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## Why Tariffs, Not Subsidies? A Search for Stylized Facts

Josh Ederington\*

Jenny Minier<sup>†</sup>

\*University of Kentucky, [ederington@uky.edu](mailto:ederington@uky.edu)

<sup>†</sup>University of Kentucky, [jminier@uky.edu](mailto:jminier@uky.edu)

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## Abstract

Barriers to trade are commonly viewed as a result of political systems in which politically influential groups benefit from and successfully lobby for protection. However, trade policy is a highly inefficient tool for redistributing income. Although recent theoretical research has focused on explanations of why (inefficient) trade barriers might be preferred to more direct means of redistribution, this research has been carried out with little empirical support. We address this gap in the literature with an exploratory cross-country empirical investigation of the economic factors correlated with a reliance on tariffs over subsidies. We find that the existing theoretical literature is consistent with the cross-country evidence.

**KEYWORDS:** tariffs, subsidies, empirical political economy

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# 1 Introduction

*Saying that trade policy exists because it serves to transfer income to favored groups is a bit like saying Sir Edmund Hillary climbed Mt. Everest because he wanted to get some mountain air. There was surely an easier way of accomplishing that objective!*

—Rodrik (1995), p. 1470

Most economists agree that barriers to trade are imposed not to increase national welfare, but as a means of redistributing income. Specifically, trade barriers exist because they benefit politically influential groups who are able to lobby successfully for them. However, it is well known that trade policy is a highly inefficient tool for redistributing income (see, for example, Dixit (1985)). If governments are interested in redistributing income to favored groups, why would they choose to do so with an inefficient policy instrument, when more efficient means of redistribution exist? The widespread use of trade barriers as a means of redistribution is even more puzzling given the standard political economic theory that both lobbyists (see Becker (1983)) and voters (see Mayer and Riezman (1987)) will favor more efficient means of transferring income.<sup>1</sup>

Recent research on the political economy of trade policy has provided several theoretical explanations of why inefficient trade barriers might be the preferred policy instrument. However, this theoretical research has been carried out with little empirical support.<sup>2</sup> We address this gap in the literature by conducting an empirical investigation of the relationship between trade barriers and more direct means of income redistribution (specifically, production subsidies).

One of the reasons for the lack of empirical work on this topic is that current theory provides very little guidance to empirical investigation. Specifically,

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<sup>1</sup>In a later paper, Mayer and Riezman (1990) provide some situations where the median voter might prefer tariffs to subsidies. These explanations are not investigated in the current version of the paper due to the lack of cross-country data regarding the characteristics of the median voter.

<sup>2</sup>A recent exception is Mitra, Thomakos, and Ulubasoglu (2004), who conduct an empirical investigation of the use of tariffs and subsidies in 37 Turkish industries during the years 1983, 1984, and 1990. They find that the use of tariffs and subsidies across industries is related to measures of demand and supply elasticity but little else. As we argue later, a possible reason for this is that the proper level of analysis is a cross-country (rather than cross-industry) study.

rather than providing an explicit equation for the optimal ratio of tariffs to alternative policy instruments, the papers in this literature simply outline general conditions under which tariffs would be the preferred instrument. In addition, the variables that these papers cite as key determinants of policy choice lack direct empirical proxies.

However, our empirical approach is guided by the available theoretical literature in two ways. First, even though many of the models in this area are industry-level in nature, they uniformly isolate country-level (not industry-level) variables as the key determinants of whether tariffs are preferred to subsidies. Thus, we use a cross-country panel data set to investigate which variables are correlated with a country's reliance on tariffs (as opposed to production subsidies) as a means of redistribution. Second, we employ a set of well-known theories to guide us in our variable selection. These include the argument that budget-constrained countries prefer tariffs to subsidies, since tariffs generate revenue while subsidies cost revenue; the argument proposed by Magee, Brock, and Young (1989), that self-interested governments might prefer tariffs to subsidies since the distortionary costs of tariffs are less noticeable to the general public; the Grossman and Helpman (1994) argument that lobbying groups might prefer lobbying for tariffs as a means of reducing costly competition among themselves; and the hypothesis of Staiger and Tabellini (1987) that a government might prefer tariffs as a means of reducing time-inconsistency problems with respect to its policy choices.

Our results suggest that the available theoretical literature is largely consistent with the cross-country evidence. Specifically, consistent with optimal obfuscation arguments, variables measuring citizens' access to information (primary school completion rates and newspaper circulation) are negatively correlated with a country's tendency to rely on tariffs as a measure of redistribution. Secondly, in support of time-inconsistency arguments, variables measuring government credibility (index measures of the extent of rule of law and risk of expropriation) are negatively correlated with tariff reliance. Finally, supportive of revenue considerations, variables measuring a country's current budgetary position (i.e., budget deficit and interest payments on government debt) are positively correlated with reliance on tariffs. In addition, we find that the determinants of tariff reliance are different across countries at different stages of development.

In Section 2, we explore the cross-country pattern of tariffs and subsidies, and we discuss the related theoretical work in Section 3. In Section 4, we discuss our data and the empirical techniques used, and present some initial results. In Section 5 we conduct a sensitivity analysis of our results. Finally, we discuss the implications of these results and conclude in Section 6.

Table 1: DESCRIPTIVE STATISTICS

	tariff	subsidy
Mean	11.3	9.51
Standard deviation	9.83	9.58
Median	9.52	6.01
Range	0-75.2	0-191
Observations	2,343	2,357

*Notes to Table:* Tariff is defined as import duties as a percentage of import value. Subsidy is defined as subsidies as a percentage of GDP. Data cover the period 1970-98. The observation of subsidy=191 is Kuwait in 1991; the next highest value is 52 (Kuwait in 1992); because of missing data for other variables, both of these observations are omitted from the following analysis. Statistics are comparable when limited to the 1,998 observations with data available for both variables.

## 2 Trade Barriers and Subsidies

In this section, we present descriptive statistics and benchmark regressions related to the determination of tariffs and subsidies across countries.

Table 1 presents descriptive statistics for the data on tariffs and subsidies, which are taken from the World Bank's World Development Indicators database. Both tariff and subsidy data are available annually from 1970 through 1998, and 141 countries have at least one year of data for both variables.<sup>3</sup> Tariffs are measured as import duties as a percentage of import value, while the measure of subsidies is subsidies as a percentage of GDP. The correlation between the tariff and subsidy variables is -0.44.

There is a small empirical literature on the cross-country (e.g., Conybeare (1983) and Mansfield and Busch (1995)) and time-series (e.g., Bohara and Kaempfer (1991)) determinants of tariff protection. Typically, this literature specifies a set of macroeconomic and institutional variables and investigates the extent to which these variables are correlated with the level of trade protection across countries (or over time). In this section, we repeat this type of analysis, but our interest is in the cross-country variation of not only tariffs but also subsidies. It should be noted that we are only looking for correlations among the variables, not attempting to address directions of causality in these regressions.

Tables 2 and 3 present results from regressing tariffs and subsidies in a fixed-effects model on a group of macroeconomic and institutional variables. In each table, tariffs are the dependent variable in Regression 1 and subsidies

<sup>3</sup>The maximum number of countries in any year is 93, in 1984.

Table 2: BASELINE REGRESSIONS

Dependent Variable:	(1) <i>Tariffs</i>	(2) <i>Subsidies</i>
GDP per capita	-0.66 (0.19)***	0.10 (0.17)
squared	0.02 (0.01)***	0.002 (0.004)
growth	1.44 (2.12)	-4.35 (2.04)**
Unemployment	-0.10 (0.05)**	0.25 (0.04)***
Inflation	-0.01 (0.02)	-0.01 (0.02)
Trade balance	1.39 (2.90)	-9.95 (2.73)***
Observations	755	760
$R^2$	0.879	0.949

*Notes to Table:* Time- and country-specific constant terms are included; reported  $R^2$  includes their effects. Tariff is defined as import duties as a percentage of import value. Subsidy is defined as subsidies as a percentage of GDP. \*\*\* indicates statistical significance at the 99% level and \*\* at the 95% level. See Appendix A for data definitions and sources.

in Regression 2. Table 2 includes the macroeconomic regressors of Bohara and Kaempfer (1991), adding GDP per capita and GDP per capita squared to account for the cross-country (panel) nature of our regressions.<sup>4</sup> The regressions in Table 3 add several additional institutional regressors similar to those of Conybeare (1983) and Mansfield and Busch (1995) to predict levels of trade protection across countries.

Given the breadth of our data set, these regressions are interesting in their own right as descriptions of the pattern of protection/support across countries. However, for the purposes of this paper, the importance of these regressions is to emphasize that the cross-country determinants of tariff protection are significantly different from the cross-country determinants of subsidies. For example, subsidies are more likely to be offered in countries with higher levels of GDP per capita, while tariffs are more common in countries with lower GDP (although the relationship between GDP per capita and tariffs is nonlinear: the coefficient estimates in Regression 1 of Table 2, for example, imply that tariffs are increasing in income at incomes above \$16,500).<sup>5</sup> Likewise, while subsidies are more prevalent in countries with high levels of unemployment, and this relationship is statistically significant in both specifications, there is no clear relationship between tariffs and unemployment. It is this cross-country variation in tariff and subsidy rates that we exploit in the following sections.

<sup>4</sup>Bohara and Kaempfer focus on U.S. time series data.

<sup>5</sup>167 of the 755 observations (22%) have incomes above this level.

Table 3: EXPANDED BASELINE REGRESSIONS

Dependent Variable:	(1) <i>Tariffs</i>	(2) <i>Subsidies</i>
GDP per capita	-0.11 (0.25)	0.30 (0.17)*
squared	0.02 (0.01)***	-0.004 (0.004)
growth	-0.02 (2.13)	-0.34 (1.56)
Unemployment	0.08 (0.06)	0.16 (0.04)***
Inflation	-0.02 (0.04)	0.01 (0.03)
Trade balance	-5.95 (3.33)*	-1.47 (2.39)
Govt expenditure	0.96 (3.25)	41.7 (2.37)***
Democracy	2.59 (0.99)***	-0.75 (0.65)
Income tax	-0.05 (0.02)**	-0.05 (0.02)***
Military spending	0.09 (0.04)**	0.003 (0.03)
Manufacturing	0.06 (0.06)	-0.003 (0.04)
Observations	513	526
$R^2$	0.923	0.981

*Notes to Table:* Tariff is defined as import duties as a percentage of import value. Subsidy is defined as subsidies as a percentage of GDP. \*\*\* indicates statistical significance at the 99% level, \*\* at the 95% level, and \* at the 90% level. Time- and country-specific constant terms are included; reported  $R^2$  includes their effects. See Appendix A for data definitions and sources.

### 3 Existing Theory

In the previous section, we showed that the determinants of the cross-country variation in tariff levels are different from the determinants of cross-country variation in subsidies. In this section, we briefly discuss the theoretical literature on the endogenous choice of tariffs and subsidies in order to provide some insight into our empirical investigation.

Two limitations of the theoretical literature with respect to empirical testing are immediately apparent. First, none of the papers provides an explicit structural equation for the optimal ratio of tariffs to subsidies; rather, they simply provide guidance to the general conditions under which tariffs may be preferred to subsidies. Second, while many of the papers do isolate a single variable that is critical in determining whether tariffs or subsidies are the preferred policy instrument (e.g., the share of the population represented by a lobby in Grossman and Helpman, 1994, the share of uninformed voters in Magee et al., 1989, the cost to labor of switching sectors in Staiger and Tabellini, 1987), these theoretical variables lack precise empirical counterparts. Given the lack of rigorous theoretical guidance, any empirical study will, by necessity, be exploratory in nature.

However, the current theoretical literature does provide some assistance in our empirical study. First, the theoretical models are unanimous in isolating country-specific (not industry-specific) variables as the determinants of whether tariffs are preferred to subsidies. For example, under the assumption that tariffs are the sole policy instrument available to governments, Grossman and Helpman (1994) provide a precise empirical specification of the cross-industry structure of protection within a country as a function of industry-specific variables. However, despite being an industry-level model, it isolates the share of the population represented by a lobby (a country-wide variable) as the determining variable in whether a tariff regime is preferred to a subsidy regime. Thus, the choice between tariffs and subsidies in the Grossman-Helpman framework is made at the national (not industry) level, according to country-level (not industry-level) characteristics. A similar pattern emerges in the other papers, where the choice between tariffs and subsidies is consistently determined by country-level characteristics. Thus, we use cross-country (panel) data in our search for insight into the preference for tariffs over subsidies.

Second, as we discuss in more detail below, the theoretical literature provides some guidance about the types of variables that should be correlated with a country's reliance on tariffs. Given the loose connection between the theories and the data, there is necessarily some overlap in the set of variables



suggested by each theory. Thus, literacy rates may be correlated with how informed voters are (as in the “optimal obfuscation” model of Magee et al. (1989)) but also may be correlated with how politically active the population is (as in the lobbying model of Grossman and Helpman (1994)). In some of these situations, one can distinguish between the predictions of different models by examining the signs of the coefficients. For example, higher literacy rates are correlated with better-informed voters, which would lead to a greater reliance on subsidies in Magee et al. (1989). However, higher literacy rates also proxy for a more politically active population, leading to a stronger reliance on tariffs in Grossman and Helpman (1994). Thus, considering the signs of the coefficients provides another possible means of distinguishing between competing explanations. In Table 4, we provide a list of the variables associated with each theory and the predicted coefficient estimate on a country’s reliance on tariffs.

In the following subsections we provide a brief synopsis of each of the relevant theories and a list of the potential explanatory variables suggested by that theory.

### 3.1 Revenue Considerations

The simplest explanation of the preference for tariffs over subsidies as a means of redistribution is that tariffs generate government revenue while subsidies cost government revenue and thus revenue-constrained governments would tend to favor tariffs as a policy instrument. Indeed, this explanation is consistent with the anecdotal observation that developing countries (and industrial countries in their early histories) rely on trade taxes as a form of revenue given the difficulties of administering more advanced tax systems.

There is an existing empirical literature on how the revenue mix of governments is related to administration and collection costs (e.g., see Kenny and Winer (2001)).<sup>6</sup> Typically, this literature uses per capita GDP, urbanization, and literacy rates as proxies for tax collection costs under the assumption that tax collection is easier in more developed countries with urban, literate populations. To this list we add a measure of bureaucratic quality, population (to capture any economies of scale in the institution of more efficient tax systems), and a measure of income taxes as a share of total government revenue (under the common assumption in this literature that countries with better administrative capabilities rely more heavily on hard-to-collect income taxes).

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<sup>6</sup>This literature typically focuses on how revenue sources such as seignorage are related to structural variables (e.g., see Cukierman, Edwards, and Tabellini (1992)); however, some papers do include trade taxes in the analysis (e.g., see Riezman and Slemrod (1987)).

Table 4: EMPIRICAL PREDICTIONS

Model	Prediction	Explanation
Revenue Considerations	GDP per capita: –	
	Income tax/revenue: –	administrative
	Bureaucratic quality: –	capabilities
	Literacy: –	
	Urbanization: –	
	Budget surplus/GDP: –	budget constraint
	Interest payments: +	
Optimal Obfuscation	Population: –	fixed cost of alternative revenue
	GDP per capita: –	
	Literacy rate: –	
	Newspapers per capita: –	better informed voters
	Skilled labor: –	
	Unskilled labor: +	
Democracy: +	responsive to voters	
Lobby Competition	Voter Participation: +	
	Unionization +	
	Literacy: +	more organized into lobbies
	Skilled labor: +	
	Unskilled labor: –	
	GDP per capita: +	
	Income Inequality (Gini): –	lobbying less competitive
Industry concentration: –		
Time Inconsistency	Unskilled labor: +	
	Highly skilled labor: +	cost of intersectoral movement of labor
	Unionization: –	
	Unemployment: –	
	Risk of expropriation: –	government
	Repudiation of contracts: –	credibility
	Rule of Law: –	

Finally, if governments rely on tariff protection due to revenue considerations, it seems possible that the tariff/subsidy mix could be related to budgetary considerations. Thus, we include measures of the size of the budget surplus/deficit and the interest payments on government debt as indicators of budgetary constraints faced by the government. A complete description of all these variables is provided in Section 4 and in the data appendix.

### 3.2 Optimal Obfuscation

A second theory of why governments might prefer using inefficient tariffs to subsidies is proposed by Magee et al. (1989) with their principle of “optimal obfuscation.” They postulate that a self-interested government may use a less direct (and hence less efficient) means of redistribution because the effects are less likely to be observed by the voters who bear the cost. This idea was also advanced by Tullock (1983) and nicely formalized by Coate and Morris (1995).

There are two key components to this explanation for the preference of tariffs over more efficient redistribution schemes. First is the existence of a sizable block of “uninformed” voters (defined as those who fail to recognize either the existence of the inefficient redistributive policies, or the distortionary costs that these policies create). An implication of this is that a country with better-informed citizens will tend to favor subsidies over tariffs as a means of redistribution. Thus, variables correlated with the informational resource base of the population (such as GDP per capita or newspapers per person) or the educational base of the population (literacy rates or education rates) should be predictors of a country’s reliance on tariffs.

The second component is that government decision-makers care about voter perception (intuitively, the less a government cares about public support, versus generating lobby contributions, the less likely it is to attempt to disguise its attempts at redistribution). Thus, we include a measure of the level of democracy as an additional explanatory variable.

### 3.3 Lobby Coordination

A third theory behind the use of trade policy as a redistributive device is that the use of an inefficient policy instrument reduces the total amount of lobbying/redistribution that occurs in equilibrium, since it increases the deadweight costs of such redistribution. Variants of this type of argument have appeared in Rodrik (1986), Wilson (1990) and Becker and Mulligan (1998). A paper of special interest to our empirical approach is that of Grossman and Helpman (1994) which argues that lobby groups might choose to lobby over less efficient

policies as a means of reducing costly competition among themselves. Intuitively, if a lobby group faces very little competition in its interactions with the government, and thus captures the entire lobbying surplus, then it will favor the more efficient means of redistribution.<sup>7</sup> However, when interest groups are more competitive in their lobbying, and thus the government captures the surplus, then Grossman and Helpman (1994) show that lobby groups will favor less efficient means of redistribution so as to reduce the equilibrium level of contributions.<sup>8</sup>

Grossman and Helpman (1994) identify the portion of the population represented by a lobby as the key variable capturing the degree of lobby competition. Thus, as proxies for the percent of the population that is politically active we use measures of voter participation rates, unionization rates, GDP per capita, and education and literacy rates. However, the proportion of politically active individuals is only directly correlated with the degree of lobbying competition if lobby groups are of approximately equal size. Thus, we also include additional measures of the equality of the economic structure (a Gini coefficient measure of the degree of income inequality and a Herfindahl index of the degree of industry concentration in the country) under the assumption that a more unequal economic structure leads to less lobbying competition. Intuitively, we expect lobbying competition to be lower when the factors of production are concentrated among a small group of people (proxied for by a high Gini coefficient) or when the economic environment is characterized by a single dominant industry (proxied for by a high Herfindahl index).

### **3.4 Time Inconsistency**

The final theory is that, for time-inconsistency purposes, a government might prefer to restrict itself to inefficient policies (which reduce the equilibrium amount of redistribution). The seminal paper on the time-inconsistency of economic policy is that of Kydland and Prescott (1977), which Staiger and Tabellini (1987) apply specifically to the issue of tariffs and subsidies. In the Staiger and Tabellini (1987) framework, governments would like to commit to

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<sup>7</sup>Thus, Grossman and Helpman (1994) provide some theoretical support for the Becker (1983) hypothesis that interest groups will favor more efficient means of transferring income to themselves.

<sup>8</sup>In a related paper, Mitra (2000) also exploits the idea that firms may wish to commit to lobbying for tariffs as a means of reducing costly competition among themselves. Likewise, a recent paper by Drazen and Limao (2004) argues that the government might wish to commit to a less efficient instrument as a means of strategically altering its bargaining power in its interaction with lobbying groups.

laissez-faire policies for efficiency reasons, but have an incentive to surprise workers injured by terms-of-trade shocks with redistributed income. To the extent that the government cannot commit to no redistribution, it may prefer the less efficient tariff instrument as a means of reducing the amount of redistribution that occurs, thus alleviating the time-inconsistency problem.

We propose two methods of searching for time-inconsistency incentives in a government's choice between tariffs and subsidies. First is the observation that more credible governments have less need to rely on inefficient instruments to constrain their policy choices. Thus, as proxies for governmental credibility we use various measures of government quality calculated by international risk agencies (specifically, measures of the rule of law, risk of expropriation and risk of repudiation of contracts). Secondly, in Staiger and Tabellini (1987), the time-inconsistency issue arose from the mobility of workers across sectors in the labor market. Specifically, they show that when it is very costly to reallocate labor across sectors (i.e., mobility costs and thus wage differentials are high), then the government prefers the more efficient subsidy while preferring tariff regimes when the cost of reallocation and thus wage differentials are low. Thus, we include additional variables related to the degree of labor mobility or wage differentials (e.g., education rates, unionization, and unemployment) in our analysis.<sup>9</sup>

## 4 Data and Empirics

### 4.1 Data

The dependent variable in all regressions is the ratio of tariffs to tariffs plus subsidies. We refer to this variable,  $t/(t + s)$ , as a country's "reliance on tariffs." This variable is constructed to proxy for the percentage increase in producer prices due to a tariff divided by the percentage increase in producer prices due to both policy instruments.<sup>10</sup> There are several issues that arise with the use of this variable. First are concerns about missing policy instruments: specifically, there is a universe of alternative trade policies (e.g.,

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<sup>9</sup>Education rates are used given the common assumption that labor mobility across sectors is related to human capital (see Becker (1962) and Kim and Kim (2000)).

<sup>10</sup>Tariffs are defined as the ratio of import duties to import value; subsidies are the ratio of subsidies to GDP. Subsidies are defined as "all unrequited, nonrepayable transfers on current account to private and public enterprises, and the cost to the public of covering the cash operating deficits on sales to the public by departmental enterprises." Interpreting these rates as a country-wide ad-valorem tariff and ad-valorem production subsidy, the interpretation of this variable follows immediately.

quotas, customs barriers) and domestic policies (e.g., tax adjustments, relaxed regulations) that are available to policy makers. Second are concerns about aggregation bias when tariff rates and/or subsidy rates differ across industries. Specifically, the protectionist effect of a tariff regime can differ widely between a country where tariff rates are uniform across industries relative to when they vary. To partially address these concerns, we analyze not only cross-sectional variation across countries and but also time-series variation within a panel setting. Specifically, in the panel regressions we include country (and time) fixed effects in all of our specifications to capture cross-country differences in policy regimes and industry mix.<sup>11</sup>

We also include GDP per capita and GDP per capita squared in all of the specifications. This is due both to the fact that a country's income or level of development is frequently stressed as a potential explanatory variable in the theoretical literature (indeed, GDP appears as an explanatory variable in three of the four theories in Table 4), and by the typical need to control for levels of development in cross-country regressions.

The other explanatory variables are suggested by the theories described in Section 3, and summarized in Table 4. From the revenue explanation, we include urbanization rates, literacy rates<sup>12</sup>, population, income tax revenue (as percentage of total tax revenue), budget surpluses/deficits (as percentage of GDP) and interest payments on debt (as a percentage of government revenue). In addition, we use a measure of bureaucratic quality from the International Country Risk Guide (ICRG) dataset, which provides annual values for indicators of the quality of governance (this dataset was created by the IRIS Center; see Knack and Keefer (1995) for details). This measure ranges from 0 to 6 with high scores indicating "an established mechanism for recruitment and training, autonomy from political pressure and the strength and expertise to govern without drastic changes in policy or interruptions in government services".

The explanatory variables suggested by the optimal obfuscation model

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<sup>11</sup>It should be noted that time-varying country-specific omitted factors that are correlated with both tariff reliance and our right-hand side variables would not be controlled for by the inclusion of fixed effects. With respect to the use of fixed effects in panel estimation, although interpreting Hausman test results is somewhat problematic, in the base regressions we can reject at the 97% level or better that the differences in estimates are not systematic, suggesting that fixed effects are appropriate. A second means of controlling for omitted factors would be to construct industry-specific measures of tariffs and subsidies. Unfortunately, comprehensive subsidy data at the industry level does not exist.

<sup>12</sup>Literacy data on an annual basis are not available for 21 of the 26 OECD member countries; literacy data are estimated by UNESCO to be over 95% for these countries. In the tables, literacy is set equal to 95% for these countries. Results are identical if literacy is set equal to 100%.

include literacy, newspapers (daily newspapers per 1,000 people), education (both the percentage of the population over age 25 that did not complete primary school, which we call “unskilled labor,” and the percentage that completed higher education, or “highly skilled labor”), and democracy. The democracy variable is based on an index of “political rights” constructed by Freedom House for a wide range of countries since 1972, which economists frequently use to proxy for levels of democracy in cross-country studies.<sup>13</sup>

The explanatory variables from the lobby competition model include unionization<sup>14</sup>, literacy, education, income inequality (the Gini coefficient) and a Herfindahl index of industry concentration. The Herfindahl index measure is constructed by squaring the total export share of the various 3-digit SIC industries within a country and then summing these squares.<sup>15</sup> Finally, as a measure of voter participation rates, we use the percentage of the voting age population that voted in a parliamentary election.<sup>16</sup>

From the time-inconsistency model, we include several measures of labor mobility and government credibility. For our measures of labor mobility we use unionization, unemployment, and education (our measures of skilled and unskilled labor). For our proxies for government credibility, we use three measures from the International Country Risk Guide (ICRG) dataset: (1) a measure of the rule of law (a 6-point scale in which low scores reflect “a tradition of depending on physical force or illegal means to settle claims,” and an indication that new governments “may be less likely to accept the obligations of the previous regime”); (2) a measure of the risk of repudiation of contracts by the government (a 10-point scale in which lower scores signify “a greater likelihood that a country will modify or repudiate a contract with a foreign business”); and (3) a proxy for government credibility (a 10-point measure of the risk of expropriation of private investment, with lower scores signifying countries “where expropriation of private foreign investment is a likely event”).

Appendix A gives more information on the sources for these data, as well as complete definitions.

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<sup>13</sup>The index is a seven-point scale, which has been converted here to range from zero (not democratic) to one (completely democratic).

<sup>14</sup>Unionization data are available only for the OECD countries.

<sup>15</sup>Thus, the Herfindahl measure ranges from 0 to 10,000, with 10,000 representing a country where all exports originate from a single 3-digit industry.

<sup>16</sup>Voter participation rates are taken from the Institute for Democracy and Electoral Assistance (IDEA) dataset. Using voter participation rates is somewhat complicated as some countries consider voting a duty and have compulsory voting laws that, in some cases, threaten sanctions for non-voting. However, dropping countries that enforce compulsory voting laws (as listed on the IDEA website) does not appreciably affect the results.

## 4.2 Cross-Sectional Analysis

In this section we attempt to uncover the determinants of a country's reliance on tariffs (as opposed to subsidies) by analyzing cross-sectional variation across countries. We do this in Table 5, where the dependent variable in each regression is a country's reliance on tariffs ( $t/(t + s)$ ). To create the cross-sectional data, our panel data are averaged over the period 1988-92, which maximizes country coverage while keeping the time period fairly short. Regression 1 of Table 5 includes a parsimonious specification, with one key variable suggested by each theory, in addition to GDP per capita and GDP per capita squared. Regression 2 expands the set of explanatory variables to include as many explanatory variables as possible, without reducing the sample size significantly, resulting in a similar sample of 74 countries.<sup>17</sup>

The coefficient estimates on GDP per capita and GDP squared are highly statistically significant in both regressions, and the magnitude of the point estimates suggests that a country's reliance on tariffs is decreasing at levels of GDP per capita up to \$15,930, after which the relationship becomes positive.<sup>18</sup>

In analyzing cross-sectional variation, the results are broadly supportive of obfuscation and time inconsistency explanations for tariff preference and not supportive of budgetary or lobby competition explanations. Specifically, the statistically significant negative coefficients on GDP per capita and newspapers per capita (in Regression 2) are consistent with a story where countries with better informed voters rely less heavily on inefficient tariffs as a form of redistribution. Likewise, the statistically significant and negative coefficients on risk of expropriation (in Regression 2) and rule of law (in Regression 1) are consistent with a story where countries with greater credibility rely less heavily on tariffs. In contrast, the negative coefficient estimate on GDP per capita and the positive coefficient on industry concentration contradict the theory that intense lobby competition results in greater reliance on tariffs. Finally, evidence on budgetary explanations for tariffs is ambiguous with both the coefficient estimates on the budget surplus/GDP ratio and interest payments on government debt (as percent of government revenue) being statistically significant and positive in Regression 2.

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<sup>17</sup>The inclusion of some variables (e.g., unionization) reduces the sample significantly, and thus they are omitted entirely from Table 5. They are included in the robustness analysis of Section 5. In section 5.3 we consider the extent to which our results apply to a smaller set of more developed countries (i.e., OECD countries).

<sup>18</sup>16 of the 75 observations in Regression 1 have levels of GDP above this level.



Table 5: FULL-SAMPLE REGRESSIONS: CROSS-SECTION

	(1)	(2)
GDP per capita	-7.01 (2.13)***	-6.31 (3.13)**
squared	0.22 (0.08)**	0.20 (0.11)*
Budget surplus	0.71 (0.64)	1.67 (0.64)**
Literacy	-0.07 (0.13)	0.00 (0.14)
Industry concentration	0.004 (0.002)**	0.006 (0.002)**
Rule of law	-4.91 (2.19)**	2.18 (2.36)
Bureaucratic quality		5.29 (2.35)**
Democracy		11.2 (9.51)
Population		0.00 (0.05)
Income tax revenue		-0.16 (0.15)
Interest payments		0.32 (0.17)*
Newspapers		-0.04 (0.02)*
Risk of repudiation		0.62 (2.66)
Risk of expropriation		-6.60 (3.12)**
Urbanization		0.03 (0.17)
Constant	103.6 (10.9)***	106.4 (19.4)***
Observations	75	74
Adjusted $R^2$	0.724	0.773

*Notes to Table:* The dependent variable is the ratio of tariffs to tariffs plus subsidies ( $t/(t + s)$ ). Data are averaged over 1988-92. Heteroskedasticity-robust standard errors appear in parentheses. \*\*\* indicates statistical significance at the 99% level, \*\* at the 95% level, and \* at the 90% level. See Appendix A for data definitions and sources.

### 4.3 Panel Analysis

In this section we attempt to uncover the determinants of a country's reliance on tariffs by analyzing panel variation across countries. As discussed previously, we include country (and time) fixed effects in all of our specifications to capture cross-country differences in policy regimes and industry mix. In addition, in all specifications the independent variables are lagged one year. This is done for several reasons. First, it seems reasonable that, given the length of the political process, government policies in one period will often be determined by the economic conditions of the previous period. Second, given that our independent variables are stochastic, lagging them reduces the possibility of contemporaneous correlation with the error term.<sup>19</sup> Finally, it assists in establishing the causality of the relationship running from our independent variables to our dependent variable. Because of concerns about potential serial correlation, we estimate panel-corrected standard errors using Prais-Winsten regression.

Table 6 is the cross-section analogue to Table 5 where the dependent variable in each regression is a country's reliance on tariffs ( $t/(t + s)$ ). As mentioned previously, we have an unbalanced panel of 141 countries for the years 1975-98. It should be noted that many of the statistically significant results are consistent across the panel and cross-section estimation: GDP and GDP squared (in both regressions), and, in Regression 2, bureaucratic quality and interest payments remain of the same sign and statistically significant. Consistent with the cross-sectional results, the coefficient estimates on GDP per capita and GDP squared are highly statistically significant in both regressions, with the magnitude of the point estimates suggesting that a country's reliance on tariffs is decreasing at levels of GDP per capita up to \$20,500.

However, there are some differences between the panel estimation and the cross-sectional estimation. In contrast to the cross-sectional analysis, the results for the fixed-effects estimation are more supportive of budgetary considerations being a primary determinant of tariff reliance. The statistically significant negative coefficient on budget surplus/GDP ratio and the statistically significant positive coefficient on interest payments on government debt are consistent with a story where countries facing tighter budgetary constraints shift toward relying more heavily on tariffs as a form of redistribution.<sup>20</sup> In

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<sup>19</sup>For example, even though we include a measure of trade volume as an additional control variable, it is possible that shocks to the structure of imports (i.e., the mix of imports across industries) could potentially be correlated with both our dependent variable (i.e., our measure of tariff reliance) and one of our independent variables. Thus, lagging our independent variable helps control for such contemporaneous shocks.

<sup>20</sup>The case for revenue considerations determining tariff reliance is not consistent with the

Table 6: FULL-SAMPLE REGRESSIONS: PANEL

	(1)	(2)
GDP per capita	-3.69 (0.83) <sup>***</sup>	-3.85 (1.01) <sup>***</sup>
squared	0.09 (0.02) <sup>***</sup>	0.09 (0.03) <sup>***</sup>
Budget surplus	-0.20 (0.10) <sup>**</sup>	-0.17 (0.11) <sup>*</sup>
Literacy	-0.35 (0.33)	-0.32 (0.38)
Industry concentration	-0.00 (0.001)	-0.00 (0.001)
Rule of law	0.26 (0.48)	-0.01 (0.59)
Democracy		-3.35 (2.07) <sup>*</sup>
Bureaucratic quality		1.42 (0.78) <sup>*</sup>
Population		-0.13 (0.12)
Income tax revenue		0.12 (0.07) <sup>*</sup>
Interest payments		0.09 (0.04) <sup>**</sup>
Newspapers		-0.01 (0.01)
Risk of repudiation		0.35 (0.45)
Risk of expropriation		-0.65 (0.68)
Urbanization		-0.30 (0.27)
Observations	1,005	903
Countries	87	87
$R^2$	0.873	0.903

*Notes to Table:* The dependent variable is the ratio of tariffs to tariffs plus subsidies ( $t/(t+s)$ ); all explanatory variables are lagged one period. Panel-corrected standard errors appear in parentheses, as described in the text. \*\*\* indicates statistical significance at the 99% level, \*\* at the 95% level, and \* at the 90% level. Time- and country-specific constant terms are included; reported  $R^2$  includes their effects. See Appendix A for data definitions and sources.

contrast, our panel results are less supportive of obfuscation and time inconsistency explanations for tariff preference as newspapers per capita, risk of expropriation and rule of law are no longer statistically significant. Indeed, the negative coefficient on democracy is opposite that predicted by the optimal obfuscation model.

Although the results in Table 5 and Table 6 are intriguing, we are concerned about the sensitivity of these estimates given that the existing theoretical literature does not state explicitly the variables that should be included in such regressions, and some of the coefficient estimates change magnitude and/or significance level when the set of other explanatory variables changes. In the next section, we discuss sensitivity analysis of our results, and provide some interpretation of the robust results.

## 5 Sensitivity Analysis

A natural concern with the results presented thus far is that they reflect spurious correlations resulting from a fairly ad hoc selection of control variables. Since the theoretical literature does not precisely identify variables to be included in the estimation, we chose two specifications to present from a large sample of possible specifications. A natural question that arises is how our results would change as we change our specification. Such concerns are magnified by the fact that, as we adjust our set of conditioning variables, our sample changes as well. In the empirical literature on economic growth, several approaches to the problem of robustness of empirical results have developed. Although our application is slightly different — we face a *lack* of previous empirical specifications, rather than a plethora — the procedures seem well-suited for our purposes. Much of the empirical growth literature follows theory in identifying variables for inclusion in growth regressions; growth theory, as with the theories of interest here, does not always provide a clear link to actual data. Second, we think that robustness should be analyzed in early empirical work, rather than waiting for contradictory findings.

For our purposes, the sensitivity analysis proposed by Sala-i-Martin (1997) seems the most relevant. Ideally, we would be able to include all possible explanatory variables in our regressions, but we quickly exhaust degrees of freedom due to the high number of variables suggested by theory. As a compromise, we employ a modified version of Sala-i-Martin (1997) for estimating

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positive coefficient on income tax revenue or bureaucratic quality. However, as we discuss in section 5, these positive coefficients are not robust.

robustness.<sup>21</sup> Specifically, for each possible explanatory variable, a series of regressions are estimated, incorporating all possible combinations of exactly three control variables (in this procedure, the control variables include all other variables of interest, as well as the variables identified by the Bohara and Kaempfer (1991) and Conybeare (1983) predicting the overall level of protection: the inflation rate, the trade balance, the ratio of military spending to all government spending, the share of manufacturing in GDP, government expenditures as a share of GDP, and imports/GDP). Given the nature of our data and the lack of precise empirical counterparts to the variables suggested by theory, multicollinearity presents a potential problem for this type of sensitivity analysis.<sup>22</sup> Thus, for each variable of interest, we exclude from the set of control variables those variables that are included to measure the same phenomenon, following Table 4 (with the exception of GDP per capita and GDP per capita squared, which are included in all regressions). For example, our proxies for “government credibility” in the time-inconsistency model include ICRG measures of the risk of expropriation, risk of repudiation and rule of law (see Table 4). Thus, when risk of expropriation is the variable of interest, we exclude risk of repudiation and rule of law from the set of control variables. Table 9 lists the variables that are dropped for each variable investigated. (Note that because the set of possible control variables changes, the number of regressions estimated for each variable of interest also changes.)

The likelihood-weighted mean of the point estimate  $\hat{\beta}_m$  and its standard deviation  $\hat{\sigma}_m$  are computed:

$$\bar{\beta}_m = \sum_{j=1}^K \omega_{mj} \hat{\beta}_{mj}; \quad \bar{\sigma}_m^2 = \sum_{j=1}^K \omega_{mj} \hat{\sigma}_{mj}^2 \quad (1)$$

where the weights  $\omega_{zj}$  are proportional to the likelihoods  $L_j$ :

$$\omega_{mj} = \frac{L_{mj}}{\sum_{i=1}^K L_{mi}} \quad (2)$$

Computing the mean and variance allows for the estimation of the CDF un-

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<sup>21</sup>Several alternatives exist. We selected this approach over several alternatives (such as the extreme bounds analysis of Leamer (1983), used in the growth literature by Levine and Renelt (1992), or the Bayesian model averaging approach of Sala-i-Martin, Doppelhofer, and Miller (2004)) for two reasons: (1) unlike extreme bounds analysis, the set of control variables consists of all possible explanatory variables; and (2) unlike model averaging, changing sample sizes do not present a problem.

<sup>22</sup>Levine and Renelt (1992) discuss the issue of multicollinearity in more detail, and also exclude from the set of possible conditioning variables those that measure the same phenomenon as the variable of interest.

der the assumption that the distribution of the  $\beta_m$  estimates is normal.<sup>23</sup> A variable can then be classified as “robust” if 90% of its distribution lies to the left or right of zero.<sup>24</sup>

We present our results for three datasets. The first is a cross-sectional data set covering as many countries as possible over the period 1988-92, comparable to the results in Table 5. The second is a panel data set covering as many countries as possible over the period 1975-98, comparable to the results in Table 6.<sup>25</sup> Finally, we present panel data results for the OECD subsample. Results for all of the samples (cross-section, panel and OECD subsamples) are summarized in Table 7, which also provides the full list of variables considered.

## 5.1 Robustness: Cross-Section

The results of the robustness procedure for cross-sectional analysis of the full sample are presented in Table 8. With each regression, in addition to GDP per capita, GDP per capita squared, and the variable of interest, exactly three control variables are included from the set of possible explanatory variables. The means in Table 8 are weighted by the estimated likelihood of the specification; results are similar when unweighted means are used.

The results from the above robustness check are quite consistent with those reported in Table 5. The negative coefficient estimate on GDP per capita and the positive coefficient on GDP squared are robust and indicate a negative relationship between income and tariff reliance which weakens at high levels of income. As in Table 5, the results are broadly supportive of the optimal obfuscation and time inconsistency explanations for tariff preference. The negative coefficients on GDP per capita and newspapers and the positive coefficient on the share of unskilled labor are all robust and supportive of the optimal obfuscation theory of tariff preference. Specifically, they are all consistent with the theory that countries with a higher portion of informed voters rely less heavily on tariffs. Likewise the negative coefficients on GDP per capita, rule of law and risk of expropriation are all robust and supportive of the time inconsistency theory of tariff preference. Specifically, they are all consistent with the idea that countries with credibility problems will rely more heavily on tariffs.

In contrast, the results of our robustness estimation are less supportive of

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<sup>23</sup>Sala-i-Martin (1997) also presents results under an assumption of non-normality; results are comparable.

<sup>24</sup>Sala-i-Martin (1997) uses a cutoff of 95%.

<sup>25</sup>For some combinations of control variables, the sample period is shorter due to missing data. In our samples, data on inequality, newspapers, and voter participation are interpolated for missing years based on that country’s observations (see Appendix A for details).

Table 7: SUMMARY OF ROBUST RESULTS

Variable	Cross-Section	Panel	OECD
GDP per capita	–	–	+
GDP per capita, squared	+	+	
Budget surplus/deficit		–	
Income taxes			–
Interest payments		+	
Urbanization		–	–
Bureaucratic quality			
Population			
Literacy			–
Unskilled labor	+		
Highly skilled labor			
Newspapers	–		–
Democracy			
Voter participation			
Inequality (Gini)	+	+	+
Concentration (Herfindahl)	+		
Rule of law	–		
Risk of repudiation			+
Risk of expropriation	–		
Unemployment			
Unionization	<i>n/a</i>	<i>n/a</i>	

*Notes to Table:* The dependent variable is the ratio of tariffs to tariffs plus subsidies ( $t/(t + s)$ ). For all samples, GDP per capita and GDP per capita squared are included in all regressions.

Signs indicate the sign of the correlation, when robust, between the variable of interest and a reliance on tariffs. All robust results are robust at the 90% level or better.

In the robustness procedure, the control variables are exactly three control variables from the set of all possible control variables including the other variables of interest, with variables proxying for the same phenomenon excluded.

See the text for more details and Appendix A for data definitions.

Table 8: ROBUSTNESS RESULTS: FULL SAMPLE (CROSS-SECTION)

Variable	$\hat{\beta}$	s.e.	<i>p</i> -value	Regs	Omitted Variables
<b>GDP per capita</b>	<b>-8.401</b>	<b>2.019</b>	<b>0.000</b>	2,024	—
<b>GDP, squared</b>	<b>0.235</b>	<b>0.084</b>	<b>0.003</b>	2,024	—
Income taxes	-0.057	0.148	0.350	1,140	bureau, lit, urban
Bureaucratic quality	3.289	2.740	0.115	1,140	inc tax, lit, urban
Literacy	-0.116	0.148	0.217	560	inc tax, bureau, urban, newspapers, skill, unskill, voter part
Urbanization	0.052	0.165	0.376	1,140	inc tax, bureau, lit
Budget surplus	0.545	0.543	0.158	1,540	interest
Interest payments	0.027	0.144	0.426	1,540	surplus
Population	-0.002	0.025	0.465	1,771	—
<b>Newspapers</b>	<b>-0.043</b>	<b>0.026</b>	<b>0.049</b>	1,140	lit, skill, unskill
Skilled labor	0.096	0.537	0.429	816	lit, news, skill, voter, unemp
<b>Unskilled labor</b>	<b>0.561</b>	<b>0.316</b>	<b>0.038</b>	816	lit, news, unskill, voter, unemp
Democracy	9.756	10.29	0.172	1,771	—
Voter participation	-0.085	0.189	0.326	1,140	lit, skill, unskill
<b>Inequality</b>	<b>0.689</b>	<b>0.266</b>	<b>0.005</b>	1,540	conc
<b>Concentration</b>	<b>0.005</b>	<b>0.003</b>	<b>0.045</b>	1,540	ineq
Unemployment	-0.376	0.800	0.319	1,330	skill, unskill
<b>Expropriation risk</b>	<b>-5.692</b>	<b>2.388</b>	<b>0.009</b>	1,330	repud, rule
Risk of repudiation	-1.951	2.509	0.218	1,330	exprop, rule
<b>Rule of law</b>	<b>-3.662</b>	<b>2.147</b>	<b>0.044</b>	1,330	exprop, repud
<b>Gov't expenditure</b>	<b>-98.73</b>	<b>20.72</b>	<b>0.000</b>	1,771	—
Inflation	-0.272	0.401	0.249	1,771	—
Trade balance	13.99	30.54	0.323	1,771	—
Manufacturing/GDP	-0.219	0.401	0.293	1,771	—
Military/total spending	-0.150	0.286	0.300	1,771	—
Imports/GDP	0.032	0.080	0.345	1,771	—

*Notes to Table:* Each row gives the mean estimate of  $\beta$  and the standard deviation computed from the mean variance from the Sala-i-Martin estimation.

Each regression includes GDP, GDP squared, and exactly three additional control variables, drawn from the other explanatory variables listed in the table. Variables excluded from this set are listed in the last column.

Means of both estimates and standard errors are weighted by likelihoods.

Bold entries are those that can be classified as robust at the 90% level or better.



the budgetary and lobby competition explanations for tariff preference. The robust and positive coefficients on inequality and industry concentration suggest that countries with less concentrated ownership of resources and less concentrated industry structures (and hence more lobbying competition) are less likely to rely on tariffs. This is opposite the prediction of lobbying competition models, which suggest that greater lobbying competition should result in greater tariff reliance. In addition, we find that none of the additional explanatory variables proxying for revenue considerations are robust in the cross section.

## 5.2 Robustness: Full Sample

The results of the robustness procedure for panel analysis of the full sample with fixed effects are presented in Table 9. As in the cross-section, each regression contains GDP per capita, GDP per capita squared, the variable of interest, and exactly three control variables from the set of possible explanatory variables. All regressions are estimated with panel-corrected standard errors.

Consistent with the panel estimates of Table 6 (and in contrast to the cross-sectional estimates), the results of the above robustness procedure are supportive of revenue considerations as being a primary determinant of tariff reliance. Specifically, the negative coefficient estimate on GDP per capita and urbanization are both robust and supportive of a story where an increase in the administrative capabilities of a country results in greater reliance on subsidies. Likewise, the negative coefficient estimate on budget surplus and the positive coefficient estimate on interest payments on government debt are also robust and consistent with budget-constrained countries shifting to greater reliance on tariffs. In contrast to the cross-sectional estimation, our panel estimates show less support for time inconsistency and optimal obfuscation explanations with none of the additional variables proxying for either voter information or government credibility being robust. Finally, we find little support for lobbying competition being a determinant of tariff reliance as, in contrast to our theoretical prediction, inequality is robustly positive in the panel estimation.

One of the more interesting results of the above analysis is that (fixed-effects) panel estimates are more supportive of revenue considerations as being a primary determinant of tariff reliance while cross-sectional estimates are more supportive of time inconsistency and optimal obfuscation as being the main determinant. This distinction appears both in the ad-hoc specifications of Tables 5 and 6 and the robust estimates of Tables 8 and 9. In a sense this

Table 9: ROBUSTNESS RESULTS: FULL SAMPLE (PANEL)

Variable	$\hat{\beta}$	s.e.	p-value	Regs	Omitted Vars
<b>GDP per capita</b>	<b>-3.187</b>	<b>0.727</b>	<b>0.000</b>	2,024	—
<b>GDP, squared</b>	<b>0.084</b>	<b>0.001</b>	<b>0.000</b>	2,024	—
Income taxes	0.055	0.067	0.206	1,140	bureau, lit, urban
Bureaucratic quality	0.611	0.874	0.242	1,140	inc tax, lit, urban
Literacy	-0.349	0.391	0.186	560	inc tax, bureau, urban, news, skill, unskill, voter
<b>Urbanization</b>	<b>-0.502</b>	<b>0.242</b>	<b>0.019</b>	1,140	inc tax, bureau, lit
<b>Budget surplus</b>	<b>-0.127</b>	<b>0.087</b>	<b>0.072</b>	1,540	interest
<b>Interest payments</b>	<b>0.058</b>	<b>0.038</b>	<b>0.064</b>	1,540	surplus
Population	-0.009	0.047	0.424	1,771	—
Newspapers	-0.012	0.011	0.152	1,140	lit, skill, unskill
Skilled labor	-0.258	0.349	0.230	816	lit, news, skill, voter, unemp
Unskilled labor	0.065	0.139	0.320	816	lit, news, unskill, voter, unemp
Democracy	1.396	2.113	0.254	1,771	—
Voter participation	0.064	0.087	0.231	1,140	lit, skill, unskill
<b>Inequality (Gini)</b>	<b>0.216</b>	<b>0.157</b>	<b>0.085</b>	1,540	conc
Concentration	-0.001	0.001	0.174	1,540	ineq
Unemployment	0.055	0.185	0.383	1,330	skill, unskill
Expropriation risk	-0.529	0.528	0.158	1,330	repud, rule
Risk of repudiation	-0.089	0.366	0.404	1,330	exprop, rule
Rule of law	0.071	0.583	0.452	1,330	exprop, repud
<b>Gov't expenditure</b>	<b>-27.50</b>	<b>6.967</b>	<b>0.000</b>	1,771	—
Inflation	-0.020	0.073	0.392	1,771	—
Trade balance	-1.644	6.604	0.402	1,771	—
Manufacturing/GDP	0.098	0.128	0.222	1,771	—
Military/total spending	-0.037	0.084	0.330	1,771	—
Imports/GDP	-0.040	0.050	0.212	1,771	—

Notes to Table: Regressions are panel regressions including time and country fixed effects; standard errors in each regression are panel-corrected. See additional notes to Table 8.

difference is not that surprising. While cross-sectional results suggest that countries with greater credibility problems and less informed voters are more likely to rely on tariffs as a means of redistribution, such a correlation might not appear in our fixed-effect panel estimates given the lack of time-series variation in many of our control variables (e.g., index measures of government credibility).

The finding in Table 9 that year-to-year changes in budgetary positions appear to influence the policy choices of governments is an interesting one. However, an obvious question is how broad this finding is. The conventional wisdom among trade economists is that, while revenue considerations might be an important consideration in developing countries (which face extensive administration costs and other barriers to raising government revenue), as countries develop and establish more efficient tax administration they become less dependent on trade taxes as a source of revenue. Indeed, in his survey of the literature, Rodrik (1995) is quite skeptical that revenue considerations would have any impact on the preference for tariffs over subsidies among more developed countries. Thus, in the following section, we repeat the estimation for the OECD subsample to investigate whether the determinants of tariff preference are different across more developed countries.

### 5.3 OECD sub-Sample

The results of the robustness procedure for panel analysis of the OECD subsample with fixed effects are presented in Table 10. As before, each regression contains GDP per capita, GDP per capita squared, the variable of interest, and exactly three control variables from the set of possible explanatory variables. As in the full-sample panel robustness analysis, all regressions are estimated with panel-corrected standard errors.

Comparing Table 10 with Table 9 reveals some interesting differences between the OECD sub-sample and the full sample. First, there is a robust and positive correlation between per-capita GDP and tariff reliance (unlike in the full sample, where the correlation is negative). This is consistent with the lobby competition explanation for tariff reliance, although the evidence is mixed as the coefficient on inequality is also robust and positive. (Of course, the positive correlation on GDP also represents the positive coefficient estimate on GDP per capita squared in the full sample.) Second, there is greater support for optimal obfuscation being a primary determinant of tariff reliance among OECD countries (relative to the full sample). Specifically, the negative coefficients on literacy and newspapers are robust and consistent with the story that an increase in the proportion of informed voters within a coun-

Table 10: ROBUSTNESS RESULTS: OECD (PANEL)

Variable	$\hat{\beta}$	s.e.	<i>p</i> -value	Regs	Omitted Vars
<b>GDP per capita</b>	<b>2.303</b>	<b>1.857</b>	<b>0.108</b>	2,300	—
GDP, squared	-0.017	0.042	0.343	2,300	—
<b>Income taxes</b>	<b>-0.206</b>	<b>0.126</b>	<b>0.051</b>	1,330	bureau, lit, urban
Bureaucratic quality	-0.518	1.265	0.341	1,330	inc tax, lit, urban
<b>Literacy</b>	<b>-2.638</b>	<b>0.862</b>	<b>0.001</b>	560	inc tax, bureau, urban, news, skill, unskill, union, voter
<b>Urbanization</b>	<b>-0.704</b>	<b>0.389</b>	<b>0.035</b>	1,330	inc tax, bureau, lit
Budget surplus	-0.034	0.123	0.391	1,771	interest
Interest payments	0.021	0.118	0.429	1,771	surplus
Population	-0.112	0.320	0.363	2,024	—
<b>Newspapers</b>	<b>-0.028</b>	<b>0.017</b>	<b>0.050</b>	1,330	lit, skill, unskill
Skilled labor	-0.149	0.297	0.308	816	lit, news, skill, voter, union, unemp
Unskilled labor	-0.085	0.193	0.330	816	lit, news, unskill, voter, union, unemp
Democracy	0.303	8.460	0.486	2,024	—
Voter participation	-0.088	0.200	0.330	1,140	lit, skill, unskill, union
Unionization	0.037	0.106	0.364	969	lit, skill, unskill, unemp
<b>Inequality</b>	<b>0.360</b>	<b>0.223</b>	<b>0.053</b>	1,771	conc
Concentration	0.004	0.005	0.220	1,771	ineq
Unemployment	-0.034	0.234	0.442	1,330	skill, unskill, union
Expropriation risk	-1.037	0.854	0.112	1,540	repud, rule
<b>Risk of repudiation</b>	<b>-1.892</b>	<b>0.655</b>	<b>0.002</b>	1,540	exprop, rule
Rule of law	-1.203	1.089	0.135	1,540	exprop, repud
Gov't expenditure	-10.68	13.01	0.206	2,024	—
Inflation	4.827	9.106	0.298	2,024	—
Trade balance	18.47	17.98	0.150	2,024	—
Manufacturing/GDP	-0.214	0.381	0.287	2,024	—
Military/total spending	-0.375	0.316	0.118	2,024	—
Imports/GDP	-0.099	0.135	0.232	2,024	—

Notes to Table: See notes to Table 9.

try will result in a lower reliance on tariffs. Third, there is greater support for time-inconsistency being a primary determinant of tariff reliance among OECD countries. Specifically, the negative coefficient on the risk of repudiation is robust and consistent with the story that an increase in government credibility will result in less reliance on tariffs. Finally, consistent with conventional wisdom, measures of current budget constraints are no longer robustly correlated with tariff reliance among the more-developed OECD subsample. However, somewhat surprisingly, we still find evidence that revenue considerations matter, even for OECD countries, as various proxies for administrative quality (i.e., literacy, urbanization and income taxes as percent of government revenue) are robust and consistent with the predictions of the theory.

## 6 Conclusion

In this paper, we have provided some initial tests of explanations for the preference of countries for tariffs as a means of income redistribution. It should be repeated that none of the theoretical models proposed a fully specified equation for the proper ratio of tariffs to other policy instruments. Thus, we were not estimating any precisely specified equations, but simply attempting to see how well the pattern of trade and subsidy determination matches (our) predictions based upon the models. Therefore, none of the results should be interpreted as an outright rejection or validation of any model; rather, our results should be viewed as a test of whether the existing theoretical literature can contribute to our understanding of the available empirical evidence on the cross-country pattern of preferences for tariffs relative to subsidies.

Based on our results, we find that it can. Consistent with the revenue explanation for tariff preference, we find that tariff reliance is correlated with measures of budgetary constraints and administrative costs across countries. Consistent with the optimal obfuscation argument, we find that tariff reliance is correlated with measures of education and literacy. Finally, consistent with the time-inconsistency argument, we find that tariff reliance is correlated with measures of government credibility. Somewhat surprisingly, given the lack of a tight connection between theory and empirics in this literature, we find that existing theories actually do a good job explaining the available evidence. In addition, our findings are consistent with trade policy usage being a result of a myriad of factors (as opposed to a single dominant model).

Finally, we find evidence that the predictors of tariff reliance differ across countries at different levels of development. Specifically, in the robust panel estimation, we find greater evidence for the time-inconsistency explanation

and optimal obfuscation explanation in the OECD sample compared to the full sample. In addition, while we find evidence for the revenue explanation in both the OECD sub-sample and the full sample, the robust predictors vary across levels of development with measures of the budgetary situation being correlated with tariff reliance in the full sample, and measures of administrative costs being correlated with tariff reliance among OECD countries.

## A Variable Definitions

The following table defines variables used in the tables. The table notes on the following page identify data sources in more detail.

Table A1: VARIABLE DEFINITIONS

Variable	Definition	Source
<i>Tariff</i>	ratio of import duties to import value	WDI
<i>Subsidy</i>	ratio of subsidies to GDP (see below)	WDI
<i>GDP per capita</i>	real GDP per capita (1985 international prices)	WDI
<i>GDP growth</i>	(1-year) log difference, real GDP per capita	WDI
<i>Unemployment</i>	unemployment as percentage of labor force	WDI
<i>Population</i>	total population	WDI
<i>Urbanization</i>	urban population as % of total population	WDI
<i>Inflation</i>	annual inflation, consumer prices	WDI
<i>Trade balance</i>	trade balance to GDP ratio	WDI
<i>Gov't expenditure</i>	government expenditure to GDP ratio	WDI
<i>Income tax revenue</i>	income taxes as percentage of total tax revenue	WDI
<i>Military spending</i>	military expenditures as percentage of central government expenditure	WDI

*Table continued on following page*

## VARIABLE DEFINITIONS CONTINUED

Variable	Definition	Source
<i>Manufacturing</i>	manufacturing value added as percentage of GDP	WDI
<i>Budget surplus</i>	budget surplus/deficit as percentage of GDP	WDI
<i>Interest</i>	interest payments as percentage of government revenue	WDI
<i>Literacy</i>	literacy rate, population over 15	WDI
<i>Newspapers</i>	daily newspapers per 1000 people	WDI
<i>Democracy</i>	index of political rights	Gastil
<i>Inequality</i>	Gini coefficient	D-S
<i>Concentration</i>	Herfindahl index based on export share of 3-digit SIC industries	Authors, from NBER
<i>Voter participation</i>	votes cast per eligible population, parliamentary elections with no presidential election	IDEA
<i>Unskilled labor</i>	percentage of the population over age 25 that did not complete primary school	B-L
<i>Skilled labor</i>	percentage of the population over age 25 that completed higher education	B-L
<i>Unionization</i>	gross union density rate (reported membership as a percent of wage- and salary-earners)	B-OECD
<i>Bureaucratic Quality</i>	6-point index of bureaucratic quality	ICRG
<i>Rule of Law</i>	6-point index of extent to which government follows rule of law	ICRG
<i>Risk of Repudiation</i>	10-point index of the risk of repudiation of contracts by the government	ICRG
<i>Expropriation Risk</i>	10-point index of the risk of expropriation of private investment	ICRG

*Data Sources:* B-L: Barro and Lee (1996). D-S: Deininger and Squire (1996). IDEA: International Institute for Democracy and Electoral Assistance (<http://www.idea.int/>) WDI: World Bank, World Development Indicators 2000. B-OECD: Blanchflower (1996). NBER: Feenstra, Lipsey, Deng, Ma, and Mo (2005). ICRG: International Country Risk Group dataset constructed by the Iris center, Knack and Keefer (1995).

Subsidies are defined as “all unrequited, nonrepayable transfers on current account to private and public enterprises, and the cost to the public of covering the cash operating deficits on sales to the public by departmental enterprises.”

The newspaper variable is available every five years between 1970 and 1990. Data for other years are interpolated linearly from the available data, as long as the values are not

more than 10 years apart.

Interpolation is used for the Gini coefficient and voter participation, as follows: if only one value is available, the values for two years in either direction are set equal to that value. If more than one value is available, interim values are linearly interpolated as long as the values are not more than 10 years apart, and extended two years in either direction.

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