



# Is the division of labour limited by the extent of the market? Evidence from French cities

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## ABSTRACT

This paper provides supportive evidence to the notion that the division of labour is limited by the extent of the (local) market. We first propose a theoretical model. Its main prediction is that scarce specialists occupations are over-represented in large cities. Using census data for French cities, we find strong empirical support for this prediction.

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## 1. Introduction

Cities offer considerable efficiency advantages for production. This empirical observation already figured prominently in Adam Smith's *Wealth of Nations* (1776) and in Alfred Marshall's *Principles* (1890). Modern econometric studies confirm it. A doubling of city workforce is generally acknowledged to increase output per worker by 2–8% (see Rosenthal and Strange, 2004, for a comprehensive survey). To explain this fact, Smith (1776) put forward one specific mechanism that builds on three propositions. First, there are some efficiency benefits to the division of labour. Second, the extent of the market limits the division of labour. Third, transportation efficiency determines the extent of the market, making cities the 'natural' markets where the division of labour takes place.

The division of labour is only one possible mechanism among many to account for the greater efficiency of cities (Duranton and Puga, 2004). Identifying the exact sources of urban increasing returns is important for both theory and policy. Theorists need empirical guidance regarding the relevance of their assumptions

and which mechanisms to investigate, whereas policy makers need to know which market failures must be addressed. In this paper, we take a step towards resolving this identification problem by providing evidence about the division of labour and its relation to city size using data for French cities in 1990. Our main result is that the division of labour strongly increases with city population.

Despite being a central tenet of economic analysis, there is remarkably little empirical work on the division of labour. The chief reason behind this paucity of work is that serious difficulties arise when attempting to measure the division of labour. Indeed, the idea behind the division of labour is that the production process can be finely divided into smaller 'tasks' as workers become more specialised. Investigating this is difficult. The range of procedures performed by, say, physicians has obviously little to do with the specialties of lawyers. Hence, a 'standard classification of tasks' would be hard to set up. Furthermore, collecting information from workers about the tasks they perform would obviously be costly. As a result, there are no systematic data on the tasks performed by large cross-sections of workers.

This said, it is no surprise that existing empirical work on the division of labour is scarce and tends to focus on particular industries: physicians in Baumgardner (1988a) or lawyers in Garicano and Hubbard (2009). These detailed case-study analyses are important because they circumvent the main measurement

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problem. They can precisely document the main determinants of the division of labour. Their results support the idea that the division of labour increases with the size of the market. However, the size of the market may not be the sole determinant of the division of labour (Becker and Murphy, 1992). In the case of lawyers, Garicano and Hubbard (2009) also highlight the importance of information and incentive problems. Even when their clients' requests do not correspond to their expertise, lawyers have an incentive to deal with them anyway since their clients are unlikely to know this.

The danger of case-studies is of course that such examples may not be representative of the wider economy and may offer a distorted perspective on the division of labour. An analysis covering the whole of manufacturing, or even better the whole economy, is needed. Our starting point is that, although there is no standard classification of tasks, in most countries there is a standard occupational classification (soc). At their finest level, these classifications usually define occupations according to job duties. We argue below that socs can provide useful information about the division of labour. The key difficulty with socs is that, except possibly for a few specific cases, their labels are not directly informative about how specialised occupations are.

To solve this conceptual problem and to guide our empirical analysis, we start by developing a simple model of the division of labour. In his famous description of the farmers in the Scottish Highlands, Adam Smith (1776, p. 122) notes that “*In the lone houses and very small villages which are scattered about in so desert a country as the Highlands of Scotland, every farmer must be a butcher, baker, and brewer for his own family.*” He also underscores (p. 121) that “*There are some sorts of industry, even of the lowest kind, which can be carried on nowhere but in a great town. A porter, for example, can find employment and subsistence in no other place.*”<sup>1</sup> Building on this insight, we assume that either generalists or specialists can perform any given task. The latter are more efficient but their labour is not divisible. In a small city, the demand for a task may not be enough to sustain a specialist and this task may then be produced by generalist labour. In an intermediate city, a higher level of demand makes it possible to sustain a discrete number of specialists while generalist labour produces the ‘remainder’ of the output. As cities get larger, the remainder produced by generalists represents an ever smaller fraction of the output.

In line with our theoretical model, the basic idea of our empirical test is to compare the distribution of workers across occupations and urban areas. We discuss and estimate a variety of specifications. Our preferred one is a logit approach. We test the null hypothesis that the division of labour is unrelated to city size against our model's prediction of a positive effect of city size on the probability of receiving scarcer specialist occupations. In conducting our test, we control for the fact that sectors are not equally represented in cities and that occupations are not evenly distributed across sectors using fixed-effects for each city-and-sector and for each occupation-and-sector.

Our analysis uses a large extract of the 1990 French census with more than 5 million observations. We have 111 three-digit French sectors, 360 urban areas grouped in seven size classes, and 454 occupations grouped in four scarcity quartiles in each sector. We strongly reject our null hypothesis in favour of the alternative hypothesis suggested by our model. The proportion of workers em-

ployed in the scarcest occupations (i.e., occupations in the first scarcity quartile) is 69% larger in Paris than in the smallest French cities.

As a theoretical contribution, our model relates to the small literature on the division of labour reviewed in Xiang and Ng (1998) and Duranton and Puga (2004). Following Baumgardner (1988b), a first strand of literature uses a framework with a continuum of tasks and labour specialisation can become ever more narrow as market size increases.<sup>2</sup> In this type of framework, the division of labour increases with market size in a smooth and continuous fashion. However, the positive effect of worker specialisation on productivity is directly assumed as a reduced-form and has not received strong micro-economic foundations.

Following Stigler (1951), a second (and less developed) strand of literature argues that larger markets allow plants to operate on average closer to their optimal scale. We develop an argument in the same spirit. A first difference is that we consider the production of tasks by workers instead of the production of goods by plants. The second difference with Stigler (1951) is that our argument relies ultimately on indivisibilities in workers' labour supply instead of plants' fixed costs.

This paucity of work on the division of labour as a source of increasing returns is in contrast with a well developed literature that provides microeconomic foundations for urban increasing returns using other features of the labour market. Helsley and Strange (1990) rely on a labour market thickness argument. More workers cause more firms to enter. In turn, this leads to better matches between workers and firms by reducing the distance between them in the skill space. The matching between firms and workers may also exhibit increasing returns when unemployed workers can apply to more vacancies in larger cities as in Coles and Smith (1998). Thicker labour markets can also reduce hold-up problems as in Matouschek and Robert-Nicoud (2005) or Helsley and Strange (2007). In turn, this increases efficiency by making workers invest more in their human capital.

As an empirical contribution looking at a large number of sectors, our work is to our knowledge unique. More generally, we are not aware of theoretically-informed empirical work focusing on the effect of the extent of the market on division of labour apart from the two case-studies already discussed above (Baumgardner, 1988a; Garicano and Hubbard, 2009).

Again, this lack of empirical work on the division of labour is in contrast with a rich literature that examines various aspects of local labour markets (see Moretti (2010), for a recent overview). Finally, it is also related to the body of work that describes differences in how economic activity is organised across cities (Duranton and Puga, 2001, 2005; Henderson, 1997; Holmes, 1999).

The rest of the paper proceeds as follows. The next section presents our theoretical framework and derives its key prediction. Section 3 presents our data and some basic descriptive evidence about the division of labour. Section 4 presents our estimation methods and our main results. Section 5 performs a series of robustness tests. Finally Section 6 concludes.

## 2. Theory

To motivate our empirical work, we consider a simple model of division of labour. In city  $i$ , the inverse-demand function for task  $k$  is

$$p_i^k = \tilde{z}_i^k - bQ_i^k, \quad (1)$$

<sup>1</sup> The 1983 feature movie *Local Hero* depicts a modern version of this. The main character is an oil-field buyer from Houston—arguably an occupation reflecting a high level of division of labour—who is sent to a small village on the Northern coast of Scotland where oil has been discovered. The first local he meets runs the sole hotel-restaurant singlehandedly. He is also the local accountant, village leader, and serves occasionally as taxi driver. As for the fisherman-pub-owner-baker, he asks somewhat incredulously to the American: “You only got one job?”

<sup>2</sup> An alternative (e.g., Michaels, 2010) is to assume complementarities across an unbounded range of tasks that lead to increasing returns, which are in turn mitigated by a need for co-ordination.

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