DOMESTIC TRADE AND MARKET SIZE IN LATE EIGHTEENTH CENTURY FRANCE[1]

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This paper checks if smaller domestic markets can explain the retardation of the Industrial Revolution in France compared to Britain. It uses an exceptional source on French domestic trade in a variety of goods in the late eighteenth century: the *Tableaux du Maximum*. The first part presents this source and the data. The second part checks if the data are plausible using a logit theoretical gravity equation. The third part uses the results of this gravity equation to compute the expected market size of specific supply centres. For all types of high value-to-weight goods, some French supply centres reached 25 million people or more. For all types of textile goods, some French supply centres reached 20 million people or more. Even taking into account differences in real, nominal and disposable income per capita, these supply centres had access to domestic markets that were at least as large as the whole of Britain. Differences in the size of foreign markets were too small to reverse that result.

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Introduction

Demand factors are not a popular answer to the perennial question of why was Britain first to experience an Industrial Revolution. Yet, growth models have shown that population and market size might be crucial variables to explain technical progress. That might because larger populations and larger markets multiply the number of ideas that may be productively combined, increase economic incentives for innovators and encourage division of labour, the payment of set-up costs, the formation of industrial districts conducive to agglomeration economies, or the rise of the factory.[3]

Yet, cross-country evidence does not show much correlation between population size and growth. However generous one might be in appraising French growth performances during the 18th and 19th century, no one would discuss that factories and technological innovation first took up in Britain; yet, British population was much smaller than French population (10 million versus 28 million in 1791).[4] A ready answer to that objection is that the population of nations is not relevant. If size intervenes through agglomeration effects, by increasing the potential reward to innovation or by allowing increased division of labour, one should look at the purchasing power of potential customers for specific production centres. This is the aim of this paper.

Domestic market integration was probably more imperfect in France than in Britain.[5] France certainly had higher trade costs than Britain due to smaller density, geography, internal institution barriers, and the limited development of new methods of distribution.[6] Yet, this paper shows that, despite these obstacles, some French production centres had access to domestic markets that were at least as large as Britain as a whole and had at least the same aggregate purchasing power. The measure of these markets is made possible by the "*Tableau du Maximum"* that were collected in 1794. They give information on trade links between 552 districts in France for fifteen different goods categories. There is no equivalent source for

[3] Kremer, "Population Growth", Galor, "Unified Growth Theory", Romer, "Endogenous Technological Change", Grossman and Helpman, *Innovation and growth*, Desmet and Parente, "Bigger is Better", Krugman, *Geography and Trade*, Murphy, Shleifer, and Vishny, "Income Distribution", Smith, *Wealth of Nations*, Yang and Ng, "Specialization and Division of Labour",

[4] Roehl, "French Industrialization". Crafts, "Exogenous or Endogenous Growth?" underlines the difficulty with the size argument (see p. 760).

[5] In the case of grain, see e.g. Chevet and Saint-Amour, "Marchés du blé".

[6] Szostak, *Role of transportation*. Yet, there had been some progress during the 18th century, as Meuvret, *Commerce des grains* (pp. 47-96) shows while examining the late 17th century situation. In general, market integration was growing with important effects: see Weir, "Crises économiques", Hoffman, *Growth in a traditional society*, Daudin, *Commerce et prospérité*.

Britain or other pre-modern economies.[7] They are more useful than grain prices to understand the Industrial Revolution, as they give specific information on textiles and hardware goods.

The usual proxy for potential market size is the sum of the size of accessible markets divided by trade costs.[8] We do not know enough on trade costs to compute this for the 18th century. This paper approximates potential market size by the sum of the size of markets that are being reached by a product. This measures the potential outlet for innovation that can be accessed without paying new set-up costs: building and maintaining trade routes, organizing regular transport services, finding trade partners and organizing the dissemination of information.[9] As such, it is a lower-bound estimate of potential market size.

The first part of the paper presents the source and the data. The second part checks if the data are plausible by comparing it to other sources and using a logit theoretical gravity equation. The third part uses the results of this gravity equation to compute expected market size for specific supply centres. Some French textile and high value-to-weight goods supply centres had access to domestic markets that were at least as large as the whole of Britain. The fourth part discusses these results, suggests that external markets probably did not make a large difference before 1792, and concludes.

1. Le Maximum

1.1. The laws of the *Maximum*[10]

The French Revolutionary government decided on 4 May 1793 to fight inflation by imposing a maximum price on grain and flour: *le Maximum des grains*. Departments (87 of them covered France then) were to impose an uniform maximum price throughout their territory. This legislation did not satisfy the government. Only output prices were capped: inflation in input prices went unchecked. The departments were too large and too heterogeneous to be submitted to a single price. As a result, on 29 September 1793, the French government decided to impose price ceilings on wages and 38 types of goods at the district level. There were 3 to 9 districts per department (see Map 1). This was called *le*

[7] It is comparable to the railroad transport databases developed from the late 19th century and used in Berry, "Spatial Structure" and Wolf, "Border effects".

[8] Harris, "Localization of Industry". Redding and Venables have shown that this can be derived from a theoretical economic geography model and that it has some explanatory power for cross-country income differences: Redding and Venables, "International Inequality".

[9] The importance of set-up costs explains the development of nodal points: see Lesger, *Amsterdam market*. The importance of these costs for contemporaneous international trade is more and more recognized: Bernard and Jensen, "Why Some Firms Export", Evenett and Venables, "Export Growth".

[10] For the presentation of the Maximum, see Le Roux, *Commerce intérieur*, p. 21-33 and Caron, *Maximum général*.

premier Maximum général. It still had the flaw that maximum prices were fixed according to the interest of each districts: like departments before them, districts that produced some goods fixed prices too high and districts that only consumed these goods fixed prices too low. This had to potential to block trade altogether.

The government quickly decided to solve that problem by setting up in November *le deuxième Maximum général.* This law might seem as the typical result of governmental hubris. It was trying to mimic the way the French government thought a market economy should work and has been called *une grande illusion libérale* by D. Margairaz for that reason.[11] To compute the "right" price, districts were to send to the *Bureau du Maximum* in Paris (part of the *Commission générale des subsistances*) a standardized list of all the goods they produced or imported from abroad, along with their price in 1790 increased by one-third. Based on these data, le *Bureau du Maximum* made in February 1794 a price list of all the goods produced or imported in France: the *Tableau général du Maximum*. This list was presented to the *Convention* on 23 February 1794 and then sent to all districts.[12] Districts were to use a standardized formula to compute the justified maximum price for each good "usually sold in their territory". The selling price was to be equal to the production or importation price, plus transport costs plus wholesale and retail trading profits of 15%.[13] Theses price lists (*Tableaux du Maximum*) were then to be sent to Paris within ten days; they arrived piecemeal throughout the spring and the summer 1794.[14] The law was abrogated in December 1794 and the data collection exercise remains unique.

Many goods, but not all, were subject to the *Maximum*. Grains were subject to their own *Maximum des grains*. Fresh fruits and vegetables, animals, shoes, furniture, earthenware… were not given maximum prices. Some districts added these goods to their *tableaux*, but they are the exception. Silk was initially part of that list, but was dropped in spring 1794 as the government decided that, being a luxury good, it did not warrant price controls. The initial list of twenty goods categories officially included is given in Table 1. The included goods represented more than two third of French industrial value-added, along with a sizeable part of agricultural value-added.[15]

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[11] Margairaz, "Maximum".
[12] This list looks like a large A5 paperback. There are two copies in the Archives Nationales: A. N. AD/XI/75 and AD/XVIII/C/315. Reproductions are available from the author.
[13] Transport costs were to be, for one quintal and one league: 4 *sous* on main roads, 4 *sous* 6 *deniers* on other roads, 2 *sous* up a river, 9 *deniers* down a river and 1 *sol* 9 *deniers* on a canal. See Le Roux, *Commerce intérieur*, p. 243-293.
[14] Ibid., p. 46, quoting Lefebvre, *Études orléannaises*, p. 306.
[15] Daudin, *Commerce et prospérité*, p. 39, 439-459.

These categories are not completely coherent. For example, raw cotton is part of *épiceries et drogueries* while raw wool or linen are aggregated with wool and linen cloths. Alcohols are part of *épiceries et drogueries* rather than drinks. However, these categories have the advantage of consistency: nearly all districts followed them to set up their *Tableau du Maximum*.

Table 1: Goods categories

Official categories	Thomas Le Roux's categories (see infra)
1- Fresh and salted meat and fish	1- Food items
2- Dried vegetables	
3- Products from living animals	
4- Drinks	2- Drinks
5- "*Épiceries et drogueries"*, including consumption goods (vinegar, honey…), first necessity goods (candles…), inputs to industries (tinctorial products…)	3- Miscellaneous consumption goods
	4- Miscellaneous production goods
6- Wool and wool cloth	5- Wool and wool cloth
7- Hemp and ropes	6- Linen and hemp
8- Linen thread and ribbon	
9 – Linen cloths	
10- Cotton threads and cloths	7- Cotton
11- Hosiery	8- Hosiery
12- National and foreign silks	9- Silks
13- Leather and hides	10- Leather products, hides and hats
14- Common and fine hats	
15- Paper	11- Paper
16- Iron	12- Iron
17- Hardware	13 – Hardware
18- Wood for industry (shook, white cooperage…)	14 – Wood for industry
19- Fire wood	15 – Fuel
20- Coal	

1.2. The *Tableaux du Maximum*[16]

Most districts complied and sent to Paris at least some documents. But not all of them listed all the nineteenth categories of goods required by the law. Table 2 gives the inventory of the *Tableaux du Maximum* in the *Archives Nationales,* based on Le Roux's work.[17]

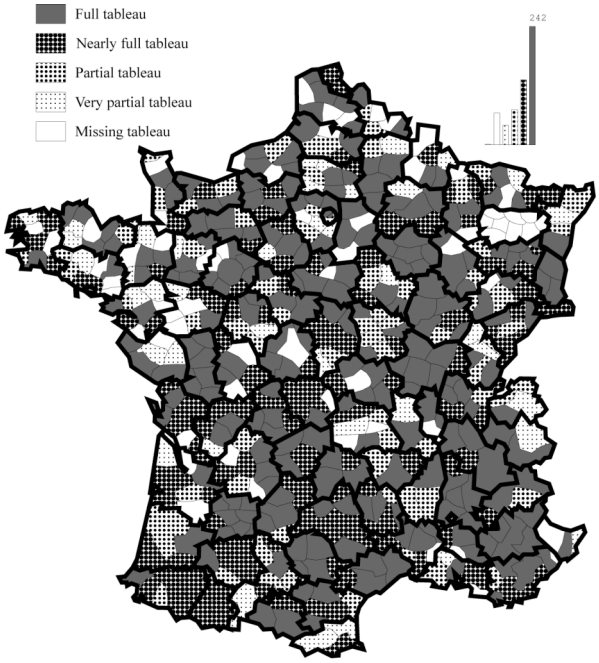
Table 2: Available *Tableaux du maximum*

Full tableaux (listing all goods categories)	242	44%
Nearly full tableaux (missing one or two minor goods category – paper, fuel…)	133	24%
Partial tableaux	72	13%
Very partial tableaux (listing very few product categories)	40	7%
Missing tableaux (no information)	65	12%
Total	552[18]	100%

Map 1 shows the geographical coverage of the *tableaux* that can be consulted in Paris.

[16] See Le Roux, *Commerce intérieur*, p. 35-73.
[17] Ibid., p. 41 along with personal research. The tableaux are to be found in the *Archives Nationales* $F^{12}1516$ to $F^{12}1544^{52}$.
[18] Including Montélimart. Even though it was not annexed to France before 1798, some other districts give it as a supply source.

Map 1: *Tableaux du Maximum* in the *Archives Nationales*



Fait avec Philcarto - http://perso.club-internet.fr/philgeo

Apart from the Meurthe department – which *tableaux* are completely missing – and the Pyrennées Orientales department – where only one nearly complete *tableau* can be found – at least one full tableau from each department is in the *Archives Nationale.* This source gives a good geographical coverage of France.

The *tableaux* are physically very diverse: from small books to large posters, printed or hand-written, from a handful of pages to more than three hundred. Yet most of them provide eight columns with the information requested by the law plus miscellaneous comments. Table 3 presents the content of the *tableaux.* Picture 1 gives the first page of a *tableau* for illustration.

Table 3: Content of the *Tableaux du Maximum*

The list of goods "usually consumed" in their territory	Where each good came from	The four thirds of their production or importation price in 1790	Distance over which they had to be transported	Transport costs	Price including authorized wholesale profits (5% of the price including transport costs)	Price including authorized retail profits (10% of the price including transport costs).	Comments (often the price of a smaller amount of goods than the one used for the computation)

Picture 1: First page of Lusignan's (Vienne) *Tableau du Maximum*

DÉPARTEMENT
DE LA VIENNE.

DISTRICT DE LUSIGNAN.

TABLEAU

Du Maximum des Denrées & Marchandises qui se consomment ordinairement dans l'étendue du District de Lusignan.

The information given by the *tableaux* does not correspond to the situation of France during the spring of 1794. Initial price lists were supposed to give prices from 1790. Districts were supposed to list goods that were "usually" (*usuellement*) consumed in their district. That was presumable understood as goods consumed before the economic troubles that accompanied the Revolution: the whole point of the exercise was to go back to the *status quo ante*, before inflation and trade disruption.

1.3. The collected data

Historians have long been quite pessimistic about the value of the *tableaux*.[19] Certainly, the prices they list should be treated with caution. Computation errors and typos are probably numerous,[20] transport cost computations partly arbitrary (even if a formula was imposed by the law, it was not easy to compute gross weight and to take into account the exact route taken) and the production prices doubtful. However, even if one leaves prices aside, these documents provide an impressive list of the origin of goods consumed in many districts in France. As such, they allow the mapping of extensive supply areas per goods categories.

Thomas Le Roux wrote a wholly remarkable book on the subject based on his Master's thesis under Dominique Margairaz and Denis Woronoff.[21] He collected a large amount of

[19] Margairaz, "Dénivellation des prix".
[20] Lefebvre, *Études orléannaises*, p. 306.
[21] Le Roux, *Commerce intérieur*.

data, most notably the list of districts supplying 62 districts in 14 goods categories (silk excluded). These 14 categories are based on the official 20 categories, some having been merged because they presented a very limited number of items (see Table 1). For each district in these 62 districts, he has drawn up a map giving the number of goods categories supplied by each French district. According to him, the beginnings of a national market can be seen in the large area surrounding Paris, but France was divided into four different markets, two of them being dynamic (around Paris and the Rhône river) and two of them being archaic (the French maritime periphery and the South-West).[22]

His conclusions stem from the qualitative examination his cartographic evidence and could probably be refined wit a quantitative examination of the evidence. Furthermore, market analysis actually needs to be good specific in order to take into account the differences in transport and marketing costs for different goods categories. This paper's method is hence quite different from Thomas Le Roux's.

Furthermore, more data have been collected from the archives. The *tableaux* of each district provide lists of goods consumed in the district along with their origin. Let us define the "supply area" of a district in a specific good as the list of districts mentioned at least once as supplying it in its *tableau.* I did not record the number of times each district was mentioned, as that would have been a very imperfect quantitative measure of trade flows anyway. The data are qualitative, and are coded simply with zeros and ones.

The supply area of one district per department has been collected – except Meurthe and Corsica, which lists are unavailable. Each district was chosen at random among the full *tableaux* of each department, excluding the ones already studied by Thomas Le Roux when possible. For Pyrénées Orientales, the most complete *tableau*, Céret's one, was selected. Districts for which the supply areas have been collected are called "consuming districts". Districts that supply at least one "consuming district" are called "supplying districts". Because all consuming districts supplied themselves with some goods, all consuming districts are also supplying districts.

The collected data give goods category specific information for 7 of Thomas le Roux's districts and 81 others, for a total of 88 consuming districts. 439 additional supplying districts supplied these 88: there are only 25 districts which consumption has not been studied and which did not supply any of the 88 districts. Map 2 represents the sample. Table 4 describes the database and the information it contains.

[22] Ibid., pp. 289-293.

Map 2: Sample

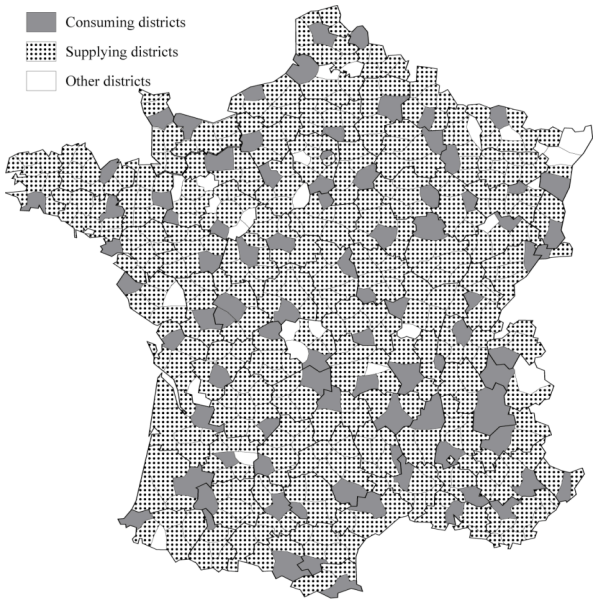


Table 4: Database

	Supplying districts	Consuming districts	Goods categories	Information	Number of observations
Goods category specific observations	522 (only 500 actually supply)	88	15 (including silk)	1 if at least one mention of the supplying district in the consuming district's *Tableaux*, 0 otherwise	728,640

2. Checking the data

2.1. Potential difficulties

It is possible that data give information on the zeal of each *agents nationaux* — the local civil servants that had to collect the information — rather than on the actual flows of goods in late eighteenth century France. Before exploring the question of market size, it is important to to check whether the data are plausible.

The *Tableaux* are the result of three different operations, each of which was an occasion for errors: establishing the production tables in every districts; gathering the production tables and completing them in Paris to write the *Tableau général du Maximum*; and setting up the *Tableaux du Maximum* (or consumption tables) in every district.

Not every district had sent its production table. The *Commission générale des subsistances* completed some of the data based on information provided by Parisian traders and established the production and price lists of the most important districts that had not

answered (including Nantes, Bordeaux and Lyon).[23] Furthermore, the consuming districts included products that had been left out of the *Tableau général du Maximum*. They used prices information coming either from direct inquiries in the producing or importing districts or from local traders.

Certainly, the zeal of individual *agent national* differed. A limited number of agents listed most individual goods from the *Tableau général du Maximum*. In general, it seems that *agents nationaux* tried to list the goods that were usually sold in shops in their district, or sometimes simply in their municipality. They would omit the goods that were brought in by peddlers or were bought by consumers in adjoining districts. Certainly, they did not have the same notion of what was the size of a trade flows that warranted the inclusion of a good in their lists. However, any discrepancies in the zeal of *agents nationaux* should be captured in the following statistical exercises by the use of district-level fixed effects.

A potentially more serious problem would arise if all *agents nationaux* had the incentive to distort the data in the same way, for example by exaggerating or minimizing the list of the goods that were consumed in their districts. It is not clear what this systematic incentive could be. They had an interest in increasing the prices of the goods their districts were producing and in decreasing the price of the goods they were consuming, but the law was explicitely set up to prevent this manipulation. At worst, they might have tried to cheat on the origin of the goods their districts were consuming in order to minimize imputed transport costs. That was probably difficult due to differentiation of goods per origin and the fact that they were supposed to pick goods in the *Tableau Général du Maximum*. Even if they were actually cheating in this way, this would minimize market sizes of each good and hence reinforce our conclusions.

Thomas Le Roux has contended that the work was on the whole properly done and that most differences in coverage come from to actual differences in consumption.[24] Confronting the district-level information with other sources allows to verify this, even if it is not possible to demonstrate it definitely.

2.2. Are the implied production data plausible?

The number of consuming districts out of the 88 I have studied supplied by each of the 522 supplying districts in each goods category should be a reasonable proxy of the production or importation level in each supplying district. Based on this information, one can draw

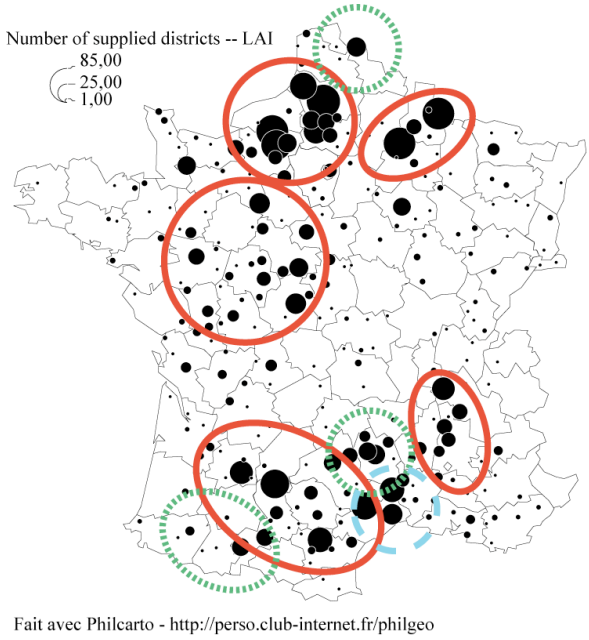
[23] Ibid., p. 58-61.
[24] Ibid., p. 64-73.

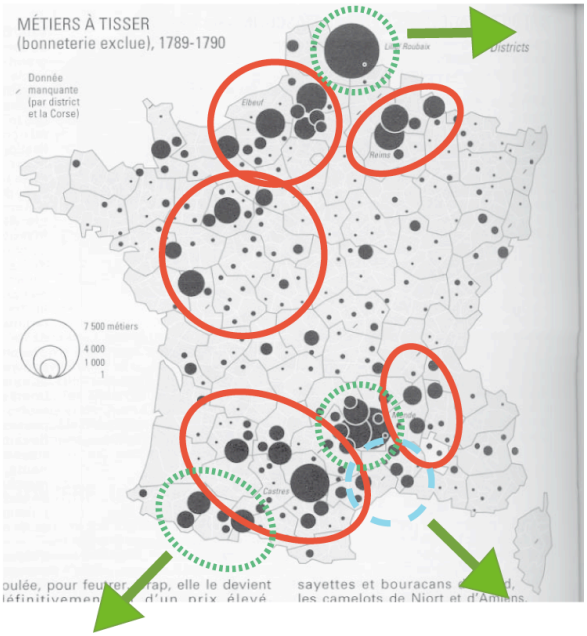
"supply maps" and compare them with production maps to check if the information given by the *Tableaux* is plausible.

Map 3 and Map 4 compare the wool cloth supply map with a map of the number of woollen looms in 1789-1790. The size of each circle is equal to the number of supplied districts by each district.

Map 3: Wool cloth supply map from the *Maximum*

Map 4: Number of woollen looms, excluding hosiery, in 1789-1790[25]





These two maps are similar. Production regions delimited by a plain line are common to both of them. Production regions delimited by a dotted line are present only in the loom map. This can be explained by the fact that the data based on the *Maximum* did not includes exports. That minimized the importance of the Lille region, the Languedoc and the Western Pyrenees, which were exporting to the Austrian Netherlands, the Levant and Spain. Furthermore, the *Maximum* map indicates the distribution centres of the *draps du Languedoc* rather than their production centers, which was more inland (see the production region delimited by a dashed line on the loom map).

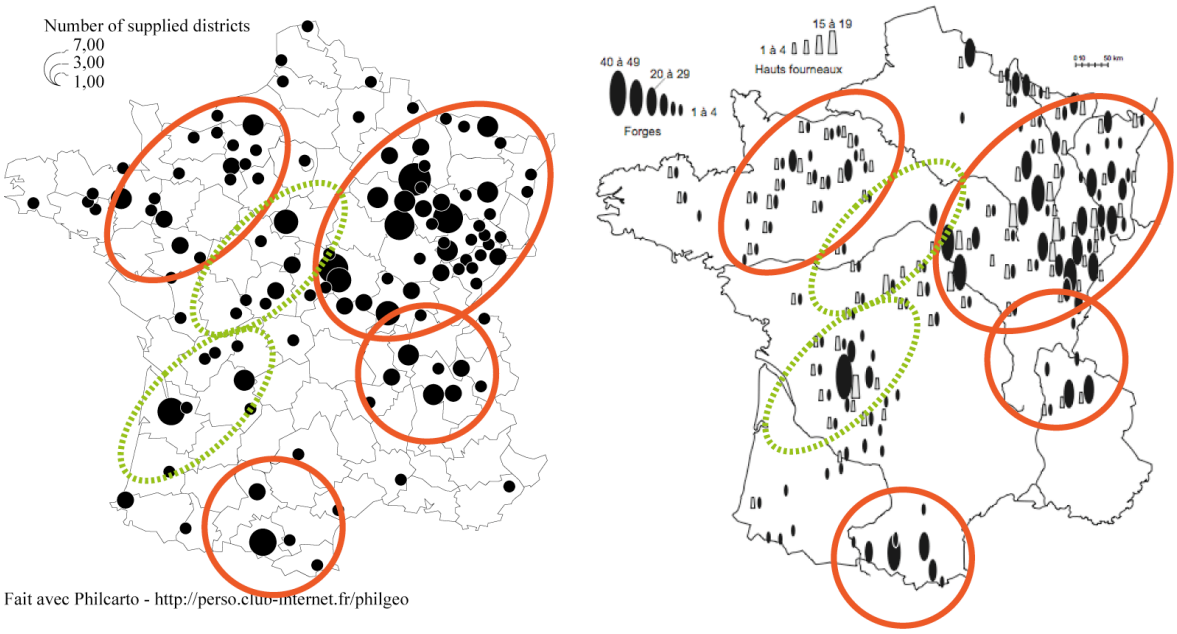
Map 5 and Map 6 compare the iron supply map with a map of furnaces in 1789. The two maps are similar: the same production areas (identified with plain lines) can be found in both maps. Main differences comes from the dotted areas. Contrary to what the *Maximum* suggests, neither Orléans nor Bordeaux were production centres. Yet, Bordeaux was a

[25] The second map comes from Béaur and Minard, eds., *Atlas/Économie*, p. 76.

redistribution centre for iron from Périgord and Orléans might have been one for iron from Nivernais and Berry. That could explain why both these cities are listed as important "supplying" districts.[26]

Map 5: Iron supply map from the *Maximum*

Map 6: Furnaces and forges in 1789[27]



Supply maps for the other goods categories are available from the author. They confirm that the proxied production data given by the *Tableaux* are plausible.

2.3. Checking bilateral trade data

Gravity models emerged in the 1960s as empirical tools to explain international trade. They get their inspiration from physics: the force of gravity depends positively on the product of the masses of the two objects and negatively on the distance between them. Similarly, gravity models explain trade flows as a positive function of the mass (measured as GDP or population…) and a negative function of distance (measured as transport costs) between trade partners. They have been very successful at explaining the pattern of trade data in a variety of settings.[28] Conforming to a gravity model would make the bilateral trade data of the *Maximum* more believable.

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[26] Ibid., p. 86
[27] The furnace map is from Léon, "La Réponse de l'industrie", p. 234 and refer to 1789.
[28] For a full discussion, see e.g. Anderson and van Wincoop, "Trade Costs" and Baldwin and Taglioni, "Gravity for Dummies".

In contrast with usual bilateral trade data, the data in the *Tableaux* do not indicate the value of trade flows, but only their existence. However, under the hypothesis that each *agent national* recorded the existence of a trade flow if it was superior to some threshold, one can use a logit regression in a usual gravity specification. Logit regressions explain the occurrence of a binary phenomenon based on the hypothesis that the explanatory variables affect the probabilities of the event according to a logistic function. There is no reason to believe that each *agent national* had the same threshold or even applied the same threshold for each good. Hence, goods-specific consuming district fixed effects must be introduced. Because production capacities and specializations differed between districts, supplying district fixed effects can be introduced as well. Having both supplying and consuming districts fixed effects solves a number of the usual interpretation difficulties with gravity models.[29] These fixed effects will capture all the district characteristics that cannot be measured otherwise.

2.3.1. Measuring mass

One expects that the number of supplied districts depends on the production capacity of each supplying district and that the number of supplying districts depends the demand level of each consuming district. Even if the supplying and consuming district fixed effect make sure that this will not disturb the estimation of the effect of distance, it is interesting to add available proxies of demand level and production capacity to check if they have the expected effect. We do not have information on district or departmental income difference. Yet, demand level and production capacity can be proxied by the district-level population and by urbanisation. The higher the population, the more demand for consumption and the more labour available for production. Towns had more diversified consumption needs: they should increase demand. Towns were both production centres and coordinating centres for local production: they should increase production. The gravity equation includes four dummy variables reflecting the existence of a town having between 10,000 and 25,000 inhabitants or more than 25,000 inhabitants in the consuming and in the supplying district. Furthermore, a number of towns were gateways for international trade: Marseilles, Bordeaux, Nantes, Lorient, Rouen, Lille and Strasbourg. The gravity equation includes a dummy to take that into account.

[29] See Anderson and van Wincoop, "Trade Costs" and Baldwin and Taglioni, "Gravity for Dummies".

District-level population is estimated using estimates of departmental population in 1791 and the 1793 census.[30] Town size come from Lepetit's work on 1794.[31] This chronological discrepancy is not too much of a problem as French population did not increase much from 1791 to 1794.

2.3.2. Measuring distance

Distance is used as a proxy for trade costs in many gravity models. It is actually possible to go further and estimate transport costs in 18th century France. Disappointingly, the information given by the important enquiry of *an III* is not useable.[32] Yet, the law of the *Maximum* actually gives a transport costs list (see note 13) that can be completed by conjectures. Table 5 gives the resulting hierarchy of transport prices.

Table 5: Relative transport costs

Type of transport	Relative cost to 1 km of trails
Trail (1km)	1
Road (1km)	0.889
Up-river (1km)	0.444
Down-river (1km)	0.167
Canals (1km)	0.389
Coastal navigation (1km)	0.3
Sea: Between Marseilles and one of Bordeaux, Nantes and Rouen[33]	200
Sea: Between Rouen and one of Bordeaux and Nantes	150
Sea: Between Bordeaux and Nantes	100

Note: this table should be read in the following way: the price of transporting a load on 1km of canal is equal to 38.9% of the price of transporting it on 1 km of trail. The price of transporting a load between Bordeaux and Nantes is 100 times more expensive than transporting it on 1 km of trail.

The road and navigable waterways network is well known. The road network was mainly organised among administrative lines centred on Paris. It was much less useful for economic activity than the network of turnpikes in Britain. There was no equivalent to the canal mania in 18th century France and a lot of them were to be built in the 19th century. Thanks to the maps of navigable waterways and *routes de postes* given in the *Atlas de la Révolution Française,* I computed transport costs between "adjacent" districts (less than 60 kilometers

[30] From Dupâquier, *Population française*, p. 82-83 (departmental population in 1791) and Laboratoire de Démographie Historique / EHESS, *Census*. District population was most of the time computed on the assumption that the evolution of population from 1791 to 1793 was the same for all districts in a department. For missing 1791 department population, the 1793 numbers were kept. For missing 1793 district and municipality populations, the estimates are based on surface. Full details of these computations are available upon request.

[31] Lepetit, *Villes dans la France moderne*, p. 450-453 (list of towns larger than 10,000 inhabitants and their population around 1794)

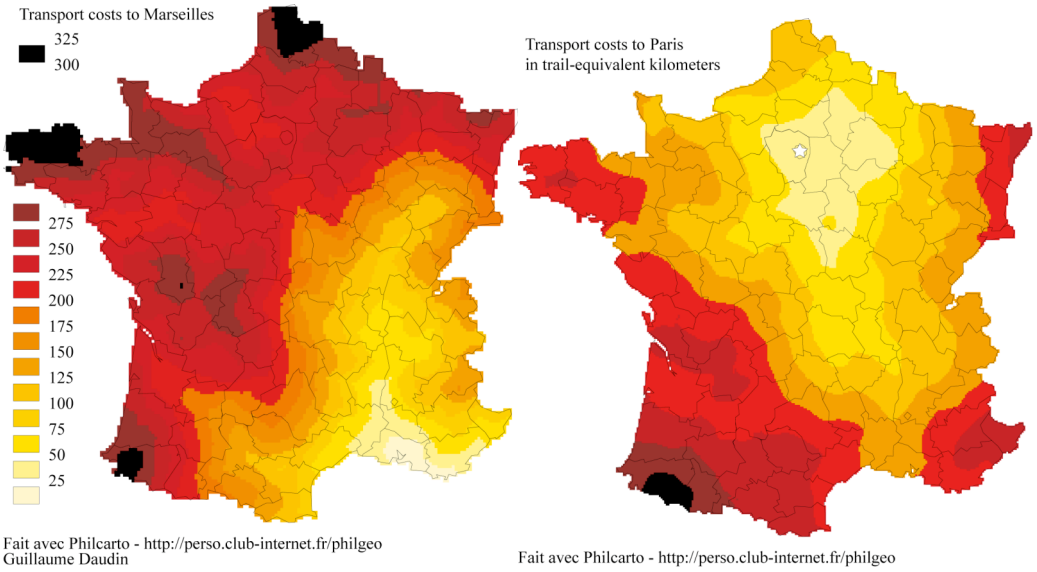
[32] Rémond, *Circulations marchandes*.

[33] According to data in Carrière, *Négociants marseillais*, pp. 623-624 showing that the cost of transport by direct sea link between Marseilles and Rouen, including insurance, was 2/3rd of the cost of transport inland by rivers, canals and roads. Other sea links are conjectural.

apart), assuming than over such small distances they were equal to the great-circle distance between administrative centres of each district modified by the available transport link.[34] Then, with the help of a network analysis program (UCINET), I computed the shortest path between every 552 districts in both directions through a short-route finding algorithm akin to the one used in navigation softwares.[35] The distance unit is the "trail-equivalent kilometre". Map 7 and Map 8 illustrate the result of these computations in the case of transport costs to Marseilles and Paris.[36]

Map 7: Transport costs to Marseilles

Map 8: Transport costs to Paris



Moving goods between two or more waterways, or from a wagon to a riverboat and to a wagon again had additional costs. The gravity equation partially takes them into account by introducing dummy variables indicating whether these transhipment costs could be avoided, i.e. when two districts were on the same sea, year-round river, seasonal river or canal-linked waterway.[37]

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[34] Arbellot, Lepetit, and Bertrand, eds., *Atlas/Routes*.
[35] Borgatti, Everett, and Freeman., *Ucinet*. The original matrix along with the
[36] Internal distance is is computed using Head and Mayer, "Illusory Border Effects" fourth formula of approximately 0.67*square root(area/π) where the area comes from Laboratoire de Démographie Historique / EHESS, *Census*.
[37] The variables used are as follow. Sea: both districts on the Channel, Atlantic or Mediterranean Sea (according to Le Bouëdec, "Coastal Shipping", p. 96, the Western point of Brittany and Gibraltar were two important boundaries in intra-European coastal trade.) / Year-round river : both districts in all-year round Seine, all-year round Loire or Rhine / river: both districts on Seine, Loire, Adour, Saône or Rhône, Somme, North rivers, Meuse, Moselle & Sarre, Vilaine, Charente, Dordogne or Garonne or their affluents. Canals: One district on Seine and one on Loire ; one on Saône/Rhône, one on Loire ; one on Canal du Midi, one on Garonne or Canal du Midi

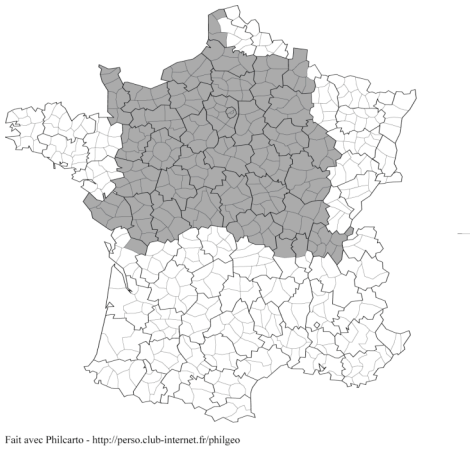
The resulting transport prices are a very rough approximation. Regional variations, due to differences in traffic volumes, different fodder prices, differences in the condition of waterways or roads, are not taken into account. Nor are seasonal variations.[38] Yet, using these data to measure distance is better than simply using great-circle distance as many gravity models do.

2.3.3. Custom union

France only became a custom union during the Revolution. As the information given by the *Tableaux* is about trade at the very beginning of the Revolution, this fact should be taken into account. Numerous private tolls (still 1,600 in 1789) and local tariffs, especially municipal ones, existed.[39] These were scattered in a relatively uniform way and should not have changed the global geography of trade: they are not taken into account in the gravity equation. Following the custom reorganisation of 1664 and 1667, French provinces were divided in three categories regarding tariffs. *Étranger effectif* included recently annexed provinces (Alsace, Franche-Comté, Lorraine, Trois-Évêchés, pays de Gex). They were treated as foreign countries: a good entering "interior" France from these places had to pay custom duties like a foreign good. They often enjoyed smaller tariffs on their borders to Switzerland and Germany than on their border with "interior" France. There was a custom union in the *Cinq Grosses Fermes*, or *Étendue* (see Map 9). But part of France was neither in the *Cinq Grosses Fermes* nor in *Étranger effectif:* the *Provinces reputées étrangères* (Artois, Bretagne, Flandre, Guyenne, Saintonge, Languedoc, Provence, Dauphiné and Lyonnais), had not been integrated in the national custom union even though they were not recent annexations. They were subject to 21 local tariffs that goods paid at specific points (*traites)*.[40]

[38] Szostak, *Role of transportation*.
[39] Conchon, *Le péage en France au XVIIIe siècle : Les privilèges à l'épreue de la réforme.*
[40] Mousnier, *Institutions de la France*, p. 412-420, Bosher, *Single Duty Project*.

Map 9: Districts that had part of their territory in the *Cinq Grosses Fermes*[41]



The complexity of the system was a cost in itself. Yet, the amount of collected custom taxes was not large. *Traites* (tariffs collected inside *Provinces réputées étrangères* or between them and the *Cinq Grosses Fermes*) represented only 0.25% of French GPP (against 0.7-0.8% for external tariffs). *Aides* (taxes mostly on alcoholic beverages) and *octroits* (a tax on goods entering cities for their consumption) were higher and amounted to respectively approximately 1.4 % and 0.35% of French GPP.[42] One can assume that trade between *Cinq Grosses Fermes* districts was less expensive than other trades. To reflect that, we introduce a *Cinq Grosses Fermes* dummy variable in the gravity equation to differentiate trade links inside the *Cinq Grosses Fermes* from others.

2.3.4. Results

One logit gravity equation is estimated for each goods category. The explained variable is $Link_{i,j,k}$ which takes the values 1 if the district i supplies the district j with the good k and 0 otherwise. The logit procedure assumes that there is a latent continuous variable $y_{i,j,k}$ such that $Link_{i,j,k} = 1$ if $y_{i,j,k} > 0$ and $Link_{i,j,k} = 0$ if $y_{i,j,k} \leq 0$. This variable is assumed to be determined by the following equation:

[41] Based on Corvisier, *Histoire moderne*, Bosher, *Single Duty Project*.
[42] Mathias and O'Brien, "Taxation in Britain and France", p. 608, 622, 631-2.

$$
\begin{aligned}
y_{i,j,k} = {} & \beta_{0,k} \\
& + \beta_{1,k}.(\text{log of transport costs from } i \text{ to } j) + \beta_{2,k}.(1 \text{ if } i \text{ and } j \text{ are part of the Cinq Grosses Fermes, 0 otherwise}) \\
& + \beta_{3..6,k}.(1 \text{ if } i \text{ and } j \text{ are on the same sea, year-round river, seasonal river or canal-linked waterway, 0 otherwise}) \quad \} \text{ Interactive variables} \\
& + \beta_{7,k}.(\text{log of the population in district } i) + \beta_{10,k}.(1 \text{ if i includes an importing town, 0 otherwise}) \\
& + \beta_{8,k}.(1 \text{ if } i \text{ includes a town between 10,000 and 25,000 excl. importing towns, 0 otherwise}) \\
& + \beta_{9,k}.(1 \text{ if } i \text{ includes a town larger than 25,000 excl. importing towns, 0 otherwise}) + \text{Supplying districts fixed effects}_{i,k} \quad \} \text{ Supplying district variables} \\
& + \beta_{11,k}.(\text{log of the population in district } j) + \beta_{12,k}.(1 \text{ if } j \text{ includes a town between 10,000 and 25,000, 0 otherwise}) \\
& + \beta_{13,k}.(1 \text{ if } j \text{ includes a town larger than 25,000, 0 otherwise}) + \text{Consuming districts fixed effects}_{j,k} \quad \} \text{ Consuming district variables} \\
& + \varepsilon
\end{aligned}
$$

Where ε is assumed to be independent from the explanatory variables and to have a standard logistic distribution.[43] The coefficients of this equation are estimated through a maximum-likelihood method. Their direct interpretation is difficult. However, exponentials of these coefficients can be interpreted as odds ratios.[44] Table 6, 8 and 9 present the results of these equations and report most odds ratios. Table 6 presents the role of interactive variables.

[43] Assuming that ε has a normal distribution would change the equation into a probit gravity equation. This does not change the results significantly, but the coefficients are more difficult to interpret.

[44] See StatCorp, *Reference K-Q*, pp. 60-68 and pp. 93-103. These procedures are quite standard and are presented in most econometric textbooks.

Table 6: Explaining trade links: the role of interactive variables

The numbers given are not the coefficients but the associated odds ratios. ***, ** and * denotes that the odds ratios are different from 1 at the 1%, 5% and 10% level. Odds ratios between brackets are not statistically different from 1.

	Log of transport costs	Cinq Grosses Fermes	Number of non-trivial observations	Quasi-R2
Cotton	0.17***	1.8***	6,873	0.50
Hosiery	0.16***	3.1***	9,309	0.42
Hardware	0.16***	(1.2)	11,484	0.51
Misc. production goods	0.15***	(1.3)	13,288	0.58
Misc. consumption goods	0.13***	1.8***	23,496	0.51
Linen and hemp	0.09***	2.8***	21,824	0.50
Wool and wool cloth	0.09***	2.8***	24,112	0.57
Leather products, hides and hats	0.06***	2.7***	24,728	0.53
Iron	0.06***	8.5***	8,814	0.45
Food items	0.05***	2.1***	20,416	0.55
Drinks	0.04***	9.1***	19,448	0.53
Paper	0.02***	(1.5)	11,390	0.59
Wood for industry	0.02***	8.2***	14,706	0.67
Fuel (wood and coal)	0.03***	(1.1)	11,088	0.66

In every case, an odds ratio higher than one means that the variable has a positive effect on the probability that a trading link exists. An odds ratio smaller than one means that the variable has a negative effect.

The second column of Table 6 should be interpreted the following way: an increase by one of the logarithm of the trail-equivalent kilometres trade costs (i.e. multiplying the trade costs by 2.7) multiplies the odds ratio that a trading link exists by the value given in the table, e.g. by 0.17 in the case of cotton. If the probability was initially 25% (odds ratio of 1/3), it is changed to 5.4% (odds ratio of 0.057). Table 7 gives guidelines for the interpretation of the transport cost odds ratio.

Table 7: Effect of an increase in transport costs on the probability that a trade link exists

Change in transport costs		Cotton	Linen and hemp	Paper
+1%	Change in the odds ratio	-1.7%	-2.4%	-3.8%
	New probability if initial probability = 90%	89.8%	89.8%	89.6%
	New probability if initial probability = 50%	49.6%	49.4%	49.0%
+10%	Change in the odds ratio	-15.5%	-20.5%	-31.1%
	New probability if initial probability = 90%	88.4%	87.7%	86.1%
	New probability if initial probability = 50%	45.8%	44.3%	40.8%
+100%	Change in the odds ratio	-70.7%	-81.2%	-93.4%
	New probability if initial probability = 90%	72.5%	62.9%	37.4%
	New probability if initial probability = 50%	22.6%	15.9%	6.2%

Table 7 should be read in the following way: increasing the transport costs between two districts by 10% reduces the odds ratio of a link existing by 15.5% in the case of cotton, 20.5% in the case of linen and hemp and 31.1% in the case of paper. If the initial probability for the existence of a link is 50%, it is reduced to 45.8% in the case of cotton, 44.3% in the case of linen and hemp and 40.8% in the case of paper.

The third column of Table 6 should be interpreted in the following way: if both districts are in the *Cinq Grosses Fermes*, the odds ratio of the existence of a trading link is multiplied by the value given in the table. E.g. in the case of cotton, the fact that districts A and B are both in the *Cinq Grosses Fermes* multiplies the ratio between the probability that A sold cotton cloths to B and the probability that A did not sell cotton cloths to B by 1.8. If the probability of A selling cotton cloths to B because of other factors was 25 % (odds ratio of 0.33), it is changed to 37% (odds ratio of 0.6).

As expected, the importance of transport costs is a function of the weight/value ratio of each product categories: the odds ratios are closer to zero for heavier goods. Also as expected, the odds ratios associated with the *Cinq Grosses Fermes* dummy are mostly significant and quite high: the odds ratios are much higher than 1. It might however be the case that this dummy also captures the better quality of the transport network in Northern France. Transhipment costs coefficients are very often insignificant and sometimes of the wrong sign (except in the case of fuel and wood for industry): they are not reported. They might be badly measured, or the number of observable links in which they apply might be too small.

Table 8 presents the odds ratios of consuming district characteristics in the gravity equation. It does not report the 88 coefficients of the district fixed effects, but the decrease of the quasi-R2 when fixed effects consuming district variables are removed gives an idea of their importance. The most important determinant of consumption intensity is the size of the population. Towns between 10,000 and 25,000 do not seem to entail more consumption than

what the population itself predict. Towns larger than 25,000 only have a positive effect for leather products and, most remarkably, for fuel. The negative effect on the diversity of miscellaneous consumption goods supply source is probably meaningless. On the whole, consuming district characteristics do not explain a lot of the variance in trade links.

Table 8: Explaining trade links: the role of consuming district variables

	Log of the population	Town between 10,000 and 25,000	Town larger than 25,000	Decrease in the quasi-R2 if consuming district fixed effects are removed
Cotton	2.0**	(0.9)	(1.6)	0.07
Hosiery	(1.2)	(2.3)	(0.9)	0.08
Hardware	3.5***	(0.5)	(0.9)	0.08
Misc. production goods	2.7***	(0.2)	(0.8)	0.10
Misc. consumption goods	3.1***	0.1**	(0.3)	0.07
Linen and hemp	2.1***	(0.2)	(1.5)	0.09
Wool and wool cloth	(1.4)	(1.6)	5.4***	0.06
Leather products, hides and hats	2.0**	5.7***	(1.7)	0.11
Iron	3.6***	(0.2)	(0.5)	0.11
Food items	(1.3)	(1.0)	(0.3)	0.06
Drinks	(1.7)	(0.2)	(0.8)	0.13
Paper	7.3***	(0.1)	(0.5)	0.11
Wood for industry	6.5***	(0.5)	(2.6)	0.10
Fuel (wood and coal)	(1.2)	(0.8)	34.5***	0.06

Table 9 presents the odds ratio of supplying district characteristics in the gravity equation. Fixed effects explain a larger part of the differences in trade links. This is can be interpreted as a sign that consumption patterns are more homogeneous than production patterns. This is expected, as there is more specialization in production than in consumption.

Table 9: Explaining trade links: the role of supplying district variables

	Log of the population	Town between 10,000 and 25,000 (not importing)	Town of more than 25,000 (not importing)	Importing town	Decrease in the quasi-R2 if supplying district fixed effects are removed
Cotton	0.1***	(0.1)	163.1***	117.2***	0.33
Hosiery	0.4***	14.3***	194.9***	3.9*	0.13
Hardware	5.8***	(0.1)	(0.3)	(2.1)	0.37
Misc. production goods	16.1***	65.1***	45.8***	5302.2***	0.26
Misc. consumption goods	(1.3)	(0.6)	(0.5)	55.2***	0.22
Linen and hemp	(0.8)	99.9***	16.2***	3776.9***	0.25
Wool and wool cloth	4.9***	(0.0)	(1.4)	(0.0)	0.37
Leather products, hides and hats	(0.5)	7.9***	11.5***	26.2***	0.10
Iron	(0.3)	4.5***	3.8*	(2.6)	0.09
Food items	2.8***	(0.1)	(0.4)	(1.6)	0.22
Drinks	(1.6)	(3.7)	(0.8)	(0.0)	0.19
Paper	(0.3)	38.2***	(5.9)	(0.9)	0.15
Wood for industry	(0.7)	(0.0)	(0.0)	(0.0)	0.10
Fuel (wood and coal)	(0.8)	(0.1)	(0.0)	(0.3)	0.07

Table 9 shows that urban centres played a role in determining the importance of the consumption area. This role was more important than in determining the diversity of consumption. The only production centres which importance was not influenced by the presence of towns were those producing hardware, miscellaneous consumption goods (this

includes honey, olive oil, alcohol…), drinks (mainly wine), wool cloth, food, wood and fuel. Apart from hardware and wool cloth, this is reasonable as most of these products were agricultural. The counter-intuitive negative role for the district's population in the case of cotton and hosiery is difficult to interpret, but might be linked to the fact that the whims of the specialization pattern in these goods are not ironed out by a large number of suppliers for these goods. Anyway, they are compensated with the very important positive role of towns.

However, Table 9 must be interpreted with some care. Supply centres that did not supply anyone with a goods category are dropped from the gravity analysis, as their fixed effects completely capture the fact that the supply no one. That would be the case, for example, for Brest in the case of cotton. Hence Table 9 only compares small supply centres with large ones. To study the characteristics of all supplying districts compared to non-supplying districts, another logistic regression can be run. The explained variable is $Supply_{i,k}$ which takes the values 1 if the district i supplies at least one district with the good k and 0 otherwise. The logit procedure assumes that there is a latent continuous variable $z_{i,k}$ such that $Supply_{i,k}$ = 1 if $z_{i,k} > 0$ and $Supply_{i,k} = 0$ if $z_{i,k} \leq 0$. This variable is determined by:

$$z_{i,k} = \gamma_{0,k} + \gamma_{1,k}.(\text{log of the population in district } i)$$
$$+\gamma_{2,k}.(1 \text{ if } i \text{ includes a town between 10,000 and 25,000 excl. importing towns, 0 otherwise})$$
$$+\gamma_{3,k}.(1 \text{ if } i \text{ includes a town larger than 25,000 excl. importing towns, 0 otherwise})$$
$$+\gamma_{4,k}.(1 \text{ if } i \text{ includes an importing town }) + \varepsilon$$

Where ε is assumed to be independent from the explanatory variables and to have a standard logistic distribution. Table 10 presents its results. The explanatory power of the regression is small, as demographic variables are of limited use to help predict which kind of goods each district will produce. Yet, Table 10 shows that the presence of an urban centre has a decisive role on whether a district will distribute goods or not: this puts to the fore the distributive role of towns.

Table 10: Explaining why a district supplied a good

	Log of the population	Town between 10,000 and 25,000 (not importing)	Town of more than 25,000 (not importing)	Importing town	Number of supplying districts (out of 552)	Quasi-R^2
Cotton	4.4***	(1.3)	4.0***	Full	79	0.12
Hosiery	2.0**	2.5**	7.8***	(2.0)	107	0.09
Hardware	(1.4)	(1.4)	3.2**	2.9*	132	0.03
Misc. production goods	1.8**	5.3***	7.2***	Full	151	0.12
Misc. consumption goods	1.6*	4.0***	6.1***	Full	267	0.07
Linen and hemp	(1.9**	3.1***	(2.0)	4.2**	248	0.06
Wool and wool cloth	(1.3)	2.2**	3.3**	(2.2)	274	0.03
Leather products, hides and hats	1.4*	4.0***	3.1**	4.7**	281	0.06
Iron	(1.3)	(1.4)	3.0**	(2.4)	113	0.02
Food items	2.4***	2.2**	(1.9)	3.6*	233	0.06
Drinks	2.4***	(1.2)	2.4*	(1.5)	221	0.05
Paper	1.8**	1.8*	(1.6)	(1.4)	134	0.03
Wood for industry	1.5*	(1.2)	(1.2)	(2.0)	171	0.01
Fuel (wood and coal)	2.0**	1.7*	(0.6)	(1.2)	132	0.03

On the whole the results of the gravity equation are what one would expect. Distance was an important impediment to trade in all goods. Distance was more important for low value-to-weight goods. The French internal custom union encouraged trade. Districts with large population. Towns of all size had a positive role in production or distribution for most of the goods. All these results reinforce our trust in the data: they can be used to measure market size.

3. Measuring the size of French markets

The easiest way to measure the size of the market for a specific good coming from a specific district would be simply to sum the population of all the districts that have declared they are consuming it. This is not possible as *tableaux du Maximum* do not exist for every consuming district. However, it is possible to use the model estimated in the preceding section to compute the probability that each district is consuming goods coming from each supplying district. Summing the population of each consuming district weighted by these probabilities yields an expected market size for each supplying district. For example, if Marseilles were predicted to have a 90% probability of supplying every French district in various consumption goods, its expected market size would be equal to 90 % of the French population.

Whether one should use the consuming district fixed effect dummies for this exercise is debatable. If they reflect simply the whims of the local administrators, they cannot provide any useful information. Yet, they might contain some information on unobserved local characteristics and extending their effects to their whole department might be useful. The

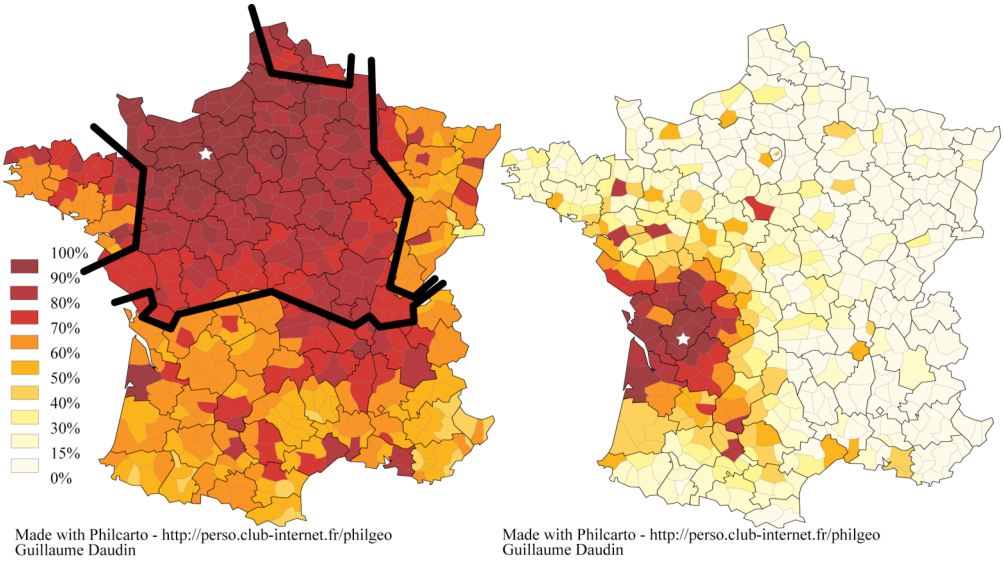
paper will present the results without including them, but the following conclusions are robust to their inclusion.

A new gravity equation is estimated without the consuming district fixed-effects. Its results are very similar to the preceding ones and are not repeated. As expected, this model has less explanatory power. The measurable characteristics of the consuming districts are more often significant, but cannot replace fully the information provided by the consumer district dummies. Transport costs have less of an effect, suggesting that consumer district dummies were indeed capturing part of the remoteness factor of some districts and not simply the whims of their *agents nationaux*.

Predicting consumption for all the 552 French districts thanks to these results, it is possible to determine the "supplying area" of each district. For illustration, Map 11 and Map 12 give the probability that each district was being supplied by L'Aigle (Orne) in hardware goods and by Angoulême (Charente) in paper goods using the predictions of the estimated gravity equation.[45] Proximity is the determinant factor in determining supplying areas. Yet, the effect of urbanization, population and the *Cinq Grosses Fermes* (which borders are shown on Map 10) can also be seen.

Map 11: Probability of a district being supplied in hardware goods by L'Aigle

Map 12: Probability of a district being supplied in paper goods by Angoulême



[45] The pin factory so famously described by Adam Smith was in L'Aigle (Smith, *Wealth of Nations*, Peaucelle, "Pin making example"). Thanks to Robert Allen for pointing this fact to me.

Thanks to this information, it is possible to compute the 95% confidence interval of the expected market size of the main supplying districts. The best estimations and the confidence intervals are shown in Table 11, Table 12, and Table 13.

Table 11: Population of the largest expected markets in millions (high value-to-weight)

Misc. production goods		**Hardware**		**Misc. consumption goods**	
Marseille (Bouches-du-Rhône)	**27.9** [26.2—28.5]	Saint-Étienne (Loire)	**25.3** [22.8—26.9]	Marseille (Bouches-du-Rhône)	**27.8** [26.0—28.5]
Rouen (Seine-Inférieure)	**26.5** [24.5—27.6]	L'Aigle (Orne)	**22.3** [19.6—24.4]	Aix (Bouches-du-Rhône)	**22.1** [19.4—24.2]
Strasbourg (Bas-Rhin)	**22.5** [19.9—24.6]	Paris (Seine)	**20.4** [17.5—22.9]	Montpellier (Hérault)	**20.7** [17.9—23.1]
Paris (Seine)	**22.3** [19.6—24.4]	Thiers (Puy-de-Dôme)	**19.7** [16.6—22.4]	Rouen (Seine-Inférieure)	**20.4** [17.6—22.7]
Montpellier (Hérault)	**18.6** [15.7—21.2]	Rouen (Seine-Inférieure)	**17.8** [14.7—20.5]	Bordeaux (Gironde)	**19.4** [16.6—21.8]

Table 12: Population of the largest expected markets in millions (textiles and leather)

Cotton		**Hosiery**		**Wool and wool cloth**	
Rouen (Seine-Inférieure)	**26.0** [23.8—27.3]	Orléans (Loiret)	**20.4** [17.1—23.0]	Amiens (Somme)	**28.0** [26.5—28.5]
Troyes (Aube)	**22.3** [19.3—24.5]	Troyes (Aube)	**14.0** [11.0—17.1]	Rouen (Seine-Inférieure)	**26.1** [24.1—27.3]
Hennebont (Morbihan)	**18.3** [15.1—21.1]	Rouen (Seine-Inférieure)	**12.8** [9.7—16.0]	Reims (Marne)	**25.6** [23.5—27.0]
Amiens (Somme)	**17.6** [14.5—20.4]	Angers (Maine-et-Loire)	**10.1** [7.1—13.5]	Sedan (Ardennes)	**25.5** [23.3—26.9]
Villefranche-Rhône (Rhône)	**14.8** [11.5—18.0]	Amiens (Somme)	**9.6** [7.0—12.5]	Louviers (Eure)	**23.2** [20.9—25.1]
Linen and hemp		**Leather products, hides and hats**			
Bernay (Eure)	**21.7** [19.2—23.9]	Paris (Seine)	**17.1** [14.3—19.8]		
Lille (Nord)	**21.0** [18.4—23.3]	Lyon (Rhône)	**10.7** [8.3—13.3]		
Rouen (Seine-Inférieure)	**14.3** [11.5—17.2]	Rouen (Seine-Inférieure)	**5.2** [3.4—7.7]		
Alençon (Orne)	**11.7** [9.2—14.7]	Niort (Deux-Sèvres)	**5.2** [3.2—7.9]		
Château-Gontier (Mayenne)	**11.6** [8.8—14.8]	Marseille (Bouches-du-Rhône)	**4.6** [2.9—6.9]		

Table 13: Population of the largest expected markets in millions (low value-to-weight)

Drinks		**Paper**		**Food items**	
Beaune (Côte-d'Or)	**9.7** [7.3—12.4]	Angoulême (Charente)	**8.3** [5.8—11.2]	Dieppe (Seine-Inférieure)	**16.6** [13.7—19.4]
Mâcon (Saône-et-Loire)	**6.6** [4.5—9.2]	Tournon (Ardèche)	**4.2** [2.6—6.5]	Marseille (Bouches-du-Rhône)	**12.0** [9.3—15.0]
Épernay (Marne)	**6.4** [4.4—8.9]	Rouen (Seine-Inférieure)	**3.6** [2.0—5.9]	Bergues (Nord)	**10.9** [8.3—13.9]
Orléans (Loiret)	**6.1** [4.0—8.8]	Thiers (Puy-de-Dôme)	**3.0** [1.7—5.4]	Boulogne (Pas-de-Calais)	**9.9** [7.3—12.8]
Auxerre (Yonne)	**6.1** [4.1—8.7]	Montargis (Loiret)	**2.7** [1.3—5.0]	Montivilliers (Seine-Inférieure)	**9.7** [6.9—12.8]
Fuel (wood and coal)		**Wood for industry**		**Iron**	
Saint-Étienne (Loire)	**1.2** [0.5—2.6]	Soissons (Aisne)	**2.7** [1.5—4.7]	Saint-Dizier (Haute-Marne)	**2.9** [1.5—5.2]
Bayeux (Calvados)	**1.1** [0.3—3.3]	Clermont (Oise)	**1.9** [0.9—3.7]	Joinville (Haute-Marne)	**2.5** [1.2—4.8]
Campagne de Lyon (Rhône)	**1.0** [0.5—2.1]	Aleçon (Orne)	**1.4** [0.4—3.7]	Châtillon-sur-Seine (Côte-d'Or)	**2.5** [1.2—4.9]
Orléans (Loiret)	**0.9** [0.5—2.8]	Lamballe (Côte-du-Nord)	**1.3** [0.4—3.2]	La Charité (Nièvre)	**2.2** [0.9—4.7]
Saint-Denis (Seine)	**0.9** [0.6—2.2]	L'Aigle (Orne)	**1.3** [0.4—3.5]	Bordeaux (Gironde)	**2.1** [1.0—4.3]

The largest French expected markets of all but the lowest value-to-weight goods were larger than the whole of Britain (9.9 million inhabitants in 1790)[46] at the 95 % confidence level. Some of the supply centres with the largest markets specialized in the redistribution of imports, especially in the case of cotton and miscellaneous consumption goods (including colonial good). Rouen was an important redistribution centres for many textiles and hardware import from Britain, even though the district of Rouen was also an important production centre. In the case of cotton, the district of Hennebont, in Brittany, included the town of Lorient through which were imported Asian goods. Yet, the majority of the supply centres mentioned in these tables were inland producers. Troyes and Amiens were not importation centres and they had a market for cotton textiles as large or larger than Britain: some French products in sectors that were important for the Industrial Revolution (e.g. cotton and hardware) indeed had domestic markets as large or larger than Britain.

Population might not be the right comparison metric, however, as French customers had certainly a smaller purchasing power than British customers. Real GDP per capita was 70 % higher in Britain than in France in 1791 and nominal GDP per capita was 75 % higher.[47] According to David Landes, one key difference between Britain and France in explaining different levels of technical innovation was the aggregate disposable income.[48] Setting the subsistence level according to Maddison's estimates at 400 1990 $, disposable real income per capita was 110 % higher in Britain than in France.[49] The comparison in nominal disposable income terms is more difficult, as we do not know what was the price of the subsistence basket in France and in Britain. However, if we make the assumption that the income level of the poorest category of the population (cottagers, poor and vagrants in England and Wales, agricultural day labourers and servants in France) was equal to the price of the subsistence basket, then disposable nominal income per capita was 85 % higher in Britain than in France.[50] Table 14 indicates the number of French markets that where larger than Britain as a whole at the 95 % confidence level using these different criteria. Even using

[46] Extrapolated from Maddison, *World Economy*, Crafts, *British Economic Growth*.
[47] Extrapolated from Maddison, *World Economy*, Crafts, *British Economic Growth*, Toutain, "Le produit intérieur brut" and Dupâquier, *Population française*, Veverka, "Governement Expenditure", quoted in Officer, "GDP for the United Kingdom" Details of the computation are available from the author.
[48] Landes, *Unbounded Prometheus*, p. 47-8. Thank you to Patrick O'Brien for pointing me to that reference.
[49] From Maddison, *Chinese Economic Performance*, discussed in Milanovic, Lindert, and Williamson, "Ancient Inequality".
[50] Morrisson and Snyder, "Income Inequality of France", Lindert and Williamson, "England's Social Tables".

the real disposable income criterion, there were French markets larger than Britain for many goods, including hardware and cotton.

Table 14: Number of French markets larger than Britain at the 95% confidence level

Criterion	Population	Real income	Nominal income	Nominal disposable income	Real disposable income
Wool and wool cloth	14	8	7	7	6
Misc. production goods	12	4	4	4	2
Misc. consumption goods	12	5	5	2	1
Hardware	8	3	2	2	1
Cotton	5	2	2	2	1
Linen and hemp	3	2	2	2	0
Hosiery	2	1	0	0	0
Leather products...	1	0	0	0	0
Food items	1	0	0	0	0

4. Discussion

Other possibly important differences in total markets might have played a role. Higher inequality in France might have restricted the potential for the formation of a large market in pertinent products to the benefit of luxury products, like silk.[51] Yet, recent computations show that the level of inequality in France was not much larger than in Britain. For 1788, Morrison and Seynder have calculated that French income distribution had a Gini coefficient of 0.59, slightly higher than in England and Wales in 1759, but equal to England and Wales in 1801, but.[52] This difference was probably too small to play an important role.

More crucially, perhaps, our comparison between France and Britain is only really valid for high value-to-weight goods. In the case of iron and coal, we verify that their French markets were smaller than Britain as a whole… this is not surprising as they were bulky goods. It would be more interesting to compare them with their actual markets in Britain. In their case, British lower transport costs could have been decisive in giving access to a larger market to British producers. But we do not have enough information to compute their actual British market sizes. Large market size for goods highly dependent on local natural resources might not mean much. Coal, for example, had a limited number of supply sources in France.[53] Even if all France was being supplied by one or two of them, the transport costs would have been so high that very little extension of the market would have been possible even with dramatic production innovations. However, the production of most goods category was possible throughout the territory: large market size did not mean that a limited number of supplying districts had a monopoly on some markets, but rather that a limited number of

[51] Murphy, Shleifer, and Vishny, "Income Distribution", Zweimüller, "Impact of Inequality".
[52] Morrisson and Snyder, "Income Inequality of France".
[53] Béaur and Minard, eds., *Atlas/Économie*, p. 85.

supplying districts were able to compete with other supplying districts over a larger territory. Still, our conclusions are valid for textiles and hardware, two staples of the Industrial Revolution in which innovation played an important role in the late eighteenth century.

The measure of market size we suggest in this paper does not sum up all the pertinent information one could be interested in. Actual market size might be an imperfect proxy of potential market size, especially if set-up trade costs are not too important. Indirect trade – through some regional nodal point – might be much less informative to the producer as to the tastes and preferences of consumers than direct trade. Producers might not benefit from a large market if local preferences are very diverse as, in this case, some innovations might only be beneficial for part of the market. However, especially for the high value-to-weight goods, examination of the consuming lists from the *Maximum* do not show large regional differences in the bundle of goods supplied by individual districts. For some innovation models, the actual scale of production in industrial districts would be more important than the potential market size. Some innovation models operate at the level of firms rather than on the level of the industrial district. The whole range of possible relations between innovation and size cannot be explored by the *Maximum*. Still, it is at least an interesting first step in its exploration.

Another possible difficult might come from the fact that differences in international markets might be more important than differences in domestic markets. Actually, Britain did not have an advantage over France in the late 18th century in its number of potential international customers. In the late 1780s, both countries had access to the full extent of European and world markets: French trade networks reached as many potential customers as British trade networks, even if they did so with less success. This is very different from the situation after 1793 when France was mostly cut off from intercontinental trade because of British naval supremacy. External trade statistics show that French products were available in the same markets as English products. Trade flows primarily give information on the scale of French and British production centres rather than on the numbers of their potential customers. French exports (including re-exports) in 1787 were 15.5 million £ and British exports in 1784-1786 were 13.5 million £. French exports in industrial goods were 7 million £ and British industrial exports were 11 million £.[54] This 4 million £ difference was less than 5 % of French

[54] Arnould, *De la balance du commerce*, Davis, *Industrial revolution*, Daudin, *Commerce et prospérité*.

industrial production.[55] However, it cannot be shown conclusively that differences in external markets were not crucial for the potential of some production centres.

Conclusion

The data gathered by the French government in 1794 are an exceptional gateway to the study of French domestic trade at the end of the 18th century. The information they give is plausible and compatible with other sources. They show that numerous French producers had access to domestic markets that were larger than Britain as a whole during this period, including in hardware and textiles. Considering, on the one hand, the economic models that have been proffered putting market size at the centre of innovation and growth in general and the Industrial Revolution in particular, and, on the other hand, the current consensus that France was handicapped by fragmented markets, this is a startling result.

The fact British producers in high-innovation goods were faced with smaller or no larger domestic markets than French producers during the Industrial Revolution obviously does not mean that Britain should not have experienced industrialization first. Rather, it shows that size-innovation relationships do not explain the cross-sectional sequence of the Industrial Revolution in Europe. Market integration in a pre-industrial setting might still be useful to understand the relatively rapid French growth during the eighteenth century. Adam Smith could certainly not predict the emergence and future form of the Industrial Revolution by describing a French pin factory based on extreme division of labour rather than on innovation or capital. He was still showing an important path to higher productivity.

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[55] Toutain, "Le produit intérieur brut".

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