THE LOCAL GROSS VALUE ADDED (GVA) OF HEADQUARTERS. THE CASE OF MADRID (SPAIN)

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1. Introduction

Internationalization and growing integration of current economies, the mass dissemination of ICT and the current economic crisis, claiming the need to return to a path of recovery and economic growth, highlight the importance for a city like Madrid, the capacity of attraction of the central headquarters of the companies.

The dynamism of the capital in the past few decades, which has placed it third in the ranking of major European cities, would not be understood without considering that the capital is a major center of economic attraction, where their headquarters are located national and foreign enterprises. In previous regional studies, it has been estimated that around a third of the value added (GVA) gross of the community of Madrid and a quarter of employment could be linked to the provision of services of headquarters and regional economic activity might be underestimated about 7%[1] in the early 2000s. Since that time, the phenomenon of the establishment in new headquarters Madrid, not only has not stopped but that has even intensified.

The objective of the work presented here is to measure the real economic impact that has the concentration of headquarters in the capital of Spain.

2. Methodology and sources

The difficulty of measuring the services of headquarters is that these activities are not intended for sale but its use by the different departments of the company, so it only accounted for costs caused by the provision of these services. He is implicitly assumed, therefore, that these services have a null input value added. This implies that he underestimates in VAB in regions where is concentrated the activities of headquarters and overestimates the same in the locations of the remaining productive units of the companies. The methodological alternative to solve that problem parts of the assumption that wage differences observed between the various departments and locations of the company reflect productivity differences between them.

The fundamental idea of the methodology, designed and managed for the first time by Ayet and Sanz (2004) is to correct the average GVA per employee value by wage differentials corresponding to different departments and locations of the companies. Below are more details the methodology used and the information that has been used for its implementation.

2.1. Sources of information

As it will be later, the calculation of the VAB from wage differentials, it requires in addition the use of sources of statistical information, in different scope. In particular, the following information will be used:
- **National accounting and Regional Spain** (National Institute of statistics INE). This font will be used VABpm in current terms and total employment, in both cases, by sectors.

- **Municipal accounting** (Ayuntamiento de Madrid). This source comes from sectorial data from the VABpm in current terms and total employment in the capital.

- **Directory of economic units** (DUS). INE. This source comes from information on establishments in the city of Madrid (sector of activity, type of establishment, number of employees, activities,...).

- **Social security contribution accounts** (CCSS). The employment data in the community of Madrid and in the country as a whole, companies with an establishment in the capital are available from this source.

The above information has been completed with the obtained from a survey of a representative sample of companies with presence in the capital. The survey has allowed to achieve the following data, differentiating those which correspond to the city of Madrid, to the rest of the CM and the rest of Spain:

- **General information about the company**: field of activity, location of Headquarters, number of establishments.

- **Workers in different departments**: direction, Administration (accounting, financial, legal, human resources), technical services (engineering, architecture, computer science and r & d), commercial (marketing, advertising, Marketing and Central purchasing department), production, auxiliary production services (warehouse, transport,...) and other.

- **Personnel expenses** distributed according to the same areas of activity and territories that the previous section.

- **Accounting company data**, which enable to estimate its GVA: sales, purchases, variation in stocks (sales and purchases), staff costs, external services and other income management.

The selection of the sample[2] has been based on the assumption that smaller companies concentrate their activity in a single establishment. In particular, it has been assumed that enterprises with less than 40 employees carry out their activities in a single location, so that the value added services headquarters is properly reflected by official data[3].

2.2. Estimation procedure

**A GVA generated by the services of headquarters[4]**

Based on information from the questionnaire information has been grouped by CNAE codes which are the basis of classification R27 who manages the city of Madrid and the classification used to present Regional and national accounting of the INE. It has been necessary to define *ad hoc* classification in order to use data from different statistical sources.

Headquarters services from a double perspective have been considered:

- **Strict headquarters Central Services (SCE)**: direction + administration
Complementary headquarters Central Services (SCC): commercial and technical services

Services extended Central Headquarters (SCA) are all the previous ones. The remaining departments (production, auxiliary services of the production - storage, transport, etc.- and others) have been termed productive activities.

Her encueta has allowed to know data from employment and remuneration of individual departments or business areas, sectors and geographical location (Madrid, rest CM and rest Spain)

The steps followed to estimate the VAB’s headquarters have been the following:

• Firstly, the employment data of the sample, to the city of Madrid, have extrapolated for what has been the territorial distribution of employment obtained in the sample to the employment data of the Social security contribution accounts for Madrid.

The result is an array of employment estimated for each sector and each territory, matrix which can transform into another that reflects the territorial distribution of employment by sectors and territories, always assuming that only companies that exceed certain size have locations in various cities. The use of small enterprises is assigned in its entirety to the city of Madrid.

• Second, they have been corrected use of the Municipal accounting data to include employment linked to enterprises in Madrid but that it is located in the rest of the CM or in the rest of Spain. It, therefore, to estimate the total employment linked to companies located in Madrid, regardless of its location (Madrid, rest CM or the rest of Spain).

In this way are available to generate a series of vectors that reflect, by sectors, the total employment generated in any territory of the country by enterprises in the capital.

• Thirdly, total employment data are distributed by areas or departments of the company and territories. For this reason, uses the information of the staffing structure of the companies provided by the sample of companies analyzed.

Given that the survey does not provide information on the behavior of the businesses with less than 50 employees, it is assumed that your template is distributed similarly to do smaller companies included in the sample, i.e., from 40 to 250 employees. And since that it has been assumed that small businesses concentrated its activity on a single site, it makes no sense trying to distribute spatially generated employment.

• Fourth, corrects data from the VAB by employee calculated based on information of the Municipal accounting by the wage differences observed in the sample, with the goal of having an approximation to the VAB per employee generated in each of the areas of the company in each of the Territories concerned.

The methodology followed in this investigation, as it said, based on the developed by Ayet and Sanz (2004), based on the hypothesis that headquarters services are of high added value and, therefore, employees that are provided will have higher salaries. As
well, by applying wage differentials obtained for the sample to the VAB by employee according to the Municipal accounting, gets an approximation of what each employee brings to the company according to the functional area to which it belongs and the territory in which its establishment is located. From here, it’s this GVA per employee multiplied by estimated for such employment area in the companies in each sector of activity in Madrid.

Finally, the GVA generated by the different areas of the companies in each of the sectors defined in Madrid is calculated adding values for each area or Department. The difference between this VAB and which provides the Municipal accounting allows to estimate the undervaluation of the added value which involves the way that currently dealt with the calculation of the contribution of the headquarters to the municipal economy.

Similarly, the VAB generated in Madrid by each of the areas or departments can be approximated of enterprises in the capital and the GVA generated by the set of considered activities of Headquarters (in strict or broad sense).

The calculation of the GVA generated by the companies present in the capital, the rest of the CM and the rest of Spain, including the one generated by the services of headquarters is analogous to which has been described briefly to Madrid. I.e. it builds of GVA and employment of national and Regional accounts data and apply the coefficients that reflect the wage differences obtained from the survey.

**B. flows of imports and exports of services of headquarters**

The territorial distribution of workers in companies is not always homogeneous; often certain activities in some locations and others, are concentrated in different places. This is precisely the idea behind this work: Madrid concentrate business establishments associated with the activities of a central headquarters and the added value generated by these activities are underestimated since it is assumed that the net surplus of exploitation they generate is zero.

On the other hand, the services provided by the headquarters are used or consumed, in greater or lesser extent, by all its establishments. Therefore, if headquarters services are concentrated in a particular location and are consumed by the enterprise as a whole there is an export of services from the first location towards the second. The latter would be therefore, importing services of the first headquarters. Flows of X and M services of Headquarters between the establishments of the company, that they have an impact on regional economies and generate export region in what has been termed effect headquarters (Ayet and Sanz 2004) are established, therefore.

The estimation of the flow of X and M Services Headquarters in Madrid has been based on two assumptions relating to how they use or consume these services by the various establishments and areas of business. The first hypothesis takes up the idea that headquarters services that perform one or more establishments of enterprises, provided for the whole of the same; consumption of these services in each territory therefore assume that it is proportional to the total number of employees in the same. The part produced but not consumed is which is exported to the rest of the company facilities. It is understood that four
headquarters services defined, consumption and exchanges with other territories of the services of management and Administration (Headquarters in strict sense SCE services) can close in this way.

The second scenario is based on the idea that the headquarters make sense insofar as that support the productive activity of the company. This is particularly timely to estimate consumption and exchange of technical services and commercial complementary headquarters Central Services (SCC) between the various business establishments. He is accordingly, will mean that the consumption of services headquarters just mentioned, is determined by the productive activity in each of the establishments of the company.

Once computed the employment available in each of the areas of the company in each of the territories on which is installed and use consumed by each of the establishments, can calculate the value of exports and imports by multiplying the employment by the VAB figures per employee (for areas and territories) calculated in the previous section. As detailed in the annex headquarters services imports carried out by establishments located in Madrid are calculated by the value of the exports from the rest of the community of Madrid and the rest of Spain. The information available forces to consider only two territories Madrid and the rest of Spain.

3. Results obtained

According to the survey, shows that workers in Madrid enjoy average pay exceeding of the set of the country about 20%, difference which is explained by the differences in remuneration in the areas of management, commercial services, production and other activities. These differences, according to economic logic, would be the result of differences in productivity. This would mean that the productivity of labour in Madrid would be higher than in the rest of Spain, being more pronounced differences in the activities in which the capital is specialized are in the tertiary sector, particularly financial services. Services Headquarters in the strict sense are showing greater earnings (26.9% higher than the average pay) and, therefore, greater productivity.

It is precisely in these central services in which the capital presents a greater specialization compared to the rest of the region and the country. Thus, observed that in Madrid, 10% of employment corresponds to strict SC services and 20.8% to SC in the broad sense, against 6.3% and 11.3% of the total of Spain, which shows that companies with presence in Madrid tend to concentrate on her employment activities of SC (with higher productivity), while retailers in the rest of the region and the country concentrated to a greater extent the productive activity.

Companies with an establishment in Madrid generated throughout the country in 2008 a VAB slightly over 298,000 million euros, of which approximately 40% are generated in the capital, 5% in the rest of the region and 55% in the rest of Spain. Of the VAB, over 24% came from SC services broadly, being the capital location in which enterprises more concentrated activity of the departments that provide these services. Thus, the contribution of the SC to the VAB estimated for the city of Madrid is a very relevant percentage, both if they are defined in the strict sense (16.4%) as broad (31.6%), and superior to what you have in the rest of the region (6.7% and 17.2%) and in the rest of Spain (12.8% and 19.8%).
The departments whose contribution to the Madrid VAB is higher are administration, followed by commercial, technical services and address, although the differences between them are not important. There are large differences by sectors, although both among the industrial sectors like services, the VAB contributed by the SC in strict and broad sense is far superior in Madrid to the rest of Spain. In the case of the GVA of the SCE industry input in Madrid is 2.06 times altogether in the country the VAB (1.73 for the SCA) and in the case of services, the GVA of the SCE in the tertiary of Madrid is 1.13 times recorded in the rest of Spain (in the case of the SCA 1.32).

The application of the methodology outlined above and detailed in the annex indicates that the Municipal accounting could be undermining the VAB capital by almost 18% (17.417 million euros), due to the incorrect valuation of SC services, especially in the sector of services. In addition, the reestimación of the VAB involves changes in the sectoral distribution of the VAB.
on which is derived from the figures estimated by the own city: 10% would increase the participation of activities such as services to companies, financial services, trade and other services and would diminish the contribution of activities such as construction and some manufacturing sectors.

<table>
<thead>
<tr>
<th>Sectors</th>
<th>VAB Municipal accounting</th>
<th>Total estimated VAB for Madrid</th>
<th>Difference in % of the Municipal accounting VAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy and mining</td>
<td>2,21</td>
<td>2,11</td>
<td>12,7</td>
</tr>
<tr>
<td>Metals and metal products</td>
<td>0,26</td>
<td>0,14</td>
<td>-35,3</td>
</tr>
<tr>
<td>Industrial machinery</td>
<td>0,45</td>
<td>0,41</td>
<td>6,18</td>
</tr>
<tr>
<td>Material transport</td>
<td>0,79</td>
<td>0,74</td>
<td>9,53</td>
</tr>
<tr>
<td>Food</td>
<td>0,54</td>
<td>0,40</td>
<td>-12,81</td>
</tr>
<tr>
<td>Paper and graphic arts</td>
<td>2,32</td>
<td>2,12</td>
<td>7,6</td>
</tr>
<tr>
<td>Chemistry</td>
<td>0,62</td>
<td>0,41</td>
<td>-22,37</td>
</tr>
<tr>
<td>Non-metallic industries</td>
<td>0,28</td>
<td>0,23</td>
<td>-2,93</td>
</tr>
<tr>
<td>Other manufacturing</td>
<td>1,29</td>
<td>0,73</td>
<td>-33,27</td>
</tr>
<tr>
<td>Construction</td>
<td>10,18</td>
<td>8,46</td>
<td>-2,11</td>
</tr>
<tr>
<td>Trade</td>
<td>12,91</td>
<td>12,45</td>
<td>13,52</td>
</tr>
<tr>
<td>Catering</td>
<td>2,62</td>
<td>2,34</td>
<td>5,18</td>
</tr>
<tr>
<td>Transport and communications</td>
<td>14,11</td>
<td>12,24</td>
<td>2,2</td>
</tr>
<tr>
<td>Services to enterprises</td>
<td>26,94</td>
<td>32,05</td>
<td>40,08</td>
</tr>
<tr>
<td>Education</td>
<td>3,35</td>
<td>3,12</td>
<td>9,62</td>
</tr>
<tr>
<td>Health</td>
<td>3,59</td>
<td>2,57</td>
<td>-15,76</td>
</tr>
<tr>
<td>Financial services</td>
<td>10,91</td>
<td>12,93</td>
<td>39,64</td>
</tr>
<tr>
<td>Other services</td>
<td>6,64</td>
<td>6,56</td>
<td>16,45</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100,00</td>
<td>100,00</td>
<td>17,77</td>
</tr>
</tbody>
</table>

Source: Own elaboration

As idea force drawn from the estimation and the analysis can point out the need to take steps to correct the underestimation of the VAB occurring in economies that concentrate the headquarters of companies with several establishments. Realized estimate confirms the leading role that has the city of Madrid in the attraction of headquarters in the general context of Spain, in particular linked to the activities of management, although it cannot ignore that the bearing of the eGovernment services to the VAB of the capital is the larger.
The establishments with services of SC, both in the strict sense as broad, often provide their services to other economic units of the firm located in the same or in another town. Therefore, it can be said that establishing flows of export and imports between establishments of enterprises and, therefore, between the cities where there are services of SC and the rest of the territory. These flows can be measured in terms of employment and gva.

The capital, the analysis of the distribution of employment that carries out activities of SCA shows that more than 54 per cent is dedicated to meet the needs of these services which have establishments located outside Madrid. At the same time, employment in SCA was located outside the capital is consumed mainly in the same establishment (62%). I.e., companies with SCA services in the capital exported these services to the rest of the country to a greater extent that imports them from other Spanish locations. This has resulted to Madrid, a coverage rate of SCA services in terms of employment of 121%. Technical services (154%), followed by commercial and direction whose values slightly exceed the average values of the SCA is the Department with greater coverage.

The results obtained in terms of GVA of the services of SCA exchanged between different establishments go in the same direction. The GVA of SCA services is consumed in the capital by 44 per cent, while the remaining 56 per cent is used by the not Madrid establishments; by contrast, only 36% of GVA generated by services of SCA the same companies have outside the city, is intended to provide services to retailers in Madrid. The rate of coverage, in terms of GVA is 163%, significantly higher value to which corresponds to employment (121%) due to differences in the VAB by employee presented each of the analyzed departments. It should be noted that the rate of coverage is superior to 100 in all areas of activity qe are members of the SCA, registering the highest values in administration.

### Balance of the VAB in central services by areas, Madrid (millions of € and %)

<table>
<thead>
<tr>
<th>Area</th>
<th>Exported from Madrid</th>
<th>Imported by Madrid</th>
<th>Balance</th>
<th>% of the balance</th>
<th>Coverage</th>
<th>% X/VAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>34.129</td>
<td>25.314</td>
<td>8.815</td>
<td>11,1</td>
<td>134,8</td>
<td>40,7</td>
</tr>
<tr>
<td>Administration</td>
<td>62.088</td>
<td>25.280</td>
<td>36.807</td>
<td>46,5</td>
<td>245,6</td>
<td>58,2</td>
</tr>
<tr>
<td>S. technical</td>
<td>56.368</td>
<td>39.194</td>
<td>17.174</td>
<td>21,7</td>
<td>143,8</td>
<td>64,5</td>
</tr>
<tr>
<td>Commercial</td>
<td>53.051</td>
<td>36.668</td>
<td>16.383</td>
<td>20,7</td>
<td>144,7</td>
<td>59,9</td>
</tr>
<tr>
<td>Total</td>
<td>205.635</td>
<td>126.456</td>
<td>79.179</td>
<td>100</td>
<td>162,6</td>
<td>56,1</td>
</tr>
</tbody>
</table>

Source: Own elaboration

By sectors, the rate of coverage of exchanges of SCA industrial companies located in Madrid is approximately 300%, while that of construction companies does not reach 100%. More sectoral detail underscores the importance of the SCA services provided Madrid establishments related to the chemical industry and energy to the rest of the country. In both cases, more than 80% of SCA services generated in the capital are consumed out of it. This situation is repeated in some activities of the madrilenian tertiary sector, in particular financial services.

Therefore, it can be said that an Effect headquarters of clear positive sign, which would measure by the balance of trade in services of SC between the capital and the rest of the
country takes place in Madrid. Carried out estimation allows to quantify this effect around 7.1% of the GVA projected for Madrid in 2008. This effect is different from what you might call *Phenomenon headquarters*, which would make reference to the magnitude of the trade in services of SC between Madrid and the rest of Spain and that would measure by the sum of the flows of export and import of these services. According to the estimate made this phenomenon would have reached in 2008 some 33 billion euros, equivalent to 30% of the estimated for Madrid VAB and reflecting the importance economic etas activities in the city in which they are located.

4. Conclusions

Of the analysis noted the leading role of SC services such as generators of employment and GVA in the city of Madrid. Thus, 10% of the total employment of Madrid provides linked to SCE and activities almost 21 per cent to the SCA, compared to 6.3% and 11.3% which represents employment in these services in the rest of Spain. In terms of GVA, the provision of services of SC is 16.4 per cent if takes into account only the SC in the strict sense and 31.6% if you take into consideration the SC in the broad sense. This contribution is far superior to that of the rest of Spain (12.8% and 19.8% respectively) and comes to confirm the relative specialization of the capital in the provision of services of SC. Both in industrial activities and services, the specialization of the Madrilenian VAB in SC services is enhanced by the data.

Headquarters services generated in Madrid establishments are used largely by establishments located outside the capital, giving rise to what has been termed *Effect seat* and reached in 2008 to 7.1% of the GVA of Madrid.

The high relative presence of central services in Madrid, along with the fact that the national accounts, regional and municipal considers null in net operating surplus generated by services of SC, to be estimated by its costs for services provided by a part of the company as a whole, translates into two effects. The first was the underestimation of the GVA of Madrid around 18% which would be computing as VAB other Spanish locations. The second, changes in the sectorial distribution of the VAB on which emerges from figures in the accounting, increasing 10% participation in activities such as services to companies, financial services, trade and other services, and lowering the contribution of some manufacturing and construction.

The realization of the importance of the SC in the GVA and employment generation obliges national Governments / regional / local attention to actions that can reinforce the factors of attraction of their own economies. In this sense, they must be identified, taken and enhanced location factors highlighted by the companies. Pull factors that can range from the provision of infrastructures of transport, human capital and ICT infrastructures, the territorial concentration of political and economic power or international connections.

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Methodological annex

METHODOLOGY FOR THE CALCULATION OF THE GVA GENERATED BY THE SERVICES OF CENTRAL HEADQUARTERS IN MADRID

1.- Information from the survey:

Employment

\( E_{st}^s \) = employment in the area \( i \) and \( t \) for the sector \( s \) territory

\( E^s_i \) = employment \( i \), for the sector \( s \) total area

\( E^s_t \) = total employment territory \( t \), for the sector \( s \)

\( E^s \) = total employment sector \( s \)

\( E \) = total employment

\( e^s_{it} = \frac{E^{s}_{it}}{E^s} \)

\( e^s_i = \frac{E^s_i}{S^s} \)

\( e^s_t = \frac{E^s_t}{S^s} \)

The previous ratios are calculated for the different sections of size \( g \):

\( e^g_{it} \) and \( e^g_i \)(this matrix would be made by employment sections and is intended to see if the internal structure of enterprises differs with the size)

Remuneration

\( R_{st}^s \) = average in the area pay \( i \) and \( t \) for the sector \( s \) territory

\( R^s_i \) = remuneration average area \( i \), for the sector \( s \)

\( R^s_t \) = remuneration average territory \( t \), for the sector \( s \)

\( R^s \) = remuneration average sector \( s \)

\( R \) = average total remuneration

\( s^t \) = \( \frac{R^{st}}{R^s} \)

The previous ratios, by size of enterprises would be:

\( s^g \) = \( \frac{R^{st}}{R^s} \)

The problem of simultaneously using both sources is that there are many inconsistencies between the data. There are many cases in which the number of employees in the city of Madrid exceeds the CM and even the national total.

2.- Extrapolation of data from employment at the city of Madrid.

The distribution of the employment data of companies with establishment in Madrid is made from, from the employment data for enterprises of more than 49 employees, according to the accounts of quotation, corrected by the coefficients of territorial distribution of employment we have obtained in the survey \( (e^s_i = \frac{E^s_i}{S^s}) \).
In this way generate, an array with the data on the sectoral and territorial distribution of employment in the enterprises of more than 49 employees.

\[ S_{m}^{g} = \text{employment of enterprises of sector with more 49 employees in Madrid} \]
\[ s = \text{employment of enterprises of sector } s \text{ with more 49 employees in Spain (CCSS)} \]

The employment of enterprises of fewer than 50 employees (from the CCSS) in the capital attach in its entirety to the city of Madrid \((G_{m}^{sp})\) therefore, the total employment in the city of Madrid, of the companies in the sector \(s\) is:

\[ G_{m}^{s} = G_{m}^{sp} + G_{m}^{G} \]

Similarly the employment in the rest of the CM could calculate (using \(e_{cm}^{s}\)) and the rest of Spain (\(e_{re}^{s}\)).

From these calculations build an array with the data of total employment estimate for the city of Madrid \((m)\), the rest of the CM \((cm)\) and the rest of Spain \((re)\), by sectors.

<table>
<thead>
<tr>
<th>R27</th>
<th>Madrid</th>
<th>Rest CM</th>
<th>Spain</th>
<th>Total employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>(G_{m}^{2})</td>
<td>((G)_{cm}^{2})</td>
<td>(G_{re}^{2})</td>
<td>((G)_{e}^{2})</td>
</tr>
<tr>
<td>...</td>
<td>(G_{s}^{s})</td>
<td>((G)_{cm}^{s})</td>
<td>(G_{re}^{s})</td>
<td>((G)_{e}^{s})</td>
</tr>
<tr>
<td>Total</td>
<td>(G_{m})</td>
<td>((G)_{cm})</td>
<td>(G_{re})</td>
<td>(G_{e})</td>
</tr>
</tbody>
</table>

From the previous matrix, can generate the territorial distribution of employment in each sector \(g_{st}\), where \(g_{ts}^{s} = G_{t}^{s} / G_{s}\). (By doing this we can ensure that \(g_{sm}^{s} + g_{cm}^{s} + g_{re}^{s} = 1\))

<table>
<thead>
<tr>
<th>R27</th>
<th>Madrid</th>
<th>Rest CM</th>
<th>Spain</th>
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<tbody>
<tr>
<td>2</td>
<td>(g_{m}^{2})</td>
<td>((g)_{cm}^{2})</td>
<td>(g_{re}^{2})</td>
<td>((g)_{e}^{2})</td>
</tr>
<tr>
<td>...</td>
<td>(G_{s}^{s})</td>
<td>((g)_{cm}^{s})</td>
<td>(G_{re}^{s})</td>
<td>((g)_{e}^{s})</td>
</tr>
<tr>
<td>Total</td>
<td>(g_{m})</td>
<td>((g)_{cm})</td>
<td>(G_{re})</td>
<td>(g_{e})</td>
</tr>
</tbody>
</table>

3.- Estimation of employment linked to companies with establishments in the city of Madrid

The next step is to correct use of the Municipal accounting data, to add employment linked to the companies in Madrid, in the rest of the CM as in the rest of Spain.

\[ C_{m}^{s} = \text{employment in the sector } s \text{ in the city of Madrid (according to the Municipal accounting)} \]
\[ L^{s} = \text{use of the companies in the sector } s \text{ presence in Madrid in three regions considered, i.e., the capital, the rest of the CM and the rest of Spain} \]
\[ L^{s} = C_{m}^{s} + C_{cm}^{s} + C_{re}^{s} \]

\[ L = \sum s^ L^{s} \]

With what gender the following vector:
The distribution of this employment among large and small is made from the percentage of employment in enterprises of < 50 (generated from the data of the CCSS) employees. As it has been said, we accept that it's companies with a single establishment and, therefore, that this job is in Madrid.

$L^{sp} = L_m \cdot \% \text{ of employment in businesses with fewer than 50 employees (CCSS)}$

$L^{sg} = L^s - L^{sp}$

4.- Distribution of employment by areas of large enterprises

For each sector $s$, employment in the area $i$ of the big companies it estimate from the coefficients $e^s_i$ obtained from the sample.

$L^{sg} = L^{sg} \cdot e^s_i$

So we get the following matrix:

<table>
<thead>
<tr>
<th></th>
<th>Address</th>
<th>.... (I)</th>
<th>Production</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>$L^2_d^g$</td>
<td>$L^2_i^g$</td>
<td>$L^2_p^g$</td>
<td>$L^2_g$</td>
</tr>
<tr>
<td>...</td>
<td>$L^s_i^g$</td>
<td></td>
<td></td>
<td>$L^{sg}$</td>
</tr>
<tr>
<td>27</td>
<td>$L^{27}_d^g$</td>
<td>$L^{27}_i^g$</td>
<td>$L^{27}_p^g$</td>
<td>$L^{27}_g$</td>
</tr>
<tr>
<td>Total</td>
<td>$L^g_d$</td>
<td>$L^g_i$</td>
<td>$L^g_p$</td>
<td>$L^g$</td>
</tr>
</tbody>
</table>

5.- Distribution of estimated work of large enterprises by areas and territories

Employment estimated in the previous point should be shared between the various regions in which corresponding to each Department activities. To do this, we use the territorial distribution of employment of each sector ($e^s_i$).

$L^{sg} \cdot e^s_i = L^{sg} \cdot E^s_i / \bar{s}$

So for each sector $s$, generate an array like the following:

<table>
<thead>
<tr>
<th></th>
<th>Madrid</th>
<th>Rest CM</th>
<th>Rest Spain</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>$L^g \cdot e^s_m \cdot e_{dir,m}$</td>
<td>$L^g \cdot e^s_cm \cdot e_{dir,cm}$</td>
<td>$L^g \cdot e^s_re \cdot e_{dir, re}$</td>
<td>$L^{sg}_{dir}$</td>
</tr>
<tr>
<td>...</td>
<td>$L^S_i \cdot e^t_i \cdot e^t, t = L^S_i \cdot E^t / S$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>$L^{S\ prod, m} \cdot e^t_{prod, m}$</td>
<td>$L^{S\ prod, cm} \cdot e^t_{prod, cm}$</td>
<td>$L^{S\ prod, re} \cdot e^t_{prod, re}$</td>
<td>$L^{S\ prod}$</td>
</tr>
<tr>
<td>Total</td>
<td>$L^{S\ dir, m}$</td>
<td>$L^{S\ cm}$</td>
<td>$L^{S\ re}$</td>
<td>$L^{S}$</td>
</tr>
</tbody>
</table>

6.- Distribution of total estimated work (> and < 50 employees) areas and territories

From the sectoral employment corresponding to small businesses ($L^{ps}$), apply the $e^i$ corresponding to the sample companies that are smaller in size (50-250 employees), and $sp$, to calculate the distribution of employment in these enterprises, between the different areas or departments.

$L^{sp} = L^{sp \ **} and^{sp}$

This job, which we have been exclusively located in Madrid, more employment generated in the same areas and territories by large companies, determined the total employment by departments and territories (and obviously) by sectors. Therefore the matrix is as follows:

<table>
<thead>
<tr>
<th>Address</th>
<th>Madrid</th>
<th>Rest CM</th>
<th>Rest Spain</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$L^{S\ dir, m} + L^{sp \ dir}$</td>
<td>$L^{S\ dir, cm}$</td>
<td>$L^{S\ dir, re}$</td>
<td>$L^{S\ dir}$</td>
</tr>
<tr>
<td>...</td>
<td>$L^{S i, m}$</td>
<td>$L^{S i, cm}$</td>
<td>$L^{S i, re}$</td>
<td>$L^{S i}$</td>
</tr>
<tr>
<td>Production</td>
<td>$L^{S\ prod, m} + L^{sp \ prod}$</td>
<td>$L^{S\ prod, cm}$</td>
<td>$L^{S\ prod, re}$</td>
<td>$L^{S \ prod}$</td>
</tr>
<tr>
<td>Total</td>
<td>$L^{S\ dir, m}$</td>
<td>$L^{S\ cm}$</td>
<td>$L^{S\ re}$</td>
<td>$L^{S}$</td>
</tr>
</tbody>
</table>

Simplifying the content of the previous matrix, what I have is, for each sector $s$:

<table>
<thead>
<tr>
<th>Address</th>
<th>Madrid</th>
<th>Rest CM</th>
<th>Rest Spain</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$L^{S\ dir, m}$</td>
<td>$L^{S\ dir, cm}$</td>
<td>$L^{S\ dir, re}$</td>
<td>$L^{S\ dir}$</td>
</tr>
<tr>
<td>...</td>
<td>$L^{S i, m}$</td>
<td>$L^{S i, cm}$</td>
<td>$L^{S i, re}$</td>
<td>$L^{S i}$</td>
</tr>
</tbody>
</table>

7.- Estimation of the VAB in Madrid including the headquarters effect

The GVA of a sector (under the SEC methodology) estimate that have generated Services Headquarters. But when the company has several establishments distributed between various regions, it is necessary to identify the contribution to the VAB for those who perform the tasks of Headquarters. So, assume that services headquarters are of high added value and this fact will be reflected in pay differentials.
Available data:

– Know the survey:
  ○ $R_{it}^s$ = average pay per employee of the sector $s$ in each area $i$ and territory $t$
  ○ $R_i^s$ = average by sector $s$ employee remuneration
  ○ $s_{it}^d$ = $R_{it}^s$ / $R_i^s$ differential wages among those working in the area (I) with respect to the remuneration of media in the territory for the sector $s$ $t$

– Of the municipal accounting ($GVA_{sm}^s$) have the GVA and employment ($C_{sm}^s$), by what can be calculated as the GVA per employee:
  ○ $VAB_{C_{sm}^s} = \frac{VAB_{s_m}^s}{C_{sm}^s}$

The distribution of the GVA generated in Madrid by sectors $s$, between the different areas of the company $i$ will be:

$$VAB_{C_{i,m}} = \frac{VAB_{s,m}^s}{C_{sm}^s} \cdot d_{i,m}^s$$

where $d_{i,m}^s = \frac{R_{i,m}^s}{R_{sm}^s}$

The GVA generated by the activities $i$ of the companies in the sector $s$ in Madrid calculate it as:

$$VAB_{s,m}^s = VAB_{C_{i,m}} \cdot L_{i,m}^s$$

where $L_{i,m}^s$ is employment in the area $i$ in Madrid

The GVA generated in Madrid by the different areas of the companies in the sector $s$, will be:

$$VAB_{s_m}^s = \sum_i VAB_{s_i,m}^s$$

Comparing this VAB which provides the Municipal accounting we have part of the VAB which is not accounted for because it is assumed that this kind of activity does not bring VAB companies.

Similarly, we can calculate the VAB generated in Madrid services each of the business areas

$$VAB_{im} = \sum_s VAB_{s_i,m}^s$$

And the GVA generated by the set of activities from Headquarters (SC):

$$VAB_{sm}^{sc} = \sum_i VAB_{im}$$

8.- Estimation of the VAB by enterprises in Madrid, in the three territories

Similarly we can calculate the GVA generated by the companies in Madrid, in the rest of the CM and Spain, including the value generated by the services of Headquarters.

For the rest of the CM the GVA and employment so we get the difference between the data that provides the Regional accounting of Madrid and the Madrid Municipal accounting data.

Generate, therefore, $VAB_{s_{cm}}^s$ and $C_{cm}^s$.

The GVA per employee in the rest of the CM shall be:

$$\frac{VAB_{C_{cm}^s}}{C_{sm}^s} = \frac{VAB_{s_{cm}}^s}{C_{cm}^s}$$

The GVA per employee for the area $i$ will be:
The GVA generated by the area i of the companies in the sector s presence in the capital, the rest of the CM shall be:
\[ VAB^s_{i, cm} = \frac{VAB^s_{i, cm}}{C^s_{i, cm}} \]

The GVA generated in the rest of the CM for different areas of the companies in the sector s that have presence in Madrid, will be:
\[ VAB^s_{cm} = \Sigma_i VAB^s_{i, cm} \]

The estimate for the rest of Spain is identical:

- The rest of Spain VAB calculate it by difference between the national total and the CM and the same is done with the job. Thus generated VAB^s_{re} and C^s_{re}.
- The GVA per employee in the rest of Spain will be:
\[ VAB^s_{re} = \frac{VAB^s_{re}}{C^s_{re}} \]

The GVA per employee for the area i will be:
\[ VAB^s_{i, re} = \frac{VAB^s_{i, re}}{C^s_{i, re}} \]

The GVA generated by the area i of the companies in the sector s presence in the capital, in the rest of Spain will be:
\[ VAB^s_{i, re} = \frac{VAB^s_{i, re}}{C^s_{i, re}} \]

The GVA generated in the rest of Spain by the different areas of the companies in the sector s that have presence in Madrid, will be:
\[ VAB^s_{re} = \Sigma_i VAB^s_{i, c, re} \]

9. The flow of imports and import of services of headquarters estimation

Starting points:

- The VAB in central services of the businesses with less than 50 employees is eaten in the place where it generates. It therefore does not affect the flow of X and m.
- Establishments may be exporting and importing headquarters services simultaneously.
- To add areas, companies (and, consequently, the sectors) and can be simultaneously X M headquarters services.

Therefore, must calculate the difference between the VAB generated in each area i (i ∈ services of Headquarters, SC) and the consumed. If the difference is positive, the establishment is exporting services of SC and vice versa when the difference is negative.

Aggregating the values of X and of the M get flows X and M in each of the sectors.
Estimation procedure:

The fundamental point is the calculation of the difference between the employment in each area \( i \) (\( i \in SC \)) in each territory, particularly Madrid, and consumed employment. The use of large companies is relevant only (> 50 employees), as those of smaller size have supposed to have a single establishment.

1. Employment in each area \( i \) (\( i \in SC \)) in Madrid, \( L_{im}^{SG} \)

\[
S_{m}^{G} = 1 = L_{m}^{G} \cdot e_{m}^{G} = L_{i}^{G} \cdot e_{i}^{G} = L_{m}^{G} \cdot E_{m}^{G} / E_{i}^{G} \\
L_{im}^{G} = L_{m}^{G} \cdot E_{m}^{G} / E_{i}^{G} \\
\rightarrow L_{m}^{G} = L_{im}^{G} + s_{G}^{im} L + L_{ire}^{G} \\
L_{m}^{G} / L_{im}^{G} = L_{im}^{G} / L_{i}^{G} + L_{m}^{G} / L_{ire}^{G} / L_{im}^{G} L = 1 = \\
= L_{m}^{G} + s_{G}^{im} L + L_{ire}^{G} / s_{G}^{im} + s_{G}^{im} + s_{G}^{ire} + s_{G}^{ire}
\]

2. Consumed in each area \( i \) employment (\( i \in SC \)) in Madrid \( N_{im}^{SG} \)

For the calculation of employment in each area \( i \) consumed in Madrid (or other territory) assume that las activities of headquarters that is taking place in any establishment, they are suitable for all establishments of the company, according to the following criteria:

The SCE (management and Administration) are consumed in proportion to total employment and the SCC (commercial and technical services) on the basis of the distribution of work in the areas of production (\( i = 5-7 \))

Remember that available in Madrid by the area \( i \) employment (SC \( \in i \)) is:

\[
L_{im}^{G} = L_{i}^{G} \cdot e_{i}^{G} = L_{i}^{G} \cdot E_{i}^{G} / E_{i}^{G}
\]

Employment consumed areas of management and Administration will be:

\[
N_{dir, m}^{G} = L_{dir, m}^{G} \cdot e_{m}^{G} = L_{dir, m}^{G} \cdot E_{m}^{G} / E_{i}^{G} \\
N_{admon, m}^{G} = L_{admon, m}^{G} \cdot e_{m}^{G} = L_{admon, m}^{G} \cdot E_{m}^{G} / E_{i}^{G}
\]

Employment consumed areas of commercial and technical services will be:

\[
N_{com, m}^{G} = L_{com, m}^{G} \cdot e_{m}^{G} = L_{com, m}^{G} \cdot E_{m}^{G} / E_{i}^{G} \\
N_{stec, m}^{G} = L_{stec, m}^{G} \cdot e_{m}^{G} = L_{stec, m}^{G} \cdot E_{m}^{G} / E_{i}^{G}
\]

Therefore, exports (or imports, according to the sign) of the SCE (Dir and Admon) areas are:

\[
X_{dir, m}^{G} = VAB_{C, dir, m}^{G} \cdot (L_{dir, m}^{G} - L_{dir, m}^{G}) / E_{i}^{G} = \]

\[
VAB_{C, dir, m}^{G} \cdot (L_{dir, m}^{G} \cdot e_{m}^{G} \cdot (1 - e_{m}^{G})) = \]

\[
VAB_{dir, m}^{G} \cdot L_{dir, m}^{G} \cdot (1 - e_{m}^{G}) = \]

\[
X_{admon, m}^{G} = VAB_{C, admon, m}^{G} \cdot (L_{admon, m}^{G} - L_{admon, m}^{G}) / E_{i}^{G} = \]

\[
VAB_{C, admon, m}^{G} \cdot L_{admon, m}^{G} \cdot (1 - e_{m}^{G} = \]

\[
VAB_{admon, m}^{G} \cdot (1 - e_{m}^{G}) = \]
For its part, exports (or imports, according to the sign) of areas of SCC (Com and STec), calculated by analogy are:

\[ X^{s \text{com}, m} = \text{VAB}^{s \text{com}, m} (1 - e^{s \text{prod}, m}) \]

\[ X^{s \text{com}, m} = \text{VAB}^{s \text{com}, m} (1 - e^{s \text{prod}, m}) \]

Madrid imports of services of SCE and SCC are exports carried out by the rest of the CM and the rest of Spain. Therefore,

\[ M^{i, m} = (\text{VAB}^{i \text{cm}+} + \text{VAB}^{i \text{re}}) (1 (e^{s \text{cm}} + e^{s \text{re}})) = X^{s \text{i, cm+re}}, \text{when } i \in \text{SCE} \]

\[ M^{i, m} = (\text{VAB}^{i \text{cm}+} + \text{VAB}^{i \text{re}}) (1 (e^{s \text{prod, cm}} + e^{s \text{prod, re}})) = X^{s \text{i, cm+re}}, \text{when } i \in \text{SCC} \]

10. **Estimation of the effect based in the city of Madrid**

The difference between \(X\) and \(M\) headquarters services is what we call *effect headquarters* and measured services of this type (and the corresponding generation of VAB) making Madrid establishments for other territories and are not assigned to the capital.

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[2] The sample has been generated by the method of random sampling stratified without replacement, using data from the CCSS for companies that have some establishment in Madrid (information obtained from the DUE) and have in Spain as universe 50 or more employees. The survey went to a total of 1000 companies, having reached a slightly higher than 50% response rate.
[3] Initially, he worked with 50 employees threshold of selection among the companies that were deemed uni and multilocalizadas. However, at the time the survey found that part of the companies that previously exceeded this limit had been a strong fit of templates throughout 2008. For this reason, it was decided to reduce to 40 the number of employees below which it is considered that the company has a unique location. However, the selection of the sample, since that was done based on data prior to 2008, was made between the universe of companies with more than 50 employees.
[5] s = sector (superscript), = 1...(n); i = area or Department of the company (subindice) = 1... m, l = territory (subscript), M, CM (rest CM) and RE (Spain rest); sizes P = small businesses; G = large business; g = sections of employment (50-250,...) = 1…7

In uppercase variables in absolute values, lowercase, ratios.

[6] Previously must normalize these proportions: \(g^{sm} + g^{scm} + g^{sre} g = 1\) (by dividing by \(g^{sm}\))

\[ 1 + g^{scm} / g^{sm} + g^{sre} / g^{sm} + 1 / g \]. To not generate more variables, maintain the same nomenclature.

[7] I.e., the employment that carries out tasks that are used (eaten) by the same establishment that provides his service.