Lisbon School of Economics & Management
Universidade de Lisboa

MASTER
ECONOMICS

MASTER'S FINAL WORK
DISSERTATION

THE ESTIMATION OF LOCAL EMPLOYMENT MULTIPLIERS FOR PORTUGAL

GONÇALO JOSÉ DE BRITO GONÇALVES MARTINS

OCTOBER – 2021

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SUPERVISION:

PROFESSOR PATRÍCIA COELHO DE MELO

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Ao meu Avô. Com o desejo
que esta Dissertação o
deixasse orgulhoso.

GLOSSARY

E.U. – European Union

FE – Fixed Effects

INE – Instituto Nacional de Estatística

IV – Instrumental Variable

M.S.A – Metropolitan Statistical Area

NUTS – Nomenclature of Territorial Units for Statistics

OECD – Organization for Economic Co-operation and Development

OLS – Ordinary Least Squares

RE – Random Effects

U.S.A. – United States of America

ABSTRACT, KEYWORDS, AND JEL CODES

This Dissertation analyses the relationship between employment in the "Tradable" and "Non-Tradable" sectors for Portugal. More specifically, the size of the employment multiplier effect between them. To do so, we have conducted a study at two different regional levels: municipalities and NUTS III for the Portuguese economy.

The aim is to measure the size of the employment multiplier of the "Tradable" sector onto the "Non-Tradable" sector through multiple econometric methods. We used Pooled OLS estimations, Panel Data estimations with fixed and random effects and Instrumental Variable Regressions.

The results from the estimations provide evidence of a statistically significant employment multiplier ranging between 0.4 and 0.9 extra jobs in the "Non-Tradable" sector for each new job in the "Tradable" sector in the average NUTS III region and between 0.32 and 0.77 in municipalities. The results are presented as an interval because the values differ with different econometric methods used.

The main conclusion from this Dissertation is that we were able to find a positive and statistically significant employment multiplier which is coherent with previous literature in this topic.

KEYWORDS: Tradable; Non-Tradable; Employment; Multiplier; Regional Economics.

JEL CODES: R11; R13; R58.

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It is hard for someone who chooses to continue the study of Economics after the undergraduate level to find a good bearing and follow it. Sometimes it is even hard to find a bearing with such a vast list of topics in the long and exciting history of the subject. I was no exception to this. In the many readings that I have been doing throughout the years, regional inequalities caught my interest in a special way.

But these were not the regional disparities I had been discussing at a macro level since my undergraduate studies. I found myself entangled with studies that enquired whether different streets within a residential block could be a factor of hindrance or boost of social and economic wellbeing to the population who lived in it (University of Newcastle et al., 2017). If there were differences within residential blocks, I wondered what challenges were faced by larger regions and the role geographic characteristics have that impact people's standard of living, and how economic agents interact differently because of that.

As I finish this work, the joy from being able to reach the end is greatly surpassed by what is left unanswered and the ideas that arise for future works.

To my parents, sister, grandparents, girlfriend, family, and friends a warm thank you. I would not have been able to finish this work without your support.

To my supervisor: Professor Patrícia Melo a heartfelt thank you, for all the patience and invaluable contributions to this work. It surely is thanks to her that this Dissertation has been finished.

ESTIMATION OF LOCAL EMPLOYMENT MULTIPLIERS FOR PORTUGAL

By Gonçalo J. B.G. Martins

THIS DISSERTATION analyses the relationship between employment in the "Tradable" and "Non-Tradable" sectors for the Portuguese NUTS III and Municipalities. It measures the size of the spill-over effect of the creation of one new job in the "Tradable" sector on the creation of jobs in the "Non-Tradable" sector of the economy, known as the employment multiplier. The results from the regression models provide evidence of an average employment multiplier ranging between 0.32 and 0.9 extra jobs in the "Non-Tradable" sector for each new job in the "Tradable" sector.

1. INTRODUCTION

The study of job creation is a complex and important topic for economic growth. Economies have different patterns of industrial specialization, which helps to explain, at least partially, differences in the magnitude of job creation and economic growth, as well as the potential spill-over effect between the so-called "Tradable" and "Non-Tradable" sectors. According to the OECD report *Productivity and Jobs in a Globalised World: (How) Can All Regions Benefit? (*OECD, 2018), the "Tradable" sector consists of the group of activities that produce goods and services *"that have the potential to be traded and therefore are subject to international competition"* (OECD, 2018). Manufacturing activities is the most obvious and popular example of economic activities included in the "Tradable" sector. By exclusion, the "Non-Tradable" sector includes the activities that produce goods and services to be consumed locally (e.g. restaurants, hairdressers, etc.) and which are not subject to international competition.

Consequently, it is generally considered by economists that the "Tradable" sector industries are the engine of economic growth, and it is this group of activities that need to be at the core of economic policy and investments. Besides the direct benefits to economic growth, there is an additional spill-over effect from "Tradable" sector jobs on "Non-Tradable" sector jobs that provide the goods and services consumed locally by "Tradable" sector workers. In other words, the number of barbers, car mechanics, or restaurant waitresses will increase as new jobs are created in factories, consultancies,

mines, or farms. This spill-over effect from the "Tradable" sector jobs to the "Non-Tradable" sector jobs is known as the local employment multiplier.

The investment plans announced by policymakers are generally expected to foster the generation of jobs both directly and indirectly, but we do not know very much about the relation between these two types of effects, which can be measured through the employment multiplier between the jobs created in the "Tradable" sector and those induced in the "Non-Tradable" sector. Is there a standardized effect of the employment multiplier from the creation of new jobs in the "Tradable" sector?

There have been several studies attempting to measure the size of the local employment multiplier. The empirical work by Enrico Moretti on *Local Multipliers* (Moretti, 2010) led to successive research, including recent work by Moretti & Thulin (2013) and Van Dijk (2015, 2016, 2018) for the United States of America (U.S.A.) and Sweden. The conceptual framework used by Moretti (2010), can be traced back to Hoyt (1941). Hoyt stated that the total wealth and jobs of a region depended solely on the strength and prosperity of its "Tradable" sector because it is responsible for the influx of revenue into the economy. Moretti estimated that a new job in the "Tradable" sector leads to 1.59 new jobs in the "Non-Tradable" sector across Metropolitan Statistical Areas (MSAs) in the U.S.A. The size of the employment multiplier increases to 2.52 new jobs in the "Non-Tradable" sector if the new "Tradable" sector job is a skilled one. One additional important insight from these studies is that additional skilled jobs in the "Tradable" sector command a higher employment multiplier compared to additional unskilled jobs in the "Tradable" sector due to the higher productivity and wages of the former Moretti (2010).

This study is a first attempt to estimate the local employment multiplier for Portugal. It asks the following research questions: Is there a local employment multiplier effect between the "Tradable" and "Non-Tradable" sectors? If so, what is the size of the multiplier effect? The study answers these questions by aggregating establishment-level microdata from the survey Quadros de Pessoal (Ministério do Trabalho, Solidariedade e Segurança Social, 2021) to derive private sector employment data for "Tradable" and "Non-Tradable" sectors for municipalities and NUTS III in Portugal in the years 1989, 1999, 2009, and 2019.

The structure of the study is as follows: The next section provides an overview of the relevant theories and main empirical studies of the employment multiplier. Section 3 and 4 describe the data used and the empirical strategy developed to estimate the local employment multipliers for Portugal. Section 5 discusses the results, whereas Section 6 draws some conclusions and implications for policy.

2. LITERATURE REVIEW

2.1. THE IDEA OF THE EMPLOYMENT MULTIPLIER

Richard Kahn's *"The Relation of Home Investment to Unemployment"* (Kahn, 1931) was published in 1931. Kahn taught at King's College, Cambridge University, and was part of the inner circle of John Maynard Keynes.[1] The term "employment multiplier" appears in Kahn's (1931) article for the first time as stated in *The Genesis of the Multiplier Theory* (Wright, 1956). In his 1931 article, Kahn studies the impact on a region's total employment from the wages of newly employed men. This is called the spill-over effect of employment from one sector on the other sector and, as stated by Kahn, results from *"... the beneficial repercussions that will result from the expenditure of the newly-employed men's wages."* (Kahn, 1931). From the beginning of the paper, we are presented with the hypothetical decision of a government to build roads. It is defined that the employees involved directly in the building of roads are "primary employment" and the remaining employees of the local economy are "secondary employment".

Although the division is not the same as the one used in Moretti (2010), the notion of causality running from newly employed man's wages on subsequent jobs is similar to that of the employment multiplier. Newly employed men participating in the building of roads receive wages and their employer earns profits from their work. In turn, the part of these increased wages and profits that are not saved will be spent on home-produced goods and services (the author assumes that only one-tenth of extra income is spent on imported products, the rest being produced locally) resulting in an addition to output and extra jobs. Despite not being discussed, the ratio of secondary to primary employment will depend on a series of assumptions made about the economy, notably the marginal rate of import. Kahn (1931) ultimately estimates that the ratio of primary to secondary employment

[1] Kahn was very important for the Keynesian School. So much so, that in a letter to Joan Robinson, John Maynard Keynes claimed that there had never been a more useful person in the world to whom one could submit his papers to, when formulating his famous *General Theory of Employment, Interest and Money* (Keynes, 1936), (Keynes, 1973, p.422).

ranges from 0.56 to 0.94: that is, an increase in 10 jobs in primary employment would lead to an additional 5 to 9 jobs in secondary employment.

Having established the notion of the employment multiplier and how it emerged, we move to the conceptual framework used in this work based on the "Tradable" to "Non-Tradable" model or, as it is alternatively called, the economic base theory.

2.2. ECONOMIC BASE THEORY

Economic base theory was first presented by Homer Hoyt, an American Economist. He was born in the late 19th century and lived through the 20th. Throughout his life, he devoted time and money to invest in real estate, while also publishing research papers to understand how and why the real estate market had its peaks and troughs, more specifically the city of Chicago. In 1941, Hoyt published an article called *"Economic Background of Cities"* (Hoyt, 1941), where he identified a link between the different employment types that exist in a city, classified as "Basic" and "Non-Basic" employment. The idea underlying the classification of employment is the same as the one referring to "Tradable" and "Non-Tradable" sectors used by Moretti (2010) and described in the OECD report (OECD, 2018) mentioned earlier. Another definition, according to Philip McCann's Modern Urban and Regional Economics (McCann, P., 2013), the "Basic" sector comprises the activities that are dependent on conditions which are external to the local economy while the "Non-Basic" activities depend, mostly, on the conditions of the local economy.

The reasoning is that some sectors in a city are responsible for the creation and maintenance of employment in other sectors. The list of jobs classified as "Basic" (or "Tradable") by Hoyt include, for example, Manufacturing, Assembling, and Refining; Trade and Finance; Extraction of Minerals or Lumbering; Tourism; Governmental services; Educational Institutions and Transportation. The income flows created in the "Basic" or "Tradable" sectors enter the city from outside through the exports of goods and services and foster the growth of "Non-Basic" or "Non-Tradable" services (and jobs) needed to cater to the needs and wishes of the "Basic" sector workers. The findings made by Hoyt (1941) are derived from observation of survey data on worker's economic

industries. The framework put forward by Hoyt is of great importance for this study and is followed by both Moretti (2010) and Van Dijk (2015, 2016, 2018) in their justification for the existence of an employment multiplier.

2.3. INPUT-OUTPUT ANALYSIS

To present an alternative but related conceptual framework, we discuss the work developed by Wassily Leontief to estimate job multipliers. Leontief was a Russian-born American economist and is the father of Input-Output Analysis Leontief (1951), which earned him the Nobel Prize for Economic Sciences in 1973. Leontief embarked on the herculean task of mathematically summarizing the full scope of a country or region's economy through input-output matrices. He compiled data from 42 sectors of the U.S. economy and modelled the input-output linkages between each pair of sectors. Through the use of survey data, Leontief was able to measure the real and monetary flows between the 42 sectors representing the U.S. economy. This allowed him to compute the flows of money between sectors, as well as the number of extra jobs that would be created as a result of investing in a given "Tradable" sector.

Input-Output matrices can be used for ex-ante estimations of the effect of large investments on a given economy. National statistics offices across the world produce a compilation of input-output matrices for their economies. In Portugal, the "Statistics Portugal" (INE) publishes input-output matrices for the economy. The most recent was published in 2017 and its base year was 2013 (Instituto Nacional de Estatística, 2017). The European Union (E.U.) has also made available a "world" input-output matrix which has data for 43 countries referring to the base year of 2014 (European Union, 2014).

As we recognize this alternative's utility, we are not interested in having an ex-ante analysis and because of that we will not choose this method as our econometric strategy. We also do not want to rely on past formulations of links between economic agents in our estimation of the employment multiplier.

2.4. DEFINING "TRADABLE" AND "NON-TRADABLE" SECTORS

There are different approaches to the definition of what constitutes the "Tradable" and "Non-Tradable" sector, all of which reveal some degree of subjectivity of the respective

author and data availability constraints. Hoyt (1941) assumed that the "Basic" or "Tradable" sector contained production activities of goods and services exported out of the producing region. Moretti (2010) defined manufacturing jobs as "Tradable", and all other services excluding agriculture, mining, government jobs, and the military are defined as "Non-Tradable".

Technological and institutional progress may present some difficulties to more traditional definitions. Paul Krugman (1991) explains that developments to communication technologies (e.g. the creation of the internet) brought additional difficulties when defining which activities are "Tradable" or not. One of the main reasons for the change is the fact that there has been a shift in some service sectors from the "Non-Tradable" to the "Tradable" sector due to a substantial decrease in the costs associated with services exports Krugman (1991). Nevertheless, the association of "Tradable" sector to exporting industries remains a backbone of current definitions. Amador and Soares (2012) state that "Tradable" and "Non-Tradable" sectors in the Portuguese context can be defined as sectors in which exports account for 15% or more than total sales. They also focus strictly on the export side of the "Tradable" sector which is useful given our conceptual framework.

Other definitions, e.g., Van Dijk (2015) and Fernandez (2014), are based on the share of labour in the same industry in different locations as a proxy to understand if a sector belongs to the "Tradable" or "Non-Tradable" sector. The approach by Van Dijk (2015) is based on Gini coefficients to assess the geographical concentration of industrial employment across cities. The rationale is that if an industry is unevenly distributed across cities, then, the production of these goods or services is concentrated in a region and the goods and services it produces are traded to the others, making the industry part of the "Tradable" sector. In industries evenly distributed across cities, one might assume that the goods and services produced there are usually consumed close to the places they are produced. Fernandez (2014) uses location quotients to estimate the industry's employment share in the city and at the national level. If the local share of the industry relative to the national/regional share is bigger which is taken as a "benchmark", then it is assumed that the activity belongs to the "Tradable" sector.

2.5. RECENT EVIDENCE ON "TRADABLE" TO "NON-TRADABLE" EMPLOYMENT MULTIPLIERS

Moretti's (2010) article *"Local Multipliers"* is the founding stone of modern employment multipliers calculation with extensive econometric treatment. It uses data from the U.S.A. for the 1980, 1990, and 2000 population census to track long-term changes in the size of the employment multiplier. As described earlier, the local economy is divided into two different sectors, the "Tradable" sector selling goods and services to the outside, and the "Non-Tradable" sector that provides goods and services locally. The rationale behind this model is that the extra income from wages of "Tradable" sector workers will spill over to the local economy: "Every time a local economy generates a new job by attracting a new business, additional jobs might also be created, mainly through increased demand for local goods and services" Moretti (2010).

Moretti also mentions the general equilibrium effects that may arise which, in theory, must also be accounted for. The extra demand for workers will make wages increase as well as housing costs in each local economy. Considering these factors, Moretti finds that an exogenous increase of one extra job in the "Tradable" sector leads to an extra 1.59 jobs in the "Non-Tradable" sector and 0.26 extra jobs on other "Tradable" jobs. The positive effect of "Tradable" jobs on other "Tradable" jobs is attributed to the agglomeration externalities that may arise, extensively discussed in his 2012 book on human capital externalities and localization and urbanization economies (Moretti, 2012).

Another interesting finding from Moretti's work is that the employer multiplier is larger for skilled "Tradable" jobs. This is coherent with the foundations of the model that skilled employees will command higher productivity and thus, higher wages leading to a bigger employment multiplier effect. Moretti found that a skilled "Tradable" job would lead to an overall average of an extra 2.52 "Non-Tradable" extra jobs on the local economy. Moretti defines a skilled job as one performed by someone who holds at least a bachelor's degree.

Moretti also studied other countries using the same model and some econometric refinements. In Moretti & Thulin (2013), the authors estimate that the employment

multiplier effect in Sweden is considerably smaller than for the United States: one extra job in the "Tradable" sector results in an increase of 0.4 to 0.8 extra jobs in the non-"Tradable" sector in the long run for Sweden.

Another author who has contributed extensively to this literature is the Dutch researcher Jasper Jacob Van Dijk. He has published several papers on employment multipliers based on Moretti's approach. In his article *Local Employment Multipliers in U.S. Cities,* Van Dijk (2016), replicates Moretti's (2010) analyses using more refined econometric estimators and a revised sample of industries, and obtains a smaller multiplier effect of 1.02. Van Dijk (2016) suggests the removal of agriculture and mining from the estimation and any industries not represented across all time-periods. In another article, *Local multipliers in United States cities: a replication of Moretti (2010),* Van Dijk (2015) can fully replicate the employment multiplier of 1.59. In the same work but implementing further econometric improvements, specifically, a different way of weighting observations, the use of Instrumental Variables estimators, etc. he obtains an employment multiplier of 0.84, which is considerably smaller when compared with Moretti's (2010) estimate of 1.59.

In a more recent study, Van Dijk (2018) uses different econometric estimations and data to estimate employment multipliers for the US economy. Instead of using only the IPUMS database for his estimations, he now uses data from the Quarterly Census of Employment & Wages data provided by the American Bureau of Labour Statistics (BLS). The main difference with the IPUMS is that the BLS employment data refers to the place of work of each worker instead of the place of residence in the American MSAs. This is important because the place of work is the place where the exogenous shock takes place for the local economy, whereas the place of residence can distort the results of the estimations. The multiplier effect resulting from the new estimations and data range between 1.17 and 1.88.

3. DATA AND VARIABLES

We constructed a panel data dataset from microdata collected in the survey *Quadros de Pessoal* (Ministério do Trabalho, Solidariedade e Segurança Social, 2021), accessible through INE's safe centre. The survey is compulsory for all private sector firms and is carried out annually, since 1986, by the Portuguese Ministry of Work, Solidarity, and Social Security[2]. There are three files containing information about firms, establishments, and workers, which are used to characterize labour market conditions in Portugal. For the purpose of this work, we have aggregated the microdata in the establishment files to generate variables for private jobs in the "Tradable" and "Non-Tradable" sectors for municipalities and NUTS III for the years 1989, 1999, 2009, and 2019. We are using these time intervals because we wish to track long term changes in our study and also to have comparable results with previous authors (who have also used 10 year variations). The choice of geographies is justified by the fact that municipalities and NUTS III regions are the best approximations to labour markets across Portugal. There are 308 municipalities and 30 NUTS III in Portugal. The analyses include the two island regions of Portugal. See Appendix 1 for definitions.[3]

In terms of the industrial classification underlying our definition of what is considered to be in the "Tradable" or "Non-Tradable" sector, the data available across all the time periods studied is set at the level of 2-digits.[4] Using more disaggregated classifications would allow for more precise definition of economic activities. Previous work has also relied on 2-digit sector codes (e.g., Moretti, (2010)) so we do not anticipate this could lead to significant problems. We follow the same approach and classify 2-digit industries

[2] The methodological documents are provided by the Portuguese Ministry of Work, Solidarity, and Social Security through INE's portal (Ministério do Trabalho, Solidariedade e Segurança Social, 2021)

[3] We are using the 2002 version of NUTS III to harmonize the observations from all the time periods and maximize the number of observations.

[4] The observations of 2009 and 2019 already had the Revision 3 of INE's Activity codes. The staff at INE was very kind to have provided me with the correspondence tables from the Revision 1 to Revision 2, Revision 2 to 2.1, and Revision 2.1 to Revision 3 so that I could harmonize the activity codes of 1989 and 1999 with the activity codes of 2009 and 2019.

between 01-39 as "Tradable" and 41-99 as "Non-Tradable". See appendix 2 for a description of the sectors.

Table I provides a summary of the main variables used in our models. On average, there are 2 823 jobs in the "Tradable" sector and 6 134 jobs in the "Non-Tradable" sector at the municipality level, and 28 861 jobs in the "Tradable" sector and 62 723 jobs in the "Non-Tradable" sector at the NUTS III level. The "Tradable" sector employs less workers than the "Non-Tradable" sector, presenting a ratio of 2.17. The bigger size of the "Non-Tradable" sector is coherent with previous estimates but the ratio's size seems to be smaller than other previous studies (Moretti (2010) finds a ratio of 4.74 and Van Dijk (2016) estimates a ratio of 4.02 with the same data set and a refined method).

TABLE I

COMPILED EMPLOYMENT NUMBERS

Region	Jobs per type of sector	#Obs	Mean	Minimum	Maximum
Municipalities	"Tradable" sector	1227	2 823	6	57 803
Municipalities	"Non-Tradable" sector	1227	6 134	34	416 776
NUTS III	"Tradable" sector	120	28 861	1620	183 837
NUTS III	"Non-Tradable" sector	120	62 723	1836	760 218

SOURCE: Quadros de Pessoal

It is also important to note that in our estimation we did not exclude the smaller municipalities in Portugal resulting in the minimums that we see in Table I in municipalities. In Table II we can see that the overall number of employed people has increased since 1989 and that the Portuguese economy is converging to the ratios of "Non-Tradable" to "Tradable" employment as found in Moretti (2010) in the U.S.A. and Sweden in Moretti & Thulin (2013). If we were to take the ratio of a single year and that year was 2019, we would have a ratio of 3.17 instead of 2.17. However, this would lead us to an overestimation of our multiplier since we would not be considering the early years of our estimation.

TABLE II

EMPLOYMENT BY YEAR

Year	"Tradable" Employment	"Non-Tradable" Employment	Total
1989	1 024 440	1 151 427	2 175 867
1999	933 370	1 646 081	2 579 451
2009	755 973	2 354 166	3 110 139
2019	749 543	2 375 053	3 124 596

SOURCE: Quadros de Pessoal

It is also worth to note that there is a decreasing tendency in the overall number of "Tradable" jobs in the Portuguese economy while there is a contrary movement in the "Non-Tradable" employment, which might be counter intuitive and might be an earlier indicator that an improved way to establish the tradability of each economic activity can be considered.

4. EMPIRICAL STRATEGY

This sections presents the empirical strategy implemented in the study, following the work by Moretti (2010) and the refinements made by Van Dijk (2015, 2016). The baseline model is as follows:

$$lnE^{NT}_{c,t+10} - lnE^{NT}_{c,t} = \alpha + \beta\left(lnE^{T}_{c,t+10} - lnE^{T}_{c,t}\right) + \delta Time_t + \varepsilon_{c,t} \quad (1)$$

where E^T is the "Tradable" sector employment, $E^{NT}$is the "Non-Tradable" sector employment, the subscript c designates the region (i.e. municipality or NUTS III), and t represents the time periods. We also include a dummy variable *Time* to control for any nationwide employment shocks in the "Non-Tradable" sector affecting all regions uniformly. The term ε is the error term accounting for unexplained variation in the data. The parameter β measures the elasticity between jobs in the "Tradable" and the "Non-Tradable" sectors.

Since our model measures changes in growth rates, the regressor β in equation (1) does not give us the real figure of the employment multiplier. To compute the actual value of the employment multiplier we need to use the ratio of jobs between the two sectors. Following previous work, the ratio used is based on the sum of all the jobs in all time periods, as in the following equation. Although this is not the ratio used either by Moretti (2010) or Van Dijk (2015, 2016), it is a good way to harmonize the ratio over the entire timespan of our estimation, instead of a fixed year which does not represent all periods and could potentially overestimate the results.

$$r = \frac{\sum_c^t E^{NT}_{c,t}}{\sum_c^t E^{T}_{c,t}} \quad (2)$$

In equation 2, we will find the ratio that is a sum of "Non-Tradable" employment over "Tradable" employment in all time-periods. It is the equation used to estimate the results mentioned above that give us a ratio of 2.17 that we will use to calculate our employment multiplier. The ratio *r* will be multiplied by the growth elasticity of "Tradable"

employment onto "Non-Tradable" employment (β in equation (1)) and the result will be our employment multiplier.

We also want to weight the observations in our study. To do so, we will follow the same method as Moretti (2010) who chose a base year to serve as the weight for each region. We will choose the year of 2019 as it is the most recent year in our estimation, and it isn't in the middle of the time-periods of our study.

There is another estimation issue that can affect our estimates, namely the possibility of endogeneity bias due to potential reverse causation and omitted variable bias. To address this issue, we follow the instrumental variable estimator approach adopted by Moretti (2010) and Van Dijk (2016). We construct the following instrument:

$$\sum_{j \in T} \left\{ \frac{N_{c,t}^{j}}{N_{c,t}^{T}} \left[\ln \left(\sum_{c \in C_t \setminus c} N_{c,t+10}^{j} \right) - \ln \left(\sum_{c \in C \setminus c} N_{c,t}^{j} \right) \right] \right\} \tag{3}$$

The idea for the instrument is based on the shift-share approach of Bartik (1991) and consists of using nationwide variation in each sector's employment to the region-specific industrial employment structure. The nationwide variation in each industry excludes own region's industrial employment.

5. DISCUSSION OF RESULTS

This section presents and discusses the results from the various estimators implemented for NUTS III and municipalities. For simplicity, the tables presented here report only the coefficient of interest and the associated employment multiplier, besides the standard metrics for model goodness of fit.

Table III

RESULTS FOR NUTS III

Estimators	Coefficient	Employment multiplier $(r*\beta)$	R-squared (R^2)
Pooled OLS Without Weights	0.1346**	0.2926	o: 0.81
Pooled OLS With Weights	0.3801***	0.8261	o: 0.78
XTREG, (FE) Without Weights	0.1341*	0.2915	w: 0.89 | b: 0.07 | o: 0.81
XTREG, (FE) With Weights	0.4220**	0.9171	w: 0.83 | b: 0.07 | o: 0.74
XTREG, (RE) Without Weights	0.1345**	0.2923	w: 0.89 | b: 0.07 | o: 0.81
XTIVREG, (FE)	0.2449**	0.5322	w: 0.88 | b: 0.07 | o: 0.81
XTIVREG, (RE)	0.1856**	0.4034	w: 0.89 | b: 0.07 | o: 0.81

LEGEND: ***, **, * denotes significance at the 1% level, 5% level, and 10% level. w: Within R^2, b: Between R^2, o: Overall R^2
SOURCE: Quadros de Pessoal, Author calculations

The results reported in Table III for NUTS III regions show a positive and statistically significant coefficient for the effect of an increase in "Tradable" sector jobs on the "Non-Tradable" jobs. To compute the corresponding employment multiplier, we multiply the coefficient by the ratio between "Non-Tradable" and "Tradable" sector; the ratio (r = 2.17) estimated for Portugal is considerably smaller than the ratio estimated by Moretti (2010) for U.S.A. MSAs (r = 4.75) and by Moretti and Thulin (2013) for Sweden (r = 3.35).

We start by using simple pooled OLS estimator to regress equation (1) and proceed to use panel data estimators based on random-effects (RE) and fixed-effects (FE). To account for the size differences between regions, we consider a version of the models that weights each observation according to its total employment size in 2019 (i.e., the same weighting scheme as Moretti, (2010)).

We observe considerable differences in the size of the multiplier across estimators and depending on whether we weight observations. Weighting the observations leads to a larger employment multiplier. Accounting for the panel structure of the dataset (i.e., both within- and between-variation) only appears to affect the size of the employment multiplier for the weighted regressions, and only marginally (from around 0.8 to 0.9). To assess which of the two panel data estimators is preferred, i.e., FE or RE, we rely on the Hausman test. The consistency of the RE model relies on the assumption of no correlation between the unit-specifics effects and the regressors, whereas the FE allows for correlation between the two. Since it was not possible to estimate the RE model using weights, we applied the Hausman test only to the unweighted panel data estimators. The Hausman test essentially tests the null hypothesis of no correlation between the two. Since we cannot reject the null hypothesis of no correlation, the RE is the preferred estimator for the unweighted observations. However, the results are very similar in both cases.

Taking the weighted version of the FE regression as the reference case (Moretti and Van Dijk also tend to select this estimator as their preferred one), we conclude that the multiplier effect is about 0.92: that is, on average, for each new job in the "Tradable" sector there is a creation of nearly another new job in the "Non-Tradable" sector across NUTS III regions. These results are similar to those obtained by Moretti and Thulin (2013) for Sweden, but smaller when compared to the results obtained for the U.S.

The IV regressions implemented to address potential endogeneity bias, estimated only using unweighted observations, reveal a relative increase in the size of the multiplier from around 0.29 (pooled OLS) to 0.40 (RE) and 0.53 (FE). Taking the FE as the reference case, this indicates that on average, an increase of 10 jobs in the "Tradable" sector is associated with an increase of about 5 new jobs in the "Non-Tradable" sector across NUTS III regions.

As noted earlier, one limitation of these models is the small sample size (i.e., 90 observations) due to the small number of regions, compared to the much larger sample size of the models estimated at the level of municipalities.

Table IV

RESULTS FOR MUNICIPALITIES

Estimators	Coefficient	Employment multiplier ($r^*\beta$)	R-squared (R^2)
Pooled OLS Without Weights	0.1742***	0.3786	o: 0.53
Pooled OLS With Weights	0.3650***	0.7933	o: 0.56
XTREG, (FE) Without Weights	0.1516***	0.3295	w: 0.63 | b: 0.06 | o: 0.53
XTREG, (FE) With Weights	0.3575***	0.7770	w: 0.65 | b: 0.09 | o: 0.48
XTREG, (RE) Without Weights	0.1738***	0.3776	w: 0.63 | b: 0.07 | o: 0.53
XTIVREG, (FE)	0.1494***	0.3247	w: 0.63 | b: 0.06 | o: 0.53
XTIVREG, (RE)	0.1762***	0.3830	w: 0.63 | b: 0.07 | o: 0.53

LEGEND: ***, **, * denotes significance at the 1% level, 5% level, and 10% level. w: Within R^2, b: Between R^2, o: Overall R^2
SOURCE: Quadros de Pessoal, Author calculations

The results reported in the table show positive and statistically significant coefficients for the employment multiplier. Overall, compared with the results obtained for the NUTS III regions, we observe that the coefficients tend to be smaller in the case of the weighted regressions and relatively similar but larger in the case of the unweighted regressions.

Similarly, to the results based on NUTS III regions, there is considerable variation in the size of the multiplier across estimators and whether we weight observations. The

weighted regressions tend to produce larger effects for both the pooled OLS (from 0.38 to 0.80) and the FE (from 0.33 to 0.78). Likewise, the panel data estimators appear to reduce the magnitude of the effect but only marginally. In addition, correcting for endogeneity through the IV panel data unweighted regressions does not seem to affect the size of the coefficient minimally: i.e. remains between 0.32-0.33 for FE and at 0.38 for RE.

Taking the weighted FE regression as the reference case, we conclude that the multiplier effect is about 0.78: that is, on average, adding 10 new jobs to the "Tradable" sector leads to a creation of about 8 new jobs in the "Non-Tradable" sector across municipalities. As for the IV regressions, estimated only using unweighted observations, the results for the FE model show that, on average, an increase of 10 jobs in the "Tradable" sector is associated with an increase of about 3 new jobs in the "Non-Tradable" sector across municipalities. All the results presented above, both in NUTS III and municipalities concern the variation over the course of 10-year time-periods.

6. CONCLUSION

There have been several theoretical and empirical works on the importance of having a strong "Tradable" sector for economic growth (Kahn, 1931; Hoyt, 1941; OECD, 2018). The OECD has stated that regions with a higher percentage of "Tradable" jobs innovate more, are more productive, and have higher wages (OECD, 2018). In this study we do not study the reasons underlying the creation of "Tradable" sector jobs, but how "Tradable" sector jobs contribute to the creation of additional jobs in the "Non-Tradable" sector, known as the employment multiplier. To the best of our knowledge this is the first study attempting to measure the employment multiplier for Portugal.

We follow the approach developed by Moretti (2010) and refined by Van Dijk (2015, 2016), which are considered the best econometric applications to the topic. They have estimated empirically the employment multiplier effect for the United States and Sweden, and find that the size of the multiplier for the U.S.A. is roughly the double of that for Sweden. They find an employment multiplier of 1.59 in the U.S.A. and a multiplier between 0.4 and 0.8 in Sweden.

In our analysis for Portugal, we find that, on average, an increase of 10 jobs in the "Tradable" sector leads to an increase of about 8 (9) jobs in the "Non-Tradable" sector across municipalities (NUTS III regions). The results are overall in agreement with existing evidence, notably for Sweden, albeit they tend to be smaller. The main reason for this seems to be the considerably smaller ratio between "Tradable" and "Non-Tradable" jobs in Portugal. If we were to use the same method for the ratio's equation, we would find a considerably bigger multiplier, although we would be over-estimating it because of not considering the earlier periods of our model.

Our study confirms the importance of the "Tradable" sector for economic growth but does not provide any guidance on the workings of "Tradable" sector job creation: it "only" confirms that this sector is a driver of additional jobs in economic activities targeting local consumption. Future research should explore the ways in which policies can promote more "Tradable" sector jobs and whether more skilled workers and a better qualified labour force can increase the size of the employment multiplier effect, as found by Moretti for the U.S.A. economy.

7. BIBLIOGRAPHY

Amador, J. and Soares, A.C. (2012). Concorrência na economia portuguesa: uma visão sobre os setores transacionável e não-transacionável. Boletim Económico - Banco De Portugal, 18(1), pp.45–62.

Bartik, T.J. (1991). Who benefits from state and local economic development policies? Kalamazoo (Mich.): W.E. Upjohn Institute For Employment Research.

European Union (2014). World Input-Output Database. [online] Available at: http://www.wiod.org/home.

Fernández, J.M.B. (2014). A New Look at Local Employment Multipliers: Preliminary Evidence from Spain. M.Sc. Thesis.

Hoyt, H. (1941). Economic Background of Cities. The Journal of Land & Public Utility Economics, 17(2), p.188.

Instituto Nacional de Estatística (2017). Sistema Integrado de Matrizes Simétricas Input-Output: 2013. [online] Available at: https://www.ine.pt/xurl/pub/293723555.

Kahn, R.F. (1931). The Relation of Home Investment to Unemployment. The Economic Journal, [online] 41(162), pp.173–198. Available at: https://www.jstor.org/stable/2223697

Keynes, J.M. (1936). The General Theory of Employment, Interest and Money. London: Macmillan.

Keynes, J.M. and Royal Economic Society (2013). The Collected Writings Of John Maynard Keynes. 13, The General Theory And After : Part I: Preparation. Cambridge: Cambridge Univ. Press For The Royal Economic Society.

Krugman, P. (1991). Geography and trade. Cambridge, Mass.: Leuven University Press/Mit Press.

Leontief, W.W. (1951). Input-Output Economics. Scientific American, 185(4), pp.15–21.

Mccann, P. (2013). Modern urban and regional economics. Oxford: Oxford University Press.

Ministério do Trabalho e da Solidariedade Social (2021). Quadros de Pessoal, 1986-2019. [online] Available at: https://www.ine.pt/ngt_server/attachfileu.jsp?look_parentBoui=298132787&att_display=n&att_download=y.

Moretti, E. (2010). Local Multipliers. American Economic Review, 100(2), pp.373–377.

Moretti, E. (2012). The new geography of jobs. Boston, Mass.: Mariner Books/Houghton Mifflin Harcourt.

Moretti, E. and Thulin, P. (2013). Local multipliers and human capital in the United States and Sweden. Industrial and Corporate Change, 22(1), pp.339–362.

Organization For Economic Cooperation And Development (OECD (2018). Productivity and jobs in a globalised world : how can all regions benefit?. Paris: OECD Publishing.

University of Newclastle, Madanipour, A., Shucksmith, M., Talbot, H. and Crawford, J. (2017). Relocal - Deliverable 1.1. Conceptual Framework for the Project. [online] Available at: https://relocal.eu/wp-content/uploads/2018/07/Deliverable-1.1.pdf.

Van Dijk, J.J. (2015). Local Multipliers In United States Cities: A Replication of Moretti (2010). Economics Series Working Papers, 771(1).

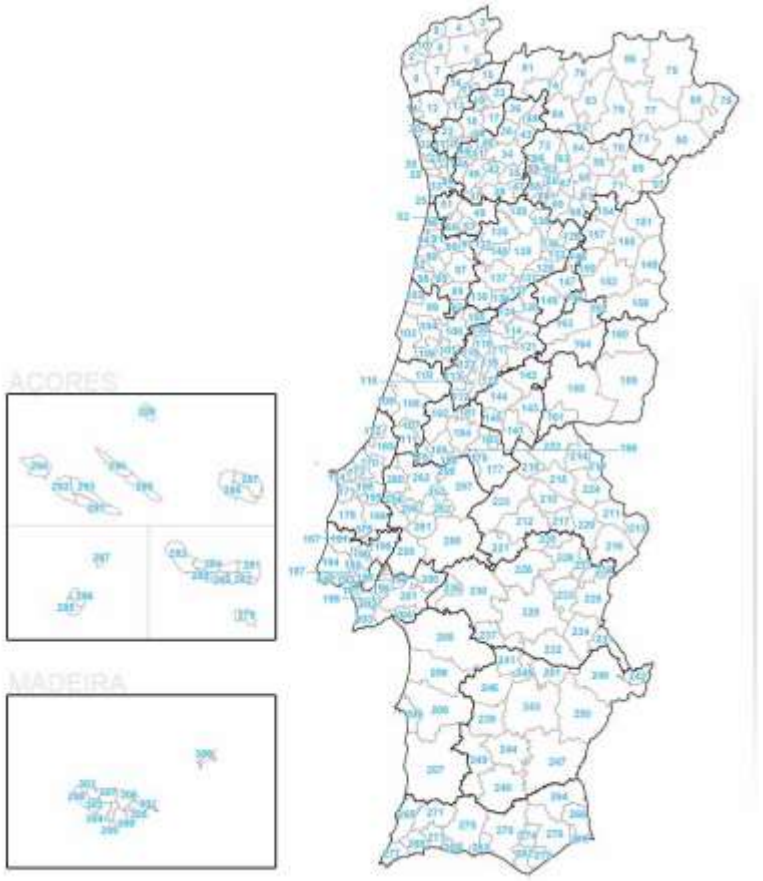
Van Dijk, J.J. (2016). Local employment multipliers in U.S. cities. Journal of Economic Geography, 17(2), p.lbw010.

Van Dijk, J.J. (2018). Robustness of econometrically estimated local multipliers across different methods and data. Journal of Regional Science, 58(2), pp.281–294.

Wright, A.LL. (1956). THE GENESIS OF THE MULTIPLIER THEORY. Oxford Economic Papers, 8(2), pp.181–193.

APPENDICES

Appendix 1 – NUTS III and Municipalities map and codification



Source: PORDATA: https://www.pordata.pt/Site_Static/PORDATA_NUTS2013_PT.pdf

Appendix II – 2-digit Economic Activity Codes - INE CAE REV 3

2-digit Activity Code	*Description*
01	Crop and animal production, hunting and related service activities
02	Forestry and logging
03	Fishing and aquaculture
05	Mining of coal and lignite
06	Extraction of crude petroleum and natural gas
07	Mining of metal ores
08	Other mining and quarrying
09	Mining support service activities
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment N.E.C.
29	Manufacture of motor vehicles, trailers, and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture
32	Other manufacturing
33	Repair and installation of machinery and equipment
35	Electricity, gas, steam, and air conditioning supply
36	Water collection, treatment, and supply
37	Sewerage
38	Waste collection, treatment, and disposal activities; materials recovery
39	Remediation activities and other waste management services
41	Construction of buildings
42	Civil engineering
43	Specialized construction activities
45	Wholesale and retail trade and repair of motor vehicles and motorcycles
46	Wholesale trade, except of motor vehicles and motorcycles
47	Retail trade, except of motor vehicles and motorcycles
49	Land transport and transport via pipelines
50	Water transport
51	Air transport
52	Warehousing and support activities for transportation

2-digit Activity Code	*Description*
53	Postal and courier activities
55	Accommodation
56	Food and beverage service activities
58	Publishing activities
59	Motion picture, video and television programme production, sound recording and music publishing activities
60	Programming and broadcasting activities
61	Telecommunications
62	Computer programming, consultancy, and related activities
63	Information service activities
64	Financial service activities, except insurance and pension funding
65	Insurance, reinsurance, and pension funding, except compulsory social security
66	Activities auxiliary to financial services and insurance activities
68	Real estate activities
69	Legal and accounting activities
70	Activities of head offices; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development
73	Advertising and market research
74	Other professional, scientific, and technical activities
75	Veterinary activities
77	Rental and leasing activities
78	Employment activities
79	Travel agency, tour operator reservation service and related activities
80	Security and investigation activities
81	Services to buildings and landscape activities
82	Office administrative, office support and other business support activities
84	Public administration and defense; compulsory social security
85	Education
86	Human health activities
87	Residential care activities
88	Social work activities without accommodation
90	Creative, arts and entertainment activities
91	Libraries, archives, museums, and other cultural activities
92	Gambling and betting activities
93	Sports activities and amusement and recreation activities
94	Activities of membership organizations
95	Repair of computers and personal and household goods
96	Other personal service activities
97	Activities of households as employers of domestic personnel
98	Undifferentiated goods- and services-producing activities of private households for own use
99	Activities of extraterritorial organizations and bodies

Source: INE