conformity Assessment Bodies (CABs) in conformity with the legislation of either party.[1] To some extend, a MRA can be viewed as an implicit acceptance that the different norms (technical regulations and standards), and testing procedures that apply in each country are simply different means of achieving the same regulatory objectives.[2]

In the absence of MRAs, exporters face important costs linked to multiple tests and conformity assessments. According to some OECD estimates the different standards and technical regulations across markets, combined with the need for multiple testing and certification procedures, constitute

[1] This implies mutual recognition of technical regulations.

[2] The distinction between standards and technical regulations is important. Technical regulations are mandatory whereas standards are voluntary. Norms are the specific requirements that products have to meet to be sold in a particular market; testing is required to assess whether products conform with the norms. The CABs issue test reports, certificates and marks of conformity. It is important to note that MRAs do not require harmonization of the technical regulations of its members.

between 2 and 10 per cent of the overall costs of production.[3]

As international trade expands, the costs of testing the products against the requirements of different jurisdictions become increasingly important. MRAs offer the possibility to avoid the duplication of tests. For example, thanks to the MRA between New Zealand and the EU, New Zealand exporters can test the conformity of their products against the relevant EU Directives domestically by authorized CABs and obtain the "CE marking."

MRAs are not across-the-board. MRAs are detailed product-specific agreements that tend to focus on the following sectors: medical devices, pharmaceuticals, telecommunications equipment, electromagnetic compatibility, toys, low voltage electrical equipment, machinery, and pressure equipment. A typical text of a MRA contains lengthy sectoral annexes specifying the detailed list of products covered. Very often, the text of the agreement also includes an agenda for extending the coverage to new sectors subject to some conditions. MRAs always specify the list of the designated CABs eligible to test conformity. It is also common for them to specify market surveillance programs to ensure that products continue to meet the health and safety requirements set out in law after the MRA comes into force.

But, what is the political motivation for MRAs? The main objective of a MRA is to promote trade by means of facilitating market access. As we have discussed above, MRAs create significant cost savings for its members because they eliminate the need for duplication of testing and certification. This in turn lowers the amount of time needed to put new products in the market, and increases the choice of products available to consumers.

One of the most important, and usually forgotten, benefits of MRAs for the world trading system has to do with regulatory protectionism. Regulatory protection arises when countries pass legislation that seeks to "raise their rivals' costs." MRAs remove the instruments available to governments to use regulations to protect industries. As Amurgo-Pacheco (2006) shows, MRAs could trigger a political economy process that removes the domestic incentives to lobby for regulatory protectionism.

The EU has been dealing with issues of harmonization (approximation in Euro-jargon), and mutual recognition in the context of the common market for many years.[4] One could argue that mutual recognition in the internal

[3]See OECD (1997).

[4]See Egan (2001) for a detailed description of the process.

goods market was the first MRA.

The EU is at the forefront in promoting MRAs. Since the completion of the internal market programme, the EU has been seeking to extend some of its trade liberalization features to international trade with its major trading partners.[5] The EU has signed MRAs with Australia (1998), Canada (1998), Israel (1999), Japan (2001), New Zealand (1998), Switzerland (2002), and the USA (1999). The USA has signed MRAs with the EU (1999), Singapore (2001), and EFTA (2005). Australia has signed MRAs with New Zealand, EFTA (1999), and Singapore (2001).

According to EU sources the MRA between the EU and the USA alone covers around 40 billion Euro worth of transatlantic trade a year and produces savings around 200 million Euro a year.[6] The EU-USA MRA covers at the moment the following sectors: telecommunications terminal equipment, electromagnetic compatibility, electrical safety, recreational craft, medical devices and pharmaceutical. Given its success the EU and the USA have already began to take the necessary steps to extend the scope the agreement as described in the sectoral annexes.

Researchers do not know much about the effects of MRAs. A study from the DG trade of the European Commission using survey data finds that between one-quarter and one-third of the respondents indicate a positive impact on the cost reduction of testing procedures after the single market programme.[7] The same study focuses on the MRA between the EU and Australia and finds a 1 per cent positive (although insignificant) effect of the MRA in creating trade. The best indication of their performance is probably the fact that MRAs are becoming increasingly common in the world trade landscape.

There has been a significant increase in the number of MRAs in recent years; and MRAs now cover an increasing share of trade between developed countries. However, not a single MRA has been signed with developing countries. The reason is that MRAs require a level of trust in a nation's technical competence and certifying bodies that few developing nations are likely to be able to provide. We believe that it will be a long time before a

[5]The single market programme was so successful that also excluded European nations, such as the EFTA countries, immediately tried to replicate many of its features such as MRAs.

[6]Source: http://trade-info.cec.eu.int/tbt/mra.cfm?id=38

[7]See Commission (2003).

MRA is signed between developed and developing nations.

We turn now to a simple theory model that helps us organize our thinking around MRAs, and analyze the implications for excluded nations.

3 A baseline model

We develop a basic model of trade where a nation called "Home" imports a homogenous good from two sources: North, and South. In order to keep the model as simple as possible we assume no domestic production of the good. Hence, the only producers of good x are located in North, and South. Country variables are denoted by the corresponding subscript.

On the supply side, we assume one industry only producing a product that can be of high-quality or low-quality. The cost of producing the good is related to its quality. The high-quality variety is more expensive to produce. The quality of the good depends upon the type of the producer.

Good x is produced in accordance with a set of internationally recognized standards, but testing procedures may differ among the countries. We assume that the quality arrives to the Home country with some stochastic. Thus, even high-quality goods have some small probability γ of being defective. This probability can be interpreted as the effectiveness of the inspection regime in place at the exporting nation. With low-quality types, the probability of obtaining a defective good is Σ, where $\Sigma > \gamma$.

It is common knowledge that the North has only one potential type and the South comes in two types.[8] In plain English, the South has complete information about North. The North produces the good with a high-quality equilibrium, and its unit cost is c_n. The South, however, has private information about its quality-type. Thus, the South has two potential types, which we will call the "low-quality type" and the "high-quality type." The unit costs for the South can be c_s^L, or c_s^H. We assume that c_s^H is larger than c_s^L. All this information is common knowledge.

On the demand side, we assume that individuals in the Home country derive zero utility from the low-quality product. *Ex-ante* everything that

[8]We assume that it is common knowledge that types are *a priori* drawn from some known distribution $\theta(t_1, ..., t_i, ..., t_n)$. Player i has conditional probability $\theta_i(t_{-i}|t_i)$ on her opponent's types $t_{-i} \cong (t_1, ..., t_{i-1}, ..., t_n)$ given her own type t_i. One way to think about this is that we include an additional player –Nature– in the game. Nature moves first and determines the types. Types are stochastic variables, "drawn by nature."

is sold in the Home country is perceived by consumers as of high-quality; goods are *de facto* the high-quality.[9] But *ex-post*, consumers realize about the true quality of the good. Low-quality products are worthless, so if it turns out that it is low-quality then they obtain zero utility.

For simplicity, we assume linear demand and supply functions. The importer's inverse linear demand function is given by expression $P[Q] = a - bQ$, where $Q = x_n + x_s$ is the aggregate quantity of good x in the market. We refer to x_n as the quantity produced by North, and x_s is the quantity produced by the South.

Due to consumer safety concerns the importing country wants to assess the nature of the exporter's inspection regime.[10] Unfortunately, the nature of the inspection regime at place in each country is not observable. The Home country can only ascertain the reliability of the goods that actually show at its border.

In this setup, the Home country tries to extract from the observed (after stage 1) whether it is a high- or low-quality regime.[11] The importing country trusts the goods coming from a high-quality regime and signs a MRA. However, it charges an inspection certification cost of ϕ when it is uncertain about the quality of the regime. We assume that both producers are atomistic in the sense that they are aware of the implications of their actions in the future but this is not a reason to modify their behaviour in stage 1.

We investigate the equilibrium of the two-stage game of Cournot competition with imperfect information.[12] The sequence of the game is as follows. In stage one, North and South play their optimal Cournot strategies. Then the Home country assesses the exporter's trustfulness from the observed quality; and, ex-post evaluation, the Home country signs a MRA with the high-quality producer and imposes barriers on the low-quality producer. In stage two, North and South play their optimal Cournot strategies given the

[9] As long as it is inside the Home country consumers believe that it is a high-quality good; so they buy it.

[10] The reason for needing to assess the nature is not an issue. It could also be because of environmental concerns, etc. What is important is that we are assuming away any regulatory protectionism reason for the MRA. Note that protection tries to benefit consumers and it is not captured by private interests.

[11] A stochastic determination of whether it is a high-quality control regime or a low-quality one. If it is not stochastic either they are all good or all defective.

[12] Games of incomplete information can be as a game of complete imperfect information. See Harsanyi (1967).

new cost structure.

3.1 Competition in quantities

We consider competition in quantities under imperfect information. Following Cournot, we assume that the two countries choose their outputs simultaneously. We look for a pure-strategy equilibrium of the game.

The North is uncertain about the South's quality-type. The North assigns probability θ to the South to be a low-quality type of producer (type L), and $1-\theta$ is the probability of being a high-quality type (type H). The total cost of producing in the North is $C_n = c_n x_n$, where c_n is the constant unit cost in the country. The total cost of producing in the South, however, is $C_s^L[x_s] = c_s^L x_s$ with probability θ, and $C_s^H[x_s] = c_s^H x_s$ with probability $1-\theta$. We denote the output choice of the low- and high-quality types of South by x_s^H and x_s^L.

Following Saloner (1987), a strategy for the South is a function $\sigma : \{c_s^L, c_s^H\} \to [0, \infty)$, where σ specifies how much to produce for each of its two possible types. A strategy for the North is a function $\tau : c_n \to [0, \infty)$.

A Bayesian Nash equilibrium is a set of type-contingent strategies such that each player maximizes its expected utility contingent on its type and taking the types of the other players' type-contingent strategies as given. The Bayesian Nash equilibrium for this game of incomplete information is a pair of mutual best-response (σ^*, τ^*).

Since the North does not know what type of South is facing its expected profit is the expected value over the South's types:

$$\begin{aligned} E(\Pi_n) = E[\theta \left(\left[a - b \left(x_s^L + x_n \right) \right] x_n - c_n x_n \right) \\ + (1-\theta) \left(\left[a - b \left(x_s^H + x_n \right) \right] x_n - c_n x_n \right)] \end{aligned} \tag{1}$$

The North is uncertain about the South's payoff because it is uncertain about its real type. The profit for the South can take two different forms: expression (2) when the country produces a low-quality good, and expression (3) when it produces the high-quality good.

$$\Pi_s^L = x_s \left(a - b \left(x_n + x_s \right) \right) - c_s^L x_s \tag{2}$$

$$\Pi_s^H = x_s \left(a - b \left(x_n + x_s \right) \right) - c_s^H x_s \tag{3}$$

In stage 1, the problem facing the North is given by maximizing its expected payoff:

$$\max_{x_n} \theta \left(\left[a - b \left(x_s^L + x_n \right) \right] x_n - c_n x_n \right) + (1-\theta) \left(\left[a - b \left(x_s^H + x_n \right) \right] x_n - c_n x_n \right) \tag{4}$$

The North equilibrium choice of quantity must satisfy the first-order condition:

$$\theta \left(a - c_n - b x_s^L - 2b x_n \right) + (1-\theta) \left(a - c_n - b x_s^H - 2b x_n \right) = 0 \tag{5}$$

Re-arranging (5) yields the North's Best Reaction Function (BRF_n):

$$BRF_n = x_n = \frac{a - c_n - b \left[\theta x_s^L + (1-\theta) x_s^H \right]}{2b} \tag{6}$$

This is simply the weighed average of the best reaction function to the output of low-quality and high-quality types of South, where the weights are θ and $1-\theta$.

The problem facing South when it produces with a low-quality equilibrium is given by:

$$\max_{x_s^L} \left(a - b \left(x_s^L + x_n \right) \right) x_s - c_s x_s \tag{7}$$

differentiating expression (7) yields the South's Best Reaction Function for a low-quality type of producer (BRF_s^L):

$$BRF_s^L = x_s^L = \frac{a - b x_n - c_s^L}{2b} \tag{8}$$

Similarly, the South's Best Reaction Function for a high-quality type of producer is given by:

$$BRF_s^H = x_s^H = \frac{a - b x_n - c_s^H}{2b} \tag{9}$$

The Bayesian-Nash equilibrium solves (6), (8), and (9) simultaneously. The Nash equilibrium strategies are given by:

$$\tau^* = x_n^* = \left[a - 2c_n + \theta c_s^L + (1-\theta) c_s^H \right] / 3b \tag{10}$$

$$\sigma^* = \begin{cases} x_s^{*L} = \left[2(a+c_n) - c_s^L(3+\theta) - (1-\theta)c_s^H\right]/6b & \text{, If } c_s = c_s^L; \\ x_s^{*H} = \left[2(a+c_n) - \theta c_s^L - (4-\theta)c_s^H\right]/6b & \text{, If } c_s = c_s^H. \end{cases} \tag{11}$$

Note that if $\theta = 0$ the standard Cournot equilibrium when South is a high-quality country results. If $\theta = 1$ we obtain the standard Cournot equilibrium when the South is a low-quality producer. If $0 < \theta < 1$, then $x_n^*[\theta = 1] < x_n^*[\theta] < x_n^*[\theta = 0]$, $x_s^{*L}[\theta] < x_s^{*L}[\theta = 1]$, and $x_s^{*H}[\theta = 0] < x_s^{*H}[\theta]$.

Figure 1 illustrates the analysis. We have plotted the best reaction functions for both possible types of South, and the only type of North. The equilibrium outcome is D when $\theta = 1$ and A when $\theta = 0$. If South is in fact a low-quality producer, the equilibrium outcome varies from D to B as θ goes from 1 to 0. Similarly, if South is a high-quality producer, the equilibrium outcome varies from A to C as θ goes from 0 to 1. The expected outcome when North assigns probability θ to the event that South is a low-quality producer varies continuously and monotonically from A to D as θ goes from 0 to 1. Notice that in equilibrium the North produces its best response to the output $(1-\theta)x_s^H + \theta x_s^L$. This is lower than its response would have been if it knew it was facing a high-quality type (c_s^H) with certainty, and higher than if it was certain that it was facing a low-quality type (c_s^L).

At the end of stage 1, the Home country observes the quality of the goods. The expected quality of products coming from the South is as follows:

$$E\left[(1-\theta)x_s^H\gamma + \theta x_s^L\Sigma\right] = (1-\theta)\gamma + \theta\Sigma \tag{12}$$

and the expected quality of products coming from North is as follows:

$$E\left[x_n\gamma\right] = \gamma \tag{13}$$

It is straight forward to verify that (12) is larger than (13). This implies that the goods coming from the South have a larger expected probability of being defective. Every unit coming from the South is inspected. Therefore, the importing country signs a MRA with the North, and thereafter it charges the inspection cost to the South.

In stage 2, the certification cost of ϕ increases the per unit cost of selling the good. Both countries play their optimal Cournot strategies given the new cost structure.

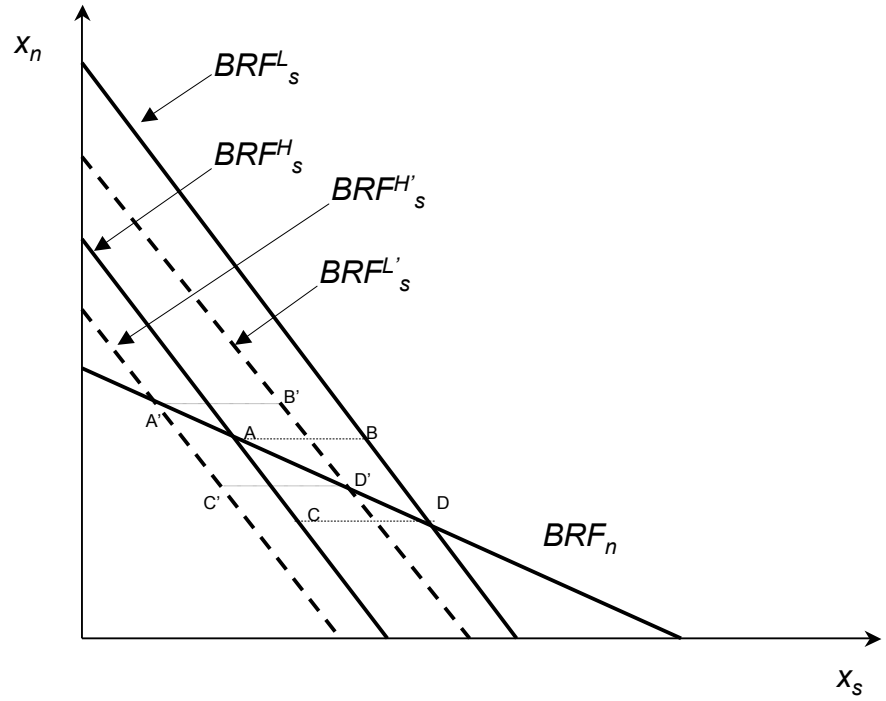

Figure 1: *Best reaction functions and equilibrium outcomes.*

The new equilibrium strategies Equation (14) for the North and Equation (15) for the South.

$$\tau^{*'} = x_n^{*'} = \left[a - 2c_n + \theta(c_s^L + \phi) + (1-\theta)(c_s^H + \phi)\right]/3b \tag{14}$$

$$\sigma^{*'} = \begin{cases} x_s^{*L'} = \left[2(a+c_n) - (c_s^L + \phi)(3+\theta) - (1-\theta)(c_s^H + \phi)\right]/6b & \text{, If } c_s = c_s^L + \phi; \\ x_s^{*H'} = \left[2(a+c_n) - \theta(c_s^L + \phi) - (4-\theta)(c_s^H + \phi)\right]/6b & \text{, If } c_s = c_s^H + \phi. \end{cases} \tag{15}$$

As we can see in Figure 1, the permanent increase in the marginal cost of producing the good shifts both BRF_s inwards. As a result, there is an impact on prices and sales. The North will enjoy a marginal cost advantage over the South.

We can verify that for a given level of θ we have that $\tau^{*'} > \tau^*$ and $\sigma^{*'} < \sigma^*$. The certification cost increases the marginal cost of the South and has an impact on the South's sales. As a result, the North's sales increase. There is a trade diversion effect.

We will discuss below some possibilities for the South to break up this equilibrium. But for the time being, note that even in the event that the South could upgrade its production capabilities and testing procedures so that all products coming from the South were of high-quality, it would still not necessarily manage to export due to the marginal cost of ascertaining the quality of each good. The South would be kept out of the market. As a result of a North-North MRA the South could end up trapped in an equilibrium situation where it does not even produce the good, and therefore it becomes impossible to build trust and sign a MRA. In essence, the MRA is creating some sort of a two-tier system of market access with the South in the second tier.

To conclude, as preferential liberalization through MRAs spreads out among developed countries without some form of international discipline, a two-tier world trading system is likely to emerge in which developed nations enjoy preferential access.

We turn now to test empirically the trade diversion hypothesis predicted by the model.

4 The impact of MRAs on trade: estimates of trade diversion

We focus the empirical investigation on the prediction of the model for excluded nations. In particular, we test whether the hypothesis that North-North MRAs harm the South's exports is true. We are going to concentrate on the MRA between the EU and the USA, which is probably the most important recognition agreement and covers an increasing share of world trade.

The implementation of the MRA between the EU and the USA is well defined in time. It came into force in 1999. But the agreement is not very transparent when it comes to the exact products covered. Details of the specific product categories covered by the MRA are included in the Annexes of the agreement. Unfortunately, the list of products is coded according to the American Code of Federal Regulations (CFR) for which no formal correspondence table exists with other standard systems of product classification such as the Combined Nomenclature.[13] In order to get around this limitation and to be able to analyze the impact of the MRA on excluded nations, we are going to focus on a specific set of pharmaceutical products for which we can be sure that are covered by the agreement. We are going to test whether or not the exports of third countries to the EU and/or the USA in these product categories have been affected.[14]

Our estimation strategy will consist in using highly disaggregated data on bilateral trade flows to estimate a common specification of the gravity model. We use dummy variables to capture the effects of the MRA, and to control for other ongoing liberalization processes such as FTAs.[15]

Concerning the geographical scope of the analysis, our focus of attention is going to be Turkey and Mexico; two relatively diversified exporting economies as well as developing nations. We also examine the trade implications of the EU-USA MRA for a group of developing nations. With this aim we have included the Mediterranean partners in the Euro-Mediterranean FTA. Finally, we have decided to include Canada as an example of a devel-

[13] According to EU DG-Trade sources the information does not exist.

[14] Available sources of highly disaggregated data are not fine enough to pick up other product categories that may have been affected by the MRA.

[15] See Anderson and van Wincoop (2003) and Baldwin and Taglioni (2006) for more on gravity.

oped country. The Canadian example is interesting because it has signed a MRA with the EU but not with the USA.

To sum up, we investigate whether the MRA between the EU and the USA had an impact on third country exports at very specific product levels. We are also going to explore whether MRAs affect trade in new goods; we estimate the effect of the MRA in creating (or preventing) new trade in the product categories covered by the MRA.

In what follows we are going to run our gravity regressions and test whether there has been a trade diversion effect. But first, let us have a closer look at our data set.

4.1 The data set

We use the highest level of internationally comparable disaggregated trade data that is publicly available, namely the 6-digit level of the Harmonised System (HS) from Comtrade database.[16] We have the data for the 1990-2004 period. The set of countries encompasses the EU,[17] a group of Mediterranean countries[18] (Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Syria, Tunisia, and Turkey), three other African countries (Mauritania, Libya, and Nigeria), the EFTA countries (Switzerland, Norway, and Island), USA, Canada, Mexico, and Japan.

Our control variables are Gross Domestic Product (GDP), and Distance (DIST). The GDP is expressed in current US dollars and it is extracted from the World Development Indicators (2006). Distance data were obtained from Jon Haveman's web site, which provides the Great Circle distance between capital cities.[19] The variable is defined as the distance between the economic center of one country to another. Note that for the EU we have selected Brussels as the center.

A couple of remarks on the data set are in order. First, the data set is very large. For each of the exporters there are 5,019 product categories for each of the 19 potential partners. This adds up to about 95,361 data points

[16]The ideal data set would be to have partner-specific export data by firm. Unfortunately such data is not available to researchers. We use instead (mirror) data on exports from the World Integrated Trade Solutions (2006).

[17]We consider the EU 15 due to the fact that data-set ends in 2004, the year of the last enlargement.

[18]The Mediterranean partners of the Euro-Mediterranean FTA.

[19]See www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources.

per year per exporter. Since we are looking for changes around the signature of the MRAs we use 1990-1998 and the "before" period and 1999-2004 as the after period.[20] This means 14 years in all, so the data set is on the order of 1,335,054 data points for each exporting nation. Pooling all 19 exporters together would create a panel of about 25 million data points, a number which defies our computational capacity. To get around this computational limitation we are going to use only one exporter's data set at a time.

Second, note that the 6-digit classification is not fine enough to pick up individual products. As a consequence, a broad analysis looking for trade diversion using the entire universe of goods and services covered by the MRA would be affected by the presence of other products that fall in the same categories but are not part of the agreement. That is, there may be product-specific trade effects that we cannot identify since they occur in categories where we find products that are beyond the scope of the MRA. After inspecting the data set and the range of products covered by the agreement we have decided to solve this problem by focusing on trade on the pharmaceutical products that are part of the MRA.[21]

The third remark concerning the data set has to do with the presence of zeros. The specification of the estimating equation, formally derived from the underlying gravity theory as in Baldwin (2006), implies the use of logarithms. Unfortunately, the presence of zero-trade values in the explained variable presents a problem. We have solved this issue shifting all trade values by one unit before applying the logarithms.[22]

4.2 Statistical estimates

We are looking for evidence of trade diversion at a very specific product level. When dealing with highly disaggregated data, the issue of zero trade flows cannot be ignored. Indeed, the fact that some product categories covered in the MRA may switch from zero to positive values is an additional interesting feature that deserves our attention. In our highly disaggregated data set

[20] The agreement came into force on December 1st 1998.

[21] The methodology to find the correspondence is very simple. It consists in comparing the definitions included in the MRA with the definitions in HS88. Details are available upon request.

[22] The variance of the distribution of trade values is not affected but the mean is increased by one unit. See Rose papers on currency unions for examples of this methodology, and Tsangarides et al. (2006) for a discussion.

censorship is clearly an important issue since many observations have zero trade. This suggests that Tobit is the appropriate econometric estimation method.

The Tobit regressions pick up the total impact of the MRA on trade in categories covered by the MRA, both the impact of trade where there was already some trade taking place, and the change in the number of categories that are being traded.

The impact of the MRA between the EU and the USA is measured using dummy variables. In particular, the trade-diversion dummy (MRA) measures the effect of the MRA between the EU and the USA on nonmember nations. If the predictions of the model are true, this variable is expected to have a negative sign. We use a preferential trade dummy (FTA) to control for trade effects of membership in one or several regional trade agreements, in addition to the trade effects predicted by the gravity model. We also control for sector-specific changes (affecting all countries) using a dummy variable (PHARMA).

The estimating equation is the familiar basic gravity model. Namely:

$$\begin{aligned} V_{od,it} = \beta_0 + \beta_1 PHARMA + \beta_2 MRA + \beta_3 GDP_d \\ + \beta_4 DIST + \beta_5 FTA + \beta_6 YEAR + \beta_7 PART + u_{it} \end{aligned} \tag{16}$$

where V_{od} is the dollar value of exports from nation-o (origin) to nation-d (destination) expressed in logarithms, i is the product category index for each 6-digit category, and t is the moment in time. GDP_d is the gross domestic product of the destination country (also expressed in logarithms), $DIST$ is the distance from the origin country to the destination nation, $YEAR$ are the time dummies, $PART$ are the partner dummies, and u_{it} is the estimation error. The time dummies deal with the conversion of all the current valued dollars to a common base year. To adjust for the nation-d price index, P_d, we included a partner dummy in each regression. Since there is a single exporting nation at each time, the partner dummies act exactly like pair dummies. The Pharma dummy is unity for all product categories in pharmaceuticals for any destination nation in the sample after the date of the agreement. The MRA dummy takes the value of one for the pharmaceutical categories included in the agreement (after 1999) and destination nation a party to the agreement.

We run the regressions for each of the countries of interest on the exporter data set with all the partner nations discussed above (19 destination countries), including all the 5,019 product categories at the 6-digit level. Table 1 summarizes the estimates of the effect of the MRA between the EU and the USA on trade in the range of pharmaceutical products covered by the agreement:[23]

Table 1: *Trade diversion estimates.*

Dependant Variable: Volume of exports (log)				
Effect of the MRA	**Coefficient**	**Marginal Effects**		
		Uncond.	**Cond.**	**Prob. Uncens.**
TUR to EU	**-0.8311*****	**-0.1566*****	**-0.1772*****	**-0.0435*****
	-0.3146	(2.64)	(2.64)	(2.64)
MEX to USA	**-3.0768*****	**-0.1739*****	**-0.436*****	**-0.0657*****
	-0.2973	(10.35)	(10.35)	(10.35)
MED to EU	**-0.409*****	**-0.063*****	**-0.080*****	**-0.018*****
	(0.058)	(0.009)	(0.011)	(0.002)
CAN to USA	**-1.8663*****	**-0.1526*****	**-0.2956*****	**-0.0546*****
	-0.2715	(6.87)	(6.87)	(6.87)
EU to USA	**0.8619*****	**0.8558*****	**0.8202*****	**0.0072*****
	-0.1209	(7.13)	(7.13)	(7.13)

Source: World Integrated Trade Solutions. Author's calculations.

Note:***significant at 1%; **significant at 5%; *significant at 10%

On the interpretation of the parameters, we should note that the estimated raw coefficients are not particularly interesting from a purely economic point of view. These are simply the effect of the independent variables on the "latent" variable that underlies the Tobit model.[24] In order to provide a simple economic interpretation of the parameters we have computed the marginal effects.[25]

[23]For expositional simplicity, we have included the complete estimation results for the entire set of regressions in the Appendix.

[24]See Greene (2003) for a more detailed formal explanation of the Tobit model.

[25]The marginal effects are obtained running the dtobit command in Stata after the corresponding Tobit estimation.

The "unconditional expected value" (marked *Uncond.*) provides the marginal effect of a one-unit change in an independent variable on the trade volume.[26] This is different from the impact on the latent variable provided by the raw coefficient. The unconditional expected value estimates the overall impact of the MRA on trade in the range of pharmaceutical products covered by the MRA, taking into account that for some products there is zero trade.

The "conditional marginal effect" (marked *Cond.*) picks up the marginal effect of the MRA on the level of exports of the pharmaceutical products of interest conditional on the exports being positive; that is uncensored. The conditional effect will allow us to capture the impact of the EU-USA MRA on the range of pharmaceutical products for which some trade was already taking place before the MRA was signed.

The "probability uncensored" (marked *Prob. Uncens.*) is the last marginal effect computed using the Tobit model. It tells us how the probability of observing positive trade in a particular category changes following a MRA (provided the category is uncensored). Thus, we will enrich the analysis providing an estimate of the impact of the MRA on the probability of observing positive trade in the pharmaceutical products included in the agreement.

The regression analysis shows that the variables of interest have the expected signs.[27] The traditional gravity variables have a statistically significant impact on trade. Countries' GDPs have positive and statistically significant impact on trade. The effect of the distance between countries (although small) is negative and statistically significant. This suggests that countries located close to each other will trade more.

The unweighed average of the overall estimated trade diversion effect (unconditional) is -14%. The unweighed average effect when we consider only the categories for which some trade was already going on increases to -23%. The unweighed average for the change in the probability of being uncensored is -5%; suggesting that the MRA decreases, on average, the probability of exporting product categories subject to the agreement. These figures are simply raw averages; the coefficients for each country vary.

The results for Turkey show evidence that the MRA between the EU and the USA has had a strong impact on Turkish exports. We estimate

[26] Here it is the discrete change of the dummy from 0 to 1.

[27] See Tables 3 to 7 in the Appendix.

the negative impact of the exports to the EU is close to 15%.[28] The trade diversion effect for those categories of pharmaceutical products that were already being traded with the EU is around 17%. The MRA between the EU and the USA reduces the probability of a non traded category to switch to positive trade by more or less 4%.

The dummy variable capturing the impact on the exports from Mexico to the USA has the expected sign for trade diversion and it is significant at conventional significance levels.[29] The estimates for the impact on Mexican exports is close to -17%. The estimated impact is even higher when we consider only the effect on those categories that were already being traded, -43%. Finally, the impact of the MRA between the EU and the USA on the probability that a Mexican product (previously not exported) becomes exported is negative and close to 6.5%.

We have treated the Mediterranean partners of the EU in the Euro-Mediterranean FTA as a block. Most of these Mediterranean countries are not big exporters of pharmaceutical products, and aggregating the export figures allows us to have a sufficient volume of exports to be able to estimate the changes resulting from the MRA between the EU and the USA. We have included a dummy variable called FTA to be able to control for the effect of the Euro-Mediterranean FTA after 1995. The results show that Euro-Med has had a significant impact close to 2% on these countries' exports. The MRA dummy has the expected sign for trade diversion and is highly significant. The results suggest that, despite the positive impact of the Euro-Mediterranean agreements on their exports, the MRA between the EU and the USA has shifted trade away from these countries. The trade diversion effect is close to 6%. The impact is even higher when we consider the effect on those categories of pharmaceutical products that were being exported before the MRA. The conditional effect estimates suggest a trade shift close to 8%. Thus, we estimate that the MRA has reduced the probability of creating new trade in the product categories covered by 2%.

The results for Canada show that trade diversion resulting from MRAs is not only a problem for developing countries but for developed nations as well. The results for Canada suggest that trade diversion has occurred, as

[28] We have controlled for the impact of the Customs Union between Turkey and the EU. The FTA (EU) dummy takes the value of one for trade with the EU as from 1996. The Customs Union came in force on 31st, December 1995.

[29] We have controlled for the impact of NAFTA on trade as from January 1st, 1994.

evidenced by Canada's reduced shares of USA imports in pharmaceuticals -15%. The estimate increases to -30% when we consider the intensive margin only (trade in old goods). We estimate that the probability of a switch is almost 5.5% lower.

Finally, the EU-USA MRA "trade creation dummy " shows a trade increase of 85%, the percentage decreases slightly to 82% when considering only categories that were already being exported. The probability of a switch increases by 7.2%. These results confirm that MRAs are trade promoting instruments among its members.

To sum up, we find the strongest evidence of trade diversion for Turkish exports of pharmaceutical products to the EU. The trade diversion estimates for Mexico and the Mediterranean countries are also very important. We also find evidence of trade diversion for Canada. The estimates of trade diversion for all countries are larger when we consider only those categories of pharmaceutical products which were already being traded before the MRA came in force. The results suggest that a MRA lowers the probability of a switch for the excluded nations. We believe that the empirical results provide reasonable empirical evidence to allow us not to reject the underlying theory presented in Section 3. In particular the hypothesis that the MRA between the EU and the USA has generated trade diversion for excluded countries.

Having noted that trade diversion is a real problem for developing nations, we now turn our attention to investigate some possible solutions.

5 Solutions to the two-tier system

We have shown that MRAs can represent a real source of concerns for excluded nations; now we turn to examine some possible solutions. The aim of this section is to contribute on the policy dimension with some simple policy prescriptions. Considering that MRAs *per se* are not a problem for developing countries (the fact that they are excluded is the problem) we argue that effective solutions to the discriminatory liberalization problem involve, some way or another, extending MRAs to developing nations. There are at least three ways forward.

The first proposal consists in a third party certifying institution to help overcome the asymmetric information problem. Deep down it is an issue of

trust; the importing nation does not trust the inspection regime in the South, and as a consequence, the South starts selling less. The less it sells the more difficult it is for the South to establish a reputation. In this setting, the South has little incentive to upgrade its quality inspection regime and production methods. One way to break this equilibrium is with the introduction of a legitimated third party certifier. The role of the third party certifier would be to ascertain objectively whether the quality inspection regimes in the South are equivalent to the North's. The independent third party certifier would improve things by facilitating market access to developing nations. With an independent third party certifier the developing countries can be sure that if they upgrade their inspection regimes and production methods to comply with international standards they will enjoy a shared improved market access in the developed countries. Of course, enforcement remains a key issue here. The international institution in charge of the assessment should be strongly backed and its decisions should prevail in case of litigation in front of international bodies such as the World Trade Organization (WTO).

The second proposal consists in reforming the WTO to introduce some sort of international discipline along the lines of Article XXIV of GATT to address the discriminatory aspects of MRA liberalization initiatives. As Baldwin (2000) notes, "the discriminatory liberalization of regulatory protection, unlike preferential tariff cutting, is largely undisciplined despite violating the WTO's MFN spirit; this lack of discipline may undermine the rules-based trade system as MRA liberalization becomes increasingly important." Under the multilateral discipline, WTO members would have to notify MRAs and ensure that their purpose is to facilitate trade between its members and not to raise trade barriers or to create adverse effects. The world trading system would also benefit from higher transparency in the product scope of the agreements. The WTO is possibly the international institution that is best placed to address the adverse effects of MRA discriminatory liberalization. Specifically, the WTO should forbid the use of rules of origin in MRAs; so that any CAB that has been recognized by a MRA could assess conformity regardless of the country of origin of the good. Rules of origin should not be allowed in MRAs because they undermine the spirit of MFN.

Finally, international development agencies could allocate resources to technical cooperation programmes that help developing countries to upgrade

their domestic inspection regimes and their production methods. In particular, the programmes could aim at helping small and medium enterprises in developing nations to test their products using CABs in developed countries. Financial aid could target the promotion and development of common infrastructure needed to certify products, such as labs, research centres, etc.

We believe that trade liberalization through MRAs will continue. This is an area of trade policy policy that has the potential to affect excluded nations; and very particularly developing countries in the coming years. Developing nations should deal with it rather sooner than later, or else risk losing market access as MRAs among developed countries spread out.

6 Concluding remarks

This paper is a first step towards understanding the trade-offs involved in mutual recognition agreements. In particular, the consequences for excluded nations.

We have first presented a model that illustrates how MRAs among developed nations can harm exporters in developing nations even when protectionism is not the main reason behind the MRA. The basic logic of the model is very simple. In a scenario where technical barriers are the result of the uncertainty about the South's high- or low-quality production equilibrium, the importing country agrees on a MRA with the North and charges a certification inspection cost to the South. As a consequence, the South faces a cost disadvantage and starts selling less. This perpetual treatment by the importing nation provokes a trade diversion effect. We argue that the proliferation of MRAs between developed countries without some form of international discipline can generate a two-tier system in which developed nations enjoy preferential access.

We use the predictions of the model to motivate our econometric analysis. We investigate whether the MRA between the EU and the USA has affected negatively exports from third countries. On the whole, we find reasonable empirical evidence in support of the trade diversion hypothesis in the range of pharmaceutical products covered by the MRA. We find the strongest evidence of trade diversion for Mexican exports to the USA; the adverse effect is close to 17%. The trade diversion estimates for Turkey and the Mediterranean countries are very important as well, around 15%,

and 6%. We also find evidence of trade diversion for developed countries. In particular, we find that Canadian exports of pharmaceutical products to the USA decreased by 15%. On the other hand, we also find that the MRA between the EU and the USA has promoted trade between the two countries in the studied range of products that are covered by the agreement.

Overall, the estimates of trade diversion for all countries are larger when we consider only those product categories for which some trade was already taking place before the MRA came in force. The results strongly suggest that following a MRA, excluded nations experience a lower probability of exporting the products covered by the MRA.

We argue that one way developing countries can overcome the problem is by setting up an international institution that can objectively assess and certify their testing procedures. The WTO could play a significant role to extend MRAs to developing nations, or at least minimize the adverse effects for excluded nations, by introducing some sort of international discipline in this type of discriminatory liberalization.

Finally, we believe that this is going to become an important issue for developing countries in the coming years. Developing nations should deal with it rather sooner than later; or else risk losing market access as MRAs among developed countries spread out.

The paper raises some interesting questions regarding this type of preferential trade liberalization. On the theoretical front further work could incorporate the role of private interests lobbying for and against MRAs. An interesting extension to the model would be to include heterogeneous goods; so it is harder for the Home country to figure out quality. As new highly disaggregated data becomes available to researchers, it would be interesting to investigate the impact of MRAs accross all liberalized product categories. Future empirical work could try to identify which MRAs have been the most discriminatory against excluded nations.

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A Appendix

Table 2: *Description of the main variables and their sources.*

Description of the main variables		
Variable	**Description**	**Source**
$V_{od,i}$	6-digit level of the Harmonised System (HS) from Comtrade database.	World Bank
MRA	This dummy variable takes the value of one for the pharmaceutical categories included in the agreement (after 1999) and destination nation a party to the agreement.	EU-USA agreement.
$PHARMA$	This dummy variable takes the value of one for the pharmaceutical categories included in the agreement.	EU-USA agreement.
$YEAR$	Dummy variable that allows for a different intercept for each year.	
$PART$	Dummy variable that allows for a different intercept for each partner.	
GDP		
$DIST$	Jon Haveman's Great Circle distance between capital cities.	www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources.
$FTA(NAFTA)$	Dummy variable that takes the value of one for trade with the USA and Canada as from January 1st, 1994.	Nafta agreement.
$FTA(EU)$	Dummy variable that takes the value of one for trade with the EU as from 1996.	European Commission web site.

Table 3: *EU exports.*

Dependant Variable: Volume of EU exports (log)				
Variable	**Coefficient**	**Marginal Effects**		
		Uncond.	**Cond.**	**Prob. Uncens.**
MRA	**0.8619*****	**0.8558*****	**0.8202*****	**0.0072*****
	-0.1209	(7.13)	(7.13)	(7.13)
PHARMA	**0.8057*****	**0.7998*****	**0.7654*****	**0.007*****
	-0.0207	(38.98)	(38.98)	(38.98)
FTA (EuroMed)	**0.0388**	**0.0383**	**0.0361**	**0.0005**
	-0.0262	(1.48)	(1.48)	(1.48)
GDP	**0.2229*****	**0.2204*****	**0.2076*****	**0.0028*****
	-0.0155	(14.38)	(14.38)	(14.38)
Distance	**-0.0003*****	**-0.0003*****	**-0.0003*****	**0*****
	0	(96.86)	(96.86)	(96.86)
Constant	**5.7852*****	**3.7205*****	**3.5036*****	**0.0475*****
	(0.1891)	(19.98)	(19.98)	(19.98)
Observations	**955919**	**955919**	**955919**	**955919**

Source: World Integrated Trade Solutions. Author's calculations.

Note:***significant at 1%; **significant at 5%; *significant at 10%

Table 4: *Turkish exports to the EU.*

Dependant Variable: Volume of Turkish exports to the EU				
Variable	**Coefficient**	**Marginal Effects**		
		Uncond.	**Cond.**	**Prob. Uncens.**
MRA	**-0.8311*****	**-0.1566*****	**-0.1772*****	**-0.0435*****
	-0.3146	(2.64)	(2.64)	(2.64)
PHARMA	**-2.7048*****	**-0.3984*****	**-0.5222*****	**-0.1195*****
	-0.0916	(29.52)	(29.52)	(29.52)
FTA (EU)	**-0.3560*****	**-0.0719*****	**-0.0782*****	**-0.0194*****
	-0.0464	(7.67)	(7.67)	(7.67)
GDP	**0.5483*****	**0.1155*****	**0.1226*****	**0.0307*****
	-0.045	(12.19)	(12.19)	(12.19)
Distance	**-0.0006*****	**-0.0001*****	**-0.0001*****	**0*****
	0	(24.71)	(24.71)	(24.71)
Constant	**-7.4723*****	**-1.5745*****	**-1.6708*****	**-0.4186*****
	(0.7638)	(9.78)	(9.78)	(9.78)
Observations	**899055**	**899055**	**899055**	**899055**

Source: World Integrated Trade Solutions. Author's calculations.

Note:***significant at 1%; **significant at 5%; *significant at 10%

Table 5: *Mexican exports to the USA.*

Dependant Variable: Volume of Mexican exports				
Variable	**Coefficient**	**Marginal Effects**		
		Uncond.	**Cond.**	**Prob. Uncens.**
MRA	**-3.0768*****	**-0.1739*****	**-0.436*****	**-0.0657*****
	-0.2973	(10.35)	(10.35)	(10.35)
PHARMA	**0.1075**	**0.0103**	**0.0179**	**0.0035**
	-0.0956	-1.12	-1.12	-1.12
FTA (NAFTA)	**0.1460****	**0.0141****	**0.0244****	**0.0048****
	-0.0571	(2.56)	(2.56)	(2.56)
GDP	**0.6022*****	**0.0568*****	**0.1*****	**0.0193*****
	-0.1077	(5.59)	(5.59)	(5.59)
Distance	**-0.0004*****	**0*****	**-0.0001*****	**0*****
	0	(15.59)	(15.59)	(15.59)
Constant	**-11.7951*****	**-1.093*****	**-1.9225*****	**-0.3713*****
	-1.2992	(8.74)	(8.74)	(8.74)
Observations	**677565**	**677565**	**677565**	**677565**

Source: World Integrated Trade Solutions. Author's calculations.

Note:***significant at 1%; **significant at 5%; *significant at 10%

Table 6: *Mediterranean exports to the EU.*

Dependant Variable: Volume of Mediterranean exports				
Variable	**Coefficient**	**Marginal Effects**		
		Uncond.	**Cond.**	**Prob. Uncens.**
MRA	**-0.409*****	**-0.063*****	**-0.080*****	**-0.018*****
	(0.058)	(0.009)	(0.011)	(0.002)
PHARMA	**-2.175*****	**-0.262*****	**-0.391*****	**-0.080*****
	(0.068)	(0.011)	(0.013)	(0.003)
FTA (EU)	**0.111***	**0.018***	**0.022***	**0.005***
	(0.059)	(0.009)	(0.012)	(0.002)
GDP	**1.203*****	**0.195*****	**0.242*****	**0.054*****
	(0.040)	(0.006)	(0.008)	(0.001)
Constant	**-24.2735*****	**-3.9503*****	**-4.8806*****	**-1.1071*****
	(0.532)	(0.0081)	(0.1070)	(0.0242)
Observations	**1430415**	**1430415**	**1430415**	**1430415**

Source: World Integrated Trade Solutions. Author's calculations.

Note:***significant at 1%; **significant at 5%; *significant at 10%

Table 7: *Canadian exports to the USA.*

Dependant Variable: Volume of Canadian exports				
Variable	**Coefficient**	**Marginal Effects**		
		Uncond.	**Cond.**	**Prob. Uncens.**
MRA	**-1.8663*****	**-0.1526*****	**-0.2956*****	**-0.0546*****
	-0.2715	(6.87)	(6.87)	(6.87)
PHARMA	**0.4135*****	**0.0492*****	**0.0741*****	**0.016*****
	-0.0696	(5.94)	(5.94)	(5.94)
FTA (NAFTA)	**0.2783*****	**0.0323*****	**0.0495*****	**0.0106*****
	-0.0475	(5.85)	(5.85)	(5.85)
GDP	**0.9723*****	**0.1082*****	**0.1704*****	**0.0359*****
	-0.0543	(17.92)	(17.92)	(17.92)
Distance	**-0.0015*****	**-0.0002*****	**-0.0003*****	**-0.0001*****
	0	(41.36)	(41.36)	(41.36)
Constant	**-8.6293**	**-0.9607*****	**-1.5123*****	**-0.3185*****
	(0.8706)	(9.91)	(9.91)	(9.91)
Observations	**1129275**	**1129275**	**1129275**	**1129275**

Source: World Integrated Trade Solutions. Author's calculations.

Note:***significant at 1%; **significant at 5%; *significant at 10%