Interdependence Pattern of Preferential Trade Agreement Memberships over Time

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Abstract

Egger and Larch (2006) empirically showed that the interdependence is stronger within than across preferential trade agreements. We find that their finding is a special case for 2005 only. By employing same econometric methodology - Bayesian heteroskedastic spatial autoregressive probit model, we find that the interdependence is stronger across than within preferential trade agreements for the periods of 1965, 1975, 1985 and 1995, while the opposite is true only for 2005.

Key words: Preferential Trade Agreements, Bayesian Heteroskedastic Spatial Autoregressive Probit Model

JEL Classification: F15, C11, C25

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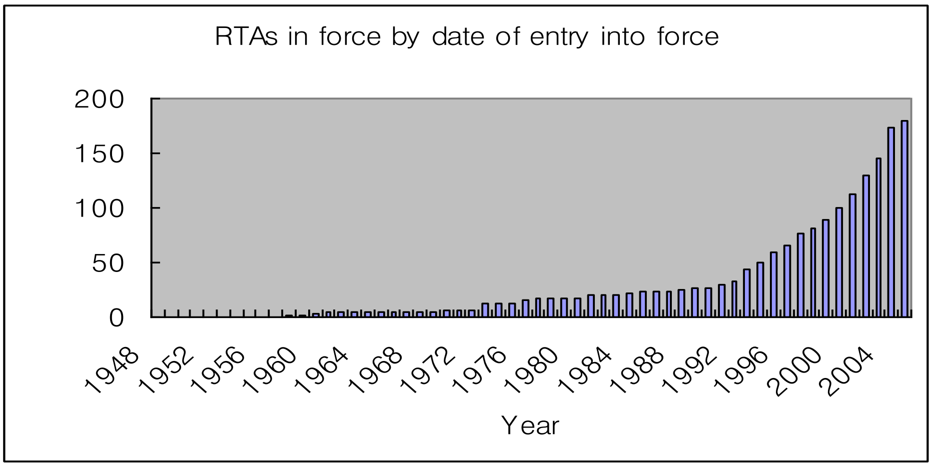
1. Introduction

The interdependence among preferential trade agreement memberships (PTAs) has been examined in some theoretical works. Baldwin (1995, 1997) shows that a country has an incentive to join in an existing PTA (hereafter we call this as ‘interdependence within PTAs’) or to create a new PTA (hereafter we call this as ‘interdependence across PTAs'). This is due to the loss of exporting market shares or the fear of capital outflows in case it stays outside PTAs. He argues that the larger the political costs between insiders and outsiders of PTAs are, the more incentives the outsider of the PTAs have to form a new PTA. Krugman (1991) investigates the world optimal bloc size of symmetric PTAs and shows interestingly that the world welfare can be maximized by a large number of small PTAs with a lower external tariff rather than a few of large PTAs with a higher external tariff. This implies that the welfare-improving growing path of PTAs can be made by the across-interdependent PTAs, not by the within-interdependent PTAs, so as to make the world consisting of a large number of small non-overlapping PTAs. Bond and Syropoulos (1996) shows that this is not always true if the size of blocs are asymmetric.

Egger and Larch (2006) is the first empirical paper that shows the existence of interdependence of PTAs. That is, a PTA creates an incentive for a country pair to participate in a PTA as well. More interestingly, they show that the interdependence is stronger within than across PTAs. In other words, countries have a stronger incentive to participate in the same PTA when their neighbors are members already, than to create another PTA. We notice that they used the data of all PTAs that exist as of year 2005. Here is the whole picture of the cumulative number of regional trade agreements (RTAs) reported to GATT/WTO since 1948 (source: www.wto.org).



[Figure 1: RTAs to the GATT/WTO by entry into force for 1948-2006]

Does their finding of the within-interdependent PTAs in 2005 also appear in the past years? How has the pattern of interdependent PTAs changed over time since 1958 when the first PTA, European Community was started by only six member countries? It is not easy to answer to these questions because the current political relationship among countries or the current size of PTAs can be endogenously changed as a result of countries' forming PTAs in previous years. To investigate the pattern of interdependence over time, we re-examine the same regression model of Egger and Larch (2006) using different time periods. In particular, we conduct Bayesian spatial autoregressive probit model for years of 1965, 1975, 1985, 1995 and 2005.

Our main empirical findings reveal the patterns of interdependent PTAs over time. Among others, first, we find that the degree of interdependence among PTAs has been increasing twice; first in 1975 and second in 2005. This may give us an empirical evidence for the conventionally alleged observation of so-called 'regionalism wave'. In Figure 1, we can observe the first surge of regionalism during the mid 1970s and the second wave from the early 1990s onwards. Since the mid 1990s the numbers are exponentially creasing over time for more than 10 years. Our results reveal a link between the regionalism waves and the strong interdependence of PTAs.

Second, we show that the stronger within-interdependence of PTAs is observed only in 2005, while the across-interdependence of PTAs is stronger for most of the years in the past. Two interpretations are possible. First, according to Baldwin's theory of regionalism, this result implies that the political costs of joining in an existing PTA have been quite large so that countries have more incentive to create a new PTA. It is only last 10 years that the costs have been reduced and thus countries have had more incentives to join in existing PTAs. Second, according to Krugman's theory, our result of the across-interdependent PTAs can be interpreted as that for the dynamic process of PTAs leading to a global welfare improving PTA formation. However, since the mid 1990s the path has been changed from the across- to the within-interdependent PTAs, which may lead to a global welfare worsening PTA formation. Bond and Syropoulos (1996) warned this possibility by re-examining Krugman's model for the case of asymmetric size of regional blocs.

The paper is organized as follows. Section 2 briefly describes the econometric model and data used in the regression. Section 3 discusses the results in details and section 4 summarizes the findings.

2. Econometric Methodology and Data

The econometric model we employ here is the same one as in Egger and Larch (2006) who also used the same model from LaSage (1999). The model is called 'Bayesian Heteroskedastic Spatial Autoregressive Probit Model'. Here we only present the regression model and the data. (For those who are interested in how to estimate the model, please see Egger and Larch (2006) for a summary and LaSage (1999) for a full explanation of the estimation process.)

$$
\begin{aligned}
y^* &= \rho W y^* + X\beta + \varepsilon \\
y &= 1[y^* > 0]
\end{aligned}
\tag{1}
$$

where $\varepsilon \sim N(0, \sigma^2 V)$ and $V = diag(v_1, v_2, ..., v_n,)$. The elements of ε are non-constant variance with $\sigma^2 v_i$ for the variance of observation *i*.

*y** and *y* are *n* times 1 vectors with *n* for the number of country-pairs. The vector *y** consists of unobservable variables for PTA membership to non PTA membership utility differentials of potential members of a PTA. We assume that when an element of the vector is positive, a country are willing to form a free trade relationship either by accession to an existing PTA or by creation of a new PTA. An element of *y* becomes 1 if a pair of countries is the member of the PTA and 0 otherwise. The data for PTAs used in our analysis is described in Appendix A. We provide the full lists of the countries in Appendix B. As you see the lists, for each period we had different number of countries used in our analysis due to the availability of other data.

The term of *Wy** is referred to as a spatial lag, which is a weighted-average of the dependent variable. We follow the same method to construct the weight matrix, *W*, suggested in Egger and Larch (2006). *W* is an *n* times *n* matrix for variables which tells the forms of the interdependence among country-pairs. The elements of *W* are assumed to inversely depend on the trade costs between the country-pairs. They use the distance between country-pairs for the trade costs, which is denoted by D_{lm} for a country pair *l* consisting of country *i* and *j* and country pair *m* of countries *h* and *k*. The weight matrix, *W*, is as follows:

$$
W = \begin{pmatrix} \omega_{11} & \cdots & \omega_{1n} \\ \vdots & \ddots & \vdots \\ \omega_{n1} & \cdots & \omega_{nn} \end{pmatrix}
$$

where $\omega_{lm} = \dfrac{w_{lm}}{\sum_m w_{lm}}$; $w_{lm} = \exp[-D_{lm}/500]$ if $D_{lm} < 2000$ (kilometers) and 0 otherwise; and $D_{lm} = \left(\sum_z \sum_{z'} D_{zz'}\right)/4$ with $D_{zz'}$ denoting a great circle distance between country *z* and *z'* where *z*=*i*, *j* and *z'*=*h*, *k*.

In order to address the issue of within- versus across-interdependence among PTAs, they introduce the following new weight matrix for the case of within-interdependence between PTAs.

$$W_d = \begin{pmatrix} \omega_{11} & \cdots & \omega_{1n} \\ \vdots & \ddots & \vdots \\ \omega_{n1} & \cdots & \omega_{nn} \end{pmatrix}_d$$

where $\omega_{lm} = 0$ if there is no overlap in the two country-pairs *l* and *m*. For example, Singapore-Korea and Singapore-Japan are captured in the above matrix. For the across-interdependence of PTAs, we can simply use $W_{ind} = W - W_d$. Examples are Canada-US and France-Italy.

We will estimate the model to see whether or not ρ, ρ_d and ρ_{in} are all positive over the period of 1965, 1975, 1985, 1995 and 2005. Furthermore, we will compare the magnitude of ρ_d and ρ_{in}. If $\rho_d > \rho_{in}$, the incentive for a country to join in an existing PTA is stronger than forming a new PTA. This result will confirm the existence of the within-interdependence among PTAs. Otherwise ($\rho_d < \rho_{in}$), countries have more incentive to create new PTAs than joining in existing PTAs, which confirms the existence of the across-interdependence.

X is *n* times *k* matrix of explanatory variables including constant, where *k* is the number of the variables. We will re-construct all of the variables in *X* as defined by Egger and Larch (2006), which also follow Baier and Bergstrand (2004)'s ones. Here we present them and mention some differences between them and us.

(1) *NATURE*: It is natural log of the inverse of the great circle distance between two trading countries' capitols coordinates. The coordinates are available from the CIA World Fact Book. We expect a positive effect of this variable on a PTA formation. That is, the lager the *NATURE* is, the closer the two countries are and thus the lower the trade costs are. So, the PTA is more likely to be formed.

(2) *DCONT*: It is 1 if two countries are located at the same continent and 0 otherwise. The continents that we use are Africa, America, Asia, Europe and Oceania. Similar to NATURE, we expect a positive effect from *DCONT*, implying countries in a same continent are more likely to form a PTA due to a lower trade cost. Note that Baier and Bergstrand (2004) did not use it as a separate explanatory variable, while Egger and

Larch (2006) did. We estimated the model with both methods and the results are better with *DCONT* as a separate one.

(3) *REMOTE*: It is $(0.5)\left\{\ln\left[\sum_{k\neq j} Dis_{ik} / (N-1)\right] + \ln\left[\sum_{k\neq i} Dis_{kj} / (N-1)\right]\right\}$, which is a country pair's remoteness from the rest of the world. Baier and Berstrand (2004)'s remoteness variable is *DCONT* times the above *REMOTE* and consider only the case that a country pair is in the same continent. However, the above variable takes care of any country pair's remoteness. Again, due to a lower trade cost, as two countries are remote from the rest of the world, they are more likely to form a PTA due to a lower trade cost. We expect a positive effect from *REMOTE* here.

(4) *RGDPsum*: It is $\ln\left(RGDP_i + RGDP_j\right)$, where *RGDP*s are the real gross domestic product of the countries. *RGDPsum* represents the total bilateral market size. We expect a positive sign as the lager the total size of the countries is, the more likely they form a PTA. World Bank's World Development Indicators provide the annual data of real GDP at constant US dollars (year 2000).

(5) *RGDPsim*: $\ln\left\{1-\left[RGDP_i / (RGDP_i + RGDP_j)\right]^2 - \left[RGDP_j / (RGDP_i + RGDP_j)\right]^2\right\}$.

Here the expected sign is positive as the two countries are similar in size of real GDP, they are more likely to form a PTA.

(6) *DKL*: It is $\left|\ln\left(RGDP_i / POP_i\right) - \ln\left(RGDP_j / POP_j\right)\right|$ where *POP*s is populations of countries and World Bank's World Development Indicators provide the total annual population over the period of 1960 to 2005. Note that this variable is the absolute value of the difference in real GDP per capita of countries. So, it tells also the dissimilarity of two countries in terms of per capita GDP. Hence, we expect a negative sign for the effect of *DKL* because countries with a more similar size are more likely to form a PTA.

However, Egger and Larch (2006) expect this sign to be positive. They assume that this variable is a proxy for the absolute value of the difference between the logs of the capital-labor ratios of country pair. Their theoretical background of this assumption is that there is high positive correlation between the capital-labor ratios and real GDP per capita. We are not sure whether this is the case or not.

(7) *SQKDL*: It is a square of *DKL*. According to our reasoning for *DKL*, it must show a positive sign because the value of *DKL* is increased. However, based on Egger and Larch (2006)'s assumption, it must show a negative sign because countries tend to be specialized as the difference of capital-labor endowment ratios are too large.

(8) *DROWKL*: Baier and Berstrand (2004) define this as the relative factor endowment difference between the rest of the world and a given country-pair. Using a similar reasoning as to *DKL*, Egger and Larch (2006) re-defined the following proxy;

$$(0.5)\left\{\left|\ln(\sum_{k\neq i} RGDP_k / \sum_{k\neq i} POP_k) - \ln(RGDP_i / POP_i)\right| + \left|\ln(\sum_{k\neq j} RGDP_k / \sum_{k\neq j} POP_k) - \ln(RGDP_j / POP_j)\right|\right\}$$

This is the relative real GDP difference between the rest of the world and a given country-pair. They expect a negative sign. That is, a country-pair with a relative large real GDP compared to that of the rest of world is less likely to form a PTA. This is because of a potential trade diversion toward its neighbor which is smaller.

We use the MATLAB program provided by LaSage's website (http://www.spatial-econometrics.com) and a supercomputing system of X86 HPC Linux Cluster which is available at 'Supercomputing & Visualization Unit / Academic Computing' in the National University of Singapore (http://www.nus.edu.sg/comcen/svu/index.htm). Normal personal computer would take extremely long times to run the regression due to the size of the data. Egger and Larch (2006) report total 108 hours of testing the model (48 hours for the construction of *W* matrix plus 60 hours for the estimation for one set of data for the year 2005). Using the supercomputer, it takes us 24 hours to test all models for the periods of 1965, 1975, 1985, 1995 and 2005 including building up the weight matrices.

3. Results

Table 1 summarizes the basic statistics and Table 2 show the results from the estimation.

[Insert Table 1 and Table 2]

First, the estimated values of ρ under *W* matrix for all years are significantly positive. It is 0.354 in 1965, 0.626 in 1975, 0.523 in 1985, 0.445 in 1995 and 0.865 in 2005. Overall the results confirm the existence of interdependence among PTAs. Interestingly, we can see a fluctuation of the degree of interdependence. That is, the value has increased in 1975 and in 2005. After 1975, the value keeps decreasing until 1995.

This finding is interesting since it may give us an empirical evidence for so-called 'regionalism wave'. Figure 1 in introduction of this paper, we can observe that the number of RTAs reported to GATT/WTO since 1948 has shown an increasing trend with two peak-times of 1970s and 2000s. Our finding implies that the regionalism wave seems to be related to the patterns of interdependence among PTAs.

Second, most of the estimated values of ρ_{in} under W_{in} and ρ_d under W_d are significantly positive. However, we see some interesting patterns of the estimated values over time. In general, ρ_{in} is stays at a high level. They are 0.730 in 1965, 0.885 in 1975, 0.870 in 1985, 0.831 in 1995 and 0.924 in 2005. The values over time show a similar pattern to the value of ρ. That is, 1975 and 2005 are the two peak years. However the pattern of ρ_d under W_d shows a quite different trend. The values stay at a low level of 0.184 in 1975 and are not significant in 1965, 1985 and 1995. However, in 2005, it becomes 0.992 which is the highest level among all values. More interestingly, we find that $\rho_{in} > \rho_d$ for the year of 1965, 1975, 1985 and 1995; and $\rho_{in} < \rho_d$ for the year of 2005. The finding of $\rho_{in} > \rho_d$ implies a stronger interdependence across than within PTAs, while that of $\rho_{in} < \rho_d$ means a stronger interdependence within than across PTAs. The latter one is similar to that of Egger and Larch (2006) who also use the data for the year of 2005. We find that in fact their finding is not a general case but special one for year 2005. We find that the opposite result to theirs is more common in the past.

Based on the domino theory of regionalism that is put forwarded by Baldwin (1995, 1997), our findings can be interpreted as such that in the past years there must have been relatively large political costs for countries to join in existing PTAs. Thus countries have tended to create new PTAs. Our results show that it is only recent years that the political costs are either reduced or dominated by the economic benefits of joining in existing PTAs.

If we borrow the theories of the Krugman (1991) and Bond and Syropoulos (1996), our findings for the periods of 1965, 1975, 1985 and 1995 may imply that since the establishment of EC in 1958 until the mid 1990s, the world had followed a global welfare improving optimal path of regionalism in a sense that interdependence occurred across PTAs and thus the world had consisted of a large number of small PTAs with lower external tariffs. This was theoretically shown by Krugman (1991) with the assumption of symmetric PTAs. However, for the last decade the path has been changed to the case of interdependence within PTAs and the world may end up with being divided into a smaller number of large PTAs with higher external tariffs.

We have more results on the other explanatory variables. First, *NATURAL* shows significant and positive signs for all cases. So the trade costs are important factors for the choice of PTAs. *DCONT* exhibits quite mixed results over time. In 1965, 1975 and 1985 the continental factors are either insignificantly negative or positive for the incentive of PTA formation. It is 1995 onwards that the continental effect turns positive. In 2005, it becomes less significant, though. However, the remoteness variable, *REMOTE* shows a consistently positive for the entire period. These results imply that it is only after 1995 that it has been more likely that PTAs are formed between countries that are located in a same continent.

Second, *RGDPsum* and *RGDPsim* show a predicted positive sign for the years, 1995 and 2005, although some of the effects for 1965, 1975 and 1985 are not statistically significant. *DKL* shows a negative effect on the PTA formation. This is consistent with our expectation. Unlike Egger and Larch (2006)'s interpretation, this result imply that the variable *DKL* reflects the degree of dissimilarity in the size of real GDP between countries. Naturally, *SQDKL* tends to show significantly positive signs for the years of 1975, 1985 and 1995, as predicted, since the dissimilarity becomes strengthened with *SQDKL*. For the years of 1965 and 2005, the results are not statistically significant. Lastly, unlike Egger and Larch (2006)'s results, *DROWKL* reveals a predicted negative sign. That is, with the fear of trade diversion, countries with large difference in the size of real GDP with the rest of the world are less likely to form a PTA among them.

4. Concluding remarks

We used a full range of data set for the years of 1965, 1975, 1985, 1995 and 2005 to re-examine the interdependence of PTAs and found that the interdependence have changed dramatically over time. Two main findings are as follows. First, the degree of interdependence among PTAs has been increased twice; first in 1975 and second 2005. Second, we show that the stronger interdependence within than across PTAs is observed only in 2005, while across-interdependence of PTAs is stronger for most of the times in the past. This second result is not just complementary to that of Egger and Larch (2006) who investigated for the year of 2005 only. In fact, our result shows that across-interdependence among PTAs has been common over time.

Appendix

A: List of Preferential Trade Agreements (132 Agreements)

Information on PTAs formations is available from the World Trade Organization website. We set up a binary dummy variable for a pair of countries that are PTA partners as of the years of 1965, 1975, 1985, 19995 and 2005 from the table of *Regional Trade Agreements Notified to the GATT/WTO and in Force By date of entry into force*, as of 31 December, 2005. The total number of PTAs that are considered in our analysis is 132 agreements. In fact, the total numbers of Regional Trade Agreements that are notified to the WTO is 186 as of 2005. However, we removed 54 cases; service agreements (34 cases), preferential agreements (18 cases) and some exceptions (2 cases). The two exceptions are Commonwealth of Independent States (CIS) and Accession of Romania to Central European Free Trade Agreement (CEFTA). CIS was formed among twelve countries (Azerbaijan, Armenia, Belarus, Georgia, Moldova, Kazakhstan, Russian Federation, Ukraine, Uzbekistan, Tajikistan, Kyrgyz Republic) in 1994. However, CIS has not seemed binding agreements because the CIS member countries formed bilateral free trade agreements each other afterwards. So we ignore CIS in the sample but include all successive bilateral agreements among themselves. CEFTA was firstly established by Romania, Bulgaria and Croatia in 1993. However, the three countries had their individual accesses to the CEFTA afterwards. The first accession to the CEFTA was made by Romania in 1997; the second accession by Bulgaria in 1999 and the last by Croatia in 2003. So we ignore the CEFTA accession by Romania in the sample, while the other two countries' accessions are counted. We provide the full lists of the 132 agreements here.

1958: European Community (EC)
1960: European Free Trade Association (EFTA)
1961: Central American Common Market (CACM)
1970: EFTA accession of Iceland
1971: EC-Overseas Countries and Territories (OCTs)
1973: EC-Switzerland and Liechtenstein; EC accession of Denmark, Ireland and United Kingdom; EC-Iceland; EC-Norway; Caribbean Community and Common Market (CARICOM)
1976: EC-Algeria
1977: Agreement on Trade and Commercial Relations Between the Government of Australia and the Government of Papua New Guinea (PATCRA); EC-Syria
1981: EC accession of Greece

1983: Closer Trade Relations Trade Agreement (CER)

1985: United State-Israel

1986: EC Accession of Portugal and Spain

1991: EC-Andorra: Southern Common Market (MERCOSUR)

1992: EFTA-Turkey

1993: EFTA-Israel; Armenia-Russian Federation; Kyrgyz Republic-Russian Federation; EC-Romania; EFTA-Romania; Faroe Islands-Norway; Faroe Islands-Iceland; EFTA-Bulgaria; EC-Bulgaria

1994: North American Free Trade Agreement (NAFTA); Georgia-Russian Federation

1995: Romania-Moldova; EC accession of Austria, Finland and Sweden; Faroe Islands-Switzerland; Kyrgyz Republic-Armenia; Kyrgyz Republic-Kazakhstan; Armenia-Moldova

1996: EC-Turkey; Georgia-Ukraine; Armenia-Turkmenistan; Georgia-Azerbaijan; Kyrgyz Republic-Moldova; Armenia-Ukraine

1997: EC-Faroe Islands; Canada-Israel; Turkey-Israel; EC-Palestinian Authority; Canada-Chile; Eurasian Economic Community (EAEC); Croatia- Former Yugoslav Republic of Macedonia (FYROM)

1998: Kyrgyz Republic-Ukraine; Romania-Turkey; EC-Tunisia; Kyrgyz Republic-Uzbekistan; Mexico-Nicaragua; Georgia-Armenia

1999: Bulgaria-Turkey; Central European Free Trade Agreement (CEFTA) accession of Bulgaria; EFTA- Palestinian Authority; Georgia-Kazakhstan; Chile-Mexico; EFTA-Morocco

2000: Georgia-Turkmenistan; EC-South Africa; Bulgaria-FYROM; EC-Morocco; EC-Israel; Israel-Mexico; EC-Mexico; Southern African Development Community (SADC); Turkey-FYROM

2001: Croatia-Bosnia and Herzegovina; New Zealand-Singapore; EFTA-FYROM; EC-FYROM; Romania-Israel; EFTA-Mexico; India-Sri Lanka; United States-Jordan; Armenia-Kazakhstan

2002: Bulgaria-Israel; EFTA-Jordan; EFTA-Croatia; Chile-Costa Rica; EC-Croatia; EC-Jordan; Chile-El Salvador; Albania-FYROM; FYROM-Bosnia and Herzegovina; Canada-Costa Rica; Japan-Singapore

2003: EFTA-Singapore; EC-Chile; CEFTA accession of Croatia; EC-Lebanon; Panama-El Salvador; Croatia-Albania; Turkey-Bosnia and Herzegovina; Turkey-Croatia; Singapore-Australia; Albania-Bulgaria; Albania-UNMIK (Kosovo); Romania-Bosnia and Herzegovina

2004: Romania-FYROM; Albania-Romania; China-Macao, China; China-Hong Kong, China;

United States-Singapore; United State-Chile; Republic of Korea-Chile; Moldova-Bosnia and Herzegovina; EU Enlargement; Bulgaria-Serbia and Montenegro; EC-Egypt; Croatia-Serbia and Montenegro; Romania-Serbia and Montenegro; Moldova-Serbia and Montenegro; Albania- Serbia and Montenegro; Moldova-Croatia; Albania-Moldova; Bulgaria-Bosnia and Herzegovina; Moldova-FYROM; Moldova-Bulgaria; Albania-Bosnia and Herzegovina; EFTA-Chile

2005: Thailand-Australia; US-Australia; Japan-Mexico; Turkey-PLO; EFTA-Tunisia; Thailand-New Zealand; Turkey-Tunisia

B: List of Countries

1965: 105 countries

Algeria, Argentina, Australia, Austria, Bahamas, Bangladesh, Belgium, Belize, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Canada, Central African Rep., Chad, Chile, China, China-Hong Kong SAR, Colombia, Congo, Costa Rica, Côte d'Ivoire, Denmark, Dominican Rep., Ecuador, Egypt, El Salvador, Fiji, Finland, France, French Polynesia, Gabon, Georgia, Ghana, Greece, Guatemala, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Kenya, Korea, Kuwait, Latvia, Lesotho, Liberia, Libya, Luxembourg, Madagascar, Malawi, Malaysia, Malta, Mauritania, Mexico, Morocco, Nepal, Netherlands, New Caledonia, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Portugal, Puerto Rico, Rwanda, Saint Vincent and the Grenadines, Senegal, Sierra Leone, Singapore, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Syria, Thailand, Togo, Trinidad and Tobago, Tunisia, United Kingdom, Uruguay, USA, Venezuela, Zambia, Zimbabwe

1975: 118 countries (13 more from 1965)

13 more: Brunei Darussalam, Cyprus, Gambia, Germany, Guinea-Bissau, Jamaica, Jordan, Mali, Saudi Arabia, Suriname, Swaziland, Turkey, United Arab Emirates

1985: 147 countries (29 more from 1975)

29 more: Albania, Angola, Antigua and Barbuda, Bahrain, Bulgaria, Cape Verde, China-Macao SAR, Comoros, Dominica, Equatorial Guinea, Estonia, Ethiopia, Grenada, Guinea, Lao People's Dem. Rep., Mauritius, Moldova, Mozambique, Namibia, Romania, Saint Kitts and Nevis, Saint Lucia, Samoa, Slovakia, Tajikistan, Tonga, Uganda, Vanuatu, Viet Nam

1995: 170 countries (24 more and 1 less from 1985)

24 more: Armenia, Azerbaijan, Belarus, Bosnia Herzegovina, Cambodia, Croatia, Czech Rep.,

Djibouti, Eritrea, FYR of Macedonia, Kazakhstan, Kyrgyzstan, Lebanon, Lithuania, Micronesia, Poland, Russian Federation, Serbia and Montenegro, Slovenia, Turkmenistan, Ukraine, United Rep. of Tanzania, Uzbekistan, Yemen
1 less: Libya

2005: 165 countries (3 more and 8 less from 1995)
3 more: Libya, Mongolia, Palau
8 less: Bahamas, Brunei Darussalam, Cyprus, French Polynesia, New Caledonia, Oman, Puerto Rico, Turkmenistan

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Table 1: Basic Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
		1965		
PTA	0.004	0.062	0.000	1.000
NATURAL	-8.735	0.755	-10.195	-4.968
RGDPsum	24.087	1.803	19.194	29.074
RGDPsim	-2.133	1.495	-9.613	-0.693
DKL	1.708	1.220	0.000	6.181
SQDKL	4.406	5.345	0.000	38.204
DCONT	0.228	0.419	0.000	1.000
REMOTE	8.916	0.174	8.616	9.645
DROWKL	1.394	0.550	0.063	3.347
		1975		
PTA	0.018	0.132	0.000	1.000
NATURAL	-8.704	0.758	-10.195	-4.909
RGDPsum	24.501	1.854	19.275	29.508
RGDPsim	-2.209	1.556	-9.843	-0.693
DKL	1.793	1.260	0.000	5.892
SQDKL	4.804	5.674	0.000	34.716
DCONT	0.230	0.421	0.000	1.000
REMOTE	0.887	0.177	8.585	9.641
DROWKL	1.432	0.603	0.060	3.377
		1985		
PTA	0.020	0.139	0.000	1.000
NATURAL	-8.713	0.767	-10.298	-4.129
RGDPsum	24.409	1.945	19.381	29.857
RGDPsim	-2.317	1.657	-10.290	-0.693
DKL	1.775	1.254	0.000	5.555
SQDKL	4.725	5.672	0.000	30.859
DCONT	0.228	0.420	0.000	1.000
REMOTE	8.901	0.180	8.599	9.701
DROWKL	1.470	0.638	0.027	3.492
		1995		
PTA	0.025	0.155	0.000	1.000
NATURAL	-8.681	0.774	-10.298	-4.129
RGDPsum	24.576	1.950	19.366	30.149
RGDPsim	-2.300	1.645	-10.402	-0.693
DKL	1.847	1.311	0.000	6.478
SQDKL	5.131	6.200	0.000	41.959
DCONT	0.224	0.417	0.000	1.000
REMOTE	8.877	0.184	8.588	9.731
DROWKL	1.598	0.693	0.040	4.104
		2005		
PTA	0.070	0.256	0.000	1.000
NATURAL	-8.670	0.770	-10.298	-4.129
RGDPsum	24.982	1.931	19.501	30.406
RGDPsim	-2.336	1.666	-10.673	-0.693
DKL	1.829	1.300	0.000	6.212
SQDKL	5.035	6.160	0.000	38.589
DCONT	0.227	0.419	0.000	1.000
REMOTE	8.850	0.185	8.548	9.730
DROWKL	1.558	0.710	0.017	3.873

Table 2: Result: Bayesian Heteroskedastic Spatial Autoregressive Probit Model

	Egger&Larch (2006)			1965			1975			1985			1995			2005		
X	W	Win	Wd	W	Win	Wd	W	Win	Wd	W	Win	Wd	W	Win	Wd	W	Win	Wd
ρ (+)	0.805	0.632	0.973	0.354	0.730	-0.017	0.626	0.885	0.184	0.523	0.870	0.101	0.445	0.831	0.011	0.865	0.924	0.992
std	0.035	0.039	0.016	0.062	0.060	0.110	0.057	0.026	0.109	0.038	0.031	0.089	0.043	0.029	0.067	0.015	0.011	0.007
NATURAL (+)	0.761	0.723	0.777	0.503	0.490	0.269	0.772	0.626	0.481	0.725	0.636	0.511	0.617	0.534	0.415	0.995	0.860	0.901
std	0.030	0.031	0.028	0.105	0.092	0.099	0.073	0.065	0.073	0.055	0.052	0.058	0.046	0.042	0.050	0.039	0.040	0.041
RGDPsum (+)	0.128	0.139	0.111	0.025	0.022	0.015	0.051	0.051	0.052	0.037	0.028	0.020	0.092	0.087	0.085	0.138	0.173	0.141
std	0.011	0.011	0.010	0.028	0.029	0.029	0.022	0.023	0.025	0.017	0.018	0.019	0.016	0.015	0.017	0.015	0.014	0.015
RGDPsim (+)	0.035	0.036	0.035	0.025	0.025	0.016	0.011	0.010	0.008	0.028	0.022	0.012	0.076	0.072	0.070	0.127	0.138	0.128
std	0.011	0.011	0.011	0.038	0.036	0.038	0.029	0.029	0.031	0.020	0.022	0.022	0.020	0.019	0.020	0.019	0.018	0.018
DKL (+) (-)	0.065	0.059	0.064	-0.075	-0.062	-0.069	-0.261	-0.253	-0.275	-0.158	-0.170	-0.197	-0.170	-0.183	-0.209	-0.010	0.012	-0.020
std	0.051	0.051	0.051	0.122	0.129	0.122	0.100	0.104	0.102	0.080	0.080	0.081	0.065	0.066	0.064	0.063	0.059	0.062
SQDKL (-) (+)	-0.062	-0.061	-0.061	0.014	0.012	0.012	0.041	0.041	0.044	0.026	0.031	0.036	0.027	0.030	0.036	-0.016	-0.012	-0.011
std	0.012	0.012	0.012	0.029	0.030	0.029	0.023	0.024	0.024	0.018	0.019	0.019	0.014	0.015	0.014	0.014	0.014	0.014
DCONT (+)	0.504	0.545	0.389	-0.093	-0.121	-0.191	0.057	0.018	-0.030	0.055	-0.006	-0.058	0.223	0.173	0.107	0.075	0.071	0.093
std	0.050	0.051	0.047	0.158	0.151	0.164	0.120	0.115	0.121	0.092	0.096	0.098	0.076	0.075	0.083	0.067	0.068	0.069
REMOTE (+)	0.297	0.336	0.293	0.582	0.752	0.529	0.800	1.026	0.796	0.786	1.072	0.900	0.560	0.876	0.738	0.490	0.335	0.214
std	0.108	0.112	0.108	0.274	0.264	0.313	0.213	0.217	0.240	0.170	0.173	0.190	0.155	0.153	0.173	0.138	0.144	0.147
DROWKL (-)	0.062	0.029	0.110	-0.040	-0.014	-0.017	-0.021	-0.005	-0.024	-0.081	-0.062	-0.099	-0.087	-0.049	-0.092	-0.118	-0.289	-0.228
std	0.030	0.030	0.028	0.089	0.086	0.092	0.065	0.066	0.072	0.048	0.051	0.052	0.039	0.040	0.042	0.037	0.037	0.036
Constant	-0.640	-1.556	-0.074	-3.419	-5.025	-4.919	-3.331	-6.752	-6.024	-3.290	-6.501	-5.840	-3.457	-6.968	-6.740	-0.401	-0.897	1.260
std	0.919	0.943	0.893	2.173	2.100	2.505	1.836	1.770	2.062	1.480	1.475	1.660	1.366	1.298	1.524	1.169	1.211	1.258
σ^2	1.213	1.221	1.206	1.296	1.290	1.322	1.273	1.276	1.300	1.274	1.283	1.307	1.273	1.280	1.305	1.253	1.263	1.270
Psuedo R^2	NA	NA	NA	0.732	0.909	0.532	0.692	0.860	0.577	0.591	0.801	0.558	0.597	0.727	0.581	0.647	0.824	0.689
Log-likelihood	-62567	-62746	-62016	-10133	-9956	-10397	-18171	-18261	-18726	-31401	-31419	-32047	-45855	-45934	-46510	-46533	-47586	-46990
Observation		15753			5460			6903			10731			14365			13530	

Note: The shaded area indicates statistically significant P-value at 5% level. "std" in X column stands for standard deviation.