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1. August 2007

Online at <http://mpa.ub.uni-muenchen.de/4319/>
MPRA Paper No. 4319, posted 1. August 2007

Skill Premiums of Trading in International Markets and Equity: Some Lessons for Pro Poor Education Policies in Developing Countries*

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Abstract

The aim of this paper is to examine whether the human capital accumulation, that is a result of increased trade, further exacerbates industrial wage differentials. We find that level of education is one of the key determinants in explaining wage inequalities. Though countries which have a higher level of human capital do well on the inequality front, our results suggest that post liberalization human capital accumulation is associated with higher premiums to skilled labor thus increasing wage gaps. In this context, governments in developing countries may need to increase the mean level of human capital to achieve equity in labor markets.

Keywords: Integration, Trade Liberalization, Wage Inequality.

JEL Classifications: F-15, I-3

1. Introduction:

Many studies have tried to capture the relationship between trade liberalization and income inequality. A recent paper by Dollar and Kraay (2004) concludes that liberalization does not significantly affect the distribution of income, and at most the relationship is of neutral nature. However their results have been widely challenged, because of their methodology and variable choice (Ravallion, 2003; and Amann et al, 2002). Ravallion (2003) points out that increased openness can lead to a rise in the demand for relatively skilled labour, which tends to be more unequally distributed in poor relative to rich countries. Arbache, Dickerson and Green (2004) find that imported technology has raised the relative demand for highly skilled labour in Brazil and thus lowered the relative wages of less educated groups. Behrman, Birdsall and Szekely (2001) observe that inequality has increased in 7 out of 18 Latin American

* Paper prepared in connection to LASA (Latin American Studies Association), XXVII International Congress on 'After the Washington Consensus: Collaborative Scholarship for a New America', September 5-8, 2007, Also available at LASA2007 CD-ROM of Congress Papers

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countries that initiated market reforms in the mid 1980s. Jayasuriya (2002), accepts that trade liberalization may have reduced consumption poverty in South Asia, but is sceptical about the so-called neutral distributional effects of liberalization. Many suggest that the distribution of the positive effects of liberalization is somewhat skewed towards urban households rather than rural ones, and to wealthy rather than poor households. See for example, Chen and Ravallion (2003), Cockburn (2002), Friedman (2000), Lofgren (1999). The evidence in this regard comes mainly from the Latin American region primarily because most of the economies there undertook rigorous reform policies in the mid 1980s following the debt crisis in that decade. Legovini, Bouillon and Lustig (2001) find that inequality in Mexico rose sharply between 1984 and 1994, and rising returns to skilled labour accounted for 20 % of the increase in the inequality in household income. Similarly, Hanson and Harrison (1999) find that the reduction in tariffs and the elimination of import licenses accounts for 23 % of the increase in the relative wages of skilled labour during 1986-1990, thus providing evidence for the role liberalization played in rising inequality in Mexico. Other country studies on Brazil, Chile, Colombia and Venezuela, also show that skilled workers received increased premiums after liberalization when compared to their unskilled counterparts (World Bank, 2001). So the balance of the evidence points to increased globalization inducing greater income inequality.

The aim of this paper is to examine the impact of increased trade on inequality, and furthermore investigate whether a higher human capital stock moderates this unequalising aspect of international trade. We specifically look at the skilled-unskilled wage differential. High initial endowments of human capital, captured by data on average years of schooling say, imply a more egalitarian society compared to countries with a lower human capital endowment. When more equal societies open up their economies further, increased trade is likely to induce less inequality upon impact because the supply of skills better matches demand. But greater international exposure also brings about technological diffusion, see Winters (2004), further raising skilled labour demand. This may raise wage inequality, in contrast to the initial egalitarian *level* effect of human capital. We attempt to measure these two opposing forces. An innovation of our paper is to employ a broad set of openness indicators to measure trade liberalization policies as well as general openness, which is an outcome, and not a policy variable. Another purpose of our analysis is to examine what type of education most reduces inequality. In settings of low human capital endowments, as measured by literacy or low primary school enrollment, a policy of relative neglect of primary in favour of expenditure on tertiary education may have a less than benign influence on inequality. Our sample of countries (see appendix 4) excludes developed nations and economies in transition because of higher stocks of human capital in those regions. The rest of the paper is organized as follows: section 2 presents the data and methodology, section 3 contains the empirical results, and finally section 4 concludes with some policy implications.

2 Data, Methodology and Empirical Analysis

We employ the UTIP-UNIDO wage inequality ‘THEIL’ measure calculated by University of Texas Inequality Project (UTIP) based on UNIDO 2001. This data set is a set of measures of the dispersion of pay across industrial categories in the manufacturing sector, drawn from the Industrial database published annually by United Nations Industrial Development Organisation (UNIDO). The Theil index is

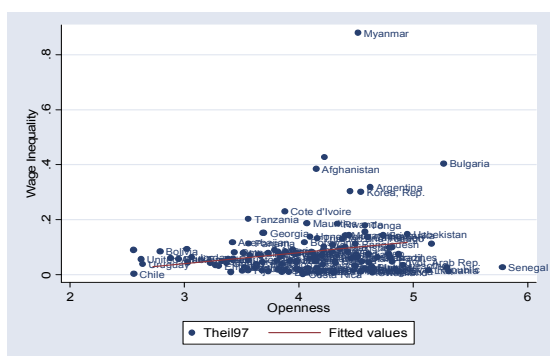
decomposable (Conceicao and Galbraith, 2000). If individuals are grouped in a mutually exclusive, completely exhaustive way, overall inequality can be separated into a between group component and a within group component. Thus, there is no interaction between these two components and so one can consider these measures additively decomposable. Moreover, of all entropy based measures, the Theil Index is the one of only two measures for which the weights in the within-groups component add to one. Therefore, overall inequality is the result of adding the two independent components: inequality between groups and inequality within groups.

Our OLS regression model is as follows:

$$THEIL97_i = \alpha + \beta OPEN_i + \gamma HK_i + \chi Disteq_i + \varepsilon_i \dots\dots\dots(1)$$

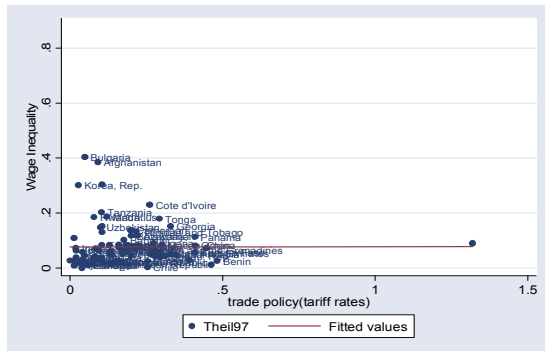
Where $THEIL97_i$ is wage inequality in country I , $OPEN_i$ and HK_i are respectively measures for openness (i.e., Exports+Imports/GDP) and human capital (i.e., average schooling years in the total population) and ε_i is the random error term, whereas $Disteq_i$ (distance from the equator) is a proxy for geography. Inclusion of human capital and geography variables will enhance the explanatory power of our model because we know from our theoretical discussion that human capital plays important role in inequality in a post liberalization period which favors skilled labor over unskilled, whereas country locations also determine patterns of trade and subsequently affecting inequality.

Before undertaking regression analysis, let us first take a look at simple graphs showing bivariate relationship between openness and inequality. Graph1 in the next page suggests that the relationship is positive. However Graph2 fails to develop any definite association between tariffs¹ and inequality. This shows that the choice of openness variable matters apropos its relation with inequality. Thus a robustness check is pre-requisite to be sure how openness affects wage inequality?



Graph1: Openness (Exports+Imports/GDP, 1985) and Wage Inequality (Theil Index, 1997)

¹ Movement in tariffs capture trade policy and show how open an economy is.



Graph2: Tariffs (Tariffs on Intermediate and Capital Goods, 1985. Source: Rose (2002) and Wage Inequality (Theil Index, 1997)

Tables 1a shows that openness is associated with increased wage inequality. However the coefficients have very small values suggesting limited role they play in explaining inequality. Small R^2 values with any of the specifications of Eq (8) suggest the same. Where as, for trade policy the result is at best insignificant. Where as education is negatively related with wage inequality for general openness indicator suggesting educated societies are less prone to wage dispersions than less educated societies.

Table 1a: OLS Regression Results for Openness

Theil Indx	1	2	3	4
lcoopen	0.04 (2.58)*	0.035 (2.6)*	0.003 (1.8)**	0.03 (1.82)***
hk	-0.009 (-2.1)**	-0.008 (-2.1)**		
disteq	0.0002 (0.35)		0.0002 (0.23)	
n	70	70	114	114
R^2	0.11	0.11	0.03	0.02

*, ** and *** denotes 1%, 5% and 10% level of significance respectively.

Table 1b: OLS Regression Results for Tariffs^

Theil Indx	1	2	3	4
tariffs	-0.0015 (-1.2)	-0.0015 (-1.2)	-0.0006 (-0.4)	-0.0007 (-0.5)
Hk	-0.008 (-1.5)	-0.008 (-1.6)		
disteq	-0.0001 (-0.1)		0.0003 (0.4)	
n	59	59	82	82
R^2	0.05	0.05	0.005	0.003

*, ** and *** denotes 1%, 5% and 10% level of significance respectively.

The above OLS regression though useful is always suspected to suffer from econometric problems such as endogeneity among variables. For example economic integration itself is effected by level of human capital a country acquires or where it is located. We need to solve for the endogeneity of openness with other explanatory variables.

Rodrik et al (2004) solve for the endogeneity of openness variables by regressing it on a set of some robust instruments. We follow their line by choosing distance from the equator and predicted trade shares computed following Frankel and Romer (1999) from a gravity equation for bilateral trade flows as instruments to our trade policy variables.

Our Instrumental Variable (IV) regression (or 2 Stage Least Square) model would carry two equations

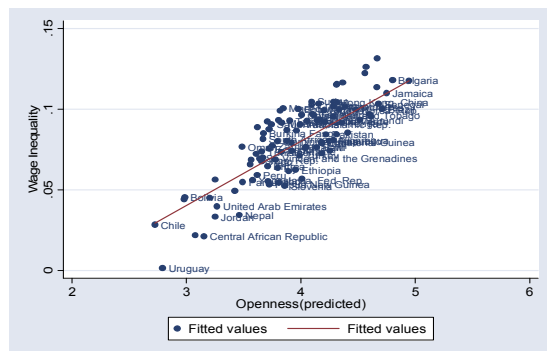
$$THEIL97_i = \sigma + \kappa OPEN_i + \nu HK_i + \varepsilon_{1i} \dots\dots\dots(2)$$

$$OPEN_i = \zeta + \tau FR_i + \psi Disteq_i + \varepsilon_{2i} \dots\dots\dots(3)$$

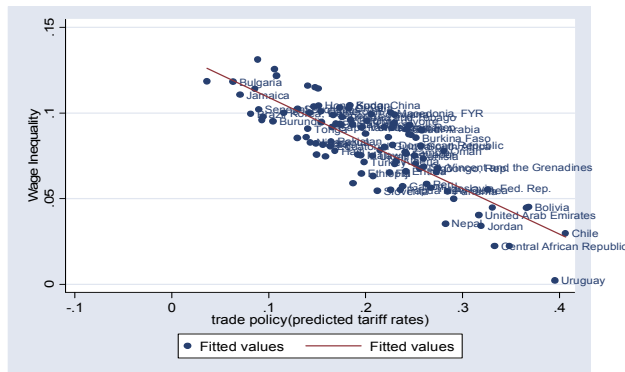
In the 1st stage, equation (3) is used to generate predicted values of our trade policy variables by regressing them on the two instruments, whereas FR_i are predicted trade shares computed by Frankel and Romer (1999). The predicted trade policy variables are employed in equation (2) as the second and final stage of IV regression analysis. Please note that the only difference between eq (2) and equation (1) is that the former does not carry $Disteq_i$ variable which is instead used as an instrument in eq (3) for our t openness concepts.

Before running the regressions we obtained graphs between the same variables of openness used in graph1 and graph 2 and Theil index to see whether we can get a moor clearer picture regarding openness inequality relationship. The only difference this time is that we used predicted values of these openness measures instead of actual values as it was the case in graph1 and grap2.

Graph3 and graph 4 clearly shows that inequality moves positively with general openness as well as open trade policy. The predicted values of openness has enabled to provide a much clear trends regarding openness/trade policy and inequality movements are concerned. On the one hand graph 3 shows that increase in trade shares after liberalization leads to higher inequality and on the other hand graph 4 suggests that decrease in tariffs carries unequal distributional effects on wages. The ensuing IV regression analysis confirms that the relationship between inequality and openness is as clear and uncontroversial as the graphs suggest.



Graph3: Openness (Predicted values of ‘Exports+Imports/GDP’, 1985) and Wage Inequality (Theil Index, 1997)



Graph4: Tariffs (Tariffs on Intermediate and Capital Goods, 1985. Source: Rose (2002) and Wage Inequality (Theil Index, 1997)

Table 2: IV Regression results With Different Specifications:

	1	2		1	2
lcopen	0.0297	0.039	Tariffs	-0.298	-0.254
	(1.19)	(2.19)**		(-2.03)**	(-1.87)***
skills65		-0.015	skills65		-0.0132
		(-2.32)**			(-1.48)
F-test	1.42	4.14**	F-test	4.11**	2.42
n	97	63	n	70	51
R^2	0.03	0.08	R^2		

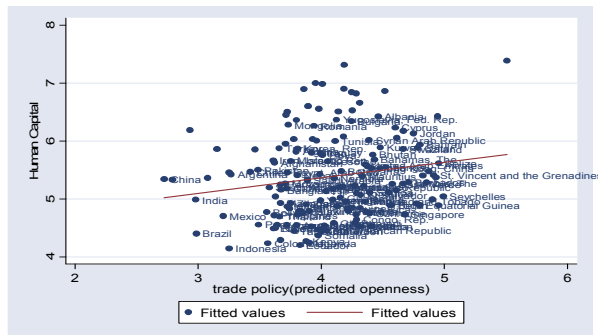
- * and ** denote significance at 5% and 10% level.

Table 2 confirm what graphs 3 and 4 showed us. Both general openness and trade policy are not only significant but they carry expected signs. We can now safely suggest that trade liberalization is behind significant wage inequality in developing countries. Another interesting observation from table 2 is that human capital is negatively related to income inequality. What does this mean in the light of our analysis?

We know from above discussion that liberalization favors skilled labor over unskilled labor. This also means that human capital under liberalization can also cause wage inequality in developing countries where there is unequal distribution of skilled and unskilled labor. However if you note, our IV regression model assume human capital to be exogenous to the processes of liberalisation. This is a valid assumption because openness enters into equation (2) as predicted values of FR and geography instruments. Thus what ever effects human capital has on inequality in our equation (2), it is quite independent to processes of openness.

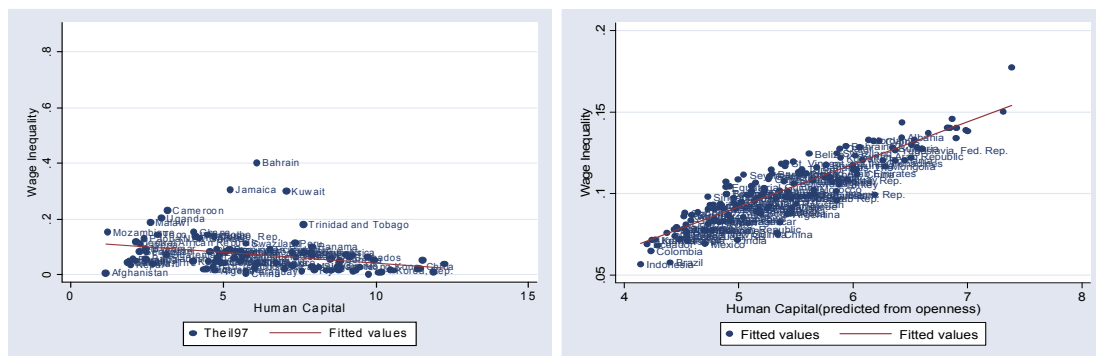
Nevertheless, it would be interesting to know what are the linkages between openness, human capital and Wage inequality? First let us see how human capital is associated with openness? Graph 5 shows that trade liberalization improves human capital in developing countries. This is true because increased international trade is followed by technology transfer which improves the general skill level in a developing country as the demand for skilled labor increase and learning by doing takes place. In short human capital is endogenous to the processes of openness as hinted by many endogenous growth models, whereas the part of skilled human capital which is endogenous to international integration will have its own effect on relative wages and

inequality and this effect is different from the one which is attributed to over all skilled human capital endowments.



Graph 5: Openness (Predicted values of ‘Exports+Imports/GDP’, 1985) and HK.

Recently, Eiche et al (2001) suggested that human capital plays a dual role in development: “We have argued that the stock of educated workers in an economy determined both the degree of income inequality and the rate of growth, and that the parameters of the demand for and supply of labor are crucial determinants of whether inequality increases or decreases as an economy accumulates human capital (p. 19)”. We know from above discussion that wage inequality in many developing countries in Latin America and other developing countries have been deteriorated amid more international trade. So in order to know whether human capital accumulation which is directly accrued through processes of trade is guilty of aggravating wage inequality in developing countries, the paper generates predicted values of human capital by regressing them on FR predicted trade shares



Graph 6: HK, 1997/98 (Predicted values) and Theil Index, 1997/98.

.In order to know whether human capital accumulation, which is directly accrued through the processes of trade, contributes to wage inequality in developing countries, the paper generates predicted values of human capital by regressing them on FR (1999) predicted trade shares. Graph 6 shows two figures. The first one illustrates a simple relation ship between human capital and wage inequality and suggests that countries with higher human capital stocks have less inequality. The second graph, where we relate human capital stocks to predicted FR trade shares, indicates the converse, suggesting that human capital accumulation due to global integration

augments wage inequality. This is in line with Tinbergen's (1975) arguments and our earlier discussion regarding the dual role of human capital in the economy.

In order to examine the dual role of human capital, we modify our 'wage inequality model' by introducing interaction terms between human capital and some selected trade policy measures.

$$THEIL_i = \lambda + \Omega Interaction_i + \rho HK_i + \varpi Disteq_i + \varepsilon_{3i} \dots\dots\dots(4)$$

$$Interaction_i = \phi + \theta FR_i + \varepsilon_{4i} \dots\dots\dots(5)$$

Interaction_i is the interaction term between openness and human capital. Since we are interested in the effect of human capital stocks on inequality while taking into account to what extent each developing country is integrated to world markets, our openness variables have to be in dummy variable form.

Table3: Interaction Terms:

THEIL97						
	1	2	3	4	5	6
Open80s						
<i>Interaction_{HK}</i>	0.0123 (0.0056)**	0.0128 (0.0055)**			0.0119 (0.0056)**	
<i>Interaction_{HYR}</i>			0.1905 (0.0872)**	0.1978 (0.0862)**		0.1839 (2.11)**
hk	-0.0042 (0.0037)	-0.0047 (0.0036)	-0.0042 (0.0038)	-0.0048 (0.0037)		
hyr					-0.0350 (0.0387)	-0.0350 (0.0387)
disteq	-0.0004 (0.0007)		-0.0005 (0.0007)		-0.0005 (0.0007)	-0.00047 (0.0007)
Constant	0.0802 (0.0276)*	0.0727 (0.0251)*	0.0778 (0.0283)*	0.0702 (0.0257)*	0.0701 (0.0246)*	0.0677 (0.0254)*
Adj. R ²	0.09	0.06	0.09	0.05	0.04	0.04
N	73	73	73	73	72	72
Tariffs						
<i>Interaction_{HK}</i>	0.0346 (0.0158)**	0.0359 (0.0156)**			0.0334 (0.1583)**	
<i>Interaction_{HYR}</i>			1.1519 (0.5275)**	1.1959 (0.5210)**		1.1123 (0.5262)**
hk	-0.0042 (0.0037)	-0.0047 (0.0036)	-0.0042 (0.0379)	-0.0047 (0.0036)		
hyr					-0.0350 (-.0387)	-0.0350 (0.0387)
disteq	-0.0004 (0.0007)		-0.0005 (0.0007)		-0.00047 (0.0007)	-0.00047 (0.0007)
Constant	-0.0910 (0.0970)	-0.1051 (0.0942)	0.5402 (0.1959)*	0.5502 (0.1945)*	-0.09530 (0.0973)	0.5142 (0.1933)*
Adj. R ²	0.09	0.06	0.09	0.06	0.08	0.04
N	73	73	73	73	72	72

- * and ** denote significance at 1% and 5% level, whereas terms in the parenthesis are standard errors for each variable.

We select only 2 such measures which can easily be converted into dummies in the light of existing literature. Our selected openness/ trade policy variables are the Sachs and Warner openness indicator (Open80s) and tariffs on intermediate inputs and capital goods (*owti*) respectively. For *owti* we followed the definition of openness by Sachs and Warner (1995) in order to generate dummies. For example, *owti* carries the

value of 0 where average tariff rates are higher than 40% and 1 for countries where average tariffs are lower than 40%.

Since there is some evidence that higher education raises inequality (Barro, 1999), we also utilize average years of higher schooling (*hyr*), in addition to average years of schooling (*hk*) as the second proxy of human capital. Both the measures of human capital are interacted with openness dummies and the resultant interaction terms '*Interaction_i*' enter the wage inequality equation (4) as predicted values of FR openness instrument in an attempt to gauge how do more openness and liberalized trade policies modify the role of human capital in determining wage inequality?

Table 3 shows average years of schooling are negatively related with inequality in all specifications of equation 4, confirming our earlier results that countries which have better school attainment, and consequently superior skilled human capital stocks do well apropos inequality. Furthermore, the results illustrates that predicted *Interaction_i* terms between average years of schooling and openness/ trade policy dummies always enter the inequality equation positively and significantly. The simple interpretation is that human capital which is accrued through processes of liberalization complements trade liberalization in worsening the gap between the haves and have nots in developing countries. This result is in line with the observation made by graph 3.

3. CONCLUSIONS:

Though the paper supports the argument that those countries which have a higher level of human capital do well on the inequality front, it also suggests that human capital which accrues through the trade liberalization and greater openness channel has inegalitarian effects. One explanation is that governments in developing countries invest in higher education at the cost of primary education in order to gain short-term benefits from globalization, and thus become prone to wage inequality after trade liberalization. In summary, our discussion suggests that the inequalities, which we witness today in developing countries, have two important determinants. First there are significant inequalities in educational attainment. Second, increased international trade transforms these education inequalities into wage inequalities by favouring skilled labour over unskilled labour.

In order to neutralize the unequal effects of trade, the focus of policy makers should be on education. Countries with more educated people are in a better position to benefit from international trade. Governments need to increase the mean level of human capital through a balanced education policy where primary education is given as much importance as higher education. An equitable education policy will decrease the skilled-unskilled wage premium, as the overall supply of low skilled and uneducated workers goes down and the supply of educated workers increases. Dur and Tuelings (2002) calls for subsidies to all levels of education as they argue that the mean level of education gives rise to general equilibrium effects that reduce wage inequality.

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APPENDIX 1.

DATA AND SOURCES:

Disteq: Distance from Equator of capital city measured as $\text{abs}(\text{Latitude})/90$. Source: Rodrik, Subramanian & Trebbi (2002)

hk: Average Schooling Years in the total population at 25, Year: 1999. Source: Barro R & J. W. Lee data set, <http://post.economics.harvard.edu/faculty/barro/data.html>

hyr: Average Years of Higher Schooling in the Total Population at 25, Year: 1999. Source: Barro R & J. W. Lee data set, <http://post.economics.harvard.edu/faculty/barro/data.html>

Lcopen: Natural logarithm of openness. Openness is given by the ratio of (nomnal) imports plus exports to GDP (in nominal US dollars), Year: 1985. Source: Penn World Tables, Mark 6.

Logfrankrom: Natural logarithm of predicted trade shares computed following Frankel and Romer (1999) from a bilateral trade equation with 'pure geography' variables. Source: Frankel and Romer (1999).

Open80: Sachs and Warners (1995) composite openness index. Source: Rose (2002).

Tariffs: Tariffs on Intermediate and Capital Goods, 1985. Source: Rose (2002)

Theil97: UTIP-UNIDO Wage Inequality THEIL Measure - calculated based on UNIDO2001 by UTIP, Year: 1997. Source: University of Texas Inequality Project (UTIP) <http://utip.gov.utexas.edu>.

APPENDIX 2:

LIST OF COUNTRIES

Afghanistan	Congo, Rep.	Jamaica	Oman
Albania	Costa Rica	Jordan	Pakistan
Algeria	Cote d'Ivoire	Kenya	Panama
Angola	Croatia	Korea, Rep.	Papua New Guinea
Argentina	Cuba	Kuwait	Paraguay
Armenia	Cyprus	Kyrgyz Republic	Peru
Azerbaijan	Dominican	Latvia	Philippines
Bahamas, The	Republic	Lesotho	Puerto Rico
Bahrain	Ecuador	Liberia	Qatar
Bangladesh	Egypt, Arab Rep.	Libya	Romania
Barbados	El Salvador	Lithuania	Rwanda
Belize	Equatorial Guinea	Macao, China	Samoa
Benin	Eritrea	Macedonia, FYR	Saudi Arabia
Bhutan	Ethiopia	Madagascar	Senegal
Bolivia	Fiji	Malawi	Seychelles
Bosnia	Gabon	Malaysia	Singapore
Botswana	Gambia, The	Mauritania	Slovak Republic
Brazil	Georgia	Mauritius	Slovenia
Bulgaria	Ghana	Mexico	Somalia
Burkina Faso	Guatemala	Moldova	South Africa
Burundi	Guinea	Mongolia	Sri Lanka St.
Cameroon	Haiti	Morocco	Vincent and the
Cape Verde	Honduras	Mozambique	Grenadines
Central African	Hong Kong, China	Myanmar	Sudan
Republic	India	Namibia	Suriname
Chile	Indonesia	Nepal	
China	Iran, Islamic Rep	Nicaragua	
Colombia	Iraq	Nigeria	