REGULATORY QUALITY AND TRADE PERFORMANCE: AN ECONOMETRIC ANALYSIS

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Abstract

Using a set of econometric models, I estimate the positive effects of a country's regulatory quality, as measured by the World Bank's World Governance Indicators, on the value of the country's GDP and its exports of manufactured goods to the United States. A second set of models estimates the effects of regulatory quality on the country's imports of manufactured goods from the United States. The estimated positive effects on trade are much larger, in percentage terms, for developing countries. Finally, I use the econometric models to simulate the effects of hypothetical changes in regulatory quality in a group of ten developing countries.

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1 Introduction

Recent international negotations, including some bilateral trade agreements and the recently launched Indo-Pacific Economic Framework for Prosperity (IPEF) talks, have aimed to improve regulatory quality in member countries, among other objectives. For example, in the Ministerial Text for the Trade Pillar of the IPEF, the Transparency and Good Regulatory Practices goal as "promoting, supporting, and improving transparency in rulemaking; allowing an opportunity for public comment by interested persons on proposed new or amended regulatory measures; improving accessibility of information, including online, about existing laws and regulatory processes; promoting internal coordination in regulatory development; and taking account of available information, science and evidence in rulemaking."[1]

In theory, increasing regulatory quality can improve a country's productivity and export performance. It can lower costs of production, and it can raise the quality of the country's products. On the other hand, if higher regulatory quality increases the amount of regulation, it might raise compliance costs. Whether the net effect of improved regulatory quality is to increase or reduce GDP and trade is an empirical question.

Investigating this issue requires a definition of regulatory quality as well as a measure. According to Parker and Kirkpatrick (2012), better regulation is characterized by consistency, transparency, accountability, targeting, and proportionality. This fits with the definition of regulatory quality in Kaufmann, Kraay and Mastruzzi (2010): "the ability of the government to formulate and implement sound policies and regulation that permit and promote private sector development." Based on the definition in Kaufmann et al. (2010), the World Bank's Worldwide Governance Indicators rate the regulatory quality of individual countries throughout the world every year.

In this paper, I estimate a set of econometric models of U.S. imports and exports of

[1] Available online at `ustr.gov/ipef`.

manufactured goods that includes the World Bank's rating of regulatory quality in the partner country as an explanatory variable. I estimate that a country's regulatory quality has a positive and statistically significant effect on the value of the country's exports to the United States, and that regulatory quality also has a positive and significant effect on the country's imports from the United States. The estimated positive effects on trade are much larger, in percentage terms, for developing countries. I use the models to simulate the trade effects of hypothetical changes in regulatory quality. Specifically, I simulate the effects of a 10% reduction in the gap between regulatory quality in a benchmark country (the United States) and regulatory quality in a developing country. The point estimates of the changes in exports to the United States range from 9.4% to 17.6%, while the point estimates of the changes in their imports from the United States range from 7.3% to 13.5%.

My econometric models update and extend an economics literature that has estimated the impact of regulatory quality on a country's income level, its growth rate, or its export performance. Parker and Kirkpatrick (2012) provides a broad overview of the quantitative research on the economic impact of regulatory policy. They note that multi-variate regression is the most common approach in the literature. They conclude that well-designed regulation can support market transitions, and regulatory simplification can reduced regulatory burden.

Djankov, McLiesh and Ramalho (2006) estimates an econometric model of the annual average growth rate of GDP per capita between 1993 and 2002 that included measures of regulatory quality from the World Bank's Doing Business database. According to their model, countries with better regulations grow faster: an increase in regulatory quality from the worst quartile to the best quartile would increase a country's annual growth rate by 2.3 percentage points. Jalilian, Parker and Kirkpatrick (2006) also estimates an econometric model of growth in GDP per capita from 1980 to 2000, using a cross-section of 117 countries and the World Bank's measure of regulatory quality. They also find a positive and statistically significant link between regulatory quality and economic growth. Likewise, Cebula and Clark

(2014) finds that regulatory quality had a positive and statistically significant impact on a country's per capita real income in a wide range of countries during the period 2003–2007, even after controlling for other measures of economic freedom and for tax burden.

Iwanow and Kirkpatrick (2007) focuses on the improvement in a country's trade performance due to trade facilitation reform and changes in regulatory quality. The authors estimate a gravity model that controls for regulatory quality and infrastructure. Their estimation sample includes 78 countries and covers the period 2000–2004. Their model indicates that a 10 percent increase in regulatory quality increased exports by 9 to 11 percent.

These statistical models of economic aggregates used in the literature (and also in this paper) are probably the only practical way to generate estimates of economy-wide effects of an improvement in the regulatory regime. The standard way to analyze the costs and benefits of changes in individual regulations is to perform a detailed regulatory impact analysis with engineering estimates of costs and perhaps a model of market interactions and reactions, like the analyses described in Hahn and Tetlock (2008). However, it is probably infeasible to assess the economy-wide effects of changing the regulatory regime by adding up a comprehensive set of detailed regulatory impact analyses. This bottom-up approach would be too burdensome and would require guessing which specific regulations might arise under the new regulatory regime that would not have arisen under the prior regime.

The rest of the paper is organized into five sections. Section 2 defines the measure of regulatory quality that I use. Section 3 describes the methodology for the econometric analysis of the effects on GDP, exports, and imports. Section 4 reports estimates of the parameters of the models. Section 5 uses the estimated models to simulate the effects of hypothetical changes in regulatory quality. Section 6 concludes. An Appendix reports additional econometric estimates.

2 Regulatory Quality

The Regulatory Quality (RQ) Index in the World Bank's Worldwide Governance Indicators (WGI) rates over 200 individual countries every year.[2] The RQ Index is described at length in Kaufmann et al. (2010). The index is meant to capture "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development." The WGI are derived from 30 underlying data sources, which include surveys of households and firms, commercial business information providers, non-government organizations, and public sector organization. The RQ Index specifically includes data from Asian Develop Bank Country Policy and Institutional Assessments, Business Enterprise Environment Surveys, Global Insight Business Conditions, Institute for Management and Development World Competitiveness Yearbooks, World Bank Country and Risk Indicators, and World Economic Forum Competitiveness Reports. RQ Index values range from -2.50 to 2.50. Table 1 reports the 2021 RQ Index values for the United States and 20 other countries.

3 Methodology

I estimate the effects of regulatory quality on a country's GDP and its trade with the United States using econometric models and a large panel of countries over the period 2002–2021. The regulatory quality measure was described in the last section. The data on the customs value of U.S. manufacturing imports and the free along-side ship value of U.S. manufacturing exports are from the U.S. International Trade Commission's Trade Dataweb.[3] The unit of observation for the trade data is country and year. GDP data for each country and year are from the World Bank's World Development Indicators.[4]

[2] The data are publicly available at `https://info.worldbank.org/governance/wgi/`.

[3] These data are available at `dataweb.usitc.gov`.

[4] These data are available at `databank.worldbank.org/source/world_development_indicators`.

Table 1: WGI Regulatory Quality Index

Countries	2021 RQ Index
United States	1.45
Argentina	-0.62
Australia	1.84
Brazil	-0.11
China	-0.31
Egypt	-0.51
France	1.24
Germany	1.63
India	-0.08
Indonesia	0.30
Japan	1.38
Korea, Republic of	1.10
Malaysia	0.72
New Zealand	1.81
Peru	0.08
Philippines	0.08
Singapore	2.23
Thailand	0.09
Turkey	-0.08
United Kingdom	1.47
Vietnam	-0.40

First, I model the effects of regulatory quality on a country's manufacturing exports to the United States. Equation (1) relates exports from country c in year t (X_{ct}) to the country's GDP (Y_{ct}), its regulatory quality (RQ_{ct}), a number of factors controlled for with country fixed effects (γ_c) and year fixed effects (δ_t), and an error term (ϵ_{ct}). The country fixed effects control for gravity factors that do not change over time, like international distance, common borders and language, and some institutions and infrastructure. These country fixed effects also function as country-pair fixed effects, since each observation is a country pair that includes the United States and the exporting country.[5] The year fixed effects control for conditions in the export market, which is the United States for all of the country pairs.

$$ln\ X_{ct} = \alpha\ ln\ Y_{ct}\ +\ \beta\ RQ_{ct}\ +\ \gamma_c\ +\ \delta_t\ +\ \epsilon_{ct} \tag{1}$$

In equation (2), the GDP in country c in year t is also a function of regulatory quality, as well as factors captured by a set of country and year fixed effects (μ_c and κ_t), and an error term (ζ_{ct}).

$$ln\ Y_{ct} = \lambda\ RQ_{ct}\ +\ \mu_c\ +\ \kappa_t\ +\ \zeta_{ct} \tag{2}$$

Equation (3) is a reduced form that combines equations (1) and (2).

$$ln\ X_{ct} = \tilde{\beta}\ RQ_{ct}\ +\ \tilde{\gamma_c}\ +\ \tilde{\delta_t}\ +\ \tilde{\epsilon}_{ct} \tag{3}$$

Equations (4), (5), (6), and (7) relate the parameter values across the three equations.

$$\tilde{\beta} = \beta\ +\ \lambda\ \alpha \tag{4}$$

[5] Baier and Bergstrand (2007) demonstrates that including country-pair fixed effects in gravity models can eliminate or at least mitigate endogeneity bias. This is important because regulatory regimes, like the trade agreements in Baier and Bergstrand (2007), are deliberate policy choices, not random assignments. Regulatory quality might be determined in part by factors that promote trade.

$$\tilde{\gamma}_c = \gamma_c \ + \alpha \ \mu_c \tag{5}$$

$$\tilde{\delta}_t = \delta_t \ + \ \alpha \ \kappa_t \tag{6}$$

$$\tilde{\epsilon}_{ct} = \epsilon_{ct} + \ \alpha \ \zeta_{ct} \tag{7}$$

Equations (1) and (2) allow a decomposition between the direct effect of RQ on exports condition on output levels (β) and the indirect effect of RQ on exports through GDP ($\alpha \ \lambda$). The reduced form in equation (3) combines the direct and indirect effects. These specifications allow the possibilities that there are positive or negative net effects of regulatory quality, and in this way they avoid the criticism in Parker and Kirkpatrick (2012) that the literature focuses too much on the costs of regulatory and too little on its benefits. In equation (3), a positive estimate of $\tilde{\beta}$ suggests that RQ increases product quality, reduces production costs, or both.

As a second step, I model the effects of regulatory quality on a country's *imports* of manufactured goods from the United States. The econometric specifications for the import analysis are almost identical to equations (1) and (3), simply replacing imports (M_{ct}) for exports (X_{ct}). Equation (2) in the import analysis is identical to its counterpart in the export analysis.

4 Estimates of the Model Parameters

I estimated the export, import, and GDP models using Ordinary Least Squares (OLS). The Appendix reports alternative Error-in-Variables Regression models based on the same specifications.

4.1 Models of Exports to the United States

Table 2 reports the estimates of the parameter values in the model of the countries' exports to the United States. The table reports robust standard errors in parentheses. All of the parameter estimates have a p-value of 0.001 or less.

Table 2: Regression Estimates for Exports

Variables	**Equation (1)**	**Equation (2)**	**Equation (3)**
Dependant Variable	$ln\ X_{ct}$	$ln\ Y_{ct}$	$ln\ X_{ct}$
RQ_{ct}	0.3179	0.3281	0.5455
	(0.0950)	(0.0221)	(0.0898)
$ln\ Y_{ct}$	0.4785		
	(0.0861)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	3,634	3,693	3,693
R^2	0.9483	0.9908	0.9473

As I discussed in the Methodology section, the models in equations (1) and (2) provide a decomposition of the RQ effects into a direct effect (0.3179) and an indirect effect through GDP (0.4785 x 0.3281 = 0.1570). In this case, the direct effect is approximately twice the magnitude of the indirect effect. The reduced-form model in equation (3) provides a total effect that does not decompose the effects in this way.

If $ln\ Y_{ct}$ and RQ_{ct} were orthogonal to ϵ_{ct}, then the OLS estimate of $\tilde{\beta}$ would be equal to the OLS estimate of $\beta\ +\ \lambda\ \alpha$. However, the estimate of $\tilde{\beta}$ in Table 2 is 0.5455, while the estimate of $\beta\ +\ \lambda\ \alpha$ is only 0.4749. The most likely explanation appear to be that there is a component of $ln\ Y_{ct}$ that is orthogonal to RQ_{ct} but not orthogonal to ϵ_{ct}. In this case, the total effect estimated from equations (1) and (2) will be biased, while the reduced-form estimate of $\tilde{\beta}$ from equation (3) will be unbiased, so I focus on the estimate of $\tilde{\beta}$ in the simulations below.

Table 3 re-estimates the models using a sample that is limited to developing countries, which I define as all countries not classified as "high income" by the World Bank. The estimate of $\tilde{\beta}$ in equation (3) is much larger for the developing countries, 0.7835 compared to 0.5455 for the full estimation sample used to estimate the models reported in Table 2.

Table 3: Model of Exports of Developing Income Countries

Variables			
Dependant Variable	$ln\ X_{ct}$	$ln\ Y_{ct}$	$ln\ X_{ct}$
RQ_{ct}	0.5151	0.3040	0.7835
	(0.1171)	(0.0266)	(0.1119)
$ln\ Y_{ct}$	0.6232		
	(0.1066)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	2,442	2,501	2,487
R^2	0.9367	0.9890	0.9351

4.2 Models of Imports from the United States

Table 4 reports the estimates of the parameter values in the model of the countries' imports from the United States. Again, all of the parameter estimates have a p-value of 0.001 or less. The table reports robust standard errors in parentheses.

Table 4: Regression Estimates for Imports

Variables			
Dependant Variable	$ln\ M_{ct}$	$ln\ Y_{ct}$	$ln\ M_{ct}$
RQ_{ct}	0.2526	0.3281	0.5187
	(0.0510)	(0.0221)	(0.0556)
$ln\ Y_{ct}$	0.6293		
	(0.0527)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	3,681	3,693	3,741
R^2	0.9674	0.9908	0.9634

The estimated effect on U.S. imports in Table 4 is only a little smaller than the percent change in U.S. exports in Table 2, 0.5187 compared to 0.5455. Table 4 decomposes the RQ effect into a direct effect (0.2526) and an indirect effect through GDP (0.6293 x 0.3281 = 0.2065). In this case, the direct effect is only slightly larger than the indirect effect. Table 5 re-estimates the import models using the estimation sample of developing countries.

Table 5: Model of Imports of Developing Income Countries

Variables			
Dependant Variable	$ln\ M_{ct}$	$ln\ Y_{ct}$	$ln\ M_{ct}$
RQ_{ct}	0.3538	0.3040	0.6124
	(0.0658)	(0.0266)	(0.0711)
$ln\ Y_{ct}$	0.5821		
	(0.0729)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	2,489	2,501	2,535
R^2	0.9523	0.9890	0.9476

5 Simulations of Policy Changes

Finally, I use the econometric models in a series of simulations. I estimate the trade effects of hypothetically increasing regulatory quality in developing countries from current levels, specifically closing 10% of the gap between the RQ in the United States and the RQ in one of the ten developing countries.

Equation (8) translates the estimated parameter values and hypothetical increases in regulatory quality into percent changes in country c's exports of manufacturing goods to the United States.

$$\frac{X'_{ct} - X_{ct}}{X_{ct}}\ 100 = \frac{e^{\tilde{\beta}\ RQ'_{ct}} - e^{\tilde{\beta}\ RQ_{ct}}}{e^{\tilde{\beta}\ RQ_{ct}}}\ 100 \tag{8}$$

where $RQ'_{ct} = RQ_{ct} + 0.10\ \max[0, RQ^*_t - RQ_{ct}]$. For the simulations, I set RQ^*_t equal to 1.45, the value for the United States in 2021. The export calculations use the econometric estimate $\tilde{\beta} = 0.7835$, with a 95% confidence interval from 0.5640 to 1.0029.

Equation (9) translates the estimated parameter values and hypothetical increases in regulatory quality into percent changes in the country's imports of manufactured goods from the United States.

$$\frac{M'_{ct} \; - \; M_{ct}}{M_{ct}} 100 = \frac{e^{\;\tilde{\beta}\; RQ'_{ct}} \; - \; e^{\;\tilde{\beta}\; RQ_{ct}}}{e^{\;\tilde{\beta}\; RQ_{ct}}} 100 \tag{9}$$

The import calculations use the econometric estimates $\tilde{\beta} = 0.6124$, with a 95% confidence interval from 0.4730 to 0.7518.

Table 6 reports the simulated percent change in manufacturing exports to the United States and manufacturing imports from the United States. The table reports 95% confidence intervals for the trade effects in square brackets, based on the confidence intervals of the econometric estimates of $\tilde{\beta}$.

Table 6: Simulations of Policy Changes

Country Reducing RQ Gap By 10%	**2021 RQ Index**	**Percent Change in Exports to the United States**	**Percent Change in Imports from the United States**
Argentina	-0.62	17.6 (12.4–23.1)	13.5 (10.3–16.8)
Brazil	-0.11	13.0 (9.2–16.9)	10.0 (7.7–12.4)
China	-0.31	14.8 (10.4–19.3)	19.3 (8.7–14.1)
Egypt	-0.51	16.6 (11.7–21.7)	12.8 (9.7–15.9)
India	-0.08	12.7 (9.0–16.6)	9.8 (7.5–12.2)
Indonesia	0.30	9.4 (6.7–12.2)	7.3 (5.6–9.0)
Philippines	0.08	11.3 (8.0–14.7)	8.8 (6.7–10.8)
Thailand	0.09	11.2 (8.0–14.6)	8.7 (6.6–10.8)
Turkey	-0.08	12.7 (9.0–16.6)	9.8 (7.5–12.2)
Vietnam	-0.40	15.6 (11.0–20.4)	12.0 (9.1–14.9)

6 Conclusions

The econometric models provide estimates of the positive impact of a country's regulatory quality on the value of the country's exports of manufactured goods to the United States, and on the country's imports of manufactured goods from the United States. The effects on exports to the United States in the simulations range from 9.4% to 17.6%, and the effects on imports from the United States range from 7.3% to 13.5%.

There are several potential extensions for future research. First, it is useful to estimate aggregate, economy-wide effects as in this paper, but it would also be informative to estimate more disaggregate effects on specific industries. Second, while the fixed effects are effective in controlling for difficult-to-measure country-specific and year-specific factors that would otherwise be omitted variables and potential endogeneity concerns, it would be useful to add additional controls that vary by country and year. Third, it would be interesting to consider a dynamic specification that estimates the speed of adjustment to changes in a country's regulatory quality. Finally, to use the model for policy analysis, it will be important to examine the details of the specific policy provisions to determine the appropriate magnitude of the change in RQ_{ct} in the simulations. I analyze the effects of closing 10% of the gap, but it is not clear whether that is the right magnitude without considering the particular provisions under consideration.

Appendix

This appendix reports error-in-variables regression models that help to mitigate potential attenuation bias due to noise in the measure of regulatory quality. Table 7 re-estimates the export models in Table 2 for the full sample of countries using the Errors-in-Variables Regression model rather than OLS. The estimated effects of regulatory quality are larger in these models than in the OLS models, those the difference from the OLS models are much smaller for samples limited to developing countries.

Table 7: Errors-in-Variables Estimates Comparable to Table 2

Variables	**Equation (1)**	**Equation (2)**	**Equation (3)**
Dependant Variable	$ln\ X_{ct}$	$ln\ Y_{ct}$	$ln\ X_{ct}$
RQ_{ct}	0.4231	0.4224	0.7105
	(0.1222)	(0.0299)	(0.1134)
$ln\ Y_{ct}$	0.4529		
	(0.0866)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	3,635	3,693	3,693
R^2	0.9484	0.9910	0.9475

Table 8 re-estimates the import models in Table 3 for the developing countries.

Table 8: Errors-in-Variables Estimates Comparable to Table 3

Variables			
Dependant Variable	$ln\ X_{ct}$	$ln\ Y_{ct}$	$ln\ X_{ct}$
RQ_{ct}	0.5665	0.3313	0.8600
	(0.1247)	(0.0284)	(0.1210)
$ln\ Y_{ct}$	0.6111		
	(0.1041)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	2,442	2,501	2,487
R^2	0.9367	0.9891	0.9353

Table 9 re-estimates the import models in Table 4 for the full set of developed and developing countries.

Table 9: Errors-in-Variables Estimates Comparable to Table 4

Variables			
Dependant Variable	$ln\ M_{ct}$	$ln\ Y_{ct}$	$ln\ M_{ct}$
RQ_{ct}	0.4231	0.4224	0.7105
	(0.1222)	(0.0290)	(0.1134)
$ln\ Y_{ct}$	0.4529		
	(0.0866)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	3,634	3,693	3,693
R^2	0.9484	0.9910	0.9475

Table 10 re-estimates the import models in Table 5 for the developing countries.

Table 10: Errors-in-Variables Estimates Comparable to Table 4

Variables			
Dependant Variable	$ln\ M_{ct}$	$ln\ Y_{ct}$	$ln\ M_{ct}$
RQ_{ct}	0.3891	0.3313	0.6712
	(0.0702)	(0.0284)	(0.0758)
$ln\ Y_{ct}$	0.5732		
	(0.0710)		
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number of Observations	2,489	2,501	2,535
R^2	0.9524	0.9891	0.9479

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