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"Task Trade and its determinants in Spain: a national and regional analysis"

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Abstract

Globalisation and technological advances have made possible to offshore specific productive tasks (that do not require physical proximity to the actual location of the work unit) to foreign countries where these are usually performed at lower costs. We analyse the effect of task trade (i.e. task offshorability) on Spanish regional and national employment levels correlating a newly built index of task-delocalisation index to key variables such as the region's wealth, the worker's age and level of education, the importance of the service sector and the technological level of the economic activities undertaken in that particular geographical area. We conclude that approximately 25% of Spanish occupations are potentially affected by task trade/offshoring and that this is likely to benefit Spanish economy (and the performance of specific regions, categories of workers and sectors) being Spain a potential recipient of tasks offshored from abroad. Also we obtain that Spain's trade in tasks correlates strongly with the above variables, presenting significant regional differences.

JEL classification: F14, F16, J23, J24, J62
Keywords: task trade, offshore, occupations, national/regional offshoring, tasks.

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1.- Introduction

Globalisation, one of the most widely studied phenomenon of recent years, has had a major social and economic impact, drastically changing the standard of living in various developing countries thanks to the fact that it has opened up foreign markets, while at the same time reshaping the relationship between the world's economic leaders and the less developed countries. One of the most evident changes in this new relationship between the two parties has been the shift of entire lines of production to plants located in the developing countries. This has had a great impact both on productivity differentials across economies as well as on the wages, employment and industrial structure of all countries.

The term globalisation is generally applied in describing the marked reduction in transportation and communication costs around the world. The former is typically invoked as the engine of the "first wave" or "first unbundling"[1] of this phenomenon and has driven the exploitation of scale economies in the production of goods. If before globalisation, production had to be localized in certain geographical regions or areas (given the impossibility or difficulties of moving goods, capital and workers), after globalisation this paradigm underwent a radical shift. Workers became keener to move and capital could be readily shifted from one region to another. Firms were then able to take advantage of scale economies by putting capital to work in regions where it was relatively more productive (and, so, they made gains from specialization effects) and by shifting production to locations where wage differentials allowed them to produce more at lower prices. Interestingly, the fall in trade and transportation costs led to a geographical clustering whereby certain regions (the developed countries, for example, of the early 19th century) became industrialized while others (the "south") were left with less productive sectors such as agriculture. In fact, as it is now clear, what we refer to as "globalisation" started long before the last few decades.

Krugman and Venables' (1995) seminal contribution outlined the process by which the countries of the "north" were able to exploit the benefits of the reduction in transportation costs (derived primarily from the development of inland waterways and railroads) and so initiate their industrialization process.

The first wave of industrialization also led to the agglomeration of technology. Arrow (1962), followed by the new growth theorists of Romer (1986) and Lucas (1988), explains how human capital became the

[1] See Baldwin (2006) for a fuller explanation of this terminology.

main driver of long-term economic growth. Thus, human capital clustered in the north, and these countries enhanced their economic performance (by way of a virtuous circle) at the expense of the non-industrialized south.

Crucially, the second wave of globalisation led to a dramatic drop in telecommunication costs as well as in the costs of transmitting ideas around the world.

Falling telecommunication costs greatly facilitated international trade in goods, services and, what concerns us here, in occupations, or "task trade". In recent years the number of studies, based on an array of methodologies, examining this trade in tasks and offshoring has increased enormously. Blinder (2006), Autor, *et al.* (2003), Bardhan and Kroll (2003) and Van Welsum and Reif (2005) are just some examples of papers that have proposed methodologies with which to analyse offshoring.

The papers by Autor *et al.* (2003) for the U.S. and Spitz-Oener (2006) for Germany apply a very high level of disaggregation of their survey data. This detail in the disaggregation allows them to classify the occupations/tasks performed by workers in simple categories based on the degree of cognitive effort. Based on this classification, they can then determine which tasks are most likely to be subject to offshoring, and which, by contrast, are more likely to remain within national boundaries.

Van Welsum and Reif (2005) identify four "offshorability attributes": (1) intensive use of ICTs, (2) an output that can be traded/ transmitted with the enablement of ICTs, (3) high-codifiable knowledge content, and (4) no face-to-face contact requirements. They find that working with data for professionals from various OECD countries, around 20% of those employed carry out a function that is potentially offshorable thanks to the rapid technological advances in ICTs and the increasing tradability of services. However, offshoring does not necessarily imply a reduction in employment in services. Many services have expanded, new ones have emerged and with the evolution in technology more are likely to be created. What's more, not all the trade in services is related to offshoring.

To undertake an applied study of offshoring a high level of data disaggregation is however required. Obtaining this information is by no means straightforward. Due to the lack of data, many studies of the Spanish economy examining offshoring assume that it is equal to the import of intermediate goods and services. Specifically, the papers of Minondo and Rubert (2001), Canals (2006), Gomez et al. (2006) and Díaz Mora et al. (2007) apply indicators of imported intermediate inputs using input-output tables. Other

studies, such as Cadarso et al. (2007), analyse the impact of offshoring on manufacturing employment. Fariñas and Martín-Marcos (2008) also analyse offshoring in the manufacturing sector, but draw their data from the Business Strategies Survey. They examine empirical evidence in support of the hypothesis that firms with higher productivity are those with the highest rates of international outsourcing.

Recent empirical literature is still very limited on this topic. A few execptions are the recent work by Lanz*et al.* (2012) looking at how offshorable and non-offshorable tasks tend to be performed together across occupations or that by Tomiura *et al.* (2012) analyzing the impact of offshoring on the workforce skill composition.

This scarce evidence, moreover, neglects the analysis of the possible differences across regions that might underpin the process of task trade and affect regions in an heterogeneous way. We insert in this literature with the novelty of studying task trade at the level of occupations (and of the tasks associated to them) and carry out the analysis at the national as well as regional level. Hence, we focus on how employment levels, and other individual characteristics such as education level, age, sex, are correlated to the share of employment in offshorable occupations and if this correlation persists over time in spite of the recent period of economic crisis. Specifically, we aim to (a) analyse the possibility of establishing a ranking of occupations in Spain and its regions based on their offshorability, (b) analyse the relationship between this offshorability index and potential explanatory variables, including gender, the worker's age and level of education, and the technological level of the economic sector; and (c) undertake the analysis for the Spanish regions to determine the degree of territorial homogeneity.

To do this, section 2 explains the concept and methodology used to calculate the level of task trade; section 3 presents the main descriptive results at the state and regional level; and Section 4 concludes.

2.- Methodology

One of the main goals of the current research, and one which also lies at the heart of studies of the task trade phenomenon in Spain and its regions, is the matching of the occupational categorization proposed by Blinder (2007) with the occupational data available for Spain.

Our first objective, therefore, is to be able to develop a ranking of the "offshorability" of Spanish occupations as a function of the offshorability of the tasks that need to be performed in each of the jobs

under review. Our assumption is the following: the work involved in each job (or occupation) can be broken down into the tasks that are performed as part of the worker's daily routine. These tasks have traditionally always been carried out by the worker entirely within his/her national boundaries but they could today just as easily be performed by other workers who do not reside in the country or region in which the final product is produced.

Hence, the general "degree of offshorability of an occupation/job" at the national (regional) level is defined by the extent to which each occupation might be fully (or partially) performed outside the national (regional) boundaries by a foreign worker. Depending on the specific tasks that have to be fulfilled by the worker, the occupation can be ranked as having a "high probability of being offshored" or as having a "medium (or null) probability of being offshored".

We begin by examining the empirical possibilities of building a similar occupational ranking to that proposed by Blinder (2007) for the U.S. In principle, the ranking built by Blinder (2007) depends on a data source that is not directly available for Spain. The data used by Blinder are drawn from the O*NET system, which serves as the US's primary source of occupational information, providing comprehensive information on key attributes and characteristics of workers and occupations. It is based on the Labour Department's Standard Occupational Classification (SOC).

The critical feature of the O*NET database is the very detailed definition of an occupation's characteristics that it is able to provide, classifying it into different areas of interest: (i) tasks, (ii) tools and technology, (iii) knowledge, (iv) skills, (v) work activity, (vi) work context, (vii) interests, (viii) work styles, (ix) work value, and (x) related occupation.

To the best of our knowledge equivalent data do not exist for Spanish occupations. This being the case, the "task analysis" we conduct here for Spain has to be an indirect one that makes, nevertheless, explicit use of Blinder's (2007) categorization. The assumption is that, similar jobs in different countries comprise similar "everyday" routines that are made up of similar tasks.

Based on this assumption, the first step in our analysis requires the matching of Spain's occupational ranking with that of the U.S.

The best data source available for undertaking such an occupational analysis is the EPA (Labour Force Survey) at the 3-digit level. This survey, however, follows the CNO-94 (National Occupational Classification) in providing definitions of the occupational categories. A direct comparison with the ranking proposed by Blinder (2007) is not immediately possible as the SOC classification does not provide a systematic match with the CNO-94. In what follows we try to overcome this issue and to provide an accurate match between Spanish and U.S. occupations.

One of the key features in our study, and one that represents an improvement on the analysis undertaken by Blinder (2007), is the fact that it considers the time dimension of the task trade phenomenon. This is possible due to the quarterly dimension of the EPA data. The data we use are those for the first quarter of the years 2000, 2008 and 2010. The year 2000 was chosen as a benchmark in order to test whether, during subsequent years, changes in the relative importance of specific occupations or jobs occurred. In other words, by comparing different time spans we are able, in principle, to determine whether the Spanish economy is actually moving towards an economic structure where occupations potentially affected by offshoring are increasing or if, instead, employment in the offshorable category is decreasing as a consequence of persistent outflow of tasks. Additionally, we can verify how the behaviour of the economic cycle affects task trade, given that 2008 might be considered the high point in the economy during the decade while by 2010 the effects of the crisis are fully visible.

It is important to note that in order to proceed with the matching of occupations in the Blinder ranking and the EPA classification, we need to compare the aggregate levels of the two systems of classification. In fact, we see that these differ considerably. In the Blinder Index (B-I) 291 occupations are listed and the following items are attached to each: (i) Rank, (ii) Offshorability index; (iii) Employment and (iv) Cumulative sum of employment. Of the four items we are only concerned with the first two for defining the offshorability index and identifying the category to which each occupation is to be assigned.

First, we sought to match the jobs listed in Blinder's occupational list with those included in the available dataset at the 3-digit level in the EPA. Matching was completed directly for those occupations that, beyond any reasonable doubt, could be attributed to the same occupational category in both systems. Based on the assumption that the same job involves reasonably similar tasks in both countries, we then attributed the same degree of offshorability to the Spanish occupation as that proposed by Blinder.

However, the numerical ranking proposed by Blinder differs to quite a marked degree from the one provided by the EPA for Spain. So, with the exception of the occupations that could be matched directly, all other occupations diverge both (i) in the numerical code attributed to them in the two classification systems and (ii) in the name or label attached to the job.

For this reason, we decided to adhere to Blinder's methodology and to re-run the classification applying our own critical judgment (where necessary) when ranking each of the remaining occupations according to their degree of offshorability. Thus, we carefully followed the Blinder's methodology steps whenever a direct match could not be found between the Spanish occupation and the U.S. job due to differences in the aggregation of occupations in the classification systems.

The first step involves determining whether the occupation has to be performed within the national boundaries. If the answer is "yes", then the occupation can be categorised as highly non-offshorable and given a rank score between 0 and 25 (on a scale from 0 to 100).

In the second step, if the occupation does not explicitly have to be performed within the national boundaries, then this means that it must to some degree be offshorable. Notice here, that the concept of offshorability works both ways. On the one hand, an occupation may be offshorable and then some of its tasks performed outside the national/regional boundaries, hence abroad. On the other hand, however, the same occupation (being defined as generally offshorable) can positively affect employment within the national/regional boundaries, if the country under scrutiny is a recipient of task trade. This may happen if, for instance, wages (and most generally the cost of labour per unit of product) in the country under examination are relatively lower (in that specific offshorable occupation) with respect to other countries abroad. If this is the case we would expect to see an increase in employment in offshorable occupations as results of the positive task trade balance.

The degree of offshorability is based on a subsequent question related to the "distance" between the worker and his or her place of work, that is, whether the worker has to be physically close to their work unit. A software engineer can, in principle, work some distance from her work unit (office) regardless of where her office is located (be it in Spain or in China, for example). If the answer to the question is "no", and the worker does not have to be physically close to her work unit (wherever this be located), then the occupation is categorised as "highly offshorable" and given a rank score between 76 and 100.

In the third step, then, it is necessary to fill the gaps and to determine the rank of offshorability for the remaining occupations. If the occupation requires the worker to stay physically close to the work unit, then the question is whether the "work unit" has to be entirely within Spanish borders. If the answer is "yes", then the occupation is considered "non-offshorable" since not all staff (or the headquarters) can be moved (at least without incurring very high costs) outside Spain or externalized. These occupations are given a rank score between 26 and 50. Thus, all the remaining occupations have to be given a score between 50 and 75, that is, they are classified as being "offshorable". As is clear, therefore, the actual process of matching each occupation to a potential offshorability index implies a certain degree of arbitrariness.

In order to compare the two methodologies (Blinder's and our own), we computed the percentage of occupations categorised in each level of offshorability. Given the results of the proposed ranking, we can simply count the proportion of occupations that falls within each category of offshorability as a percentage of the total number of occupations. The results (see Table 1) show that for the CNO-94 classification, more than 57% of occupations are categorised directly as "highly non offshorable" If we then consider the "non offshorable" category, the total percentage of occupations deemed not to be offshorable to varying degrees amounts to 73% of all occupations. In the classification used by Blinder (2007), occupations considered "highly non offshorable" account for 65.2%, which is higher than the number proposed by the CNO classification. But if we consider "highly non offshorable" and "non offshorable" occupations together the share is 74.3%, which is very similar to that obtained for the CNO-94.

The occupations considered "highly offshorable", on the other hand, represent almost 13% of all occupations in the CNO, while just over 14% are classified as "offshorable". This means that, if we follow the criteria proposed by Blinder, approximately 27% of the occupations of the EPA can be considered potentially offshorable. In Blinder's classification, the share of these two categories is slightly lower at 25.7%.

*Table 1. Offshorability occupational category according to the EPA and O * NET.*

Category	CNO-94		O*NET	
	Total Occupations.	% of all occupations	Total Occupations	% of all occupations
Highly Offshorable	27	12.7%	59	7.2%
Offshorable	30	14.2%	151	18.5%
Non Offshorable	34	16.0%	74	9.1%
Highly non Offshorable	121	57.1%	533	65.2%
All occupations*	212	100%	817	100%

* There are duplicate occupations based on aggregation. In the EPA to 3 digits are 207 occupations.

Source: Blinder (2006) and own.

It should be noted that these statistics do not correspond to the number of workers employed in each of the categories, but rather to the number of occupation types in each category of total occupations listed on the EPA to a 3-digit disaggregation. Therefore, these data, though interesting in themselves, tell us nothing about the extent to which the Spanish economy is exposed to the phenomenon of task trade. However, it is clear that our data present similarities with Blinder's classification for the U.S., and these similarities point to the accuracy of the proposed classification. These percentages - around 25% of offshorability - are also similar to those for countries other than Spain and the USA.

3.- Descriptive statistics

The EPA data provide some additional information about the educational level and other characteristics of those interviewed. Some variables are potentially interesting for the categorization of offshorability and for policymaking considerations: Gender, Age and Education. We cross this information for these aforementioned dimensions with the ranking of occupations in order to determine whether significant differences are experienced according to the age, gender and education of workers.

3.1 National level

Our analysis of the degree of offshorability of occupations in Spain was conducted with data for years 2000, 2008, and 2010. This allows us to verify the importance of this phenomenon in three different years and to analyse its evolution at distinct points in the business cycle (growth, 2000-2008 and recession, 2008-2010) over the employment levels in these categories.

Considering the four categories defined above, 1) highly offshorable, 2) offshorable, 3) non offshorable and 4) highly non offshorable, the results obtained for the whole of Spain (see Table 3) show that 24.3% of workers in 2010 performed their tasks in occupations that are affected by varying degrees of offshorability (categories 1 and 2), corresponding to 7.9% in the category of highly offshorable occupations and 16.4% in that of offshorable jobs. If we compare this figure with those recorded in 2000 and 2008, we find there has been a slight increase in the share of employment in offshorable occupations, attributable to the increase in employment of occupations classified as highly offshorable. By contrast, the relative importance of occupations unaffected by offshoring has fallen, most of this fall being attributable to occupations in the category of highly non offshorable, while non offshorable occupations have remained almost unchanged.

These variations can be explained in part by the increase in occupations that has occurred over the decade. Thus, between 2000 and 2010, highly offshorable occupations grew in number by 46.8%, while total employment growth is up just 19.4%. By contrast, highly non offshorable occupations grew by only 17.1%.

Table 2. Relative importance of employment in the offshoring categories. Spain.

	Year 2000	Year 2008	Year 2010	Growth 2000-2008	Growth 2008-2010	Growth 2000-2010
1. Highly offshorable	6.5%	7.4%	7.9%	52.2%	-3.5%	46.8%
2. Offshorable	16.5%	16.3%	16.4%	30.5%	-9.3%	18.4%
3. Non offshorable	10.6%	10.5%	10.6%	30.0%	-8.7%	18.7%
4. Highly non offshorable	66.4%	65.8%	65.1%	30.9%	-10.5%	17.1%
All	100%	100%	100%	32,1%	-9,6%	19,4%

The evolution that occurred between 2008 and 2010 provides additional knowledge about the effects of the recent economic downturn, which is affecting not only the evolution of employment but also its structure. Thus, one of the main effects of recessions of this kind is a reduction in employment, but the impact of this varies depending on the worker's profile and specific occupation. If we turn our attention to the crisis that unfolded between 2008 and 2010, it can be seen that there has been a 9.6% drop in employment. However, if we look at this in terms of categories of offshoring, it becomes evident that the occupations that are least affected by the crisis are those that are classed as highly offshorable with the least reduction in overall employment. Such jobs have fallen by just 3.5%, while employment in highly non offshorable occupation has fallen by 10.5%. In the intermediate categories (offshorable and non

offshorable occupations), the rate of employment has barely changed, recording similar falls, but not as great as overall employment.

Of interest to us here is the question as to whether the healthier employment trend presented by highly offshorable occupations has occurred only in the most recent years of crisis or whether the trend can be extended to stages of economic growth? Data from the last decade show that the evolution presented by the employment in highly offshorable occupations has been good both in the recent years of crisis and in the previous period, 2000 to 2008, when employment in highly offshorable occupations grew by 52.2% while total employment grew by 32.1%. However, in the period of crisis, the relative growth of highly offshorable occupations has increased the period of expansion.

This is a crucial and interesting result. If for some countries, the rise of task trade and of offshorable occupations can represent a problem, putting a lot of competitive pressure on national employment, in the case of the Spanish economy, this does not seem to happen. In fact, the opposite dynamics seems to take place, with the employment in potentially offshorable occupation rising the peak of the economic cycle and decreasing less than the average during the economic crisis. This result seems to suggest that Spain is a recipient of task trade rather than a "donor".

When we consider the workers by gender (see Table 3) we find, in relative terms, that offshorable occupations are more common among men than among women. In 2010, 30% of male workers were employed in occupations that present some degree of offshorability, while only 17.1% of women worked in such occupations. Few differences were found in this regard between the situations in 2000 and 2010. In both years, the percentage of men who held skilled jobs with some degree of offshorability was considerably higher than that of women. Nevertheless, between 2000 and 2010 there was a particularly marked increase in this kind of occupation being performed by women (69.7% in the case of highly offshorable occupations and 63.0% in that of offshorable jobs) as opposed to a much slower rate of growth among men (37.0 and 6.2% respectively). These results reflect the higher growth in total female employment (43.7%) compared to that of men (5.3%), while the new occupations created have been largely offshorable.

Table 3. Relative importance of the number of workers employed in the categories of offshoring by gender. Spain.

	2000		2008		2010		Growth 2000-2010	
	Men	Women	Men	Women	Men	Women	Men	Women
Highly offshorable	7.1%	5.3%	8.1%	6.5%	9.3%	6.2%	37.0%	69.7%
Offshorable	20.6%	9.6%	20.4%	10.7%	20.7%	10.9%	6.2%	63.0%
Non offshorable	7.9%	15.3%	7.8%	14.1%	8.1%	13.6%	8.5%	27.7%
Highly non offshorable	64.4%	69.8%	63.8%	68.6%	61.9%	69.3%	1.1%	42.5%
All	100%	100%	100%	100%	100%	100%	5,3%	43,7%

Several studies, including Van Welsum and Reif (2005), have attributed the growth in the number of occupations that are potentially offshorable to a number of causes. Among these, advances in technological and ICT services have led to an increase in occupations associated with higher educational requirements. Thus, workers with a medium or higher educational level tend to perform tasks with a greater degree of offshorabilty. To test this theory in the Spanish case, we calculated the number of workers in the different occupations differentiating according to four levels of education: 1) primary education or less, 2) secondary education - first stage, 3) secondary education - second stage and 4) higher education.

The results (see Table 4) show that the phenomenon of offshorability is most likely to affect workers with a higher level of education. In 2010, 37% of workers with higher education were employed in offshorable occupations. This percentage fell to 22% in the case of workers with the second stage of secondary education, 14.5% among those with the first stage of secondary education and 11.7% among those with only primary education or lower. Indeed the result confirms the idea that in order to perform tasks and jobs that can be considered as offshorable, workers need to be endowed with the sufficient human capital in order to exploit the possibilities proposed by new technologies. Many of the offshorable tasks, in fact, imply a heavy use of personal computer, internet, and more broadly, of knowledge that can be transferred through the use of newly developed Information and Communication Technologies (ICT). Non-offshorable occupations, instead, usually do not require high levels of human capital to be performed and only moderate knowledge of ICT.

Table 4. Relative importance of the number of workers employed in the various categories of offshoring by level of education. Spain.

	2000				2010			
	Ed. 1	Ed. 2	Ed. 3	Ed. 4	Ed. 1	Ed. 2	Ed. 3	Ed. 4
Highly offshorable	2.0%	3.0%	5.2%	14.9%	1.5%	2.0%	5.0%	16.3%
Offshorable	12.5%	14.1%	20.6%	19.9%	10.2%	12.5%	17.0%	20.7%
Non offshorable	3.5%	6.9%	17.5%	16.3%	3.1%	6.4%	12.5%	15.0%
Highly non offshorable	81.9%	76.0%	56.7%	48.8%	85.2%	79.2%	65.5%	48.1%
All	100%	100%	100%	100%	100%	100%	100%	100%

Note: Ed. 1: Primary education or less; Ed. 2: Secondary education - first stage; Ed. 3: Secondary education - second stage; Ed. 4: Higher education.

Table 5 shows that the number of occupations has grown more than proportionally for those workers with higher levels of education, and that this growth has been mainly in offshorable/highly offshorable tasks. The increased importance of offshorability for workers with higher educational levels is observable in each of the three years considered, although the rise is greater in 2010 with respect to the figures for the year 2000. This is due to the larger increase in occupations with some degree of offshorability. The growth in the number of tasks classified as highly offshorable or offshorable in this decade was 26.4%, while the growth in occupations classified as highly non offshorable or offshorable was 17.3%. These differences in employment growth by type of occupation are concentrated in workers with higher levels of education since they are the ones, in relative terms, who are most frequently employed in these occupations.

Table 5. Growth in the relative importance of the number of workers employed in the offshoring categories by level of education. Spain

	Growth 2000-2010				
	Ed. 1	Ed. 2	Ed. 3	Ed. 4	All
Highly offshorable	-57.6%	-22.3%	45.8%	70.5%	46.8%
Offshorable	-52.6%	4.2%	23.5%	62.3%	18.4%
Non offshorable	-49.4%	8.3%	7.4%	43.4%	18.7%
Highly non offshorable	-39.6%	22.2%	73.5%	53.9%	17.1%
All	-41.9%	17.4%	50.2%	56.3%	19.4%

Note: Ed. 1: Primary education or less; Ed. 2: Secondary education - first stage; Ed. 3: Secondary education - second stage; Ed. 4: Higher education.

Similarly, if we consider the age of the workers, additional conclusions can be drawn. To determine whether there are differences according to age, we calculated the number of workers in the different

occupations, distinguishing six age groups: from 16 to 25, 26 to 35, 36 to 45, 46 to 55, 56 to 65, and over the age of 65 years old (see Table 6).

Table 6. Relative importance of the number of workers employed in the categories of offshoring by age. Spain

	2000						2010					
	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
Highly offshorable	5.2%	7.8%	6.7%	5.8%	4.3%	7.8%	6.1%	10.3%	8.2%	6.2%	5.7%	11.0%
Offshorable	12.8%	16.4%	17.2%	18.4%	17.2%	20.4%	11.6%	15.7%	17.8%	16.3%	18.3%	19.1%
Non offshorable	9.3%	12.0%	11.6%	9.8%	7.1%	4.3%	8.5%	11.2%	10.7%	11.0%	9.2%	4.5%
Highly non offshorable	72.6%	63.9%	64.6%	66.0%	71.4%	67.4%	73.8%	62.8%	63.3%	66.5%	66.8%	65.4%
All	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Note: Age 1: from 16 to 25 years; Age 2: from 26 to 35; Age 3: from 36 to 45; Age 4: from 46 to 55; Age 5: from 56 to 65 and Age 6: over the age of 65.

The results indicate that workers under the age of 26 are employed in occupations that are less likely to be offshored than is the case of older workers. This result is recorded in all of the three years analysed. Similarly over this time period, workers aged over 65, and therefore those close to retirement, perform tasks that are largely offshorable. Thus, in 2010, 17.7% of workers under 26 are employed in occupations that have some degree of offshoring. This percentage increases to 26% among those aged 26-45, to 22.5% among those aged 46-55 years, to 24% for those aged 56-65 years and to 30% for those workers over the age of 65.

Table 7. Growth in the relative importance of the number of workers employed in the categories of offshoring by age. Spain

	Growth 2000-2010						
	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	All
Highly offshorable	-21.9%	47.0%	60.3%	52.7%	104.2%	111.0%	46.8%
Offshorable	-39.4%	6.4%	35.2%	26.7%	61.7%	41.3%	18.4%
Non offshorable	-38.5%	4.1%	21.2%	60.6%	95.7%	58.0%	18.7%
Highly non offshorable	-32.0%	9.3%	28.0%	43.6%	42.2%	46.5%	17.1%
All	-33.1%	11.2%	30.6%	42.7%	52.0%	51.0%	19.4%

Note: Age 1: from 16 to 25 years; Age 2: from 26 to 35; Age 3: from 36 to 45; Age 4: from 46 to 55; Age 5: from 56 to 65 and Age 6: over the age of 65.

The variation recorded between 2000 and 2010 is indicative of a marked growth (over 100%) in the number of highly offshorable tasks for workers over the age of 56. By contrast, the only age group in which there has been a fall in the number of highly offshorable occupations is that of workers aged between 16 and 25. However, it is worth noting that while in this age group there has been a decline in

employment for all categories, highly offshorable occupations is the category that has performed best, with a fall of 21.9%.

3.2 Regional Level

It is of interest to know whether the results obtained for task trade at the national level are confirmed also at the regional level. Spain, in this sense, is a good example, given the high level of self-government and the regional specialisation that is found both sectorally and in education. Table 8 shows that there are substantial differences in the importance of the phenomenon of task trade and offshoring across regions. Some, in fact, heavily depend on the employment in highly offshorable occupations, while others, instead, rely on more traditional and less offshorable types of jobs.

Table 8. Relative importance of the number of workers employed in the various categories of offshoring. Spanish Regions. Year 2010.

	Highly offshorable	Offshorable	Non offshorable	Highly non offshorable
Andalucía	6.0%	14.5%	9.3%	70.2%
Aragón	7.8%	16.7%	10.8%	64.8%
Asturias	6.9%	16.1%	10.3%	66.6%
Baleares	5.9%	14.6%	9.1%	70.4%
Canarias	4.8%	13.3%	9.3%	72.6%
Cantabria	6.3%	15.5%	9.6%	68.6%
Castilla-León	6.1%	16.6%	9.8%	67.5%
Castilla-La Mancha	5.4%	14.5%	9.0%	71.0%
Cataluña	9.1%	18.0%	10.9%	62.0%
Comunidad Valenciana	7.2%	16.5%	9.3%	67.0%
Extremadura	4.8%	13.8%	6.7%	74.6%
Galicia	7.0%	16.3%	9.7%	67.0%
Madrid	12.5%	18.6%	14.1%	54.8%
Murcia	4.7%	13.9%	7.1%	74.3%
Navarra	7.1%	16.8%	11.8%	64.2%
País Vasco	10.3%	17.0%	13.1%	59.6%
La Rioja	7.7%	17.9%	12.4%	62.1%
Ceuta y Melilla	6.8%	9.3%	10.8%	73.1%
Spain	7.9%	16.4%	10.6%	65.1%

The regions in which, in relative terms, there are more workers employed in occupations that are affected to some degree by offshoring (categories 1 and 2) are Madrid (31.1% of workers), País Vasco (27.3%), Cataluña (27.1%), La Rioja (25.6%) and Aragón (24.5%). However, other regions present figures at the opposite extreme, like Extremadura (18.7%), Murcia (18.6%), Islas Canarias (18.1%) and Ceuta and Melilla (16.1%).

Given these results, the question arises as to whether the differences between the relative importance of offshoring are related somehow to the level of per capita output or other variables of interest. To analyze this hypothesis, we calculated the correlation coefficient between the relative importance of employment in offshorable occupations and gross value added per capita in the years 2000, 2008 and 2010. The correlation coefficients take values of 0.78, 0.80 and 0.82, respectively, confirming the existence of a relationship between the level of gross value added per capita and the importance of offshoring (see Table 9). This is also a very interesting result. One should not infer a causal relation between the employment in offshorable occupations and regional economic performance (i.e. GDP levels) from a simple correlation index. This latter hints to the strong association between high productivity, on the one hand, and a certain types of economic structure on the other (i.e. that based on offshorable occupations which are fast growing in terms of employment level). To put it in other terms, richer regions are also employing larger shares of workers in offshorable occupations while, viceversa, regions which base their production on employment in more traditional and less offshorable occupations seem to be associated to lower GDP levels.

Table 9. Correlations of the offshorability index. Spanish Regions.

	2000	2008	2010
GVA per capita	0.78***	0.80***	0.82***
Employment in the industrial sector	0.30	0.34	0.48*
Employment in the service sector	0.34	0.14*	-0.02
Employment in the industrial sector. High and medium-high technology	0.52**	0.53**	0.75***
Employment in the industrial sector. High technology	0.74***	0.81***	0.57**
Total employment. High and medium-high technology	0.68***	0.81***	0.81***
Primary Education or less	-0.82***	-0.46*	-0.46*
Secondary Education. First stage	-0.10*	-0.61***	-0.67***
Secondary Education. Second stage	0.47*	0.49**	0.26
Higher Education	0.62***	0.62***	0.70***

Note: * significant at ten, ** five, *** one per cent.

In order to better investigate these dynamics we analyse whether the differences in the intensity of offshoring in the regions might be attributable to the relative importance of certain productive sectors (and which ones). In this case, we calculated the correlation coefficients between the index of offshorability and the relative importance of employment levels in several sectors. The results show that there is a significant correlation (at the 10% level in 2010) between the weight of employment in the industrial sector and the importance of offshoring and a very weak (non significant) correlation between offshoring and the weight of employment in the service sector. This said, however, we find a positive,

high and significant correlation between the importance of offshoring and the weight of employment in industries with medium and high technological content (a coefficient of 0.75 in 2010). Moreover, the correlation has increased over the three years analysed. This relationship is even stronger if we include all employment in medium and high technological sectors. In this case, the correlation coefficient for the year 2010, which is significant at the 1% level, is 0.81.

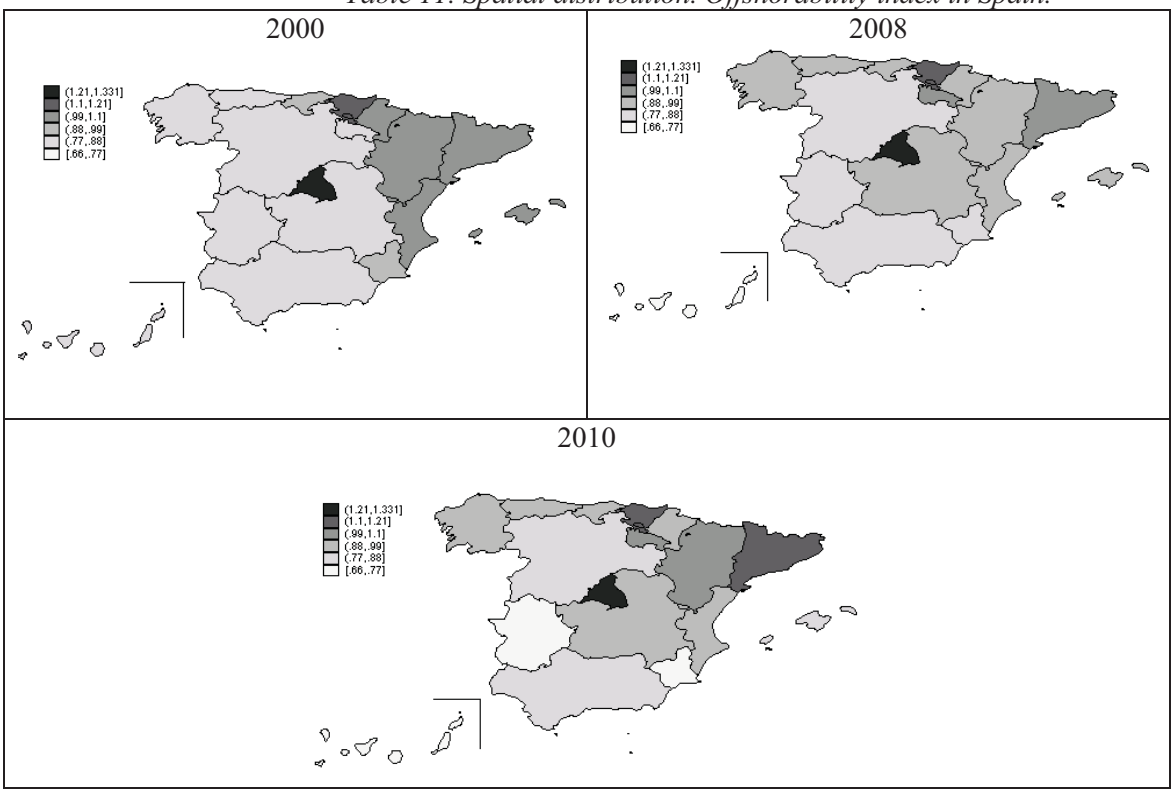
Several authors, including Blinder (2006), conclude that offshoring has a greater potential to affect workers with a high level of education. To check on this hypothesis in the case of the Spanish regions, we calculate the correlation coefficients between the importance of employment in offshorable occupations and the regional share of the population with given levels of education. The results obtained for 2010 (see Table 9) show a negative relationship between regional employment in offshorable occupations and primary education (significant at the 10% level) and the first stage of secondary education (significant at the 1% level). By contrast, a positive relationship (a coefficient of 0.7 in 2010) was found between the importance of offshoring and having a higher education (significant at the 1% level) as expected.

Table 10. Changes in offshoring. Spanish Regions.

	Highly offshorable and offshorable categories		
	2000	2008	2010
Andalucía	19.1%	20.1%	20.5%
Aragón	22.8%	23.2%	24.5%
Asturias	18.7%	22.6%	23.0%
Baleares	23.7%	21.4%	20.5%
Canarias	18.6%	17.6%	18.1%
Cantabria	20.5%	22.9%	21.8%
Castilla-León	20.0%	23.2%	22.7%
Castilla-La Mancha	18.8%	18.7%	19.9%
Cataluña	24.9%	25.7%	27.1%
Comunidad Valenciana	24.0%	21.9%	23.8%
Extremadura	18.9%	18.7%	18.7%
Galicia	19.8%	23.1%	23.3%
Madrid	29.6%	31.5%	31.1%
Murcia	21.4%	20.3%	18.6%
Navarra	24.4%	22.6%	23.9%
País Vasco	26.0%	26.7%	27.3%
La Rioja	18.5%	23.9%	25.6%
Ceuta y Melilla	19.7%	16.3%	16.1%
Spain	*23.0%*	*23.7%*	*24.3%*

Moreover, we find that in most regions there has been an increase in the importance of offshoring over the last decade (see Table 10). Thus, only in Islas Baleares, Valencia, Extremadura, Murcia and Navarra is the percentage number of workers employed in offshorable lower in 2010 than it was ten years earlier. The regions of Islas Baleares and Murcia record the largest reductions in the relative importance of offshoring. At the opposite extreme we find La Rioja and Asturias, which have recorded the largest increases. Thus, in La Rioja the percentage of workers performing tasks with some degree of offshorability has increased from 18.5 to 25.6%, while in Asturias it has grown from 18.7 to 23%. This evolution (towards a higher level of offshorability) is also captured in the maps in Table 11.

Table 11. Spatial distribution. Offshorability index in Spain.



The spatial distribution of the offshorability index of the Spanish regions presents significant changes over time. The maps in Table 11 show the results for the less restrictive definition i.e., that obtained by combining the offshorable and highly offshorable categories. Thus, in 2010, as previously discussed, it can be clearly seen that the richest regions (approximated by the gross value added per capita), namely, Madrid, Cataluña, La Rioja and the País Vasco, present the greatest degree of offshorability. By contrast, the poorest regions, including Murcia and Extremadura, present the lowest offshorability. This result is

not unexpected given the differences in the degree of technology present in each regional economy. It is more likely that the most advanced economies have a greater number proportionally of technically trained employees. This also implies that the penetration of ICTs is likely to be higher in certain regional markets leaving them more exposed to the possibility of task trade. These results are consistent with those obtained using correlation coefficients. Thus, we found a high correlation between the index of offshorability and the weight of the population with higher education and workers employed in tasks involving high and medium-high technology.

A further aspect to consider is whether the regions do specialise in occupations with different degrees of offshorability and how this relates to economic performance. To do this, we have studied the level of specialization of each region; thus, the closer the index value is to one, the greater the regional specialization in offshorable occupations.

We define the regional specialization index as:

$$RS_i = \frac{RW_{i\,of} / RW_{it}}{SW_{i\,of} / SW_{it}}$$

where $RW_{i\,of}$ is the number of workers in occupations offshorable in the region i, $RW_{i\,t}$ is the total number of workers in the region i, $SW_{i,of}$ is the number of workers in occupations offshorable in Spain and , $SWi_{\,t}$ is the total number of workers in Spain.

The results of the specialization index (see Table 12) show that by 2010 the regions of Madrid, Cataluña, País Vasco, La Rioja and Aragon are the only ones that are more specialized than Spain as a whole in occupations with some degree of offshoring (categories 1 and 2), with index values of 1.28, 1.12, 1.05 and 1.01 respectively. Ceuta and Melilla (index 0.66), Islas Canarias (0.74), Murcia (0.76) and Extremadura (0.77) lie at the opposite extreme. However, if we focus solely on tasks that are highly offshorable (category 1), only three regions (Madrid - 1.58, País Vasco - 1.3 and Catalonia - 1.15) present a greater specialization than Spain as a whole. Note that these regions are also ranked highest in terms of

the weight of workers in high and medium-high technology and gross value added per capita (see Table 10).

*Table 12. Offshorability. Specialization Index *. Spanish Regions. Year 2010*

	Highly offshorable (1)	Offshorable (2)	Highly offshorable and offshorable (1) and (2)
Andalucía	0.76	0.89	0.84
Aragón	0.98	1.02	1.01
Asturias	0.87	0.98	0.95
Baleares	0.74	0.89	0.84
Canarias	0.60	0.81	0.74
Cantabria	0.80	0.95	0.90
Castilla-León	0.77	1.01	0.93
Castilla-La Mancha	0.69	0.88	0.82
Cataluña	1.15	1.10	1.12
Comunidad Valenciana	0.91	1.01	0.98
Extremadura	0.61	0.84	0.77
Galicia	0.88	0.99	0.96
Madrid	1.58	1.14	1.28
Murcia	0.59	0.85	0.76
Navarra	0.89	1.03	0.98
País Vasco	1.30	1.04	1.12
La Rioja	0.97	1.09	1.05
Ceuta y Melilla	0.86	0.57	0.66
Spain	*1*	*1*	*1*

* Regional-occupational specialization index: higher (lower) value than 1 means that the region is comparatively more (less) specialized than the whole of Spain in the type of occupation.

4.- Conclusions

The old paradigm that international competition takes place at the sector level is being modified due to the existence of trade in tasks.

We have analysed the instruments available to measure the importance of task trade and we have assessed its potential impact in Spain and its regions. We have matched the occupations of the Spanish Classification (National Classification of Occupations, CNO-94) with the classification used by Blinder (2006). Following this methodology, we also devised a four-category classification of offshorability for data from Spain.

We have obtained results regarding the number of employees in Spain and all its regions that are affected by potential task trade and offshorability. The results show the importance of the phenomena of task trade

and offshorability, which potentially affects almost 25% of Spanish workers. This result, at the national level, is similar to that reported for other OECD countries. The relative share of workers potentially affected by offshoring represents a similar percentage to that found by other authors for other economies. Van Welsum and Reif (2005), for example, find that about a quarter of U.S. and EU-15 workers have jobs that can be potentially offshored.

Departing from previous contribution our analysis, conducted at the regional level, indicates that the percentage of employment in offshorable occupations can vary greatly from one region to another. For Spain we obtain figures that range form 16.1 or 18.1% to 27.3 or 31.1%, indicative of the extent to which the regions are affected by the sectoral distribution (specialization) of their economic activity.

Some additional results for Spain show that employment in offshorable occupations is more likely to affect male workers (although this gender gap has been narrowed in recent years). Moreover, our results show that, in relative terms, younger workers perform tasks that are less subject to offshoring, due, among other factors, to their lower educational level.

Using different descriptive analyses, we find that the region's wealth, the percentage of those with low levels of education, the percentage of workers employed at the sectoral level, and the technological activities required of the workers are all relevant variables when associated to the employment level in offshorable occupations.

The employment in offshorable occupations is hence both growing above the average (for Spain overall) and associated at the regional level to better economic performance indicators indicating that Spain is benefitting (rather than loosing) from the possibility that tasks can be traded within its national boundaries.

Interestingly, we can also conclude that workers with a high level of education are the ones most likely to be affected by offshorability. This result is similar to that obtained by Blinder (2006) for the USA. Similarly, offshoring seems most likely to affect specific tasks within the industrial and service sectors with high technological content, in which the results of the tasks can easily be moved while incurring relatively low costs. Moreover, the more traditional occupations, including those related to agriculture and textiles, in which the level of human capital required is lower, show little potential for being affected by offshoring. It is these results that are responsible for differences in levels of offshorability across

Spanish regions. In the light of this discussion, offshorability can be considered both a risk and an opportunity. This obviously points to the need for increased training policies so as to attract potentially offshorable activities (in areas such as services, R&D, design, etc.) from other countries. More offshorability means more competition, but to be able to face this challenge, what is required are better conditions for attracting high value-added activities.

As a result, policies to promote the knowledge economy, based on the enhancement of the educational level of workers, should be framed in a context of global competitiveness. In fact, many unskilled workers perform tasks that are, by their nature, fully protected from global competition. In this sense, it is much more likely that tasks such as those performed by the financial analyst will be exposed to the processes of offshorability than, for example, those performed by a taxi driver.

Our evidence from Spain for the period 2000-2010 suggests that the offshorable tasks that have grown most in number are related, in the main, to occupations that require a high level of training. An adequate level of human capital allows, hence, to exploit the potential gains coming from task trade in countries where wages are relatively lower.

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