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A NEW LOOK AT LOCAL EMPLOYMENT MULTIPLIERS: PRELIMINARY EVIDENCE FROM SPAIN

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Abstract

Based on a recent wave of studies citing the work of Moretti (2010), this paper provides preliminary evidence as to the effects of local tradable employment upon local non-tradable employment for Spain. Using a location quotient approach for the division of basic and non-basic employment in the regional accounting database , initial evidence for the period 1995-2008 suggests a short-term (year on year) local employment multiplier effect of 1.13 jobs in the non-tradable sector as a result of the creation of 1 job in the tradable sector. For the same period the long-term multiplier as measured for the two periods 1995-2001 and 2001-2007 is almost double with 2.1 jobs being created in the non-tradable sector as a result of one job created in the tradable sector. Apart from the obvious policy implications for Spanish regional and economic development in terms of job creation, the paper adopts a rigorous approach towards obtaining a convincing or at the very least satisfactory division of basic and non-basic employment for posterior empirical estimation of a local employment multiplier. In this context, the paper grants more attention than, a priori would appear to be the case, for similar studies in this field. I consider the latter to be one of my principal contributions in this paper.

Key words: Local employment multipliers, location quotients, tradable and non-tradable sectors, basic and non-basic goods, regional and development economics, macroeconomics.

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1. INTRODUCTION

1.1 Subject and Motivation

During a recession or economic crisis, such as the one we are experiencing at present, job losses is one of the principal concerns of governments worldwide not only from an economic but also from a social welfare standpoint. The opening of a factory in a depressed area, be it in a region, town or a city or the provision of State-Aid for the support of a local industry are perceived as positive macro-economic stimuli for economies. At a local level the “newly- incorporated” worker armed with “new-found” income in the form of wages embarks on a personalized spending programme which translates itself into new demands for goods and services. Whilst the foregoing seems to relate the simplistic labour-wage-income-demand process which students learn in their earliest initiation to basic economic theory, the effects of demand are diverse and to say the very least very disperse in terms of the economy and more often than not difficult to quantify. The latter “quantification” has and continues to be to the present day, one of the greatest challenges facing policy-makers and economists alike.

The current study seeks to “quantify” one of these effects by posing the following question “How does job creation or a change in employment in the tradable sector of an economy effect employment in the non-tradable sector of the economy?” In general terms, the aforementioned “quantification” or “effect” has for economists come to be known as an *employment multiplier.*

The latter concept is attributable in its origins to Richard Ferdinand Kahn, a British economist and contemporary of John Maynard Keynes. Kahn explained the concept for the first time in his seminal 1931 article *(Kahn, Richard Ferdinand (1931) "The Relation of Home Investment to Unemployment"; Economic Journal 41 (162): 173-198).* As one of the 5 members of the Cambridge Circus (a group of young economists closely associated with Keynes at Cambridge University), Kahn was also one of Keynes' closest collaborators on the creation of Keynes' *General Theory of Employment, Interest and Money (1936).* In fact Keynes cited Kahn in the latter publication as inspiring his own well-known *investment multiplier*.

On a personal basis, I have also found inspiration and motivation (and needless to say, relief), in the fact that the first paper to be written by myself as an author for public review is based on a well-established theory developed by an eminent economist who was additionally born and educated in my country of birth.

1.2 Aim and Contribution

The magnitude of local multipliers is of utmost importance for regional economic development policies and more so for countries like Spain which have historically registered higher than average levels of unemployment as compared with other member states of the European Union. The state and local governments dedicate considerable amounts of taxpayer monies on fiscal incentives directed on a local, regional and countrywide scale towards the creation of new businesses and as a result more jobs. These are invariably directed towards tradable goods producing sectors, that supposedly "provide greater economic benefits" (Bartik, 2003). This being said, the effects of these policies in terms of efficiency and the exact nature of their effects on employment is not fully understood and until relatively recently there was a lack of empirical evidence in this respect. Given the current economic scenario and closer to home the austerity measures implemented in Spain and other EU countries, measuring the success of expenditure packages via the study of local employment multipliers and general equilibrium effects is vital for government fiscal policies and cost savings.

In spite of the ubiquity of the local multiplier effect in arguments favouring industry-orientated place-based policies, as a question it does not seem to have been rigorously documented before the work of Moretti (2010). Given its interest, the study has received numerous citations and a recent replicated study by Faggio and Overman (2014) applied to public sector employment in the United Kingdom. Jofre-Monseny et al (May 2014) have conducted a recent preliminary draft study which similarly to the latter considers local multipliers for Spanish public employment.

The present paper offers an initial contribution but not conclusive attempt at estimating a local employment multiplier for Spain, using the methodology proposed by Moretti. My principal aim is to establish a similar but probably less conclusive or specific connection between the changes in basic activities or tradable (exportable) goods with respect to local Spanish employment. Here I adopt a less sophisticated approach in order to study Spanish provinces rather than cities. In contrast to the aforementioned papers, I consider a local multiplier at a more aggregated regional level applying a similar calculation to the Spanish provincial employment statistics available from the Spanish regional accounting database (Contabilidad Regional de España). The study considers the period 1995-2008.

Despite a somewhat exhaustive review of the literature (Section 2) apart from the paper already mentioned above, there is at the date of writing, an apparent absence of studies on the subject with respect to Spain. The author is therefore something of a "novel pioneer" in this subject area as she is in much of the empirical methodology that follows. This being said, with a view to improving in a minor way those studies that exist, here I propose an alternative methodology to the shift-share approaches used by Moretti (2010) and Faggio et al (2014), based upon the use of the location quotient discussed in more detail in Section 3.

The short-run and long-term applicability of the location quotient as one of the principal approaches advocated by economic base theory was the focus of a lively but short-lived debate between Douglass C. North (1955, 1956) and Charles M Tiebout (1956a, 1956b). This is a widely used application in regional and economic development research which offers a way to separate or breakdown basic or tradable activities from non-basic or non-tradable activities (defined in Section 3.1).

In this study I apply the technique using the underlying economic information present in Spanish regional accounting employment data. This is a potential method which with more time could receive additional refinements to those already considered herein and it is by no means the only method. However at the time of writing it seemed a worthwhile alternative to use which has allowed me to obtain some initial results.

It is also worth highlighting at the outset, that perhaps the hardest task in performing the final estimation has been the preparation of the data and the division of the sectors into tradable and non-tradable activities for posterior econometric estimation. A convincing or at the very least satisfactory division of the tradable and non-tradable sectors is essential to the mission in hand i.e. the calculation of a Spanish short term and long term multiplier and as such, underpins my empirical study. In this sense I grant this aspect more attention than *a priori* would appear to be the case for similar studies in this field. I consider the latter to be one of my principal contributions in this paper.

1.3 General concepts

Here I dedicate a brief section to the definition and explanation of various concepts and terms essential and a required preamble, to the reading and understanding of the text that follows.

1.3.1. Basic and Non-basic

The *economic base* technique is grounded on the assumption that the local economy can be divided into two very general sectors, namely a *basic (or non-local) sector* and a *non-basic (or local) sector* defined as follows:

- ***Basic Sector (Tradable activities):*** This sector is made up of local businesses (firms) that are entirely dependent upon external factors. Manufacturing and local resource-oriented firms (for example, mining) are usually considered to be basic sector firms because their fortunes depend largely upon non-local factors, they usually export their goods. Basic industries are usually assumed to be agriculture, mining, tourism, federal government and manufacturing (in part).
- ***Non-basic Sector (Non-tradable activities)*:** The non-basic sector, in contrast, is composed of those firms that depend largely upon local business conditions. For example, a local grocery store sells its goods to local households, businesses, and individuals. Its clientele is locally based and, therefore, its products are consumed locally. Examples of non-basic industries are retail, commercial banking, local government, local public schools and almost all local services (such as restaurants, drycleaners, and pharmacies) which depend almost entirely on local factors.

Given the aforementioned division, the total economy can be considered to be composed of basic and non- basic sectors and in consequence employment must be assigned in an identical manner to either sector. This idea is essential to understanding the treatment and division of the Spanish provincial employment data considered in this study.

In terms of the notation used in the remainder of the text, I have denominated the aforementioned relationship and the division of tradable (basic) and non-tradable (non-basic) as follows:

$$N = N^{T} + N^{NT} \tag{1}$$

Where N is total national employment and N^{T} and N^{NT} are tradable employment and non-tradable employment respectively. Likewise for each sector *s*:

$$N_s = N_s^{T} + N_s^{NT} \tag{2}$$

Where N_S is total national employment in sector *s* and N_s^{T} and N_s^{NT} are tradable employment and non-tradable employment in sector *s* respectively.

1.3.2 The Base Multiplier

The method for estimating the impact of the basic sector upon the local economy is the Base Multiplier, which is the ratio of total employment in time *t* to the basic sector employment in time *t*. The base multiplier is calculated as follows:

Base Multiplier (*BM*) = Total Employment in Year *t* / Basic Employment in Year *t*

$$\text{Base Multiplier } (BM) = \frac{\text{Total Employment in Year } t}{\text{Basic Employment in Year } t}$$

Which using the notation of equation (1) can be expressed as

$$BM = \frac{N_t}{N_t^T} = \frac{N_t^T + N_t^{NT}}{N_t^T} \qquad (3)$$

Likewise for each sector *s* (omitting the time sub-index *t* for simplification purposes) we obtain

$$BM_s = \frac{N_s}{N_s^T} = \frac{N_s^T + N_s^{NT}}{N_s^T} \qquad (4)$$

Simply stated, the Base Multiplier can provide insight as to how many non-basic jobs are created by one base job. For example-if the basic multiplier for an area is two, this means that for every new job in the basic sector there will be an additional job created in the non-basic sector.

1.3.3 Economic Base Analysis Techniques

Economic Base Analysis can be performed using several different techniques which are always based on the foregoing concepts such as the assignment of firms to basic or non-basic sectors and the calculation of a base multiplier (or multipliers).There are any number of ways to analyze the strengths/weaknesses, specializations, and overall diversity of the local economy. Ideally, economic base analysis should use industry output and trade flows to and from a locality. However, due to data disclosure issues this is not possible for some localities. The alternative is to use employment data as in the case of the present study and the majority of related papers.

The three main techniques used by planners are described below:

I. *Assumption Technique:* The Assumption Technique as an analytical tool is by far the simplest in that it allocates all local employment to basic or non-basic sectors by “assuming” that certain industries are inherently basic sector jobs and others are non-basic sector jobs.

II. *Minimum Requirements Technique:* The Minimum Requirements Technique is by contrast the most complex economic base analysis method requiring a comparison of the local economy with the economies of a sample of similarly sized regions.

III. *Location Quotient Technique:* The Location Quotient Technique determines the level of Basic sector employment by comparing the local economy or the relative concentration of a given industry in a given locality to the economy of a larger geographic unit such as the whole nation, the state, or the region. As the chosen approach for the present study, it is thus discussed in more depth in Section 3.

1.4 Structure of the Study

This paper is structured as follows: In Section 2, I briefly review some of the empirical literature on local multipliers highlighting in particular the paper of Moretti which has served as a starting point for this paper and the paper of Faggio and Overman (2014) which has been used for the empirical model. In Section 3, I discuss the location quotient as well as several necessary refinements of the latter. In Section 4, I summarise descriptively and graphically the division of basic and non-basic employment resulting from the division applied by the location quotient technique to this study. In Section 5, I develop the theoretical models for the empirical model. In section 6, I present the data and expose the methodology and empirical strategy followed to estimate local multipliers. In Section 7, I present and comment the different sets of results. Section 8 is dedicated to overall conclusions and to a discussion of further research areas.

2. LITERATURE REVIEW

In terms of the subject matter, the present paper is more directly related with recent literature, commencing with Enrico Moretti (2010), which aims at estimating the elasticity of local tradable employment with respect to non-tradable employment. Most of the macroeconomic papers on multipliers consider the elasticity of overall employment to public spending. In this respect Mendel (2012) suggests that a relationship probably exists between the two latter elasticities although there appears to be no consensus on how they relate to each other in theoretical terms. Here I review the applied microeconomics branch focused more on non-tradable to tradable elasticity and vice-versa. Given that the motivation for the present paper is based on the idea proposed by Moretti, it is appropriate at the outset summarising briefly the contents of his study.

As Moretti correctly comments in the opening line of his simply titled "Local Multipliers", every time a local economy generates a new job by attracting a new business, additional jobs may also potentially be created (the multiplier effect), via an increase in the demand for local goods and services. The study using US census data for 1980, 1990 and 2000 estimates a long-term employment multiplier at the local level and specifically seeks to quantify the long-term change in the number of jobs in a city y´s tradable manufacturing and non-tradable sectors generated by an exogenous increase in the number of jobs in the tradable sector, allowing for an endogenous reallocation of factors and adjustment of prices. He finds an elasticity of 0.34 implying that each additional job in manufacturing (i.e. a tradable job) in a given city induces the creation of 1.6 non-tradable ones. Additionally reference is made to the stronger multiplier effects for skilled workers with an elasticity of 0.257 and 2.52 jobs induced as opposed to the 1 job generated in the unskilled case. Moretti does not investigate what drives this effect- whether this is due to the higher purchasing power per job created of the skilled worker or whether a specific effect accompanies high-skilled jobs. Whilst his findings use city-based data in general Moretti additionally comments that within a simple framework the local multiplier for the tradable sector should be smaller than the one for the non-tradable sector and potentially negative. This is because the increase in labour costs generated by initial labour demand shocks local producers of tradables resulting in a negative effect which may in part be offset by agglomeration externalities, if they exist and an increase in demand for intermediate inputs if supply chains are localized. Moretti finds empirically that adding an additional job to one part of the tradable sector does not have a significant effect on other parts of the tradable sector.

Moretti and Thulin (2012) is a replicate study of Moretti (2010) based on Swedish data. Compared with the US data they find a smaller effect with an average 0.49 non-tradable jobs per tradable job and a far stronger effect for high-tech jobs (1.11 induced jobs) and jobs occupied by individuals with higher level education (2.79). Again no investigation is made as to what drives this effect- whether higher purchasing power per job or some alternative externality such as knowledge spillover. The US/Sweden disparity is explained in terms of the differences in labour supply elasticity (lower in the Swedish case due to unemployment benefits and less labour mobility) and tradable sector technology (the US commanding a higher tradable sector wage premium). The empirical specifications of the Swedish and US study however differ, given that the former allows for local labour market fixed effects and use a linear change in employment as opposed to a linear change in log employment in the latter US case. Hence the comparability of results is unclear.

Blasio and Menon (2011) again use the Moretti (2010) specification with data from Italy. For the Italian case the authors estimate the local labor variation via some sample analysis (e.g. Northern versus Southern local labour markets) – both in tradable and non-tradable sectors – due to an exogenous shift in local employment in tradable sectors. None of their specifications shows evidence of positive spillovers from tradable to non-tradable employment i.e. the local impact of employment growth in the tradable sectors is zero. They attribute these results to low labour mobility, a centralized wage setting system (which prevents adjusting wages in line with local productivity) and the very heavy regulation of the non-tradable sector in Italy which undermines its labour supply elasticity.

All of the foregoing three papers resort to the same shift-share instrumental variable in the spirit of Bartik (1991) as a means of overcoming potential endogeneity issues. In the same spirit I adopt a similar empirical model based on the two stage least squares model using instrumental variables as the Faggio and Overman study (2014) outlined below.

Magrini and Gerolimetto (2011) adopt a different approach to estimating local multipliers using US data on employment provided by the Bureau of Economic Analysis and covering 363 metropolitan statistical areas for the period 2001 to 2008 (a similar period to that used in the present paper). They estimate a totally non-parametric model and account from special dependencies between unitary observations which allows them as authors to study how the multiplier varies with, for instance, the size of the local labour market (measured by total tradable employment) or with some asymmetric effect (i.e. differing elasticities for tradable job creation and destruction). They find that the local multiplier expressed as an elasticity increases with the size of local labour markets and decreases or experiences lower elasticities when tradable jobs are destroyed rather than when they are created.

The paper of Clément Malgouyres (2013) represents a preliminary study for France again adopting the Moretti (2010) model and additional elements of the foregoing papers such as the shift-share instrumental variable approach (Bartik 1991) and a test of the asymmetry suggested in the Magrini et al (2011) study but applied to a parametric setting. An additional contribution is the use of an instrument based on trade shocks in the form of an “import- per- worker” index based on the study by Autor et al (2012). With these elements Malgouyres develops a simple spatial equilibrium model in order to investigate theoretically (an aspect less exposed in other studies) what determines the sign and magnitude of local multipliers (defined as the elasticity of employment in the non-tradable sector with respect to an increase in employment in the tradable sector). He then estimates a local multiplier for France finding elasticity situated between 0.32 and 0.50 implying a job-to job effect between 1.2 and 1.9. This is considerably higher than previous studies (Italian case) and similar to findings based on American data and Malgouyres concludes that his results are lower than the figures usually quoted to justify the place-based and industrial policies applied in France.

The foregoing literature considers local multipliers as stemming mainly from an increase in the demand for final goods and naturally with an increase in local manufacturing activities (as a proxy for the tradable sector), an increase in the local purchase of inputs is to be expected. The existence of input-output tables (such as those employed by Attewell et al (2013) for defining tradable and non-tradable sectors within the production measure of New Zealand´s GDP) would assist in the documentation of inter-industry linkages enabling something of a decomposition or disaggregation of the overall multiplier effect into two demand-related effects, one for non-tradable inputs and the other for non-tradable final goods. However given the nature of the data used in the present study, this methodology results extremely complex in order to undertake empirical work in a credible way.

Despite a somewhat exhaustive review of the literature with particular focus to my own paper and the existing European studies which are closer to home and more appropriate for comparison purposes, there is an apparently surprising lack of studies on the subject in as far as Spain is concerned. The most recent one for Spain replicates to a great extent the paper of Faggio et al (2014) and is a preliminary draft by Jofre-Monseny et al (2014). Given that I have based my theoretical model in part on the former study I will comment briefly on its contents.

Basing themselves yet again on the Moretti (2010) which appears to be something of a reference paper for most recent research on the subject of local multipliers, Faggio and Overman (2014) estimate the multiplier effects of public sector job relocations outside London. Again employing the shift-share approach, their results based on 2004-2008 employment changes at the British Local Authority Level, indicate that overall private employment does not change with public employment although the industry mix changes in favour of the non-tradable sector. The Spanish replicate by Jofre-Monseny et al (2014) seeks to complement the British study by focusing on very long-run changes in employment and allowing for sluggish price adjustments. They consider the period between 1980 and 2001 following Franco´s death in 1975 characterized by a massive 140% increase in public administration employment. This latter late development of the Spanish Public Sector allows the authors to harness the geographical distribution of the pre-democratic and somewhat immature public administration of 1970 for the purpose of predicting city-level changes in public employment in the 1980-2001 period. Their results indicate that public administration employment has a positive multiplier effect for the non-tradable sector (1.7 additional jobs) and a negative effect for the tradable sector (0.6 job losses).

In terms of literature, the focus of the present study rather than considering public sector employment considers the calculation of a short-term and a long-term national local employment multiplier for Spain based on highly aggregated provincial employment data. In this sense it is more in line with the studies conducted by Magrini et al (2011) for Italy and Malgouyres (2013) for France but differs in that it does not employ the shift-share analysis but instead using an adapted location quotient approach. It does coincide with the majority of the papers cited in its econometric strategy in that it uses ordinary-least squares regressions with the pertinent control variables as well as two stage least squares regressions with specific instrumental variables for the purpose of dealing with endogeneity issues. These aspects will be mentioned again in more detail in Sections 5 and 6 below.

The literature relating to the location quotient method and its limitations will be discussed in context within Section 3.5 dedicated to a "fine-tuning" of my location quotient approach.

3. LOCATION QUOTIENT METHODOLOGY

3.1 The Location Quotient Technique

The Location Quotient Technique (henceforth denoted as LQ) is the most commonly utilized economic base analysis method and has been used by regional analyst for over 60 years. Location quotients compare the local share of a given industry to the share of that industry for a larger area. This concept measures the relative specialization and concentration of an industry in the local economy compared to the larger area (usually the nation). The LQ is simply defined as the ratio of an industry's share of the local employment (locality) divided by its share of the reference area (the national economy, the state, or the region).

"The location quotient approach estimates the basic employment in each industry by relating an industry's local employment share to its national employment share." (Klosterman, (1990) p. 149)

For the purpose of assigning my Spanish employment data sample either to trade or non-trade activities a satisfactory calculation of the LQ is fundamental for the posterior econometric regressions aimed at estimating the employment multiplier object of the study. Hence the separation of basic and non-basic employment is made using the information relating to specialization as revealed by the *location quotient* for employment.

The formula and notation I use for computing the LQ for provincial employment by sector is:

$$LQ_{sp} = \frac{n_{sp}/N_s}{n_p/N} \qquad (5)$$

Where LQ_{sp} is the location quotient, n_{sp} is employment in province *p* in sector *s*, N_s is total employment for the Spanish economy in sector *s*, n_p is total employment in province *p* and N is the total employment for the Spanish economy.

Examining this formula more closely, we see that to allocate employment to the basic and non-basic sectors, location quotients are calculated for each industry or sector. Simply stated, the LQ method compares Local Employment to National Employment in a benchmark economy (our benchmark here, being Spain), thereby providing evidence for the existence of basic employment in a given industry or sector.

Following its calculation and assuming that the benchmark economy is self-sufficient, the interpretation of the Location Quotient is very simple with only three possible general outcomes possible as follows:

1) Industries with LQ's = 1 (Self-Sufficiency) = All Employment is Non-Basic
A LQ that is equal to 1 suggests that the local employment is exactly sufficient to meet the local demand for a given good or service in the area economy (here, each Spanish province). Therefore, all of this employment is also considered non-basic because none of these goods or services are exported to non-local areas (here, other Spanish provinces).

2) Industries with LQ's < 1 (Net Importer) = All Employment is Non-Basic
A LQ that is less than 1 suggests that local employment is less than was expected for a given industry. Therefore, that industry is not even meeting local demand for a given good or service and must import its product if the area is to maintain normal consumption patterns. Therefore all of this employment is considered non-basic by definition.

3) Industries with LQ's > 1 (Net Exporter) = ***Some*** Employment is Basic
A LQ that is greater than 1 provides evidence of basic employment for a given industry. When an LQ > 1.0, the analyst concludes that local employment is greater than expected and it is therefore assumed that this "***extra***" employment is ***basic***. In other words the area economy (i.e. each Spanish province) has more than enough employment in the industry or sector to supply the region with its product. These extra jobs then must export their goods and services to non-local areas which, by definition, makes them Basic sector employment. The words "extra" and "basic" have been high-

lighted in the text because an LQ > 1.0 does not mean that all employment in that industry is basic, only that proportion of the industry that is responsible for the excess production is basic.

As mentioned by W.A Schaffer (2010), it is convenient to maintain the initial formulas as expressed by my aforementioned equations 1 to 4 (Section 1.3) as a reminder to the logic behind the economic base theory and compute location quotients as expressed above in my equation 5 as reminders throughout this text of the strengths of the exporting sectors.

Estimation of export employment for each sector in an area can be used together with total employment for the calculation of the average employment multiplier, With a set of values of between 10 and 20 years (here the period spans 14 years), an acceptable marginal multiplier (short and long-term) can be estimated empirically by relatively simple regression techniques the main objective of this study.

3.2. Division of basic and non-basic activities

As mentioned previously, the creation of employment in basic activities or for tradable goods gives rise to employment growth in non-basic activities. Here I propose to use the information proportioned by the location quotient calculated for the employment of the Spanish Regional Accounting Data base to firstly, separate and a posteriori calculate the trends in employment made possible by the estimation of the mathematical expression (5) already mentioned above. The most common interpretation of the latter is that values superior to unity indicate concentration and specialization, whilst values falling below the mean value indicate importation activity (Aurioles y Giussani, 1995).

As an initial approximation to the segregation of activities, it is proposed here to identify the value for basic and non-basic employment with the sectorial information relating to specialization and concentration for each region.

3.3. Preliminary study applying the location quotient approach

In a prior preparatory study using for calculation purposes the LQ as expressed in equation (5), the average value of the location quotient by sector was calculated for the period (LQ_{pst}), classifying basic employment as the value of employment for sector *s* in year *t*, when the difference was positive, the remaining employment being classified as *non-basic*. Aggregating the positive values for the six sectors available in the regional accounting database, I obtained at a preliminary stage the annual series for the *basic* employment of province p in year t and, by arithmetic difference with total employment per province, the employment classifiable as *non-basic*.

This focus permitted the use of the latent information present in the data series for employment and, in particular, took advantage of those changes in specialization which occurred throughout the period between provinces (inter-provincial) and within provinces (intra-provincial) without the need to recur to *a priori* classifications (e.g. construction, *non-basic*) such as those used in the aforementioned assumption approach. Almeria illustrated this situation very well: both the quotient for agriculture as well as that for construction displayed values superior to unity, indicating that a *core* activity is being produced for export (outside the province, potentially agriculture given the province´s fruit and vegetable exports), which additionally attracts activity localized within the region. Despite my satisfaction with what appeared to be a reasonable division of basic and non-basic activities for Almeria there were a number of provinces which with a prior knowledge of their economic activity yielded disconcerting results which were difficult to interpret.

These results were part and parcel of a calculation of the location quotient without taking into account the limitations inherent in the essentially non-realistic assumptions used by this technique which are discussed in detail in the next section.

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3.4. Limitations of the location quotient approach

The LQ approach is subject to several limitations in the division of the tradable and non-tradable sectors which require special attention and are discussed below. Likewise the results of my aforementioned study have motivated a new "adjusted" LQ calculation for use in the present paper´s database with a view to improving the quality of the data for estimation purposes.

In terms of literature reviews I read with great interest the paper by Shu-hen Chiang (2009) which suggests that several of the assumptions of the LQ limit its general applicability and usefulness. A more complete critique as to the shortcomings of the location quotient approach and indeed other techniques such as SSA and potential "corrective measures" is also exposed in the paper by Mustafa Dinc (2002).

The main limitations arise from several assumptions implicit in the LQ model noted briefly below:

- The assumption that regional technology is similar to reference technology.

- The assumption that regional demand patterns are similar to national averages. In other words that local and benchmark (Spain) consumptions are the same.
- The assumption that no international trade or cross-hauling exists. Namely that all local demands are met by local production wherever possible.
- The assumption that regional labour is just as productive as its national counterparts. This represents the principal adjustment made to the data.

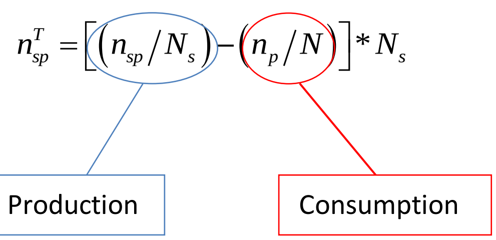
These are better discussed in the context of the “refinements” to the LQ calculation described in the next section.

3.5. “Fine tuning” or refinements to the LQ calculation

As an overall evaluation the location quotient technique is by far the most popular method for studying a local economy offering a good balance of control and complexity to the analyst. However the analyst must be careful not to interpret location quotients blindly. Additionally a number of refinements can be utilised with a view to minimising the impacts of the aforementioned assumptions underlying the technique.

The refinements applied here to the location quotient or as I denote them “the fine-tuning”, are based on ideas exposed by Richard E Klosterman (1990) in his publication “Community and Analysis Planning Techniques” (Chapter 10) and also Klosterman et al (1993, Chapter 9, p 164) as well as the aforementioned paper of Dinc (2002).

3.5.1 Calculation of Basic Employment



Source: Own elaboration based on a presentation by T. Chapin (2004).

Using my previous notation, the abovementioned equation assumes that Basic employment is a function of the difference between supply (production) and demand (consumption). However this equation makes several assumptions about production and consumption described below.

3.5.2 LQs >1

If LQs >1, basic employment in sector s of province p can be expressed as follows:

$$n_{sp}^{T} = [(n_{sp} / N_s) - (n_p / N)] * N_s \quad (6)$$

$$n_{sp}^{NT} = n_{sp} - n_{sp}^{T} \quad (7)$$

The results obtained using the LQ as expressed in equation (6) tend to underestimate basic employment and the exportable activities confirming the limitation of this focus. A data base for the division of the data into basic and non-basic was created in this respect but precisely for aforementioned reason was rejected as a basis for empirical study

3.5.3. Consumption

As already mentioned previously one of the major assumptions of the LQ technique is that Regional or in this case provincial consumption is equal to National consumption i.e. there is no variation in consumption patterns across space. This we know to be false and to give an extreme example, the provinces of mainland Spain (e.g. Asturias, Madrid, Granada, Navarra, the provinces within the autonomous communities of Aragon and Cataluña) which benefit from ski resorts and favourable climatic conditions in terms of snow, are likely to purchase more skiing equipment than provinces in the Balearic or Canary Islands. The diversity of Spain in terms of the differences between provinces obviously makes this an important consideration. The upshot is that if Local Consumption is greater than National Consumption then there will be a tendency using the LQ approach to underestimate local consumption and thereby overestimate basic employment (because more goods are consumed locally and not exported). In this sense population and total personal income adjustments can be applied.

In this initial study an adjustment for consumption has not been contemplated as such given that while consumption patterns differ from one province to another, I assume that they have not changed significantly relative to Spain as whole for the period considered. Additionally, in the empirical regression for the estimation of the local national employment multiplier, I have attempted to isolate or control any required consumption adjustment by using variables such as population (inferred above) and population density when estimating the local national employment multiplier.

3.5.4 Export and Cross-hauling adjustments

The LQ technique assumes that there are no net national exports or imports i.e. Production is equal to Consumption. This is very rarely the case, and in fact Spain as the national benchmark for the study has historically and currently imported more goods than it exports. On a provincial basis:

•If there are net national imports then Consumption > Production and the technique will understate the local share of national consumption and overstate basic employment.

•If there are net national exports then Consumption < Production and the technique will overstate the local share of national consumption and understate basic employment.

Various potential adjustments exist such as at a very basic level a calculation of employment that is tied to national consumption (a Proportion Domestic) by industry. As mentioned at the beginning of this section, Chiang (2009) advocates a more sophisticated approach which harnesses on a theoretical basis the law of comparative advantage as a conceptual framework for determining whether trade is basic or non-basic and offers an approach for reexamining the LQ from the viewpoints of both interregional and international trade, where the former corrects LQ from dependence problems of the location theory and the latter injects international trade into the LQ offering additional exports which is obviously relevant in the globalized world of today.

Cross-hauling refers to the import of goods in an export sector. The LQ approach assumes that no cross-hauling exists for goods between local and national areas. For example, a winery or several wineries in Haro, La Rioja may produce 1% of Spain´s wine and the local area may also consume 1% of Spain´s wine. The LQ technique assumes that the local Haro wineries account entirely for this 1% consumption. However "Cross-hauling" essentially exists because although the wineries export a sizeable amount of the product, local vendors in Haro will simultaneously be importing other wines from other provinces or abroad to sell locally. *Product mix* is also an issue given that very few areas maintain industries producing products across the entire range of an industrial sector. The upshot is that some goods must be imported and others invariably exported. As cited by Klosterman (1993 p 143), "The effects of crosshauling can be reduced by using more refined industrial categories…." something which in the form of more disaggregated data is not always readily available as is the case for the database used in this study.

The above are obvious limitations to the use of the LQ approach. Needless to say all potential adjustments serve to better the empirical database but due to their complexity, in particular those proposed by Chiang (2009) fall beyond the scope of this study but present an interesting area for future research.

3.5.5 Productivity Adjustment for the study database

Following consideration of the nature and underlying features of the database for Spanish provincial employment this adjustment was applied as being the most relevant and simple to implement as a refinement or "fine tuning" to my division of basic and non-basic employment in this study. As already mentioned, one of the major assumptions of the Location Quotient is that labour productivity is the same for local workers and national workers e.g. local construction workers build homes at the same rate as the average national construction worker. However if in reality Local Productivity is higher than National Productivity then the equation will tend to *underestimate* the regional share of national production and thus *underestimate* basic employment. If by contrast the reverse situation is true, namely Local Productivity is lower than National Productivity then the equation will *overestimate* the regional share of national production and *overestimate* basic employment. In order to correct for this it is possible to use a ratio of regional value added to national value added.

Gross Value Added (GVA) is used to measure the contribution to an economy of each individual producer, industry or sector in an area or in the present case a province. As a measure of output it tells us about the economic performance of an area. (As such it is linked to Gross Domestic Product (GDP) with GDP being equal to GVA plus taxies minus the subsidies on products).

Value-added data is available for Spain on a provincial basis for 6 sectors, Agriculture, Energy, Industry, Construction, Market and Non-Market Services, making it possible to refine the calculation of basic employment correcting the data for nominal productivity. This being the case this so-called "productivity" adjustment has been applied to the LQ calculation and represents the major adjustment to my database.

Making use of the provincial data available for gross value added (at current prices) and employment contained in the CRE, base 2000, a coefficient corrected for productivity can be defined as follows:

$$v_s = \left(\frac{gva_s}{n_s}\right) / \left(\frac{GVA_s}{N_s}\right)$$

This applied to equation (6) above, gives the following expression for the calculation of basic employment in sector *s* of province *p:*

$$n_{sp}^{T} = [v_s (n_{sp} / N_s) - (n_p / N)] * N_s / v_s \qquad (8)$$

The sector *s* represents agriculture, energy, industry, construction, tradable and non-tradable services. This adjustment applied to the database has the effect of increasing basic employment.

The division of the data into tradable and non-tradable sectors and an analysis of the evolution of the series representing basic and non-basic employment as represented in the database will be commented and described graphically with some examples in the next section.

4. THE PRODUCTIVITY ADJUSTED DATA BASE

4.1. *Comparisons with the unadjusted data base*

With reference to the preliminary study mentioned in section 3.3 above a comparison of the original data base with my new productivity adjusted database confirms the fact that the non-refined LQ underestimates basic employment on an annual basis and hence for the entire period.

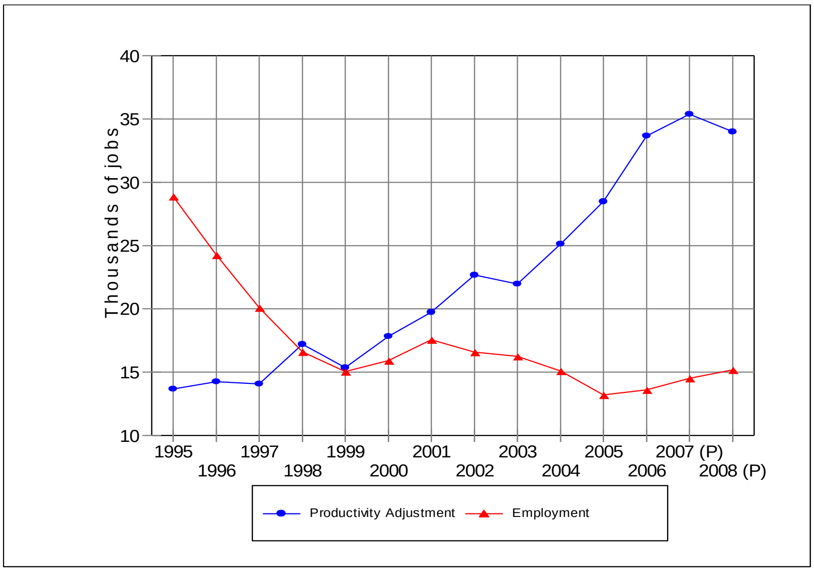
The incorporation of the adjustment using GVA as expressed in equation (8) injects a dynamic dimension into the database which reflects particular features pertinent to the productivity of each province. With respect to the latter, the diversity of the Spanish provinces should be taken into consideration for the calculation of tradable and non-tradable employment given that it is an important indicator of economic performance. Productivity differences can arise due to a combination of factors; natural resources, climatic conditions, economies of scale or scope, location and urban economies of scale but to name a few contributing factors.

A comparison of the new productivity database with the aforementioned unadjusted database of my preliminary study deserves some comment.

Overall, on a year by year basis, my new adjusted database offers a higher calculation in absolute cumulative terms of Spanish tradable employment for the entire period 1995-2008. For the same period, using the original unadjusted database, employment in the tradable sector amounted to 27,012,400 with non-basic jobs amounting to 223,507,800. This compares with a total of 28,363,100 basic jobs and 222,157,100 non-basic jobs in my new productivity adjusted database reflecting an increase of 1,350,700 jobs in the tradable sector and a corresponding decrease in the non-tradable sector. In structural terms before using the unadjusted LQ, the contribution of basic employment to total employment was 10.8% whereas with the adjusted LQ the contribution is now 11.3%. Whilst this reflects only a 0.5% change in total employment for the period, it could prove relevant for the purpose of empirical work and for the purpose of calculating a short and long-term local employment multiplier.

The cases of Asturias, Barcelona and Madrid are commented below as it sheds light on the adjustment made by the productivity adjustment to the method of dividing trade and non-trade with the LQ technique.

Graph 1: Asturias: tradable employment: adjusted versus non-adjusted database



Source: own estimates based on INE, *Contabilidad Regional de España, base 2000*, serie homogénea, March 2011

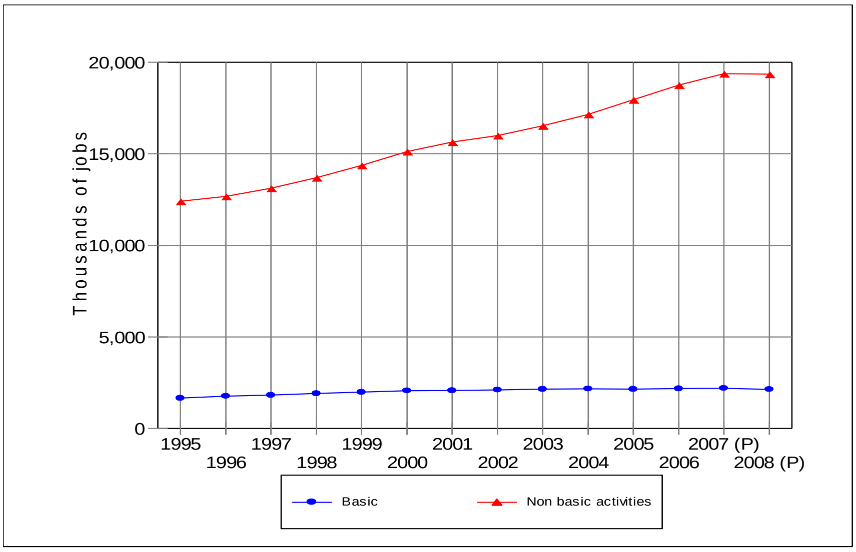
Graph 1 above, represents tradable employment data using both the unadjusted database and productivity adjusted database for the period 1995-2008. At the start of the period Asturias generated less output per employee (lower productivity) than national employees on the whole and as per 1995 reported 28,900 jobs in the tradable sector as compared to the productivity adjusted database which reported 13,700 jobs in the tradable sector for the same year. As indicated in Section 3.5.5 above if Asturian local productivity is lower than national productivity as the graph would appear to indicate, the LQ approach will tend to overestimate the regional share of national production and overestimate basic employment. The converse is true for Asturias in 2008 with local productivity per employee higher than the national equivalent. Here whilst as shown in Graph 1 above the unadjusted database registers 15,200 tradable jobs for Asturias meaning that the LQ equation underestimates its regional share of national production and thus basic employment. This compares with the 34,000 jobs, more than double in the tradable sector calculated with the productivity adjusted database. If these sorts of differences occur for one or more provinces the cumulative effect on the division of basic and non-basic employment is to say the least significant.

Another two examples, are Barcelona and Madrid which in the unadjusted database reported respectively, 1995 tradable employment of 256,700 jobs (334,000 in 2008) and 224,900 jobs (370,700 in 2008) as opposed to comparable figures in the productivity adjusted data base of 283,900 tradable jobs(363,700 in 2008) for Barcelona and 351,500 tradable jobs in 1995 (441,200 in 2008) for Madrid. For both years, the productivity per employee of Barcelona and Madrid was superior to the productivity of the national employee and in both cases yet again the unadjusted balance sheet registered lower basic employment as a result of the underestimation of the regional contribution to national employment. In the case of key provinces these differences are particularly significant and could give rise to errors for empirical work.

4.2. *The evolution of tradable and non-tradable employment (1995-2008)*

The division of tradable and non-tradable employment as expressed by the database used in this study and its evolution over the period is shown in Graph 2 below:

Graph 2: Spain: employment in basic (trade) and non- basic activities (non-traded)



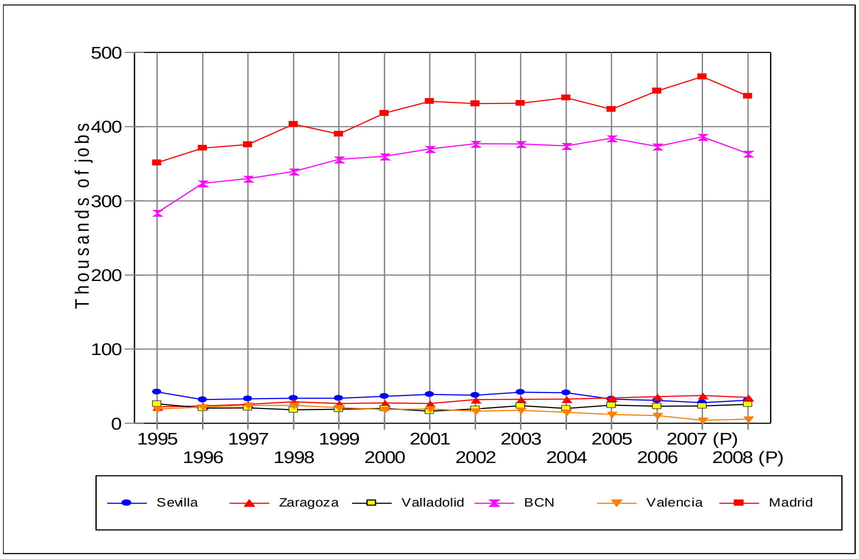
Source: own estimates based on INE, *Contabilidad Regional de España, base 2000*, serie homogénea, March 2011

It is easy to see that whilst employment in the tradable sector remained practically unaltered, employment in the non-tradable sector experienced an increasing and positive trend. In relative terms using 1995 as the base year the % growth in tradable employment stood at 28.6 % (2.13 million jobs in 2008 as compared with 1.65 million jobs in 1995). Non-tradable employment registered a spectacular 55.96% increase for the period (19.35 million jobs in 2008 versus the 12.4 million in 2005). The average annual accumulated rate of growth for tradable employment $g^{T}(1995, 2008)$ was 1.98 % whilst for Non-tradable employment the equivalent growth rate $g^{NT}(1995, 2008)$ was 3.48 %.

Spain is a predominantly service based country in line with other European countries with major sectors such as tourism, energy and banking the evolution for the 1995- 2008 period reflects other economic factors. The period was marked by the construction boom and the use of EU structural funds for economic development. During these years, the latter funding was aimed fundamentally at the improvement of national highways and infrastructures to service rail transport (AVE) and airports. Indirectly this underpinned a generalized need for improvements in infrastructures on a national and regional level as well as by way of support to Spain´s booming tourist industry.

Given the extension of the database being used, I highlight below some examples of the evolution of total employment for what I denominate as reference provinces, principally Madrid and Barcelona but also Sevilla, Zaragoza, Valladolid and Valencia. This is shown in Graph 3 below.

Graph 3: Evolution of employment in reference provinces (1995-2008)

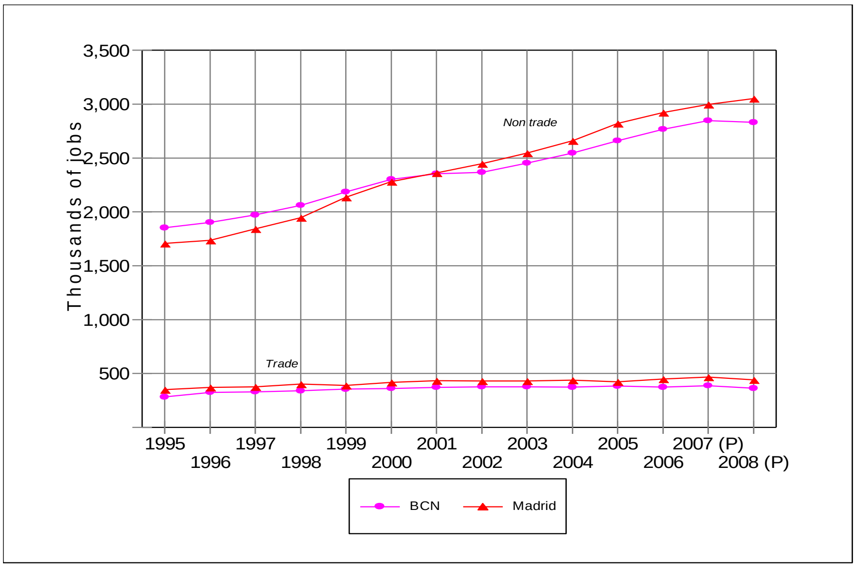


Source: own estimates based on INE, *Contabilidad Regional de España, base 2000*, serie homogénea, March 2011

The graph clearly indicates that Madrid and Barcelona are key job creators whilst the other reference provinces already mentioned seem to maintain virtually unaltered levels of employment for the period. In the case of the former provinces and major cities the evolution of employment witnesses what appear to be three economic cycles with economic downturns in 1995, 2005 and a more pronounced decline in the “twilight” of the recession initiated by the global crisis in 2008.

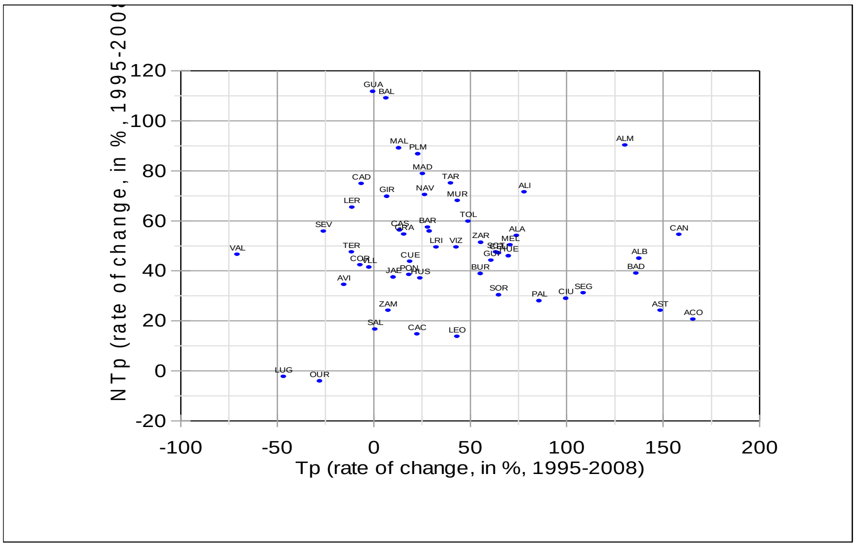
Graph 4 below highlights the similar evolution of the two principal reference provinces and autonomous communities over the period, with Madrid overtaking Barcelona in non-trade employment following the year 2000 economic downturn.

Graph 4: Barcelona and Madrid: employment in basic (trade) and non- basic activities (non-traded)



Source: own estimates based on INE, *Contabilidad Regional de España, base 2000*, serie homogénea, March 2011

Graph 5: Spain province: Rate of change (%) of employment in basic (trade) and non- basic activities (non-traded)



Source: Elaborated with data of INE, *Contabilidad Regional de España, base 2000*, serie homogénea, March 2011

The growth of tradable and non-tradable employment for the period 1995-2008 of my study is shown in Graph 5 above for all Spanish provinces and is indicative of the diversity of Spanish provincial employment and the divergences in the growth of non-tradable and tradable jobs.

5. THEORETICAL SPECIFICATION FOR THE EMPIRICAL MODEL

5.1 Theoretical and empirical framework

The theoretical model for this paper is as I said at the outset, inspired by the study of Moretti (2010) which has been used as the reference paper for recent studies regarding local employment multipliers and as such has been cited by them and received a greater or lesser degree of replication. Whilst the paper has been part and parcel my motivation for the current study in terms of empirical methodology it is described in a somewhat reduced manner and given its complexity results difficult for me to simulate for my own study. It is for this reason that the econometric methodology hinges on the work of Faggio and Overman (2014) which while extremely sophisticated has proved easier for me to use as an empirical model.

This having been said both studies adopt similar theoretical models and assumptions adapted to their specific study and multiplier estimate. In the same spirit I use a similar conceptual framework.

Assume that each Spanish province is a competitive economy using the factor labour to produce a nationally traded good whose price is exogenous and a non-traded good whose price is determined locally. Labour is assumed to be mobile across the different sectors of the local economy (province). Assume that wages in the tradable and non-tradable sector are determined locally. The mobility assumption means that marginal products and wages are equalized across sectors on a provincial basis. To keep things simple, I assume that workers choose either to work in the tradable sector at a certain wage or alternatively in the non-traded sector. Local or provincial labour supply is upward sloping and depends on local or provincial preferences, the degree of labour mobility across provinces and the responsiveness of local or provincial housing supply. The greater the mobility of workers and the more responsive is the local or provincial housing supply the more elastic is local labour supply.

Moretti (2010) considers a permanent increase in local labour demand for traded goods. I adopt a similar assumption and consider a permanent increase in provincial labour demand for traded goods. The direct effect of increased production for the province is to increase local provincial employment in traded goods. Employment in other sectors, namely non-trade, unemployment, local prices (wages, non-traded goods and house prices) labour and housing supply are then subject to general equilibrium adjustment on a provincial basis.

These are, in very simple terms the theoretical assumptions of my model. The next section is dedicated to the specification of the regression equations used in this study.

5.2 Specification of the Regression Equations

The breakdown which follows in the specification of the regression equations used in this study does not correspond to a causal relationship between basic and non-basic employment. For this purpose I first evaluate the regression equation proposed by Moretti (2010) –using panel data for the period 1995-2008- and secondly the alternative linear regression equation of Faggio and Overman (2014), using cross-Sectional data.

The following equation (9) is one of two used by Moretti (2010) for his city-based study and here it is expressed using my notation (equation 5) substituting his *c* (city) with *p* (province):

$$\Delta n_{pt}^{NT} = \alpha + \Delta n_{pt}^{T}\beta + \gamma d_t + \varepsilon_{pt} \qquad (9)$$

Where Δn_{pt}^{NT} is the change in non-tradable (NT) employment in province *p* in time *t*, Δn_{pt}^{T} is the change in tradable employment (*T*) in province *p* in time *t*, d_t is an indicator for the second time period used and ε_{pt} is the error term.

The regression used by Faggio and Overman (2014) with cross-sectional data is a close replication of a study by Card (2007) estimating the impact of immigration on US cities. The dependent variable in this study represented the contribution of private sector employment to total employment growth and the independent variable with coefficient β the contribution of public sector employment. The variable X is a set of characteristics which the authors see as affecting private sector growth (control variables). It is expressed as follows:

$$\frac{n_{pt}^{NT} - n_{pt-k}^{NT}}{N_{pt-k}} = \alpha + \beta \frac{n_{pt}^{T} - n_{pt-k}^{T}}{N_{pt-k}} + \gamma X + \varepsilon_{pt} \qquad (10)$$

I have specified an almost identical equation for my own study using principally equation 10 with the additional corporation of the time variable suggested by Moretti:

$$\frac{n_{pt}^{NT} - n_{pt-k}^{NT}}{N_{pt-k}} = \alpha + \beta \frac{n_{pt}^{T} - n_{pt-k}^{T}}{N_{pt-k}} + \lambda X + \gamma d_t + \varepsilon_{pt} \quad (11)$$

Where n_{pt}^{NT} and n_{pt-k}^{NT} are variables representing the number of jobs in the non-trade (*NT*) sector in province *p* at time *t* and *t-k*, respectively, n_{pt}^{T} and n_{pt-k}^{T} are variables representing the number of jobs in the tradable (*T*) sector in province *p* at time *t* and *t-k*, respectively, N_{pt-k} is total employment (i.e. the sum of tradable and non-tradable jobs) in province *p* at time *t-k*. X represents a vector of control variables discussed below, d_t represents a dummy time variable for period *t* and ε_{pt} is the error term.

5.3 Theoretical Specification for the use of Instrumental Variables

Given that my empirical methodology replicates Moretti (2010) and Faggio and Overman (2014) involves a two stage least squares regression using instrumental variables I briefly comment the theoretical framework for the choice of my instrumental variables.

As mentioned at the outset, this type of models may suffer from problems associated with endogenous variables (here n_{pt}^{T} and n_{pt}^{NT}) i.e. tradable and non-tradable employment arising from a correlation between the error term ε_j (characteristics unobserved by the investigator) & the aforementioned independent variable, namely that:

$Cov(\varepsilon_{pt}, n_{pt}^{T}) \neq 0$ (the covariance between is not zero.)

One solution is to estimate a two stage least squares model (2SLS) as adopted by both the studies on which I base my empirical models:

The first stage involves performing a regression of the endogenous variable (n_{pt}^{T}) on the instrumental variables selected thus obtaining adjusted values. In the second stage we run a regression of the endogenous variable (n_{pt}^{T}) on the instrumental variables as well as the adjusted values calculated for the stage one regression. In order to ensure that a valid instrumental variable (z_{pt}) has been chosen it should comply with the following two conditions:

$$Cov(z_{pt}, n_{pt}^{T}) \neq 0$$

$$Cov(z_{pt}, \varepsilon_{pt}) = 0$$

The second condition cannot be tested, but using the above-mentioned criteria I have been able to select the instruments discussed in the next section.

6. THE EMPIRICAL MODEL

6.1 *Data Source and description*

The principal data source used is the Instituto Nacional de Estadística (INE), Contabilidad Regional de España, base 2000, homogeneous series March 2011. Use has also been made of the database provided by the Instituto Valenciano de Investigaciones Económicas (IVIE) for the calculation of some of the variables calculated for the study. In the main, the latter source makes use of the INE database for most of the variables used here. Some use has also been made of data from the Fundación BBVA (FBBVA).

For the purpose of this study the principal database used was that relating to employment data covering 52 Spanish provinces and broken down by specialization into five sectors: Agriculture, Energy, Industry, Construction and Services. Given that the object of this paper is the calculation of a local employment multiplier the data used is expressed as the number of jobs as opposed to the number of persons employed.

The time period selected covers the years 1995-2008 using a balanced homogeneous dataset. It would have been interesting to have extended the study beyond 2008 but unfortunately the data for 2009 and the years to date now refers to number of persons as opposed to number of jobs meaning that I would have been working with an unbalanced and non-homogeneous data panel. Some doubt arose as well as to the use of the years 2007 and 2008 due to the onset of the global crisis and economic recession but in the case of Spain the real impact appears to have taken its toll in employment terms from 2009 onwards.

Other data used specifically in the calculation of the location quotient includes the productivity adjustment contemplated under the refinements to the LQ calculation in Section 3.5.6 also has its origin in the aforementioned regional accounting database.

The study has required a basket of variables for use as controls and/or instrumental variables. Given that my study is different to those I have used as empirical models, my priority has been to keep the investigation and the empirical methodology variables firmly focused on the calculation of a local provincial employment multiplier for Spain, in the context of the underlying information provided by the database.

Whilst I coincide in part with some of the control and instrumental variables used by both Moretti(2010) and Faggio and Overman (2014) the nature of my study, the diversity of the Spanish provinces are the factors that have influenced my choice of control and instrumental variables. These are described in the next section.

6.2 Control and Instrumental Variables

I coincide with Faggio and Overman (2014) in the use of two different types of variables, being those associated with population and different levels of education.

For the former variables I have used *population* (in persons) and population density (population per kilometer squared) as well as the *differences* in these over the period on a year to year basis (for the estimation of my short-term employment multiplier) and on the two period basis (for the estimation of my long-term multiplier). The use of these is logical given that an increase in local population or differing population densities on a provincial basis would increase the demand for local provincial services and this, ceteris paribus, would in turn potentially increase the demand for my dependent variable non-tradable employment.

Likewise, in line with Faggio and Overman (2014), I have used three levels of education but differently. Again making use of the provincial data (Source: IVIE 2013), using an adapted formula of my afore-mentioned equation 5, I calculated 3 human capital location quotients each incorporating 3 levels of education and based on persons occupied in employment on a provincial basis. The first level *LQH1* covers uneducated and primary education, *LHQ2* elementary and superior bachiller, FP1 and FP2 and *LHQ3* university education (persons holding diplomas, degrees and beyond). Whilst my study is not orientated towards an estimation of the influence of skilled or for that matter unskilled workers on non-tradable provincial employment, I considered these variables as being of potential use as either control or instrumental variables.

In the spirit of Solow (1956) and Swan (1956) and as a reflection of my recent macroeconomic studies in general equilibrium, I decided to incorporate a variable defined as *capital per job* calculated using provincial productive capital (on a sectorial basis (Source: FBBVA-IVIE 2011)) divided by jobs (Source : INE; base 2000, March 2011). My expectation was that this could have a positive effect on non-tradable employment although potentially a reduced one given that higher levels of capital per job are associated with sectors such as manufacturing traditionally part of the tradable activity sector. Thus it could prove a valuable two-way control variable.

As a reflection of the 1995-2008 period under consideration, I decided to use three specific variables. The period was characterized as mentioned in section 4 by EU structural funds with a lot of job-creation in infrastructures and in particular those related to highways. For this purpose I created a variable for *road infrastructures* per job calculated using provincial capital investment in road infrastructures (stock of roads and motorways (Source: FBBVA-IVIE 2011)) divided by jobs (Source: INE; base 2000, March 2011). Likewise the period was characterized by the boom in construction and for this purpose I again calculated the *location quotient for construction* my expectation being that it would influence my dependent variable positively.

An additional variable used in the regression was the *location quotient for non-market services.* Both the latter and the former LQ for construction are used intuitively as potential controls or instrumental variables. I select these two location quotients given that in the literature relating to regional economics, construction and non-market services are traditionally considered as “non-trade goods activities”, namely, construction and non-market services. This permitted me to test the right-hand side of the regression of trade employment with the non-trade specialization, both of which form the two sides of the “employment” coin.

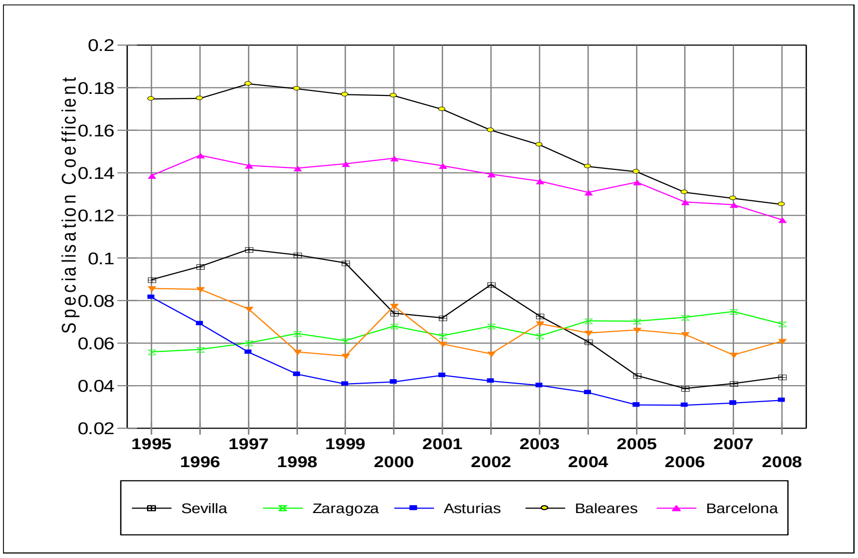
Lastly, I used a variable extensively used in regional and development economics known as the *regional specialization coefficient* (Hoover and Giarratani (1985), pp 262-263).This is calculated using my own notation as follows:

$$CE_p = \frac{1}{2}\sum_{s=1}^{6}\left|\left(\frac{n_{sp}}{n_p}\right)-\left(\frac{N_s}{N}\right)\right|$$

Where s is the sectorial specialization by province (1 to 6 given that we have available six sectors, n_{sp} is provincial employment in sector s, n_p is total provincial employment, N_s is national employment in sector s and N is total national employment.

As a measure of specialization it takes values between 0 (minimum specialization) and 1 (maximum specialization). The specialization coefficient is depicted graphically below for five different provinces, Sevilla, Asturias, Baleares, Barcelona and Zaragoza:

Graph 6: Specialization coefficient for five provinces (1995-2008)



Source: own estimates based on INE, *Contabilidad Regional de España, base 2000*, serie homogénea, March 2011

Thus I consider the specialization coefficient to be a useful control or potential instrumental variable.

Whilst the foregoing variables are perhaps unusual, I thought that testing them would inject an investigative element into my estimation of a local provincial employment multiplier for Spain whilst maintaining features relating to provinces, tradable and non-tradable employment and the specific time period considered by my study.

6.3 Descriptive Statistics

The descriptive statistics for the variables used are shown in Tables 1 and 2 of Appendix A. Table 1 refers to the variables used in the estimation of the short-term multiplier covering a span of 13 years whilst Table 2 refers to those used in the estimation of the long-term multiplier over the two periods

1995-2001 and 2001-2007. Given that we do not observe any missing values or apparent anomalies in the descriptive statistics above, the data in principle appears to be correct and complete for my estimation purposes.

6.4 Methodology

Both multipliers were estimated using the model expressed in equation (11) above. It is worth mentioning at this stage that the use of differences in the study variables of interest, here the dependent variable non-tradable employment and the independent variable for tradable employment is to avoid problems of spurious regression caused by unit root, potentially present in non-stationary panels. These are normally detected when results yield very high R^2 values and require specific tests such as Pedroni or Likelihood-Based Cointegration Tests. It is almost certainly one of the reasons behind the use by Moretti and Faggio and Overman of differences as opposed to absolute values as this reduces the effect of cointegration between panels and for long time series. I have replicated their methodology to avoid this problem which is actually quite common with databases of the type used in this study.

In terms of this study the usual types of tests for collinearity were performed.

6.4.1 First step: Ordinary Least Squares

Equation (11) was estimated via ORDINARY LEAST SQUARES (OLS) using the programme GRETL. Panel data treatment was given to the data comprising for the estimation of the short-term multiplier 52 cross-Sectional units representing the 52 Spanish provinces and 13 time periods for the years 1995-2007(676 observations). The long-term multiplier was granted cross-sectional data treatment given that only two time periods (1995-2001 and 2001-2007) were necessary for its calculation. The fixed effects or random effects model used for the calculation of the short term multiplier under the next step is therefore inappropriate. Instead for the longer term model I opted for an OLS approach with the incorporation of two time dummies as controls in order to detect specific factors in the periods 1995- 2001 and 2001-2007 which could influence my estimates of the multiplier.

The methodology used was an initial OLS regression of the dependent variable NT (Non-tradable employment) against the independent variable T (Tradable employment). I then repeated the regression but this time including as regressors together with the independent variable T my control variables. The results are shown below in columns (1) and (2) of Tables 3 and 4 of Appendix A.

6.4.2 Second step: Fixed effects and Random Effects

Once the results had been obtained, I proceeded to perform two further regressions for the short-term (13 year model), one for fixed effects and the other for random effects using the same regressors as for the OLS estimation. A posteriori I performed the Hausman test in order to ascertain which of the models provided the most adequate results. Invariably, the test of Hausman resulted in the selection of the fixed effects model for the estimation of equation (11) for the short -term multiplier. The results are shown are again shown below in Table 3 column (3) of Appendix A.

6.4.3 Third step: Two stage Least Squares (2SLS) with Instrumental Variables (IV)

The methodology was already discussed under Section 5.3 above. As its name suggests the first stage involves performing a regression of T on the instrumental variables selected thus obtaining adjusted values. In the second stage Gretl runs a regression of the endogenous variable T on the instrumental variables as well as the adjusted values calculated for the stage one regression. The Gretl system yields automatic output and performs a Sargan test for over-identification of restrictions to validate the instrumental variables and accept the null hypothesis that the model is correctly specified. More precisely the hypothesis being tested with the Sargan test is that the instrumental variables are uncorrelated to some set of residuals, and therefore they are acceptable, healthy, instruments. If the null hypothesis is confirmed statistically (that is, not rejected my benchmark being a p statistic superior to 0.05), the instruments pass the test; they are valid by this criterion. The results are shown are shown below in Tables 3 and 4 of Appendix A.

Section 7 deals with my findings. At this stage it is worthwhile highlighting that I underwent a somewhat arduous task estimating numerous models for both the short-term and long-term employment multiplier. At the end of the day I adopted fairly simple control variables and decided to maintain for comparative purposes an almost identical set of regressors and the same instrumental variables. My decision to offer one multiplier model or another was based on the resultant Sargan test and a low LM value as well as criteria relating to the expected signs of the coefficients, their significance levels and overall explanatory power in terms of the model for the estimation of a local provincial employment multiplier.

7. RESULTS AND DISCUSSION

The results of the empirical work are presented in Tables 3-6 of Appendix A. For simplicity purposes and given the identical procedure adopted for the calculation of both the short-term and long-term local multipliers, I have decided to replicate the results in the steps already described in the previous section.

7.1 First step: Ordinary Least Squares Results

We observe from the regression for the short-term multiplier that the coefficient for tradable employment T is negative (-0.279) but statistically significant at the 1% level. Here the interpretation is that for every 100 jobs created in the tradable sector jobs 27.9 are lost in the non-tradable sector. Likewise for the long-term multiplier, the coefficient for tradable employment T also proved negative (-0.187) but this time statistically insignificant. At this early stage and in the absence of any regressor control variables this is acceptable but difficult to interpret.

As explained by Moretti (2010) the local multiplier for the tradable sector is usually smaller than the one for the non-tradable sector and potentially negative. This is because the increase in labour costs generated by an initial demand shock hurts local producers of tradables. This negative effect may in part be offset by those agglomeration externalities should they exist, thereby increasing the demand for intermediate inputs, if supply chains are localised. In the context of the shorter-term multiplier this makes a lot of sense and this is perhaps the reason why it is statistically significant as compared with its long-term equivalent.

I performed a second OLS regression but this time including as regressors my control variables. Various models were estimated using a variety of control variables and this being said, ones such as the quotient for specialization which I personally expected would yield interesting results did not, particularly when combined with other variables such as capital per job. I finally adopted three basic control variables to accompany my independent regressor T, namely capital per job, the location quotient for construction and population. The reasons for using these were already explained in the previous section. The results of the regression are presented under column (2) of Tables 3 and 4 of Appendix A.

For the short-term multiplier my independent variable T was again negative (-0.249) statistically significant at the 1% level but smaller in magnitude than in the OLS regression without controls. Likewise capital per job and population were statistically significant also at the 1% level with positive coefficients as was to be expected but extremely small in magnitude. The coefficient for the location quotient of construction was also positive as expected but statistically insignificant. It is worth mentioning that R-squared improved substantially, although in line with the Faggio and Overman (2010) I have been working with very low values throughout the study.

In the case of the long-term multiplier, again the coefficient for T was negative and statistically insignificant but like its short-term counterpart much smaller (-0.0348) and very close to zero. This signposted me that I was potentially on the way to obtaining a positive sign for the coefficient of T. In terms of the other variables, again capital per job and population proved statistically significant the former at the 1% level of significance and the latter at the 5% level but with very small positive effects. Again the R-square improved dramatically, albeit the low levels at which I was performing my estimations. As in the former case the location quotient for construction proved statistically insignificant and now marginally negative (-1.91). Overall the non-significance of the variable of interest T required further investigation.

The OLS regression for the long-term multiplier involved the regression of my independent variable T as well as my control variables, capital per job, population, the location quotient for construction and additionally the two time variables. The dependent variable remained statistically insignificant and negative with small values for the coefficients of capital per worker (significant at the 1% level) and population (significant at the 5% level).

7.2 Second step: Fixed effects Results

In the case of the short-term multiplier I decided to perform regressions for fixed effects and random effects models using the dependent variable NT, my independent variable T and my previous control regressors. My independent variable trade remained negative and increased in magnitude (-0.03542) and was again statistically significant at the 1% level as were my other control variables , capital per job, population and the location quotient for construction the former displaying a small positive coefficient and the latter two variables displaying relatively small negative coefficients i.e. signs opposed to those expected. The results are presented under columns (3) and (4) of Table 3.

7.3 Third step: Results of Two stage Least Squares (2SLS) with Instrumental Variables (IV)

Whilst my results have been tabulated in Tables 3 and 4 of Appendix A, I additionally show the results of my Gretl output for each multiplier in Tables 5 and 6. In both cases similar control variables were used capital per job, population and the location quotient for construction. The instrumental variables chosen in common to the estimation of both multipliers were the three variables relating to the location quotients for different levels of education, the specialization coefficient, population density, road infrastructures and the location quotient for non-market services all as defined in the foregoing text. The difference existed in that instrumental variables were used in the form of time dummies (12 for the short-term multiplier) and two for the long-term multiplier.

Using an almost identical model the Sargan test validated the use of the instrumental variables reporting a value of test statistic LM=1.52167 in the case of the short-term multiplier and LM = 0.192573 in the case of the long-term multiplier with p values of 0.677279 and 0.978779 respectively exceeding my 5% benchmark in both cases.

In the case of the short-term multiplier my independent variable trade yielded a positive coefficient of 1.1335 and in the case of the long-tern multiplier again a positive coefficient of 2.1138 both coinciding in statistical significance at the 5% level. Additionally the majority of my control variables proved statistically significant at different levels except for the specific case of capital per job in the long-term model. In both cases variables such as population, the location quotient displayed positive signs as was to be expected or at least desired. The results are visible under Tables 5 and 6 respectively.

To conclude this section, my efforts would appear to provide evidence of a positive short-term local multiplier for Spanish employment of 1.13335 meaning that the creation of one job in the tradable sector creates 1.13 jobs in the non-tradable sector. Likewise my estimates suggest that over a long-term period the local employment multiplier almost doubles with one job in the tradable or basic sector creating 2.1138 jobs in the non-tradable or non-basic sector. As already commented in the text excluding the preliminary work of Jofre et al (2014) in the public sector I have no basis for comparison although in realistic terms my estimates would appear reasonable. My title suggests preliminary evidence and further work must be taken and I must gain more econometric expertise to undertake it. This having been said I am pleased with my research and the results.

8. CONCLUDING REMARKS AND FURTHER RESEARCH

Local multipliers and more particularly those linked to employment cover a field of study encompassing various economic subject areas: regional and development economics; macroeconomics; labour economics and at its purest theoretical level advanced microeconomics. Richard F Kahn would undoubtedly be more than satisfied with the "multiplier effect" in terms of the research associated with his original idea which continues at a "greater than 1" pace more than 80 years after its publication.

Reflecting upon the work carried out in this paper and more precisely the extensive reading list self-inflicted for the purpose, I see many potential areas for research and wish to centre on an aspect which I perceive to be lacking to date.

Whilst the majority of the literature has been undertaken by eminent economists from some of the most prestigious international institutions, the study of local employment multipliers has invariably been restricted in the case of national multipliers to one particular country. Although in their conclusions authors inevitably make reference to the magnitude or nature of the country multiplier object of their research and draw international comparisons, methodological differences between studies (even those positive ones which incorporate improved measurement techniques or data treatment) fail to offer a degree of consistency for country comparisons. Whilst countries differ, basic macroeconomic statistics and indicators are available from institutions such as the World Bank and nearer to home Eurostat. Harnessing the data for several countries and applying a consistent across-the board uniform methodology would in the case of the estimation of local multipliers provide an improved basis of comparison rather than the array of "individualized" country studies which dominate the literature.

In the light of my foregoing and somewhat critical comments, the following studies come to mind: Firstly, a calculation similar to that conducted here using data for Spain and several other European countries but applying the same estimation technique to all. Additionally a dual estimation approach using both the shift-share and LQ approach would be interesting to observe the differences if any that could arise in the estimation of the Spanish local employment multiplier.

Secondly, in a similar spirit to the latter, a study of more recent members or potential entrants to the European Union (henceforth EU). Given the complexities of EU funding, state-aid and the allocation of the European budget which invariably receives criticism from recipients and non-recipients alike, monitorisation of economic zones on a regional and local basis is essential for policy-makers. Hence a look at multipliers for new and potential entrants may be an interesting area of research from an EU standpoint. I would also like to consider spatial econometric treatment, widely used of late for similar research but I am limited because although related closely to regional economics I am not familiar with the methodologies used.

Thirdly, and more easily applicable is the use of the current database to research the effect of immigrant workers in Spain on non-tradable employment given that for the period concerned and still today they play a reasonably important role in local (non-trade) services sectors. The study of Card (2007), already cited is an excellent model for replication. In this regard a closer study of skilled or unskilled workers and their impact on either the tradable or non-tradable sector may prove of interest.

Fourthly, a study of potential improvements or adjustments to data such as those required by the location approach and the other techniques mentioned in this study would prove interesting and useful given that as economists empirical work hinges to a great extent on the reliability of the data used.

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APPENDIX A

Table 1: Descriptive statistics for short-term multiplier

Summary Statistics, using the observations 1:01 - 52:13

Variable	Mean	Median	Minimum	Maximum
NT	2.67529	2.85336	-16.1573	22.8320
T	0.322020	0.292219	-7.49458	13.9695
Pop	795023.	529061.	61118.0	6.11210e+006
DiffPop	9179.92	2555.50	-4626.00	149562.
DenPop	273.812	57.7755	8.80121	5100.67
DiffDenPop	2.40050	0.320170	-16.5548	104.400
k_l	101283.	100736.	48210.5	158890.
Infrastructure	7549.98	6874.74	1148.32	19405.6
Qspecial	0.126822	0.120425	0.0294469	0.330199
LQH1	1.06532	1.03329	0.0878442	3.22686
LQH2	0.962003	0.964821	0.387573	1.47714
LQH3	0.884398	0.852786	0.355412	1.69418
LQConstruct	1.03673	1.00752	0.449086	2.05864
LQNMServices	1.03465	0.987388	0.530721	2.58310
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
NT	3.62824	1.35620	0.0920116	3.84164
T	1.69747	5.27131	0.753001	8.64624
Pop	984287.	1.23806	3.48702	13.0599
DiffPop	18954.9	2.06483	3.99122	19.7614
DenPop	819.602	2.99330	4.74312	21.7460
DiffDenPop	8.25062	3.43705	7.38847	65.3862
k_l	18025.4	0.177971	0.0876086	1.26534
Infrastructure	3764.31	0.498586	0.744791	0.0969346
Qspecial	0.0597384	0.471041	1.16545	1.86862
LQH1	0.309811	0.290814	1.15662	6.54801
LQH2	0.164834	0.171344	-0.109545	0.767031
LQH3	0.217888	0.246369	0.768526	1.11600
LQConstruct	0.240996	0.232458	0.646421	0.700822
LQNMServices	0.328478	0.317479	2.90530	10.4114
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
NT	-2.75014	7.90219	3.93573	0
T	-2.17183	2.92603	1.51209	0
Pop	91620.4	2.17095e+006	584543.	0
DiffPop	-1669.35	40315.0	10378.3	0
DenPop	11.8047	675.403	129.197	0
DiffDenPop	-0.215974	10.9869	1.48825	0
k_l	71943.2	136232.	18958.2	0
Infrastructure	2146.38	15359.4	4773.21	0
Qspecial	0.0480371	0.254399	0.0713305	0
LQH1	0.614465	1.59297	0.376447	0
LQH2	0.675553	1.25392	0.193641	0
LQH3	0.581917	1.26184	0.277618	0
LQConstruct	0.693888	1.48406	0.314035	0
LQNMServices	0.696434	1.34671	0.264394	0

Table 2: Descriptive statistics for long-term multiplier

Summary Statistics, using the observations 1:1 - 52:2

Variable	Mean	Median	Minimum	Maximum
NT	19.1461	18.6003	-15.4065	47.2541
T	2.38033	1.73827	-10.8968	15.6698
Pop	770283.	515703.	61118.0	5.35026e+006
DiffPop	52747.3	13918.5	-20960.0	761840.
DenPop	267.572	55.3107	8.80121	4939.82
DiffDenPop	13.7253	1.94220	-6.71318	382.177
k_l	99336.3	98205.0	48641.9	158890.
Infrastructure	7334.61	6881.61	1210.16	17064.2
Qspecial	0.126803	0.118340	0.0294469	0.322769
LQH1	1.08330	1.07196	0.238138	1.85731
LQH2	0.956035	0.953236	0.551577	1.47714
LQH3	0.890967	0.870924	0.491530	1.63215
LQConstruct	1.04513	1.04152	0.479673	1.67045
LQNMServices	1.02630	0.967335	0.600135	2.53930
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
NT	10.6733	0.557465	-0.132979	1.38824
T	4.52035	1.89904	0.548594	0.973379
Pop	946040.	1.22817	3.45106	12.6792
DiffPop	108386.	2.05482	3.95590	19.4681
DenPop	808.207	3.02053	4.73445	21.5980
DiffDenPop	42.9207	3.12711	6.70063	51.8509
k_l	19172.8	0.193009	0.131073	1.23894
Infrastructure	3588.68	0.489281	0.746864	0.173253
Qspecial	0.0583004	0.459770	1.17784	1.84979
LQH1	0.253777	0.234263	0.0600475	1.68249
LQH2	0.150978	0.157921	0.0400878	1.61036
LQH3	0.222448	0.249670	1.10521	1.61861
LQConstruct	0.232074	0.222054	0.374693	0.194658
LQNMServices	0.316625	0.308511	2.77106	10.1779
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
NT	1.53537	38.3260	12.2107	0
T	-4.29849	11.6624	4.76813	0
Pop	91237.0	2.18277e+006	562268.	0
DiffPop	-10357.0	247441.	62987.0	0
DenPop	11.6999	657.044	124.479	0
DiffDenPop	-1.23612	65.7637	8.32053	0
k_l	61746.8	133953.	19801.9	0
Infrastructure	2044.36	15456.2	4478.66	0
Qspecial	0.0520874	0.259134	0.0682004	0
LQH1	0.729275	1.47162	0.290755	0
LQH2	0.689946	1.16151	0.183374	0
LQH3	0.599637	1.38540	0.275934	0
LQConstruct	0.696968	1.50809	0.303795	0
	0.672528	1.36169	0.245897	0

Table 3. Results for the short-term multiplier.

	Pooled OLS		Fixed effects		IV
	(1)	(2)	(3)	(4)	(5)
Trade (T)	-0.2795***	-0.2492***	-0.29217***	-0.3542***	1.13335**
	(0.0816)	(0.0810)	(0.0830889)	(0.0786)	(0.5299)
Capital per job (k_l)		2.73e-05***		0.0001***	2.79e-05**
		(2.78e-05)		(2.32 e-05)	(1.42 e-05)
LQConstruct		0.3853		-3.43141***	3.6877***
		(0.5819)		(1.1829)	(1.1046)
Population (Pop)		3.09e-07**		-5.82e-06***	7.10e-07***
		(1.40e-07)		(1.80e-06)	(2.73 e-07)
Intercept	2.7653***	-0.6554	2.76938***	-4.1851	-7.2946***
	(0.1409)	(0.9167)	(0.138948)	(3.1240)	(2.0525)
Observations	676	676	676	676	676
R-square	0.0171	0.043443	0.118879	0.224062	0.009256
Sargan test					1.52167
					(0.6772)
Hausman test				40.8832	
				(0.0000)	

Dependent variable is NT

Standard errors in parenthesis.

***denotes significance at 1 percent level, ** denotes significance at 5 percent level, * denotes significance at 10 percent level

Table 4. Results for the long-term multiplier

	Pooled OLS			IV
	(1)	(2)	(3)	(4)
Trade (T)	-0.1876	-0.0348	-0.0324065	2.1138**
	(0. 2330)	(0.2106)	(0. 230829)	(1-02355)
Capital per job (k_l)		0.0002***	0.0002***	0.00019603
		(5.19e-05)	(5.19e-05)	(0.000131531)
LQConstruct		-1.91533	-1.90016	38.6941**
		(4.33701)	(4.3869)	(15.8344)
Population (Pop)		2.44e-06**	2.44e-06**	7.95702e-06***
		(1.02717e-06)	(1.03311e-06)	(3.00067 e-06)
Dummy t1			-0.062731	-7.45663*
Intercept	19.5925***	-2.8318	-2.82536	-48.1995**
	(1.18611)	(6.2690)	(6.30427)	(23.3607)
Observations	104	104	104	104
R-square	0.006310	0.203044	0.203052	0.040765
Sargan test				0.1926
				(0.9787)

Dependent variable is NT

Standard errors in parenthesis.

***denotes significance at 1 percent level, ** denotes significance at 5 percent level, * denotes significance at 10 percent level

Table 5. 2SLS Results for the short-term multiplier

Short-term Model: TSLS, using 676 observations
Dependent variable: NT
Instrumented: T k_l LQConstruct Pop
Instruments: const Infrastructure Qspecial DenPop LQH1 LQH2 LQH3 dt_1 dt_2 dt_3 dt_4 dt_5 dt_6 dt_7 dt_8 dt_9 dt_10 dt_11 dt_12 LQNMServices

	Coefficient	*Std. Error*	*z*	*p-value*	
const	-7.29455	2.05252	-3.5539	0.00038	***
T	1.13335	0.529829	2.1391	0.03243	**
k_l	2.78727e-05	1.42049e-05	1.9622	0.04974	**
LQConstruct	3.68769	1.10456	3.3386	0.00084	***
Pop	7.6982e-07	2.72939e-07	2.8205	0.00480	***
dt_1	1.22111	1.03889	1.1754	0.23983	
dt_2	1.82137	0.969882	1.8779	0.06039	*
dt_3	3.00956	1.01461	2.9662	0.00301	***
dt_4	1.59307	1.00096	1.5915	0.11149	
dt_5	3.32868	0.932904	3.5681	0.00036	***
dt_6	2.76052	0.873365	3.1608	0.00157	***
dt_7	1.59717	0.890572	1.7934	0.07291	*
dt_8	2.13669	0.898865	2.3771	0.01745	**
dt_9	2.35334	0.892707	2.6362	0.00838	***
dt_10	4.13146	0.837042	4.9358	<0.00001	***
dt_11	3.81531	0.853162	4.4720	<0.00001	***
dt_12	2.73868	0.86853	3.1532	0.00161	***

Mean dependent var	2.675291	S.D. dependent var	3.628242
Sum squared resid	11836.60	S.E. of regression	4.238095
R-squared	0.009256	Adjusted R-squared	-0.014798
F(16, 659)	3.948184	P-value(F)	3.61e-07

Hausman test -
Null hypothesis: OLS estimates are consistent
Asymptotic test statistic: Chi-square(4) = 40.8832
with p-value = 2.84171e-008

Sargan over-identification test -
Null hypothesis: all instruments are valid
Test statistic: LM = 1.52167
with p-value = P(Chi-square(3) > 1.52167) = 0.677279

Table 6. 2SLS Results for the Long-term multiplier

Long-term Model: TSLS, using 104 observations
Dependent variable: NT
Instrumented: T k_l LQConstruct Pop
Instruments: const LQNMServices dt_1 QSpecial DenPop
Infrastructure LQH1 LQH2 LQH3

	Coefficient	*Std. Error*	*z*	*p-value*	
const	-48.1995	23.3607	-2.0633	0.03909	**
T	2.1138	1.02355	2.0652	0.03891	**
k_l	0.00019603	0.000131531	1.4904	0.13613	
LQConstruct	38.6941	15.8344	2.4437	0.01454	**
Pop	7.95702e-06	3.00067e-06	2.6517	0.00801	***
dt_1	-7.45663	4.49862	-1.6575	0.09741	*

Mean dependent var	19.14606	S.D. dependent var	10.67326
Sum squared resid	24741.40	S.E. of regression	15.88909
R-squared	0.040765	Adjusted R-squared	-0.008175
F(5, 98)	5.494795	P-value(F)	0.000168

Hausman test -
Null hypothesis: OLS estimates are consistent
Asymptotic test statistic: Chi-square(4) = 47.68
with p-value = 1.10048e-009

Sargan over-identification test -
Null hypothesis: all instruments are valid
Test statistic: LM = 0.192573
with p-value = P(Chi-square(3) > 0.192573) = 0.978779