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2008/06/EPS

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Abstract

In this paper, we present two alternative models of trade and unemployment, in which unemployment is generated through a search mechanism. The basic framework of the first model is Ricardian in that the only factor of production is labor and trade is based on relative technological differences. The second model has a Heckscher-Ohlin (H-O) framework with two factors of production, namely labor and capital that are intersectorally mobile. Using cross-country data on various measures of trade policy, unemployment and a variety of controls, we find strong evidence for the Ricardian prediction that unemployment and trade openness are negatively related (protection and unemployment are positively related). We do not find any support for the H-O prediction that this relation between trade openness and unemployment changes from negative to positive as we move from labor-abundant to capital-abundant countries. Our results are robust to the inclusion of controls for labor market institutions and macroeconomic distortions. They hold for both ordinary least squares and instrumental-variables approaches, where the latter accounts for the endogeneity of trade policy to unemployment and possible measurement errors in trade policy variables.

1 Introduction

While unemployment is one of the big economic problems, trade economists have generally tended to abstract away from it. Most trade models are full employment models with fully flexible wages. Implicitly, this means trade economists do not believe that trade is an important factor in the determination of unemployment. There are, of course, exceptions to this rule, and there does exist a small but growing literature on the relationship between trade and unemployment.[1] Outside the economics profession, there are people who believe that one of the important effects of trade is the destruction of jobs, leading to significant unemployment. Such reports are common in the various popular forms of the news media which completely ignore the

[1] The most prominent contributors to this literature are Carl Davidson and Steve Matusz. See Davidson et al. (1999) for a representative work and Davidson and Matusz (2004) for a survey. Also see Moore and Ranjan (2005) and Mitra and Ranjan (2007) for recent contributions to this literature.

creation of new jobs as a result of international trade.[2] Therefore, there is a need for not only theoretical work but also rigorous empirical work investigating the effects of trade on unemployment.[3]

In this paper, we present two alternative models of trade and unemployment. While the mechanism generating unemployment is the same, namely search unemployment, in both models, the structure of the economy in one model is different from that in the other. One has a Ricardian structure where trade is generated purely due to relative technological differences, the other framework is Heckscher-Ohlin where trade is generated as a result of relative factor endowment differences.

Due to the different economic structures, we have different predictions on the effects of trade on unemployment from the two models. While the Ricardian model predicts that trade liberalization (or tariff reduction) will result in a reduction in unemployment, the Heckscher-Ohlin structure predicts that this will happen only if the country in question is labor-abundant. In the Heckscher-Ohlin model of trade and unemployment, trade liberalization in fact can increase unemployment in a labor-scarce economy. While this second part of the Heckscher-Ohlin prediction has the potential to be music to the ears of protectionists in developed countries, our empirical work does not support this prediction. We in fact find strong empirical support from our cross-country regressions for the Ricardian prediction that trade openness and unemployment are negatively related across all countries. It is important here to understand the intuition behind this result. Trade in a two-sector Ricardian model results in an increase in the value of the marginal product of labor in one of the sectors (the export sector) due to an increase in the domestic relative price of the good produced in that sector. Since the other sector (the import-competing sector), where the marginal product of labor would have been lower, cannot survive trade liberalization, the economywide value of marginal product of labor also goes up. There is more investment in job search and the posting of jobs and we get a reduction

[2] A search of news articles in the New York Times since 1990, reveals a total of 275 articles on NAFTA as the primary subject. Out of this, 147 articles talk about job destruction in the US as a consequence of NAFTA. Also, Davidson and Matusz (2004) point out that most of the statements made in the House and the Senate during the NAFTA debate were about NAFTA's impact on jobs. They point out, that in sharp contrast, there is not a listing for unemployment in the index of the 4000 pages long *Handbook of International Economics*, primarily used by academic economists.

[3] Empirical work on trade and unemployment is virtually non-existent. An exception is some analysis of the correlation between job destruction and net exports across sectors in chapter 4 of the book by Davidson and Matusz (2004). They find a negative correlation between the two (equivalent to a positive correlation between net imports and job destruction), and perform some further regressions to look deeper into this correlation. See Davidson and Matusz (2005) for a more detailed empirical analysis. For an in-depth and interesting political-economy empirical analysis of how labor turnover in the US determines support for or against free trade and whether it is along factor lines or industry lines, see Magee, Davidson and Matusz (2002).

in unemployment.

It is also important to understand the intuition behind the alternative Heckscher-Ohlin prediction that does not hold in the data. Unlike in the first model where the only factor of production is labor, the two tradable goods here are produced using labor and capital. Firms can rent capital anytime they decide to hire a worker and undertake production. In an economy that is capital abundant relative to rest of the world, before the opening of trade the relative price of the capital intensive good is lower than in the rest of the world. Therefore, opening up to trade will imply an increase in the relative price of the capital-intensive good in this country. Thus the demand for capital goes up and that for labor goes down. There is here a modified Stolper-Samuelson effect - the wage falls, the rental on capital rises and the unemployment rate rises. The results in this model are reversed in a country that is labor-abundant as trade increases the implicit demand for the services of labor and reduces the implicit demand for the services of capital, which implies that the wage rate goes up and unemployment goes down.

Our empirical work in this paper uses cross-country data. We use a number variables that capture trade policy such as unweighted average tariffs, import weighted average import duty, the overall trade restrictiveness index (OTRI), a measure that includes both formal and informal barriers to trade, a variable measuring the non-tariff barrier (NTB) coverage ratio and the standard measure of openness measured as the ratio of trade to GDP. The dependent variable is overall national unemployment rate. We use several control variables that capture the varying labor-market institutions across countries. These capture the strength of labor unions, labor-market rigidity, the nature of labor laws etc. Other controls capture the varying macroeconomic economic environments of the different countries. These controls include variables such as output volatility, black-market premium etc. We also check robustness of results to instrumenting our trade policy variables. The reasons for instrumenting arise from the endogeneity of trade policy to unemployment as well possible measurement errors in trade policy variables. The instruments we use include the number of years as a GATT/WTO member since the GATT was founded, a developing country dummy (to capture the fact that developing country members might be given concessions in GATT with respect to reciprocity in trade liberalization as well as the fact that their income tax systems might not be advanced enough) and a lagged variable to capture reliance on tax revenues from domestic sources. For the traditional openness measure, we use gravity-based variables and additional geographical variables as instruments. Finally, since we are looking at steady-state predictions of these models, we primarily use decade averages of data.

We find strong evidence for the Ricardian prediction that unemployment and trade openness are negatively related (protection and unemployment are positively related). We do not find any support for the H-O

prediction that the relation between trade and unemployment changes from negative to positive as we move from labor-abundant to capital-abundant countries. Our results are robust to the inclusion and exclusion of controls and hold using both ordinary least squares as well as instrumental-variables approaches.

The plan of the rest of the paper is as follows. We first present a simple Ricardian model with search unemployment and derive the implications of trade liberalization on unemployment. Then we present results of trade liberalization on unemployment in a Heckscher-Ohlin model with search unemployment, the details of which are given in an appendix. Having derived our empirical predictions from the theoretical model, we undertake empirical analysis.

2 The Model

2.1 Production Structure

The economy produces a single final good and two intermediate goods. The final good is non-tradable, while the intermediate goods are tradable. The final good is denoted by Z and the two intermediate goods are denoted by X and Y. Further, denote the prices of X and Y in terms of the final good as p_x and p_y, respectively. The production function for the final good is as follows:

$$Z = \frac{AX^{1-\alpha}Y^{\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}}$$

Given the prices p_x, and p_y, of inputs, the unit cost for producing Z is given as follows.

$$c(p_x, p_y) = \frac{1}{A}\left(p_x\right)^{1-\alpha}\left(p_y\right)^{\alpha} \tag{1}$$

Since Z is chosen as the numeraire, $c(p_x, p_y) = 1$, or

$$\frac{1}{A}\left(p_x\right)^{1-\alpha}\left(p_y\right)^{\alpha} = 1 \tag{2}$$

The above demand functions imply the following relative demand for the two intermediate goods.

$$\frac{X^d}{Y^d} = \frac{(1-\alpha)p_y}{\alpha p_x} \tag{3}$$

Labor is the only factor of production. The total number of workers in the economy is L each supplying one unit of labor inelastically when employed. Our description of the labor market corresponds to a standard Pissarides (2000) style search model embedded in a two sector set up. A producing unit in the intermediate

goods production is a job-worker match. New producing pairs are created at a rate determined by a matching function of two measures of labor market participation, vacancies and unemployment. Job destruction is a response to idiosyncratic shocks to the productivity of existing job-worker matches.

For X production a unit of labor should be matched with an entrepreneur who has the technology to produce the intermediate good X. Similarly, for the production of Y a unit of labor should be matched with an entrepreneur who has the technology to produce the intermediate good Y. A worker-job match in sector $i = x, y$ produces output h_i. If L_i is the total number of workers employed in sector i, then the aggregate production in each sector is given by

$$X = L_x h_x; Y = L_y h_y$$

Therefore, the relative supply of the two intermediate goods is

$$\frac{X^S}{Y^S} = \frac{h_x L_x}{h_y L_y} \tag{4}$$

The total number of matches in the labor market is determined by the matching technology. Assume the following simple matching technology. Denote the number of vacancies in the economy per unit of time by vL and the number of unemployed per unit of time by uL. Define $\theta = \frac{v}{u}$ as a measure of market tightness. We assume that unemployed workers search for a job and can be randomly matched with an employer in either of the two sectors. That is, despite having two sectors for production there is an integrated labor market. The flow of matches per unit of time is a linear homogeneous function of uL and vL. For simplicity we assume a Cobb-Douglas form of matching technology:

$$M[v, u] = mv^{\gamma}u^{1-\gamma}L = m\theta^{\gamma}uL$$

With this specification the job finding rate for an unemployed is simply $\frac{M}{uL} = m\theta^{\gamma}$, while the rate at which vacant jobs are filled is simply $\frac{M}{vL} = m\theta^{\gamma-1}$. Clearly, the former is an increasing function of the market tightness, while the latter is a decreasing function of the market tightness.

Denote the recruitment cost in terms of the final good by δ. The unemployment benefit for workers is fixed in terms of the final good at b. The wage of workers in sector-i is w_i in terms of the numeraire good. We assume that the matches in each sector are broken at an exogenous rate of λ per period. λ can be viewed as an arrival rate of a shock that leads to job destruction. Given the above description of labor market, the net flow into unemployment per period of time is

$$\dot{u} = \lambda(1 - u) - m\theta^{\gamma}u$$

In the steady-state the rate of unemployment is constant. Therefore, the steady-state unemployment in the economy is given by

$$u = \frac{\lambda}{\lambda + m\theta^{\gamma}} \tag{5}$$

To solve for the endogenous variables of interest-$p_x, p_y, w_i, \theta, u-$we proceed as follows. Start with a particular pair of prices p_x and p_y satisfying equation (2). Once a job is filled, an entrepreneur in sector-i receives the flow of the value of output from the match $h_i p_i$ less the sectoral wage (w_i) until the match is dissolved. Let J_i be the present discounted value of a filled job in sector i and V_i the present discounted value of a vacant job in sector i. Then, in steady state, the entrepreneur's problem is characterized by two Bellman equations

$$\rho J_i = h_i p_i - w_i + \lambda(V_i - J_i) \tag{6}$$

$$\rho V_i = -\delta + m\theta^{\gamma-1}(J_i - V_i) \tag{7}$$

Given free entry, all profit opportunities from posting vacancies are exploited. Hence, $V_i = 0$. Substituting this condition into equations (6) and (7) implies

$$J_i = \frac{\delta}{m\theta^{\gamma-1}} = \frac{h_i p_i - w_i}{\rho + \lambda} \tag{8}$$

or

$$h_i p_i - w_i = \frac{(\rho + \lambda)\delta}{m\theta^{\gamma-1}} \tag{9}$$

Let W_i denote the present discounted value of employment in sector i and U the present discounted value of unemployment for a worker. Then, in steady state, the worker's problem is also characterized by two Bellman equations:

$$\rho W_i = w_i + \lambda(U - W_i) \tag{10}$$

$$\rho U = b + m\theta^{\gamma}(W^e - U) \tag{11}$$

where W^e is the expected value of employment for a worker who may end up with a job in either of the two sectors.

Wage is determined through a process of Nash bargaining between the worker and the entrepreneur. In the appendix, we derive the following expression for wage.

$$w = w_x = w_y = (1 - \beta)b + \beta(h_i p_i + \theta\delta) \tag{12}$$

Since wages are identical in the two sectors, (12) implies that the relative goods price must satisfy the following.

$$\frac{p_x}{p_y} = \frac{h_y}{h_x} \tag{13}$$

The result above implies that despite the presence of search generated unemployment the relative goods prices are determined completely by technology as in the standard Ricardian model. The absolute prices .p_x and p_y are determined by equations (2) and (13). Given this the other variables of interest - w, θ, and u – are determined by the following 3 equations.

$$h_i p_i - w = \frac{(\rho + \lambda)\delta}{m\theta^{\gamma-1}}; i = x, y \tag{14}$$

$$w = (1 - \beta)b + \beta(h_i p_i + \theta\delta);\ i = x, y \tag{15}$$

$$u = \frac{\lambda}{\lambda + m\theta^{\gamma}} \tag{16}$$

2.2 Comparative Statics

2.2.1 Changes in labor-market rigidity parameters

Note from (14)-(15) that

$$h_x p_x = b + \frac{\beta\theta\delta}{1-\beta} + \frac{(\rho + \lambda)\delta\theta^{1-\gamma}}{(1-\beta)m}$$

Therefore, for a given product price ratio, a higher b, β or δ leads to a lower θ and consequently a higher unemployment.

2.2.2 International Trade

Suppose this economy is now opened up to international trade. Also, suppose this economy has a comparative advantage in X and is a small open economy. Therefore, the autarky price of X is less than its world price. Using the A superscript to denote autarky and W superscript to denote world, we have $\left(\frac{p_x}{p_y}\right)^A = \frac{h_y}{h_x} < \left(\frac{p_x}{p_y}\right)^W$. After opening up to trade the relative price of X will rise to the world relative price and hence $h_x p_x > h_y p_y$. It was shown in (32) in the appendix that since workers do not have sectoral affiliation, Nash bargaining implies firms in both sectors have to pay the same wage to workers. This implies that $h_y p_y < w_x + \frac{(\rho+\lambda)\delta}{m\theta^{\gamma-1}}$, and hence sector Y is no longer viable in the economy, therefore, as in the standard Ricardian model, the economy will specialize in the production of X. What happens to the unemployment

after opening to trade? An increase in $\left(\frac{p_x}{p_y}\right)$ implies from (2) an increase in p_x . To see the impact of an increase in increase in p_x, note from (14)-(15) that

$$\frac{d\theta}{dp_x} = \frac{h_x}{\frac{\beta\delta}{1-\beta} + \frac{(1-\gamma)(\rho+\lambda)\delta\theta^{-\gamma}}{(1-\beta)m}} > 0 \tag{17}$$

Therefore, $\frac{dw}{dp_x} > 0$ and $\frac{du}{dp_x} < 0$. Starting from a positive tariff on good Y, trade liberalization has a similar effect. Even though there is complete specialization in this model, unemployment responds to tariff here. An increase in tariff leads to a reduction in the domestic price of X and therefore a reduction in w and an increase in the unemployment rate. This gives the following result:

Proposition 1 *Opening up to trade or a reduction in import tariffs in a Ricardian model with search generated unemployment leads to a decrease in unemployment and an increase in the real wage of workers.*

A similar result can be derived in a Ricardian model with a continuum of goods.

2.3 Extension: The Heckscher-Ohlin Model

Let us alter the above model to a two factor model and assume that X and Y are produced using labor and capital. Firms can rent capital anytime they decide to hire a worker and undertake production. For simplicity we assume that firms can return the capital to the owner upon the destruction of a job. Let us assume that X is more capital intensive than Y.Assuming that our economy is capital abundant relative to rest of the world, before the opening of trade in the intermediate goods the relative price of the capital intensive intermediate good X is lower here than in the rest of the world. Therefore, opening up to trade will imply an increase in the relative price of X in the home country. This implies an increase in p_x and a decrease in p_y. Thus the demand for capital goes up and that for labor goes down. We show in the appendix that this leads to a modified Stolper-Samuelson effect - the wage falls, the rental on capital rises and the unemployment rate rises. Results are reversed in a country that is labor-abundant as trade increases the implicit demand for the services of labor and reduces the implicit demand for the services of capital, the wage rate goes up and unemployment goes down. The results derived in the appendix are summarized below.

Proposition 2 *The impact of international trade (or an import tariff reduction) on a capital abundant country is a decrease in the wage rate and an increase in the rate of unemployment of labor, while in the case of a labor-abundant country the wage rate goes up and unemployment goes down as a result of trade liberalization.*

3 Data Description

To examine the relationship between trade protection and unemployment we collected data on multiple trade policy measures, unemployment rates and a variety of controls over the period 1990-2000.

3.1 Unemployment rate

Our dependent variable is the unemployment rate (as percentage of the labor force) from the International Finance Statistics. This variable is averaged over the decade of the 1990s to smooth out any business cycle fluctuations. We have data on 92 countries and the variable ranges from a low of 0.9% for Azerbaijan to a high of 55.6% for Ethiopia.

3.2 Trade Policies

Countries may resort to a variety of policy instruments in order to protect trade. These include: tariffs, quotas, non-automatic licensing, antidumping duties, countervailing duties, tariff rate quotas, export taxes, etc. Finding a single measure of trade protection that summarizes such a multiplicity of instruments is a task economists have long struggled with. Often the literature relies on outcome measures such as trade flows, e.g., $\left(\frac{X+M}{GDP}\right)$. The rationale is that this trade flow measure summarizes the impact of the underlying trade policy instruments. The problem is that they also vary with differences in tastes, macroeconomic shocks, geographic attributes, and other factors such as rainfall, which could be falsely attributed to trade policy. Single measures such an average tariff rate or a quota coverage ratio may only capture a fraction of the protectionist position of the country.

To account for these problems we use not simply the outcome measure $\left(\frac{X+M}{GDP}\right)$ mentioned above but also a variety of direct trade policy measures. Our first direct measure is the unweighted average external tariff data recently made available by the World Bank. A second measure is total import duties collected as a percentage of total imports from the World Development Indicators.[4] The problem with both variables is that trade policy is determined at the tariff line level and with more than 5000 tariff lines in the tariff schedule of developing and developed countries, summarizing all this information in one aggregate measure, through weighted or unweighted averages, may yield inaccurate or incomplete measures.[5] While neither the

[4] Note the import duty measure is a weighted average of import duties on each good where the weights are the share of imports of that good in total imports.

[5] For example, for the import duty measure, imports subject to high protection rates are likely to be small and therefore

average tariff measure nor the import duty measure is perfect, Rodrik and Rodriguez (2000) argue that these are the most direct measures of trade restrictions, that there is little evidence for the existence of serious biases in these indicators, and that they do a relatively decent job in ranking countries according to the restrictiveness of their trade regimes. We supplement the tariff measures with a quota coverage ratio, which measures the non-tariff barrier frequency. This variable is available for only 28 countries for a single year in the 1990s.

To tackle the shortcoming of these three direct measures of trade protection, Kee, Nicita and Olarreaga (2006) have attempted to combine the myriad trade policy instruments into an Overall Trade Restrictiveness Index (OTRI).[6] First they transform all the information on non-tariff barriers into a price equivalent by calculating an Ad-Valorem Equivalent of non-tariff barriers to make it directly comparable to a tariff. Next they use an aggregation procedure that answers the following question: What is the equivalent uniform tariff that would keep imports of a country at their observed levels? Based on imports, OTRI captures the trade distortions that each country imposes on its import bundle. Weights are an increasing function of import shares and elasticities of import demand at the tariff line level, which capture the importance that restrictions on these good would have on the overall restrictiveness.

Finally, it may be argued that attention needs to be paid not just to formal trade barriers but also to informal ones such as corruption in customs, and the time and costs of navigating administrative red tape. Anderson and Marcouiller (2002) show that these informal barriers to trade can be modeled as a tax equivalent on imports and that trade expands dramatically when supported by a legal system capable of enforcing commercial contracts and by transparent and impartial formulation and implementation of government economic policy. Similarly, the WTO strongly believes that agreements on trade facilitation will provide a significant boost to world trade. We use a measure from the Economic Freedom of the World Project, which itself is based on a survey question from the Global Competitiveness Report that asks respondents to rate hidden import barriers. Countries receive a rating from 0-10 with higher numbers indicating lower barriers. We combine this rating with a similar rating on formal trade barriers (tariffs and trade tax revenues) using a simple average and recode it as (10 − original rating) to obtain our GCR Measure of trade barriers. This variable is available for a single year in the 1990s.

will be attributed small weights in an import-weighted aggregation, which would underestimate the restrictiveness of those tariffs. Similarly, for the unweighted average tariff measure, very low tariffs on economically meaningless goods would create a downward bias in this measure of trade protection.

[6] Their methodology follows that developed by Anderson and Neary (1994).

3.3 Controls

Botero et al (2004) argue that every country in the world has established a complex system of laws and institutions intended to protect the interests of workers and to help assure a minimum standard of living for its population. These include employment laws that govern the individual employment contract, and collective or industrial relations laws that regulate the bargaining, adoption, and enforcement of collective agreements, the organization of trade unions, and the industrial action by workers and employers. We use their index of employment laws that captures the rigidity of alternative employment contracts, cost of increasing hours worked, cost of firing workers, and difficulty of dismissal procedures. The index measures both the legal and effective protection available to workers. Our second control is an index of labor union power again from Botero et al (2004). This variable measures protection afforded to and the power of labor unions. Controlling for labor union power and employment laws is critical since this could lead to an omitted variable bias. Countries with strong union power are likely to exhibit both higher levels of trade protection and higher rates of unemployment.[7] Both measures are available for a single year (1997). A third institutional control is the civil rights index from Freedom House. Measured on a scale of 1 to 7, with higher numbers signifying greater restrictions on civil liberties, this variable captures freedom of expression, the right to organize, the rule of law and personal autonomy.

Recessions and expansions, booms and busts are a standard feature of most economies in the world today. In recent years, the severity of such output volatility has accelerated as many countries have experienced significant economic crisis - examples include the Latin American debt crisis, the East Asian financial crisis, the collapse of output in the former Communist states of Eastern Europe. These countries all experienced high levels of unemployment in the post-crisis phase, some for long periods of time such as Indonesia and Russia. To control for this effect, we include a measure of output volatility. We follow Ramey and Ramey (1995) and measure output volatility as the standard deviation of the annual growth rate of GDP per capita for each of the countries in our sample over the period 1990-2000. We also included the Black Market Premium on the exchange rate to capture macroeconomic distortions. Finally, to allow for the unemployment rates to differ with the level of development, we control for the size of the economy using a measure of labor force and real GDP from World Development Indicators. The two controls together are tantamount to using GDP per worker as a control.

[7] We also used data on trade union membership as a percentage of labor force from Rama and Artecona (2002). This variable was not significant in any of the specifications.

Table 1 provides the summary statistics, a brief description of all our variables, and the various data sources used.

4 Trade Protection and Unemployment: Results

4.1 Ricardian Specification

Proposition 1 states that within a Ricardian model a higher tariff should lead to higher levels of unemployment. We evaluate this proposition by regressing the unemployment rate on each of our 6 measures of trade policy. Our objective is to examine whether, more protectionist countries experience higher rates of unemployment, and whether this relationship is robust to controlling for labor laws, macroeconomic distortions and country size, and to endogeneity concerns, and that the relationship holds both across countries and within countries over time.

Figures 1 and 2 show the correlation between unemployment rate and the unweighted tariff measure and OTRI protection measures. There is a clear positive relationship between unemployment and each of the two protection measures. The unconditional raw correlation is positive and significant at the 1% level of significance.

4.2 OLS Estimates

Tables 2 and 3 check the robustness of this relationship to alternate measures of protection and to the inclusion of controls. Table 2 shows that almost all our measures of trade protection, are positively and significantly associated with higher rates of unemployment.[8] The exception is the quota measure which has the right sign, but is not significant. The data on the quota measure is limited and the measure is also subject measurement error (see Harrigan, 1993).[9] All models as a whole are significant and our variables account for 4-24% of the cross-country variation in unemployment rates. Table 3 shows that this relationship is robust to controlling for country size, for labor union power, for employment laws, for macroeconomic distortions and fluctuations, and civil liberties. All models as a whole are significant and our variables account for 21-33% of

[8] Note that $\left(\frac{X+M}{GDP}\right)$ is a measure of openness so we expect a negative sign on this variable.

[9] It also does not distinguish between barriers that are highly restrictive and barriers that are not binding and have little effect. Nor is it possible to measure the impact of relaxing quotas on trade flows. The coverage ratio only suggests that barriers to trade exist, but cannot measure their effect.

the cross-country variation in unemployment rates. In terms of the controls, we find evidence that countries where labor unions have greater power also exhibit higher rates of unemployment. This is consistent with the outcome of our comparative static exercise with respect to our labor-market parameters in our theory section.

The numbers in table 3 imply that a 1% increase in the average tariff rate increases the unemployment rate by more than 0.3%. Across protection measures, the unweighted tariff rate has the strongest effect – a one standard deviation increase in leads to a 2.7% increase in the unemployment rate. The corresponding numbers for import duties, OTRI, GCR, and openness measures are 2.4%, 1.6%, 2.3% and -1.6%, respectively.

Finally, we experimented with a host of other controls to convince ourselves of the robustness of our results. These include per capita GDP in lieu of GDP, the growth rate of per capita GDP, the real interest rate, a deterioration in the terms of trade (between the decade of the 80s and 90s), a rigidity of employment index from the World Bank's "Doing Business" database, and a measure of domestic distortions from Alesina and Perotti (1996). The predicted effect of trade restrictions survives across these permutations.[10]

4.3 Instrumental Variable Estimates

There are two potential problems with the results reported in table 3: omitted variables and endogeneity of trade policies. It is plausible to argue that an omitted variable may affect both unemployment and trade policies, or that countries that exhibit more unemployment face populist pressures (domestically) to raise trade barriers (reverse causality). Indeed, this version of the reverse causality argument does generate a positive (conditional) correlation between unemployment and protection. We address these concerns by using instrumental variables.[11] Incidentally, instrumental variables will help us also deal with measurement error problems, which might be present in many of the protectionist measures, especially the quota measure. The presence of measurement error creates an attenuation bias, i.e., it works against finding a significant relationship between protectionism and unemployment. If the instruments help us deal with the measurement error we should see an increase in the absolute value of the coefficient. If, on the other hand, endogeneity has an important impact on our OLS estimates, then we should see a decrease in the absolute value of the

[10] These results are available upon request.

[11] A second way to deal with reverse causality is to use lagged values of the trade protection measures. When we regress unemployment in the 1990s on trade policies in the 1980s all the results on the unweighted tariff, import duties and $\left(\frac{X+M}{GDP}\right)$ are confirmed. While the coefficients are positive and significant for each of the measures, the magnitude of the effect declines, as compared to those in table 3.

coefficient on trade policy.

Finding good instruments for trade policy is not a simple task. The instruments for trade policies we propose are the number of years that a country has remained outside of the GATT/WTO since its inception in 1948, a dummy for developing countries, and the proportion of tax revenues that each country obtains from taxes on domestic activities in the 1980s. Rose (2004) finds that nearly all countries liberalized after acceding to GATT, but not immediately. The average lag between GATT accession and liberalization of the trade regime is almost a decade. So the longer a country stays outside the GATT the larger will be its degree of protectionism. Rodrik (1995) argues that developed countries have advanced tax structures and are less likely to rely on trade taxes as a source of revenue. The high administrative cost of raising revenue from domestic taxes is an important reason for the use of tariffs in the early stages of development (Limão and Panagariya, 2007). To capture this revenue motive for protection, we therefore include a developing country dummy (equal to zero for High Income countries and one for Low and Middle Income countries)[12] along with the share of tax revenues from domestic sources in overall tax revenues for the decade of the 80s (lagged value of dependence on domestic tax revenues). The developing country dummy also captures the fact that developing country members of the GATT get concessions with respect to showing reciprocity to trade reforms by other member countries.[13]

For the outcome based measure of trade policy $\left(\frac{X+M}{GDP}\right)$, we use a distinct set of instruments. The instruments we use are those suggested by Frankel and Romer (1999) and Rose (2004). Frankel and Romer regress bilateral trade flows (as a share of a country's GDP) on measures of country mass, distance between the trade partners, and a few other geographical variables, and then constructing a predicted aggregate trade share for each country on the basis of the coefficients estimated. This constructed trade share is then used as an instrument for actual trade shares. Rose (2004) calculates a remoteness index as a weighted average of a country's trading partners' GDP where the weights are distance to the trading partners. This is a multilateral analogue to geographic distance and affects trade volumes. Our first stage regressions support these conjectures across all measures and yields a partial R^2 of between 30-63% (see second last row of table

[12] Here we follow the World Bank's classification of countries into various income groups.

[13] The World Values Survey reports the proportion of respondents in each country who feel that imports should be limited. If governments respond to populist pressures this should also be a valid instrument for trade policies. The coefficient on trade policies remain positive and significant if we use this measure as an additional instrument. However, table 4 does not include this variable as an instrument, since it is available for only a small set of countries. All first stage regressions are available from the authors on request.

4).

Table 4 shows the IV results and we see that the coefficient on all protectionist measures, apart from OTRI, remains positive and significant, while that on $\left(\frac{X+M}{GDP}\right)$ remains negative and significant. Even in the case of OTRI, it is marginally significant at around the 12 percent level and has the correct sign. Moreover, now the quota variable is significant as well. However, the number of observations for both the OTRI and the quota measure is small, so that inferences for these measures are less likely to be valid. For a majority of the measures of trade policies, we observe only a marginal decline in the absolute value of the estimates (when we restrict our OLS estimates to the same set of countries as those in table 4.)

Next we provide purely economic arguments as to why the instruments we use are good instruments. None of these variables should be correlated with unemployment directly in addition to being related to it through our right-hand side variables, i.e., the instrumental variables should not be correlated with the error terms of our regressions. For example, the number of years outside the GATT/WTO will affect unemployment only through the tariff level. Also this variable is not expected to be endogenous to unemployment. Whether a country is developed or developing should not be related to unemployment directly in either direction, especially in addition to the relationship of GDP and population with unemployment. Also, the dependence of a country on domestic sources of revenues should not have any additional relationship with unemployment above and beyond the one through tariffs and beyond what is captured by a country's income level. The gravity and additional geographical variables used to instrument openness are completely exogenous to our model and should not be correlated with unemployment above and beyond their correlation through our right-hand side variables.

Finally, we provide some econometric justifications for the validity of our instruments. Hansen-Sargan tests (the p-value of this is reported on the last row of table 4) fail to reject the null hypothesis of overidentifying restrictions confirming the validity of our instruments. Moreover, for each of the estimates, the Anderson-Rubin test and the Stock-Wright (2000) $S-$statistic fails to reject the null hypothesis that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero, and, that the overidentifying restrictions are valid. Both tests are robust to the presence of weak instruments.

4.4 Estimation with Panel Data

Our next objective is to examine how shifts in the degree of protection within a country affects the unemployment rate. This should provide strong evidence on the link between the two. This task is non-trivial

given that unemployment rates are subject to business cycle fluctuations and data on protection measures is not available over long periods of time. Moreover, trade policies tend to be very stable over time. Despite this difficulty in capturing the time-variation in the trade protection data series, we attempt to provide at least a partial view of the robustness of our results using within-country variation.

We create a panel of 10-year averaged data starting in 1980 which results in two nonoverlapping periods. Data is available over time for only three of our trade policy measures - the unweighted tariff, import duties and $\left(\frac{X+M}{GDP}\right)$. OTRI, GCR and quota are available only for a single year as is data on employment laws and labor union power. In table 5 we present pooled OLS results with these three measures of trade protection. Columns 1-3 show that across measure of trade policy a rise in protectionism is associated with a rise in unemployment rates. We also find that country with more rigid employment laws also exhibit higher rates of unemployment. To address the reverse causality concern, that countries with higher levels of unemployment are more likely to be protectionist, columns 4-6 use the trade policy measure from the previous decade. Our results again show that countries that were more protectionist in the past exhibit higher rates of unemployment in subsequent years.[14]

A fixed effects regression for this two period panel does not indicate a significant effect of any of the trade policy measures on unemployment. But such a result could also be due to the fact that there may simply not be enough within-country variation in the variables of interest. To capture this variation, we next use a yearly panel and present results with country specific fixed effects. The fixed effects dramatically reduces the scope for omitted variables and mis-measurement that may plague our estimates, as the intercepts take out all variation that is time-invariant and specific to a particular country. Preliminary analyses also indicate the presence of serial correlation and that the residuals follow a first order autoregressive process[15] Accordingly, we use the fixed effects estimation procedure from Baltagi and Wu (1999) with AR(1) disturbances for the error term.

Columns 1-6 in table 6 presents these results. [16] The first three columns use contemporaneous trade policy

[14] We also examined how this relationship changes when we include lagged unemployment rates as regressors. While this results in biased estimates, we find that lagged unemployment enters with a positive and significant sign, and that the import duty and the trade flows measure significantly affect the unemployment rate in the predicted direction.

[15] We use the Baltagi-Wu statistic to check for serial correlation. This statistic is equivalent to the Durbin-Watson statistic and is the relevant statistic for a test of serial correlation in the case of an unbalanced panel. We obtain a value of the Baltagi-Wu statistic far below 2 which indicates that correction for serial correlation is necessary.

[16] We do not have sufficient observations over time for the Black Market Premium and for Output Volatility. The latter by construction is mainly cross-sectional since we calculate the volatility of output over time for each country.

measures while the second three columns lag each measure by a year. We see that countries that initiated a decline in their overall unweighted tariffs experienced a fall in their unemployment rates. Similarly, those countries that became more open in terms of trade volumes (our outcome measure of trade orientation) also experienced a significant decline in unemployment rates. We fail to find evidence for this relationship for the import duty measure. Our numbers imply that a 1% decline in the unweighted tariff reduces unemployment rate by 0.06%, while a 1% increase in trade flows (lagged by a year) reduces unemployment by 0.11%.

4.5 Hecksher-Ohlin specification

As Proposition 2 states, within a Hecksher-Ohlin world, an increase in trade restrictions will raise unemployment in labor abundant countries and reduce them in capital-abundant countries. As a first pass, we classified each country as capital or labor abundant according to whether its capital-labor ratio in 1990 was above or below the median capital-labor ratio. Next, we regressed unemployment on the trade protection measures separately for the capital-abundant sample and for the labor-abundant sample. For both samples, and for each of the direct measures of trade restrictions, we obtain a positive coefficient on trade protection. However, subdividing the sample on the basis of the median is somewhat ad hoc. A priori, we do not know the critical level of (K/L) where the relationship between trade restrictions and unemployment changes sign. The following specification takes care of this problem by allowing the data to tell us the exact location of this turning point:

$$Unemployment_i = \alpha_0 + \alpha_1 TR_i + \alpha_2 TR_i \times (K/L)_i + \alpha_3 (K/L)_i + \mathbf{X}_i \boldsymbol{\beta} + \epsilon_i$$

where TR_i is the extent of trade restrictions in country i, $Unemployment_i$ is the measure of unemployment, $(K/L)_i$ is the capital-labor ratio for the year 1990 and $\mathbf{X}_i$ is a row vector of control variables. Taking the partial derivative of $Unempolyment_i$ with respect to TR_i, we have

$$\frac{\partial Unempolyment_i}{\partial (TR)_i} = \alpha_1 + \alpha_2 (K/L)_i$$

The prediction of the Proposition 2 is that $\alpha_1 > 0$ and $\alpha_2 < 0$ such that $\alpha_1 + \alpha_2 (K/L)_i \gtrless 0$ as $(K/L)_i \lessgtr (K/L)^*$ where $(K/L)^* = -\alpha_1/\alpha_2$ is the turning point capital-labor ratio determined endogenously from the data, given our estimating equation. Another requirement for the prediction to hold is that $(K/L)^*$ should lie within the range of values of (K/L) in the dataset, i.e., $(K/L)^{MIN} < (K/L)^* < (K/L)^{MAX}$.

Table 6 presents the estimates with this specification. The last two rows count the number of countries that are below (above) the critical capital labor ratio and have a positive (negative) relation between trade

restrictions and unemployment. As table 6, shows we have almost no support for the Hecksher-Ohlin proposition. For the tariff measure α_2 is positive rather than negative. For OTRI, GCR, Import Duty and Quota while the signs are correct, neither α_1 nor α_2 are significant. Moreover, even ignoring the insignificance of the coefficients, our estimates indicate that there is not a single country with a negative relationship between trade restrictions and unemployment for tariffs, import duties and GCR measures. For OTRI and quota, the numbers are 7 and 3 respectively. Finally, for the $\left(\frac{X+M}{GDP}\right)$ measure 42 out of 48 countries exhibit a negative relation between trade volumes and openness.[17]

5 Conclusions

In this paper, we present two alternative models, namely Ricardian and Heckscher-Ohlin, of trade and unemployment, in which unemployment is generated through a search mechanism. Our results provide strong evidence for Proposition 1 that comes out of our Ricardian model: protectionism increases unemployment rates both across countries and within countries over time. This relationship is robust to controlling for employment laws, trade union power, civil liberties, country and labor force size. Resolving endogeneity concerns through the use of instrumental variables estimation leaves our results qualitatively unaffected. We also obtain some evidence that Proposition 1 is valid within countries over time as well. On the other hand, there is almost no evidence for the Hecksher-Ohlin proposition which states that the impact of trade policies on unemployment is conditional on whether the country is labor abundant or capital abundant. Instead, using the Hecksher-Ohlin specification indicates that for almost all countries protectionist policies lead to higher levels of unemployment, validating the Ricardian specification instead.

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A Appendix:

A.1 Determination of wage in the Ricardian search model

The equations (10) and (11) imply the following

$$U = \frac{b + m\theta^{\gamma} W^{e}}{\rho + \lambda} \tag{18}$$

$$W_i - U = \frac{w_i}{\rho + \lambda} - \frac{\rho}{\rho + \lambda} U = \frac{w_i}{\rho + \lambda} - \frac{\rho}{\rho + \lambda} \left(\frac{b + m\theta^{\gamma} W^{e}}{\rho + \lambda} \right) \tag{19}$$

Nash bargaining implies that w_i is given by

$$w_i = \arg\max (W_i - U)^{\beta} (J_i - V_i)^{1-\beta} \tag{20}$$

where $0 \leq \beta \leq 1$ captures the bargaining power of workers. The first order condition is given by

$$W_i - U = \frac{\beta}{1-\beta}(J_i - V_i) \tag{21}$$

The above expression relates the worker surplus from the match to the entrepreneur's surplus. Substituting into equation (21) from equations (19) and (8) gives a solution for the wage:

$$w_i = \frac{\beta}{1-\beta}\frac{(\rho+\lambda)\delta}{m\theta^{\gamma-1}} + \frac{\rho(b + m\theta^{\gamma}W^e)}{\rho+\lambda} \tag{22}$$

From the above expression it is clear that $w_x = w_y$, that is, the wage is the same in both sectors. This also implies that $W_x = W_y = W^e$, which in turn implies from (10) and (11)

$$W_i - U = \frac{w-b}{\rho+\lambda+m\theta^{\gamma}} \tag{23}$$

Using the above expression and (8) in (21) we get the following convenient form for wage which is reported in the text.

$$w = w_x = w_y = (1-\beta)b + \beta(h_i p_i + \theta\delta) \tag{24}$$

A.2 Heckscher-Ohlin Model with unemployment

Instead of a single factor of production, suppose there are two factors of production: labor and capital. Once a match is created, a firm rents capital and undertakes production. For simplicity, assume that firms can return the capital to the owner upon the destruction of a job. The production functions in the two intermediate goods sectors, once the matches are formed, are given by

$$x = k_x^{\phi_x}; y = k_y^{\phi_y}; 0 < \phi_i < 1$$

k_i is the capital per worker in sector- i. If L_i is the total number of workers employed in sector i, then the aggregate production in each sector is given by

$$X = L_x k_x^{\phi_x}; Y = L_y k_y^{\phi_y}$$

The total amount of capital employed in sector i is $K_i = L_i k_i$. Further it is assumed that $\phi_x > \phi_y$, which guarantees that X is more capital intensive than Y. The wage in sector-i is denoted by w_i and the rental of capital by r.

The description of the labor market is exactly the same as in the Ricardian model described in the text. Therefore, the economywide unemployment rate is

$$u = \frac{\lambda}{\lambda + m\theta^{\gamma}} \tag{25}$$

Therefore, if we know θ we can find the rate of unemployment in the economy. Next we look at the determination of θ. The asset value of a vacant job, V_i, is characaterized by the following Bellman equation

$$\rho V_i = -\delta + m\theta^{\gamma-1}(J_i - V_i) \tag{26}$$

Again free entry implies $V_i = 0$, which implies the following from (26)

$$J_i = \frac{\delta}{m\theta^{\gamma-1}}; \text{ for } i = X, Y \tag{27}$$

The value from an occupied job, J_i, satisfies the following Bellman equation

$$\rho J_i = p_i k_i^{\phi_i} - rk_i - w_i - \lambda J_i \tag{28}$$

Making use of (28) to substitute out J_i from equation (27) we get the following equation

$$p_i k_i^{\phi_i} - rk_i - w_i = \frac{(\rho + \lambda)\delta}{m\theta^{\gamma-1}} \tag{29}$$

(29) is another way to write the zero profit condition from a vacant job mentioned earlier.

The optimal choice of k_i is determined by maximizing J_i in equation (28) taking the wage rate w and the rental r as given. This leads to the following condition governing the optimal choice of k_i

$$p_i \phi_i k_i^{\phi_i - 1} = r \tag{30}$$

On the worker side, everything is exactly the same as in the text. Therefore, Nash bargaining implies the following equation for wages.

$$W_i - U = \frac{\beta}{1-\beta}(J_i - V_i) \tag{31}$$

Using the same steps as discussed in the text, it can be verified that the wages must be the same in the two sectors: $w_x = w_y$. The equation determining wages can be written in a convenient form as follows.

$$w_i = (1-\beta)b + \beta(p_i k_i^{\phi_i} - rk_i + \delta\theta) \tag{32}$$

Since wages are the same in the two sectors, from (29) we get

$$p_x k_x^{\phi x} - rk_x = p_y k_y^{\phi_y} - rk_y \tag{33}$$

The total capital stock of the economy is given by K. The market clearing condition in the factor market implies the following.

$$\varepsilon k_x + (1-\varepsilon)k_y = \frac{K}{(1-u)L}$$

where $\varepsilon = \frac{L_x}{(1-u)L}$ is the share of sector X in the total labor force, and L_x is the amount of labor employed in sector X in steady state.

The model is solved as follows. Start with any $\frac{p_x}{p_y}$. The absolute prices p_x and p_y corresponding to this $\frac{p_x}{p_y}$ are obtained from (2). For this pair of prices p_x and p_y the following 7 variables-w, r, θ, u, ε, k_x, and k_y can be found from the equations derived above, which are gathered below.

$$p_x k_x^{\phi_x} - rk_x - w = \frac{(\rho+\lambda)\,\delta}{m\theta^{\gamma-1}} \tag{34}$$

$$p_y k_y^{\phi_y} - rk_y - w = \frac{(\rho+\lambda)\,\delta}{m\theta^{\gamma-1}} \tag{35}$$

$$w = (1-\beta)b + \beta(p_x k_x^{\phi_x} - rk_x + \delta\theta) \tag{36}$$

$$w = (1-\beta)b + \beta(p_y k_y^{\phi_y} - rk_y + \delta\theta) \tag{37}$$

$$p_x \phi_x k_x^{\phi_x - 1} = r \tag{38}$$

$$p_y \phi_y k_y^{\phi_y - 1} = r \tag{39}$$

$$u = \frac{\lambda}{\lambda + m\theta^{\gamma}} \tag{40}$$

$$\varepsilon k_x + (1-\varepsilon)k_y = \frac{K}{(1-u)L} \tag{41}$$

In (34)-(37) there are 3 independent equations, and therefore, 7 independent equations in (34)-(41) determine the 7 endogenous variables of interest: w, r, θ, u, ε, k_x, and k_y. The relative supply of the two intermediate goods X and Y at these prices can be written as

$$\frac{X^s}{Y^s} = \frac{\varepsilon k_x^{\phi_x}}{(1-\varepsilon)k_y^{\phi_y}} \tag{42}$$

Next we show that the relative supply of good X is increasing in the relative price $\frac{p_x}{p_y}$. To show this increase the relative price slightly from the level chosen earlier. From (2) this implies an increase in p_x and a decrease in p_y. Below we show that this implies an increase in $\frac{X^s}{Y^s}$. From (34), (35), (38) and (39) we get

$$k_x = \left(\frac{\phi_y}{\phi_x}\right)^{\frac{\phi_y}{\phi_x-\phi_y}} \left(\frac{1-\phi_x}{1-\phi_y}\right)^{\frac{\phi_y-1}{\phi_x-\phi_y}} \left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y-\phi_x}} \tag{43}$$

$$k_y = \left(\frac{\phi_y}{\phi_x}\right)^{\frac{\phi_x}{\phi_x-\phi_y}} \left(\frac{1-\phi_x}{1-\phi_y}\right)^{\frac{\phi_x-1}{\phi_x-\phi_y}} \left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y-\phi_x}} \tag{44}$$

Therefore, an increase in $\frac{p_x}{p_y}$ decreases both k_x and k_y. From (38) this implies an increase in r. Further, since $p_y k_y^{\phi_y} - rk_y = (1-\phi_y)p_y k_y^{\phi_y}$ and both p_y and k_y decrease, $p_y k_y^{\phi_y} - rk_y$ decreases as well. From (33) this implies a decrease in $p_x k_x^{\phi x} - rk_x$ as well. Now, it can be easily shown that this leads to a decrease in w, θ, and consequently an increase in u.

Next, from equation (41) we have

$$(k_x - k_y)d\varepsilon = d(\frac{K}{(1-u)L}) - \varepsilon dk_x - (1-\varepsilon)dk_y \tag{45}$$

Therefore, an increase in $p \equiv \frac{p_x}{p_y}$ implies an unambiguous increase in ε. With a little bit of algebra it can be verified that (45) implies $\frac{d\log\varepsilon}{d\log p} > 1$.. Since (43) and (44) imply $\phi_x \frac{d\log k_x}{d\log p} - \phi_y \frac{d\log k_y}{d\log p} = -1$, it follows from (42) that $\frac{X^s}{Y^s}$ is unambiguously increasing in p. From (3) we know that $\frac{X^d}{Y^d}$ is decreasing in p. Therefore, the autarky equilibrium is obtained by the intersection of the relative demand and the relative supply curves.

What happens when $\frac{K}{L}$ increases? Holding the relative price p constant, the only impact of an increase in $\frac{K}{L}$ is to increase ε, which in turn implies a rightward shift in the relative supply curve. Therefore, the equilibrium relative price p is lower the larger the $\frac{K}{L}$. Therefore, $\frac{K}{L}$ becomes a source of comparative advantage as in the standard Heckscher-Ohlin model.

A.3 Impact of Trade

Assuming that our economy is capital abundant relative to rest of the world, before the opening of trade in the intermediate goods, the comparative statics discussed earlier implies that the relative price of the capital intensive intermediate good X is lower in our economy. Therefore, opening up to trade in the intermediate goods will imply an increase in the relative price of X. So, the impact of trade in intermediate goods is captured by an increase in the relative price $\frac{p_x}{p_y}$. This implies an increase in p_x and a decrease in p_y. As discussed earlier, this leads to the following changes: $dw < 0, dr > 0$, and $d\theta < 0, du > 0$ The opposite happens to a country having a comparative advantage in the labor intensive good. The results are summarized in proposition 2 in the text.

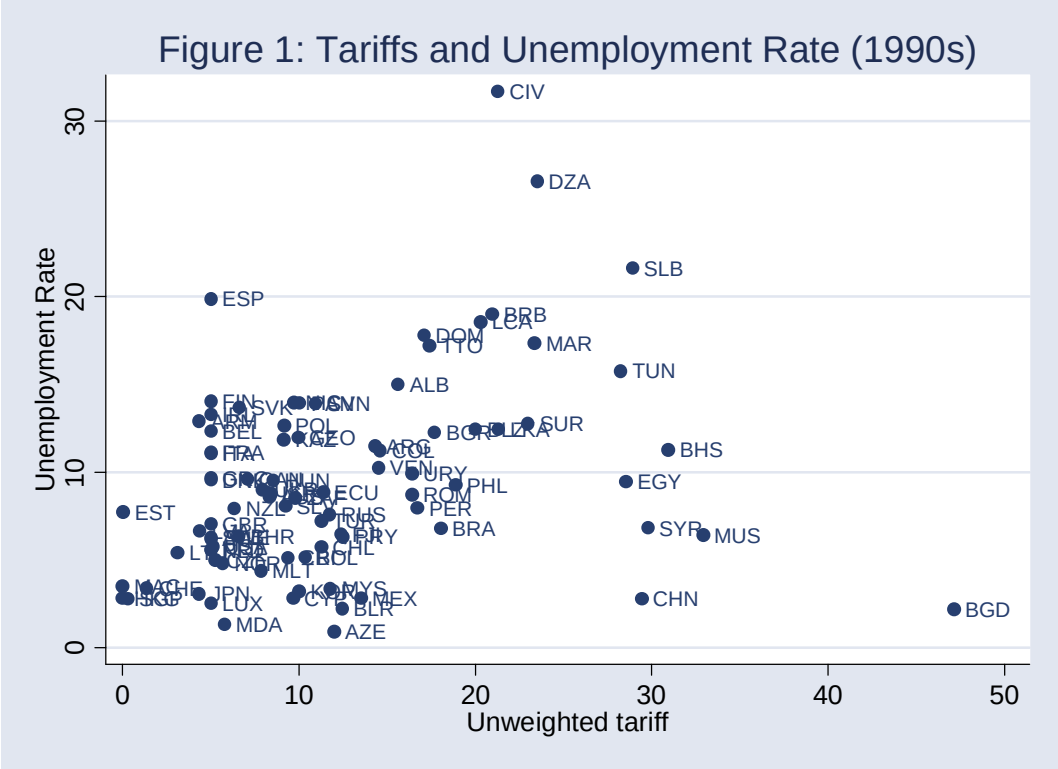
Figure 1: Tariffs and Unemployment Rate (1990s)
Unemployment Rate
Unweighted tariff
0
10
20
30
40
50
CIV
DZA
SLB
ESP
BRB
LCA
DOM
TTO
MAR
TUN
ALB
SUR
BHS
EGY
EST
SYR
MUS
BRA
CHN
BGD
LUX
MDA
AZE

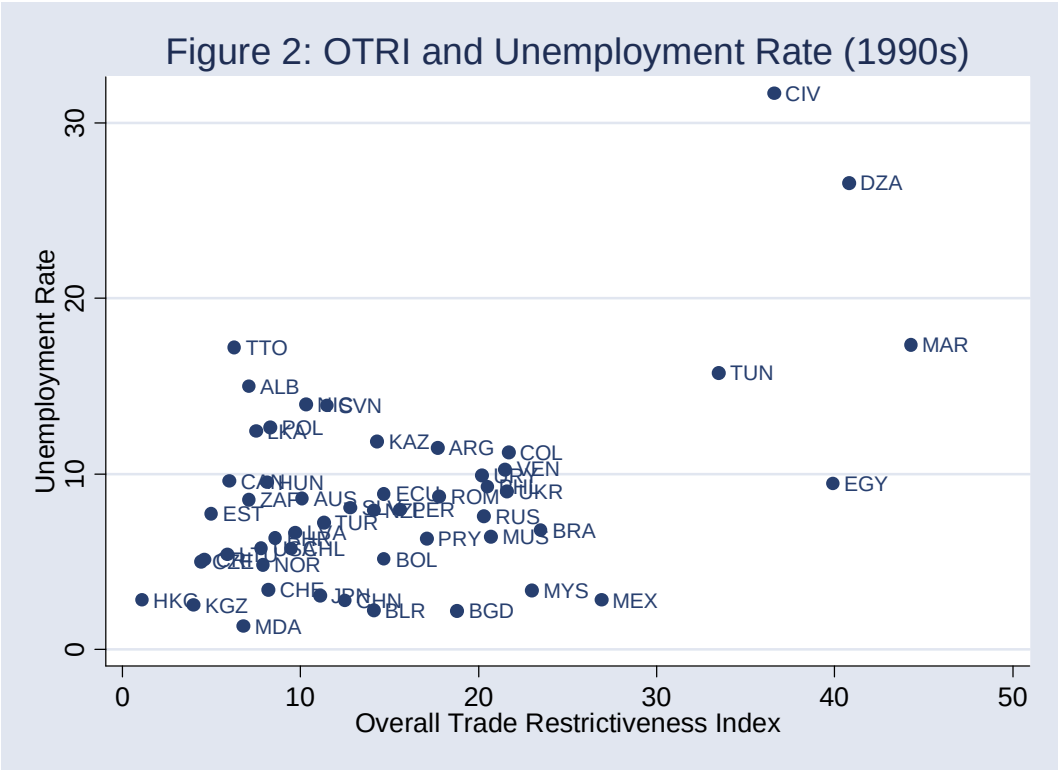
Figure 2: OTRI and Unemployment Rate (1990s)
Unemployment Rate
Overall Trade Restrictiveness Index
0
10
20
30
40
50
CIV
DZA
MAR
TTO
TUN
ALB
KAZ
ARG
COL
EGY
EST
RUS
PRY
MUS
BRA
BOL
HKG
KGZ
MDA
MYS
MEX
BLR
BGD

Table 1: Data Description and Summary Statistics

Variable	*N*	Mean	Description
Unemployment Rate	90	9.87	Unemployment as percentage of the labor force. Source: International Finance Statistics, 2007
Unweighted Tariff	175	15.13	Unweighted average tariff. Source: World Bank. Averaged for the 1990s
Overall Trade Restrictiveness Index	89	16.13	Overall Trade Restrictiveness Index (includes tariffs and NTBs). Based on imports, it captures the trade distortions that each country imposes on its import bundle. Source: Kee, Nicita and Olarreaga (2006)
GCR Trade Barriers	115	3.19	Average of ratings for taxes on international trade, mean tariff rates and hidden import barriers. Ratings range from 0 to 10 are recoded so higher numbers reflect higher trade barriers. Source Economic Freedom of the World Project, Fraser Institute.
Import Duty	131	8.78	Import Duties as a percentage of total imports. Source: WDI, 2007. Averaged for the 1990s
Quota	28	14.71	Quota coverage ratio. 1989-94. Source: World Bank.
Openness (X+M/GDP)	182	84.21	Total trade as a ratio of GDP in constant prices. Source: Penn World Table 6.2. Averaged for the 1990s.
Employment laws index	83	0.43	Measures the protection of labor and employment laws as the average of: (1) Alternative employment contracts; (2) Cost of increasing hours worked; (3) Cost of firing workers; and (4) Dismissal procedures. Source: Botero et al (2004). Available for 1997.
Labor Union Power	83	0.49	Measures statutory protection and power of unions as the average of the following seven dummy variables which equal one: (1) if employees have the right to unionize; (2) if employees have the right to collective bargaining; (3) if employees have the legal duty to bargain with unions; (4) if collective contracts are extended to third parties by law; (5) if the law allows closed shops; (6) if workers, or unions, or both have a right to appoint members to the Boards of Directors; and (7) if workers' councils are mandated by law. Source: Botero et al (2004). Available for 1997.
GDP	184	16.84	Real GDP at PPP in constant 2000 dollars (logged). Source: WDI, 2007. Averaged for the 1990s
Labor Force	201	15.08	Total labor force (logged). Source: WDI, 2007. Averaged for the 1990s
Civil Liberties	186	3.67	Measures Freedom of Expression and Belief, Associational and Organizational Right, Rule of Law, and Personal Autonomy and Individual Rights. From 1-7 with higher numbers representing less freedom. Source: Freedom House. Averaged for the 1990s
Output Volatility	182	6.17	Standard deviation of growth rate in 1990s of real per capita GDP (logged). Calculated from PWT, 6.2
Black Market Premium	121	4.99	Percentage difference between official and black market exchange rate. Source Economic Freedom of the World Project, Fraser Institute.
Capital-labor ratio	115	9.24	Log of capital labor ratio for the year 1990. Source: Easterly and Levine (2001) who use aggregate investment and depreciation data to construct capital per worker series for each country.
Developing country dummy	208	0.73	Equals zero if country is classified as High Income in 1990 by the World Bank and zero otherwise.
No. of years outside GATT/WTO	185	21.69	Number of years the country stayed outside GATT/WTO since 1948 or since independence. Source: www.wto.org
Domestic tax revenue share in total tax revenues	93	0.8	Proportion of tax revenues from taxes on domestic activities in the 1980s. Source: International Financial Statistics

Table 2: The Effect of Trade Policies on the Unemployment Rate (Ricardian specification)

	(1)	(2)	(3)	(4)	(5)	(6)
Unweighted Tariff	0.287*					
	(0.148)					
Overall Trade Restrictiveness Index		0.308***				
		(0.102)				
GCR trade barriers			1.124**			
			(0.501)			
Import Duty				0.597***		
				(0.218)		
Quota					0.058	
					(0.048)	
Openness (X+M/GDP)						-0.027**
						(0.014)
Observations	87	53	77	82	19	89
R-squared	0.12	0.13	0.15	0.24	0.10	0.04

All regressions include a constant (not reported). Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
All variables are averaged over the 1990s, except OTRI, GCR trade barriers and Quota which are available for a single year.

Table 3: The Effect of Trade Policies on the Unemployment Rate
(Ricardian specification; with controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Unweighted Tariff	0.388***					
	(0.091)					
Overall Trade Restrictiveness Index		0.169*				
		(0.097)				
GCR trade barriers			1.537***			
			(0.544)			
Import Duty				0.517***		
				(0.103)		
Quota					0.074	
					(0.055)	
Openness (X+M/GDP)						-0.032**
						(0.013)
Employment laws index	-0.602	0.893	-1.496	-2.530	1.112	-2.514
	(2.652)	(2.893)	(2.703)	(2.617)	(6.318)	(2.906)
Labor Union Power	5.208*	0.288	4.673	7.507***	8.273	5.836*
	(2.735)	(3.718)	(2.895)	(2.759)	(8.974)	(2.946)
GDP	1.110	-0.707	0.590	0.976	-4.246	0.686
	(0.977)	(1.688)	(0.999)	(1.054)	(2.446)	(1.328)
Labor Force	-1.953*	-0.025	-1.625	-1.463	2.524	-2.034
	(1.027)	(1.938)	(1.026)	(1.087)	(2.198)	(1.416)
Civil Liberties	-0.826*	-0.318	-0.467	-0.468	0.065	0.773
	(0.436)	(1.012)	(0.514)	(0.486)	(0.747)	(0.590)
Output Volatility	0.398	0.362	0.034	0.347	1.271	0.350
	(0.292)	(0.333)	(0.314)	(0.271)	(0.941)	(0.312)
Black Market Premium	-0.008	0.017	0.006	-0.022	0.678	-0.016
	(0.029)	(0.035)	(0.026)	(0.033)	(0.477)	(0.033)
Observations	55	35	55	54	17	55
R-squared	0.31	0.32	0.30	0.35	0.48	0.23

All regressions include a constant (not reported). Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
All variables are averaged over the 1990s, except OTRI, GCR trade barriers and Quota which are available for a single year. Employment laws index and labor union power are available only for 1997.

Table 4: Instrumental Variables Results for the Effect of Trade Policies on Unemployment Rate (Ricardian specification; with controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Unweighted Tariff	0.299*					
	(0.164)					
Overall Trade Restrictiveness Index		0.188				
		(0.120)				
GCR trade barriers			1.306**			
			(0.625)			
Import Duty				0.364**		
				(0.179)		
Quota					0.084*	
					(0.049)	
Openness Indicator (X+M/GDP)						-0.039*
						(0.020)
Employment laws index	-2.007	0.162	-3.159	-3.206	1.396	-4.083
	(2.806)	(3.736)	(2.644)	(2.596)	(5.158)	(3.318)
Labor Union Power	7.571**	1.699	8.490**	8.701***	8.206	5.974**
	(3.539)	(4.972)	(3.348)	(3.376)	(6.097)	(2.701)
GDP	0.957	-0.653	0.384	0.511	-3.834**	-0.385
	(1.585)	(1.444)	(1.341)	(1.473)	(1.686)	(0.899)
Labor Force	-1.508	0.141	-0.978	-1.064	1.950	-0.884
	(1.771)	(1.504)	(1.499)	(1.643)	(1.687)	(0.984)
Civil Liberties	0.319	0.548	0.346	0.257	1.307**	0.421
	(0.376)	(0.383)	(0.390)	(0.381)	(0.655)	(0.335)
Output Volatility	-0.025	-0.005	-0.029	-0.026	0.772**	-0.014
	(0.039)	(0.055)	(0.039)	(0.038)	(0.362)	(0.032)
Black Market Premium	8.035	12.930	10.616	11.068	37.001***	30.545***
	(10.343)	(13.340)	(9.714)	(9.920)	(11.145)	(10.916)
Observations	44	25	44	43	16	56
First stage partial R-squared	0.34	0.39	0.49	0.47	0.47	0.38
OID test p-value	0.71	0.4	0.83	0.85	0.25	0.21

All regressions include a constant (not reported). Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
All variables are averaged over the 1990s, except OTRI, TRI and Quota which are available for a single year. Employment laws index and labor union power are available only for 1997. Instruments for trade policies: Dummy for developing countries; share of tax revenues from domestic sources and number of years the country stayed outside GATT since inception in 1948. Instruments for *(X+M/GDP)*: Frankel-Romer instruments; remoteness index from Rose (2004). The last two rows report a partial R^2 from the first stage regressions and the *p-value* from a test of overidentification.

Table 5: Panel Data Results on the Effect of Trade Policies on Unemployment Rate (Ricardian Specification; Pooled OLS)

	(1)	(2)	(3)	(4)	(5)	(6)
Unweighted Tariff	0.132**			0.123*		
	(0.062)			(0.072)		
Import Duty		0.362***			0.225**	
		(0.073)			(0.084)	
Openness (X+M/GDP)			-0.020*			-0.036*
			(0.011)			(0.019)
Employment laws index	5.477**	7.859***	5.888**	6.296*	9.730***	8.845**
	(2.424)	(2.263)	(2.497)	(3.716)	(3.429)	(3.402)
Labor Union Power	-0.794	-2.936	-2.286	-1.251	-4.477	-3.986
	(2.166)	(1.953)	(2.205)	(3.113)	(2.727)	(2.780)
GDP	0.431	0.173	0.066	0.651	-0.647	-0.148
	(1.048)	(0.878)	(0.947)	(1.328)	(1.262)	(1.328)
Labor Force	-1.126	-0.445	-1.014	-1.351	0.359	-1.186
	(1.090)	(0.857)	(0.986)	(1.437)	(1.340)	(1.367)
Civil Liberties	0.119	0.443	-0.387	0.218	0.656	-0.520
	(0.426)	(0.357)	(0.469)	(0.613)	(0.588)	(0.635)
Output Volatility	0.175	0.259	0.203	0.300	0.573	0.474
	(0.238)	(0.216)	(0.231)	(0.443)	(0.399)	(0.356)
Black Market Premium	-0.105**	-0.134***	-0.065**	-0.031	-0.028	-0.036
	(0.040)	(0.031)	(0.025)	(0.040)	(0.036)	(0.037)
Observations	94	93	95	46	47	48
R-squared	0.15	0.25	0.16	0.16	0.28	0.28

All regressions include a constant (not reported). Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Columns 1-3 show pooled OLS results with contemporaneous trade policy measures.
Columns 4-6 show OLS results with lagged trade policy measures.
Two time periods are included: 1980-1989 and 1990-2000. All variables are averaged by each decade (1980-1989; 1990-2000).

Table 6: Panel Data Results on the Effect of Trade Policies on Unemployment Rate (Ricardian Specification; Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Unweighted Tariff	0.063***			0.034*		
	(0.020)			(0.019)		
Import Duty		-0.017			-0.017	
		(0.057)			(0.054)	
Openness (X+M/GDP)			-0.008			-0.011**
			(0.005)			(0.005)
GDP	0.832	-3.705***	-2.937***	0.611	-4.171***	-2.973***
	(0.580)	(1.022)	(0.781)	(0.573)	(1.044)	(0.799)
Labor Force	-0.116	24.683***	18.537***	0.276	29.377***	18.630***
	(1.370)	(5.930)	(4.514)	(1.293)	(6.246)	(4.523)
Civil Liberties	1.356***	-0.020	0.232*	1.041***	0.018	0.218
	(0.165)	(0.167)	(0.135)	(0.166)	(0.163)	(0.137)
Observations	868	607	1256	831	659	1245
Number of countries	86	75	86	85	76	86

All regressions include a constant (not reported) and country fixed effects.
Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Columns 1-3 show results with contemporaneous trade policy measures; Columns 4-6 show results with lagged trade policy measures.

Table 6: The Effect of Trade Policies on the Unemployment Rate (Hecksher-Ohlin specification; with controls)

	Unweighted tariff	*Overall Trade Restrictiveness Index*	*GCR Trade Barriers*	*Import Duty*	*Quota*	*Openness (X+M/GDP)*
Trade Policy Measure	0.152	0.740	5.624	2.838	1.543	0.171
	(0.216)	(0.925)	(5.686)	(1.776)	(1.342)	(0.208)
*Trade Policy*Capital-labor ratio*	0.024	-0.067	-0.383	-0.243	-0.151	-0.019
	(0.025)	(0.100)	(0.576)	(0.183)	(0.135)	(0.020)
Capital-labor ratio	-0.246	-0.213	1.390	2.098	5.256	0.116
	(1.959)	(3.634)	(2.821)	(2.544)	(7.906)	(2.321)
Employment laws index	-1.485	-0.744	-2.447	-2.928	-1.146	-3.554
	(3.404)	(3.810)	(3.348)	(3.242)	(7.227)	(3.513)
Labor Union Power	6.266	2.568	6.366	7.265*	8.793	7.845*
	(3.940)	(5.157)	(4.010)	(3.846)	(8.570)	(3.945)
GDP	0.443	-0.807	-0.184	-1.146	-7.294	1.258
	(2.365)	(3.330)	(2.449)	(2.569)	(7.120)	(2.270)
Labor Force	-1.205	0.191	-0.746	0.637	6.162	-2.539
	(2.385)	(3.319)	(2.411)	(2.568)	(7.115)	(2.328)
Civil Liberties	-0.832	-0.809	-0.751	-0.651	-1.315	0.434
	(0.743)	(1.118)	(0.716)	(0.712)	(1.520)	(0.906)
Output Volatility	0.278	0.672	0.383	0.363	0.732	0.556
	(0.440)	(0.499)	(0.415)	(0.419)	(0.952)	(0.430)
Black market premium	-0.026	0.041	-0.009	-0.005	0.203	-0.010
	(0.103)	(0.098)	(0.098)	(0.098)	(0.815)	(0.102)
Constant	11.029	14.173	-1.463	-10.116	-19.197	24.471
	(15.760)	(26.084)	(22.816)	(20.550)	(66.272)	(19.283)
Observations	48	29	48	47	17	48
R-squared	0.30	0.41	0.35	0.39	0.61	0.29
Positive relation	48	22	48	47	14	6
Negative relation	0	7	0	0	3	42

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
All variables are averaged over the 1990s, except OTRI, TRI and Quota which are available for a single year.
Employment laws index and labor union power are available only for 1997.
The last 2 rows divides the number of observations into countries that have a positive and countries that have a negative relation between trade policy and unemployment rate.

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