Trade openness and income – a re-examination

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Abstract: This study uses a new, innovative measure of trade protection and finds that less trade protection is associated with higher income per capita, using data from 131 developed and developing countries.

Keywords: *trade restrictiveness, tariff aggregators, income per capita*

JEL classification: *F10, F13*

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Introduction

The relationship between trade policy and the level of income is still an open question in the development literature. Theoretical models show that trade openness promotes an efficient allocation of resources through comparative advantage, leading to increased income levels. However, the empirical evidence is still mixed.[1] One potential explanation for the often contrasting results is the difficulty in measuring "trade liberalization" or "openness". A large number of studies used trade volumes, or the share of trade in GDP as proxies for trade openness.[2] Others have used trade barriers, like average or import-weighted average tariff rates[3] or composite measures, like Dollar's (1992) price distortion and variability index or Sachs and Warner's (1995) openness index.

However, none of these measures is without major shortcomings. As Kee et al. (2009) note, the volume of trade may also capture macroeconomic shocks, differences in tastes and other factors not related to trade policy; the composite measures may reflect poor economic management, or are primarily affected by geographic characteristics. The arithmetic or the trade-weighted average tariffs are without theoretical foundation and they may also introduce significant biases in estimation (Manole and Martin, 2006).

This paper furthers our knowledge of the relation between trade openness and income by using a new, innovative index of trade restrictiveness (TRI), which is *consistent* and based on theoretically sound aggregation procedures. In addition, we account for misspecification errors by carefully including in the regression geography-related and institutional variables that are likely to influence the level of income.[4] We also account for possible endogeneity in estimation by using an instrumental variables technique.

We focus on 131 countries, both developed and developing and find that lower level of trade protection is associated with higher per-capita income. The results are robust to accounting for geography-related, and institutional variables and correcting for endogeneity in estimation.

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[1] See Yahikkaya (2003) and Rodriguez and Rodrik (2001) for an extensive review of the literature.
[2] See among others Frankel and Romer (1999), Irwin and Tervio(2002), etc.
[3] See Edwards (1998), Clemens and Williamson (2001), etc.
[4] Rodrik et al. (2004) highlight the importance of institutional quality in the trade-income regressions.

2. The Trade Restrictiveness Index

In this paper we use the framework proposed by Bach and Martin (2001) and Manole and Martin (2006), which built on the seminal paper by Anderson and Neary (1996). We calculate yearly Trade Restrictiveness Indices that measure the degree of protection in the economy for 131 countries, between 1990 and 2004.[5] For every country and year we build a model of the economy taking into account all import tariffs, and calculate the welfare level in the economy. The TRI is the equivalent uniform tariff that leaves the welfare level unchanged. This aggregator is obtained by solving a system of nonlinear equations.

The model assumes that the structure of a competitive, small open economy can be captured by the following system of equations:

The income-expenditure condition,

$$e(\boldsymbol{p}, u) - r(\boldsymbol{p}, \boldsymbol{v}) - (\boldsymbol{e_p} - \boldsymbol{r_p})'(\boldsymbol{p} - \boldsymbol{p^w}) - f = 0 \quad (1)$$

and the vector of behavioral equations[6],

$$e_{\boldsymbol{p}}(\boldsymbol{p}, u) - r_{\boldsymbol{p}}(\boldsymbol{p}, \boldsymbol{v}) = \boldsymbol{m} \quad (2)$$

where $e(\boldsymbol{p},u)$ is the expenditure function of the representative household, $\boldsymbol{p}$ is a given vector of domestic sectoral price aggregates, u is domestic utility, $r(\boldsymbol{p},\boldsymbol{v})$ is domestic revenue from production, and $\boldsymbol{v}$ is a vector of productive resources; $\boldsymbol{m}$ is the vector of imports, and f is the exogenously-determined net financial inflow from abroad. We can define $\boldsymbol{B}$ as the balance-of-trade function, which captures the financial inflow necessary to keep the level of utility u^0 constant when prices $\boldsymbol{p}$ change (Anderson and Neary, 1996).

Based on equation (1) and considering prices $\boldsymbol{p}$ – a vector of domestic prices and $\boldsymbol{p^w}$- a vector of world prices, and the level of utility u^0 as exogenous, $\boldsymbol{B}$ can be written as:

$$\boldsymbol{B}(\mathbf{p}, u^0) = e(\mathbf{p}, u^0) - r(\mathbf{p}, \mathbf{v}) - (\mathbf{e_p} - \mathbf{r_p})(\mathbf{p} - \mathbf{p^w}) - f \quad (3)$$

[5] The time span is determined by tariff data availability.
[6] Bold letters denote vectors.

We introduce TRI as the uniform tariff that keeps the welfare constant. In the framework presented above, TRI is the solution of the following non-linear equation:

$$B(\mathbf{p}^{\mathbf{w}}(1+ \text{TRI}), u^0) = B(\mathbf{p}, u^0) \quad (4)$$

Domestic prices contain trade distortions. We computed and solved equation (4) for all country/year combinations were data was available. To obtain *consistent* aggregators, we used all tariffs at the highest level of disaggregation for which data is available, i.e. six digits (World Bank, WITS)[7]. Figure 1 presents the constructed TRIs, averaged over the period 2000-2004, relative to GDP per capita.

3. Model Specification

The model specification is as follows:

$$\text{lnGDPpc}_{jt} = \alpha + \beta_1 \text{ lnTRI}_{jt} + \beta_2 \text{ Geography}_j + \beta_3 \text{ Institutions}_{jt} + \beta_4 \text{ Macro Variables}_{jt} + e_{jt}$$

where lnGDPpc_{jt} is the log GDP per capita of country j over period t, measured in PPP US dollars. lnTRI_{jt} stands for Trade Restrictiveness Index; the Geography_j variables are distance to the equator and a dummy for landlocked countries (Dollar and Kraay, 2002); Institutions_{jt} variables are Law and Order, and Government Stability (International Country Risk Guide, 2007). Macro Variables_{jt} capture other factors that may impact income, like market size (proxied by population), human capital investment (proxied by secondary school enrollment), macroeconomic price stability (proxied by inflation rate), and the depth of financial sector (proxied by the average ratio of credit to GDP). All variables come from World Development Indicators database, World Bank, 2007. We also add to the regression the Ethno-linguistic fractionalization of the population, which is likely to affect income (Alesina et al., 2003). We use five-year averages of all time-varying variables to smooth variations over time.

[7] The TRI measure does not control for NTBs.

The control variables of interest, in particular TRI_{jt} and $Institutions_{jt}$ are likely to be endogeneous. We instrument for TRI_{jt} using its one period lag, and for institutions using the legal origin, i.e. whether a country has a British, German, French, Scandinavian, or Socialist origin for its legal system (see Bolaky and Freund, 2008, and Bormann et al. 2006, etc.).

4. Estimation Results

The results using the OLS specification are presented in Table 1. We start with the basic regression where income is regressed on population, TRI_{jt} index and the two geography variables: distance from equator, and the dummy for landlock countries. The TRI_{jt} variable is negative and statistically significant, suggesting that higher trade protection is associated with lower per capita income. Population has negative effect on per capita income; countries further away from the equator have higher income, while being landlocked negatively impacts income. Subsequently, we introduce the Ethnic fractionalization variable and one by one, the institutional variables. We find that Law and Order and Government Stability have a positive and significant effect on income per capita. We then account for macroeconomic policies that may affect income: inflation, the level of human capital and the development of financial sector. The TRI_{jt} variable remains negative and statistically significant throughout. The coefficient is economically significant, as it implies that a 1% decrease in trade restrictiveness leads to an approximately 0.3% increase in income per capita.

To avoid endogeneity bias, we re-estimate the above regressions using instrumental variables technique. The results are presented in Tables 2. The Shea partial R^2 and the Sargan test confirm the validity of the instruments. The TRI_{jt} variable remains negative and statistically significant, confirming our hypothesis that lower trade protection is associated with higher income per capita.

In conclusion, this study uses a new, innovative measure of openness to trade and finds that lower trade protection leads to higher levels of income per capita. The results are robust to accounting for geography-related, and institutional variables as well as correcting for possible endogeneity in estimation.

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Figure 1
TRI and GDP per capita

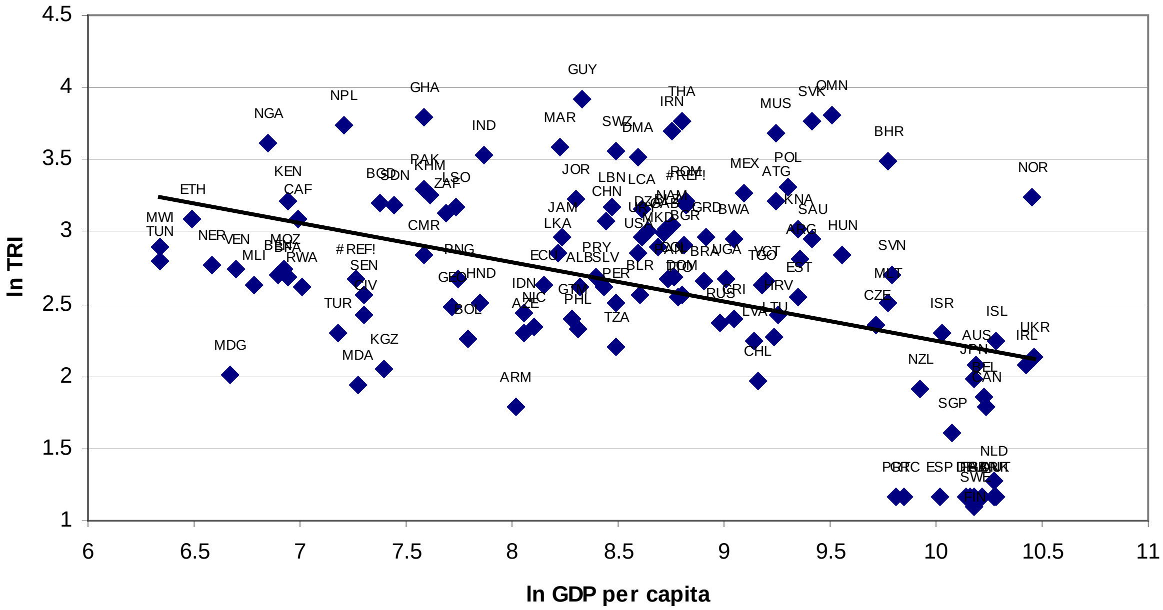

Table 1: OLS regressions

$logTRI_{jt}$	**-0.301***** **[0.063]**	**-0.347***** **[0.065]**	**-0.306***** **[0.066]**	**-0.306***** **[0.066]**	**-0.298***** **[0.066]**	**-0.164***** **[0.054]**	**-0.159**** **[0.066]**
$logPopulation_{jt}$	-0.100***	-0.043	-0.015	-0.016	-0.01	0.007	0.012
	[0.024]	[0.033]	[0.033]	[0.033]	[0.033]	[0.026]	[0.028]
$Landlock_{j}$	-0.971***	-0.852***	-0.705***	-0.707***	-0.660***	-0.288**	-0.452***
	[0.122]	[0.139]	[0.150]	[0.151]	[0.152]	[0.124]	[0.139]
Distance $equator_{j}$	0.032***	0.033***	0.021***	0.021***	0.021***	0.008**	0.007*
	[0.003]	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Ethnic $fractionalization_{j}$		-0.007***	-0.008***	-0.008***	-0.009***	-0.006***	-0.004***
		[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Law & $order_{jt}$			0.193***	0.195***	0.174***	0.121***	0.115***
			[0.045]	[0.046]	[0.047]	[0.039]	[0.041]
Govt. $stability_{jt}$				-0.005	-0.018	-0.025	-0.039
				[0.034]	[0.034]	[0.026]	[0.030]
$Inflation_{jt}$					-0.007*	-0.002	-0.006
					[0.004]	[0.003]	[0.004]
Secondary sch. $enrollment_{jt}$						0.017***	0.019***
						[0.002]	[0.002]
Claims private $sector_{jt}$							0.008**
							[0.004]
Constant	10.394***	9.902***	8.882***	8.932***	9.077***	7.674***	7.510***
	[0.441]	[0.565]	[0.593]	[0.670]	[0.669]	[0.538]	[0.571]
No. Observations	270	205	195	195	195	180	143
R-squared	0.54	0.7	0.71	0.71	0.72	0.84	0.82

Standard errors in brackets: * significant at 10%; ** significant at 5%; *** significant at 1%

Table 2. Instrumental variables regressions

$logTRI_{jt}$	**-0.262****	**-0.249****	**-0.251****	**-0.148***	**-0.148**
	[0.110]	**[0.117]**	**[0.112]**	**[0.088]**	**[0.121]**
$logPopulation_{jt}$	0.005	0.045	0.037	0.02	0.021
	[0.047]	[0.072]	[0.063]	[0.042]	[0.043]
$Landlock_{j}$	-0.923***	-0.599	-0.667	-0.572**	-0.663**
	[0.230]	[0.483]	[0.412]	[0.287]	[0.292]
Distance $equator_{j}$	0.001	0.002	0.002	-0.01	-0.01
	[0.010]	[0.011]	[0.011]	[0.011]	[0.011]
Ethnic $fractionalization_{j}$	-0.009***	-0.012***	-0.011***	-0.007***	-0.006**
	[0.003]	[0.004]	[0.004]	[0.003]	[0.003]
Law & $order_{jt}$	0.505***	0.422**	0.426**	0.407**	0.375**
	[0.158]	[0.198]	[0.182]	[0.171]	[0.156]
Govt. $stability_{jt}$		0.351	0.263	-0.022	0.003
		[0.451]	[0.412]	[0.272]	[0.268]
$Inflation_{jt}$			-0.002	-0.006	-0.004
			[0.011]	[0.015]	[0.016]
Secondary sch. $enrollment_{jt}$				0.014***	0.017***
				[0.003]	[0.003]
Claims private $sector_{jt}$					0.010
					[0.006]
No. Observations	108	108	108	98	74
Shea partial R2 of first-stage regressions					
TRI_{jt}	0.66	0.64	0.66	0.66	0.57
Law & $order_{jt}$	0.17	0.13	0.15	0.11	0.14
Govt. $Stability_{jt}$		0.04	0.05	0.07	0.08
Sargan overidentification test	2.58	1.76	1.84	4.11	0.88
Chi-sq(1) P-val	0.28	0.18	0.17	0.05	0.35

Standard errors in brackets: * significant at 10%; ** significant at 5%; *** significant at 1%