The Impact of Trade Openness on Labor Force Participation Rate

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Abstract

In this article we investigate the impact of trade openness on labor force participation rate. We use tariff rate as the main indicator of trade openness and we employ the number of regional trade agreements and the average tariff rate in the neighbors' countries as instrumental variables to diminish the endogeneity problem of the tariff rate.We find that trade openness increases the participation rate which is economically and statistically significant. The results show that this correlation is robust under controlling for different variables and using various specifications. We find that 10 percentage point increase in tariff rate lowers the participation rate by 4-6 percentage point and this relationship is more severe in the long-run. Finally, we show that changes in labor force population accounts for about 27% of changes in unemployment rate following a trade liberalization.

Keywords: international trade, labor force participation rate, trade openness

JEL Classification F10, F14, F16, F41

1   Introduction

In this article we estimate empirically the relation between participation rate and trade openness (our main indicator for openness is tariff rate[1]) using a panel of 94 countries

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[1]tariff rate indicator is the weighted average of tariff rate of all imported products during a year using import volumes as weights.

during 1990 to 2012. Tariff rate is a prevalent indicator of trade barrier used in empirical studies of international trade since it is associated mostly with exogenous policy variables in comparison with other applicable indicators such as trade volume over GDP, which might be endogenously influenced by employment condition and growth of the economy.

Furthermore, we have employed an instrumental variable of trade conditions in neighboring countries to reduce the endogeneity problem of tariff rates[2]. Specifically, we use number of regional trade agreements and average of tariff rates in neighboring countries as an instrument for tariff rate. We assert that countries in regions with high level of competition in international trade reduce their tariff rates to preserve their competitiveness in their geographic region since first, neighboring countries are usually main trade partners and second, countries outside the region may substitute a high tariff partner by its low tariff neighbor.

Figure 1 depicts the relationship of participation rate and trade openness indicated by the weighted average tariff rates. For each variable, its time average is subtracted in order to eliminate country fixed effects. This figure intuitively demonstrates a negative relationship between tariff rate and participation rate. This statement is supported by our empirical strategy. Throughout this article, we show that this negative relationship is significant and robust considering various control variables. Moreover, this correlation is strengthened in the long-run.

Despite the importance of labor market in political discussion about international trade, most of classical theories in international trade which aim to estimate the welfare effects of free trade, assume full employment and perfect reallocation of labor force to sectors with comparative advantage, for practical purpose. However, violation of these assumptions can have significant effect on the welfare gain of trade.

At the end of 90s, some prominent articles investigated the subject of the changes in labor market equilibrium after a decrease in trade barriers. These articles adopt two main approaches: Some articles concentrate on changes in unemployment rate following trade openness and some others measure the extent and pace of labor force reallocation to sectors with comparative advantage.

Although these articles release the assumption of full employment, they assume the

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[2]tariff rate might be endogenous to labor market conditions since some countries may have ran simultaneous reforms in labor market policies as well as trade policies

Figure 1: The relationship between participation rate and average tariff rate
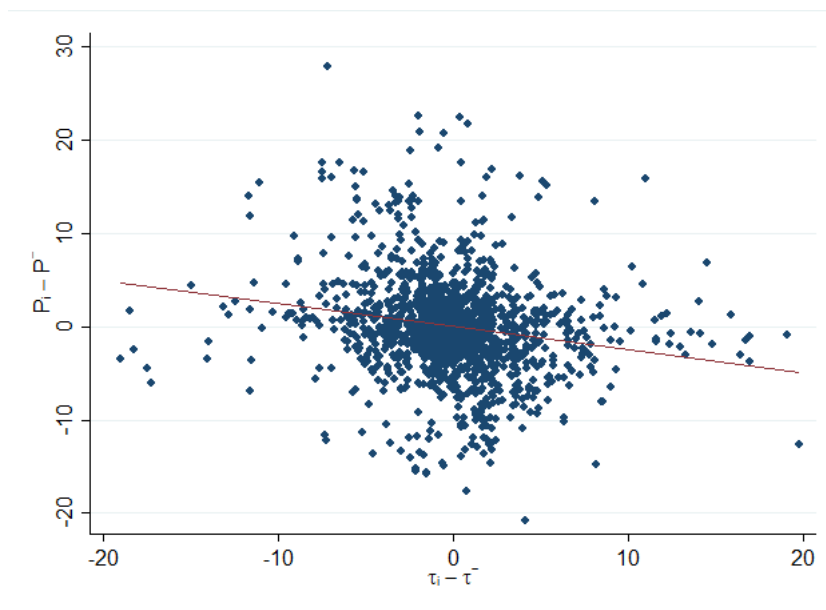
Note: Vertical axis indicates the difference between the participation rate and average of this variable during time for each country. Horizontal axis displays similar calculation for tariff rate

participation rate to be constant. Therefore, they can explain the changes in unemployment rate through job creation and destruction exclusively. However, in general, trade openness may affect the incentives of agents to enter or exit the labor market and it will lead to changes in unemployment rate as well. For example, trade may induce participation in labor market by enhancing positive expectation about labor condition in exporting industries. In this paper we show that changes in labor force population accounts for about 27% of changes in unemployment rate and the rest is due to changes in unemployed population.

It is important to identify the changes in participation rate following a trade openness since it can influence the interpretation of welfare gain from trade. More precisely, if trade openness enhance unemployment, it is important to determine whether it is a consequence of job destruction or increase in participation rate. If it is a result of the first, it can attenuate welfare gains from trade; however, if it is a follow-up of the later, it may even boost welfare gains.

This article is related to two trends of researches which focus on the relation between labor market outcomes and inernational integration: First, articles which evaluate the changes in labor market condition, specifically changes in unemployment rate, after a

trade openness; second, articles which estimate the scale of labor force reallocation to the industries with comparative advantage.

In the first trend, Davidsson et al.(1999) [11], Helpman and Itskhoski (2010) [24], Zhou (2017) [38], Kang (2015) [25] and Fugazza et al. (2014) [20] show a heterogenous effect of trade openness on labor market depending on the level of labor market frictions. These articles state that by decreasing trade barriers, unemployment rate will rise in countries with comparative advantage in high friction sectors and it will lower in countries with comparative advantage in low friction sectors.

The second trend concentrate on the reallocation of labor force. Dix-Carneiro (2014) [12], Cosar (2010) [9] and Wacziarg and Wallack (2004) [37] assert that complete reallocation of labor force is an empirically unproven assumption. They claim that after trade liberalization, workers face a number of obstacles such as geographical barriers or high cost of achieving the human capital of expanding industries, which prevent them from transferring to prosperous export sectors. Artuc and McLaren (2010) [3], Artuc et al.(2010) [2] and Dix-Carneiro (2014) [12] calculate the cost of reallocation for workers which they estimate to be multiple times of annual average wage of a worker. Hence, this high cost of reallocation dissipate at least half of expected welfare gains from free trade [12].

All these researches attempt to include labor market into free trade evaluation assuming labor force to be constant; however, in general case, changes in participation rate may have significant influence on assessing trade openness. Increase in participation rate indicate long-term positive expectation about economic conditions despite plausible short-term negative consequences. On the other hand, as Pissarides (1990) [31] indicates, unemployment rate and participation rate are interdependent.[3] Furthermore,Pries and Rogersson(2004) [32], Garibaldi and Wasmer (2005) [21] and Alvarez and Shimer (2011) [1] emphasis the role of participants and non-participants on labor market outcomes. Hence, this article focus on the subject of participation rate as a notable labor

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[3]Changes in participation rate have an effect on unemployment rate by increasing the number of agents searching for a job i.e. changing labor market tightness. On the other hand, changes in participation rate affects unemployment rate through two major channels identified by Pissarides (1990): Added worker effect and discouragement effect. Added worker effect represent the situation when having an unemployed worker in the household prompts other members to participate in the labor market. Discouragement effect represent the situation when high numbers of unemployed workers discourage them from finding a job; therefore, they exit the labor market.

market factor and track its changes along trade indicators.

This paper follows a similar methodological approach of Wacziarg and Wallack (2004) [37], Dutt et al. (2009) [16], Fugazza et al. (2014) [20], Gozgor (2014) [23], Francis and Zheng (2011) [19] and Felbermayer et al. (2011) [18] which use panel regression for a number of countries through time to investigate the relationship between a labor market indicator and a trade openness index, conventionally tariff rate. Our innovation is to introduce an instrumental variable to reduce the endogeneity problem of such regression and to investigate the effect of trade conditions on labor force participation rates.

2 Empirical Strategy

In both classic and advance trade theories (see for example Melitz (2008) [29] and Costinot and Rodriguez-Clare (2014) [10]), it is emphasized that trade openness will enhance aggregate total factor productivity and consequently, increase the average wages. On the other hand, Pissarides (1990) [31] shows that more people will participat when wages are higher, labor market tightness is higher and the rates of interest and job loss is lower. Following this theoretical approach, we assert that trade openness will elicit positive expectation about the economic condition among people and hence, they will participate more in the labor market since the expected value of participation rise when average wages increase.

We introduce the following specification to test the empirical relationship between participation rate and trade openness indicator which is mostly average tariff rate in a panel of 93 countries during 22 years:

$$P_{tc} = \alpha_0 + \alpha_1 \tau_{tc} + \alpha_2 L_{tc} + \alpha_3 X_{tc} + y_t + d_c + \varepsilon_{tc} \tag{1}$$

In which P_{tc} represents participation rate in year t in country c, τ_{tc} is trade openness indicator; namely tariff rate in base line estimations and other openness indices in alternative estimations. L_{tc} is the labor regulation variable which indicates the level of government interference in the labor market to control for any special labor market condition. Controlling for the labor market features is necessary in order to show that the trade openness can affect participation rate while labor market conditions are fixed; thus, this variable is included to capture labor market effects specifically. X_{tc} is the set of control variables and y_t and d_c are year and country fixed effects, respectively.

Estimation of α_1 is prone to several endogeneity problems which will result in a biased estimation. For example, some countries may simultaneously implement several reform programs in both labor market and trade policy. Moreover, one of the incentives for policy makers to set trade barriers is protecting domestic labor market from international competition; hence, labor market crisis may induce certain protectionist policies. Therefore, we address three problems of omitted variable, reverse causality and measurement error using an instrumental variable for tariff rate and running a two stage least square regression.

The IV is defined as trade condition in neighboring countries. We use the number of regional trade agreements and average tariff rate of surrounding countries in the first stage of the regression.[4]. It is assumed that trade policies are strongly correlated with trade condition in neighboring countries for two reasons: first, countries in the same geographical region are major trade partners of one another; second, they are in tough competition to attract outsider partners since they may be easily substituted regarding their geographical distance. Moreover, trade policy in other countries may not affect labor market condition unless through trade variables.

Some control variables, which are considered to be correlated with both dependent and independent variable, are also included to check the robustness of the baseline regression. GDP per capita is used to control the effect of business cycles on trade and labor indicators. High income countries have higher total participation rate because of the high rate of female participation; on the other hand, these countries set lower tariff rates. Thus, an income indicator, here GDP per capita should be controlled to ensure that there is no spurious correlation between dependent and independent variables.

Inflation is included to control the effect of monetary policy related variables. Countries with high inflation rate have unstable exchange rates. Therefore, they set high level of trade barriers to protect their domestic industries from this uncertainty in foreign ex-

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[4]We use "World Bank" geographical classification to calculate trade condition in neighboring countries i.e. average tariff rate and total number of RTAs. This classification divide countries into 18 geographical regions: Australia and New Zealand, Caribbean, Central America, Central Asia, Eastern Africa, Eastern Asia, Eastern Europe, North America, Northern Africa, Northern Europe, South America, South-Eastern Asia, Southern Africa, Southern Asia, Southern Europe, Western Africa, Western Asia, Western Europe. This classification divide countries to their neighborhood but it represent a better division than direct neighbors regarding trade partners.

change rate. Plus, in the short term, inflation rate is correlated with unemployment and consequently, participation decision through the mechanism of Philips curve.

Size of government is another control variable. Custom tariff is a source of tax income for the government hence, it has the incentive to raise the revenue from this source; on the other hand, large governments have high resources to interfere in the labor market as it is the case in welfare states. Black market exchange rate and exchange rate variability are two variables controlled to capture the effect of black market in both trade and labor markets. Legal system property rights is a significant factor determining the decision of participating in formal labor market; moreover, if property rights are not precisely defined, custom tax is the most reliable income source for the government and hence, it will intend to increase trade taxes.

Employment in agriculture is also another important determinants of both trade and labor market policies. In countries in which most people are working in agriculture sector, participation rate is generally high because of the special form of agricultural jobs. It is easy to get a job with little skills and frictions in the labor matching is low. On the other hand, since poor countries depend largely on agricultural production, this sector benefit several exceptions in trade agreements under surveillance of WTO. Thus, we insert the share of value added of agriculture sector of GDP to control the effect of the agriculture sector.

We also include base year GDP per capita multiplied by time trend to capture divergence of countries with different initial income. Finally, lead of GDP per capita is controlled to capture the expectation about future of the economy. In the next section, we present a summary of our data described above.

3 Data Description

In this article we use the trade and labor market along with other macroeconomics data from 93 countries during 1990 to 2012. We restricted our sample to 93 countries for which we had the data both for labor market and trade indicators (a list of countries can be found in the appendix). Table 1 displays the summary statistics of our main variables.

We obtain data on participation rate from "International Labor Organization (ILO)". Participation rate is defined as the ratio of total number of labor force i.e. employed and

Table 1: Summary statistics

	Mean	SD	Min	Max
Average Tariff rate(%)	5.61	5.14	0.00	53.95
Participation Rate(%)	57.80	10.29	29.40	87.45
Labor regulations	3.85	1.48	0.50	7.70
Openness (%)	70.68	51.78	11.62	398.43
GDP per capita(1000 US Dollars)	13.80	16.44	0.19	89.80
Inflation(%)	12.82	118.56	-17.22	2700.44
Property rights	5.97	1.71	2.00	9.50
Black market premium	0.30	1.37	0.00	10.00
Size of Government	3.57	1.41	0.60	7.60
Agriculture to GDP(%)	8.63	8.40	0.04	55.81
Observations	1679			

Note: Dollar values are reportted in real US dollars-2005 base year. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. Size of government, Property right an Black market premium are also index variables ranging from 0-10 with 0 for small governments, low property rights and low black market premium in exchange rate. Agriculture to GDP is the share of value added in agriculture sector to GDP. Exchange rate variability is the distance of exchange rate for one US dollar from its long-run trend

Source: Clemens and Williamson (2002), Freedom of the World Institute, International Labor Organization, World Bank, World Integrated Trade Solution, World Trade Organization

unemployed people to the population is working age, 15-65 years old. Participation rate ranges from 30%-85% with an average value of 58% among our observation. High rate of participation rate usually attributes to agricultural economies and its low rate conrresponds to countries with low rate of female participation.

ILO reports the data from 6 sources: Labour force survey, Household income/expenditure survey, Official estimate, Population census, Employment office records, Other administrative records and related sources, Other household survey. We consider the Labour Force Survey (LFS) as our main source and use the growth rate of participation rate (or unemployment rate) reported in other sources to interpolate the missing values of LFS. We have also droped the countries with less than 9 observations in both trade and labor market indicators.

Tariff rate is defined as the ratio of total annual custom tax income to the value of import multiplied by 100. The data is obtained from Clemens and Williamson(2002) [7] for years before 2002 and "World Integrated Trade Solution (TRAINS)" for 2002-2012. We have checked the similarity of the two data sets for years available in both data sets; however, we also control for year dummies in order to be sure about no specific annual measurement error. Average tariff rate ranges approximately from 1%-54% and its average level is about 6%; observations with low tariff rates attribute to east Asian economies such as Singapore and Hong Kong and observations with high tariff rates correspond to countries prior to accession in WTO such as Iran and Bangladesh. Furthermore, we use other trade openness indicators such as import to GDP, export to GDP and trade volume to GDP which are conventional openness indicators in the literature to delineate the robustness of the results to other trade openness definition. The data on trade openness is obtained from the "World Trade Organization (WTO)".

The data of GDP per capita is obtained from "World Bank" and it is adjcuted for inflation using United States GDP deflator. GDP per capita ranges from 188 dollars in least developed economies such as Afghanistan and Ethiopia to 85000 dollars in OECD economies. The average GDP per capita in our data set is approximately 14000 dollars.

Inflation rate is also obtained from "World Bank". It has a range of -17% to 2700%. Its low rates are observed in countries such as Oman in 2009 and its high rates in countries such as Brazil in 1990 which has experienced a period of hyper inflations.

We also use Labor Regulation variable to control for labor market conditions. The

data for Labor Regulation is obtained from "Freedom of the World" institute. It is constituted of nine different variables and is indexed in a measure of 0 to 10 if here is no friction in the labor market, the country gets a score of 10 and if the labor market is completely regulated, the country gets 0. For practical purpose, we transfer this index so that it indicates labor market frictions, with 0 represents no friction and 10 represents the market with maximum friction (we do so by differencing this index from 10). On average, the countries in our data set get a score of 4 in this index.

We also include other macroeconomic variables to control for factors influencing both labor and trade conditions to decrease the omitted variable bias. These variables consist of the size of government, property right index, black market exchange rate, exchange rates variability,share of value added of agriculture sector of total GDP. and they are obtained from "World Bank" and "Freedom of the World" institute.

Besides, we address three problems of omitted variable bias, reverse causality and measurement error using the method of two stage least square employing number of regional trade agreements and average tariff rate in neighboring countries. We believe that trade policies are highly correlated with the trade policies of neighboring countries since countries in the same geographical region are the main trade partners of one another and competitors for attracting partners from outside of the geographical region; hence they respond to the trade policy of the neighbors in order to maintain their status in regional competition (we show the relevance of our IV later). The data on regional trade agreements is constructed based on documents in Regional Trade Agreements Information System of "World Trade Organization (WTO)". Annual number of regional trade agreements range from 0-5; Turkey and singapore contracted 5 regional trade agreements in 1998 and 2003, respectively.

Table 2 displays summary statistics for the selected variables. We split the data based on the number of regional trade agreements in neighboring countries (denoting as RTA in this article) into two groups: upper and lower than average. This table shows that countries in a trade competitive region i.e. in a region where surrounding countries have high number of regional trade agreements, implement lower tariff rates, on average. Average tariff rate in countries with high number of RTAs is 1.5 percentage point lower than countries with low number of RTAs. This difference is statistically significant with t-stat 3.8. This fact roughly illustrates the relevance of the IV variable which will be

discussed with more precision later in the first stage regression.

Furthermore, the data in table 2 is also split in two groups according to average tariff rate in each country. Participation rate in countries with high tariff rate is 1.5 percentage point lower than countries with low tariff rate and this difference is statistically significant with t-stat 3.6 which will be demonstrated with more detail in the second stage regression.

Table 2: Summary statistics in different groups

	Number of RTAs in neighboring countries		Average tariff rate		
	Low	High	Low	High	Total
Average Tariff rate(%)	9.0	7.5	4.3	14.3	7.9
	(7.4)	(7.7)	(3.2)	(8.9)	(7.6)
Participation Rate(%)	55.6	55.5	56.1	54.5	55.5
	(9.6)	(12.7)	(10.2)	(14.2)	(11.9)
Labor regulations	3.8	3.8	3.6	4.0	3.8
	(1.7)	(1.5)	(1.5)	(1.6)	(1.6)
Observations	402	1186	1083	505	1588

Note: Mean coefficients are reported and standard errors are in parentheses. Dollar values are reportted in real US dollars-2005 base year using US GDP deflator to convert the nominal values. Low and High corresponds to lower and higher than average of the respective variable

Source: Clemens and Williamson (2002), Freedom of the World Institute, International Labor Organization, World Bank, World Integrated Trade Solution, World Trade Organization

Table 3 displays the first stage regression of average tariff rate on instrumental variables. In the first and second column, two instrumental variables, average tariff rate and number of regional trade agreements in neighboring countries, are used separately. Lower tariff rate in neighboring countries ($Tariffrate_{nbr}$) and higher regional trade agreements (RTA) are correlated with lower average tariff rate as it was expected. This relationship is statistically significant. We use both IVs in the first stage of the following estimations and this first stage estimation is presented in column 3

The F-statistics of first stage regressions are above the critical value suggested by

Staiger and Stock (1994) [36]; hence, it cannot assert that instruments are weak. More-over, Sargan-Hansen test of overidentification results a p-value of 0.955 for these two IVs. Hence, we fail to reject the null hypothesis that our instruments are valid by a considerable margin.

Forth column of table 3 presents an alternative instrumental variable introduced by Dollar and Kraay (2002) [14]. For this purpose, we use the growth of tariff rate (annual changes in tariff rate) as the instrumental variable for tariff rate. This instrument is also significant and its weakness can be ruled out. This IV can be used to check the robustness of the result with a different IV.

Table 3: First stage regression

	(1)	(2)	(3)	(4)
	Average tariff rate(%)	Average tariff rate(%)	Average tariff rate(%)	Average tariff rate(%)
	(τ_{ct})	(τ_{ct})	(τ_{ct})	(τ_{ct})
RTA	-0.0647 *		-0.0476	
	(-1.64)		(-1.00)	
$Tariffrate_{nbr}$ (τ_{nbr})		0.245***	0.246***	
		(3.37)	(3.34)	
Tariff growth ($\Delta\tau$)				1.014***
				(3.70)
Constant	686.9***	7.740***	7.824***	9.910***
	(10.71)	(9.76)	(9.64)	(14.25)
Observation	1679	1644	1628	1597
F-stat	10.58	12.11	12.03	11.15
Country fixed effect	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes

Note: RTA represents number of regional trde agreements in neighboring countries; $Tariffrate_{nbr}$ is average tariff rate in neighboring countries and Tariff growth is annual changes in tariff rate. t-statistics are in parenthesis. Standard errors are corrected for heteroskedasticity. $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4 Results

Table 4 displays the results for the baseline regression of equation 1. The relationship between labor force participation rate and average tariff is negative and significant at 5% level. In the first column, no instrumental variable is used for the tariff rate. This column shows that 10 percentage point decrease in average tariff rate corresponds to 1.2 percentage point increase in participation rate. In second column, average tariff rate is instrumented using main instrumental variables i.e. RTA and average tariff rate of neighboring countries. This baseline regression shows that 10 percentage point decrease

in average tariff rate results in approximately 4 percentage point increase in participation rate. The comparison between these two columns demonstarte that there was an upward bias in the correlation between participation rate and tariff rate which indicates an attenuation in the estimation due to the measurement error or an ommited variable which influences both tariff rate and participation rate in the same dicrection.

This relationship is also valid using alternative IV or trade openness indicator. In the third column, growth of tariff is used as the IV for level of tariff rate. The results are negative and significant and its magnitude is close to the main regression. In the fourth column, openness variable is used instead of tariff rate and it is instrumented in a similar way. Openness is defined as the ratio of trade volume over GDP and its result of this regression is consistent with the first column; higher openness is correlated with higher participation rate.

At this point, we can employ the same startegy to separate the effect of changes in participation and unemployment population on unemployment rate. We know that unemployment rate $= \frac{\text{unemployment population}}{\text{labor force population}}$. Hence, with a logarithmic transformation we can seperate the changes as follows: $\%\Delta$unemployment rate $= \%\Delta$unemployment population$-$ $\%\Delta$labor force population. To estimate the percentage changes in above variables we employ a log-linear regression similar to equation 1. Table 5 shows the results. All coefficients are statistically significant at 5% level. One percentage point decrease in tariff rate is correlated with 4.31% decrease in unemployment population and 1.66% increase in participation rate which implies that 27% of the changes in unemployment rate is due to the changes in labor force. Therefore, we cannot deny the role of participating population on when analyzing the relationship between trade and labor market conditions.

We now show that our estimation is robust in different country groups, specifications and in presence of various controlling variables. The coefficient of average tariff rate remains negative and significant by running separate regression in developing and developed countries. The magnitude is higher than average in developed economies and lower in developing countries. This may be due to bigger informal sector in developing countries for which we cannot capture the data of participation rate. The results are also valid excluding economies with high inflation rate and highly populated countries. (See table 6)

Table 4: Panel regression of participation rate on trade oppenness indicators

	(1) No IV	(2) Baseline	(3) Alternative IV	(4) Alternative Indicator[a]
Average tariff rate(%)	-0.12***	-0.391**	-0.359**	
	(-2.05)	(-1.97)	(-2.48)	
Labor market regulations	-0.07	-0.104	0.0149	0.0599
	(-0.28)	(-0.26)	(0.06)	(0.23)
openness				0.106**
				(2.18)
Constant	56.95***	59.16***	59.07***	50.81***
	(40.08)	(24.34)	(32.68)	(18.09)
Observation	1004	963	960	953
Groups	91	88	91	88
Country fixed effect	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes

[a]This indicator is also instrumented using RTA and average tariff rate in neighboring countries

Note: First column displays the result of the regression of participation rate on average tariff rate. Second columns uses number of regional trade agreements and average tariff rate in neighboring countries as IV for tariff rate. Third column uses the annual change in tariff rate as the IV for tariff rate. Forth column uses openness indicator (trade volume over GDP) instead of tariff rate. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. t-statistics are in parenthesis. Standard errors are corrected for heteroskedasticity * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Log-linear regression of unemployment rate, unemployment population and labor force population on average tariff rate

	(1) log(Unemployment rate)	(2) log(Unemployment population)	(3) log(Labor force population)
Average tariff rate(%)	0.0597***	0.0431**	-0.0166**
	(3.06)	(2.52)	(-2.03)
Labor market regulations	0.0392	0.0517	0.0125
	(0.69)	(0.82)	(1.01)
Constant	-3.016***	5.610***	8.625***
	(-10.83)	(20.29)	(73.87)
Observation	866	866	866
Groups	85	85	85
Country fixed effect	yes	yes	yes
Year fixed effect	yes	yes	yes

Note: In all columns number of regional trade agreements and average tariff rate in neighboring countries are used as IV for tariff rate. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. Standard errors are corrected for heteroskedasticity. t-statistics are in perethesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Panel regression of participation rate on trade oppenness indicators - Various samples

	(1)	(2)	(3)	(4)
	Developing Coutries	Developed Countries	Excluding Countries with Inflation>50%	Excluding top 5% Biggest Countries
Average tariff rate(%)	-0.236***	-1.778***	-0.379*	-0.612***
	(-3.56)	(-23.01)	(-1.88)	(-2.70)
Labor market regulations	-1.478***	0.557**	-0.0395	-0.167
	(-8.36)	(2.55)	(-0.14)	(-0.43)
Constant	50.52***	69.91***	59.49***	60.28***
	(31.19)	(409.65)	(26.85)	(22.02)
Observation	405	558	887	913
Groups	44	44	82	83
Country fixed effect	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes

Note: Number of regional trade agreements and average tariff rate in neighboring countries are used as IV for tariff rate. The size of the country in the last column is considered as the working age population. t-statistics are in parenthesis. Standard errors are corrected for heteroskedasticity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7 shows the results of the estimation of equation 1 including various control variables. In all columns, the coefficient of tariff rate is negative and statistically significant and its magnitude is between 0.4 to 0.55.

Among control variables, size of government and agriculture to GDP are statistically significant. The coefficient for the size of government is positive which imply that larger governments are correlated with higher participation rate which is prevalent in western European countries. Moreover, the agriculture to GDP is positive and significant which confirm the intuition that agricultural economies have high participation rates[5].

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[5]regressions are run omitting the outliers in inflation rate such as country-years with hyper inflation or deflation and the results are robust

Table 7: Panel regression of participation rate on trade oppenness indicators-Robustness check

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Participation rate	Participation rate	Participation rate	Participation rate	Participation rate	Participation rate	Participation rate
Average tariff rate(%)	-0.459*	-0.492**	-0.372***	-0.419***	-0.359***	-0.359***	-0.336***
	(-1.87)	(-2.43)	(-3.01)	(-3.09)	(-2.66)	(-2.72)	(-3.55)
Labor market regulations	-0.0438	-0.214	-0.181	-0.216	-0.213	-0.222	-0.453
	(-0.10)	(-0.50)	(-0.38)	(-0.48)	(-0.47)	(-0.50)	(-0.86)
GDP percapita	0.0810	0.0994	0.0503	0.0564	0.0631	0.0624	0.0155
	(1.23)	(1.64)	(0.90)	(1.22)	(1.29)	(1.29)	(0.29)
Size of government		0.953***	0.755***	0.701***	0.707***	0.692***	0.816***
		(3.18)	(2.85)	(2.96)	(3.24)	(2.87)	(2.72)
Agriculture to GDP			0.275***	0.277**	0.329***	0.321***	0.311***
			(2.60)	(2.47)	(2.61)	(2.80)	(3.05)
Inflation				0.00126	0.000685	0.000628	0.000465
				(0.85)	(0.40)	(0.37)	(0.25)
Property rights					0.827*	0.866	0.776
					(1.75)	(1.54)	(0.99)
Black market premium						-0.123	-0.0819
						(-0.38)	(-0.22)
Exchange rate variability							0.000751
							(0.85)
Constant	59.26***	63.86***	60.15***	59.78***	53.78***	54.70***	55.79***
	(21.95)	(25.83)	(32.91)	(30.06)	(11.97)	(17.82)	(21.26)
Observation	948	946	912	903	902	902	717
Groups	87	87	86	86	86	86	85
Country fixed effect	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes

Note:Table shows the robustness of the baseline estimation. In all regressions RTA and average annual tariff rate of neighboring countries are used as an IV for average annual tariff rate. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. Size of government, Property right an Black market premium are also index variables ranging from 0-10 with 0 for small governments, low property rights and low black market premium in exchange rate. Agriculture to GDP is the share of value added in agriculture sector to GDP. Exchange rate variability is the distance of exchange rate for one US dollar from its long-run trend. t-statistics are in parenthesis. Standard errors are clustered in income group level $* p < 0.1$, $** p < 0.05*** p < 0.01$

18

In table 8, we change the regression specification. In all these different specifications, panel fixed effect regression with no time fixed effects, pooled OLS regression and random effect regression, the coefficient of tariff rate remains negative and significant as it is the case in previous tables. In the first column, year dummies are dropped, instead, initial level of GDP per capita multiplied by time trend is controlled. The interaction of initial GDP per capita and time trend has a negative and significant coefficient and since GDP is positively correlated with participation rate, this indicates that participation rates in different countries are converging. Furthermore, lead of GDP per capita is controlled to capture expectation to the future of the economy; as it was expected, optimism about future of the economy positively correlated with participation rate since it increases the expected wage [29] and consequently the present discounted value of unemployment; in other words, unemployment becomes more valuable in comparison to staying out of the labor force. [31]

Column 2 represents the pooled OLS regression with country and time fixed effects included. The coefficient of tariff rate in this regression is still negative and significant and its magnitude is of the same order of former estimates. Fourth and third columns display the random effect regression in which geographical region and income groups are controlled. In all these alternative specifications, the estimated relation between tariff rate and participation rate is robust.

4.1 Heterogeneous Effect

In this section we estimate the effect of trade barriers on participation rate in different quantiles of the dependent variable. For this purpose, we run an IV quantile regression for ten quantiles of participation rate in the baseline regression. Figure 2 shows that in lower quantiles of participation rate the magnitude of the correlation between this variable and average tariff rate is comparable to the mean estimation and it decreases in higher quantiles in which the coefficient becomes positive although insignificant. In these estimates, labor market regulations, time and country fixed effects are controlled and RTA and average tariff rate in neighboring countries are used as instrumental variables for tariff rate.

With another approach, we aim to investigate the heterogeneous effects of different controlling variables. For this purpose, we insert the interaction between controlling vari-

Table 8: Different specifications

	(1) No time fixed effect	(2) Pooled regression	(3) Random effect	(4) Random effect
Average tariff rate(%)	-0.427***	-0.691***	-0.409*	-0.385*
	(-3.37)	(-5.42)	(-1.87)	(-1.76)
Labor market regulations	-0.746***	-0.541**	-0.235	-0.285
	(-3.12)	(-2.17)	(-0.97)	(-1.18)
GDP per capita[+1]	0.137***			
	(3.72)			
Size of government	1.035***	0.858***	0.695***	0.666***
	(4.42)	(3.50)	(2.97)	(2.86)
Agriculture to GDP	0.198	0.616***	0.427***	0.341***
	(1.51)	(4.65)	(3.91)	(2.88)
Inflation	0.000956	0.000790	0.000616	0.000622
	(0.79)	(0.58)	(0.48)	(0.48)
Property rights	0.411	0.442	0.975***	0.925**
	(1.26)	(1.29)	(2.71)	(2.58)
Black market premium	0.129	0.735***	0.166	0.139
	(0.59)	(3.81)	(0.82)	(0.69)
$GDP_{90} * Trend$	-0.00357*			
	(-1.87)			
GDP per capita		0.106***	0.0807**	0.0682*
		(3.27)	(2.03)	(1.70)
Constant	56.91***	65.31***	58.48***	58.82***
	(15.83)	(18.32)	(8.37)	(8.81)
Observation	821	902	902	902
Groups	85		86	86
Country fixed effect	yes	yes	no	no
Year fixed effect	no	yes	yes	yes
Region dummies	no	no	yes	yes
Income dummies	no	no	no	yes

Note:Table shows different specifications for the estimation. First column is a panel fixed effect regression with no time fixed effect, second column is for ordinary least square estimation. Third and forth columns show random effect regression. In all regressions RTA and average tariff rate of neighboring countries are used as an IV for average annual tariff rate. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. Size of government, Property right an Black market premium are also index variables ranging from 0-10 with 0 for small governments, low property rights and low black market premium in exchange rate. Agriculture to GDP is the share of value added in agriculture sector to GDP. $GDP_{90} * Trend$ is the product of GDP per capita in 1990 and simple time trend. t-statistics are in parenthesis. Standard errors are clustered in income group level
* $p < 0.1$, ** $p < 0.05$*** $p < 0.01$

Figure 2: Quantile regression estimation
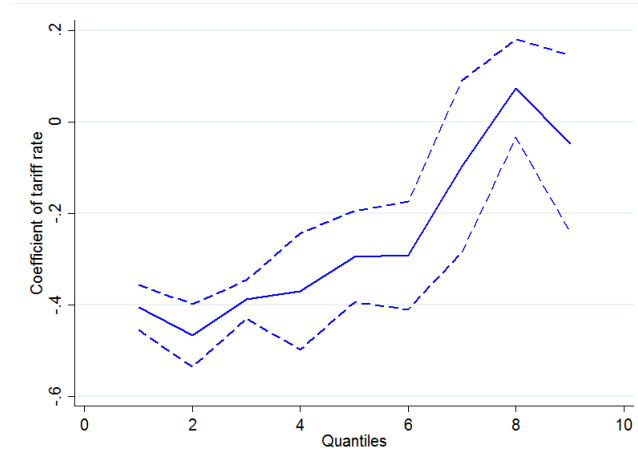
Note: Vertical axis indicates the coefficient of average tariff rate in a quantile regression. Horizontal ten quantiles. Labor market regulations, time and country fixed effects are controlled and standard errors are corrected for heteroskedasticity. Dashed lines show one standard deviation for the estimates.

ables described in the previous section and average tariff rate into the baseline regression. Table 9 shows the results. Only two variables, labor market regulations and size of government, intensify the relationship between participation rate and average tariff rate i.e. the coefficient of average tariff rate rises with increase in labor regulations and size of government. All other variables attenuate the relationship.

Table 9: Heterogeneous Effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Labor regulations	GDP percapita	Size of government	Inflation	Agriculture to GDP	Property rights	Black market premium
Average tariff rate(τ)	-1.261***	-0.431*	-0.901**	-0.432**	-0.986*	-1.033*	-2.712**
	(-3.70)	(-1.76)	(-2.01)	(-2.01)	(-1.87)	(-1.75)	(-2.19)
Labor market regulations (L)	0.634	-0.148	-0.192	-0.171	0.0732	-0.213	-0.719*
	(1.19)	(-0.33)	(-0.38)	(-0.43)	(0.18)	(-0.50)	(-1.81)
$L*\tau$	-0.193***						
	(-3.99)						
Control Variable (C)		0.0627	1.649***	-0.00322	0.0663	-0.690	-3.486***
		(0.98)	(2.88)	(-1.30)	(0.19)	(-0.68)	(-3.15)
$C*\tau$		0.0120**	-0.108*	0.000326*	0.0318	0.167*	0.258**
		(2.21)	(-1.78)	(1.93)	(1.43)	(1.76)	(2.18)
Constant	61.59***	57.58***	67.06***	58.83***	61.22***	60.10***	88.78***
	(23.44)	(23.48)	(16.87)	(25.09)	(10.37)	(8.33)	(7.43)
Observation	963	948	961	951	927	961	960
Groups	88	87	88	88	87	88	88
Country fixed effect	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes

In all regressions RTA and average tariff rate of neighboring countries are used as an IV for average annual tariff rate. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. Size of government, Property right an Black market premium are also index variables ranging from 0-10 with 0 for small governments, low property rights and low black market premium in exchange rate. Agriculture to GDP is the share of value added in agriculture sector to GDP. Control variables are specified in the column header. $C*\tau$ shows the interaction term between corresponding control variable and average tariff rate. Standard errors are clustered in income group level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.2 Long-run Effect

In this section we try to evaluate the long-run relationship of participation rate and trade barrier. For this purpose, we take three strategies: first, we average our observations in 5 year intervals and repeat the previous regression. Second, we run cross-sectional regression of 5 year average of variables in the previous empirical model which is considered to be close to long-run estimation; third, we insert 3 and 5 lags of tariff rate and calculate the sum of immediate and correspondent lags which is the net impact after 3 or 5 years.

Table 10 shows the result of a panel fixed effect regression with the observations averaged in 5 year intervals. This table shows that first, the absolute magnitude of the coefficient of average tariff is larger than previous regressions which implies that the relation between trade openness and participation rate amplifies in long-run. Second, despite the results of table 4 and 7 the coefficient of labor market regulation is significant which shows a log-run relationship between labor market determinants and participation rate.

Table 10: Panel regression of participation rate on trade oppenness indicators-5 year average

	(1) Participation rate	(2) Participation rate	(3) Participation rate	(4) Participation rate	(5) Participation rate	(6) Participation rate	(7) Participation rate
Average tariff rate(%)	-1.135*	-1.074*	-1.011	-1.075	-1.318*	-1.228**	-1.433*
	(-1.72)	(-1.66)	(-1.55)	(-1.55)	(-1.73)	(-2.43)	(-1.91)
Labor market regulations	-1.183*	-1.115*	-1.414**	-1.595***	-1.760***	-1.678***	-1.969**
	(-1.84)	(-1.80)	(-2.54)	(-3.40)	(-3.12)	(-3.34)	(-2.05)
GDP percapita	0.213***	0.196**	0.195***	0.194*	0.229**	0.206**	0.247
	(2.86)	(2.53)	(2.95)	(1.88)	(2.14)	(2.21)	(1.58)
Inflation		0.00454***	0.00407***	0.00367**	0.00500***	0.00385***	0.00340***
		(3.05)	(2.82)	(2.53)	(2.64)	(5.33)	(3.55)
Size of government			1.499***	1.827***	1.993***	1.714***	1.947**
			(3.56)	(5.11)	(5.63)	(4.12)	(2.56)
Exchange rate variability				0.00177***	0.00174***	0.00174***	0.00188***
				(12.45)	(11.38)	(12.15)	(6.98)
Property rights					-1.287	-0.702	-0.897
					(-1.33)	(-1.09)	(-0.98)
Black market premium						-0.817	-0.768
						(-1.35)	(-1.25)
Share in Agr. production							-0.504
							(-0.72)
Constant	56.97***	56.69***	63.01***	65.70***	75.24***	77.81***	80.56***
	(11.61)	(11.71)	(17.45)	(17.49)	(8.70)	(11.09)	(8.15)
Observation	257	256	255	255	255	230	230
Groups	88	88	88	88	88	87	87
Country fixed effect	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes

Note: All variables are averaged over separate 5-year periods. In all regressions RTA and average tariff rate of neighboring countries are used as an IV for average annual tariff rate. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. Size of government, Property right an Black market premium are also index variables ranging from 0-10 with 0 for small governments, low property rights and low black market premium in exchange rate. Share in Agr. is the share of each country form employment in agriculture sector. t-statistics are in parenthesis. Standard errors are clustered in income group level $* p < 0.1$, $** p < 0.05$ $*** p < 0.01$

Table 11: Cross sectional regression of participation rate on tariff rate in 5-year periods

	(1)	(2)	(3)	(4)
	1993-1997	1998-2002	2003-2007	2008-2012
Average tariff rate (%)	-1.043*	-0.432	-0.879**	-1.183**
	(-1.69)	(-1.50)	(-2.12)	(-2.03)
Labor market regulations	1.532	0.923	1.320	0.722
	(1.60)	(0.97)	(1.64)	(0.91)
Constant	56.43***	52.07***	52.76***	58.68***
	(8.10)	(8.56)	(9.41)	(8.89)
N	46	79	88	87

Note:In all regressions RTA and average tariff rate of neighboring countries are used as an IV for average annual tariff rate. All variables are averaged over separate 5-year period and OLS cross sectional regression are run for each period indicated above. Labor market regulations is an index of 0-10 for which 0 assigns to economies with no regulation in the labor market and 10 to economies with maximum level of regulations. t-statistics are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11 shows the cross-sectional regression for four separate 5-year intervals. Except for the 1998-2002, all other estimation are negative and significant and their absolute magnitude are larger than previous estimation which confirm the results of the previous regression.

Table 12 displays the baseline regression and regressions including 3 and 5 lags of average tariff rate. The last two rows delineate the sum of immediate and lag coefficients and χ^2 statistics for significance of the sum, respectively. This estimation indicate that long-run relationship is more severe than immediate estimation which is compatible with the result of table 11. Moreover, the magnitude of the effect after 3 years is higher than after 5 years. This suggests that although the long-run effect is more serious than short-run, the correlation between participation rate and trade barriers does not grow continuously with time.

5   Conclusion

One of the most prominent arguments supporting trade barriers is protecting labor market from international competition. In this article we study empirically the relationship

Table 12: Long run effect

	(1)	(2)	(3)
	Participation rate	Participation rate	Participation rate
Average tariff rate(%)	-0.391**	-0.479	-0.340
	(-1.98)	(-0.86)	(-0.55)
Labor market regulations	-0.104	-0.116	-0.172
	(-0.42)	(-0.39)	(-0.50)
Average tariff[-1]		-0.166	0.245
		(-0.36)	(0.44)
Average tariff[-2]		-0.123	-0.272
		(-0.46)	(-1.20)
Average tariff[-3]		-0.379	-0.249
		(-1.28)	(-0.59)
Average tariff[-4]			-0.194
			(-0.44)
Average tariff[-5]			-0.216
			(-0.83)
Constant	59.16***	64.51***	64.40***
	(28.25)	(18.14)	(18.08)
$SumL_0 - L_n$	-0.391**	-1.165***	-1.026 ***
χ^2 for the sum	(0.0476)	(0.0025)	(0.0046)
Observation	963	891	859
Groups	88	87	86
Country fixed effect	yes	yes	yes
Year fixed effect	yes	yes	yes

Note: Table shows the result of the baseline regression and estimations including lag variables of average tariff rate. Last row shows the sum of level and lag variables. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

between trade openness and a labor market variable namely participation rate. The results show that lower trade barriers is correlated with higher participation rate and this relationship is statistically significant. A limit of our analysis is the fact that we do not have the data for informal sector workers. However, our results show that this relationship is valid even in developing countries where informal sector is bigger; furthermore, another implication of our results may be the switch of workers from informal to formal sectors in the economy.

The estimations are based on a fixed-effect panel regression for 91 countries during 22 years from 1990 to 2012. In order to abate the endogeneity problem of estimations, a two stage least square approach is used employing trade condition in neighboring countries as instrumental variable. More precisely, average tariff rate and total number of regional trade agreements in surrounding countries are used in the first stage as instruments for average tariff rate. The intuition behind selecting this IV is that higher competition in geographical region enhance countries to decrease their trade barriers and reinforce their own trade status.

The results are robust to inclusion of various control variables such as GDP per capita, size of government, black market exchange rate, property rights, employment in agriculture, etc. We have also tested the sensitivity of estimations to other regression specifications; the coefficients are also negative and significant in pooled and between regressions. Moreover, the results are confirmed using another trade indicator i.e. trade volume over GDP and using an alternative IV for tariff rate which was growth in tariff rate.

Ten percentage point decrease in tariff rate is associated with 4-6 percentage point increase in participation rate and this relationship is more severe in the long-run (approximately, 8-12 percentage point in the long-run). Furthermore, participation rates are converging in different countries. We have also found that changes in labor force population explains for about 27% of the changes in unemployment rate and the rest is due to the changes in unemployed population.

In prospective researches, one can construct a theoretical model based on the model presented in Pissarides [31] in an open economy to infer the mechanism behind the results of this paper and study the data with more precision. In this article we attribute the results to the positive expectation about future economic condition, in the model, we

will investigate how different factors affect this optimism and consequently, labor market outcomes.

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A   Appendix

Table 13: List of countries and their corresponding average tariff rate and participation rate during the period of study (1990-2012)

Country	Avg. Tariff Rate	Avg. Participation Rate	Country	Avg. Tariff Rate	Avg. Participation Rate	Country	Avg. Tariff Rate	Avg. Participation Rate
Albania	7.1	48.0	Greece	2.9	51.4	Nigeria	16.3	68.3
Algeria	12.6	34.2	Guatemala	5.0	42.3	Norway	1.5	71.5
Argentina	9.2	45.7	Honduras	6.6	53.0	Pakistan	20.6	30.4
Australia	6.4	63.8	Hungary	2.9	50.5	Panama	6.1	63.8
Austria	2.9	56.5	Iceland	3.6	80.5	Paraguay	6.9	48.4
Bahamas	25.5	60.0	India	25.1	46.5	Peru	9.4	51.6
Bangladesh	22.5	62.4	Indonesia	5.4	64.5	Philippines	8.1	65.2
Belgium	2.9	51.6	Iran, Islamic Rep.	22.7	22.3	Poland	2.9	57.0
Belize	10.2	61.5	Ireland	2.9	58.2	Portugal	2.9	60.4
Bolivia	6.8	48.9	Israel	1.5	54.7	Romania	2.9	57.1
Botswana	14.0	55.5	Italy	2.9	48.6	Russian Federation	7.1	58.8
Brazil	11.0	62.7	Jamaica	10.7	49.0	Singapore	0.1	64.8
Bulgaria	2.7	51.3	Japan	3.1	54.0	Slovak Republic	2.8	59.8
Canada	2.2	66.3	Korea, Rep.	7.7	61.4	Slovenia	2.8	55.2
Chile	6.9	55.1	Kuwait	3.4	47.7	South Africa	5.4	55.9
Colombia	9.7	57.6	Kyrgyz Republic	3.7	63.2	Spain	2.9	54.0
Costa Rica	6.1	56.1	Latvia	2.9	59.3	Sri Lanka	12.9	50.6
Croatia	4.2	47.1	Lesotho	16.2	53.7	Sweden	2.9	67.8
Cuba	8.7	52.3	Lithuania	2.9	58.4	Switzerland	2.8	67.7
Cyprus	2.9	57.4	Luxembourg	2.9	54.1	Syrian Arab Republic	21.1	38.3
Czech Republic	2.8	57.5	Macedonia, FYR	4.3	54.3	Thailand	10.5	56.2
Denmark	2.9	65.6	Madagascar	13.8	70.2	Trinidad and Tobago	8.6	60.9
Dominican Republic	11.8	55.9	Malaysia	4.7	64.8	Tunisia	21.6	45.1
Ecuador	8.5	49.3	Malta	2.9	50.4	Turkey	3.6	50.9
Egypt, Arab Rep.	15.5	44.2	Mauritius	10.8	58.1	United Kingdom	2.9	62.2
El Salvador	5.3	37.9	Mexico	7.3	45.0	United States	2.3	66.2
Estonia	2.9	57.6	Morocco	18.1	50.0	Uruguay	7.3	49.6
Finland	2.9	58.9	Namibia	6.7	56.3	Venezuela, RB	11.4	60.4
France	2.9	56.0	Nepal	13.0	85.5	Vietnam	13.3	67.2
Georgia	4.3	64.6	Netherlands	2.9	62.7	Zimbabwe	19.3	57.3
Germany	2.9	58.4	New Zealand	4.7	65.2			