APPENDIX TO "International Trade and Unemployment: Theory and Cross-National Evidence" by Dutt, Mitra, and Ranjan (2008)

This document presents additional theoretical and empirical results for the paper **"International Trade and Unemployment: Theory and Cross-National Evidence" by Dutt, Mitra, and Ranjan (2008)**. Our recommendation to readers is to first read the original paper (also on this website) and then turn to this document for additional theoretical results, graphs, summary statistics, and a series of robustness checks. This appendix has a theory part, followed by an empirical part.

1 Appendix: Theory

In this section, we have proofs of a couple results that we use to prove propositions 1 and 2 in the paper. These proofs are followed by a detailed discussion of the implications of incorporating asymmetries (across sectors and countries) labor-market frictions into our theoretical analysis. We finally have a discussion of the role of labor-market participation.

1.1 Proofs

In this subsection, we have the proofs of two results we use to prove our propositions.

To prove: Starting from the autarky price, θ increases as p_x increases, when $\phi_x = \phi_y, m_x = m_y, \delta_x = \delta_y, \lambda_x = \lambda_y$.

Proof: Starting from the autarky price, to see the impact of an increase in p_x, note that the following 4 equations determine θ, w, r, k for a given p_x

$$p_x h_x k^{\phi} - rk - w = \frac{(\rho+\lambda)\delta}{m\theta^{\gamma-1}} \quad (1)$$

$$w = (1-\beta)b + \beta(p_x h_x k^{\phi} - rk + \delta\theta) \quad (2)$$

$$p_x h_x \phi k^{\phi-1} = r \quad (3)$$

$$k = \frac{K}{(1-u)L} = \frac{K(\lambda + m\theta^{\gamma})}{m\theta^{\gamma}L} \quad (4)$$

Now, using $p_x h_x \phi k^{\phi-1} = r$ we can eliminate r from (1)-(2) and get

$$(1-\phi)p_x h_x k^{\phi} = b + \frac{\beta\delta\theta}{1-\beta} + \frac{(\rho+\lambda)\delta}{(1-\beta)m\theta^{\gamma-1}} \quad (5)$$

Next, substitute out k in the above expression using (4) to get

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

Note from above that the r.h.s is increasing in θ. Therefore,θ is increasing in p_x.

To prove: $\frac{X^s}{Y^s}$ is increasing in $\frac{p_x}{p_y}$ when $\phi_x > \phi_y, m_x = m_y, \delta_x = \delta_y, \lambda_x = \lambda_y$.

Proof: From (22) and (23) in the text we get

$$\frac{k_x}{k_y} = \left(\frac{\phi_x}{\phi_y}\right)\left(\frac{1-\phi_y}{1-\phi_x}\right) \tag{6}$$

which is a constant. Equating the rental obtained by capital in the two sectors we have $p_x h_x \phi_x k_x^{\phi_x - 1} = p_y h_y \phi_y k_y^{\phi_y - 1}$, which in turn gives us

$$\frac{k_x^{\phi_x - 1}}{k_y^{\phi_y - 1}} = \frac{\phi_y p_y h_y}{\phi_x p_x h_x}. \tag{7}$$

Multiplying (6) by (7) and denoting ,$\left(\frac{1-\phi_y}{1-\phi_x}\right)\frac{h_y}{h_x}$ by H, we have

$$\frac{k_x^{\phi_x}}{k_y^{\phi_y}} = H\frac{p_y}{p_x}.$$

Denoting $\left(\frac{\phi_x}{\phi_y}\right)\left(\frac{1-\phi_y}{1-\phi_x}\right)$ by A, we can plug $\frac{k_x}{k_y} = A$ into $\varepsilon k_x + (1-\varepsilon)k_y = \frac{K}{(1-u)L}$ to get

$$\frac{\varepsilon}{(1-\varepsilon)} = \frac{K - (1-u)k_y L}{A(1-u)k_y L - K}.$$

We can write $k_y = C\left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y - \phi_x}}$ where $C = \left(\frac{\phi_y}{\phi_x}\right)^{\frac{\phi_x}{\phi_x - \phi_y}}\left(\frac{1-\phi_x}{1-\phi_y}\right)^{\frac{\phi_x - 1}{\phi_x - \phi_y}}\left(\frac{h_x}{h_y}\right)^{\frac{1}{\phi_y - \phi_x}}$. Plugging this and $\frac{k_x^{\phi_x}}{k_y^{\phi_y}} = H\frac{p_y}{p_x}$ into relative supply, we have

$$\begin{aligned}
\frac{\varepsilon}{(1-\varepsilon)}\frac{k_x^{\phi_x}}{k_y^{\phi_y}}\frac{h_x}{h_y} &= \frac{h_x}{h_y}H\frac{K - (1-u)C\left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y - \phi_x}}L}{A(1-u)C\left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y - \phi_x}}L - K}\frac{p_y}{p_x} \\
&= \frac{h_x}{h_y}H\frac{K - (1-u)C\left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y - \phi_x}}L}{A(1-u)C\left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y - \phi_x}+1}L - K\frac{p_x}{p_y}}
\end{aligned}$$

which is clearly increasing in $\frac{p_x}{p_y}$ for given u (since $\frac{1}{\phi_y - \phi_x} < -1$) and is increasing in u for given $\frac{p_x}{p_y}$. (Note that it is easy to show that both $K - (1-u)C\left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y - \phi_x}}L$ and $A(1-u)C\left(\frac{p_x}{p_y}\right)^{\frac{1}{\phi_y - \phi_x}+1}L - K\frac{p_x}{p_y}$ are positive.) We have shown in the text that u is increasing in $\frac{p_x}{p_y}$. Thus, relative supply of X is overall increasing in $\frac{p_x}{p_y}$.

1.2 Introducing Asymmetries in Labor-Market Frictions

Davidson, Martin and Matusz (1999) have shown that countries that have in general higher efficiency in matching are the ones that have a comparative advantage in goods produced in high unemployment sectors. Such goods are more search-intensive. In Davidson, Martin and Matusz such a sector is one that has a high job destruction rate. In our two-sector set up, one can get the same result very easily for the case for which $\phi_x = \phi_y = 0$. A common Hicks-neutral increase in efficiency in matching in the two sectors will reduce the autarky price of the sector that has the higher vacancy costs and/or the job destruction rate. To see this note that with differential search costs and $\phi_x = \phi_y = 0$, the following two equations determine w_i and θ_i for a given p_i.

$$p_i h_i - w_i = \frac{(\rho + \lambda_i)\delta_i}{m_i \theta_i^{\gamma-1}} \tag{8}$$

$$w_i = (1-\beta)b + \beta(p_i h_i + \delta_i \theta_i) \tag{9}$$

The autarky equilibrium of this model can be determined as follows. If $\delta_x \neq \delta_y$, our no arbitrage condition $\delta_x \theta_x = \delta_y \theta_y$ implies that market tightness is lower and unemployment higher in the higher vacancy cost sector. Equations (8) and (9) above in conjunction with the no arbitrage condition implies that the wage is higher in this sector. As p_x goes up, p_y should go down from the zero profit (unit cost equals one) condition of the numeraire final good. This can be represented by a downward sloping curve in the (p_x, p_y) space and we call this relationship (or the curve) ZPC to denote the zero profit condition in the numeraire sector. There is another relationship we can plot in this space as follows. As p_x goes up, the value of the marginal product of labor goes up in the X sector. Using equations (8) and (9), we see that this leads to an increase in θ_x. Since $\delta_x \theta_x = \delta_y \theta_y$, it should be the case that θ_y also goes up. From (8) and (9), wage in sector Y goes up, and so does the vacancy cost per worker, $\frac{(\rho+\lambda_i)\delta_i}{m_i \theta_i^{\gamma-1}}$. Thus, p_y goes up and so we get an upward sloping curve in the (p_x, p_y) space. This is basically a representation of the no arbitrage condition (and so we call this curve NA) and it intersects the downward sloping ZPC. The relative supply curve of this economy is thus horizontal at this relative price.

Using (8) and (9), and setting $h_i = 1$ to eliminate productivity differences between the sectors to focus on differences arising purely from search parameters, we have the price differential condition $p_x - p_y = \frac{1}{1-\beta}\left[\frac{(\rho+\lambda_x)\delta_x}{m_x \theta_x^{\gamma-1}} - \frac{(\rho+\lambda_y)\delta_y}{m_y \theta_y^{\gamma-1}}\right]$, which must hold at every point on the NA curve. If the vacancy cost per worker is higher in the X sector, i.e., if $\frac{(\rho+\lambda_x)\delta_x}{m_x \theta_x^{\gamma-1}} - \frac{(\rho+\lambda_y)\delta_y}{m_y \theta_y^{\gamma-1}} > 0$, then it can easily be shown that in the above

price differential condition $\frac{1}{1-\beta}\left[\frac{(\rho+\lambda_x)\delta_x}{m_x\theta_x^{\gamma-1}}-\frac{(\rho+\lambda_y)\delta_y}{m_y\theta_y^{\gamma-1}}\right]$ (and therefore p_x-p_y) goes down for given p_y with an equiproportional increase in m_x and m_y (with the effect of this equiproportional increase in m_x and m_y on θ_x and θ_y for given p_y factored in).[1] This shifts the NA curve to the left and reduces equilibrium p_x in autarky (given by the intersection of the ZPC and the new NA curve). If, for analytical simplicity, the ranking of $\frac{(\rho+\lambda_i)\delta_i}{m_i}$ between the two sectors is driven by an intersectoral difference in just one labor-market parameter at a time (either $m_x < m_y$ or $\delta_x > \delta_y$ or $\lambda_x > \delta_y$) with the others remaining equal across sectors, then a country with a higher matching efficiency will have a comparative advantage in the higher unemployment sector, and upon opening to international trade, this sector will expand while the other sector will shrink. As has been argued in Davidson, Martin and Matusz, we should expect to see higher matching efficiency in the more advanced countries. We know from our data that the capital-abundant countries are more advanced. Thus, in a more advanced (capital-abundant) country, the higher unemployment sector will expand at the cost of the lower unemployment sector. The opposite will be the case in a developing (capital-scarce) country. The composition effect of this move to freer trade takes us in the direction of our Heckscher-Ohlin prediction summarized in proposition 2 in the paper.

1.3 The Role of Labor Force Participation

In our analysis, we have so far abstracted from labor force participation. In the pure one-factor, two-sector Ricardian world, we can clearly see that the size of the labor force does not matter in the determination of the unemployment rate. This is because of our assumption of constant returns to scale in search (matching).[2] For the two factor case, for given K/L ratio, an increase in the size of the labor force means a proportional increase in the capital stock and therefore in the size of the economy. Under constant returns to scale in search, an increase in the size of the economy for given K/L should not affect the unemployment rate. As will be seen later, we do control for the K/L ratio for our Heckscher-Ohlin regressions. However, the K/L itself will be determined by the participation rate for given capital to working age population ratio. If the

[1] It is easy to see from the pricing (job creation) equation $p_y = w_y + \frac{(\rho+\lambda_y)\delta_y}{m_y\theta_y^{\gamma-1}}$ (with the wage equation, $w_y = b + \frac{\beta}{1-\beta}(\delta_y\theta_y + \frac{(\rho+\lambda_y)\delta_y}{m_y\theta_y^{\gamma-1}})$ plugged into it) that for a constant p_y an increase in m_y leads to an increase in θ_y but at same time leads to a reduction in $\frac{(\rho+\lambda_y)\delta_y}{m_y\theta_y^{\gamma-1}}$. Thus when $\left[\frac{(\rho+\lambda_x)\delta_x}{m_x\theta_x^{\gamma-1}}-\frac{(\rho+\lambda_y)\delta_y}{m_y\theta_y^{\gamma-1}}\right] > 0$, we have a fall in $\left[\frac{(\rho+\lambda_x)\delta_x}{m_x\theta_x^{\gamma-1}}-\frac{(\rho+\lambda_y)\delta_y}{m_y\theta_y^{\gamma-1}}\right] = \left[\frac{(\rho+\lambda_x)}{(\rho+\lambda_y)}\left(\frac{\delta_x}{\delta_y}\right)^{\gamma}\frac{m_y}{m_x}-1\right]\frac{(\rho+\lambda_y)\delta_y}{m_y\theta_y^{\gamma-1}}$ (with the no arbitrage condition $\delta_x\theta_x = \delta_y\theta_y$ plugged in) as a result of an equiproportional increase in m_x and m_y.

[2] See chapter 7 of Pissarides (2000).

labor force participation rate is exogenous to the model, there will be no problem in our empirical work, as our estimating equation (as will be seen later) for the Heckscher-Ohlin model will, in any event, require us to control for the K/L ratio. On the other hand, there is the possibility that the participation rate is endogenously determined within the model and that it is endogenous to the unemployment rate. It is reasonable, however, to argue that the unemployment rate can, at best, be a very minor determinant of the K/L ratio. From the Solow growth model in which the capital stock itself is endogenous, we know that the main determinants of an economy's capital per worker are the savings rate, the rate of depreciation and the population growth rate.

In the case of non-constant returns to scale in search, in the one-factor Ricardian model, the unemployment rate becomes a function of the size of the labor force and therefore, of the labor force participation rate and the size of the working age population. If the size of the labor force is totally exogenous to the unemployment rate (but is correlated with the other control variables), we can just go ahead and control for it to solve the omitted variables problem. If the labor force participation rate is endogenous to the model and to the unemployment rate in particular, we can write the reduced forms of both the unemployment rate and the labor force participation rate as functions only of the fundamentals (exogenous variables/parameters) of our model, including trade policy. Thus, not controlling for labor force participation (as long as one is controlling for working age population) will not be a problem, unless we really want to know the effect of trade policy on the unemployment rate specifically for given participation rates, in which case we control for and instrument the labor force participation rate.

2 Appendix: Empirics

In this section, we present additional figures, more details regarding the data and various additional robustness checks with our cross-sectional and panel regressions.

2.1 Figures

Figures A1-A4 plot various measures of trade policy against the unemployment rate. A1 and A2 use import duties while A3 and A4 use the Overall Trade Restrictiveness Index from Kee, Nicita and Olarreaga (2006). All graphs show a positive relationship. Since Ethiopia (ETH) exhibits an unemployment rate of 55.6%, figures A2 and A4 drop Ethiopia so that the positive relationship is graphically more striking.

2.2 Data Description

Tables A1 and A2 provide the summary statistics, a brief description of all our variables, and the various data sources used. (A1 for cross-sectional data and A2 for panel data)

2.3 Cross-Section Results

2.3.1 Quota

Table A3 shows the results with quotas as the measure of protection. Column 1 uses the Ricardian specification with controls; column 2 adds controls for country size, for labor union power, for employment laws, for macroeconomic distortions and fluctuations, and civil liberties. In neither case, is the coefficient on quotas significant. Only when we instrument quotas, as shown in column 3, is its coefficient significant. However, inferences with this measure is less likely to be valid given the small country coverage and the measurement error in this variable (see Harrigan, 1993). This measure 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. Finally column 4 shows that even with quotas, we have no support for the Hecksher-Ohlin proposition. While the signs are correct, neither quotas nor its interaction with the capital-labor ratio is significant. Our estimates indicate that there only three countries exhibit a negative relationship between quotas and unemployment.[3]

2.3.2 Additional Macroeconomic Controls

Table A4 shows that our results are robust to a host of other macroeconomic controls. The additional controls used are the inflation rate (based on the consumer price index), the nominal interest rate[4], a deterioration in the terms of trade (between the decade of the 80s and 90s), and a measure of domestic distortions from Alesina and Perotti (1996). The predicted effect of trade restrictions survives for all measures apart from OTRI.

[3] Similar results hold if we add labor market participation variables as additional regressors.

[4] The two are equivalent to using the real interest rate.

2.3.3 Controls for Labor Market Participation

Table A5 shows results with the GCR trade barriers (columns 1-3) and $\frac{X+M}{GDP}$ (columns 4-6) where we also control for the labor market participation variables. Columns 1 and 4 show OLS estimates while the rest present IV estimates. Columns 2 and 5 instrument only trade policy while columns 3 and 6 also instrument the labor participation variable. We use the crude death rate and HIV prevalence in the population aged 15-49, as additional instruments in columns 3 and 6. Across both measures of trade policy, and for both estimation techniques, we find that countries who are more protectionist exhibit higher levels of unemployment. Neither labor market participation variables consistently influence the unemployment rate.

2.4 Panel Data Results

2.4.1 Unweighted Tariffs

For our panel results presented here, we use the unweighted tariff rate for which we have the most comprehensive data over time. The data spans 1985-2004 and summary statistics for all variables are shown in Table A2.

As mentioned in the theory section of the main paper, unemployment is likely to go up as a result of change in trade policy in the short-run, regardless of whether a country raises or lowers tariff rates. The underlying intuition is that while job destruction is instantaneous, job creation takes time. To evaluate the evidence for this effect, as well as to evaluate the short-run and long-run impact of trade policies, our specification includes, a) the lagged unemployment rate as a regressor (lagged by one year); b) a variable equal to the absolute change in tariff rate calculated over the previous year; and c) lagged values of tariff rates, lagged by 1-4 years. Therefore, we estimate the following dynamic specification with tariffs as a measure of trade policy:

$$u_{it} = a_1 u_{it-1} + b_0 \left|T_{it} - T_{it-1}\right| + b_1 T_{it-1} + ... + b_4 T_{it-4} + + \mathbf{X}_{it}\mathbf{B} + (\eta_i + \upsilon_{it})\,;\ i = 1, 2, ...N;\ t = 2, 4, ...T \quad (10)$$

where u_{it} is the unemployment rate in country i at time t, u_{it-1} is the lagged unemployment rate, T_{it-k} is unweighted tariff in country i at time $(t-k)$; $\mathbf{X}_{it}$ is the vector of control variables; η_i is a time invariant country-specific effect possibly correlated with the explanatory variables and υ_{it} is an error term.

Column (1) of Table A6 presents the pooled OLS estimates of equation (10). The absolute change in tariffs is insignificant and has the wrong sign, while the tariffs only at lag 3 are significant. [5] However,

[5] If we drop the term, absolute change in tariffs, we get similar results - tariffs at lag 3 are significant. We also experimented

the fact that η_i is stochastic implies that they are necessarily correlated with the lagged dependent variable u_{it-1}.This implies that the pooled OLS estimates are inconsistent and this bias does not vanish even as the number of countries in the sample increases. The within-country estimator presented in column (2) eliminates this source of inconsistency by subtracting the mean values (within each country) from each of the variables, which eliminates the country-specific effects η_i. For both the pooled OLS and fixed-effect estimates, we do not find evidence that a contemporaneous change in tariff rates, whether positive or negative, leads to any change in the unemployment rate. Further a reduction in tariffs induces a fall in unemployment but it takes three years for this effect to manifest itself. For the within-estimates, a 1% increase in tariffs raises the short-run level of unemployment by 0.05% and the long-run levels of unemployment by 0.17%.[6]

The within estimator is consistent only in panels where T is large - the transformed lagged dependent variable is correlated with the transformed error term and this correlation goes to zero only as T gets large. In the results presented in Table A6, T is small ($T = 7$ for the majority of countries) so this correlation does not vanish and the within estimator is also likely to be inconsistent. Therefore, we employ a generalized method of moments (GMM) procedure developed by Arellano and Bond (1991) to generate consistent estimates of the parameters of interest and their asymptotic variance-covariance. Estimation proceeds by first differencing the equation (10) - this eliminates the country-specific effects η_i from the model - and instrumenting the lagged dependent variable by appropriately lagged levels of the unemployment rate.

With respect to tariffs, we examine two sub-cases: In the first, tariffs are assumed to be predetermined in the sense that $E\left[tariff_{it}v_{is}\right] = 0$ for all $s \geq t$ and $E\left[tariff_{it}v_{is}\right] \neq 0$ for all $s < t$. In the second, tariffs are assumed to be endogenous so that $E\left[tariff_{it}v_{is}\right] = 0$ for all $s > t$ and $E\left[tariff_{it}v_{is}\right] \neq 0$ for all $s \leq t$. In both cases, appropriately lagged values of tariffs, are available as instruments. For the other explanatory variables, we adopt the weaker assumption that GDP_{it} is predetermined, that the working-age population, and civil rights are exogenous.

The GMM estimator is consistent provided the error term v_{it} is not serially correlated and provided the lagged values of the explanatory variables are valid instruments. We perform two specification tests suggested by Arellano and Bond (1991). The first examines serial correlation in the error term. It tests whether the differenced error term (the residuals from the regression in differences) is first- and second-order

by considering only 'big' absolute changes in tariffs using various cutoffs to define 'big.' This too did not make a difference to our results.

[6] To the obtain long-run effect, each coefficient must be divided by 1 minus the coefficient on the lagged dependent variable. For tariffs, this equals $0.054/(1 - 0.684) = 0.17$.

serially correlated. First order serial correlation of the differenced error term is expected even if the original error term (in levels) is uncorrelated, unless the latter follows a random walk. Second-order serial correlation of the differenced residual indicates that the original error term is serially correlated, which means that the moment conditions are invalid. On the other hand, if the test fails to reject the null hypothesis of no second-order serial correlation, we conclude that the original error term is serially uncorrelated and the moment conditions are well specified. The second specification test is a Hansen test of over-identifying restrictions, which tests the null hypothesis of overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. Failure to reject this null hypothesis gives support to the validity of instruments. $p-$values for these tests are reported in the last three rows of Table A6.

Columns 3-5 in Table A6 presents these results. In column 3, tariffs are treated as predetermined; in column 4, tariffs are treated as endogenous; in column 5 we add the labor market participation variables. We see that for all three specifications, countries that initiated a decline in their overall unweighted tariffs experienced a fall in their unemployment rates after a lag of three years. For columns 4 and 5, our numbers imply that a 1% decline in the unweighted tariff reduces unemployment rate in the long-run by 0.12%. The variable, absolute change in tariff rates, is insignificant as before. Overall, across specifications we obtain a consistent finding that a fall in tariffs reduces unemployment after a lag of three years.

2.4.2 Effect of Trade Liberalization in a Hecksher-Ohlin Specification

Our final table - Table A7 - extends the panel results on trade liberalization to the Hecksher-Ohlin setting. Table A7 uses the liberalization dummy from Wacziarg and Welch (2008), and interacts this liberalization dummy with the capital-labor ratio.[7] For the pooled OLS estimates in column 1, the within-estimates in column2, and the GMM estimates in columns 3-5, neither the liberalization dummy variable not their interaction with capital-labor ratio are significant. In this sense, our panel results simply replicate our cross-sectional findings for the Hecksher-Ohlin specification.

[7] We use capital-labor ratio in the year 1990. This is the last year where there is data on capital-labor ratio from Easterly and Levine (2001). Since the capital-labor ratio is time invariant, it is subsumed within the country-fixed effects. All columns include GDP, labor force, and civil rights as controls (not shown.) Column 5 also includes labor market participation measures.

References

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[3] Davidson, C., Martin, L., and Matusz, S. (1999). 'Trade and search generated unemployment,' *Journal of International Economics* 48, pp.271-299.

[4] Easterly, W. and Levine, R. (2001). 'It's Not Factor Accumulation: Stylized Facts and Growth Models,' *World Bank Economic Review*, vol.15(2), pp. 177–219.

[5] Harrigan, J. (1993). 'OECD Imports and Trade Barriers in 1983,' *Journal of International Economics,* 35(1), pp. 91-111.

[6] Kee, H. L., Nicita, A. and Olarreaga, M. (2006). 'Estimating Trade Restrictiveness Indices,' *Policy Research Working Paper Series* 3860, The World Bank.

[7] Wacziarg, R. and Welch, K. H. (2008). 'Trade Liberalization and Growth: New Evidence,' *World Bank Economic Review*, 22(2), pp. 187-231.

Figure A1: Import Duty and Unemployment Rate (1990s)

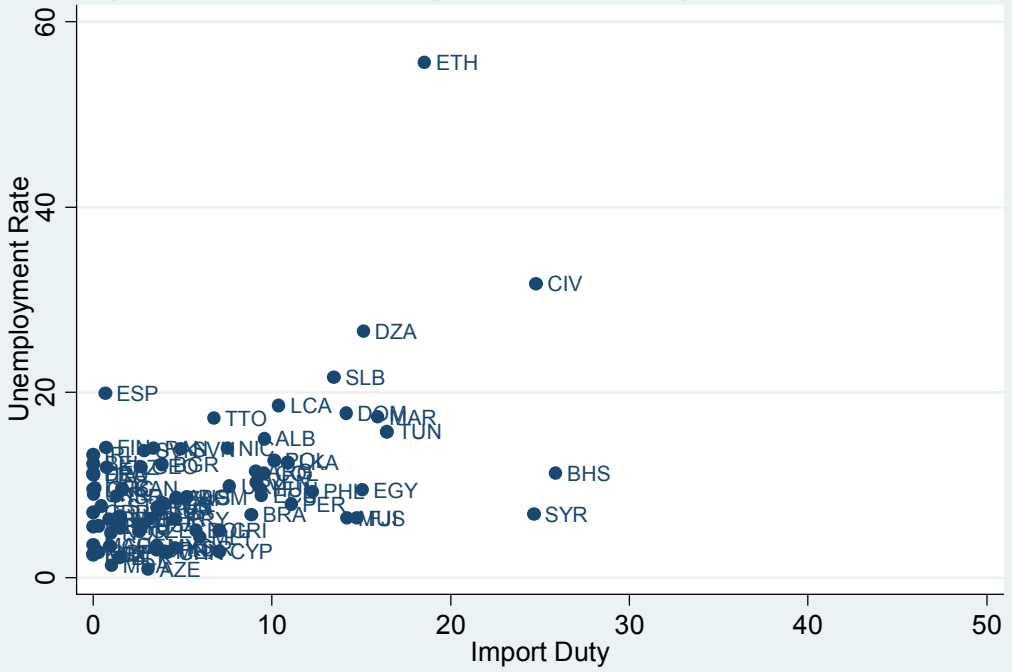
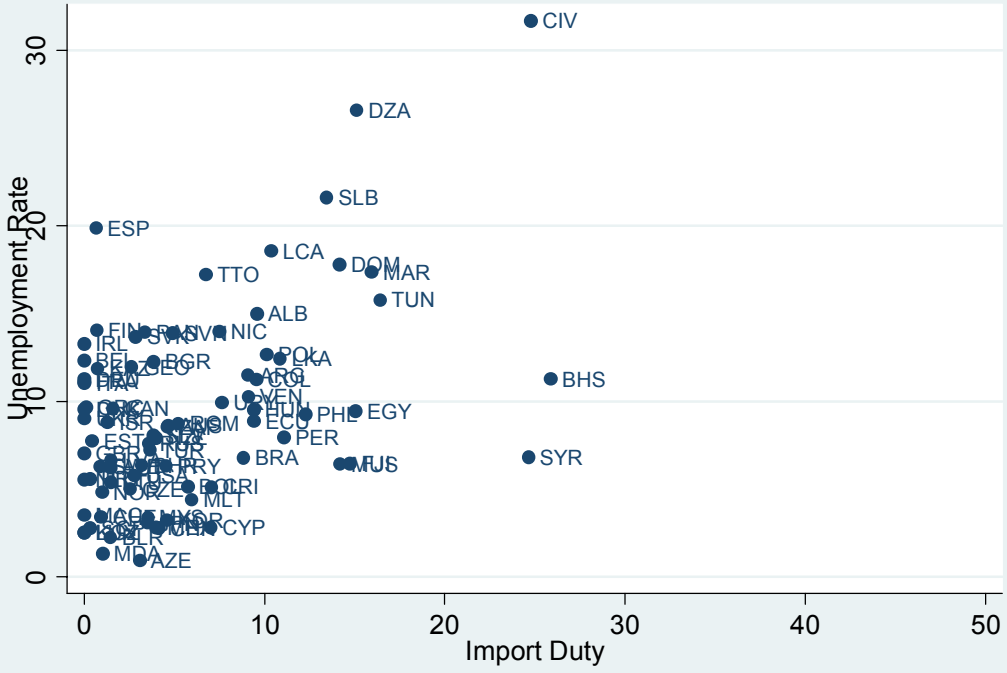


Figure A2: Import Duty and Unemployment Rate (ETH dropped)



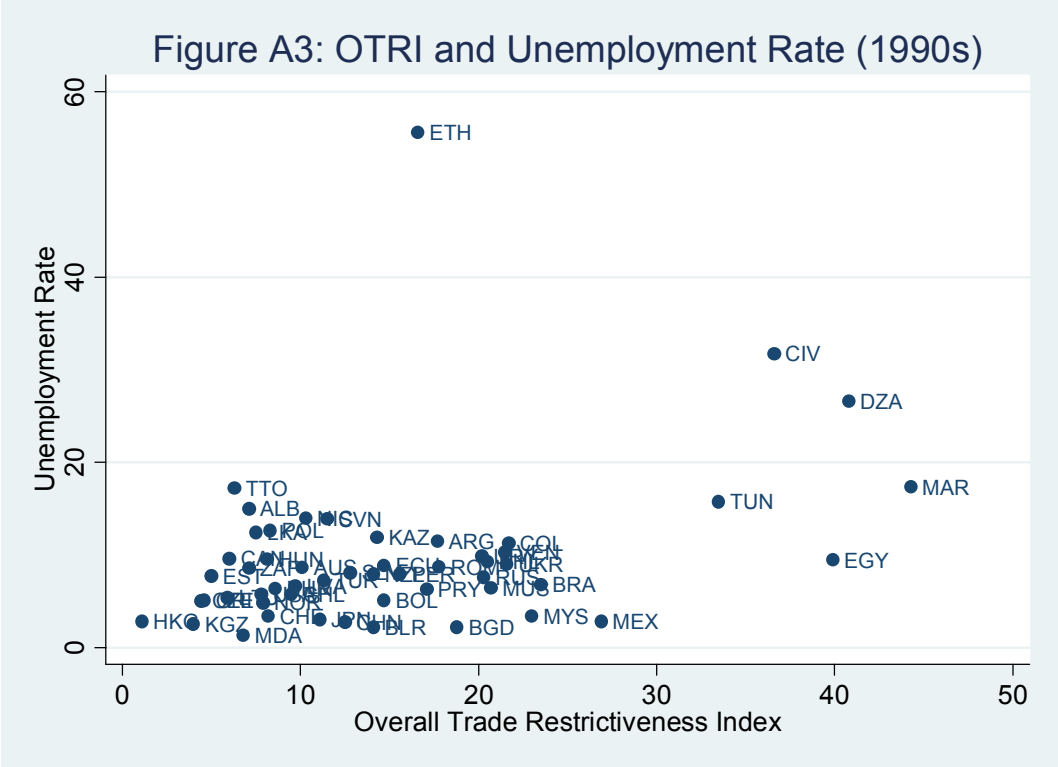


Figure A3: OTRI and Unemployment Rate (1990s)
Unemployment Rate
0
20
40
60
Overall Trade Restrictiveness Index
0
10
20
30
40
50
ETH
CIV
DZA
TUN
MAR
EGY
TTO
ALB
SVN
KAZ
ARG
COL
BRA
MUS
PRY
BOL
MYS
MEX
BGD
HKG
KGZ
MDA

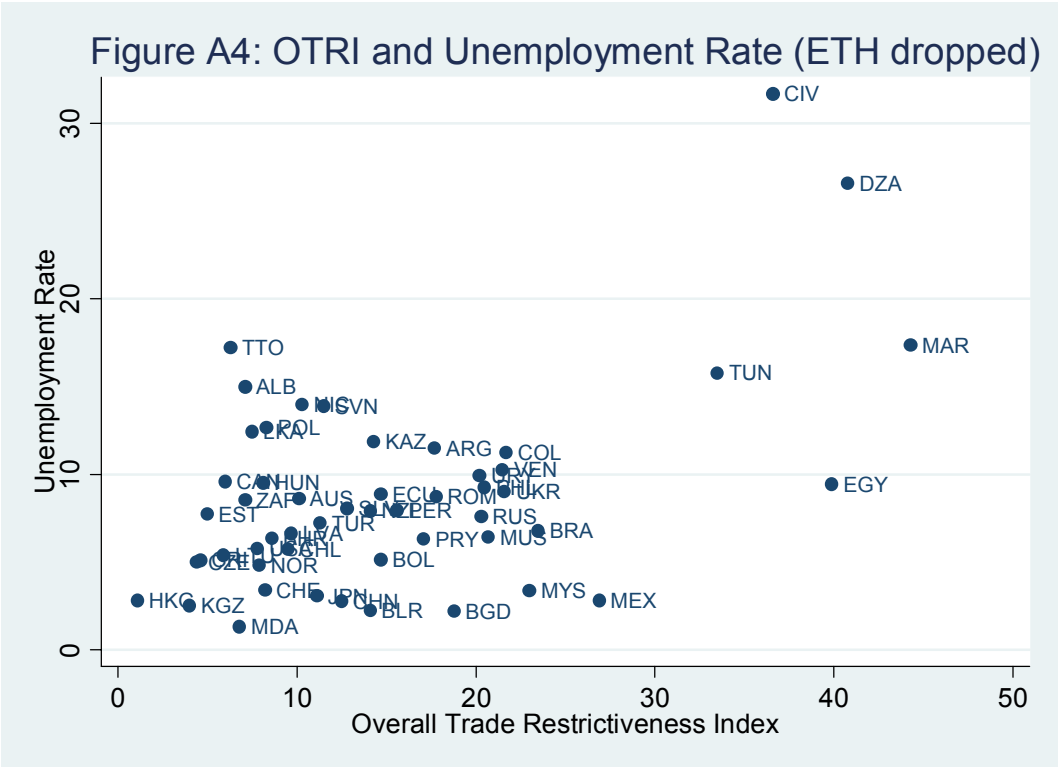


Figure A4: OTRI and Unemployment Rate (ETH dropped)
Unemployment Rate
0
10
20
30
Overall Trade Restrictiveness Index
0
10
20
30
40
50
CIV
DZA
TUN
MAR
EGY
TTO
ALB
SVN
KAZ
ARG
COL
BRA
MUS
PRY
BOL
MYS
MEX
BGD
HKG
KGZ
MDA

Table A1: Cross-Sectional 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
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
Population (ages 15-64)	204	19.99	Number of people aged 15-64 (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.
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
Labor market participation rate	199	69.22	Labor force participation rate, total (% of total population ages 15-64). Source: WDI, 2007. Averaged for the 1990s
Female labor market participation rate	199	55.6	Labor force participation rate, female (% of female population ages 15-64). Source: WDI, 2007. Averaged for the 1990s

Table A2: Panel Data Description and Summary Statistics

Variable	*N*	Mean	Description
Unemployment Rate	1586	8.95	Unemployment as percentage of the labor force. Source: International Finance Statistics, 2007
Unweighted Tariff	1290	13.37	Unweighted average tariff. Source: World Bank.
GDP	2065	18.09	Real GDP at PPP in constant 2000 dollars (logged). Source: WDI, 2007
Population (ages 15-64)	2484	15.48	Number of people aged 15-64 (logged). Source: WDI, 2007.
Civil Liberties	2150	2.97	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.
Labor market participation rate	2484	68.01	Labor force participation rate, total (% of total population ages 15-64). Source: WDI, 2007.
Female labor market participation rate	2484	54.18	Labor force participation rate, female (% of female population ages 15-64). Source: WDI, 2007
Liberalization dummy	1998	0.73	Dummy =1 in years following the year of a permanent trade liberalization. Permanent liberalization are from Wacziarg and Welch (2008).

Table A3: The Effect of Quotas on the Unemployment Rate

	(1)	(2)	(3)	(4)
	Ricardian OLS	*Ricardian OLS with controls*	*Ricardian IV with controls*	*Hecksher-Ohlin OLS with controls*
Quota	0.058	0.074	0.102**	1.543
	(0.048)	(0.055)	(0.045)	(1.342)
*Quota*Capital-labor ratio*				-0.151
				(0.135)
Capital-labor ratio				5.256
				(7.906)
Employment laws index		1.112	1.833	-1.146
		(6.318)	(4.636)	(7.227)
Labor Union Power		8.273	8.251	8.793
		(8.974)	(5.561)	(8.570)
GDP		-4.246	-3.851***	-7.294
		(2.446)	(1.438)	(7.120)
Labor Force		2.524	1.901	6.162
		(2.198)	(1.419)	(7.115)
Civil Liberties		0.065	0.003	-1.315
		(0.747)	(0.587)	(1.520)
Output Volatility		1.271	1.321**	0.732
		(0.941)	(0.637)	(0.952)
Black Market Premium		0.678	0.735**	0.203
		(0.477)	(0.366)	(0.815)
Observations	19	17	16	17
R-squared	0.10	0.48		0.61
First stage partial R-squared			0.57	
OID test p-value			0.61	

All regressions include a constant (not reported). Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table A4: The Effect of Trade Policies on the Unemployment Rate (Ricardian specification; additional macroeconomic controls)

	(1)	(2)	(3)	(4)	(5)
Unweighted Tariff	0.348**				
	(0.146)				
Overall Trade Restrictiveness Index		0.088			
		(0.128)			
GCR trade barriers			1.768**		
			(0.822)		
Import Duty				0.460**	
				(0.180)	
Openness Indicator (X+M)/GDP					-0.023*
					(0.013)
Employment laws index	-2.489	-1.840	-3.025	-3.805	-3.578
	(3.042)	(3.673)	(3.395)	(3.166)	(3.302)
Labor Union Power	7.358	-8.085	8.134**	9.633**	6.964*
	(4.351)	(6.633)	(3.817)	(4.385)	(4.081)
GDP	-2.330*	-4.465*	-0.685	-1.336	-2.267*
	(1.328)	(2.137)	(1.678)	(1.637)	(1.320)
Population (ages 15-64)	1.588	4.355*	-0.138	0.780	1.253
	(1.305)	(2.155)	(1.944)	(1.728)	(1.393)
Civil Liberties	-1.253**	-2.150	-0.978*	-0.957	-0.321
	(0.487)	(1.221)	(0.513)	(0.644)	(0.724)
Output Volatility	0.197	1.184	0.396	0.326	0.611
	(0.508)	(0.867)	(0.483)	(0.474)	(0.474)
Black market premium	-0.017	0.037	-0.005	-0.026	-0.020
	(0.063)	(0.087)	(0.047)	(0.053)	(0.058)
Inflation	0.077	0.073	-0.014	0.046	0.045
	(0.057)	(0.062)	(0.052)	(0.055)	(0.057)
Nominal interest rate	-0.075	-0.070	0.013	-0.047	-0.046
	(0.053)	(0.057)	(0.049)	(0.052)	(0.053)
Domestic distortions	0.018	1.575	-1.102	-1.195	-0.529
	(2.376)	(2.020)	(2.124)	(2.002)	(2.455)
Change in terms of trade	0.057	-0.056	0.041	0.045	0.039
	(0.048)	(0.057)	(0.048)	(0.050)	(0.049)
Observations	46	26	46	45	46
R-squared	0.34	0.54	0.35	0.38	0.32

All regressions include a constant (not reported). Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Domestic distortions is from Alesina and Perotti (1996); Inflation is calculated using CPI; Change in terms of trade is calculated as change between the decade of the 80s and 90s.

Table A5: The Effect of Trade Barriers & Openness on the Unemployment Rate (Ricardian specification; Controlling for Labor Market Participation)

	(1)	(2)	(3)	(4)	(5)	(6)
GCR trade barriers	1.057**	1.733***	2.027***			
	(0.512)	(0.651)	(0.737)			
(X+M)/GDP				-0.017*	-0.047*	-0.039*
				(0.010)	(0.027)	(0.023)
Employment laws index	-4.058	-5.285**	-5.942**	-4.803*	-5.919**	-0.237
	(2.589)	(2.483)	(2.764)	(2.642)	(2.618)	(0.324)
Labor Union Power	5.881*	7.411**	7.380**	6.705**	7.304***	-5.649*
	(2.925)	(3.055)	(3.181)	(2.882)	(2.754)	(3.003)
GDP	-0.790	-0.506	-0.254	-1.028	0.417	7.149**
	(0.983)	(1.149)	(1.178)	(1.150)	(1.785)	(2.981)
Population (ages 15-64)	0.331	0.060	-0.169	0.494	-1.619	0.057
	(1.147)	(1.251)	(1.311)	(1.279)	(2.350)	(1.626)
Civil Liberties	-1.381**	-1.415**	-1.287*	-0.765	0.185	-1.093
	(0.520)	(0.659)	(0.715)	(0.691)	(1.097)	(2.108)
Output Volatility	0.112	0.270	0.238	0.320	0.407	-0.050
	(0.320)	(0.379)	(0.402)	(0.330)	(0.281)	(0.964)
Black Market Premium	0.018	-0.006	0.002	0.006	-0.020	0.384
	(0.037)	(0.036)	(0.038)	(0.042)	(0.043)	(0.317)
Labor market participation rate	-0.230	-0.300*	-0.528	-0.245	-0.231	-0.014
	(0.169)	(0.161)	(0.359)	(0.184)	(0.203)	(0.084)
Female labor market participation rate	-0.012	0.067	0.209	-0.019	-0.014	-0.013
	(0.120)	(0.134)	(0.246)	(0.131)	(0.131)	(0.181)
Observations	55	44	44	55	55	55
R-squared	0.41			0.37		
First stage partial R-squared (trade policy)		0.5	0.48		0.29	0.29
First stage partial R-squared (participation rate))			0.31			0.34
OID test p-value		0.86	0.39		0.21	0.42

All variables are averaged over the 1990s. Employment laws index and labor union power are available only for 1997.
All regressions include a constant (not reported). Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Instruments for GCR: Share of tax revenues from domestic sources; Number of years the country stayed outside GATT since inception in 1948.
Instruments for *(X+M/GDP)*: Frankel-Romer instruments and remoteness index from Rose (2004).
Additional instruments when labor market participation is instrumented: Percentage of working age population; Crude death rate per 1000.
Columns 1 and 4 present OLS estimates; columns 2, 3, 5 and 6 present IV estimates. In columns 2 and 5 we only instrument trade policies. In columns 3 and 6 we also instrument labor market participation.
The last two rows report a partial R^2 from the first stage regressions and the *p-value* from a test of overidentification.

Table A6: Panel Data Results on the Effect of Unweighted Tariff on Unemployment Rate (Ricardian Specification)

	(1)	(2)	(3)	(4)	(5)
Unemployment ($t-1$)	0.945***	0.684***	0.544***	0.551***	0.548***
	(0.025)	(0.041)	(0.118)	(0.071)	(0.060)
Tariff ($t-1$)	0.010	0.010	-0.012	0.004	0.014
	(0.033)	(0.032)	(0.031)	(0.036)	(0.044)
Tariff ($t-2$)	-0.045	-0.038	-0.029	-0.022	-0.023
	(0.044)	(0.037)	(0.026)	(0.032)	(0.031)
Tariff ($t-3$)	0.063*	0.054*	0.050*	0.053*	0.053*
	(0.037)	(0.029)	(0.027)	(0.028)	(0.031)
Tariff ($t-4$)	-0.029*	-0.042	-0.018	-0.028	-0.027
	(0.017)	(0.026)	(0.038)	(0.026)	(0.031)
Absolute change in tariff between t and t-1	-0.023	-0.031	-0.012	-0.015	-0.028
	(0.026)	(0.033)	(0.026)	(0.026)	(0.028)
GDP (t)	-0.280*	-1.548	-2.608	-3.024	-3.050*
	(0.151)	(0.991)	(1.726)	(2.146)	(1.810)
Population (ages 15-64) (t)	0.276*	5.319**	7.065**	9.271*	10.370***
	(0.155)	(2.152)	(3.489)	(5.232)	(3.846)
Civil liberties (t)	-0.043	-0.189*	-0.302**	-0.297**	-0.339**
	(0.068)	(0.095)	(0.128)	(0.118)	(0.158)
Labor market participation rate (t)					-0.353
					(0.313)
Female labor market participation rate (t)					0.104
					(0.179)
Observations	465	465	382	382	382
Number of countries	71	71	60	60	60
Specification test (p-values)					
OID test			1	1	1
Serial correlation: AR(1) test			0.10	0.09	0.06
Serial correlation: AR(2) test			0.56	0.57	0.47

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Column 1 shows pooled OLS estimates; column 2 shows within-estimates with country-fixed effects; columns 3-4 present Arellano-Bond GMM (difference) estimates. In columns 3-5 all variables are first-differenced which removes country-fixed effects, and the lagged differenced unemployment is instrumented by higher lags of the unemployment level. Column 3 treats the tariff rate as predetermined; column 4 treats it as endogenous. Column 5 adds participation rates to column 4.

Table A7: The Effect of Permanent Trade Liberalization on Unemployment Rate (Hecksher-Ohlin Specification)

	(1)	(2)	(3)	(4)	(5)
Unemployment ($t-1$)	0.956***	0.822***	0.666***	0.625***	0.650***
	(0.015)	(0.039)	(0.084)	(0.081)	(0.081)
Liberalization dummy (t)	2.478	5.334	16.024	11.073	10.810
	(5.673)	(4.719)	(13.657)	(9.615)	(12.555)
Liberalization dummy (t)* *Capital-labor ratio*	-0.147	-0.484	-1.748	-1.229	-1.213
	(0.584)	(0.487)	(1.412)	(1.021)	(1.333)
Liberalization dummy ($t-1$)	-3.771	-3.827	-7.587	1.246	-0.886
	(4.046)	(3.703)	(8.069)	(6.859)	(8.736)
Liberalization dummy (t-*1*)* *Capital-labor ratio*	0.276	0.295	0.665	-0.263	-0.043
	(0.422)	(0.384)	(0.824)	(0.744)	(0.925)
Liberalization dummy ($t-2$)	-3.618	-2.301	-2.544	-1.693	2.040
	(6.480)	(5.269)	(10.670)	(9.005)	(8.494)
Liberalization dummy (t-*2*)* *Capital-labor ratio*	0.356	0.219	0.242	0.182	-0.233
	(0.663)	(0.551)	(1.087)	(0.948)	(0.868)
Liberalization dummy ($t-3$)	4.347	4.431	-2.682	-1.413	3.439
	(3.900)	(3.824)	(12.113)	(8.830)	(9.943)
Liberalization dummy (t-*3*)* *Capital-labor ratio*	-0.413	-0.436	0.272	0.151	-0.327
	(0.426)	(0.411)	(1.246)	(0.903)	(1.008)
Liberalization dummy ($t-4$)	-1.122	-2.550	-12.766	-15.379	-10.493
	(3.206)	(3.975)	(9.347)	(9.559)	(13.306)
Liberalization dummy (t-*4*)* *Capital-labor ratio*	0.073	0.229	1.221	1.477	0.962
	(0.339)	(0.412)	(0.960)	(0.963)	(1.359)
Observations	951	951	880	880	880
Number of countries	60	60	59	59	59
Specification test (p-values)					
OID test			1	1	1
Serial correlation: AR(1) test			0.01	0.01	0.01
Serial correlation: AR(2) test			0.21	0.19	0.28

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Column 1 shows pooled OLS estimates; column 2 shows within-estimates with country-fixed effects; columns 3-5 present Arellano-Bond GMM (difference) estimates. In columns 3-5, all variables are in first-differences which removes country-fixed effects and the lagged differenced unemployment is instrumented by higher lags of the unemployment level. Column 3 treats the liberalization dummy and interaction term as pre-determined and column 4 treats them as endogenous. All columns include GDP, population (ages 15-64) and civil liberties as controls (not shown). Column 5 also includes total labor market participation rate and female labor market participation rate.