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Impact of International Trade on Income and Income Inequality

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Abstract

The impact of international trade on the level and distribution of income has been the field of focus in international economics. There have been empirical studies supporting and opposing trade openness but most of the studies drew the results from cross sectional data. In this study, we use panel data to investigate the trade's impact on levels and distribution of income. Analysis of a balanced panel of country level data revealed that trade openness increases income. Results using an unbalanced panel data set revealed that trade openness increases income inequality in the overall sample but when we split the sample in to two groups, trade increases inequality in developing countries but it reduces inequality in developed countries though the coefficient is not statistically significant.

1. Introduction

The impact of trade on the level and distribution of income has been a topic of considerable debate among academics and policy makers, especially in developing countries. It is widely believed that the trade openness creates a competitive environment which results in quality products leading to the economic growth. Empirical support for the view that trade openness promotes economic growth can be found in a number of studies though trade does not appear to be a particularly robust predictor of economic growth (Ravallion, 2004). A prime objective of globalization is to provide better quality of life around the world by taking advantage of the international market. International trade also provides scope for economic development and poverty reduction. But the anti-globalization processions and demonstrations are commonplace whenever there is a World Trade Organization (WTO) meeting which suggests that all is not well with globalization.

As one aspect of globalization, heated arguments have been thrown regarding how much, poor people from developing countries gain from trade openness. Pro-globalization economists argue that poor people gain adequately from the international trade while some others are skeptical and are of the view that a disproportionate share of gain from international trade goes to the people who can't really be termed as poor. Ravallion (2004) argues that globalization is very likely to lower absolute poverty provided if one accepts the view that trade does not affect inequality but fosters economic growth. However, trade will have detrimental impact on poor people if the benefits of trade go to non-poor people. This argument is well supported by the fact that access to new technologies favors skilled and educated work force rather than unskilled laborers. But there also exists possibility that inequality in the developing countries might decline because of an increased demand for the unskilled labor while the existence of wage gap between skilled and unskilled laborers in some of the countries is inevitable. It happens as poor and unskilled people do not have access to the much needed information which plays a major role in almost every sphere. Though there is a question mark regarding the impact of trade openness on income and its distribution, it is also important to realize the factors which determine it. Whether trade has a positive influence or not depends on the pattern of growth followed by the countries and global economic policy. It is the opinion of experts that the risks and costs of globalization during recessions affect the developing countries more while the benefits from it during the global economic bloom is not equally distributed. Recent studies indicate the limited or lack of convergence among the trading partners as the reason for the fear that globalization might hurt the poor and downtrodden. Nissanke and Thorbecke (2004) argue that the trade openness is a

necessary but not a sufficient condition for successful development in a world of interdependent evolution. They go on to claim that greater openness also tends to be associated with greater volatility and economic shocks, which affect the vulnerable and poor households harder and deepen poverty and income inequality at least temporarily, as it happened during the Asian financial crisis. It is also the concern of welfare economists in the developing world that the globalization will put the small scale industries in jeopardy as the international manufacturers can produce in large factories and export it to developing countries such as India, and sub-Saharan Africa at cheaper price. But they also concede the fact that even these small scale industries have gained by their ability to sell the products in international markets and realize the truth that globalization is a double edged sword.

Inequality can be put in to perspective with an example. Kaushik Basu (2004) made a comparison between Norway (richest) and Sierra Leone (poorest) both with the population of 5 million. Sierra Leone has a per capita income of $500 and Norway $ 36,690 even after making purchasing power parity corrections. If we pick a person at random in Norway, he is 73 times as wealthy as a person chosen randomly in Sierra Leone. But what impact globalization has caused to this gap in the cited example is open to question. Hence, it is imperative on our part to empirically test whether trade openness has any significant impact on income and income inequality.

In an effort to understand the globalization and its impact on income and its distribution, various methods have been used including cross country regressions, aggregate time series analysis and simulation methods using both partial and general equilibrium analyses. But most of the studies have used cross country regressions which

have been criticized on two grounds. The first problem has to do with the involvement of differences in cultures, legal systems, or other institutions in the outcome of variable under study. Inclusion of fixed effects in a panel regression helps to account for it. The second problem is with data comparability among countries which can't be accounted by cross country regressions.

In the context of preceding discussions, in this paper we re-examine the impacts of trade openness on per capita income, and distribution of income within country, using both a balanced and unbalanced panel data for both developing and developed countries of the world.

The remainder of this paper is organized as follows. In Section 2, we briefly summarize the past studies that are directly relevant for the purpose of this paper. In Section 3, we describe data. In Section 4, we discuss our empirical strategy, results. Finally, we conclude in Section 5.

2. Past Studies

There is a large literature examining the impact of trade or globalization on income and income inequality. Therefore, here we do not attempt to review the entire existing literature. Instead, we briefly summarize past studies that are directly relevant for this paper. First, we present relevant studies that have examined the impact of trade on income, followed by studies on impact of trade on income inequality or distribution of income.

2.1 Impact of Trade on Income

In a seminal paper, Frankel and Romer (1999) studied the impact of trade on income. They used data for 150 countries for the year 1985. In order to correct for the endogeneity of trade, they employed Instrumental Variable (IV) techniques, and used country's geographic characters such as countries' distance from their trading partners as instruments for trade. They showed that trade has statistically significant impact on income across countries.

Rodriguez and Rodrik (2001) studied the impact of trade policies on economic growth and their finding questioned the validity of results obtained by Frankel and Romer (1999). They found little evidence supporting the claim that open trade policies are positively associated with economic growth and also concluded that the existing correlation is unauthenticated. They argued that the geography-based instruments used in the earlier studies might be correlated with other geographic variables that affect income through non-trade channels and the trade estimate is just capturing these non-trade effects. This is well supported by their empirical results that the trade coefficient was not statistically significant when geography indicators are introduced as controls in the income equation.

Following Frankel and Romer (1999), Irwin and Tervio (2002) examined the impact of trade on income, using data for different time periods: pre-World War I period (1913), the interwar period (1928), the great depression (1938), the early postwar period (1954) and for many years in the post-war period (1964, 1975, 1985, 1990). They tested the robustness of results by using both OLS and IV techniques. Their effort yielded similar results and confirmed the findings of Frankel and Romer across different time periods. They found that the IV estimate was higher than the OLS estimate across most of

the time periods and also rejected the hypothesis that OLS and IV estimates are same for three samples which included two of the more recent samples. Thus, there have been contradicting results about the impact of trade on the level of income.

Marta Noguer and Marc Siscart (2003) re-examined the relationship between trade and income and found that the estimate remains positive and significant even after introducing the geographic controls of Rodriguez and Rodrik. They have used a much richer data set without an imputation stage to get the estimates with greater precision. Their result is remarkably robust to a wide array of geographical and institutional controls, across time, and to the use of slightly different instrument. They also show that while raising productivity, trade affects income mostly through enhanced capital accumulation.

T.N.Srinivasan and Bhagwati (1999) evaluated various research papers to see whether the revisionists studying the impact of trade openness on growth are right or not. They argued that there exists a positive link between trade openness and growth performance and strongly criticized the studies with cross country regressions. They point out the lack of good theoretical foundations, appropriate econometric methodology and good data with cross country regressions and suggested that the estimates from these cross-country regressions can't be relied upon.

David and Winters (2000) in a special study series paper "Trade, Income disparity and poverty" with WTO, argued that trade liberalization is generally a positive contributor to poverty alleviation as it (1) allows people to exploit their productive potential, (2) assists economic growth, (3) curtails arbitrary policy interventions, and (4)

helps to insulate against shocks. Moreover, they suggested that most trade reforms create some losers and poverty may be exacerbated temporarily.

Dollar and Kraay (2001) studied whether the growth is good for poor or not and found that average income of the poorest fifth of the society rise proportionately with average incomes. They empirically show that economic growth and the policies and institutions that support it on average benefit the poorest in society as much as anyone else.

Santarelli and Figini (2002) studied the effect of globalization on poverty in developing countries. They used trade openness and financial openness to measure the globalization and concluded that trade openness and the size of the government is associated with lower poverty levels, while financial openness is associated with more poverty although not statistically robust. They also found substantial difference in relative and absolute poverty. Their results showed that trade openness tend not to significantly affect relative poverty, while financial openness is linked to higher relative poverty.

Zhang and Ondrich (2004) in their effort to study how cross country differences in export openness and import openness separately affect the real per capita income levels, found that export and import have distinct effects. They also employed instrumental variable estimation and their estimates revealed that only export has positive correlation with income, but not import and concluded that countries with higher export intensity, as opposed to high import intensity, have higher per capita income, ceteris paribus. But taken together as "total trade openness effect"- export openness + import openness-the resulting coefficient is positive which is in confirmity with the earlier findings.

2.2 Impact of Trade on Income Inequality

Calderon and Chong (2001) studied the external sector and income inequality in interdependent economies using a dynamic panel data approach, and showed that the intensity of capital controls, the exchange rate, the type of exports, and the volume of trade affect the long run distribution of income. They grouped the data in 5 year averages for the period 1960-1995. In general, their result shows that trade reduces income inequality but when interactive dummies are used to test whether trade openness has opposing effect with respect to income inequality depending upon the development, they find that trade openness was positive and barely significant for industrial countries and it was negative and statistically significant for developing countries.

Spilimbergo, Londono and Szekely (1999) investigated the empirical links among factor endowments, trade and personal income distribution. Using panel data, they showed that land and capital intensive countries have a less equal income distribution, while skill intensive countries have more equal income distribution. In addition, they found that the effect of trade openness on inequality of income depend on factor endowments.

Dollar and Kraay (2001) studied the effect of globalization on inequality and poverty. They first identified the group of developing countries that are participating more in globalization and then compared it with the rich countries. They came up with a series of important findings; (1) the post-1980 globalizers are catching up to the rich countries while rest of the developing world is falling farther behind, (2) they find a strong positive effect of trade on growth, (3) increase in growth rate that accompanies

expanded trade leads to proportionate increases in incomes of the poor, and concluded that globalization leads to faster growth and poverty reduction in poor countries.

Duncan (2000) also argues that there is a strong association between economic growth and the reduction of absolute poverty. He also suggested that small countries gain more by participating in the globalization process.

Ghose (2001) used a sample of 96 economies over a 16 year period, 1981-1997. They conclude that inter-country inequality has indeed been growing, but international inequality has been declining at the same time.

Cornia (2003) reviewed changes in global, between country and within-country inequality over 1980-2000. They found that recent changes in global and between-country inequality are not marked and depend in part on the conventions adopted for their measurement. In contrast, within-country inequality has risen clearly in two thirds of the 73 countries in the sample, because of the policy drive towards domestic deregulation and external liberalization.

Wan, Lu and Chen (2004) in order to examine the regional inequality in China, estimated an income generating function, incorporating trade and FDI variables and then used value decomposition technique to quantify the contributions of globalization to regional income inequality. They found that globalization constitutes a positive and substantial share to regional inequality and the share rises over time while the capital is one of the largest and increasingly important contributors to regional inequality.

Kahai and Simmons (2005), in one of the very few studies, used Gini index as a measure of inequality to explore its link with globalization. Controlling for structural and social indicators, they find that for developing countries globalization is positively

associated with an increase in inequality, while it is insignificant in case of developed countries. For all countries in their sample, the results indicate that worsening of the globalization index is associated with an increase in income inequality.

Anderson (2005) showed that increased openness affects income inequalities within developing countries by affecting asset, spatial and gender inequalities, and also the amount of income distribution. He further points out that most time-series studies find that greater openness has increased the demand for skilled labor, but most cross-country studies find that greater trade openness has had little impact on overall income inequality. He explains that this discrepancy might be due to the fact that countries selected for time series analysis does not represent the developing world. Also he opines that the effect of openness on income inequality via the relative demand for skilled labor have been offset by its effects via other channels.

3. Methodology

In order to accomplish our stated objectives, we use a panel data on trade, income, and in-country distribution of income for a set of both developed and developing countries. In the following, we describe the data used in this paper, followed by the model and results for each of the objectives separately.

3.1 Data

To examine the impact of trade on income, we used a panel data on international trade and level of income for 60 countries over a period of 1985-1994. Thus, our sample size consists of 600 observations. Our sample of countries consists of both developed and developing countries of the world for which comparable and consistent data were

available from various sources, including the World Bank (see Appendix B for a complete list of countries in the sample). The dependent variable of interest is real per capita Gross Domestic Production at PPP (PCGDP), and explanatory variables include: openness to trade, which is defined as percentage of GDP that is accounted by (Import + Export); geographic areas of the countries included in the sample; population of the countries; indices of democracy and corruption; gross secondary school enrollments; latitude of the countries; distance of the countries from the equator and a dummy variable to account for the landlockedness. The data on openness to trade, per capita GDP and population have been obtained from the Penn World Tables (Penn World Table 6.1). The data on the geographical areas of various countries were collected from the website, (http://www.infoplease.com/ipa/A0004379.html). Frankel and Romer (1999) and Irwin and Tervio (2002) also used data from the Penn World Tables for examining the impacts of trade on income. However, they used bilateral trade data obtained from the International Monetary Fund's Trade statistics.

Following previous studies, we use a measure of openness to trade (percentage of GDP accounted by export+import) as an indicator of international trade. The explanatory variable democracy index is measured on a 0-10 scale, where a higher value of index represents a greater degree of democracy. The data on the measure of democracy was collected from the Center for International Development and Conflict Management. It has been reasonably argued that effectiveness of trade policy on economic growth, in general, is contingent upon whether a country has a functioning democracy, conducive law and order situation, and whether the economy is free from civil and political strives. Thus, a functioning democracy of a country assumes significance as the effectiveness of trade on

income growth is very much contingent upon it and past studies have shown that politically volatile and unstable countries did not realize the full benefit of free trade. Similarly, a corruption variable is used to examine the effect of corruption on income as we suggest it might influence trade openness and income by illegal means. Data for this variable has been obtained from the International Country Risk Guide. Corruption is measured on a 0-6 scale where higher index values indicate greater degree of corruptedness and vice versa. We have used secondary school enrollments as education plays an important role in determining the income as well as trade awareness. Data on secondary school enrollment has been collected from the World Development Indicators report (2000) of World Bank.

Data on variables, latitude and distance from the equator of countries in the sample have been collected from CID geography data, available online. (http://www.cid.harvard.edu/ciddata/ciddata.html). We have included these variables to check the robustness of our result to the inclusion of these geographic controls. We have used latitude of the countries as a proxy for institutional quality (Hall and Jones, 1999) as high-latitude countries were mainly settled by Europeans, who carried their good institutions with them.

The dummy variable, landlocked indicates whether the country has access to sea or not. It is assumed that if the country does not have access to the sea (Landlock=1) then that reduces the opportunities for trade and if the country has sea access (Landlock=0) then that enhances the opportunities for trade.

We have used almost the same set of variables and the sources in addition to Gini coefficient to quantify the effect of trade openness on income inequality. The data set for

this objective contained 44 countries which include 23 developing countries (164 observations) and 21 developed countries (180 observations) over the period of 1984 to 1997 with 344 observations (see appendix B for a complete list of countries included in the unbalanced panel data).

We followed Wikipedia; an encyclopedia which can be found online at http://en.wikipedia.org/wiki/Developed_nation (for carrying out second objective) to classify the countries into developed and developing countries. Our dependent variable is Gini coefficient and we have used it as a measure of income inequality in a country.

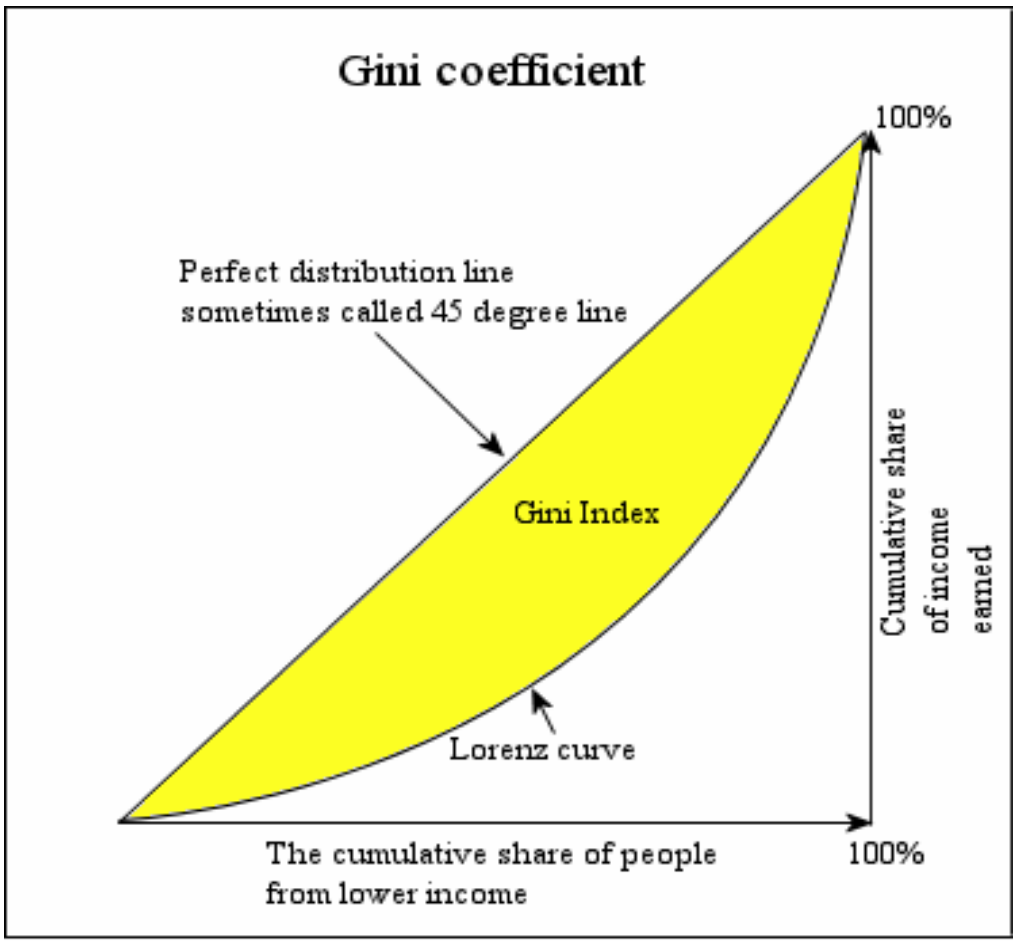

Figure 3.1: Gini Coefficient

Gini measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. This variable is measured between 0 and 1 with 0 accounting for perfect equality and 1 being perfectly in equal. Figure 3.1 illustrates gini coefficient. We have collected the data for this variable from the Deininger-Squire (1996) data set which is available at the World Institute of Development Economics Research (WIDER) website.

We have averaged the Gini coefficients for some years which had more than one estimate and then used it in the model. The explanatory variables used are: area and population of the countries; openness to trade; democracy and corruption indices; and a dummy variable for landlockedness. We have also used a dummy variable to account for developed countries and the dummy variable takes the value of 1 if it the country is a developed country and 0 otherwise.

3.1.1 Descriptive Statistics

Two separate, but related data sets are used to carry out the two objectives of the study. Data set for examining the effects of trade on income levels (Objective 1) is a balanced panel of 60 countries for ten years (1985-1994). Data set for investigating the distributional effect of trade is an unbalanced panel of 44 countries for 1984-1997 periods for a total of 344 observations. We report the descriptive statistics of both the data sets in tables 1 and 2 respectively.

The Per capita income of the countries (PCGDP) varies from a low of $387 to a high of $26,834 with a mean of $7,935 (Table 1) which shows a great variability in income among countries. Trade openness has a minimum of 13.24 % and a maximum of

403.10 % with a mean of 65.35 % and it indicates that some economies are more open to trade than others. The mean of corruption and democracy indices are 2.15 and 4.34, respectively, which means on an average the countries are corrupt and non-democratic. The mean, standard deviation, minimum and maximum of other variables are given in the tables 1 and 2.

Table 1. Definitions and descriptive statistics of variables used in Model (1).

Variable	Definition	Mean	Std Dev	Min	Max
PCGDP	Per Capita income measured in US dollars	7934.88	6604.06	387.15	26834.12
Pop	Population of country measured in 1,000	62966.24	178819.91	793.00	1190918.02
Area	Area of the country measured in Sq.km	1286983.55	2457338.04	692.70	9984670.00
Trade	Trade openness (Import+export)/ GDP	65.35	51.35	13.24	403.10
Land lock	Landlocked ness of the countries (1=Yes, 0=No)	0.13	0.34	0	1
CI	Corruption Index measured in 0-6 scale(0=Least, 6=Most)	2.15	1.40	0	6
Democracy	Measured in 0-10 scale(0=Least, 6=Most)	5.79	4.34	0	10
Litsec	Secondary school enrollment expressed in percentage	64.60	32.28	3.30	146.19
Distance (DFE)	Distance of the countries from the equator (Absolute value of latitude)	0.31	0.21	0.005	0.75
Latitude	Latitude of the countries measured in degrees	0.19	0.32	-0.46	0.75

The dependent variable for explaining income distributional effects of trade is Gini coefficient. The Gini coefficient has a mean of 37.48 with a minimum of 21.20 and

a maximum of 63.05 (Table 2) reflecting wide disparity in income distribution among countries. The mean, standard deviation, minimum and maximum of other variables used in the model (2) are also given in the table 2. Although similar explanatory variables are used in both data sets, the descriptive statistics are different because of differences in sample compositions.

Table 2. Definitions and descriptive statistics of variables used in Model (2)

Variable	Definition	Mean	Std Dev	Min	Max
Gini	Measure of inequality expressed in % (0=Perfect equality, 1=Perfect inequality)	37.48	10.06	21.20	63.05
Trade	Trade openness (Import+export)/ GDP	69.27	64.47	13.24	403.09
PCGDP	Per Capita income measured in dollars	11030.52	6915.48	1034.08	27894.92
Pop	Population of countries measured in thousands	88770.62	219490.33	2350.41	1215414.27
Area	Area of the countries measured in Sq.km	1786968.35	3201303.91	692.70	9984670.00
CI	Corruption Index measured in 0-6 scale (0=Least, 6=Most)	1.64	1.37	0	6
Democracy	Measured in 0-10 scale (0=Least, 6=Most)	7.43	3.66	0	10
Litsec	Secondary school enrollment expressed in percentage	80.29	29.98	16.89	152.69
Land lock	Landlocked ness of the countries (1=Yes, 0=No)	0.04	0.19	0	1
Developed	Development of the country (1=developed 0=developing)	0.52	0.50	0	1

3.2. The Impact of Trade on Income

The topic trade and its impact on income become an issue of considerable debate among academics and policy makers, especially among developing countries. Numerous studies have examined the impact of trade on income but mostly with cross sectional data. We re-examine the impact of trade on income using a panel data set, unlike past studies. In the following, we discuss the empirical specification of the model, construction of instrument, and the method of estimation. Essentially we estimated our regression equation by using error component two-stage least square random effects IV regression model (EC2SLS) of Baltagi (2005).

3.2.1 The Model

The main aspects of the Frankel-Romer (1999), Irwin-Tervio (2002) and Noguer-Siscart (2003) papers were the inclusion of geographic characteristics as they are highly correlated with trade and uncorrelated with income. Therefore, they have used these geographic attributes, especially distance from the one's trading partner, as the instruments to study the impact of trade on income. In this paper, we use trade openness instead of bilateral trade as an indicator of international trade and also we employ different instruments. More specifically, we use area and population as the instruments for trade openness, as these variables are important determinants of the within country trade which eventually affects the trade openness. The intuition is that the countries which have larger area and population inclined to have lower trade openness than the smaller ones. For example India will have lesser trade openness than Singapore as India has larger area and population than Singapore does.

The conventional approach to examine the impact of trade on income is to regress the Log of per-capita income on the log of trade openness, indices of corruption and democracy, secondary school enrollment and dummy landlock using Pooled OLS technique as given in equation (1).

$$\text{Log}(PCGDP_{i,t}) = \beta_0 + \beta_1 \text{Log}(\text{Trade})_{i,t} + \beta_2 CI_{i,t} + \beta_3 \text{Democracy}_{i,t} + \beta_4 \text{Litsec}_{i,t} + \beta_5 \text{land lock}_i + \mu_{i,t} \quad (1)$$

where variable definitions are given in table 1 and appendix A. The variable, trade, on the right hand side of equation (1) is endogenous. For instance, countries with higher income have better infrastructure facilities that in turn enable them to trade more, while poor countries might not. Thus, there is a simultaneous feedback effects between income and trade. So, under these circumstances estimate of parameter coefficient β_1 will be biased if equation (1) is estimated by Ordinary Least Squares (OLS) method, because of the positive correlation between trade and μ. Moreover, trade could be correlated with the stochastic error, u, because of the measurement error in the explanatory variable openness to trade and in this case too estimated coefficient β_1 will be biased if it is estimated by OLS technique. So, in order to obtain unbiased and consistent estimates of parameters, we use the same two-stage least square (2SLS) procedure followed by Frankel-Romer but we have used EC2SLS random effects IV regression (Baltagi, 2005) instead of the gravity model used by Frankel and Romer.

3.2.2 Constructing the Instruments

We estimate model (1) by error component two-stage least square (EC2SLS) procedure. Essentially, our empirical model in equation (1) is random effect model that is estimated by EC2SLS random effects IV Regression method. We have used random effects model against the fixed effects model as our data set did not exhaust all the countries in the world. The area and population of a country are used as instruments for trade as these variables are important determinants of trade openness but they do not have any significant contribution in determining the income except they operate through trade. Also income does not affect these geographic attributes. To see how significant area and population are in determining trade openness, we regressed country's trade openness on area, population, corruption and democracy indices, secondary school enrollment and dummy landlock (equation 1.2) and found that area and population are statistically very significant.

Frankel and Romer (1999) constructed the instrument by regressing bilateral trade on the set of geographic variables including distance between the trading partners and then aggregated the predicted values across all the countries. They calculate the predicted values of bilateral trade not only for all pairs of their 62 sample countries, but also for another 88 countries for which data on bilateral trade is not available by imputation. Irwin and Tervio also followed the same methodology but they constructed the instrument slightly in a different way, in which the bilateral trade shares are not imputed for countries for which they did not have bilateral trade data but they always impute them for country pairs that have zero reported bilateral trade.

We estimate the instrument by regressing trade openness on area, population, corruption and democracy indices, secondary school enrollment and dummy landlock and then use the predicted trade values in the second stage.

3.2.3 FIRST STAGE REGRESSION

$$\text{Log (Trade)}_{i,t} = C_0 + C_1 \text{ Log (area)}_i + C_2 \text{ Log (Pop)}_{i,t} + C_3 \text{ CI}_{i,t} + C_4 \text{ Democracy}_{i,t} + C_5 \text{ Litsec}_{i,t} + C_6 \text{ Land lock}_i + V_{i,t} \quad (1.2)$$

The equation (1.2) of model (1) states that the country's trade openness is explained by geographical size (measured by its geographical), population, corruption and democracy indices, secondary school enrollment and dummy landlock. The instrument is constructed by predicting the values for trade. The predicted value of trade (Instrument) is then used in the second stage regression.

3.2.4 SECOND STAGE REGRESSION

The predicted value of trade (Instrument) has been substituted in place of trade in Model (1) and is estimated using EC2SLS random effects IV Regression which gives the heteroskedasticity corrected standard errors. .

$$\text{Log (PCGDP}_{i,t}) = \alpha_0 + \alpha_1 \text{ Log (Trade)}_{i,t} + \alpha_2 \text{ CI}_{i,t} + \alpha_3 \text{ Democracy}_{i,t} + \alpha_4 \text{ Litsec}_{i,t} + \alpha_5 \text{ land lock}_i + \varepsilon_{i,t} \quad (1.3)$$

The information regarding possible OLS bias can be obtained by comparing the slope parameters α_1 and β_1. Other determinants of per-capita income are considered to be

uncorrelated with the instruments and are thus included in the error term. We have also run the same model by including some other geographic controls to see how robust our results are. In an earlier study, Rodriguez and Rodrik (2001) have questioned the validity of using geography based instruments as geography affects income directly and failing to control for these channels might impart bias to the estimates. They re-run the Frankel and Romer's equation and show that the trade coefficient is not robust and becomes insignificant to the inclusion of any of the summary indicators of geography (distance to the equator, the percentage of a country's land area in the tropics, and a set of regional dummies). They concluded that there exists no independent effect of trade on income. But Noguer and Siscart (2003) have re-run the Rodriguez and Rodrik's regressions and found that trade remains significant and robust even after the inclusion of geographic controls. They concluded that the insignificance of trade estimate in Rodriguez and Rodrik (2001) is because of their weak instrument. Again, both of the studies used cross sectional data for the above findings. We have used panel data and run model (1) with the inclusion of distance from the equator in one regression and latitude in another regression all other variables remaining the same using EC2SLS random-effects IV regression procedure. Our empirical results show that trade remains positive and significant variable even after the inclusion of these geographic controls and result is robust to the inclusion of geographic controls.

3.2.5 Discussion of Empirical Results

We begin by reporting the pooled OLS estimates of the regression of log of per-capita income on log of trade openness, corruption and democracy indices, secondary school enrollment and the dummy landlock (Table 3) of model (1).

Table 3: Pooled OLS estimates of income model (1)

Variable Name	Parameter Estimate	Standard Errors	T Value
Constant	6.999*	0.16205	43.19
Trade	0.077**	0.03382	2.30
Corruption Index (CI)	-0.137*	0.01969	-6.94
Democracy Index	0.052*	0.00625	8.36
Secondary school Enrollment (Litsec)	0.019*	0.00095	20.06
Land Lock	-0.209*	0.06046	-3.46
R-Square	0.7941		
Adjusted R-Square	0.7924		
Number of Observations	600		

Dependent variable: Log per-capita GDP

Note: *. Significant at 1% level of significance, **. Significant at 5% level of Significance

Results from pooled OLS regression in table 1 reveal that the per-capita income increases by about .078 % for every 1 % increase in the trade openness and this relation is significant at 5% level of significance. Frankel-Romer's coefficient for trade using cross sectional data was .85 and it was significant at 1% level. As expected, our results show that the corruption has a negative and statistically significant impact on level of per capita income. Also the result shows that higher democracy leads to higher income and the corresponding coefficient is significant at 1% level. Income increases by about 1.9 % for every 1% increase in secondary school enrollment and the coefficient is statistically significant at 1% level. The result also reveals that if the country is landlocked then

income gets reduced by about 20% and it is statistically very significant at 1% level. Tables 4 and 5 show the results of equations (1.2) and (1.3) of model (1), respectively.

Table 4 gives the estimated coefficients for first stage regression of model (1) (Equation 1.2) in which we show that the instruments which we have used are indeed significant.

Table 4: Parameter estimates for equation (1.2)

Instrument	Parameter Estimate	Standard Errors	T Value	P Value
Constant	7.521*	0.14940	50.34	<.0001
Log of Area	-0.14238*	0.01232	-11.55	<.0001
Log of Pop	-0.16806*	0.01471	-11.42	<.0001
Landlock	0.07605	0.04933	1.54	0.1237
Corruption index (CI)	-0.00809	0.01577	-0.51	0.6079
Democracy index	-0.01633*	0.00506	-3.23	0.0013
Secondary school Enrollment (Litsec)	0.00058280	0.00076829	0.76	0.4484
R-Square	0.5852			
Adjusted R-Square	0.5810			
Number of Observations	600			

Dependent variable: Log of Trade

Note: *. Significant at 1% level of significance

The first stage regression reveals that area and population are determinants of trade openness and it is indeed correlated with trade and also both the coefficients are statistically significant at 1% level. Hence we have used area and population to instrument for trade.

Table 5 presents the results of three specifications of income model. The three specifications differ in the inclusion of latitude and distance from the equator variables.

Results for specification one indicate that trade openness is positive and statistically very significant. The estimated coefficient of 0.4769 indicates that per capita income increases by about 0.48% for every 1% increase in trade and it is statistically significant at 1% level

Frankel and Romer (1999) found that 1% change in trade increases the income by about 2-3% while Noguer and Siscart (2003) found that 1% increase in trade increases the income by about 2.5%.The difference in the magnitude of their coefficients and our coefficient might be due to the fact that we have used panel data instead of cross sectional data and also we have used trade openness instead of bilateral trade. As expected, the result reveals that corruption reduces the income while higher degree of democracy and secondary school enrollment increase the income and all the three coefficients are statistically very significant at 1% level. Also if the country is landlocked and does not have sea access, then that reduces the income by about 43 % and it is statistically very significant at 1% level.

Table 5: EC2SLS random effects IV regression estimates of model (1)

Variable	Specification 1	Specification 2	Specification 3
Constant	5.7041* (0.3460)	4.7254* (0.3703)	5.6886* (0.3404)
Trade	0.4769* (0.0839)	0.6031* (0.0858)	0.4612* (0.0823)
Corruption Index (CI)	-0.0382* (0.0156)	-0.0061 (0.0162)	-0.0311* (0.0156)
Democracy Index	0.0282* (0.0053)	0.0230* (0.0053)	0.0270* (0.0052)
Secondary School Enrollment	0.0138*	0.0109*	0.0131*

(Litsec)	(0.0008)	(0.0009)	(0.0009)
Landlock	-0.4264* (0.1422)	-0.4267* (0.1434)	-0.3350* (0.1435)
Distance from the Equator (DFE)	-	2.0078* (0.2651)	-
Latitude	-	-	0.5094* (0.1616)
R-Square	0.6719	0.6756	0.6619
Number of Observations	600	600	600

Dependent variable: Log of Per-capita GDP

* Indicates statistical significance at 1% level

Robust standard errors are given in parentheses

We have also run two more specifications of income model to check for the robustness of our result to the inclusion of geographic controls. These results are also presented in Table 5. In the specification 2, we have included distance from the equator as the geographic control besides trade, corruption and democracy indices, secondary school enrollment and the dummy landlock. The estimated trade coefficient increased in the magnitude when compared to regression 1, while remaining statistically significant at 1% level. In specification 3, we have just replaced distance from the equator with latitude (as a proxy for institutional quality) and trade coefficient remains statistically very significant at 1% level which means our main result that trade openness is income augmenting is robust to the inclusion of other geographic controls as well.

There has been a considerable debate on whether international trade increases income with conflicting evidence from several studies. An objective of this thesis is to quantify the influence of trade openness on income using panel data in contrast to cross sectional data used by the earlier studies. We have used EC2SLS random effects IV

regression model where we have used area and population to instrument for trade openness. Our result shows that percapita income of a country increases by about 0.48% for every 1% increase in trade and this relation is statistically significant at 1% level. Our result is in conformity with the earlier findings of Frankel and Romer (1999), Irwin and Tervio (2002) and Noguer and Siscart (2003) that trade increases income. We have also checked the robustness of our result by including the geographic controls like distance from the equator and latitude and the trade estimate retains its statistical significance at 1% level and robust to the inclusion of those geographic variables.

3.3 Impact of Trade on Income Inequality

Many studies have attempted to examine the impact of international trade on income inequality, and empirical evidence so far has very conflicting. Some studies point out the declining trend of within country inequality through trade openness and some argue that it increases inequality on the whole. Ghose (2001) argues that inter-country inequality has grown over the years while international inequality has declined. Hence, it is imperative to understand the link between trade openness and inequality. Most of the earlier studies used cross sectional data for this purpose and we are of the view that the results from cross sectional studies are spurious and we have tried our best to investigate using panel data though it is unbalanced. The study might let us know the effect of openness on absolute poverty when combined with evidence on links between trade openness and economic growth. For example, if we know that trade openness raises economic growth, but has no effect on the distribution of income, we can be reasonably sure that openness reduces absolute poverty. It can also tell us the likelihood of

implementing openness increasing policies and how trade openness affects well-being of individuals' and households'. In the next section we discuss about the model, construction of the instrument, EC2SLS random effects IV regression model and the empirical findings.

3.3.1 The Model

Calderon and Chong (2000) have done a similar study in which they used dynamic panel data to know the link between external sector and income inequality in interdependent economies. They allowed for the possibility of simultaneity and reverse causation by assuming weak exogeneity of the explanatory variables and they have used instruments to control for the exogeneity. They also eliminate the country-effects by first-differencing approach. Though our approach has close resemblance, it is different in many aspects. They grouped the data in 5-year averages for the period 1960-1995 while we use an unbalanced panel of 44 countries from 1984-1996. Since our data set did not exhaust all the countries in the world, we use EC2SLS random effects model against their first differencing approach. Our basic model is;

$$\text{Log (Gini)}_{i,t} = \beta_0 + \beta_1 \text{Log (Trade)}_{i,t} + \beta_2 \text{Landlock}_i + \beta_3 \text{Democracy}_{i,t} + \beta_4 CI_{i,t} + \beta_5 \text{Developed}_i + \mu_{i,t} \quad (2)$$

where, trade refers to trade openness that explains the income inequality and we believe that trade openness is endogenous and it is correlated with error term. For example, countries with higher income and lower inequality might trade more because of better

infrastructure, while countries with higher inequality might not. Thus, there exists a simultaneous impact between income inequality and trade openness. To overcome this problem of endogeneity we have used Geography based variables; area and population to instrument for trade and then we estimated the model (2) with EC2SLS random effects IV regression procedure.

3.3.2 Constructing Instruments

We estimate the model (2) by EC2SLS procedure. Ours' is a random effects model and we use random effects model as we only have 44 countries in our data set. We have used area and population of the countries as instruments as they affect the trade openness but do not have any significant influence on income inequality except some indirect effects.

Our instrument is constructed by regressing log of trade openness on area and population along with other explanatory variables democracy and corruption indices, the dummies landlock and developed and then we predict the values to be used in the second stage regression. The same regression also reveals the statistical significance of the variables area and population in explaining trade openness.

3.3.3 First Stage Regression

$$\text{Log (Trade)}_{i,t} = \alpha_0 + \alpha_1 \text{Log (area)}_i + \alpha_2 \text{Log (pop)}_i + \alpha_3 \text{Democracy}_{i,t} + \alpha_4 \text{CI}_{i,t} + \alpha_5 \text{Landlock}_i + \alpha_6 \text{Developed}_i + \varepsilon_{i,t} \quad (2.1)$$

where "developed" refers to the developed countries. In this model, countries trade openness is explained by its area, population, the democracy and corruption level, the

dummies landlock and developed. Then the values for the trade are predicted and the predicted values replace the variable trade in our basic model (2).

3.3.4 Second Stage Regression

The predicted value of trade (instrumented) has been substituted in place of trade openness in model (2) and is estimated using EC2SLS procedure.

$$\text{Log (Gini)}_{i,t} = \beta_0 + \beta_1 \text{Log (Trade)}_{i,t} + \beta_2 \text{Landlock}_i + \beta_3 \text{Democracy}_{i,t} + \beta_4 \text{CI}_{i,t} + \beta_5 \text{Developed}_i + \mu_{i,t} \quad (2.2)$$

We have used a dummy variable for developed countries as there exist a common opinion that effect of trade on inequality differs based on development (Anderson, 2005). We have also used the dummy for landlockedness, democracy and corruption indices as controls.

3.3.5 Discussion of Empirical Results

We report the first stage results (Table 6) of model (2) where we can see that our instruments, area and population are indeed significant in explaining trade.

We regressed log of trade on log of area, log of population, democracy and corruption indices and the dummies landlock and developed countries and the result show that both area and population are significant at 1% level. Hence we think it is appropriate to use these variables to instrument fro trade. Although democracy index is significant, we did not use it as an instrument as it might affect both trade and income inequality.

Table 6: First stage parameter estimates of model (2)

Variable Name	Parameter Estimate	Standard Errors	T Value	P Value
Constant	7.8060	0.1528*	51.06	<.0001
Log of Area	-0.1538	0.0133*	-11.54	<.0001
Log of Pop	-0.1482	0.0191*	-7.76	<.0001
Land lock	-0.0446	0.0969	-0.46	0.6456
Democracy index	-0.0388	0.0067*	-5.75	<.0001
Corruption Index	-0.0548	0.0223*	-2.46	0.0145
Developed	0.0499	0.0580	0.86	0.3902
R-Square	0.7092			
Adjusted R-Square	0.7040			
Number of Observations	344			

Dependent variable: Log of Trade

* Indicates statistical significance at 1% level

We now report the EC2SLS random effects IV regression results (Table 7) of model (2). The result of the model (2) reveals that trade openness has positive and significant effect on income inequality. The income inequality increases by 0.14% for every 1% increase in trade openness and the coefficient is statistically significant at 1% level. This result is somewhat consistent with Feenstra (1997) and Wood (2002) theoretical models which say that greater openness raise overall inequality in all countries.

Table 7: EC2SLS random effects IV regression estimates of model (2) for overall sample

Variable Name	Parameter Estimate	Standard Errors	Z Value	P Value
Constant	3.1621*	0.2198	14.38	0.000
Trade	0.1382*	0.0543	2.54	0.011
Landlock	-0.3847*	0.1491	-2.58	0.010
Democracy Index	0.0079*	0.0031	2.52	0.012
Corruption Index	-0.0013	0.0104	-0.13	0.898
Developed	-0.3041*	0.0667	-4.56	0.000
R-Square	0.2551			
Number of Observations	344			

Dependent variable: Log Gini

* Indicates statistical significance at 1% level

The dummy variable for landlockedness is negative and statistically significant at 1% level and we think that the negative sign is due to the fact that trade through sea access affects only people who live in coastal areas more and other regions does not get benefited equally and also people who get benefited more through sea access belong to upper middle income and upper income categories and hence the countries which are landlocked, has lesser income inequality. The sign for democracy index remained positive and it is statistically significant too at 1% level. Trade increases income and democracy has a positive influence (Table 5) on it but it also increases inequality because of the fact that income of the people who belong to upper middle and upper income categories increase more when compared to lower income people in democratic countries and that played its part in the positive sign for democracy index. The sign for corruption index is surprising as it reveals that more corruption reduces inequality but it is not

statistically significant. We also checked whether trade has any opposing influence depending on the development using dummy developed as an intercept shifter and the result reveals that trade openness increases inequality overall and in developed countries too but the increase in inequality is more in overall sample of countries than the developed countries. But we have also divided the same data set in two separate data sets based on the development as developed countries and developing and underdeveloped countries and ran the model (2) to see whether there are any significant changes between two samples. We compare the results in table 8.

Table 8: EC2SLS random effects IV regression estimates of model (2) with developed and developing countries sample

Variable	Developed countries	Developing countries
Constant	4.2795 (0.3224)*	2.9959 (0.3013)*
Trade	-0.0634 (0.0487)	0.1920 (0.0751)*
Landlock	-0.1248 (0.0909)	-0.5657 (0.2700)**
Democracy Index	-0.0576 (0.0149)*	0.0070 (0.0032)**
Corruption Index	0.0106 (0.0155)	-0.0132 (0.0136)
R-Square	0.3731	0.1199
Number of Observations	180	164

Dependent variable: Log Gini

* Indicates statistical significance at 1% level; ** Indicates statistical significance at 5% level; Robust standard errors are given in parentheses

The result in table 8 throws some interesting results and differences between developed countries and developing and underdeveloped countries. The trade openness reduces

inequality in developed countries but the coefficient is not statistically significant but trade openness increases inequality in developing and underdeveloped countries and the coefficient is statistically significant at 1% level. The sign for the dummy landlock is negative which means sea access increases inequality and the coefficient is statistically significant for developing countries while it is insignificant for developed countries. Democracy reduces inequality in developed countries and the coefficient is statistically significant at 1% level while it increases inequality in developing countries with the coefficient statistically significant at 5% level. This contrasting result shows that the developed countries have better functioning democracy than the developing and underdeveloped countries. The coefficient for corruption index is not significant in both the samples though it is positive in developed countries sample and negative in developing countries sample.

Trade openness is one of the defining phenomenons of modern era. Those who support trade openness and globalization claim that openness to the world economy would encourage capital flows to poor economies and promote economic growth which would result in less economic inequality. But the skeptics of openness paint a different picture saying that the forces of openness can lead to even more inequality and empirical evidence on the benefits and costs of openness are mixed one. There have been few papers supporting both the arguments but most of the studies used cross sectional data to derive their conclusion which we think is spurious. Calderon and Chong (2000) used unbalanced panel of averages and they concluded that increase in volume of trade reduces the inequality in the long run and when they used interactive dummies to see whether there is any opposing effect on inequality based on the development, the result

revealed that the impact of openness is positive and barely significant for industrial countries, it is negative and statistically significant for developing countries. But we have used unbalanced panel data for 44 countries and our result revealed that the trade openness increases inequality by about 0.14% for every 1% increase in trade openness and the coefficient is statistically significant at 1% level. We also used a dummy to see whether there is any separate effect on developed countries and the result reveals that the trade openness increases inequality in overall sample and in developed countries too but the magnitude of increase is smaller in the developed countries. The other control variables, democracy and corruption indices have positive and negative impacts on inequality, respectively. The coefficient for democracy index is statistically significant while it is not, incase of corruption index. The coefficient for the dummy landlock is statistically significant at 1% level. The positive and negative sign for democracy and landlock respectively shows that the democracy and sea access of the countries favors upper middle income and upper income people than the lower income people which leads to the inequality. When we split the sample into developed and developing countries, the trade openness increases inequality in developing countries and the coefficient is statistically significant at 1% level while the trade openness is not significant in developed countries. The result for democracy index shows that developed countries have better democracy when compared to developing and underdeveloped countries. Corruption index turned out to be insignificant in both the samples.

4. Concluding Remarks

The impact of trade openness on income and income inequality has received its due attention in international and development economics. Many empirical studies show

that trade promotes income while few studies questioned the validity of those results. There are some studies which are pointing to an increasing inequality in the world income distribution and a divergence in the income growth rates as a consequence of globalization. But the authors of most of the empirical studies used cross sectional data to derive their conclusions which we think do not give clear picture. Few studies have used unbalanced panel of averages to find out the impact of trade on inequality. We have investigated the same problem using the panel data and we have used balanced panel of 60 countries to study the impact trade on income and unbalanced panel of 44 countries to see the link between trade and income inequality.

The results of our investigation have been discussed in detail in the previous chapter. The results for the first objective revealed that trade openness increases income significantly. Likewise better democracy and secondary school enrollment also has a positive influence on income while corruption index and landlockedness of the countries have a negative influence. The investigation to study the influence of trade on income inequality revealed that trade openness increases within country inequality in overall sample and in developed countries the magnitude of the increase seems to be lesser. The separate analysis for both developed and developing countries show that trade openness increases inequality in developing countries while it is not in developed countries. Also the developed countries have better functioning democracy than developing and underdeveloped countries. Corruption index is not significant in both the samples. Hence, our conclusion is trade openness increases income but it also increases income inequality though the magnitude of increase in inequality is lesser in developed countries.

There also exist some possibilities for further improvement. We have used lesser number of countries in our sample and the conclusions will have more credence if we exhaust all the countries. Also we have used unbalanced panel to derive the inferences on the link between trade openness and income inequality and it will be a good idea to try the same problem with a balanced panel by including all the countries in the world.

APPENDIX A. VARIABLES USED, DESCRIPTION AND DATA SOURCES

Variable	Description	Sources
PCGDP	Real GDP per capita ($)	Penn World Table 6.1
Pop	Population of the countries measured in thousands	Penn World Table 6.1
Log Pop	Logarithm of Population	Penn World Table 6.1
Area	Area of the countries measured in square kilometers	http://www.infoplease.com/ipa/A0004379.html.
Log Area	Logarithm of Area	http://www.infoplease.com/ipa/A0004379.html.
Trade	Trade openness which is (Import+export)/ GDP	Penn World Table 6.1
Landlock	Landlocked ness of the countries(1=Yes, 0=No)	World Atlas
CI	Corruption Index measured in 0-6 scale(0=Least, 6=Most)	IRIS center(University of Maryland), International Country Risk Guide
Democracy	Measured in 0-10 scale(0=Least, 10=Most)	Center for International Development and Conflict Management.
Litsec	Secondary school enrollment expressed in percentage	World Development Indicators (2000)
Distance (DFE)	Absolute value of latitude of the country, scaled to take values between 0 and 1 where 0 is the equator	CID geography data downloaded from http://www.cid.harvard.edu/ciddata/ciddata.html
Latitude	Latitude of the country scaled to take values between 0 and 1, where 0 is the equator	CID geography data downloaded from http://www.cid.harvard.edu/ciddata/ciddata.html
Gini Index	Measure of inequality expressed in % (0=Perfect equality, 1=Perfect inequality)	Deininger and Squire(1996) data set Downloaded from http://www.wider.unu.edu/wiid/wiid-introduction-2005-1.htm
Developed	Development of the countries (1=Developed 0=Developing)	Wikipedia; an encyclopedia found at http://en.wikipedia.org/wiki/Developed_nation

APPENDIX B. COUNTRIES INCLUDED IN THE SAMPLE

S.No.	Sample of countries for 1st objective (Balanced Panel)	Sample of countries for 2nd objective (Unbalanced Panel)
1	Algeria	
2	Argentina	
3	Australia	Australia
4	Austria	Austria
5	Belgium	Belgium
6	Botswana	
7	Brazil	Brazil
8	Cameroon	
9	Canada	Canada
10	Chile	Chile
11	China	China
12	Columbia	Columbia
13	Costa Rica	Costa Rica
14	Denmark	Denmark
15	Ecuador	
16	Egypt	Egypt
17	Ethiopia	
18	Finland	Finland
19	France	France
20	Greece	Greece
21	Guyana	
22	India	India
23	Indonesia	Indonesia
24	Ireland	Ireland
25	Israel	Israel
26	Italy	Italy
27	Japan	Japan
28	Jordan	
29	Kenya	
30	Malawi	
31	Malaysia	Malaysia
32	Mexico	Mexico
33	Morocco	
34	Netherlands	Netherlands
35	New Zealand	New Zealand
36	Nigeria	
37	Norway	Norway
38	Papua New Guinea	
39	Paraguay	
40	Peru	Peru
41	Poland	Poland

42	Portugal	
43	Senegal	
44	Singapore	Singapore
45	Spain	Spain
46	Sri Lanka	
47	Sweden	Sweden
48	Switzerland	
49	Tanzania	
50	Thailand	Thailand
51	Togo	
52	Trinidad	
53	Tunisia	
54	Turkey	
55	United Kingdom	United Kingdom
56	United States	United States
57	Uruguay	
58	Venezuela	Venezuela
59	Zambia	
60	Zimbabwe	
61		Bulgaria
62		Dominican Republic
63		El Salvador
64		Hungary
65		Jamaica
66		Korea
67		Pakistan
68		Panama
69		Philippines
70		Romania
Total	**60**	**44**

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