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On the heterogeneous effect of trade on unemployment

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Abstract

This paper tests a series of predictions about the possible relationship between trade and unemployment. Empirical results show that trade reduces unemployment in countries with comparative advantage in sectors with more efficient labour markets and leads to higher unemployment in countries with comparative advantage in sectors with less efficient labour markets. These results are obtained in a panel dataset of 107 countries covering the period 1995-2009. They further help reconcile the apparently contradicting evidence in the empirical literature and contrasting political views on the impact of trade on unemployment.

JEL classification: F10, F13, F16.
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Contents

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1. Introduction

Does international trade create or destroy jobs? Theoretical insights from Carrère et al. (2014)[1] suggest that patterns of trade and sector-specific labour market frictions interact in shaping aggregate unemployment. More precisely, if a country has a comparative advantage in sectors that have less efficient labour markets, then trade reallocates resources towards these sectors, and thereby may increase aggregate unemployment. Conversely, if comparative advantage and sector-specific labour market efficiency are positively correlated, unemployment falls with trade. This paper develops an empirical strategy aiming at testing this theoretical prediction. We find strong empirical support for the latter in a panel of 107 countries that account for more than 95 percent of world trade over the period 1995-2009.

Integrating labour market frictions in trade models as in Carrère et al. (2014) is important for at least three reasons. First, such a setting allows trade to destroy or create jobs, rather than assume away the impact of trade on unemployment. Until fairly recently, most economists would agree with Krugman (1992) that "it should be possible to emphasize to students that the level of employment is a macroeconomic issue...with microeconomic policies like tariffs having little net effect." Most international economics textbooks have no chapter on the impact of trade on unemployment. Our paper contributes to the filling of this gap. Second, the net impact of trade on unemployment is likely to be complex and ambiguous as illustrated in Helpman and Itskhoki (2010). It is therefore important to understand when to expect the adverse effects to dominate. Our paper provides an empirical test of the sector reallocation effect, a theoretical prediction we obtain building on Helpman and Itskhoki (2010) and Dornbusch, Fisher, and Samuelson (1977). Third, the relationship between trade and unemployment is an important political issue. Policymakers are convinced that there is a link between the two, but they disagree on the direction to which unemployment moves with trade. Voters seem to be convinced about this link, too, as voting patterns in the recent us presidential election suggest (Autor, Dorn, Hanson, and Majilesi, 2016). Our model and empirical evidence claim that the answer depends on the correlation between patterns of trade and labour market frictions.

Bringing Carrère et al. (2014) theoretical predictions to the data requires three steps. First, we need a measure of comparative advantage and a measure of sectoral labour market efficiency. We measure the former using the fixed-effect gravity approached introduced by Costinot, Donaldson and Komunjer (2012) and developed further by Hanson, Lind, and Muendler (2015). We construct the latter building on the simple idea that observed country-level unemployment rates are a weighted-sum of sector-level unemployment rates, where weights are given by labour force shares in each sector. Using data on aggregate unemployment and employment by sector we are then able to estimate sector-specific unemployment rates. Owing to the lack of time coverage in the sector level employment data that is available, we further assume that these sector-specific unemployment rates are common across countries in our baseline estimation.[2] We show that this new measure of sector-specific labour market frictions is positively correlated with existing proxies of labour market frictions such as labour union coverage. In a second step, we compute country-specific correlations between measures of comparative advantage and sector-specific unemployment rates. The country with the highest average correlation in our sample is the Russian Federation, which therefore has a comparative advantage in sectors with more inefficient labour markets. The country with the lowest average negative correlation is Israel, which therefore has a comparative advantage in sectors with more efficient labour markets.

Our third and final step involves testing whether unemployment is lower in countries where the correlation between comparative advantage and sector level labour market efficiency is high. The empirical results confirm this theoretical prediction. Robustness checks addressing measurement error and endogeneity of our measure of correlation to aggregate unemployment provide evidence that our results are robust.

[1] They develop a model that introduces search and matching labour market frictions in a trade model with a continuum of sectors to address this question. Comparative advantage drives the patterns of trade, whereas labour market frictions generate equilibrium unemployment. In our model, labour market frictions are sector-specific and the aggregate unemployment rate of a country can be thought of as a weighted average of these sector-specific labour market frictions.

[2] Note that, unlike in Cuñat and Melitz (2012), this identifying assumption implies that sector specific labour market frictions cannot be a source of comparative advantage. The model is general insofar as we do not impose this assumption in the theory, and we show that the qualitative theoretical predictions are identical. In the robustness checks sub-section we provide evidence suggesting that our results are not sensitive to this assumption.

The rest of the paper is organized as follow. Next section briefly discusses the main contributions to the literature on trade and (un)employment with a precise reference to the originality of Carrère et al. (2014) set up and predictions. Section 3 describes the empirical strategy followed to test these predictions. Section 4 presents our core results and a series of robustness checks. Last session briefly discusses the practical relevance of our empirical evidence.

2. Trade and (un)employment: theoretical insights and empirical evidence

This paper builds on a growing literature on the impact of trade on unemployment. This literature has abandoned the assumption that workers displaced by trade reform are simply reallocated to new productive activities. However, whether equilibrium unemployment rises or falls because of trade reform remains an open question.

2.1 Trade and unemployment: theory

Theory provides contradicting answers as discussed in Helpman, Itskhoki, Muendler and Redding (2013). In an early contribution, Brecher (1974) develops a model of a small open economy with a minimum wage to show that the impact of trade liberalization on welfare and unemployment depends on relative factor endowments: labour-abundant countries experience a fall in unemployment as they open up to trade, whereas capital-abundant countries see unemployment increase. Davis (1998), building on Brecher's setup and allowing for terms-of-trade effects in a world with two identical economies except for their labour market rigidities, shows that openness reduces welfare and increases unemployment in the economy with more rigid labour markets. Davidson, Martin and Matusz (1999) assume that sectoral labour market frictions can be a source of comparative advantage and differences across sectors eventually manifest themselves as Ricardian technology differences. In this framework, they show that the impact of trade liberalization on unemployment depends on relative capital-labour endowments across different countries as in Brecher (1974). More precisely, when a relatively capital-abundant large country begins to trade with a small, relatively labour-abundant country, unemployed workers in the large country unambiguously suffer welfare losses even if the small country has a less efficient labour market. Cuñat and Melitz (2012) also recognize that labour market frictions can play an important role in framing comparative advantage patterns. However, they highlight a different mechanism, exploring how differences in the volatility of industries (defined as the variance of firm-level shocks) affect the reallocation of workers across firms within an industry. Their findings suggests that firms in countries with greater labour market flexibility are better able to respond to firm-specific shocks by hiring and firing workers, which gives countries with more flexible labour market institutions a comparative advantage in more volatile industries. Nevertheless the relationship between unemployment and trade liberalization is not explicitly modeled. Helpman and Itskhoki (2010) build a Diamond-Mortensen-Pisarrides (henceforth DMP) model of labour market frictions in a two-sector `new trade' model; a competitive sector produces a homogeneous good and a monopolistically competitive sector produces a differentiated good. They show that a country with relatively low frictions in the differentiated-good sector will be a net exporter of that good. Intuitively, lower frictions imply lower labour costs and, coupled with the `Home-Market' effect a-la Krugman (1980), create a comparative advantage in the differentiated sector. The impact of trade on unemployment is ambiguous, with unemployment raising or falling in both or one country being possible depending on the extent of labour frictions in the differentiated sector relative to the homogenous-good sector.

2.2 Trade and unemployment: empirical evidence

When theory provides contradicting answers, the natural next step is to look for patterns in the data. However, the rapidly growing empirical literature has not found an unambiguous unemployment response to trade liberalization either. Several important papers suggest that trade liberalization or import growth have led to an

increase in unemployment. Revenga (1994) provides evidence in this direction for Mexico's manufacturing, Harrison and Revenga (1998) for Czechia, Poland, Romania and Slovakia, Pessoa (2016), Menezes-Filho and Muendler (2011) and Mesquita and Najberg (2000) for Brazil, Levinsohn (1999) and Edwards and Edwards (1996) for Chile, and Rama (1994) for Uruguay. There are also several important papers suggesting that trade has no impact on unemployment. Trefler (2004) provides such evidence for Canada for his long-run estimates. Bentivogli and Pagano (1999) show that trade has little or no impact in France, Germany, Italy and the United Kingdom of Great Britain and Northern Ireland. Goldberg and Pavnick (2005) findings suggest that there is no impact of trade on unemployment in Colombia. Hasan et al (2012) obtain similar results for India. Finally, there is also evidence suggesting that trade opening has led to reductions in unemployment. Kee and Hoon (2005) and Nathanson (2011) show that this is the case in Singapore and Israel, respectively. Milner and Wright (1998) found that openness reduce unemployment in Mauritius. Lee (2005) shows that trade growth reduced unemployment in China, India and Malaysia. Felbermayr, Prat and Schmerer (2011) show that in the long-run, higher trade openness is associated with a lower structural rate of unemployment. The fact is established using both a panel data from 20 OECD countries, and using cross-sectional data on a larger set of countries. Their benchmark specification suggests that "a 10 percentage point increase in total trade openness reduces aggregate unemployment by about three quarters of one percentage point". Heid and Larch (2016) evaluate the effects of regional trade agreements (RTAs) for sample of 28 OECD countries. Employment effects are positive in most cases. Moreover they find that introducing RTAs as observed in 2006 leads to greater welfare increases when accounting for aggregate employment effects. Dutt, Mitra and Ranjan (2009) provide evidence that more open economies have lower unemployment rates on average for a large sample of developing and developed countries. In an earlier study, Currie and Harrison (1997) assess the impact of trade reform on employment in manufacturing firms in Morocco in the 1980s. This paper does not investigate the direct impact of trade reform on unemployment but offers insights on the role of trade protection on labour market composition. Their results suggest that employment in the average firm has been unaffected by the reduction of tariffs and the elimination of quotas. However, exporting firms and industries most affected by the reforms (textiles, beverages and apparel) experienced a significant decline in employment. Currie and Harrison (1997)'s results further indicate that government-controlled firms behaved quite differently from privately-own firms. Government-controlled firms actually increased employment in response to tariff reductions, mostly by hiring low-paid temporary workers.

2.3 Reconciling theory and empirics

Recent contributions by Carrère et al. (2014) and Carrère, Grujovic and Robert-Nicoud (2015) have highlighted adjustment mechanisms able to reconcile the a priori contrasting theoretical and empirical results discussed above. Reforms that increase aggregate demand lead to job creation, raising both incomes and wages and reducing unemployment. Aggregate unemployment, which is usually of interest to policy-makers, and real wages, which economists tend to focus on, are, in this view, two sides of the same coin. However, trade reforms also reallocate resources across sectors, and sectors have heterogeneous labour market frictions. If a trade reform reallocates labour to a sector with high frictions, unemployment increases, and vice versa. This mechanism illustrates why real income and frictional unemployment effects of trade liberalisation can be imperfectly correlated.

In the context of a trade reform Carrère et al. (2014) theoretical predictions indicate that trade openness has an ambiguous effect on unemployment. The sign of this effect depends on the correlation between sector level labour market frictions and revealed comparative advantage. More precisely, if positively correlated, then opening up to trade is expected to increase unemployment. If negatively correlated, then opening up to trade is expected to reduce unemployment. Hence, aggregate unemployment would fall only if a trade reform leads to the reallocation of labour towards sectors with relatively low labour market frictions assuming that the overall expansion effect is positive. In other words, reallocation effects may dampen real income effects on unemployment and possibly welfare. Empirical results presented below confirm these theoretical predictions. Moreover, predictions based on their estimated correlation coefficients are in line with evidence based on single country case studies discussed previously.

3. Empirical strategy

There are 23 sectors in our data. We put forward the following empirical model in order to test the qualitative predictions retrieved form the theoretical framework:

$$ln(u_{ct}) = \beta_c + \beta_t + \beta_1 \rho_{ct} + \beta_2 ln(w/p)_{ct} + \epsilon_{ct} \quad (1)$$

where u_{ct} is aggregate unemployment in country c at time t, ρ_{ct} is the correlation between the country's comparative advantage and its sector level labour market frictions, w/p_{ct} is real wages which is proxied with GDP per capita to also control for business cycles, and ϵ_{ct} is an *i.i.d* error term. β_c and β_t are country and time-specific fixed effects, respectively. The former control for any time-invariant determinant of unemployment, such as differences in institutional setups at the aggregate level, and the latter for aggregate shocks that may affect unemployment in all countries in a given year, such as global technological shocks. The reference theoretical framework predicts a positive coefficient for the correlation variable ($\beta_1 > 0$). Having a comparative advantage in sectors with more inefficient labour markets is associated with higher aggregate unemployment rate, ceteris paribus. Real wages and the unemployment are expected to be negatively related. We should thus obtain $\beta_2 < 0$. A larger income per capita is associated with a lower level of unemployment.

A measure of the correlation between comparative advantage and labour market frictions for each country and year is required in order to implement the empirical model. In order to compute this correlation, we thus need measures of both comparative advantage and labour market frictions at the sector level.

3.1 Measuring comparative advantage

As a measure of comparative advantage we use Costinot, Donaldson and Komunjer (2012) methodology based on a fixed-effect gravity model. For every year t we estimate

$$ln(x_{cpz}) = \alpha_{cp} + \alpha_{cz} + \alpha_{pz} + \epsilon_{cpz} \quad (2)$$

where subscript c stands for the exporting country, p for partners and z for sectors, and therefore x_{cpz} are exports of good z from country c to partner p. We are interested in the α_{cpz} fixed-effects which after a monotonic transformation provide a measure of the export capability of country c in tradable sector z relative to a benchmark country. Comparative advantage of country c in sector z is then given by

$$r_{ctz} = e^{\alpha_{ctz}/\sigma} \quad (3)$$

Where σ is the elasticity of exports with respect to productivity. We use Costinot, Donaldson and Komunjer's (2012) estimate of $\sigma = 6{:}53$ to compute r_{ctz}. As a robustness test we also use Hanson, Lind and Muendler's (2015) normalization. They argue that, because of the presence of the importer-industry fixed effect in (2), export capability is only identified up to an industry normalization. This normalization differences out both worldwide industry supply conditions and worldwide industry demand conditions.

3.2 Measuring sector level labour market frictions

The second component of ρ_{ct} is the vector of the unemployment rates at the sector level. We face two constraints given the available data. First, to the best of our knowledge there exist no data on sector-specific labour market frictions or unemployment covering a wide range of countries and time periods. We thus need to estimate unemployment rates at the sector level. Second, the time period we use is relatively short and there

is insufficient time variation to identify unemployment rates at the sector level using a within estimator. In order to estimate the unemployment rates at the sector level, our identifying assumption is that u_z is common across all countries and constant over time. We relax the assumption that u_z is the same across all countries in the robustness subsection 4.2. The unemployment rate of any country is a weighted average of the unemployment rates prevailing in the sectors active in this country. Let L_{ct} and L_{ctz} denote the aggregate and sector-z labour forces of country c in year t, respectively; under our identifying assumption, we may then write the accounting identity linking aggregate unemployment u_{ctz} in c in year t and u_z as,

$$u_{ct} = \sum_{z=1}^{23} \omega_{czt} u_z \text{ , where } \omega_{czt} \equiv \frac{L_{ctz}}{L_{ct}} \quad (4)$$

is the share of sector z in the labour force of country c at time t, with $\sum_{z=1}^{23} \omega_{czt} = 1$

We observe the left-hand-side of (4) but we observe neither u_z nor the vector of workforce at the level of sectors, L_{czt} (which includes job seekers as well as current employees). However, we do observe employment in each sector H_{czt}; in turn, we exploit the fact that H_{czt}, L_{czt}, and u_z are related by the following identity,

$$L_{ctz} = H_{ctz} + u_z L_{ctz} = \frac{H_{czt}}{1-u_z} \quad (5)$$

By the same token, we may write $L_{czt} = \sum_{z=1}^{23} \frac{H_{czt}}{1-u_{ct}}$. Substituting this expression and (5) into (4) yields

$$\frac{u_{ct}}{1-u_{ct}} = \sum_{z=1}^{23} \frac{u_z}{1-u_z} \frac{H_{czt}}{H_{ct}}$$

Where $H_{ct} = \sum_{z=1}^{23} H_{ctz}$ is aggregate employment.

Adding an *i.i.d.* error term to this expression to allow for measurement error in u_{ct} (which may include country and year fixed components), and defining employment shares as $\overline{\omega}_{ctz} \equiv \frac{H_{ctz}}{H_{ct}}$, we obtain:

$$\frac{u_{ct}}{1-u_{ct}} = \sum_{z=1}^{23} \beta_z \, \overline{\omega}_{czt} + \epsilon_{ct} \quad (6)$$

where $\beta_z \equiv \frac{u_z}{1-u_z}$ can be estimated by ordinary least squares and the value of u_z can be recovered by $u_z = \frac{\beta_z}{1-\beta_z}$.

We estimate u_z using data for 1995-2009 under our identifying assumption $u_{ctz} = u_z$. We relax the assumption that u_z is common across all countries in the sample to allow u_z to first vary by region and then by country in subsection 4.2, which allows for labour market frictions to be a source of comparative advantage as in Cuñat and Melitz (2012). We also address potential endogeneity concerns associated with the estimation of (1) and the construction of (6) in subsection 3.4 below.

Table 1 provides the estimated u_z and their bootstrapped standard errors for 21 manufacturing sectors, and two broad agriculture and services sectors. These values can be interpreted as sector-specific unemployment rates (in %) due to labour market frictions. The mean and a median of this distribution are around 15 percent with a standard deviation of 5, a maximum of 25 and a minimum of 6 percent.

We interpret a higher union membership rate as a proxy for a higher worker bargaining weight in the wage bargaining process. We can then test the external validity of our sector-specific labour market frictions by correlating our estimates with an index of labour union incidence in the United States of America constructed

using data from the Union Membership and Coverage Database. The available estimates are compiled from the Current Population Survey.[3] We use estimates for the period 1995-2009.

Figure 1 plots union membership (expressed as a share of total employment) in sector z against our measure u_z. The figure also reports the underlying linear correlation and the 95 percent confidence interval; the estimated correlation is positive (slope = 0.27) and statistically different from zero (standard error = 0.08). Similar results are obtained using data by Robinson (1995) for forty Canadian industries.

3.3 Correlation between labour market frictions and revealed comparative advantage

Equipped with our measures of comparative advantage r_{czt} and sector level labour market frictions u_z, we can construct the correlation between labour market frictions and labour market inefficiency, ρ_{ct}. Table 2 displays the median ρ during the period 1995-2009 for each country in our sample. We rank countries from the lowest to the highest ρ. The country with the highest ρ is the Russian Federation, suggesting that more open trade is associated with higher unemployment in this country. At the other end of the spectrum, the country with the lowest ρ is Israel, which makes it the country where trade liberalization is the most likely to result in a fall in unemployment. Note that Brazil, Chile, Czechia, Poland, Romania, Slovakia, and Uruguay, which are countries for which existing studies suggest that trade liberalization contributed to increases in unemployment, are among the countries with the highest ρ. Similarly, Singapore and Israel, which are countries for which existing studies suggest that trade liberalization contributed to a decline in unemployment, are among the countries with the lowest ρ. This prima facie evidence is in line with the theoretical predictions of our model.[4]

3.4 Identification issues

There are three potential issues associated with the estimation of (19). We address them in turn. The first source of concern is associated with the fact that aggregate unemployment rates are used to construct our measures of sector market frictions at the sector level; these are in turn used to construct our key right-hand side variable, ρ_{ct}, on which we regress u_{ct}. Thus, there seems to be a cause of endogeneity. Before proceeding to propose a correction to this source of bias, note that the problem is strongly mitigated by the fact that we do not regress u_{ct} on u_z in (19) -which would lead to a simultaneity bias by construction- but on ρ_{ct}, which is the correlation between country c's comparative advantage and u_z. We aim to rule out any remaining potential concern by undertaking four different robustness tests. First, instead of using our measure of u_z to compute ρ_{ct}, we use the measure of unionization rates by sector in the United States of America provided in the Union membership and coverage dataset used in Figure 1. This circumvents any circularity concern. Second, we divide our sample into two sub-periods and estimate u_z with data for the early period (1995-1999) and only estimate (19) with data for the later period (2000-2009). Third, in the spirit of Angrist, Imbens, and Krueger's (1999) `Jackknife' iv estimator, we compute the vector of u_z's for each country separately, using data from all countries but country c itself; we label this c-specific estimate of u_z by $u_z^{\setminus(c)}$. We then construct ρct using $u_z^{\setminus(c)}$ instead of u_z. Finally, we undertake a Placebo test in which we assign unemployment rates randomly to each country and then estimate u_z. We next compute ρ_{ct} and, finally, re-estimate (1) using the randomly assigned unemployment rates as dependent variable. The coefficient of ρ_{ct} is expected to be statistically indistinguishable from zero under the null hypothesis that the simultaneity bias is negligible.

[3] Data available at www.unionstats.com.

[4] Note however that the value of ρ is not a sufficient statistic to predict the impact of trade liberalization on unemployment as trade liberalization may have a direct impact on unemployment that does not go through the reallocation of resources. Indeed, trade liberalization may lead to increases or decreases in real wages which will in turn affect labour demand and aggregate unemployment.

The second issue to be dealt with is measurement error in ρ_{ct} that arises because we estimate u_z. We do two things in order to attenuate the role of outliers: (i) we replace the standard correlation by the Spearman rank correlation between r_{czt} and u_z, and (ii) we create five categories for ρ_{ct}, one for each quintile, and we regress u_{ct} on these dummies instead of on ρ_{ct}.

The third potential issue we address is the identifying assumption that sector level labour market frictions are common across all countries. Allowing labour market frictions to vary across both sectors and countries is a straightforward exercise that does not alter the central qualitative predictions of Carrère et al. (2014) model. However, the empirical implementation of such an extension is impracticable. Indeed, it would require estimates of sector level market frictions by country, which requires substantial time variation.

We have maximum fifteen years of data per country and sector, and therefore we lack the statistical power to estimate labour market frictions at this level of disaggregation.

Nevertheless, we relax the assumption that sector-specific labour market frictions are common across all countries by first allowing them to vary across groups of countries at similar level of development. More formally, we estimate equation (6) in two different samples, allowing for labour market frictions at the sector level to be different between advanced and emerging economies. Second, we rely on the non-linearities on the left-hand-side of (6) to compute labour market frictions at the sector level that vary across countries and time. In order to do so, let us define the odds of unemployment in country c sector z and time t as an additive function of country, sector and time components:

$$\beta_{czt} \equiv \frac{u_{czt}}{1-u_{czt}} = \beta_c + \beta_z + \beta_t \qquad (7)$$

where β_c captures cross-country labour market institutional differences, and β_t controls for worldwide business cycles; β_z captures the previous sector specific effect given by the labour shares in each sector, $\overline{\omega}_{ctz} \equiv \frac{H_{czt}}{H_{ct}}$, as in (6). We henceforth assume that country specific effects are a linear function of the country's labour market rigidity index (LAMRIG) provided by Campos and Nugent (2012).[5] Adding an *i.i.d.* error term for measurement error, we can rewrite (6) as:

$$\frac{u_{ct}}{1-u_{ct}} = \gamma \times LAMRIG_c + \sum_{z=1}^{23} \beta_z \, \overline{\omega}_{czt} + \beta_t + \epsilon_{ct} \qquad (8)$$

The β 's and γ can be estimated using ordinary least squares. We can then compute sector, country and time specific labour market frictions, u_{czt} using (7):

$$u_{czt} = \frac{\beta_{czt}}{1-\beta_{czt}} \qquad (9)$$

which we can then correlate with the measure of revealed comparative advantage to construct ρ_{ct}.

4. Empirical Results

We start by discussing the main results associated with the estimation of (1) and then turn to various robustness tests.

4.1 Baseline estimations

Table 3 displays the results of the estimation of (1). Column (1) reports the baseline estimates, which are in line with both theoretical predictions: a higher correlation between sector level labour market frictions and comparative advantage is associated with higher levels of unemployment; and a higher level of per capita GDP (the real wage in the reference theoretical framework) is associated with a lower level of unemployment. The

[5] Specifically, we use the average value of Campos and Nugent's (2012) index, which is an update of Botero, Djankov, La Porta, Lopez de Silanes and Shleifer's (2004) index.

quantitative effects are also meaningful: a one-standard deviation increase in ρ is associated with a 5.3 percent increase in total unemployment; and a ten-percent increase in per-capita GDP is associated with a seven-percent reduction in total unemployment (this elasticity is stable across all specifications). Column (2) uses the normalized measure of comparative advantage introduced by Hanson, Lind, and Muendler (2015) instead of Costinot, Donaldson, and Komunjer's (2012) measure. The empirical results are again in line with our theoretical predictions, a one standard deviation increase in ρ being associated with a 4.6 percent increase in total unemployment.

The correlation ρ in the regression of Column (3) is constructed using unionization rates by sector in the United States of America instead of our measure of u_z. The motivation for this exercise is that the bargaining weight of workers is higher in sectors with stronger labour unions; in equilibrium, higher labour bargaining weights raise wages and the degree of labour market frictions. Our results are robust to the use of this alternative measure, which alleviates potential concerns associated with the construction of u_z.

Columns (4) and (5) aim to reduce the influence of possible outliers and to address measurement error in the correlation between comparative advantage and sector level labour market frictions. In Column (4), ρ is redefined as the Spearman rank correlation between u_z and r_{czt}; qualitative results are unchanged and quantitative results are similar. We transform the correlation measure into five quintile dummies in Column (5) with the aim of attenuating the role of potential outliers further; the default category is the first correlation quintile. We expect positive and non-decreasing coefficients as one moves up the distribution of ρ - unemployment is higher in countries with a strong correlation between comparative advantage and sector level labour market frictions. The results are once more in line with our theoretical predictions.

Finally, Column (6) introduces a measure of trade policy restrictiveness to the baseline regression as a time-varying control in order to mitigate potential omitted variable bias. While the coefficient of the average tariff is not statistically significant, the coefficient of per capita GDP is unchanged and the coefficient of ρ doubles; both remain precisely estimated.[6]

4.2 Robustness checks

We perform different robustness checks. Table 4 reports the results of the first five of them. Column (1) reproduces the baseline estimation of Table 3, Column (1), in order to ease comparison with the regression results of this subsection. The next three columns address concerns regarding the fact that measures of ρ_{ct} may be endogenous by construction (see discussion in subsection 3.4). In the specification of Column (2), the $u_z's$ are estimated running (6) on data for the time period 1995-1999 while we run the aggregate unemployment regression (1) on data for the time period 2000-2009. This methodology mitigates the time dimension of the potential simultaneity bias associated with the construction of ρ. Reassuringly, the results of Columns (1) and (2) are statistically indistinguishable from one another at the usual significance levels. Column (3) performs a placebo test where aggregate unemployment rates are sampled randomly from the actual distribution to different countries; we then implement our algorithm as before - first estimating sector level labour market frictions using (6); then computing their correlation with comparative advantage, and finally estimating the impact of the correlation on the randomly assigned unemployment as per (1). We perform 100 iterations and we report the average coefficients and standard deviations. As expected under the null hypothesis that the correlation between u_{ct} and ρ_{ct} is not mechanical, the estimate of β_1 is statistically indistinguishable from zero. Note that the estimate of the coefficient of per capita GDP, β_2, is also statistically insignificant, which was also to be expected from this placebo specification. A final exercise helps us rule out the possibility that our results are the spurious outcome of a simultaneity bias. In the specification the results of which we report in Column (4), for each country c, we construct ρ_{ct} using estimates of u_z obtained from running (24) on all countries but c; thus, the error term in (19) is orthogonal to ρ and other regressors by construction. In this way, we obtain a different estimate of u_z for each c, which we label $u_z^{\setminus(c)}$, and we construct ρ_{ct} replacing u_z by $u_z^{\setminus(c)}$; such a procedure is similar in spirit to Angrist, Imbens, and Krueger's

[6] Note that the absence of a significant relationship between the average tariff and the unemployment rate is consistent with an extension of our theory that allows for positive trade costs (which shows that the average tariff has an ambiguous effect on aggregate unemployment) and is in line with extant empirical work (which tends to find ambiguous effects). See Carrère, Fugazza, Olarreaga, and Robert-Nicoud (2014).

(1999) `Jackknife' instrumental variable estimator. Results are qualitatively identical and quantitatively very close to those of the baseline regression reported in Column (1).
Column (5) deals with a different issue. We have assumed throughout that sector-specific labour market frictions are common across all countries, regardless of their level of development. Here, we relax this (arguably strong) assumption by dividing the world into high and low-income countries as defined by the World Bank and then estimate u_z for each of these two samples separately. We calculate ρ_{ct} and estimate the impact of ρ_{ct} on u_{ct} for each country as before. The results show that the coefficient of per capita GDP are stable and that coefficient of interest, β_1, is halved but remains statistically positive and quantitatively meaningful.[7] Note that by estimating different u_z in high and low-income countries we are allowing the labour market frictions to be a source of comparative advantage. Again, as argued before, Corollary 2 does not depend on whether labour market frictions are a source of comparative advantage. Finally in Table 5 we report the results of all specifications in our baseline, but using an estimate of sector labour market frictions that also varies across countries and time. It is constructed using equations (25)-(27). Note that running (26), the estimated coefficient of the labour market rigidity measures is positive as expected, and statistically significant at the 1 percent level. This outcome suggests that in countries with more rigid labour markets we observer higher odds of unemployment. All columns in Table 5 confirm (and most reinforce) the benchmark results in Table 3. A higher correlation between sector level labour market frictions and comparative advantage leads to higher levels of unemployment.

5. Discussion

This paper clearly points to the need to qualify precisely the context in which some trade reform is undertaken. The “one size does not fit all” general recommendation recurrently heard in the sphere of development policy practitioners fully applies to the expected impact of trade liberalization. Indeed, Carrère et al. (2014) theoretical framework shows that trade leads to higher unemployment in countries with comparative advantage in sectors with low labour market efficiency, and to lower unemployment in countries with comparative advantage in sectors with high labour market efficiency. We test this prediction in a panel dataset of 107 countries covering the period 1995-2009 and find that the data support the latter. These findings help explain the apparent lack of consensus in the empirical literature regarding the impact of trade liberalization on unemployment. Harrison and Revenga (1998) find that trade liberalization increased unemployment in Czechia, Poland, Romania and Slovakia. Menezes-Filho and Muendler (2011) and Mesquita and Najberg (2000) provide evidence of a similar impact in Brazil, Edwards and Edwards (1996) in Chile, and Rama (1994) in Uruguay. These are all countries for which our empirical model predicts a positive and statistically significant impact of trade liberalization on unemployment, because our estimates of the correlation between labour market frictions and comparative advantage in these countries are large and positive. Bentivogli and Pagano (1999) show that trade has little or no impact in France, Germany, Italy and the United Kingdom. Treer (1994) finds a similar result for Canada. This set of findings is again consistent with our empirical results, since the average correlation between comparative advantage and sector level labour market frictions is in the statistical insignificant range for these countries. Finally, Kee and Hoon (2005) and Nathanson (2011) show that trade reduces unemployment in Singapore and Israel, respectively. These findings are once again consistent with our empirical results because of the large and negative correlation between labour market frictions and comparative advantage in these countries. Our results for OECD countries display substantial heterogeneity but, in most cases, our results are in line with those of Felbermayr, Prat, and Schmerer (2011) for a sample of twenty OECD countries. Our paper confirms the Carrère et al. (2014) central finding that labour market frictions at the sector level and comparative advantage interact in shaping the aggregate unemployment rate of countries. In their two-country setting, `comparative advantage' is synonymous to trade patterns. In a multi-country environment, trade patterns are jointly determined by comparative advantage, the whole matrix of bilateral trade frictions, as well as general equilibrium effects. In a related paper, Carrère, Grujovic, and Robert-Nicoud (2015) extend the current work to

[7] Only 6 out of the 100 β_1 coefficients we estimated in the placebo regressions were positive and statistically significant; 6 were negative and statistically significant, and the remaining 88 coefficients β_1 coefficients were statistically insignificant.

a quantitative model of trade and frictional unemployment. Other applications of this finding are possible. Applying it to trade in value added would be another natural venue. We leave it for further research.

The relationship between trade and employment is also often debated amongst policy makers and political actors and often goes beyond pure analytical motivations. Our findings may help reconciliate apparently opposing views. Indeed, one strong message can be retrieved from our empirical evidence: even if a country is able to increase its trade following its comparative advantage pattern the associated employment and earnings effects may not be optimal from a social point of view. That is, even if a country is able to intensify its trade based on its relative competitive advantage, the reallocation of factors of production and in particular that of labour needed to accompany this intensification may end up in a worsening of overall labour market conditions with lower employment and possible lower average earnings. For instance, if because of trade policy workers are forced to move to sectors with relatively higher frictions than their current sector higher unemployment will be generated even if trade policy promoted sectors with relatively higher comparative advantage. In plain words, what is good for trade is not systematically good for employment and vice versa.
Our results are also helpful in defining how policy makers and trade practitioners should approach trade reform and negotiations. Even if policy makers are able either to negotiate a trade agreement or implement some trade-oriented policy that fully accounts for and "promotes" the comparative advantage pattern of their economy, they may generate more unemployment. As a consequence, it becomes crucial to consider the labour market functioning at the sector level and comparative advantage pattern simultaneously to get an idea of the primary employment effects of trade reform. In developing countries the incidence and role of informality should also be accounted for.[8] Informality is pervasive in most developing countries and its existence is not driven exclusively by tax and regulations voidance motives. It may have a strong sectoral component and any reallocation of productive resources could affect its very incidence and eventually undermine any positive trade outcome. Moreover the results of our paper further suggest that if a government had to improve comparative advantage and competitiveness in some sectors, independently of the use or not of trade policy, it should select those sectors characterized by a labour market with lower frictions.

[8] UNCTAD (2018) provides a general practical framework based on these insights that can serve as a basis for an integrated treatment of trade and employment in policy making.

References

Anderson, James, 2009. Globalization and Income Distribution: A Specific Factors Continuum Approach. NBER Working Paper # 14643.
Angrist, Joshua D., Guido W. Imbens, and Alan Krueger, 1999. Jackknife instrumental variables estimation. Journal of Applied Econometrics 14(1), 57-67.
Artuç, Erhan, Shubham Chaudhuri and John McLaren, 2010. Trade schocks and labour adjustment: a structural empirical approach. American Economic Review 100(3), 1008-1045.
Artuç, Erhan, Daniel Lederman and Guido Porto, 2015. A mapping of labour mobility costs in the developing world. Journal of International Economics 95(1), 28-41.
Artuç, Erhan and John McLaren, 2015. Trade policy and wage inequality: A structural analysis with occupational and sectoral mobility. Journal of International Economics 97(2), 278-294.
Autor, David, David Dorn and Gordon Hanson, 2016. The China shock: Learning from labour market adjustments to large changes in trade. Annual Review of Economics 8, 241-258.
Autor, David, David Dorn, Gordon Hanson and Kaveh Majilesi, 2016. A note on the effect of rising trade exposure on the 2016 presidential election. Mimeo.
Bentivogli, Chiara and Patrizio Pagano, 1999. Trade, Job Destruction and Job Creation in European Manufacturing. Open Economies Review 10, 165-184.
Botero, Juan, Simeon Djankov, Rafael La Porta, Florencio L_opez de Silanes and Andrei Shleifer, 2004. The Regulation of Labour. Quarterly Journal of Economics 119, 1339-1382.
Brecher, Richard, 1974. Minimum Wage Rates and the Pure Theory of International Trade. Quarterly Journal of Economics 88, 98-116.
Caliendo, Lorenzo, Maximiliano Dvorkin and Fernando Parro, 2015. Trade and labour market dynamics. Federal Reserve Bank of St. Louis working paper # 2015-009C.
Campos, Nauro, and Jeffrey Nugent, 2012. The Dynamics of the Regulation of Labour in Developing and Developed Countries since 1960. IZA Discussion Paper 6881.
Carrère, Céline, Marco Fugazza, Marcelo Olarreaga, and Frédéric Robert-Nicoud, 2014. Trade in unemployment. CEPR working paper 9916.
Carrère, Céline, Anja Grujovic and Frédéric Robert-Nicoud, 2015. Trade and frictional unemployment in the global economy. CEPR working paper 10692 (revised).
Costinot, Arnaud, Dave Donaldson, and Ivana Komunjer, 2012. What goods do countries' trade? A quantitative exploration of Ricardo's ideas. Review of Economic Studies 79, 581-608.
Cuñat, Alejandro and Marc Melitz, 2012. Volatility, Labour Market Flexibility, and the Pattern of Comparative Advantage. Journal of the European Economic Association 10, 225-254.
Davidson, Carl, Lawrence Martin and Stephen Matusz, 1999. Trade and Search Generated Unemployment. Journal of International Economics 48(2), 271-99.
Davis, Donald, 1998. Does European Unemployment Prop Up American Wages? National Labour Markets and Global Trade. American Economic Review 88, 478-494.
Davis, Donald R and James Harrigan, 2011. Good jobs, bad jobs, and trade liberalization. Journal of International Economics 84(1), 26-36.
Dornbusch, Rudiger, Stanley Fischer, and Paul Samuelson, 1977. Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods. American Economic Review 67(5), 823-39.
Dix-Carneiro, Rafael, 2014. Trade Liberalization and labour market dynamics. Econometrica, 82, 825-885.
Dutt, P., Devashish Mitra and Priya Ranjan, 2009. International Trade and Unemployment: Theory and Cross-National Evidence. Journal of International Economics 78(1), 32-44.
Edwards, Sebastian and Alejandra Edwards, 1996. Trade Liberalization and Unemployment: Policy Issues and Evidence from Chile. Cuadernos de Economia 33: 227-50.
Egger, Hartmut and Udo Kreickemeier, 2009. Firm Heterogeneity and the Labour Market Effects of Trade Liberalization. International Economic Review 50(1), 187-216.
Felbermayr, Gabriel, Julien Prat and Hans-Jörg Schmerer, 2011. Trade and unemployment: What do the data say? European Economic Review, 55, 741-758.
Gaulier, Guillaume and Soledad Zignago, 2010. BACI: International Trade Database at the Product-Level. CEPII Working Paper # 2010-23.

Hanson, Gordon, Nelson Lind, and Marc-Andreas Muendler, 2015. The dynamics of comparative advantage. Cesifo working paper # 5622.
Harrison, Anne and Ana Revenga. 1998. Labour Markets, Foreign Investment and Trade Policy Reform. In Trade Policy Reform: Lessons and Implications, edited by J. Nash and W. Takacs, Washington DC: World Bank.
Heid, Benedikt and Mario Larch, 2016. Gravity with unemployment. Journal of International Economics 101, 70-85.
Helpman, Elhanan and Oleg Itskhoki, 2010. Labour Market Rigidities, Trade and Unemployment. Review of Economic Studies 77 (3), 1100-1137.
Helpman, Elhanan, Oleg Itskhoki and Stephen Redding, 2010. Inequality and Unemployment in a Global Economy. Econometrica 78, 1239-1283.
Helpman, Elhanan, Oleg Itskhoki and Stephen Redding, 2013. Trade and labour market outcomes. In Acemoglu, Arellano, and Dekel (Eds.) Advances in Economics and
Econometrics, Tenth World Congress, vol. 2: Applied Economics. Cambridge University Press.
Itskhoki, Oleg and Elhanan Helpman, 2014. Firms, Trade and Labour Market Dynamics. In progress.
Kemp, Murray, 1962. The Gain from International Trade. The Economic Journal 72(288), 803-819.
Krugman, Paul, 1992. What Do Undergrads Need to Know About Trade? American Economic Review 83(2), 23-26.
Krugman, Paul, 1980. Scale Economies, Product Differentiation, and the Pattern of Trade. The American Economic Review 70(5), 950-959.
Kee, Hiau Looi and H.T. Hoon. 2005. Trade, capital accumulation and structural unemployment: an empirical study of the Singapore economy. Journal of Development Economics 77: 125- 152.
Menezes-Filho, Naercio and Marc-Andreas Muendler, 2011. Labour reallocation in response to trade reforms. NBER working paper 17372.
Mesquita, Mauricio and Sheila Najberg, 2000. Trade liberalization in Brazil: creating or exporting jobs? Journal of Development Studies 30(3), 78-100.
Nathanson, Roby, 2011. Growth, economic policies and employment linkages: Israel. ILO Employment Working Paper No. 83, Geneva.
Rama, Martin, 1994. The labour market and trade reform in manufacturing. In M. Connolly and Jaime de Melo (Eds.): Effects of Protectionism on a Small Country: The Case of Uruguay. World Bank, Washington DC.
Robinson, Chris, 1995. Union Incidence in the Public and Private Sectors. Canadian Journal of Economics 28(4b), 1056-76.
Samuelson, Paul, 1962. The Gains from International Trade Once Again. The Economic Journal 72(288), 820-829.
Treer, Daniel, 2004. The Long and Short of the Canada-U.S. Free Trade Agreement. American Economic Review 94(4), 870-895.
UNCTAD, 2018. Market Access Trade and Sustainable Development: the Labour Market Channel. Developing Countries in International Trade 2017. UNCTAD, Geneva.

Data Appendix

We use trade and unemployment data for 107 countries for the period 1995-2009. Trade data comes originally from United Nations' Comtrade, but we use the clean version provided by CEPII's BACI (Gaulier and Zignago, 2010). Unemployment and employment data are from the ILO (KILM 6th edition). Average tariffs are from UNCTAD's Trains which is also available through WITS. Collected duties are from the World Bank's World Development Indicators. Gravity variables are from the CEPII. The appendix table below provides descriptive statistics for the variables used in the estimation of (1).

Appendix Table: Descriptive statistics 1995-2009

Variable	Obs	Mean	Std. Dev.	Min	Max
$\ln(u_{ct})$	1189	2.00	0.60	-0.51	3.62
$\ln(w_{ct}/p_{ct})$	1189	8.66	1.40	5.29	11.46
ρ_{ct}	1189	0.08	0.13	-0.64	0.50
Average tariff	910	1.92	0.82	0.00	3.74

Tables and figures

Table 1: Sector level labour market frictions

Sector	u_z	u_z (standard error)	Share of z
Medical, precision and optical instruments	6.34%	0.032	0.68%
Radio,television and communication equipment	8.73%	0.029	0.62%
Machinery and equipment n.e.c.	11.80%	0.03	2.61%
Textiles	11.88%	0.032	1.86%
Rubber and plastics products	12.15%	0.04	1.12%
Non-metallic mineral products	12.56%	0.038	1.81%
Printing and publishing	12.86%	0.036	1.72%
Furniture; manufacturing n.e.c.	13.64%	0.042	1.35%
Services	14.96%	0.045	54.89%
Agriculture	15.07%	0.045	14.17%
Food, beverages and Tobacco	15.19%	0.047	6.21%
Fabricated metal products	15.41%	0.047	2.92%
Wearing apparel, fur	16.05%	0.05	2.07%
Other transport equipment	16.10%	0.052	0.77%
Chemicals and chemical products	16.83%	0.052	1.80%
Wood products (excl. furniture)	16.97%	0.056	1.27%
Office, accounting and computing machinery	17.19%	0.06	0.17%
Coke,refined petroleum products,nuclear fuel	17.42%	0.07	0.18%
Motor vehicles, trailers, semi-trailers	17.60%	0.061	0.72%
Paper and paper products	18.79%	0.064	0.90%
Basic metals	20.31%	0.069	0.90%
Leather, leather products and footwear	21.70%	0.078	0.50%
Electrical machinery and apparatus	25.31%	0.082	0.76%

Note: Sector-specific unemployment rates (u_z) are obtained using a nonlinear combination of parameter estimates. Thus, calculations of the associated standard errors are based on the delta method, which is a good approximation appropriate in large samples. Sector shares correspond to averages over 95 countries and 1995-2009. The linear regression to obtain the ρ_{ct} estimates which are then used to obtain the sector-specific unemployment rates is performed on a sample of 843 observations, with 95 countries over the 1995-2009 period. The R^2 of that regression is 0.173.

Table 2: Correlation between labour market frictions and comparative advantage (median ρ for 1995-2009)

Country name	Country code	ρ	ρ (standard error)
Russian Federation (the)	RUS	0.32	0.05
Romania	ROM	0.32	0.07
Cabo Verde	CPV	0.31	0.07
Algeria	DZA	0.3	0.06
Ukraine	UKR	0.29	0.05
The former Yugoslav Republic of Macedonia	MKD	0.29	0.06
Croatia	HRV	0.28	0.06

Trinidad and Tobago	TTO	0.27	0.05
Chile	CHL	0.27	0.04
Albania	ALB	0.27	0.06
Grenada	GRD	0.27	0.06
Cameroon	CMR	0.27	0.06
Togo	TGO	0.25	0.05
Argentina	ARG	0.25	0.05
Comoros (the)	COM	0.25	0.05
Venezuela (Bolivarian Republic of)	VEN	0.24	0.05
Ghana	GHA	0.24	0.05
Brazil	BRA	0.24	0.05
Saint Vincent and the Grenadine	VCT	0.24	0.06
Nigeria	NGA	0.24	0.06
Tunisia	TUN	0.24	0.06
Guinea	GIN	0.23	0.06
Georgia	GEO	0.23	0.06
Burundi	BDI	0.22	0.06
Zambia	ZMB	0.22	0.05
Côte d'Ivoire	CIV	0.22	0.04
Slovakia	SVK	0.22	0.06
Poland	POL	0.22	0.06
Sudan (the)	SDN	0.22	0.05
Jamaica	JAM	0.22	0.05
Latvia	LVA	0.22	0.05
Paraguay	PRY	0.22	0.04
Gambia (the)	GMB	0.22	0.06
Saint Kitts and Nevis	KNA	0.22	0.07
Morocco	MAR	0.21	0.05
South Africa	ZAF	0.21	0.06
Bulgaria	BGR	0.21	0.06
Belize	BLZ	0.2	0.05
Groenland	GRL	0.2	0.05
United Republic of Tanzania (the)	TZA	0.2	0.05
Slovenia	SLV	0.19	0.05
Azerbaijan	AZE	0.19	0.05
Colombia	COL	0.19	0.05
Oman	OMN	0.19	0.05
Republic of Moldova (the)	MDA	0.19	0.05
Bolivia (Plurinational State of)	BOL	0.19	0.05
Rwanda	RWA	0.19	0.06
Estonia	EST	0.19	0.06
Surinam	SUR	0.18	0.04
Maldives	MDV	0.18	0.05
Kenya	KEN	0.18	0.05
Central African Republic (the)	CAF	0.18	0.06
Saudi Arabia	SAU	0.18	0.05
Uganda	UGA	0.18	0.05

Peru	PER	0.17	0.04
Gabon	GAB	0.17	0.06
Mongolia	MNG	0.17	0.06
Guatemala	GTM	0.17	0.05
Senegal	SEN	0.16	0.06
Honduras	HND	0.16	0.04
Lebannon	LBN	0.16	0.05
Indonesia	IDN	0.16	0.05
Portugal	PRT	0.15	0.05
Nicaragua	NIC	0.15	0.04
St. Lucia	LCA	0.15	0.06
Egypt	EGY	0.14	0.05
Ethiopia	ETH	0.14	0.05
Faroe Isl.	FRO	0.14	0.05
Macao (China)	MAC	0.14	0.06
Uruguay	URY	0.13	0.04
Greece	GRC	0.13	0.05
Hungary	HUN	0.13	0.06
Turkey	TUR	0.13	0.05
Cyprus	CYP	0.13	0.06
Madagascar	MDG	0.13	0.05
India	IND	0.13	0.06
Czechia	CZE	0.12	0.06
Niger	NER	0.11	0.06
Spain	ESP	0.11	0.05
Ecuador	ECU	0.11	0.05
Polynesia	PYF	0.11	0.06
Jordan	JOR	0.1	0.05
Burkina Faso	BFA	0.1	0.06
Dominica	DMA	0.1	0.05
Malawi	MWI	0.09	0.04
Lithuania	LTU	0.09	0.05
Panama	PAN	0.09	0.06
Mali	MLI	0.09	0.05
Bangladesh	BGD	0.09	0.04
Costa Rica	CRI	0.08	0.06
Belgium	BEL	0.08	0.05
Barbados	BRB	0.08	0.05
Andorra	AND	0.08	0.06
Slovenia	SVN	0.07	0.06
Luxembourg	LUX	0.06	0.05
France	FRA	0.06	0.06
Seychelles	SYC	0.06	0.06
Netherlands (the)	NLD	0.05	0.06
Austria	AUT	0.05	0.05
Norway	NOR	0.05	0.06
Mexico	MEX	0.04	0.06

Australia	AUS	0.04	0.06
Italy	ITA	0.04	0.05
Iceland	ISL	0.03	0.06
Finland	FIN	0.03	0.05
China	CHN	0.02	0.05
United Kingdom	GBR	0.02	0.06
Canada	CAN	0.02	0.06
New Zealand	NZL	0.02	0.05
Germany	DEU	0.01	0.06
Thailand	THA	0.01	0.05
Mauritius	MUS	0.01	0.05
Malta	MLT	0	0.06
Sweden	SWE	-0.02	0.06
Philippines (the)	PHL	-0.05	0.06
Republic of Korea (the)	KOR	-0.06	0.05
United States of America (the)	USA	-0.08	0.06
Singapore	SGP	-0.09	0.06
Ireland	IRL	-0.09	0.05
Malaysia	MYS	-0.1	0.05
Switzerland	CHE	-0.1	0.05
Japan	JPN	-0.11	0.05
Denmark	DNK	-0.11	0.05
Hong Kong (China)	HKG	-0.15	0.05
Israel	ISR	-0.26	0.05

Table 3: Trade and unemployment (benchmark estimations)

	Baseline	Hanson et al.	Unionization rate	Rank	Quintiles	Tariff
	(1)	(2)	(3)	(4)	(5)	(6)
ln gdp per capita	-0.69***	-0.70***	-0.69***	-0.69***	-0.68***	-0.63***
	(0.16)	(0.17)	(0.16)	(0.17)	(0.07)	(0.18)
Correlation r_{czt} and u_z	0.41**	0.35**	0.21**	0.26**		0.60**
	(0.18)	(0.17)	(0.09)	(0.09)		(0.22)
2nd quintile					0.05	
					(0.04)	
3rd quintile					0.07**	
					(0.03)	
4th quintile					0.09*	
					(0.05)	
5th quintile					0.15*	
					(0.06)	
Avg. Tariff						-0.07
						(0.06)
Observations	1189	1189	1189	1189	1189	910
R^2	0.21	0.21	0.21	0.21	0.21	0.23

Note: Estimations are OLS unless otherwise specified. All regressions are at the country-year level. All regressions have country and year fixed effects. r_{czt} denotes `revealed comparative advantage.' In column (5), the levels of the correlations are replaced by four dummies; the default category is the first quintile. Robust standard errors in parentheses are clustered at the country level. *** p < 1%, ** p < 5%, and * p < 10%.

Table 4: Trade and unemployment (robustness estimations)

	Baseline	2-period	Placebo	\c	2-region
	(1)	(2)	(3)	(4)	(5)
ln gdp per capita	-0.69***	-0.72***	-0.09	-0.70***	-0.66***
	(0.16)	(0.20)	(0.17)	(0.19)	(0.16)
Correlation r_{czt} and u_z	0.41**	0.38**	0.01	0.45***	0.27**
	(0.18)	(0.16)	(0.40)	(0.18)	(0.11)
Observations	1189	739	1189	1189	1189
R^2 (pseudo R^2 in Col. 2)	0.21	0.32	n.a.	0.21	0.21

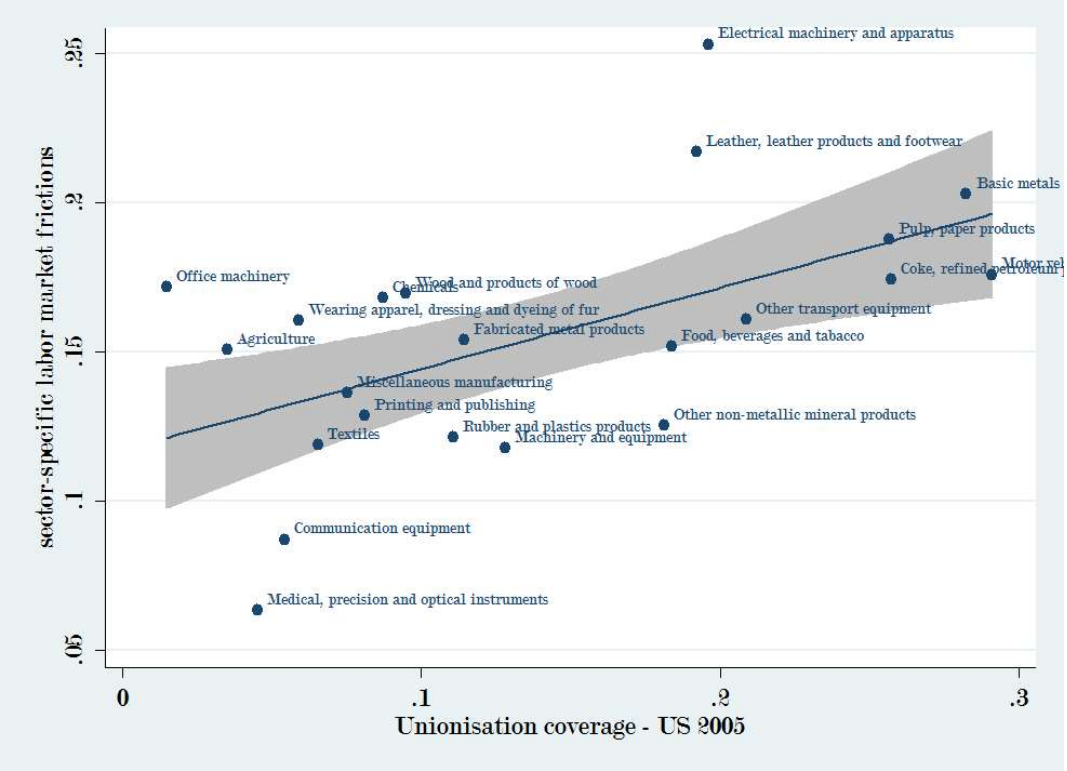
Note: OLS estimates unless otherwise specified. All regressions are at the country, year level. All regressions have country and year fixed effects. r_{czt} denotes `revealed comparative advantage.' Robust standard errors in parentheses are clustered at the country level. *** p < 1%, ** p < 5%, and * p < 10%.

Table 5: Trade and unemployment (using country and time-varying u_{czt})

	Baseline	Hanson et al.	Unionization rate	Rank	Quintiles	Tariff
	(1)	(2)	(3)	(4)	(5)	(6)
ln gdp per capita	-0.73***	-0.75***	-0.73***	-0.74***	-0.72***	-0.70***
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
Correlation r_{czt} and u_z	0.56**	0.50***	0.30**	0.26***		0.51**
	(0.23)	(0.19)	(0.14)	(0.10)		(0.24)
2nd quintile					0.07*	
					(0.04)	
3rd quintile					0.012**	
					(0.06)	
4th quintile					0.16**	
					(0.07)	
5th quintile					0.21***	
					(0.08)	
Avg. Tariff						-0.07
						(0.06)
Observations	1109	1109	1109	1109	1109	910
R^2	0.23	0.23	0.23	0.23	0.23	0.27

Note: Estimations are OLS unless otherwise specified. All regressions are at the country-year level. All regressions have country and year fixed effects. r_{czt} denotes `revealed comparative advantage.' In column (5), the levels of the correlations are replaced by four dummies; the default category is the first quintile. Robust standard errors in parentheses are clustered at the country level. *** p < 1%, ** p < 5%, and * p < 10%.

Figure 1. Correlation between u_z and indices of labour union incidence



Note: Computed using the estimated u_z and the Union Membership and Coverage Database (www.unionstats.com).