Trade Liberalization and Unemployment:

Theory and Evidence from India[#]

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Abstract

A widely held view among the public is that trade liberalization increases unemployment. In this paper we use state- and industry-level data on unemployment rates and trade protection from India to examine what the data say. We find little evidence to support the view that unemployment rises with trade liberalization. On the contrary, our analysis suggests that to the extent there is a statistically significant relationship, unemployment declines with trade liberalization in certain contexts. In particular, our state-level analysis reveals that urban unemployment declines with liberalization in states with more flexible labor markets and larger employment shares in net exporter industries. Moreover, our industry-level analysis indicates that workers in industries experiencing greater reductions in trade protection were less likely to become unemployed, especially in net export industries. There is some weak evidence that the short-run impact of a tariff reduction may be a quick increase in unemployment prior to reduction to a lower steady-state unemployment rate. Our results can be explained using a theoretical framework incorporating trade and search-generated unemployment and some institutional features of the Indian economy.

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1. Introduction

There now exists a small but growing literature on the relationship between trade and unemployment.[1] Most of this literature is theoretical with some exceptions. One exception is Dutt, Mitra and Ranjan (2009).[2] Using cross-country data on trade policy, unemployment, and various controls, and controlling for endogeneity and measurement-error problems, they find that unemployment and trade openness are negatively related. Using panel data, they find an unemployment-increasing short-run impact of trade liberalization, followed by an unemployment-reducing effect leading to the new steady state. While that paper finds interesting empirical regularities that can be explained using plausible models of trade and search unemployment, the standard criticisms of cross-country regressions apply to that study as well. Countries differ from each other in very important ways that cannot always be controlled for by variables we use in such regressions. Therefore, we begin our analysis by going down to the next level from cross-country analysis – i.e., to an intra-country analysis of state-level and industry-specific unemployment derived from "employment-unemployment" surveys carried out by India's National Sample Survey Organisation (NSSO). India is a developing country that has, in the last couple of decades, experienced major trade reforms and where a significant proportion of the population lives below the poverty line. This makes such a study potentially quite useful for policy analysis.

Importantly, constitutional arrangements which give India's states considerable regulatory power over economic matters and the large size of India's states – many of which have populations larger than the vast majority of countries and possess unique ethno-linguistic characteristics – make such an analysis meaningful. In particular, interstate variations in labor regulations (see Besley and Burgess, 2004) and low mobility across Indian states (see Dyson Cassen, and Visaria, 2004 and Topalova, 2010) suggest that treating each state as an independent labor market is a reasonable approximation. Additionally, we adopt broadly 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 (2009) for recent contributions to this literature.

[2] Another 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.

strategy of Topalova (2007) and Hasan, Mitra, and Ural (2007) and exploit variations in industrial composition across Indian states (districts in the case of Topalova) around the time of the major trade liberalization of the early 1990s, and the variation in the degree of liberalization across industries over time to construct state-specific measures of protection. This allows us to determine whether states more exposed to reductions in protection experienced increases or decreases in unemployment rates.

We then complement our cross-state analysis of the relationship between unemployment and liberalization with a detailed analysis based purely on changes in industry-level variations in protection over time. More specifically, we examine whether workers in industries experiencing greater reductions in trade protection were more or less likely to become unemployed. We also check what this relationship looks like in the presence of controls for other elements of India's policy reforms.

Insofar as our state-level analysis is concerned, we find that overall (rural plus urban) unemployment on average does not have any relationship with average protection (weighted average with 1993 sectoral employment as weights) over time and across states. However, there are some conditional relationships between the two variables in certain types of states. In states with more flexible labor markets, there is evidence that on average overall and urban unemployment are positively related to protection. In other words, trade liberalization there can reduce unemployment. We also find that reductions in protection reduce unemployment in the urban sectors of states with large employment shares in net exporter industries. Across such states and within such states over time, the employment-weighted protection and unemployment are positively correlated. This is true across all the three measures of protection we use.

Turning to our analysis based purely on industry-level protection, we find hardly any evidence that workers in industries that experienced larger reductions in protection were more likely to be unemployed. In fact, there seems to be some evidence to the contrary that such workers could actually have been less likely to become unemployed, a result that is stronger in net exporter industries. There is some weak evidence that the immediate short-run effect of a tariff reduction may be an increase in unemployment prior to reduction to a lower steady-state unemployment rate (long-run fall in the unemployment rate.

We show how our empirical results are consistent with the impact of trade liberalization in a two sector model, with labor being the only factor of production and where unemployment arises due to search frictions.[3] We discuss two extreme cases: (a) perfect labor mobility (the Ricardian case), where comparative advantage is exclusively productivity-driven and (b) no intersectoral labor mobility (where labor becomes sector-specific), where comparative advantage, while still dependent on productivity, is also driven by relative sectoral labor force size. Our empirical results fall in between the two extremes, depending on the flexibility of labor markets. The results get closer to the predictions of the model with perfect intersectoral labor mobility as we move from states with rigid labor laws to those with labor laws that lead to more flexible labor markets.

It must be pointed out here that our empirical results can also be related to the predictions of some other theoretical models in the trade and unemployment literature. While an unemployment reducing effect of trade liberalization, through an aggregate productivity effect based on firm selection, is obtained in the theoretical work of Felbermayr, Prat and Schmerer (2008), the opposite result is possible in Helpman and Itskhoki (2007). To the extent that trade, in the two-sector model by Helpman and Itskhoki, leads to higher aggregate productivity in their differentiated products sector subject to search frictions, this sector expands in size and the other sector, which is frictionless and has zero unemployment as a result, shrinks. A similar result is also obtained in Janiak (2007). There are other papers in the literature, such as Davidson, Martin and Matusz (1999) and Moore and Ranjan (2005) where the effect of trade on overall unemployment is ambiguous.[4]

In the next section (section 2), we present a theoretical framework to guide us in our empirical analysis. In section 3, we discuss the Indian policy framework. This is followed by our empirical strategy in section 4, the data in section 5 and the empirical results in section 6. We finally end with some concluding remarks in section 7.

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[3] It is also shown that the theoretical results are robust to modeling unemployment through efficiency wages as in Shapiro and Stiglitz (1984).

[4] In Davidson, Martin and Matusz the results depend on intersectoral and international differences in labor-market frictions. In Moore and Ranjan, there are two kinds of labor (skilled and unskilled) and the effects of trade on the unemployment of these two kinds of workers go in opposite directions, making the impact on overall unemployment ambiguous.

2. Trade and Unemployment: Theoretical Framework

Production Structure

Consider an economy that 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:

$$Z = \frac{AX^{1-\alpha}Y^{\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}};0 < \alpha < 1 \tag{1}$$

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

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

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

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

The production function for Z implies the following relative demand for the two intermediate goods.

$$\frac{X^d}{Y^d} = \frac{(1-\alpha)p_y}{\alpha p_x} \tag{4}$$

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 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, namely vacancies and unemployment. Job destruction is a response to idiosyncratic shocks to the productivity of existing job-worker matches.

The production functions (in these one-worker firms) in the two intermediate goods sectors, once the matches are formed, are given by

$$x = h_x l_x ; y = h_y l_y \quad (5)$$

If L_i is the total number of workers affiliated with sector-i, u_i the unemployment rate in sector-i, then the number of employed in sector-i is (1- u_i) L_i. The aggregate production in each sector is given by

$$X = h_x(1-u_x)L_x ; Y = h_y(1-u_y)L_y ; L_x + L_y = L \quad (6)$$

The relative supply of the two intermediate goods is

$$\frac{X^s}{Y^s} = \frac{h_x(1-u_x)L_x}{h_y(1-u_y)L_y} \quad (7)$$

The total number of matches in the labor market is determined by the matching technology given as follows. Let v_i be the vacancy rate (i.e., the number of vacancies divided by the labor force) in sector-i. Define $\theta_i = v_i/u_i$ as a measure of market tightness, and let m_i be a scale parameter in the matching function. Then, write the flow of matches in each sector per unit time as follows:

$$M_i(v_i L_i, u_i L_i) = m_i (v_i)^{\gamma} (u_i)^{1-\gamma} L_i = m_i (\theta_i)^{\gamma} u_i L_i ; 0 < \gamma < 1 \quad (8)$$

where γ is a parameter capturing the vacancy intensity of this Cobb-Douglas matching function. Then, the exit rate (from unemployment) for an unemployed searcher in sector-i is $\frac{M_i}{u_i L_i} = m_i \theta_i^{\gamma}$, and the rate at which vacant jobs are filled is $\frac{M_i}{v_i L_i} = m_i \theta_i^{\gamma-1}$. The former is an increasing function of market tightness, and the latter is a decreasing function of market tightness.Assume that the matches in sector-i are broken at an exogenous rate of λ_i per period. λ_i 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

$$\dot{u}_i = \lambda_i (1-u_i) - m_i \theta_i^{\gamma} u_i \quad (9)$$

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

$$u_i = \frac{\lambda_i}{\lambda_i + m_i \theta_i^{\gamma}} \tag{10}$$

Denote the recruitment cost in sector-i in terms of the final good by δ_i, the firing cost by F_i and the exogenous discount factor by ρ. The asset value of a vacant job, V_i is characterized by the following Bellman equation

$$\rho V_i = -\delta_i + m_i \theta^{\gamma-1}(J_i - V_i) \tag{11}$$

where J_i is the value of an occupied job. Denoting the wage of workers in sector-i by w_i in terms of the numeraire, the asset value of an occupied job, J_i satisfies the following Bellman equation

$$\rho J_i = p_i h_i - w_i - \lambda_i (J_i + F_i) \tag{12}$$

Note that when the job is destroyed, the firm not only loses J_i but also has to pay the firing cost F_i.

Free entry in job creation implies $V_i = 0$, which implies the following from (11) above.

$$J_i = \frac{\delta_i}{m_i \theta^{\gamma-1}} \tag{13}$$

Equations (12) and (13) imply

$$p_i h_i - w_i - \lambda_i F_i = \frac{\delta_i (\rho + \lambda_i)}{m_i \theta^{\gamma-1}} \tag{14}$$

The above is also a zero profit condition which says that the value of a match equals the wage plus the expected hiring and firing costs.

Wage Determination

On the worker side, unemployed workers in each sector receive a flow benefit of b in units of the final good. This "benefit" includes the value of leisure as well as unemployment insurance payments. Let W_i denote the present discounted value of employment in sector i and U_i the present discounted value of unemployment. The Bellman equations governing W_i and U_i are given by:

$$\rho W_i = w_i + \lambda_i (U_i - W_i) \tag{15}$$

$$\rho U_i = b + m_i \theta_i^{\gamma} (W_i - U_i) \tag{16}$$

Wage is determined through a process of Nash bargaining between the worker and the entrepreneur where the value of a job for an entrepreneur is given by J_i and the surplus of a worker from a job is W_i - U_i. Denoting the bargaining power of workers by β, Nash bargaining implies the following equation for wages:[5]

$$Wi - Ui = \frac{\beta}{1-\beta} J_i \tag{17}$$

Note from (16) and (17) that

$$\rho U_i = b + \frac{\beta}{1-\beta} m_i \theta_i^{\gamma} J_i = b + \frac{\beta}{1-\beta} \delta_i \theta_i \tag{18}$$

where the last equality is obtained by using the expression for J_i in (13) above. By substituting out the expressions for J_i, W_i, and U_i using (12), (15), and (18), respectively, in (17) obtain

$$w_i = (1-\beta)b + \beta(p_i h_i + \delta_i \theta_i - \lambda_i F_i) \tag{19}$$

Now, a worker should be indifferent between searching in either sector. Therefore, the no arbitrage condition is given by

$$U_x = U_y \tag{20}$$

which in turn implies from (18) that in equilibrium

$$\delta_x \theta_x = \delta_y \theta_y \tag{21}$$

That is, the market tightness in each sector is proportional to the recruitment cost.

The model is solved as follows. For any p_x/p_y the prices p_x and p_y in terms of the numeraire are obtained from equation (3). For this pair of prices p_x and p_y, equations (10), (14) and (19) determine w_i, θ_i, and u_i. It is easy to verify that an increase in p_x/p_y leads to an increase in $\theta_x/\ \theta_y$. Therefore, we get an upward sloping relationship between p_x/p_y and $\theta_x/\ \theta_y$. Next, the no arbitrage condition (21) implies that $\theta_x/\ \theta_y$ must equal $\delta_x/\ \delta_y$. We can obtain the corresponding p_x/p_y and the values of w_i, θ_i, and u_i as described above. Next,

[5] In the presence of a firing cost, the initial wage for an open job may be different from the continuation wage for an occupied job. In particular, in the case of a continuing job, the job destruction not only causes a loss of surplus of J_i for the firm, but also a payment of firing cost F_i. Therefore, the firm's surplus from an occupied job is J_i+F_i. This leads to a slightly different expression for the continuation wage from the one derived in our paper. See the discussion in Pissarides (2000), chapter 9, on this issue and the justification for using initial wage which is what is relevant for a firm calculating the returns from a new vacancy.

the relative supply in (8) and the relative demand in (7) together with the aggregate resource constraint, $L_x + L_y = L$, determine L_i.

Impact of International Trade.

When the country opens up to trade, the relative price changes depending on the country's comparative advantage, which in turn depends on h_i and the labor market parameters: m_i, δ_i, λ_i, and F_i. Given the Ricardian nature of the model, if labor is completely mobile across sectors, then the country will completely specialize in the good in which it has a comparative advantage.

To see the impact of trade on unemployment, gather the relevant equations (10), (14) and (19) below.

$$p_i h_i - w_i - \lambda_i F_i = \frac{\delta_i(\rho + \lambda_i)}{m_i \theta^{\gamma-1}} \tag{22}$$

$$w_i = (1-\beta)b + \beta(p_i h_i + \delta_i \theta_i - \lambda_i F_i) \tag{23}$$

$$u_i = \frac{\lambda_i}{\lambda_i + m_i \theta_i^{\gamma}} \tag{24}$$

Eliminate w_i from (22) and (23) to get

$$p_i h_i = b + \lambda_i F_i + \frac{\beta}{1-\beta}\delta_i \theta_i + \frac{\delta_i(\rho + \lambda_i)}{(1-\beta) m_i \theta^{\gamma-1}} \tag{25}$$

From (24) obtain

$$\frac{\partial \theta_i}{\partial p_i} = \frac{(1-\beta)h_i}{\delta_i \left(\beta + \frac{(\rho + \lambda_i)(1-\gamma)\theta^{-\gamma}}{m_i} \right)} > 0 \tag{26}$$

Next, note from (24) that

$$\frac{\partial u_i}{\partial p_i} = \frac{-\lambda_i m_i \gamma \theta^{\gamma-1}}{\left(\lambda_i + m_i \theta^{\gamma}\right)^2} \frac{\partial \theta_i}{\partial p_i} = -\gamma u_i (1-u_i) \frac{1}{\theta_i} \frac{\partial \theta_i}{\partial p_i} < 0 \tag{27}$$

where the last equality follows from (26). The intuition is very simple: an increase in the price of a product leads to an increase in the value of the marginal product of labor involved in the production of that good.

This leads to incentives for firms in that sector to increase the number of vacancies they post relative to the number of workers searching for jobs.

Without loss of generality, suppose the country has a comparative advantage in good *X*. Trade in this case will raise the relative price of *X,* which implies an increase in p_x and a decrease in p_y. Given the Ricardian nature of the model, the no-arbitrage condition cannot be satisfied anymore and all labor will move to sector *X*. It is clear from (27) above that the post-trade unemployment in sector *X* is lower than before. The impact on the economy-wide unemployment depends on whether the *X* sector had higher or lower unemployment to begin with. If the *Y* sector had lower unemployment to begin with, then the impact of trade on economy-wide unemployment is ambiguous. Otherwise, trade reduces unemployment, including in the neutral case with symmetric search friction across sectors ($\delta_x = \delta_y$), in which case under autarky both sectors have the same unemployment rate.

In the more likely case of costly labor mobility (which could be due to loss of skills in moving from one sector to another or some other idiosyncratic costs due to heterogeneity of preferences),[6] the country may remain incompletely specialized even after opening to trade and the no-arbitrage condition is satisfied for the marginal worker. In this case, the unemployment rate decreases in sector *X* and increases in sector *Y*. The net impact on economy-wide unemployment is going to be ambiguous, as the overall unemployment will be a labor-force weighted average of the two sector-specific unemployment rates.

Using the logic we have developed so far, it is easy to see that in a multisectoral model, a tariff reduction in an import competing sector, as long as that sector exists, will lead to an increase in the unemployment rate within that sector. The reason is that a tariff reduction leads to a reduction in the domestic price of that good and therefore to a reduction in the value of the marginal product of labor within that sector.

In our empirical analysis, sectoral employment-unemployment status is available for all the rounds of the survey we use only at the two-digit level. At this coarse level of disaggregation, it is difficult to differentiate between import tariffs on output and inputs. The reason is that at this level of (dis)aggregation,

[6] See Mitra and Ranjan (2010) for the impact of offshoring on unemployment in a search model with mobility cost.

a high fraction of the input into a sector comes from itself. While we have not modeled the interaction between labor working in a sector in combination with a complementary input being used in the same sector, a reduction in the tariff on (and therefore the domestic price of) such an imported input is analogous to an increase in labor productivity. In our model, that is an increase in h_i. Such an increase in h_i can also be brought about through a precompetitive effect of import competition, which we do not model here. An appropriate model of trade with imperfect competition (or monopoly), where the demand for the domestically produced product becomes flatter as a result of a reduction in the tariff on an imperfectly substitutable imported good, will lead to more investment in productivity enhancement. (See Devarajan and Rodrik,, 1991). From (25), we get

$$\frac{\partial\theta_i}{\partial h_i}=\frac{p_i}{\delta_i\left(\beta+\dfrac{(\rho+\lambda_i)(1-\gamma)\theta^{-\gamma}}{m_i}\right)}>0 \text{ and } \frac{\partial u_i}{\partial h_i}=-\gamma u_i(1-u_i)\frac{1}{\theta_i}\frac{\partial\theta_i}{\partial p_i}<0$$

The interaction between labor-market rigidity and trade liberalization

Next, we analyze how firing costs affect the impact of trade on unemployment. That is, we are interested in analyzing the sign of $\dfrac{\partial\left(\partial u_i/\partial p_i\right)}{\partial F_i}$. Use the following simplifying notation: $t_i \equiv \dfrac{1}{\theta_i}\dfrac{\partial\theta_i}{\partial p_i}$. Now, using (27) write

$$\frac{\partial\left(\partial u_i/\partial p_i\right)}{\partial F_i}=-\gamma(1-2u_i)t_i\frac{\partial u_i}{\partial F_i}-\gamma u_i(1-u_i)\frac{\partial t_i}{\partial F_i} \tag{28}$$

Next, note from the equation for unemployment in (24) that

$$\frac{\partial u_i}{\partial F_i}=\frac{-\lambda_i m_i\gamma\theta^{\gamma-1}}{\left(\lambda_i+m_i\theta^{\gamma}\right)^2}\frac{\partial\theta_i}{\partial F_i}=-\gamma u_i(1-u_i)\frac{1}{\theta_i}\frac{\partial\theta_i}{\partial F_i} \tag{29}$$

Next, using (26) write

$$t_i\equiv\frac{1}{\theta_i}\frac{\partial\theta_i}{\partial p_i}=\frac{1-\beta}{\delta_i\left(\beta\theta+\dfrac{(\rho+\lambda_i)(1-\gamma)\theta^{1-\gamma}}{m_i}\right)} \tag{30}$$

Therefore,

$$\frac{\partial t_i}{\partial F_i} = -\frac{(1-\beta)\left(\beta + \frac{(\rho+\lambda_i)(1-\gamma)^2\theta^{-\gamma}}{m_i}\right)}{\delta_i\left(\beta\theta + \frac{(\rho+\lambda_i)(1-\gamma)\theta^{1-\gamma}}{m_i}\right)^2}\frac{\partial\theta_i}{\partial F_i} \tag{31}$$

Finally, from (24) obtain

$$\frac{\partial\theta_i}{\partial F_i} = -\frac{\lambda_i}{\frac{\beta}{1-\beta}\delta_i + \frac{\delta_i(\rho+\lambda_i)(1-\gamma)}{(1-\beta)m_i\theta^{\gamma}}} < 0 \tag{32}$$

Thus market tightness goes down and as a result unemployment goes up with an increase in firing costs. Finally, use (29), (31) and (32) in (28) to obtain

$$\frac{\partial\left(\partial u_i/\partial p_i\right)}{\partial F_i} = \gamma u_i(1-u_i)\left(\frac{\gamma(1-2u_i)t_i}{\theta_i} + \frac{(1-\beta)\left(\beta + \frac{(\rho+\lambda_i)(1-\gamma)^2\theta^{-\gamma}}{m_i}\right)}{\delta_i\left(\beta\theta + \frac{(\rho+\lambda_i)(1-\gamma)\theta^{1-\gamma}}{m_i}\right)^2}\right)\frac{\partial\theta_i}{\partial F_i} < 0$$

That is, a greater firing cost increases the impact of trade on unemployment in absolute value (since apart from the negative cross-partial second derivative above, we have $\partial u_i/\partial p_i < 0$), i.e., when firing costs are high, we get bigger reductions in unemployment from a price increase. It is important to note here that $\partial(\partial\theta_i/\partial p_i)/\partial F_i$ is negative. Since $\partial\theta_i/\partial p_i$ is positive, the negative $\partial(\partial\theta_i/\partial p_i)/\partial F_i$ means that the impact of liberalization price increase on market tightness gets smaller as firing cost increases. What drives the conversion of smaller and smaller changes in market tightness to larger and larger changes in unemployment? This effect comes at the point of conversion of market tightness into unemployment as follows. u_i is a decreasing and convex function of θ_i. The convexity means that given increases in market tightness lead to larger reductions in market tightness at low market tightness. This, combined with the fact that at high firing cost the degree of market tightness is low, is driving our result. Note that our model has an exogenous rate of job destruction. If job destruction is endogenous, then the firing cost affects both job destruction and creation. In addition to affecting unemployment through market tightness, the firing cost also has a direct effect on the unemployment rate. This will make $\partial(\partial u_i/\partial p_i)/\partial F_i$ ambiguous. Thus the effect of firing costs on how unemployment responds to trade liberalization is an empirical one. In our empirical work in this paper, this is related to the issue of the variation in labor market rigidity coming from the variation in labor laws across the different Indian states. The states with more pro-employee labor laws are the ones that are considered to have more rigid labor laws where we can think of firms face higher firing costs. In addition, these pro-employee laws increase bargaining power of workers, which increases wage, but that reduces labor market tightness and increases sectoral unemployment. Furthermore, we can show in our model (where the rate of job destruction is exogenous) that $\partial(\partial\theta_i/\partial p_i)/\partial\beta < 0$, but because unemployment is convex and decreasing in market tightness $\partial(\partial u_i/\partial p_i)/\partial\beta$ can be shown to have an ambiguous sign in our model.

Short-run effects

So far our theoretical exercise has focused on the steady state effects of trade on unemployment. To analyze the instantaneous impact effect of a change in trade policy assume no intersectoral mobility of labor and endogenize job destruction along the lines of Pissarides (Chapter 2). A firm-job pair starts at full productivity at the point of creation. At each subsequent point in time, a firm-specific (job-specific) productivity shock is received by each firm at a Poisson arrival rate. The threshold productivity level for a firm's survival is determined by profits corresponding to the productivity level and is the one for which the firm just breaks even. Any shock that lowers the productivity level below this leads to the destruction of the firm or job. With a change in trade policy (increase or reduction in import protection), the domestic relative price of one of the two sectors goes up, while that of the other sector goes down. In the sector where the price goes up, the threshold productivity for survival falls, as a result of which the job destruction rate falls, and market tightness and job creation rate rise. In the other sector where the price goes down, the threshold productivity rises as a result of which the job destruction rate rises and the job creation rate falls. Starting from a steady state in which the job creation rate equals the job destruction rate, upon a change in trade policy, we get net job creation in the sector with a price rise and net job destruction in the sector that experiences a price fall. Job creation takes time, while job destruction can take place immediately. Therefore, the impact effect will be an increase in unemployment in the sector with the price fall (and in the overall economy) and no change in unemployment on impact in the sector with the price rise (even though unemployment gradually falls there on its way to a new steady state).

3. The Indian Policy and Institutional Framework

We next provide an overview of the Indian regulatory and institutional framework, an understanding of which is important for the analysis we undertake in this paper. There are two features of the Indian policy landscape that have an important bearing on the strategy we adopt for estimating the impact of trade protection on unemployment rates. First, notwithstanding some earlier efforts, India undertook a dramatic liberalization of trade policies in 1991. Thus, for example, mean tariffs, which were 128 percent before July 1991, had fallen to roughly 35 percent by 1997-98 and the standard deviation of tariffs during this period went down from 41 percentage points to roughly 15. Significantly, the trade liberalization was unanticipated. It was the result of strong conditionality imposed by the International Monetary Fund (IMF) in return for IMF assistance for dealing with a balance of payments crisis. Given several earlier attempts to avoid IMF loans and the associated conditionalities, the liberalization came as a surprise.[7] Given its large and unanticipated nature, the trade liberalization of 1991 presents researchers an excellent opportunity to examine the effects of trade using data on trade protection and variables whose relationship with trade we are interested in examining spanning the years prior to 1991 and later.[8]

Second, the impact of India's trade liberalization on unemployment can be expected to vary across Indian states. One reason is that the degree to which states are exposed to trade protection is unlikely to be a constant. In particular, the composition of employment across industries will typically vary across states thereby leading states to be differentially exposed to trade liberalization. Another reason has to do with the

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[7] In addition to the reduction of tariff levels and their dispersion, trade liberalization involved the removal of most licensing and other non-tariff barriers on all imports of intermediate and capital goods, the broadening and simplification of export incentives, the removal of export restrictions, the elimination of the trade monopolies of the state trading agencies, and the simplification of the trade regime. Trade liberalization was also accompanied by full convertibility of the domestic currency for foreign exchange transactions. See Hasan, Mitra, and Ramaswamy (2007) and the sources cited therein for more details.

[8] See also the discussion in Topalova (2007) and (2004a) on the extent to which India's trade liberalization was an endogenous outcome of political and economic processes. In particular, Topalova's analysis indicates that at least until 1996 , the variation in reductions in protection across industries was unlikely to be driven by economic and political factors that would give rise to concerns about trade policy variables being endogenous in our empirical analysis.

fact that the regulatory environment varies across India's states.[9] To the extent that the effects of trade liberalization are influenced by the nature of the regulatory environment in which economic activity takes place, the impact of trade liberalization on unemployment can be expected to vary across India's states.

An element of regulation that is especially relevant for the analysis of this paper is labor market regulation. Under the Indian constitution, both the central (federal) government as well as individual state governments have the authority to legislate on labor related issues. In fact, the latter have the authority to amend central legislations or to introduce subsidiary legislations. In addition, the enforcement of many labor regulations, even those enacted by the central government, lies with the state governments.[10] Thus, the placement of labor issues in the Indian constitution suggests variation in labor regulations and/or their enforcement across India's states. It is important to take into account this variation in assessing the impact of trade liberalization on unemployment given the considerable debate among analysts regarding the effects of labor market regulations, especially certain elements of the Industrial Disputes Act (IDA) which makes it necessary for firms employing more than 100 workers to obtain the permission of state governments in order to retrench or lay off workers -- permission which some analysts argue is rarely forthcoming and thereby ends up raising the effective cost of labor usage in production.[11]

4. Empirical Strategy

We analyze the relationship between trade protection and unemployment using two empirical strategies. A first strategy is along the lines of Topalova (2007) and Hasan, Mitra, and Ural (2007), both of which examine the relationship between trade liberalization and poverty, and exploits variation in the extent of openness across India's states to identify the effects of trade liberalization on unemployment rates. A second strategy exploits variation in the extent of protection across industries and over time to determine whether industries experiencing greater reductions in protection saw greater unemployment among their workers. This strategy

[9] This is because India's constitution gives its states control over various areas of regulation. In these areas, states have the authority to enact their own laws and amend legislations passed by the Central (federal) government. Typically, states also have the authority to decide on the specific administrative rules and procedures for enforcing legislations passed by the center.

[10] See Anant et al (2006) for a detailed discussion of India's labor-market regulations.

[11] A similar case could be made for other types of regulation -- for example, product market regulations. We discuss this possibility in more detail later.

closely follows that of Attanasio, Goldberg, and Pavcnik (2004) and is also related to the approach of Menezes-Filho and Muendler (2006).

4.1 State-Level Analysis

In the context of the foregoing discussion, our strategy for estimating the impact of trade protection on state unemployment relies on estimating variants of the following basic regression specification:

$$\ln y_{it}^{j} = \alpha + \beta_1 protection_{it-1}^{j} + \beta_2 protection_{it-1}^{j} * regulation_i + \delta_i + \mu_t + \varepsilon_{it} \qquad (33)$$

where y^j_{it} is the natural logarithm of the unemployment rate in state *i* and sector *j* (i.e., for the state as a whole or a state's rural sector or its urban sector), $protection^j_{it-1}$ refers to a measure of state-level trade protection (explained later) lagged once per state *i* and sector *j* in order to alleviate concerns about endogeneity and for allowing time for unemployment to respond to protection, and $regulation_i$ is a time-invariant variable capturing the stance of regulations across states. δ_i represents fixed state effects, μ_t represents year dummies, and ε_{it} represents an identically and independently distributed error term.

The effect of trade liberalization on unemployment can be gauged by considering the marginal effect of protection on unemployment. This is the sum of two terms: $\beta_1 + \beta_2 \cdot regulation$. The first-term represents the direct effect of trade protection on unemployment. Ignoring the second term, a positively signed estimate of β_1 implies that reductions (increases) in protection are associated with reductions (increases) in the unemployment rate. However, the nature of regulations may influence how protection affects unemployment. The term β_2 -- the coefficient on the interaction between our measures of protection and state-level regulations -- is designed to capture this. Suppose, for example, that *regulation* is a dummy variable capturing whether or not labor market regulations are flexible (pro-business) or not across Indian states. A positively signed estimate of β_2 implies that reductions (increases) in protection are associated with bigger reductions (smaller increases) in unemployment in states with flexible (inflexible) labor market regulations. Of course, the total effect of trade liberalization will depend on the sum of the two terms and vary across states.

It needs to be acknowledged that the validity of the above inferences would weaken in the face of interstate migration of workers. For example, unemployed individuals in states with flexible labor regulations and experiencing large declines in trade protection, may move out of such states. A positively signed estimate of β_2 may then be at least partly driven by such movements of workers.[12] Fortunately for our analysis, India is a country with relatively low migration rates. As borne out by the detailed work of Dyson Cassen, and Visaria (2004) using decennial population census data, the bulk of migration in India occurs among women on account of marriage; mobility for economic reasons is limited. Moreover, the migration that occurs, does so mostly within and across districts and very seldom across states. In fact, interstate migration has been declining in recent decades.[13] These considerations strongly suggest that our results are unlikely to be driven by changes in the composition of the workforce at the state level.

4.2 Industry-Level Analysis

We next turn to our industry-level analysis. While the data available to us does not describe the industry in which unemployed workers are seeking employment, they do inform us about their most recent previous industry of employment (if any). This allows us to focus on the effect of trade protection on the probability that a worker with previous work experience in a given industry has become unemployed. To do so we employ the two-stage approach used by Attanasio, Goldberg, and Pavcnik (2004) and Goldberg and Pavcnik (2005). This approach is based on the industry wage premium methodology used in the labor literature. In the first stage, we estimate the following equation:

$$unemployed_{it} = a_1 + \beta_3 X_{it} + \gamma_s + \gamma_k + e_{it} \qquad (34)$$

where $unemployed_{jt}$ is an indicator variable that is 1 for workers with previous experience who have been become unemployed and 0 otherwise. X_{jt} captures individual characteristics such as age, age squared, dummies for male workers, rural workers, and indicator variables for educational status. γ_s are state dummies

[12] We are grateful to a referee for not only pointing this out, but also for directing us to some of the relevant literature.

[13] Admittedly, the low estimates of migration reported in the decennial census may underestimate economic migration of shorter duration, as well as circulatory migration between rural and urban areas. Recent surveys by the NSSO have sought to capture some of these dimensions by applying a tighter definition than that allowed by census data. According to these surveys, the levels of migration are going up, but it is hard to discern an acceleration in migration in recent decades, especially across states (Anant et al, 2006). Low labor mobility across Indian states is also clearly pointed to in the work of Munshi and Rosenzweig (2007) and Topalova (2004b).

while γ_k are industry dummies. For unemployed workers γ_k captures the immediate past industry in which they worked. Finally e_{it} is an identically and independently distributed error term.

The industry dummy variable coefficients represent the part of the probability of unemployment that cannot be explained by individual characteristics and are instead due to a worker's industry affiliation. Obtaining industry measures of the probability of unemployment in this manner is advantageous since the individual characteristics above control for composition differences (based on age, education etc) across industries. This ensures that the relationship between the probability of unemployment and trade protection in the second stage are not driven by such compositional differences.

As is the case in the previous literature (see Attanasio, Goldberg, and Pavcnik, 2004 and Goldberg and Pavcnik, 2005), we normalize our industry coefficients by converting them to a deviation from an employment-weighted average industry probability of unemployment. The normalized industry coefficients thus represent the probability of becoming unemployed in an industry relative to that probability in an average industry. The normalized industry unemployment probabilities and their standard errors are calculated using the Haisken-DeNew and Schmidt (1997) approach. The first-stage regressions are estimated separately for each year in our sample.

In the second stage, we estimate the following equation:

$$\Delta\Psi_{kt} = a_2 + \beta_4\, \Delta protection_{kt-1} + \lambda_t + \Delta\eta_{kt} \qquad (35)$$

where $\Delta\Psi_{kt}$ is the one-period change in the normalized industry unemployment probability for industry k at time t. .$\Delta protection_{kt-1}$ is the one-period change in industry-level trade protection. λ_t are time dummies that capture the role of macroeconomic factors that may be driving the changes in unemployment probabilities across time. Finally, $\Delta\eta_{kt}$ is the one-period change in the identically and independently distributed error term. We run (35) in one-period changes following the preferred specification of Attanasio, Goldberg, and Pavcnik (2004). Note here that "period" refers to a round of the survey and time difference between two such consecutive rounds is usually 6 years. Thus our estimation is effectively done in long differences and perhaps, given data constraints (the time duration between rounds), captures only steady-state effects. However, we also try long differences in four different time lags simultaneously in the hopes of capturing some of the transitional dynamics (short-run and long-run effects). Note here also that time t is measured in years and so t-1 refers to a one-year lag.

The effect of trade protection on the relative probability of becoming unemployed is determined by the sign of β_4. A positively signed estimate of β_4 implies that reductions (increases) in protection are associated with reductions (increases) in the relative probability of becoming unemployed. While the overall relationship between trade protection and the probability of becoming unemployed is ambiguous in theory, based on the discussion in Section 2, we expect that lower trade protection will lead to a decline in the relative probability of becoming unemployed in comparative advantage industries. The reason for this is that in such industries, exports should dominate imports and in the case of exports, the impact of industry-level import tariff is expected to be mainly through the impact of input rather than output tariffs (as mentioned before, it is otherwise difficult to separate the effects of tariffs on imports of output and inputs at the maximum degree of disaggregation available). To test this hypothesis we interact $\Delta protection_{kt-1}$ with an indicator variable for net export industries as well as with an industry-level measure of labor intensity. We expect the coefficient of the interaction terms to be positive.

Since the dependent variable in equation (35) is estimated it induces additional noise in the error term. As the measurement error is in the left-hand side variable, the coefficients in the second stage will be consistently estimated. However, the second stage estimates will have a higher estimated variance due to this reason. To account for this we estimate equation (35) using weighted least squares (WLS) where the inverse of the variance of the industry unemployment probabilities estimated in the first stage will act as weights. We also correct for general forms of heteroskedasticity by computing Huber-White robust standard errors.

The industry-level measures of trade protection are also particularly susceptible to endogeneity bias. This is because trade policy can be used to protect declining industries that are driving large increases in unemployment. To the extent that such political economy factors are time varying, they will not be removed by the first-differencing in equation (35). In addition, while the trade reforms of 1991 were conducted under external pressure and can thus be considered exogenous, the same cannot be said of the latter periods in our sample. Topalova (2004a) argues that after 1996 the external pressure that led to the initial reforms had abated and thus trade policy was more likely to be driven by political economy factors.

To address such concerns for endogeneity we employ the approach used by Goldberg and Pavcnik (2005). This methodology involves instrumenting the differenced protection term in equation (35) using the following instruments: (a) two-period lagged protection data, and (b) protection data from the initial year of the sample. This instrumental variable strategy rests on the assumption that while past protection levels determine current changes in protection they are less likely to be correlated with current changes in the error term.

5. Data

5.1 State-Level Unemployment

State- and sector-specific unemployment rates – i.e., unemployment rates for the state as a whole as well as its rural and urban subcomponents – were computed using data from the "employment-unemployment" surveys carried out by India's National Sample Survey Organisation (NSSO). The employment-unemployment surveys are the most comprehensive source for computing unemployment rates in India; accordingly, we utilize the four most recent quinquennial rounds of the surveys covering the years 1987-88, 1993- 94, 1999-2000, and 2004-05 – years which enable our analysis to span a period that starts approximately three years prior to the trade liberalization of 1991 and ends fairly recently.[14, 15] The quinquennial round surveys are often referred to as large sample rounds of the NSSO's surveys (as distinct from smaller sample annual rounds that may or may not include the employment-unemployment survey), given that they entail surveys of well over a hundred thousand households involving a multi-stage stratified sampling strategy over a full year.

The employment- unemployment surveys collect information on demographic characteristics of all household members as well as information on their participation in economic activities based on three

[14] Survey work in each of the rounds was carried out between July and June. For example, the 1987-88 survey is based on data collected between July 1987 and June 1988. In the remainder of this paper, we refer, for simplicity, to each of the four survey years in terms of the first year of the survey. For example, we refer to 1987-88 as 1987.

[15] NSS released two types of datasets for Round 55: Schedule 10 (basic) and Schedule 10.1 (revisit). Our analysis uses data from Schedule 10; however, official reports from NSSO use results from combined Schedule 10/ 10.1.

reference periods, 365 days prior to the survey (or "usual status"), one week prior to the survey (or "current weekly status") and each day of the 7 days prior to the survey (or "current daily status"). The information on participation in economic activities can be used to infer labor force status of an individual; i.e., whether they are in the labor force or not, and in case they are, whether they are employed or unemployed. For a subset of individuals – those engaged in wage employment in the week prior to the survey – information is also collected on wage earnings.

It is useful to briefly go over the concepts and definitions adopted by the NSSO for determining labor force status based on the employment - unemployment surveys for the two reference periods used to compute unemployment rates in this paper: 365 days and one week prior to the survey.[16] For any given reference period, an individual can be engaged in one or more of the following three activities: working; not working, but either making tangible efforts to seek work or being available for work if it is available; and neither engaged in work nor available for work. A unique labor force status for each individual can be arrived at by adopting a major *time* or *priority* criterion.

The time criterion is used for determining the labor force status of individuals based on the 365 day reference period. An individual is first assigned to be either in the labor force or out of it depending on which activity dominated in terms of the time spent. They are then assigned to be either employed or unemployed depending on which of the two accounted for more of their time over 365 days. Turning to the current week reference period, an individual's labor force status is based on the priority criterion, whereby the status of working is given primacy. Specifically, a person is considered employed if they had worked for at least one hour on at least one day during the seven days preceding the survey. If a person had not done so, but had made efforts to get work or had been available for work, they are considered unemployed. A person who had neither worked nor was available for work any time of the reference week is considered as outside of the labor force. For both the reference periods, the unemployment rate is easily arrived at by computing the ratio of the number of unemployed to the size of the labor force.

[16] For more details on the employment-unemployment surveys and the various concepts and definitions used, see NSSO (2000).

We followed the above for computing unemployment rates for 15 major states of India using both the 365 day reference period as well as the one-week reference period.[17, 18] In addition to considering unemployment rates at the state level as a whole, we also consider unemployment rates separately for the rural and urban sectors within states. Our empirical results for the state-level analysis were qualitatively very similar across unemployment rates based on a reference period of 365 days or the week prior to the survey. Also the two unemployment series are highly correlated. We therefore limit our discussion to unemployment rates based on the seven-day reference period. A few of our unemployment numbers deviate sometimes just a little from those reported in the NSSO's official publications mainly on account of the fact that we restrict at the outset attention to individuals aged between 15 and 65. There are only very few cases of such deviations.[19]

5.2 Industry-Specific Unemployment

Beginning with the 1993-1994 round the NSSO surveys asked follow-up questions to individuals that were unemployed during the previous week. These follow-up questions asked unemployed workers whether they had worked previously and the industry of their previous employment. This information was used to construct the industry-specific unemployment variable used in the paper. In particular, unemployed workers who had worked previously were assigned a value of 1 and were considered "unemployed" while all other employed individuals were assigned a value of 0. Unemployed workers were then assigned the industry in

[17] We deviate from the NSSO's procedures on one account and that is to treat individuals categorized as casual wage workers who did not work during the week prior to the survey due to temporary illness as employed. (The NSSO treats such individuals as out of the labor force.) Since such individuals are very few in numbers, their treatment does not make any material difference to estimates of the unemployment rate.

[18] After 2000, three new states were formed: Chattisgarh, formerly part of Madhya Pradesh; Jharkhand, formerly part of Bihar; and, Uttaranchal, formerly part of Uttar Pradesh. In order to maintain consistency across years, we do not consider these new states separately and instead consider the earlier state boundaries.

[19] For the most part, deviations between our numbers and those reported in NSSO publications are trivial. The only exception is for 1999 (round 55). This is mainly due to the fact that the unemployment rates reported by the NSSO for round 55 are based on including information from revisits to some sample households. It is unclear why the NSSO followed this procedure. In any case, we did not use data from the revisits in order to maintain consistency across years (data from revisits either does not exist, or has not been provided in public use files for any other round). Personal communication with some NSSO staff indicates that omitting information from the revisits is appropriate for our purposes.

which they were previously employed. Note that unemployed individuals who had never worked were excluded from this analysis as they could not be assigned to a particular industry.

One complication with the industry data in the various NSSO surveys is that the industrial classification changed starting with the 1999-2000 round. In particular, while the 1993-1994 round used the 1987 National Industrial Classification (NIC), the 1999-2000 and 2004-2005 rounds used the 1998 NIC. To ensure that the industry data in all three rounds were comparable, we converted all of the industry data to the two-digit 1987 NIC level. Finally, note that since the industry-level analysis starts with the 1993-1994 round, it does not cover the period prior to the trade reforms of 1991.

5.3 Protection

We use information on commodity-specific tariff rates and NTB coverage rate from Pandey (1999) and Das (2008) to construct industry-specific tariff rates and non-tariff coverage rates at the 2-digit industry level for each year relevant to our analysis.[20] There are 32 such industries spanning agriculture, mining, and manufacturing industries. A multicollinearity problem arises when tariffs and non-tariff barriers are simultaneously used on the right-hand side of our regressions. This is due to the strong correlation between the two protection measures and it prevents the precise estimation of their individual effects. To get around this problem, a combined measure of tariffs and non-tariff barriers is calculated using principal component analysis (PCA). PCA is commonly used to reduce the dimension of a matrix of correlated variables by combining them into a smaller set of variables that contains most of the variation in the data. In our case, the first principal component contains approximately 90% of the variation in the protection data for all industry groups, and hence is used as a combined measure.

As for state-level trade protection used in our state-level analysis, we follow Topalova (2007) and Hasan, Mitra, and Ural (2007) and construct state- specific measures of trade protection at three levels of

[20] Pandey reports commodity-specific tariff rates and NTB coverage rate for various years over the period 1988 to 1998. Das (2008) updates these for various years up to 2003 using the methodology of Pandey. We use simple linear interpolation to account for the fact that there are some years between 1988 and 2003 for which we do not have information on trade protection. Additionally, as is explained below, our estimation strategy requires that we also have protection related data for 1986. We estimate these by assuming that tariff and NTB coverage rates grew at the same annual rate between 1986 and 1988 as they did between 1988 and 1989. The NTB coverage rates estimated for 1986 are bounded at 100%.

aggregation -- i.e., the state as a whole, as well as for urban and rural sectors within states. In particular, we weight industry level tariff rates and NTB coverage rates for agricultural, mining, and manufacturing industries by state and sector specific employment shares as follows:

$$Tariff_{it}^{j} = \sum_{k} \gamma_{ik,1993}^{j} * Ind\_Tariff_{kt} \qquad (36)$$

$$NTB_{it}^{j} = \sum_{k} \gamma_{ik,1993}^{j} * Ind\_NTB_{kt} \qquad (37)$$

where $\gamma_{ik,1993}^{j}$ is the employment share of industry *k* in broad sector *j* (urban, rural or overall) of state *i* derived from the 1993 employment-unemployment survey.[21] Ind_Tariff_{kt} and Ind_NTB_{kt} are 2-digit industry specific tariff rates and non-tariff coverage rates for each year *t*. $\sum_{k_m} \gamma_{ik,1993}^{j} = 1$ where *k* represents tradable 2-digit industries (comprising agricultural, mining, and manufacturing industries). Non-tradable industries were excluded from the calculations.[22] As in the case of industry-specific measures of protection, a combined measure of tariffs and non-tariff barriers is calculated specific to each state using PCA.

5.4 Labor-Market Flexibility

As noted in Section 3, India's states can be expected to vary in terms of the flexibility of their labor markets. We use two approaches to partition states in terms of whether they have flexible labor markets or not. A first approach starts with Besley and Burgess' (2004) coding of amendments to the Industrial Disputes Act (IDA) between 1958 and 1992 as pro-employee, anti-employee, or neutral, and extends it to 2004.[23] Five states are

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21 1993-94 is one of the middle years in our data and we thus treat this as the base (reference) year in the construction of our state-level openness index. Like in the case of any good index, the weights therefore are not allowed to change from one year to another. One potential drawback of using 1993-94 as the base year is that although close to the dramatic trade liberalization of 1991, it is still approximately 2 years after that event. It is possible that employment in states with large concentration of protected industries prior to the 1991 liberalization may have already declined by 1993-94. In this case, using 1993-94 is the base year may understate the impact of liberalization on unemployment.

22 Similar employment-weighted protection measures have been used in other recent studies. One such example is Edmonds, Pavcnik and Topalova (2008). The idea here is that there is an interaction between the industry-level tariff vector and the employment vector in the determination of various outcomes. This measure of state-level protection has been theoretically justified by Kovak (2010) using a multi-region, multi-industry trade model with sector-specific factors and labor that is mobile across sectors, with all factors being totally immobile across regions.

23 Besley and Burgess (2004) consider each state-level amendment to the IDA between 1958 and 1992 and code it as a 1, -1, or 0 depending on whether the amendment in question is deemed to be pro-employee, anti-employee, or neutral. The scores are then

found to have had anti-employee amendments (in net year terms, as defined in Besley and Burgess, 2004): Andhra Pradesh, Karnataka, Kerala, Rajasthan, and Tamil Nadu.[24] Since anti-employee amendments are likely to give rise to flexible labor markets, a natural partition of states would be to treat these five states as having flexible labor markets.[25] These states are termed *Flex* states in our empirical analysis. For these states the variable *Flex* equals 1, while it takes the value of 0 for other states.

This partition has some puzzling features, however. Maharashtra and Gujarat, two of India's most industrialized states, are categorized as having inflexible labor markets on account of having passed pro-employee amendments to the IDA. However, Indian businesses typically perceive these states to be good locations for setting up manufacturing plants. It is questionable whether Indian businesses would consider Maharashtra and Gujarat to be especially good destinations for their capital if their labor markets were very rigid. Conversely, Kerala is categorized as having a flexible labor market despite an industrial record which is patchy in comparison with that of Maharashtra and Gujarat. Moreover, few Indian businesses would consider it a prime location for setting up manufacturing activity.

An alternative partition of states arises by including Maharashtra and Gujarat in the list of states with flexible labor markets while dropping Kerala. A World Bank research project on the investment climate faced by manufacturing firms across ten Indian states lends strong support to such a switch (see Dollar, Iarossi, and Mengistae (2002) and World Bank (2003)).[26] First, rankings by managers of surveyed firms lead Maharashtra and Gujarat to be the two states categorized as "Best Investment Climate" states; Kerala was one of the three "Poor Investment Climate" states. Second, the study reports that small and medium sized enterprises receive twice as many factory inspections a year in poor climate states (of which Kerala is a member) as in the two best climate states of Maharashtra and Gujarat. This suggests that even if IDA amendments have been pro-

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cumulated over time with any multiple amendments for a given year coded to give the general direction of change. See Besley and Burgess (2004) for details. (The Besley and Burgess coding is available at http://econ/lse/ac.uk/staff/rburgess/#wp.)

[24] With the exception of Karnataka these anti-employee amendments took place in 1980 or earlier. For Karnataka the anti-employee amendments take place in 1988.

[25] An alternative measure of labor-market flexibility/rigidity would have been to use the cumulative scores on amendments. This is the approach of Besley and Burgess (2004). Using these scores in place of our labor-market flexibility dummy variable leaves our results qualitatively unchanged.

[26] Over a thousand firms were surveyed across ten states. Over nine hundred belong to the manufacturing sector.

employee in the Maharashtra and Gujarat, their enforcement may be weak. Finally, a question on firms' perceptions about "over-manning" – i.e., how the optimal level of employment would differ from current employment given the current level of output – indicate that while over-manning is present in all states, it is lowest on average in Maharashtra and Gujarat.[27] Thus, we consider a modified partition in which Maharashtra and Gujarat are treated as states with flexible labor markets while Kerala is treated as a state with inflexible labor markets. The six states with flexible labor markets as per this modification are termed *Flex2* states (i.e., Andhra Pradesh, Gujarat Karnataka, Maharashtra, Rajasthan, and Tamil Nadu). For these states the variable *Flex2* equals 1, while it takes the value of 0 for other states.

We also consider a final alternative partition of states that has recently been used by Gupta, Hasan, and Kumar (2009). This partition is based on combining information from Besley and Burgess (2004), Bhattacharjea (2008), and OECD (2007).[28] Bhattacharjea focuses his attention on characterizing state level differences in Chapter VB of the IDA (which relates specifically to the requirement for firms to seek government permission for layoffs, retrenchments, and closures). However, Bhattacharjea considers not only the content of legislative amendments, but also judicial interpretations to Chapter VB in assessing the stance of states vis-à-vis labor regulation. He also carries out his own assessment of legislative amendments as opposed to relying on that of Besley and Burgess. The OECD study uses a very different approach and relies on a survey of key informants to identify the areas in which states have made specific changes to the implementation and administration of labor laws (including not only the IDA but other regulations as well). The OECD study aggregates the responses on each individual item across the various regulatory and administrative areas into an index that reflects the extent to which procedural changes have reduced transaction costs vis-à-vis labor issues. Gupta et al take each of the three studies, partition states into those with flexible, neutral, or inflexible labor regulations and then finally come up with a composite labor market

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[27] A supplement to the original World Bank survey carried out in two good investment climate states and one poor investment climate state was aimed at determining the reasons behind over-manning. The results indicated that over-manning was partially the result of labor hoarding in anticipation of higher growth in the future in the good investment climate states but hardly so in the poor investment climate state. In fact, labor regulations were noted as a major reason for over-manning in the latter. This lends indirect support to the notion that given Maharashtra and Gujarat's ranking as best investment climate states, labor regulations have in effect been less binding on firms than the amendments to the IDA may suggest.

[28] See also Bhattacharjea (2006) for a critique of the Besley-Burgess coding.

regulation indicator variable using a simple majority rule across the different partitions. Based on their work, we define *Flex3* which takes a value of 1 for five states deemed to have flexible labor regulations (Andhra Pradesh, Karnataka, Rajasthan, Tamil Nadu, and Uttar Pradesh) and 0 for the remaining states.[29]

5.5 Other Variables

Employment share of net exporter industries and of net importer industries: Since trade liberalization is bound to affect net exporting/importing industries in different ways, we construct the share of employment in net exporting/importing industries for each state. First, we use information on exports and imports for 1989-90 to categorize industries as either a net exporting industry if net exports are greater than zero, or a net importing industry, if net exports are less than zero. We then compute state-specific employment shares for the urban sector for each of our years using the employment-industry information contained in the NSSO employment-unemployment survey data for that year. We limit our attention to the urban sector because at the 2-digit industry level at which we work, trade volumes can vary significantly within the 2-digit 'agricultural production' industry. For example, important subcomponents of this industry include wheat and rice. While protection patterns for the two are very similar over the years, one is a net exporting industry while the other is a net importing industry. On aggregate, the agricultural production industry is a net importer. Since both wheat and rice account for large shares of employment in rural areas, we think it unadvisable to classify the entire industry as a net importer.

Product market regulations: We also use in some of our empirical analysis a time invariant measure of product market regulations across Indian states. As with labor market regulations, some aspects of India's product market regulations are determined at the state-level; moreover, it is the state which is responsible for their enforcement. Our measure of state-level product market regulations (PMR) is that created by Gupta, Hasan, and Kumar (2009) using a survey of product market regulations across Indian states carried out by OECD (2007) and results from an investment climate survey of Indian states carried out by the World Bank.

[29] While, as is obvious from our discussion above, we believe Gujarat and Maharashtra are most likely states with relatively flexible labor markets and labor laws, there are some ongoing debates on coding of some states including these two. We therefore use the third measure to show the robustness of our results to using all existing measures, allowing the reader to pick his or her preferred measure.

The PMR variable takes the value of 1 for states which have relatively competitive product market regulations (Haryana, Karnataka, Maharashtra, Punjab, and Tamil Nadu). PMR for the remaining states takes a value of zero.

The upper two panels of Table 1 provide summary statistics for protection and unemployment rates for the 15 states and years our empirical analysis is based on. As can be seen quite clearly, India experienced a fairly remarkable reduction in tariffs and non-tariff barriers over the period covered in our paper. There has been some increase in tariffs between 1998 and 2003, however, driven largely by industries prevalent in rural employment (i.e., agricultural products). As for the reported unemployment rates, it may be noted from the reported variances that there is considerable variation in these across states and over time . The last panel of Table 1 describes the percentage of unemployed workers previously employed in an industry relative to all employed workers in the industry. This is done for each year for which the data is available. The data suggests that the average percentage of unemployed workers across all 32 industries we work with increased from 1.31% in 1993 (the first year for which we have such information) to 3.6% in 2004. This increase is by no means uniform, with there being tremendous variation in the change of unemployment probabilities across the 32 industries. The last three rows, which describe the 10^{th}, 50^{th}, and 90^{th} percentile values of the percentage of unemployed workers previously employed in an industry relative to all employed workers in that industry, indicate this quite clearly.

Table 2 provides more details on our trade protection variables by state and subsector (i.e., overall, rural, and urban) for the initial and final years of our data. It also describes how states are coded in terms of the labor market and product market regulation variables.

6. Results

6.1 State Unemployment

In Table 3, we present results using the overall unemployment rate as the dependent variable. In all our regressions present in this table and all subsequent ones, we use state-level fixed effects and year dummies. The state-level protection measures used are tariffs and NTB weighted by employment across the different tradable sectors, as well as a principal-components combination of the two. There is no evidence of any effect of protection on unemployment. The protection measure is mostly positive but insignificant. This is true across all measures of protection, when there are no controls. When an additional variable, namely an interaction of these protection measures with the state-level labor-market flexibility measure (either *Flex*1 or *Flex2* or *Flex3*) or product market regulation (*PMR*), is introduced, we find that this variable (especially in the case of tariffs) is positive but in most cases only mildly statistically insignificant. The protection variable, by itself, still remains positive and insignificant.

However, taking into account the overall effects of protection on unemployment -- i.e., incorporating not only the own protection terms but also the interactions terms -- we find that in states with more flexible labor markets as measured through either *Flex2* or *Flex3*, unemployment is positively and significantly related to protection. In other words, we find evidence that trade liberalization can reduce unemployment in states with flexible labor markets. Consider the estimates reported in column 3 of Table 3. In states with flexible labor markets, a one percentage point increase in the employment-weighted tariff rate leads to a 0.75 percent increase in the unemployment rate (0.00388+0.00361).[30] A Wald test reveals this effect to be statistically significant at the 10% level. Since tariff rates declined by an average of 21% in states with flexible labor markets between 1987 and 1993, this reduction in protection translates into a decline in the unemployment rate of approximately 16%. The average unemployment rate in states with flexible labor markets was 4.75% in 1987. A 16% decline would mean an unemployment rate of 3.99% by 1993. Given that the actual unemployment rate in 1993 was 2.94% in these states our estimates suggest that trade liberalization had an economically significant impact on reducing unemployment rates in these states. Qualitatively similar results are obtained for the estimates reported in column 4 and columns 13 and 14, the latter two based on the principal-components combination of the employment-weighted tariffs and NTBs.

In Table 4 for rural unemployment, we find results somewhat similar to what we found for overall unemployment in Table 3. However, the significance of the interaction terms involving protection and the *Flex* variables is particularly weak. This suggests that a positive relationship between protection and

[30] Note here that the dependent variable is the logarithm of unemployment rate and employment-weighted protection is obtained by computing the employment-weighted average of protection measured in percentage points.

unemployment may be stronger in urban areas. This is indeed what we find in Table 5. Here, the various estimates provide strong evidence across all protection and labor market flexibility measures that in the states with flexible labor markets, protection and unemployment are positively related. In particular, there is strong evidence from columns 2, 3, 4, 7, 8, 9, 12, 13 and 14 of Table 5 that trade liberalization reduces urban unemployment in states with flexible labor markets. For example, in states with flexible labor markets the estimates reported in column 2 indicate that a one percentage point increase in the employment-weighted tariff rate leads to a 1.1 percent increase in the unemployment rate (0.00788+0.00321). Since average employment-weighted tariff rates in the urban sectors of states with flexible labor markets declined from 131% to 93.6% (i.e., a decline of approximately 37 percentage points) between 1987 and 1993, the estimates of column 2 suggest a 41.5% decline in the urban unemployment rate in such states. With an average urban unemployment rate of 6.62% in the states in 1987, the tariff reductions would imply unemployment rates to fall to 3.87% in 1993. (The actual average unemployment rate in 1993 was 4.72%.)

While these results are consistent with the notion that the benefits of trade liberalization will outweigh its costs in environments characterized by a high degree of factor mobility (labor mobility in this case), alternative interpretations of these results are possible. Perhaps the most relevant one is the possibility that the positive interaction involving protection and flexible labor regulations we find is capturing the beneficial effects of the latter on state's economic growth.[31] As found by Besley and Burgess using data from 1957 to 1997, states with flexible labor regulations tended to grow faster. A regression of the log of GSDP per capita on year dummies and our FLEX dummies for the four years being considered here (1987, 1993, 1999, and 2004) is only partly supportive of this. In particular, only the coefficient on FLEX2 is positive and statistically significant (while that on FLEX3 is negative but insignificant). Nevertheless, when we introduce the log of gross state domestic product (GSDP) per capita as an additional regressor in the models estimated in Table 5, all of our protection terms, direct as well as those involving interactions with the flexibility

[31] Another alternative possibility is that our results are being driven by trends in unemployment that depend on the importance of traded industries in state employment. However, introducing the 1993 employment shares for nontradables in interaction with protection terms as an additional regressor in the models estimated in Table 5 does not change results too dramatically. In particular, all interactions between protection and FLEX2 remaine positive and statistically significant. And while those involving FLEX1 and FLEX3 do not, several of the direct protection terms remain positive and statistically significant (namely tariff rates in the regressions involving both FLEX1 as well as FLEX3, and the first principal component in the regression involving FLEX3).

measures, become statistically insignificant. However, they remain positively signed. As for the GSDP terms, the coefficients on these are negative and statistically significant coefficients so that states which grow faster experience negative and significant reductions in unemployment. Of course, given that economic growth is probably the single most important correlate of unemployment rates, these results should not be too surprising. They do, however, suggest some caution in interpreting the results of Table 5.

In Table 6, we consider two more controls: the employment share of net exporter industries denoted by ENX (or of the net importer industries denoted by ENM) interacted with protection, and the triple interaction of ENX or ENM, protection and labor market flexibility.[32] This is done to capture restricted labor mobility across sectors. There is fairly strong evidence from columns 1, 5 and 9 that in states with a high employment share of net exporter industries, urban unemployment is positively related to employment-weighted protection and trade liberalization in such states reduces unemployment. There is no evidence that such effects conditional on the employment share of net exporter industries additionally vary between rigid and flexible labor market states. The results in Tables 5 and 6 lead us to believe that ENX and ENM for urban areas are highly correlated with labor market flexibility. In fact looking at the data, we do find that ENX on average is about 18 percent higher for the more flexible labor market states (as measured by our Flex2 variable) than the remaining states. While ENM is also higher for the flexible states, the differential is much smaller (only 8 percent). Therefore, once we control for the ENX or ENM interactions, there is nothing remaining to be explained by labor market flexibility.

6.2 Industry-Specific Unemployment

We next move to the impact of trade protection on the relative probability of becoming unemployed in a particular industry. Recall that the dependent variable here represents the probability of becoming unemployed in an industry relative to that probability in an average industry. Table A1 presents the estimation results for equation (34), which were used to calculate the industry unemployment probabilities. The results suggest that the probability of becoming unemployed is higher among younger, urban, and less educated

[32] Our discussion is based on the *Flex2* measure of labor market flexibility. Using *Flex3* does not change our key results.

workers. In the interest of space we did not report the actual industry coefficients. These results are available upon request.

Table 7 presents the results with the relative probability of becoming unemployed in a particular industry as the dependent variable. All regressions are in first differences and include year dummies. In addition, because the dependent variable is estimated we will use weighted least squares (WLS) where the inverse of the variance of the industry unemployment probabilities estimated in the first stage will act as weights. Finally, due to the data limitations discussed in Section 5.2, the industry-level analysis starts with the 1993-1994 round and does not cover the period prior to the trade reforms of 1991. The results in columns 1-3 do not suggest that trade protection has a statistically significant effect on the probability of becoming unemployed. In fact, the positive coefficient on all three protection measures suggest that lower trade protection is associated with lower probabilities of becoming unemployed, although the magnitude of the effect is small.

The industry-level protection measures used in columns 1-3 are particularly susceptible to endogeneity bias. This is because trade policy can be used to protect declining industries that are driving large increases in unemployment. To the extent that such political economy factors are time varying, they will not be removed by the first-differencing used in columns 1-3. To address such endogeneity concerns we will instrument the differenced protection term in the baseline specification using the following instruments: (a) two-period lagged protection data, and (b) protection data from the initial year of the sample. This instrumental variable (IV) strategy rests on the assumption that while past protection levels determine current changes in protection they are less likely to be correlated with current changes in the error term.

Columns 4-6 in Table 7 present the IV results. The coefficients for the one-period change in output tariffs and the principal component between tariffs and NTB's suggest that lower protection leads to lower probabilities of becoming unemployed. These results are significant at the 5% level. However, when we use output NTB's to capture protection we find no evidence of an effect of protection on the probability of becoming unemployed. The instruments themselves comfortably pass the over-identification test, while the first-stage F-statistic suggests that the instruments have adequate strength. Nonetheless, given the small sample sizes and the fact that the IV coefficients are larger than their OLS counterparts, the reader should interpret the IV results with caution.

Our analysis in Section 2 suggested that industry characteristics may have an important role in the relationship between trade protection and the probability of becoming unemployed. In particular, we expect that lower trade protection should reduce unemployment probabilities in comparative advantage sectors, which are expected to expand after trade liberalization. We examine this in Table 8 by interacting our protection measures in the baseline specification with an indicator for net export industries and a measure of the labor intensity of an industry. The coefficient for the interaction term in column 1 suggests that lower protection leads to a statistically significant decrease in the probability of becoming unemployed in net export industries. The result is qualitatively unchanged when we use alternate measures of protection in columns 2-3.

Columns 4-6 use the labor intensity of an industry as a measure of its comparative advantage. Labor intensity is captured by the share of wages in value added in an industry and is obtained from the 1992 NBER-CES Manufacturing Industry Database. The original data were for US industries and were concorded to the Indian two-digit National Industrial Classification (NIC) level. Note that the data is only available for manufacturing industries. The results suggest that lower protection leads to lower unemployment probabilities in labor intensive (i.e. comparative advantage) sectors, although the coefficients are not statistically significant.

Finally, in the period examined is this paper, India undertook several other reforms aimed at liberalizing the economy. Such reforms included the removal of strict licensing requirements that, among other things, dictated the size of firms as well as the removal of restrictions on foreign-direct investment (FDI). We first examine the importance of the removal of licensing requirements by including a measure of de-licensing in columns 7-9. The data on de-licensing are for three-digit manufacturing industries and are obtained from Aghion, Burgess, Redding, and Zilibotti (2008). We converted the three-digit data to weighted two-digit aggregates using each three-digit industry's share of output as weights. The resulting data captures the weighted fraction of each two-digit industry that was de-licensed. The results in columns 7-9 suggest that even after controlling for de-licensing, the relationship between trade protection and industry unemployment probabilities remain unchanged. In addition, the coefficients for de-licensing suggest that the removal of licensing restrictions increased the probability of becoming unemployed. However, barring column 9, this result is statistically insignificant.

We next turn to the role of FDI liberalization in columns 10-12. The data on FDI liberalization are for four-digit manufacturing industries and are obtained from Sivadasan (2009). The original measure is an indicator variable that is 1 for industries where restrictions on FDI were loosened and 0 otherwise. We converted the four-digit data to weighted two-digit aggregates using each four-digit industry's share of output as weights. The resulting data captures the weighted fraction of each two-digit industry that experienced FDI liberalization. The results in columns 10-12 indicate that even after controlling for FDI liberalization, the relationship between trade protection and industry unemployment remain unchanged. However, the coefficient on the interaction term, while statistically insignificant, suggests that lower trade protection led to higher unemployment in industries that experienced greater FDI liberalization.

Finally, we introduce additional lags separately and altogether in Table 9 in the hopes of finding any possible dynamics in the data to be able to separate short-run effects from long-run effects. As mentioned before, the long time interval between any two consecutive rounds of the data poses a serious challenge in this regard. When the various lags of protection are introduced separately, as in columns (1) through (4), we find that they are all positive. Except for the first lag, the others are also highly significant. It is important to note that the various lags of protection are highly correlated with each other. Thus, a simple interpretation of these results is that trade liberalization reduces industry-specific unemployment but with a lag. In column (5) when all the lags are simultaneously introduced, while the first lag is negative and significant at the 10 percent level, the second and third lags are positive, with second lag being significant at the 10 percent level. Also, the coefficients of the second and third lags add up to much more than the first lag, indicating that the long-run effect of trade liberalization is unemployment reducing even though the immediate impact can be unemployment increasing. This is consistent with the short-run predictions in our theory section.

7. Concluding Remarks

In this paper, we have empirically examined the relationship between trade protection and unemployment using data from Indian states. We find that trade liberalization has an unemployment reducing effect in states with flexible labor markets, and in states with a high employment share in the net export sectors. In addition to the state-level findings, we also find that workers in industries experiencing greater trade liberalization were *less* likely to become unemployed, especially in net export industries. There is some evidence that this effect probably works with a small lag and in the short-run there is the possibility of an unemployment increasing effect of trade liberalization in the case of industry-specific unemployment.

These results can be explained using a theoretical framework incorporating trade and search-generated unemployment and institutional features of the Indian economy such as limited or no intersectoral mobility and labor-market rigidities. In doing our analysis, we follow some of the recent literature on cross-regional analysis of the impact of trade liberalization on poverty, child labor, human capital etc to construct state-level protection measures as the employment weighted-averages of industry-level protection measures such as tariffs or alternatively NTBs.[33] These measures of state-level protection are inverse measures of the degree to which a state is exposed to globalization. It could also be viewed as the interaction between a state's vector of sectoral employment shares and the vector of industry-level protection. In other words, there is an implicit assumption in using this measure that the state-level responses to reductions in the various industry-level tariffs will depend on how employment is distributed across sectors. This assumption seems to be reasonable, especially in our context.

In conclusion, the empirical results in this paper provide support for trade liberalization along with complementary reforms in domestic policy, i.e., the full benefits of trade reforms cannot be reaped without domestic labor market reforms. We also see that states with a bigger share of the urban population in net-export sectors are ones where trade reforms are more effective in reducing urban unemployment. While this is certainly a function of comparative advantage, certain export-promotion strategies also might be useful.

[33] See for instance Edmonds, Pavcnik and Topalova (2008) and Topalova (2010).

Exporting also has to do with search for and matching with buyers abroad. This is an area where the government may have a role to play.[34]

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[34] See for instance Freund and Pierola (2009) where, using data on the Peruvian "non-traditional" agricultural sector, they find considerable evidence for the role of risk taking, search and creativity on the part of what they call "export entrepreneurs" in finding export markets and the right products for those markets. One can argue here that government assistance will be useful especially in sectors where firms are small.

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TABLE 1. Summary Statistics

Trade Protection Measure* (State-Level):	*1986*	*1992*	*1998*	*2003*
Overall Tariff (%)	94.69	70.63	24.38	27.19
Rural Tariff (%)	90.22	67.86	22.86	27.37
Urban Tariff (%)	131.49	93.84	36.72	25.59
Overall Non-Tariff Barriers (%)	100.00	80.80	70.48	17.43
Rural Non-Tariff Barriers (%)	100.00	81.54	72.47	18.49
Urban Non-Tariff Barriers (%)	100.00	74.25	53.33	8.31

	*Average** (Variance)*			
Labor Measures (State-Level):	*1987*	*1993*	*1999*	*2004*
Overall Unemployment Rate (%)	5.58 (13.55)	4.09 (5.03)	4.70 (9.52)	5.06 (12.48)
Rural Unemployment Rate (%)	5.09 (14.17)	3.48 (4.59)	4.28 (10.36)	4.58 (12.22)
Urban Unemployment Rate (%)	7.49 (14.28)	6.41 (8.01)	6.43 (8.80)	7.04 (16.33)

Labor Measures (Industry-Level): Unemployed workers previously employed in an industry relative to all employed workers in the industry	*1993*	*1999*	*2004*
All Agriculture, Mining, and Manufacturing Industries (%)	1.31	1.86	3.60
10^{th} percentile (%)	0.00	0.16	0.00
50^{th} percentile (%)	1.30	1.66	1.86
90^{th} percentile (%)	2.48	3.93	4.73

Notes:
* Trade protection measures are introduced in our regression equations with a one-year lag.
** The average is taken over the 15 major states.

TABLE 2. Independent Variables: Initial Year and Final Year

State	*Andhra Pradesh*	*Assam*	*Bihar*	*Gujarat*	*Haryana*	*Karnataka*	*Kerala*	*Madhya Pradesh*	*Maharashtra*	*Orissa*	*Punjab*	*Rajasthan*	*Tamil Nadu*	*Uttar Pradesh*	*West Bengal*
Tariff (%)															
Initial year	88.25	104.56	79.93	95.08	91.56	92.92	149.55	81.55	89.09	84.54	91.26	89.19	99.55	85.81	97.49
Final year	26.63	31.93	25.62	25.18	25.34	27.36	39.10	25.72	25.69	25.46	25.12	25.38	26.53	25.74	27.03
Tariff (Rural) (%)															
Initial year	85.26	104.09	78.27	87.29	82.90	88.22	149.82	78.61	81.59	82.35	83.18	86.24	91.98	82.17	91.30
Final year	26.49	32.17	25.63	25.63	25.44	27.31	40.02	25.72	25.98	25.48	25.44	25.43	26.44	25.71	27.59
Tariff (Urban) (%)															
Initial year	120.04	124.15	122.63	144.04	138.37	127.29	148.35	119.61	134.72	130.75	136.58	124.61	135.41	126.67	139.18
Final year	28.12	21.91	25.15	22.35	24.83	27.68	34.73	25.77	23.98	24.92	23.31	24.76	26.98	26.09	23.27
Non-tariff Barriers (%)															
Initial year	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Final year	17.92	18.47	20.31	17.76	17.22	17.47	10.73	19.95	18.26	18.96	17.38	16.66	15.61	18.83	15.87
Non-tariff Barriers (Rural) (%)															
Initial year	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Final year	18.65	18.78	20.78	19.32	19.17	18.58	11.34	20.67	19.92	19.37	19.13	17.23	17.37	19.67	17.42
Non-tariff Barriers (Urban) (%)															
Initial year	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Final year	10.15	5.90	8.20	7.94	6.66	9.36	7.81	10.67	8.18	10.08	7.56	9.91	7.28	9.41	5.48
ENX (Urban) (%)															
Initial year	18.39	7.10	12.62	24.81	21.38	20.71	24.60	15.25	18.50	13.06	21.69	16.20	25.29	17.27	20.52
Final year	9.06	5.37	8.63	17.73	15.63	12.84	14.86	11.85	12.32	7.16	14.57	15.35	16.49	15.10	15.21
ENM (Urban) (%)															
Initial year	18.35	6.57	29.21	14.88	17.59	24.26	12.47	21.56	18.43	16.43	13.35	20.15	17.63	17.67	17.10
Final year	14.15	7.74	21.79	16.13	16.48	13.04	10.45	16.11	13.84	18.93	11.28	14.85	14.37	13.50	10.33
FLEX1	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0
FLEX2	1	0	0	1	0	1	0	0	1	0	0	1	1	0	0
FLEX3	1	0	0	0	0	1	0	0	0	0	0	1	1	1	0
PMR	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0

Note: FLEX variables and PMR are time-invariant: They take the same values throughout the years.

TABLE 3. Unemployment rates: Overall

	Tariff					*NTB*					*First principal component*				
Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Constant	1.28762	1.60203	1.09159	1.07125	1.18648	0.62925	1.46479	0.50774	0.60421	0.58564	1.34562	1.54875	1.27282	1.24272	1.3235
	[3.66]***	[3.24]***	[3.30]***	[3.08]***	[3.30]***	[0.30]	[0.65]	[0.27]	[0.32]	[0.29]	[5.25]***	[4.55]***	[5.99]***	[5.60]***	[5.37]***
L. Protection	0.00322	-0.00106	0.00388	0.00431	0.00346	0.00963	0.00057	0.0096	0.00875	0.0097	0.13897	0.00659	0.1527	0.17258	0.13987
	[0.94]	[0.18]	[1.28]	[1.36]	[1.07]	[0.47]	[0.02]	[0.51]	[0.47]	[0.48]	[1.08]	[0.03]	[1.49]	[1.60]	[1.19]
L. Protection*FLEX1		0.00263					0.00214					0.04841			
		[1.02]					[0.81]					[0.87]			
L. Protection*FLEX2			0.00361					0.00312					0.07022		
			[1.60]					[1.35]					[1.54]		
L. Protection*FLEX3				0.00373					0.00339					0.0764	
				[1.57]					[1.45]					[1.61]	
L. Protection*PMR					0.00254					0.00111					0.03548
					[1.10]					[0.46]					[0.74]
Observations	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Number of states	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
R-squared	0.22	0.24	0.27	0.26	0.24	0.22	0.23	0.26	0.26	0.22	0.22	0.24	0.27	0.27	0.23

Notes: State fixed –effects regressions. Absolute value of robust t statistics in brackets. Also included among the independent variables but not reported are the year dummy variables (1987 is the reference year)

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 4. Unemployment rates: Rural

	Tariff					*NTB*					*First principal component*				
Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Constant	1.27722	1.58085	1.08146	1.06153	1.14687	1.08508	2.06773	0.87766	1.04705	1.04009	1.32797	1.53476	1.2334	1.23202	1.28808
	[3.52]***	[3.17]***	[2.73]***	[2.59]**	[2.92]***	[0.53]	[0.93]	[0.45]	[0.56]	[0.50]	[5.09]***	[4.53]***	[4.73]***	[4.67]***	[4.74]***
L. Protection	0.00204	-0.00235	0.00294	0.00305	0.00276	0.00376	-0.00686	0.00462	0.00284	0.00408	0.07635	-0.06209	0.10517	0.10413	0.09148
	[0.58]	[0.38]	[0.83]	[0.86]	[0.78]	[0.19]	[0.30]	[0.24]	[0.15]	[0.20]	[0.62]	[0.32]	[0.88]	[0.90]	[0.74]
L. Protection*FLEX1		0.00276					0.00238					0.0526			
		[0.85]					[0.73]					[0.78]			
L. Protection*FLEX2			0.00331					0.00305					0.0666		
			[1.05]					[1.00]					[1.08]		
L. Protection*FLEX3				0.00432					0.00391					0.08566	
				[1.38]					[1.34]					[1.42]	
L. Protection*PMR					0.00231					0.00038					0.02476
					[0.70]					[0.12]					[0.38]
Observations	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Number of states	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
R-squared	0.21	0.23	0.23	0.25	0.22	0.21	0.22	0.23	0.25	0.21	0.21	0.23	0.24	0.25	0.22

Notes: State fixed –effects regressions. Absolute value of robust t statistics in brackets. Also included among the independent variables but not reported are the year dummy variables (1987 is the reference year)

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 5. Unemployment rates: Urban

	Tariff					*NTB*					*First principal component*				
Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Constant	0.89871	0.47973	0.7302	-0.00729	1.00703	2.78717	2.80177	2.55172	2.56494	2.81688	1.72778	1.40804	1.6086	1.22054	1.82063
	[1.15]	[0.65]	[1.00]	[0.01]	[1.27]	[2.50]**	[2.43]**	[2.48]**	[2.31]**	[2.51]**	[2.94]***	[2.42]**	[3.18]***	[2.01]*	[3.01]***
L. Protection	0.0079	0.010	0.0079	0.01375	0.0067	-0.00852	-0.00974	-0.00776	-0.00728	-0.00936	0.10751	0.2461	0.1334	0.3452	0.0471
	[1.36]	[1.82]*	[1.43]	[2.54]**	[1.15]	[0.77]	[0.85]	[0.77]	[0.66]	[0.84]	[0.36]	[0.84]	[0.52]	[1.13]	[0.15]
L. Protection*FLEX1		0.0032					0.00321					0.0826			
		[2.68]**					[2.06]**					[2.18]**			
L. Protection*FLEX2			0.0032					0.00398					0.0902		
			[3.00]***					[2.76]***					[2.94]***		
L. Protection*FLEX3				0.00318					0.00292					0.07999	
				[2.29]**					[1.78]*					[1.98]*	
L. Protection*PMR					0.0012					0.00162					0.0357
					[1.01]					[0.96]					[1.02]
Observations	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Number of states	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
R-squared	0.17	0.29	0.31	0.27	0.19	0.15	0.23	0.28	0.22	0.17	0.14	0.25	0.29	0.23	0.16

Notes: State fixed –effects regressions. Absolute value of robust t statistics in brackets. Also included among the independent variables but not reported are the year dummy variables (1987 is the reference year)

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 6. Unemployment rates: Urban (ENX/ENM variables)

	Tariff				*NTB*				*First principal component*			
Variables	1	2	3	4	5	6	7	8	9	10	11	12
Constant	1.56859	0.38341	1.21599	0.2666	3.28084	2.75259	2.99752	2.37558	2.10542	1.7528	1.86895	1.60519
	[1.80]*	[0.46]	[1.51]	[0.32]	[2.93]***	[2.39]**	[2.94]***	[2.33]**	[3.18]***	[2.53]**	[3.05]***	[2.80]***
L. Protection	-0.0011	0.00953	0.00263	0.01156	-0.01891	-0.00855	-0.01482	-0.00408	-0.25664	0.10236	-0.10201	0.17492
	[0.14]	[1.70]*	[0.38]	[1.89]*	[1.70]*	[0.75]	[1.42]	[0.39]	[0.68]	[0.33]	[0.29]	[0.66]
L. Protection*ENX	0.00021		0.0001		0.00029		0.00016		0.00897		0.0057	
	[2.14]**		[1.06]		[2.61]**		[1.30]		[2.00]*		[1.15]	
L. Protection*ENM		0.00013		0		0.00002		-0.00011		-0.00045		-0.00342
		[0.89]		[0.02]		[0.13]		[0.83]		[0.08]		[0.76]
L. Protection*FLEX2*ENX			0.00013				0.0002				-0.00005	
			[0.57]				[1.17]				[0.01]	
L. Protection*FLEX2*ENM				0.00039				0.00039				0.0194
				[1.49]				[1.35]				[1.43]
L. Protection*FLEX2			-0.00024	-0.00445			-0.00097	-0.00332			0.07492	-0.2243
			[0.04]	[0.83]			[0.22]	[0.56]			[0.61]	[0.98]
Observations	60	60	60	60	60	60	60	60	60	60	60	60
Number of states	15	15	15	15	15	15	15	15	15	15	15	15
R-squared	0.25	0.19	0.34	0.36	0.26	0.15	0.35	0.31	0.23	0.14	0.32	0.32

Notes: State fixed –effects regressions. Absolute value of robust t statistics in brackets. Also included among the independent variables but not reported are the year dummy variables (1987 is the reference year)

* significant at 10%; ** significant at 5%; *** significant at 1%

TABLE 7. Trade Liberalization and Unemployment Among Workers Who Had Worked Previously

Variables	FD			2SLS - FD		
	1	2	3	4	5	6
Constant	-0.001	0.000	0.001	-0.001	-0.005	0.015**
	[0.903]	[0.066]	[0.401]	[0.641]	[1.113]	[2.071]
Δ[L.Output Tariffs]	0.008			0.044**		
	[1.220]			[2.267]		
Δ[L.Output NTB]		0.001			-0.009	
		[0.207]			[0.977]	
Δ[L.First Principal Component]			0.144			1.425**
			[0.622]			[1.988]
Observations	64	64	64	64	64	64
Number of Industries	32	32	32	32	32	32
F-stat. for instrument strength	-	-	-	7.45	7.15	6.23
OID test p-value	-	-	-	0.69	0.94	0.75
R-squared	0.018	0.001	0.006	-	-	-

Notes: The dependent variable is the one-period change in the probability of becoming unemployed in an industry relative to that probability in an average industry. Protection measures have been lagged by one year and divided by 100. 2SLS-FD refers to first-difference regressions where the first-differenced protection measures have been instrumented using two-period lagged protection data and the protection data from the initial year of the sample. Note that first differencing here refers to differencing between two successive survey rounds that are generally six years apart and “period” here refers to a survey round.. Absolute value of robust t statistics in brackets. Also included among the independent variables but not reported are the year dummy variables (1999 is the reference year).

*** p<0.01, ** p<0.05, * p<0.1

TABLE 8. Industry Characteristics

	Net Export Industry			Labor Intensity			De-licensing			FDI Liberalization		
Variables	1	2	3	4	5	6	7	8	9	10	11	12
Constant	0.000	0.006	0.005	-0.004**	0.000	0.004	-0.005**	0.002	0.006	-0.004**	-0.002	0.003
	[0.396]	[1.459]	[1.473]	[2.165]	[0.062]	[0.511]	[2.515]	[0.360]	[0.843]	[2.224]	[0.231]	[0.345]
Δ[L.Output Tariffs]	-0.000			0.009			0.010			0.014		
	[0.016]			[0.746]			[0.762]			[1.112]		
Δ[L.Output Tariffs*Industry Characteristic]	0.012**			0.011			-0.001			-0.011		
	[2.055]			[0.680]			[0.248]			[0.880]		
Δ[L.Output NTB]		0.010			0.002			0.010			0.012	
		[1.487]			[0.176]			[0.866]			[1.102]	
Δ[L.Output NTB*Industry Characteristic]		0.003			0.034			0.012			-0.031	
		[0.439]			[1.594]			[1.274]			[1.579]	
Δ[L.First Principal Component]			0.372			0.005			0.008			0.008
			[1.449]			[1.015]			[1.625]			[1.498]
Δ[L.First Principal Component*Industry			0.153			0.006			0.002			-0.005
Characteristic]			[0.828]			[1.010]			[0.827]			[0.917]
Δ[Industry Characteristic]							0.006	0.004	0.009**			
							[1.378]	[0.629]	[2.671]			
Observations	56	56	56	36	36	36	36	36	36	34	34	34
Number of Industries	28	28	28	18	18	18	18	18	18	17	17	17
R-squared	0.084	0.043	0.065	0.075	0.099	0.100	0.076	0.109	0.110	0.167	0.211	0.213

Notes: All regressions are in first differences. The dependent variable is the one-period change in the probability of becoming unemployed in an industry relative to that probability in an average industry. Protection measures have been lagged by one year and divided by 100. Columns 4-12 are for manufacturing industries only. Absolute value of robust t statistics in brackets. Also included among the independent variables but not reported are the year dummy variables [1999 is the reference year].

*** p<0.01, ** p<0.05, * p<0.1

TABLE 9. Dynamics and additional time lags with industry-level protection

Variables	1	2	3	4	5
Constant	-0.001	-0.002**	-0.002**	-0.002*	-0.003
	[0.903]	[2.108]	[2.101]	[1.875]	[1.575]
Δ[L.Output Tariffs]	0.008				-0.016*
	[1.220]				[1.684]
Δ[L2.Output Tariffs]		0.010***			0.040*
		[2.831]			[1.786]
Δ[L3.Output Tariffs]			0.009***		0.001
			[2.747]		[0.044]
Δ[L4.Output Tariffs]				0.010***	-0.025
				[2.721]	[1.286]
Observations	64	64	64	64	64
Number of Industries	32	32	32	32	32
R-squared	0.018	0.085	0.074	0.069	0.122

Notes: The dependent variable is the one-period change in the probability of becoming unemployed in an industry relative to that probability in an average industry. Protection measures have been lagged and divided by 100. Absolute value of robust t statistics in brackets. Also included among the independent variables but not reported are the year dummy variables (1999 is the reference year).

*** p<0.01, ** p<0.05, * p<0.1

TABLE A1: First-Stage Regression Results

	1993	*1999*	*2004*
	1	2	3
Constant	0.032***	0.061***	0.078***
	(0.005)	(0.009)	(0.009)
Age	-0.000***	-0.002***	-0.001***
	(0.000)	(0.000)	(0.000)
Age Squared	0.000	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Male	0.001	-0.000	-0.003**
	(0.001)	(0.002)	(0.001)
Rural	-0.004***	-0.006***	-0.003
	(0.001)	(0.002)	(0.002)
Primary Education or Below	-0.004***	-0.009**	-0.003*
	(0.001)	(0.004)	(0.002)
Middle School Education	-0.004***	-0.012***	-0.008***
	(0.001)	(0.003)	(0.002)
Secondary Education	-0.003**	-0.015***	-0.007***
	(0.001)	(0.003)	(0.002)
Upper Secondary or Graduate	-0.004**	-0.005	-0.005**
Education	(0.002)	(0.003)	(0.002)
Post Graduate Education	-0.003	-0.006	-0.006
	(0.003)	(0.004)	(0.004)
Observations	119802	120219	114904
R-squared	0.006	0.024	0.024

Notes: The dependent variable takes the value of 1 for unemployed individuals that have worked previously and is 0 for employed individuals. Standard errors in parentheses. Also included among the independent variables but not reported are the industry and state dummy variables.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$