

Aplicações de Econometria 2020

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Capítulo 2- International Trade and Structural Unemployment: Evidence from the OECD countries

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Abstract

This paper seeks to investigate the possible relationship between a country's structural rate of unemployment and its relative openness to international trade. To that end, we regress a data panel of unemployment and trade openness for the 36 member-states of the OECD, controlling for business cycle and labor market structure effects. No evidence that higher openness to international trade has unemployment increasing effects, on average, in the OECD countries is found.

Keywords: Trade openness, unemployment, labour market institutions, structural adjustment

1. Introduction

Theoretical treatments of an economy integrated into a system of international trade, have traditionally shown a neglect of its effects on that country's level of unemployment.

In the field of International trade, models frequently assume full-employment at the national level as one of its starting points, and as such, sterilize the capacity of most theoretical models to clarify issues regarding variations in a nation's employment in consequence of different trade policies. The primary questions with which this field of economic theory concerns itself, become therefore dissociated from the main issues raised amidst the political concerns regarding trade policy.

With the emergence of theoretical instruments, particularly relevant to analyse frictions, adjustment and matching costs in the labour market (Pissarides, Christopher, 2000; Mortensen, Dale; Pissarides, Christopher, 1994), new potential models become available to investigate the relation of changes in the unemployment rate, as a function of changing labour market conditions brought about by adjustments to a different regime of participation in international markets.

This new theoretical understanding of labour market dynamics, abandons previous assumptions that a nation's employment level depends strictly from internal macroeconomic factors (Belenkiy and Riker, 2015) influenced by changes in aggregate demand in the short-term, and an exogenous level of equilibrium unemployment in the long-term, which detaches international trade theory from labour market results.

Incorporating asymmetrical information and different labour market structures in an open economy model, shows that there's a theoretically ambiguous movement in employment given a change in trade policy regime (Helpman, Itskhoki and Redding, 2010; Davidson, Martin and Matusz, 1999; Felbermayr et al. ,2011), depending on how labour market search and matching features interact with the specific sectors that experience reallocation of productive factors and individual characteristics of the displaced workers.

For this reason, empirical research is primarily necessary in order to shed light upon the particular effects of a nation's degree of trade openness on the rate of individuals within the labour force involuntarily unemployed.

In this study, building upon this surging current of recent empirical research on the subject, we aim to investigate the causality between a developed country's unemployment and its openness to international trade. This analysis becomes particularly relevant given recent developments in the escalation of a US – China trade conflict and the depart of the United Kingdom from the EU's customs union, amidst of which concerns regarding the relation between trade and unemployment are raised in the political and social debate that ensues.

Dutt, Mitra and Ranjan (2009), empirically test the corollaries of two alternative trade models, both integrating search and matching costs in the model's labour markets, being one of the Ricardian type, i.e. it specifies comparative advantage according to productive technology differences; and another of the Hecksher-Ohlin type, which specifies comparative advantage according to differences in relative factor endowments. Through a cross-sectional regression of 80 countries, Dutt et al. find robust evidence that the long-run effects of higher trade openness lower the unemployment rate. However, its particularly notable in this same study, that within 1 to 2 years immediately after specific liberalization episodes, on average, there's an associated increase in unemployment, suggesting that short-run and long-run effects have an opposite impact on the unemployment rate.

Felbermayr, Prat and Schmerer (2011), through a GMM (generalized method of moments) regression of a data panel for 20 OECD countries and a cross-sectional 2SLS (two stage least-squares) regression for a broader sample of 62 countries, using a set of control variables for institutional and geographical factors, find robust results the suggest an inverse relation between the structural rate of unemployment and openness to international trade, in line with previous results found in Dutt et al. (2009).

The same inverse relation between the unemployment rate and the volume of trade relative to GDP is equally found in Gozgor (2017), using the same method of specifying two different structural models, each specifying different sources of comparative advantage used previously in Dutt et al. (2009), obtaining consistent results with that same

study and with Felbermayr et al. (2011). Additionally, in the same paper, the relation of the unemployment rate to indexes of other social, economic and political aspects of globalization is also tested, yielding a similar negative relation for most measures, although these are not found to be statistically significant.

On another side, a whole set of literature that focuses on frictions in the labour market brought about by the opening of certain sectors to international competition, reports an increase in unemployment, most notably, Autor, Dorn and Hanson (2013) and Trefler (2001), analyse how higher import competition has impacted local labour markets in the United States, and Canada, respectively, and find a negative effect on employment and labour force participation, especially in regions dependent on manufacturing, and workers with low formal education.

In line with the previously referred studies, Kletzer (2004) establishes some stylized facts regarding job losses associated with higher import competition also for the United States. This investigation focuses essentially on the short-run and the process of intersectoral reallocation of resources, and reports some particularly relevant regularities: displaced workers tend to have low formal qualification, an advanced age, on average, and a large part of their human capital tends to be sector specific to the industry they have previously employed, observing that this poses great difficulty for these set of workers to find employment once they become unemployed, and reports that about half of those that are reemployed, do so in the same sector they were previously employed.

Additionally, in the model developed by Helpman, Itskhoki and Redding (2010), we can conclude that the expanding export sector after trade liberalization, tends to employ workers with higher levels of human capital and formal qualifications, a result that is empirically observed in Felbermayr et al. (2011), and another model developed by Moore and Ranjan (2005). This suggest that relatively small aggregate movements in the non-cyclical portion of unemployment, may have underlying larger opposite movements in the employment of individuals with different skills, education and overall human capital, and as such, it becomes relevant to empirically assess this groups unemployment rate given a change in trade policy.

2. Data and Methods

In order to estimate the effects of higher economic openness on a country's structural rate of unemployment, we use a data panel for the 36 member states of the OECD, using a set of relevant control variables, collected for the periods between 1994 to 2018.

All the data are collected either from the World Bank's or the OECD's official databases, and can be respectively consulted at <https://data.worldbank.org/> and <https://data.oecd.org/>.

2.1. Variables

Bellow we discuss the main variables of which we make use to model and empirically estimate the relationship between unemployment rates and trade regimes:

Unemployment Rate

For the purposes of our study, we use as a dependent variable the total number of involuntarily unemployed individuals as a percentage of the total labour force, usually reported as the official unemployment rate for each country.

International comparisons of unemployment rates can be problematic, since different classification rules can distort the figures relative to other countries, and so requiring international harmonization across countries in order for these figures to become comparable. The data we use for the measures of this variable are taken from the World Bank official database, which is itself transposed from the data collected by the International Labour Organization, through direct surveys to households, and provides harmonized unemployment data across all countries for which it is measured.

Additionally, problems related with the quality and representativity of unemployment figures used in this study are considered to be very minimal, since we use data only for a limited set of developed countries with relatively sophisticated institutions and methods of statistically assessing unemployment rates.

Aggregate unemployment rates are composed by three theoretically distinct categories, cyclical, frictional and structural. The first relates to unemployment sourced

by a fall in aggregate demand, and thus output, below its trend level across the business cycle; the second relates to a component of unemployment caused by labour market frictions, such as asymmetric information, that render the process of finding an efficient match between a given job and an individual worker costly, thus extending the time of unemployment for a set of individuals; and finally, the third type relates to a mismatch between the structure of the economy and the particular types of qualifications and characteristics of workers it requires, and the particular types of qualifications and characteristics workers currently supply.

Structural and frictional components of unemployment are empirically difficult to disentangle and the causes which may turn these particularly persistent heavily interact, making the boundaries of specifically frictional and structural unemployment extremely ambiguous. As such, for the purposes of this paper, we treat all non-cyclical components of unemployment as the relevant magnitude we seek to empirically assess, however since it concerns trade related structural adjustments, and consequent variations in employment, of which search frictions play a role, we name this component under the encompassing term of 'structural unemployment' throughout the paper.

In addition to the aggregate levels of unemployment, we analyse the unemployment rates for specific segments of the labour force, using statistics divided by formal educational attainment into three categories established by the International Standard Classification of Education (ISCED 2011), these being: Low, corresponding to individuals whose last completed schooling cycle corresponds to basic or lower secondary education; Medium, which refers to individuals who completed upper-secondary or post-secondary non-tertiary education; and finally, Advanced, attributed to those individuals with either first or second stage tertiary education. For these, the unemployment rates constitute the number of involuntarily unemployed workers as a percentage of the total portion of the labour force that verifies the same educational attainment level.

Trade Openness

The most common measure to define the openness to international trade of an economy is simply the sum of the total value of imports and exports as a percentage of a

country's total GDP. Given that this measure has extensively been used in many studies in order to investigate the effects of international trade on various variables, especially cross-country trade and growth regressions, we use this as one of the variables that indicate how internationally integrated an economy is.

Alcala and Ciccone (2004), propose an openness measure expressed in purchasing power parity in order to purge the data from the Balassa-Samuelson effect, whereby different levels of productivity, even ones endogenously generated by engagement in international trade, alters the ratio of the total value of the tradable and non-tradable goods and services relative to GDP when expressed in nominal terms. However, since our sample is composed entirely of similar developed countries, we thus consider nominal distortions caused by this effect relatively unimportant for the purposes of our study, noting however that in larger samples with higher variability in labour productivity, the use of an openness measure expressed in real terms becomes particularly relevant.

Average weighted tariff rate

The average weighted tariff rate is calculated as the average of all imposed tariffs by a given country on imported products, weighted by the percentage of each import category to which a tariff is applied, in the total volume of that country's imports, which allows for a more realistic measure of effective protection applied by a tariff structure than the computation of a simple average tariff rate would yield.

In this study, we alternatively make use of this measure as an assessment of the effect of trade policy instruments on a country's unemployment, given that the trade openness measure directly represents a trade policy outcome, that is however influenced by a set of other extraneous factors.

Output Gap

The output gap is defined as the percentual deviation of actual output or GDP from its potential level, given the total productive capacity in the economy, at any given period of time.

The empirical and theoretical relation between the unemployment rate and a short-term differential between actual and potential output is essentially captured by Okun's Law, whereby a fall of output below trend, or potential, implies an increase in the unemployment rate below its NAIRU (non-accelerating inflation rate of unemployment) level, and vice versa. This underpins the short-run marginal trade-off between unemployment and inflation, known as the Philips curve.

Given that we seek to estimate structural relationships, such as that between international trade related variables and unemployment, when the unemployment rate is at its steady-state equilibrium level, we require then a control variable in order to eliminate the influence of cyclical fluctuations on employment, making use of output gap estimates for each country, at each year for which we collect data, as a proxy of the influence of business cycle variations in the unemployment rate.

This becomes all the more necessary since short-run cyclical variations in the level of aggregate demand have an endogenous relation to both unemployment and the volume of a country's imports and exports, that is, the fall of GDP below trend, and thus the increase in the rate of unemployment, also depresses the demand for imports, the same being true for the reverse case. On another hand, an autonomous rise or fall in the volume of exports, induces a corresponding rise or fall in GDP and employment. There is no reason however to suppose that this effect will be perfectly proportional to variations in GDP, especially in periods of high unemployment, where the multiplier effect of this variables is more likely to be different to 1, thus introducing bias in the measures of openness to trade and its relation to unemployment, at least relative to the type of relationships we seek to estimate.

Real-time output gap estimates can prove to be especially unreliable (Watson, 2012; Nelson and Nikolov, 2003), however, for the purpose of this study we use only historically revised estimates, for which the methods of estimating potential output yield naturally more consistent results.

The output gap data we use to control for business cycle effects is taken from the estimates performed by the OECD for its member states; for a discussion and explanation of the methods employed in these estimates see Chalaux and Guillemette (2019).

Labour Force Participation Rate

Labour force participation rate refers to the percentage of the total population, between the ages 15 and 64, for the reference period, that constitute the active workforce, either employed or actively seeking employment.

When unemployed individuals stop to actively seek employment, and thus leave the labour force and an individual not currently in the workforce suddenly becomes employed, the unemployment rate also decreases. We introduce this variable in order to control for variations in unemployment that may be caused entirely by changes in workforce participation, especially those that may be related to structural changes in trade policy. Given that the structural components of unemployment are particularly persistent, trade related variations in unemployment has a higher likelihood of being influenced by variations in the labour force.

Madanizadeh and Pilvar (2019) present an empirical investigation in which a 10-percentage point increase in the tariff rate, decreases, other factors constant, the labour force participation rate in 4 to 5 percentage point, which credits the fact that controlling for variations in labour force participation is necessary in order to purge the data from misleading changes in employment.

Labour Market Institutions

The results from Nickell, Nunziata and Ochel (2005), and Bassanini and Duval (2006), suggest that a shift in labour market institutions (Union coverage, unemployment benefits, layoff regulations, etc.) can explain a proportion of unemployment rates for the OECD countries, and that these interact extensively with macroeconomic shocks in determining the magnitude and duration of unemployment. Blanchard and Wolfers (2000), also argue that the way by which certain labour market institutions can significantly determine unemployment is to the extent of which they interact with the effects caused by exogenous shocks, causing a higher heterogeneity in variations in employment across countries, even for a relatively symmetrical shock.

As such, it becomes relevant to control for a portion of the variance in unemployment rates that may be caused by shifts or differences in the institutional factors composing the labour market, especially if these have meaningful interactions with the cyclical variations in unemployment which we seek to also control for.

In order to hold these factors that compose different institutional structures across countries and across time, we include in the regression a set of variables measuring different institutions of the labour market, for which data is collected and provided by the OECD.

Firstly, we introduce a synthetic index for the strictness of employment protection legislation, constructed by the OECD, varying on a scale from 0 to 6, whereby higher scores represent higher legislative restrictions on both individual and collective dismissals. The full description of methodology and scales used in the computation of this index can be consulted in <https://www.oecd.org/els/emp/EPL-Methodology.pdf>.

Additionally, we include the collective bargaining coverage rate, that is, the number of workers covered by the rules of a collective bargaining agreement, as a percentage of total employed wage earners.

Nickell and Layard (1999), Dolenc and Laporšek (2010) and Bassanini and Duval (2006), provide quantitative evidence that the tax wedge, defined as the ratio between the amount of taxes paid by an average single worker, as a percentage of total labour costs (salaries plus employer paid benefits), by raising labour costs of firms seem to be associated with lower unemployment, and as such this measure is included as one of the features of labour market structure we seek to explicitly control for.

In addition to this, we include a proxy measure of the potential effects of unemployment benefits in the duration or prevalence of unemployment by including the total value of publicly provided unemployment benefits as a percentage of a country's total GDP.

In Bassanini and Duval (2006), both the tax wedge and the scale of unemployment benefits have a significant aggravating impact on unemployment, employment protection legislation indicators have a negative correlation with unemployment, while other labour market institutions studied are not found to be statistically significant determinants of unemployment rates.

Table.1- Descriptive statistics

Variables	Mean	Median	S. D	Min	Max
Unemployment rate (U)	7,849	6,991	4,173	1,805	27,47
Trade Openness (TRD)	90,14	73,71	54,24	16,10	416,4
Average Weighted Tariff rate (TRFF)	2,974	2,220	2,093	0,490	16,77
Output Gap (OUTG)	-0,679	-0,699	3,049	-15,49	14,51
Labour Force Participation rate (LFPr)	69,75	71,13	9,387	31,85	89,09
Total Population (POP)	3,44e ⁺⁰⁷	1,05e ⁺⁰⁷	5,45e ⁺⁰⁷	2,6e ⁺⁰⁵	3,27e ⁺⁰⁸
Employment Protection index (LFPr)	2,162	2,230	0,766	0,256	4,583
Collective Bargaining Coverage rate (CBC)	51,43	49,54	30,25	5,401	100,0
Tax Wedge (TAX)	36,44	38,25	10,69	7,000	57,10
Unemployment Protection Spending (UPS)	0,849	0,601	0,772	0,000	4,427

<https://data.worldbank.org/>
<https://data.oecd.org/>

2.2. The Model

We make use of an unbalanced panel data set for the 36 OECD member states, with significant variability across the time dimension, for the period of 1995 to 2018, in order to identify the causal relationship between unemployment and trade, through a Fixed Effects panel regression.

The main empirical model which we seek to estimate is specified as follows:

$$U_{t,i} = \beta_0 + \beta_1 TRD_{t-1,i} + \beta_2 TRFF_{t-1,i} + \beta_3 OUTG_{t-1,i} + \beta_4 LFPr_{t-1,i} + \beta_5 STR_{t-1,i} + \beta_6 CBC_{t-1,i} + \beta_7 TAX_{t-1,i} + \beta_8 UPS_{t-1,i} + FE_i + FE_t + \varepsilon \quad (1)$$

The dependent variable of the model is specified as the unemployment rate of a given country i , in a given year t , and is represented by $U_{i,t}$, while the main independent variables whose parameters are meant to identify the relationship between openness to international trade and unemployment, are the trade openness measure, represented by $TRD_{i,t-1}$, and the average weighted tariff rate, represented by $TRFF_{i,t-1}$, for a given country i , and the prior year relative to the unemployment rate, $t-1$.

This however, means that both variables are specified as the first lag of the variable, relative to the year observed for the dependent variable. This specification is justified on two grounds, firstly, it evades certain biases stemming from reverse causality, whereby trade policy instruments and outcomes may be influenced by public decision-makers in response to the unemployment rate, another reason stems from the reasonable assumption of a lagged impulse response between trade policy shocks and unemployment, given that the process by which both are expected to be linked requires series of long and dilatory structural adjustments in the economy.

An extensive set of control variables are included in the regression in order to control for possible bias, which can be minimized by including other relevant variables correlated with both the main explanatory variables and the dependent variable of the model. For all of this control variables, it is also specified that their observed value in a year $t-1$, has an impact on unemployment in year t , for a given country i . $LFP_{i,t-1}$, represents the labour force participation rate. Additionally, $OUTG_{i,t-1}$ expresses the output gap observed at the year $t-1$, relative to a year t for the observed unemployment rate. The control variables for labour market institutions, $STR_{i,t-1}$, $CBC_{i,t-1}$, $TAX_{i,t-1}$ and $UPS_{i,t-1}$, express respectively, the index for employment regulation strictness, the percent coverage by collective bargaining agreements of the employed labour force, the tax wedge, and the percent weight of unemployment benefit on a countries GDP, all specified as the first lag relative to the observation for the unemployment rate as stated.

FE_i and FE_t , both represent the vectors of effects caused by unobserved heterogeneity, either across countries, or across time, respectively, that may be simultaneously correlated with the dependent variable and the explanatory ones; the inclusion of corrective measures for this types of effects shall depend on the values for the panel diagnostic tests for the different specifications of the model.

Finally, E , represents the error term, that is all of the unobserved factors that cause variability in the unemployment rate, assumed to be independent of the explanatory variables.

3. Results

In table 2, are presented the results of the regression of the coefficients for each variable in equation (1), across different specifications.

We execute the regression for a panel of 36 OECD countries, for the period ranging from 1994 to 2018, with the observed unemployment rate at a given year, for a given country, as the dependent variable.

The White test for a heteroskedastic error term, rejects the null hypothesis of homoskedasticity for the error term at the level of significance below 1% for all of the variant specifications of the model, suggesting heavy correlation between the variance of the residues of the regression and the explanatory variables. Therefore, in order to reliably perform statistical inference, it is necessary to compute heteroskedasticity robust standard-deviation estimates of each parameter, which are presented under the respective estimated values.

For each model variant, the p-values of the hausman specification test, testing consistency of the fixed effect's estimator against the random effect's estimator are presented. Since the p-values for the Hausman test are inferior to 1% for all of the included regressions, the fixed effects estimator is applied, through a least squares dummy variable (LSDV) model. Additionally, the p-value of the F-test for the joint significance of the country-specific and time-specific dummy variables is inferior to 1%, and thus, for all of the included specifications, these are jointly significant.

Under specification (1), the main measuring variable of the effects of international trade is the trade openness measure previously discussed. The coefficient estimate associated to this measure presents a statistically significant inverse relationship between the percentage of exports and imports to GDP and the unemployment rate, whereby a 1 percentage point increase in trade openness is correlated with a 0.055-percentage point decrease in the equilibrium unemployment rate for the average OECD economy.

The output gap for the first variant is highly significant, at a level of significance lower than 1%, suggesting that cyclical fluctuations in unemployment around the trend are highly prevalent on average for the OECD countries in the sampled period. Given that the output gap is constructed as the difference between actual and potential annual GDP, the associated negative coefficient reflects an increase in unemployment the more actual GDP falls short of its trend potential, and therefore reflecting the well-known countercyclical nature of unemployment.

Table.2 - Panel regression: 36 OECD countries (1994 - 2018)

Variables (t-1)	(1)	(2)	(3)	(4)	(5)
<i>TRD</i>	-0,055** (0,024)	–	-0,056** (0,024)	-0,048** (0,022)	–
<i>TRFF</i>	–	-0,104 (0,230)	-0,069 (0,208)	–	0,098 (0,204)
<i>OUTG</i>	-0,506*** (0,073)	-0,578*** (0,103)	-0,505*** (0,074)	-0,428*** (0,078)	-0,481*** (0,100)
<i>LFPr</i>	0,2229 (0,142)	0,258 (0,163)	0,221 (0,142)	0,192 (0,137)	0,218 (0,153)
<i>STR</i>	-1,701* (0,850)	-0,801 (1,107)	-1,699* (0,853)	-1,418* (0,738)	-0,624 (0,937)
<i>CBC</i>	-0,0628 (0,064)	-0,050 (0,071)	-0,063 (0,064)	-0,028 (0,054)	-0,014 (0,060)
<i>TAX</i>	0,171 (0,151)	0,182 (0,179)	0,167 (0,153)	0,110 (0,138)	0,113 (0,158)
<i>UPS</i>	3,589*** (0,793)	3,323*** (0,962)	3,599*** (0,806)	3,497*** (0,803)	3,259*** (0,948)
<i>OUTG</i> ²	–	–	–	0,025*** (0,0075)	0,028*** (0,007)
R ² _{adj.}	0,884	0,873	0,883	0,894	0,886
N	273	273	273	273	273
Hausman	0,0001	0,002	0,0001	0,0001	0,0015
F-test (DV)	1,118e ⁻⁰¹⁷	3,612e ⁻⁰¹²	8,856e ⁻⁰¹⁴	2,612e ⁻⁰²³	6,390e ⁻⁰³²

The notations, " *", " **", " ***", " ****", signify that the coefficient estimates are respectively statistically significant at 10%, 5% and 1%.

For each model variant, the p-values of the hausman specification test, testing consistency of the fixed effect's estimator against the random effect's estimator are presented. Since the p-values for the Hausman test are inferior to 1% for all of the included regressions, the fixed effects estimator is applied, through a least squares dummy variable (LSDV) model. Additionally, the p-value of the F-test for the joint significance of the country-specific and time-specific dummy variables is inferior to 1%, and thus, for all of the included specifications, these are jointly significant.

Under specification (1), the main measuring variable of the effects of international trade is the trade openness measure previously discussed. The coefficient estimate associated to this measure presents a statistically significant inverse relationship between the percentage of exports and imports to GDP and the unemployment rate, whereby a 1 percentage point increase in trade openness is correlated with a 0.055-percentage point decrease in the equilibrium unemployment rate for the average OECD economy.

The output gap for the first variant is highly significant, at a level of significance lower than 1%, suggesting that cyclical fluctuations in unemployment around the trend are highly prevalent on average for the OECD countries in the sampled period. Given that the output gap is constructed as the difference between actual and potential annual GDP, the associated negative coefficient reflects an increase in unemployment the more actual GDP falls short of its trend potential, and therefore reflecting the well-known countercyclical nature of unemployment.

Additionally, the percentage of unemployment protection expenses on GDP is also found to be highly statistically significant at the level of 1%, the highest performing variable in terms of statistical significance of the labour market structure controls, with an aggravating effect upon unemployment of proximally 3.5 percentage points for each 1% increase of unemployment protection expenses upon GDP. The employment protection legislation index also shows an inverse relationship with the structural unemployment rate, suggesting that in the long-run it may promote the preservation of jobs than otherwise, or at least more than it may hypothetically discourage hiring, though statistically much less significant. The remaining labour market related variables are however not found to be statistically significant.

Specification (2) swaps the trade openness index for the average weighted tariff rate as a measure of exposure to international competition, noting that paradoxically the effects of tariffs also show an inverse correlation with unemployment such as trade openness, although not statistically significant and thus likely that the measured effect is not reflective of a veritable causal relationship. As it would be expected, the output gap remains highly significant and preserves a similar magnitude, of around 0.5 percentage points increase in unemployment for each percentage point deviation of actual from potential output. The is observed for unemployment protection spending, remaining highly significant and with a considerable increasing effect on equilibrium unemployment.

Variant (3) regresses the openness index simultaneously with the average tariff rate. Interestingly, the coefficient estimates for both trade related measures preserve a similar magnitude and level of significance when estimated together, which would suggest a low correlation between the percentage of imports and exports over GDP and the average tariff rate of a country, and that the imposition or reduction of tariffs may not influence the volume of trade of a country to a sufficient degree as to affect the level of unemployment. Similarly, to other specifications, both the public unemployment spending and output gap coefficients remain highly significant and with large effects upon employment.

Specifications, (4) and (5) add the squared value of the output gap to the regression, for which the coefficient estimates are highly significant, at the level of 1%, a relationship that

signifies a non-linear variation in unemployment for a given variation in the output gap. The inflexion point of the quadratic function occurs along the positive range of the output deviation, that is, when actual output exceeds the economy's capacity by a certain magnitude, the percent reduction in unemployment starts to decrease until it becomes null. This may be plausibly interpreted as follows, past the point the unemployment rate reaches its natural rate, i.e. the unemployment rate constituted by its structural and frictional component, a successive increase in the positive deviation of actual output from potential output, can result in a slightly lower unemployment rate than the natural rate, and inflation expected to rise, however, past this point, the decrease in unemployment starts to face a diminishing rate until it reaches a point where a further increase in output does not lower unemployment.

Regression (4), adds the non-linear component of the output gap, using the trade openness index as the indicator of the effects of foreign competition. The addition of a quadratic term for the output gap does not however meaningfully change the estimate for the effects of openness to trade, which has a similar impact found in the preceding specifications, with a p-value still below 5%.

Alternatively, regression (5) changes the trade openness indicator for the average tariff rate, and adds the quadratic term of the output gap. The coefficient estimate for the effect of tariffs on unemployment keeps being statistically non-significant, however more interesting, after introducing a non-linear control for business cycle effects, the direction of the relationship between tariffs and unemployment reverses, and becomes positive, meaning that higher tariff rates would have an aggravating effect of unemployment in the long run, that however, not being statistically significant may prove to be arbitrary statistical artifact of the chosen sample.

Being highly significant, and highly reducing specification error of the model, as measured by the p-value associated with the RESET specification test (although still not within the range where the null hypothesis is not rejected), introducing the polynomial form of the output gap is important to obtain a better calibrated control for the influence of cyclical variations in unemployment that may bias the results. For both regressions, the average inflexion point for quadratic function between the unemployment rate and the output gap is estimated at the deviation of actual output above the long-term trend by approximately 8,6%.

Summarily, trade openness shows an inverse relationship with unemployment, of around 0.48 to 0.56 percentage point decrease in the unemployment rate, for each 10-percentage point increase in the percentage of imports and exports over GDP, across specifications, in line with the findings of previous research, namely Felbermayr, Prat, and Schmerer (2011), Dutt, Mitra and Ranjan (2009) and Gozgor (2013), which also find an inverse effect of trade openness on

unemployment within a similar order of magnitude. It is important to remember, however, that the trade openness index is a composite of the volume of both exports and imports, and thus it is theoretically plausible that the empirically measured effect of this variable may contain within itself countervailing effects depending on the relative evolution of each sector; that is, if the exporting sector expands relatively more than import substitute industries decline, it is conceivable that the effect tends to be more negative, and vice-versa. These two components are not however independent, due to the organization of international trade patterns in global supply chains, the exporting and domestic industries of a given country may require a big percentage of imported inputs and thus, a growth in the volume of exports, which may reduce unemployment, is also accompanied by a growth in imports, for example, Ijtsma, Levell, Los and Timmer (2018), estimate that approximately 18% of the UK's industries inputs are imported from other countries, and as such import tariffs impose higher costs upon exporting domestic industries.

The weighted average tariff rate, also seems to have a negative effect on unemployment, which could be interpreted as preventing domestic firms from being outcompeted by foreign firms without meaningfully affecting employment in exporting sectors, although this relationship is found to not be statistically significant, and thus it is probable it may arise due to random variation in the sample, and becomes positive when non-linear effects of cyclical fluctuations are explicitly controlled for.

This may signify that aggregate movements in the relative weight of trade on GDP indicate structural shifts in the economy that have a measurable impact upon the equilibrium unemployment rate, but the change in tariff rates is not a major determinant of these.

Similarly, to Nickell (1997), Nickell and Layard (1999), and Felbermayr et al. (2011), only few labour market institutions have, individually, a statistically significant effect on unemployment. The index of employment protection and the rate of coverage of collective bargaining agreements are found to have a reducing impact in unemployment, while the tax wedge is found to have an increasing effect, which are however statistically non-significant; only unemployment benefits spending is found to be highly significant, being associated with higher rates of unemployment, which can be interpreted as increasing the average reservation wage, that is, the lowest wage at which an unemployed worker is willing to accept a given job.

3.1. Additional Results

In addition to the previous results, it is also relevant to study the effects of foreign trade upon the unemployment rates decomposed by different levels of formal education. It can be expected that workers with lower formal education attainment may bear a disproportional impact in terms of unemployment upon an opening of the economy to foreign competition, as empirically suggested in Kletzer (2004), and Autor, Dorn and Hanson (2013).

In the model of Helpman, Itskhoki and Redding (2010), the exporting sector expands as a result of higher exposure to international trade, however, the labour market search-and-matching process in the economic readjustment, screens out workers with lower levels of human capital, and thus may provide a theoretical underpinning for this type of phenomenon.

Table.3- Panel regression: Formal education decomposed unemployment rates (1994-2018)

Variables (t-1)	(1)	(2)	(3)
<i>TRD</i>	0,0049 (0,0162)	-0,0635* (0,0314)	0,023* (0,012)
<i>TRFF</i>	0,075 (0,090)	-0,0887 (0,294)	0,0815 (0,157)
<i>OUTG</i>	0,088 (0,071)	-0,204** (0,0803)	0,114 (0,0893)
<i>LFP_r</i>	-0,109 (0,118)	0,158 (0,224)	0,545** (0,262)
<i>STR</i>	-1,899* (1,069)	-3,873** (1,896)	1,655** (0,802)
<i>CBC</i>	-0,015 (0,039)	-0,0996 (0,1004)	-0,063 (0,039)
<i>TAX</i>	-0,129 (0,112)	0,142** (0,169)	-0,159 (0,158)
<i>UPS</i>	1,007 (0,793)	4,795*** (0,9708)	0,765 (1,040)
$R^2_{adj.}$	0,994	0,818	0,732
N	207	252	266
Hausman	0,1338	0,00015	5,318e ⁻⁰⁰⁷
F-test (DV)	2,527e ⁻⁰⁶⁰	2,650e ⁻⁰¹³	1,085e ⁻⁰¹⁰

The notations, " *", " **", " ***", signify that the coefficient estimates are respectively statistically significant at 10%, 5% and 1%.

Columns (1), (2) and (3), respectively refer to the unemployment regressions for the groups of low, medium and advanced educational attainment, according to the International Standard Classification of Education (ISCED 2011).

For the group of lower education attainment, almost none of the explanatory variables are show to be statistically significant, except for the index of employment protection which is determined as significant at 10%, with an associated inverse correlation with the unemployment rate for this particular group. However, some things may be noticed, as it could be expected, the trade openness index does show a positive relationship with unemployment for the lower education group, although not statistically significant.

The medium education group's unemployment rate is found to have a negative correlation with trade openness, significant at the level of 10%. For this group, the output gap associated coefficient, also shows the countercyclical nature of unemployment, which contrary to what may be expected does not seem to appear in the data for the low education group; additionally most of the labour market variables are significant, having the employment protection index an expected negative effect on unemployment, while the tax wedge and the proportion of unemployment benefits have an aggravating effect on unemployment.

For the advanced education group's unemployment rate, the effect coefficient associated to trade openness is also significant only at 10%, although contrary to the expected, higher trade openness seems to be associated with higher unemployment among this group. Business cycle effects also do not seem to have a statistically significant impact on the unemployment of this group, besides which the associated coefficient shows a pro-cyclical movement in the unemployment rate for this subsection of workers.

4. Conclusion

This study seeks to determine the effects higher exposure to foreign trade has on the unemployment rates, for the OECD countries, for both the total population and different educational groups.

The results suggest that a greater exposure of an economy to higher volumes of trade does affect the level of unemployment. The trade openness measure, volume of imports and exports as a percentage of GDP, across three different specifications is found to have a statistically significant inverse correlation with unemployment, that suggests that a higher volume of trade in proportion to a country's GDP reduces, rather than promote non-cyclical unemployment, which Dutt, Mitra and Ranjan (2009), interpret as a predominance of Ricardian-type productivity effects over an Heckscher-Ohlin composition effect, which under preexisting frictions in the labour market, the first is expected to have a reducing effect upon unemployment and the later an increasing effect for capital abundant countries such as those that constitute the OECD.

The Coefficient estimate for Tariff rates is found not to be statistically significant, although more puzzlingly, there seems to be a low correlation between tariff rates and trade openness, and the simultaneous regression of both this variable does not meaningfully change the respective coefficient estimates.

It may be noted also, that the inclusion of the output gap as a control for the effect of business cycles on unemployment proves to be highly significant, and the negative sign associated to the estimated coefficient reflects the countercyclical movement of the unemployment rate across the sample, for which is found evidence of a non-linear relation between cyclical movements in GDP and unemployment. For this reason, controlling for the impacts of business cycles is important for the study of the effects of international trade on an economy.

Additionally, by disaggregating the unemployment rate in three groups of different formal education, puzzling results are observed, for example trade openness appears as positively correlated with the unemployment rates for both the low and advanced education groups, and negatively correlated with the medium education group's unemployment, while the output gap reflects a procyclical variation in unemployment for both of the former groups and the expected countercyclical variation for the medium education group, noting however that for the lower and advanced educational group neither trade openness nor the output gap are found to be statistical significant.

What this suggests, is that trade related structural changes are associated with decreases in the non-cyclical component of unemployment, although the low correlation between trade openness and tariff rates, also suggests that the latter is not an effective instrument in order to influence the effects of trade, particularly if the political motivation stems from a need to address structural unemployment.

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