[preliminary and incomplete]
An Anatomy of International Trade: Evidence from French Firms[1]

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Abstract

We look beneath bilateral trade data by examining the exports and imports of individual French manufacturing firms. One striking finding is that variation in trade volumes across sources and destinations is much more the consequence of variation in the number of firms participating than in how much each one buys or sells. At the same time, the variation in trade volumes across firms is much more the consequence of variation in amounts sold to or bought from a given number of trading partners rather than in the number of trading partners. Also striking is the heterogeneity of firm participation. A vast majority of purchases or sales are tiny, while a tiny fraction of firms account for most trade. If they trade at all most firms export to or import from only one country, but most trade is accounted for by firms that export and import widely.

Key words: International trade, exporting, productivity, heterogeneity
JEL classification: F11; F17; O33

1 Introduction

A new empirical literature has emerged that examines international trade at the level of individual producers. Bernard and Jensen (1995, 1999a), Clerides, Lach, and Tybout (1998), and Aw, Chung, and Roberts (1998) among others, have shown that exporters are typically in the minority; they tend to be more productive and larger; yet they usually export only a small fraction of their output. All of these characteristics suggest that individual producers face substantial hurdles in entering foreign markets.

In response to these empirical studies a new theoretical literature has emerged that tries to model international trade at the producer level. Bernard, Eaton, Jensen, and Kortum (2000) (Henceforth BEJK) develop a Ricardian model of plant-level export behavior while Melitz (2000) provides a model based on monopolistic competition. Essential to either explanation are trade barriers that deter many producers who sell at home from entering foreign markets. In BEJK these barriers take the form of simple "iceberg" transport costs that are proportional to the amount shipped. Melitz, however, assumes a fixed cost of exporting.

This work raises a number of new questions about entry into different national markets. Fixed costs suggest a threshold level of sales are needed for a new market to be worth entering. Once the fixed cost is overcome, however, a foreign producer should not face any cost disadvantage at the margin. With only variable costs, market size should be irrelevant to where a producer decides to sell, but foreign sellers would face a cost disadvantage limiting their market share.

Distinguishing the different forms of entry barriers facing foreign firms requires information on exactly which countries individual producers enter. Previous em-

pirical work has been restricted by lack of data on individual export destinations. Researchers have known whether a producer exported and how much it sold, but not its ability to penetrate individual national markets.

Our work makes use of an extensive source of data that has not yet been tapped to shed light on these questions. French Customs collect administrative data on French firms that have international trade activities. The resulting dataset is matched with another administrative dataset of fiscal origin (BRN) that includes most balance-sheet variables (value-added, total assets, labor costs, revenues) as well as employment for almost all French firms. The Customs data comprise information on the products that are exported or imported and, more importantly here, on the individual countries to which each firm exports, as well as the national origin of its imports (see Biscourp and Kramarz, 2001). Our study exploits these data to learn about the different kinds of barriers producers face in transacting abroad.

2 Linking Firm and Aggregate Trade Data: Some Basic Mechanics

Since we are analyzing dimensions of trade data that have rarely been seen, we present some basic mechanics to guide our exploration of the numbers. It turns out that these basic mechanics can say a lot about what any model needs to contend with in order to explain first-order features of these data. And many standard models can be rejected out of hand.

Consider total French exports to a particular country c, X_c^E. One decomposition can be achieved using aggregate trade data, breaking up X_c^E into (i) country c's total purchases, Y_c, and (ii) the share of those purchases that are imports from France S_c^I.

Our firm-level data allow a second decomposition of X_c^E, into (i) the number of firms selling to country c, N_c^E, and (ii) the average amount exported by each $\overline{X}_{c.}^E$ Hence, denoting the logarithm of any variable V as v, we can write:

$$x_c^E = s_c^I + y_c = n_c^E + \overline{x}_c^E. \tag{1}$$

The first decomposition of total exports into market size and market share is implicit in the gravity equation, in which market share captures the distance effect and y_c the mass (of importer) effect.[1] But we can now pursue how the gravity relationship itself decomposes into sales per exporter and number of exporters. In particular, we can see how much the decline in exports with distance is due to less exports by given firms and how much is due to a decline in the number of exporters. We can also ask the extent to which a larger market attracts more sales from given firms or an increase in the number of entrants.

Different models of international trade are not silent on these issues. Many assume perfect specialization, that is, every country produces a unique set of goods. Furthermore, they assume that all goods are desired everywhere. Prominent examples include the Armington (1969) model and the Krugman (1979) model of monopolistic competition and trade. Under these assumptions each producer sells everywhere. Hence variation in $\overline{x}_c^E$ across destinations drives all the variation in x_c^E.

The model developed by Eaton and Kortum (2001) takes the Ricardian approach of assuming that any country can in principle produce any good. Each type of good

[1]The standard gravity formulation posits that exports X_c^E from France to country c obey the formula:

$$X_c^E = \frac{Y_c Q}{f(d_c)},$$

where Q is French production, d_c is the distance between France and country c, and f is some increasing function. Dividing the relationship by Y_c gives French market share in c, S_c^I, which varies across c due only to d_c.

is consumed everywhere, and is bought from the low cost supplier to the market. Because of geographic barriers, the country that supplies the good at lowest cost may vary from destination to destination.

Bernard, Eaton, Jensen, and Kortum (2000) (henceforth BEJK) go on to assume that there is a single lowest-cost producer in any country. Hence at most one firm in a country will produce the good. If the good is imported, of course, some foreign competitor has undercut the lowest-cost domestic producer (who is consequently inactive). Alternatively, the low-cost domestic producer may overcome foreign competition and supply the domestic market, possibly supplying markets abroad as well. BEJK find that the model can explain how much U.S. manufacturing plants export. Since U.S. data do not reveal individual export destinations at the plant level, they cannot evaluate the model's predictions about *where* U.S. plants export. The French data do provide evidence at the firm level on export destinations.

Unlike models with perfect specialization, the BEJK formulation is consistent with variation across export destinations in both the number n_c^E of French firms exporting to destination c and the average amount $\overline{x}_c^E$ sold by each. Variation in the number of exporters n_c^E reflects the ease with which French firms can overcome the geographic barriers imposed by selling to destination c (compared with competitors elsewhere) while variation in $\overline{x}_c^E$ reflects differences in the sales price across markets and differences in market size.

An implication, then, is that while n_c^E and $\overline{x}_c^E$ can both vary, the variation in n_c^E correlates with variation in French market share s_c^I but not market size y_c. On the other hand, average exports $\overline{x}_c^E$ correlate with y_c but not s_c^I. That is, differences in market share reflect the number of firms selling there, while differences in market size

govern average sales of the firms that do sell there.

Turning to French imports from country c, $X^I_{c,}$ we obtain similar decompositions. First, at the aggregate level X^I_c can be broken into (i) country c's total production, Q_c, and (ii) the share of that production exported to France S^E_c. Second, using the firm-level data X^I_c can be broken into (i) the number of French firms importing from country c, N^I_c, and (ii) the average amount imported by each from that source $\overline{X}^I_{c.}$ Hence:

$$x^I_c = s^E_c + q_c = n^I_c + \overline{x}^I_c. \tag{2}$$

In parallel with exports, the first decomposition is implicit in the gravity equation, with share capturing the distance effect and q_c the mass (of exporter) effect.[2] As with exports, we can see how much the decline in imports with distance is due to smaller purchases by given firms and how much is due to a decline in the number of importers from a source. We can also ask the extent to which a larger source sells more to given firms or broadens its sales to a larger number.

We take a first look at the mechanics of exporting and importing using the French firm-level data described in Biscourp and Kramarz (2001). We limit our analysis to manufactures in 1986. On the import side we distinguish between imports of intermediates and final goods. We make this distinction based on the NAP100 product classification of the firm's output and the imported good. When the two are in the same three-digit product class we classify the import as final. Otherwise we deem

[2]The standard gravity formulation, as applied to French imports from c, X^I_c, is:

$$X^I_c = \frac{YQ_c}{f(d_c)},$$

where Y is French expenditure, d_c is the distance between France and country c, and f is some increasing function. Dividing the relationship by Q_c gives the share of country c's production exported to France, S^E_c, which varies across c due only to d_c.

it an intermediate. We augment the firm-level data with aggregate data on manufacturing production and absorption in 112 countries. The appendix describes the data.

2.1 Results for Exporters

The table below presents the variance-covariance matrix for the four variables n_c^E, $\overline{x}_c^E$, s_c^I, and y_c.

	n_c^E	$\overline{x}_c^E$	s_c^I	y_c
n_c^E	2.02			
$\overline{x}_c^E$	0.51	0.77		
s_c^I	.73	-0.24	1.66	
y_c	1.81	1.51	-1.17	4.49

Note that this table throws sand in the face of all of the models discussed above. First, contrary to Armington and Krugman, there is much more action at the extensive margin rather than at the intensive margin: The variance in the number of French firms selling to a country (2.02) is much greater than the variance in average sales per firm (0.77).

We get a slightly different angle on this point from the simple regressions:

$$\begin{aligned} n_c^E &= \underset{(0.03)}{0.66 x_c^E} \quad R^2 = 0.83 \\ \\ \bar{x}_c^E &= \underset{(0.03)}{0.34 x_c^E} \quad R^2 = 0.56 \end{aligned}$$

which indicate that two-thirds of the variation in what France sells to different countries is reflected in the number of firms exporting there. (Throughout regressions have included constants, which absorb units of measurement and are of no independent interest. We do not report them.) The elasticity of the average amount shipped per firm with respect to total exports is only one-third.

Does breaking up total exports into market share and market size matter? The BEJK model implies that all variation in the number of firms selling to a market is picked up by market share, while all of the variation in sales per firm is associated with market size.

The following regressions bear out the first but not the second prediction:

$$\begin{array}{rcccc} n_c^E & = & 0.88 s_c^I & + & 0.63 y_c \\ & & (0.04) & & (0.02) \end{array} \quad R^2 = 0.88$$

$$\begin{array}{rcccc} \bar{x}_c^E & = & 0.12 s_c^I & + & 0.37 y_c \\ & & (0.04) & & (0.02) \end{array} \quad R^2 = 0.69$$

As BEJK would predict, the number of French firms selling to a market varies nearly in proportion to French market share. But it also shows that the elasticity with respect to market size is almost two-thirds, rather than zero as in their model.

In summary, much more variation in total exports is due to variation in the number of exporters than in the amount sold per exporter, regardless of whether total exports vary due to market share or market size. This finding might tend to support the view that a firm faces a fixed cost of entering a national market, along the lines of Melitz (2000). In that case a country that provides France more export opportunities (due either to its size or to easy access) can accommodate more French firms while still offering each one enough in sales to cover the entry cost. To pursue this possibility we examine below the heterogeneity across French firms in how much they sell to particular markets. But, first, we turn to a preliminary analysis of French firms as importers.

2.2 Results for Importers

We present results for imports of intermediate goods since the results for final goods were not notably different. The table below presents the variance-covariance matrix for the four variables n_c^I, $\overline{x}_c^E$, s_c^I,and y_c.

	n_c^I	$\overline{x}_c^I$	s_c^E	q_c
n_c^I	4.60			
$\overline{x}_c^I$	0.09	1.38		
s_c^E	.65	1.57	3.69	
q_c	4.03	-.10	-1.47	5.40

The story is rather similar to that for exports. Most variation in total imports is on the extensive margin (the number of importers) and not the intensive margin (how much each one buys). The regressions below make the comparison with exports easier to digest:

$$\begin{array}{rcll} n_c^I & = & \underset{(0.04)}{0.76x_c^I} & R^2 = 0.78 \end{array}$$

$$\begin{array}{rcll} \bar{x}_c^I & = & \underset{(0.04)}{0.24x_c^I} & R^2 = 0.25 \end{array}$$

Comparing these regressions to their export counterparts, an even larger fraction of the variation in aggregate import volumes translates into the number of participants rather than amount purchased per participant.

Somewhat at variance with the exporter results is how the relationship between participation and average volume relates to the role of export share (distance) and total production (mass), described by the regressions below:

$$\begin{array}{rcllll} n_c^I & = & \underset{(0.04)}{0.53s_c^E} & + & \underset{(0.04)}{0.89q_c} & R^2 = 0.86 \end{array}$$

$$\begin{array}{rcllll} \bar{x}_c^I & = & \underset{(0.04)}{0.47s_c^E} & + & \underset{(0.04)}{0.11q_c} & R^2 = 0.52 \end{array}$$

A larger export share to France actually translates nearly as much into more purchases per importer as into more importers, while larger total production is almost all reflected in having more customers. (In contrast, on the French export side, a one percent larger import share from France generated only about one-tenth of a percent more exports per French exporter). Sales per customer rise with total output with an elasticity of only 10 percent. (The comparable "mass" elasticity for French exports is 37 percent.)

3 Firm Heterogeneity in Trade

A fact that our analysis above obscured is the enormous heterogeneity in the participation of French firms in international markets. In fact, most firms trade very little with only a few partners, while most trade volumes are accounted for by a small number of firms that trade large amounts with many countries.

3.1 Heterogeneity in Exporting

Figure 1 plots export amounts by firms in the tenth, fiftieth, and ninety-ninth percentile against total French exports to different destinations. As implied by the fixed-cost argument, the amounts exported by firms in the lowest two categories rise hardly at all with total exports. (A regression coefficient implies an elasticity of .05 and .16, respectively: Hence, for example, a doubling of total French exports implies that the exports of the median firm to that destination rise by only 16 percent.) For firms at the ninety-ninth percentile the relationship between firm and aggregate sales is more discernible, but a regression still yields an elasticity of only .34.

Problematic for the fixed cost explanation in these data is the very small amount exported by most of the firms selling in any market. The median amount exported

by a firm to a country is on average FF96,000 (about one-fifteenth of mean exports of a firm to a country) while a firm at the tenth percentile on average sells only about FF7,500. Any fixed cost would have to be trivial given the low revenues earned by many firms. Moreover, the contribution to total exports of the firms near the margin of entry appears tiny.

Another dimension of exporter heterogeneity that standard models have not said much about is the set of countries they sell to. A large fraction, 38 percent, sell to only one destination. At the other extreme one firm sells to over 150 countries. Figure 2 shows the frequency of the number of countries to which exporters sell, which declines almost monotonically in the number of destinations.[3]

But exporters who sell to a large number of destinations tend to deliver more to any one of them. Only one-third of a percent of exporters ship to all of the top 19 destinations, yet these firms account for 27 percent of French exports. At the other extreme, the 38 percent of firms exporting to only a single country account for less than one percent of French exports.

Figure 3 indicates average sales per country per firm categorized according to how many destinations the firm serves. There is a striking positive slope to this relationship. As it turns out, the results in Figures 2 and 3 have virtually offsetting effects on total exports by firms in each category; that is, the fraction of total French exports that we can attribute to firms in each category of market diversity is roughly the same.

A final question is the extent to which firms export to the same countries given

[3]A striking feature of the frequencies plotted in Figure 2 is the long tail. It is far more skewed than the Poisson or Exponential distribution. In fact the distribution is not far from the one implied by Zipf's Law, as Figure 2b illustrates.

the number of countries that they serve. We look more closely at exporters selling in only one country (the most common outcome). Of these firms, 8.0 percent sell only to Belgium-Luxembourg, 6.4 percent sell only to Switzerland, 4.6 percent sell only to West Germany, and 2.4 percent sell only to Italy. Thus, there is no natural hierarchy of destinations.

3.2 Heterogeneity in Importing

Even more heterogeneity is apparent in import behavior. Figure 4 plots import amounts by firms in the tenth, fiftieth, and ninety-ninth percentile against total French imports from different sources. Even more than the case with exports, the amounts imported by firms in the lowest two categories do not rise with total imports. (The regression coefficients imply elasticities of $-.05$ and .01, respectively.) For firms at the ninety-ninth percentile the relationship between firm and aggregate sales is more pronounced than with exports, with an elasticity of .44.

The median amount imported by a firm from a country is on average FF540,000 (about one-fiftieth of mean imports of a firm from a country) while a firm at the tenth percentile on average buys FF76,000.

Import sources tend to be even more specialized than export destinations: 47 percent of importers buy from only one foreign country. Figure 5 shows the frequency of the number of countries from which importers buy, which declines almost monotonically in the number of sources.

But importers who buy from a large number of sources tend to buy more from any one of them. Figure 6 indicates average purchases per country per firm categorized according to how many sources it has. Comparing it with Figure 3, the rise is not quite as dramatic, as it gets reversed at the top.

3.3 Firm-Level Decompositions

Just as we could decompose aggregate bilateral trade volumes into average volume per French firm and number of French firms, we can decompose firm trade volumes into average volume per country and number of countries. Beginning with exports we can decompose total exports by firm j, $X^E(j)$, into average sales per destination $\overline{X}^E(j)$ and number of destinations $N^E(j)$. In logarithms:

$$x^E(j) = n^E(j) + \overline{x}^E(j).$$

Simple regressions of $n^E(j)$ and $\overline{x}^E(j)$ on $x^E(j)$ yield:

$$\begin{array}{rcll} n^E(j) & = & \underset{(0.001)}{0.34x^E(j)} & R^2 = 0.63 \end{array}$$

$$\begin{array}{rcll} \bar{x}^E(j) & = & \underset{(0.001)}{0.66x^E(j)} & R^2 = 0.87 \end{array}$$

In contrast with aggregate exports, in which two-thirds of the variation of what France sells to a destination is reflected in the number of firms selling there, only one-third of the variation in what a French firm exports is reflected in the number of foreign markets it serves. The rest is reflected in its actual sales in each.

In parallel with our analysis of aggregate *imports*, we can also decompose firm j's total exports $X^E(j)$ into total sales $Q(j)$ and fraction of sales exported $s^E(j)$. Decomposing $x^E(j)$ in the regressions above yields:

$$\begin{array}{rcllll} n^E(j) & = & \underset{(0.002)}{0.32s^E(j)} & + & \underset{(0.002)}{0.37q(j)} & R^2 = 0.64 \end{array}$$

$$\begin{array}{rcllll} \bar{x}^E(j) & = & \underset{(0.002)}{0.68s^E(j)} & + & \underset{(0.002)}{0.63q(j)} & R^2 = 0.87 \end{array}$$

In contrast with our finding for aggregate volumes, the division of total exports into export share and firm size does not matter much.

Turning to imports we can decompose total imports by firm j, $X^I(j)$, into average purchases per source $\overline{X}^I(j)$ and number of destinations $N^I(j)$. In logarithms:

$$x^I(j) = n^I(j) + \overline{x}^I(j).$$

Simple regressions of $n^I(j)$ and $\overline{x}^I(j)$ on $x^I(j)$ yield:

$$\begin{array}{rcll} n^I(j) & = & 0.25x^I(j) & R^2 = 0.58 \\ & & (0.001) & \end{array}$$

$$\begin{array}{rcll} \bar{x}^I(j) & = & 0.75x^I(j) & R^2 = 0.93 \\ & & (0.001) & \end{array}$$

As with the firm-level export equation, most of the variation in what firms buy is associated with the quantity purchased per source rather than in the number of sources.

We can also decompose firm j's imports $X^I(j)$ into total sales $Q(j)$ and imports as a fraction of sales $s^I(j)$. Decomposing $x^I(j)$ in the regressions above yields:

$$\begin{array}{rcllll} n^I(j) & = & 0.21s^I(j) & + & 0.28q(j) & R^2 = 0.60 \\ & & (0.001) & & (0.001) & \end{array}$$

$$\begin{array}{rcllll} \bar{x}^I(j) & = & 0.79s^I(j) & + & 0.72q(j) & R^2 = 0.93 \\ & & (0.001) & & (0.001) & \end{array}$$

Again, at the firm level, decomposing trade volumes into trade orientation and size makes little difference.

4 A Probabilistic Interpretation

A summary conclusion is that the French data have not been kind to any of the "off-the-shelf" models of firm participation in export activity. None of them predicts the extent to which larger and more popular destinations are served by more firms rather than larger sales per firm while simultaneously explaining why most exporters sell only very small amounts.

We do not attempt here to provide a complete economic explanation of what we have found. Instead we outline a probabilistic framework for interpreting our findings that we hope will stimulate further work. The strategy is to describe this rather complex dataset in terms of a small set of underlying parameters which have a straightforward interpretation. We can use the data to estimate these parameters. The ability of the effects reflected in these parameters to explain the model depends on the model's goodness of fit. If the fit is very good then the forces captured by these parameters can explain what is going on. Otherwise we need to look for more subtle interactions to understand the data. We describe the model as it applies to exports by French firms, ignoring for now the determination of domestic sales and imports.

4.1 Firm Export Behavior

We consider individual French firms $j = 1, ..., J$ in a world with C countries that are potential export destinations. Firm j can be described in terms of (i) the set of countries to which it sells, denoted by a C-element vector $\delta(j)$, where $\delta_c(j) = 1$ if firm j sells in to country c and $\delta_c(j) = 0$ otherwise and (ii) the firm's sales in each country, denoted by a C-element vector $X(j)$, where $X_c(j)$ equals firm j's sales in

market c.

Our model is very parsimonious in that one parameter $\gamma(j)$ describes each firm while one parameter Π_c describes each destination-country c. Firm j's probability of entering destination c is given by $\pi_c(j) = 1 - e^{-\Pi_c \gamma(j)}$. We treat these probabilities as independent across destinations. Here $\gamma(j) \geq 0$ governs firm j's proclivity to export and $\Pi_c > 0$ the ease of entering market c. The probability of observing a particular realization δ of the vector $\delta(j)$ is therefore:

$$\Pr[\delta(j) = \delta] = \prod_{c=1}^{C} \pi_c(j)^{\delta_c} [1 - \pi_c(j)]^{(1-\delta_c)}.$$

Although entry for a given firm is independent across markets, heterogeneity across firms in their proclivity to export will generate the appearance of correlation as firms with high values of $\gamma(j)$ will more often enter many markets.

We also allow for sales in any country that firm j does enter to depend on its underlying proclivity to export. In particular, the typical element of the sales vector $X(j)$ is:

$$X_c(j) = \delta_c(j) e^{\epsilon \gamma(j)} \overline{X}_c u_c(j).$$

The term $\overline{X}_c$ governs the size of an individual firm's market in country c, which could potentially be related to the ease of entry Π_c into market c. The parameter ϵ determines the link between the proclivity to export and sales conditional on exporting. If $\epsilon > 0$ then a firm that is better at entering markets tends to sell more upon entry. Conversely, $\epsilon < 0$ means firms that sell more widely tend to sell less in any individual market. We thus allow for a correlation between the number of markets a firm enters and how much it sells in those markets. Our functional forms and parameterization imply that a one percent higher value of $1/[1 - \pi_c(j)]$ is associated with (on average)

ϵ/Π_c percent more sales in that market. Finally, $u(j)$ is a vector of shocks to firm j sales across markets, drawn independently across firms (but not necessarily countries) from a distribution $G(u)$. While u is independent of the probability of entering any market, it is potentially correlated across markets. We normalize $E[u_c(j)] = 1$.

Firms differ *ex ante* according to their proclivity to export, $\gamma(j)$. (*Ex post* they will also differ according to the realizations of $\delta(j)$ and $X(j)$ given $\gamma(j)$.) We treat $\gamma(j)$ as unobservable at the firm level, drawn from a probability density $f(\gamma)$., We normalize the mean of the distribution so that $E[\gamma(j)] = 1$. Many results of the model will be expressed in terms of the associated moment generating function, $M(t) = \int_0^\infty e^{t\gamma} f(\gamma) d\gamma$.

These assumptions yield predictions about the probability that a firm will sell to any market c and about how much it sells there if it does enter. The unconditional probability of a firm entering market c is:

$$P_c = \int_0^\infty [1 - e^{-\Pi_c \gamma}] f(\gamma) d\gamma = M(0) - M(-\Pi_c), \tag{3}$$

which is increasing in Π_c. Entry into market c is also easier for a firm with a higher $\gamma(j)$. The density of $\gamma(j)$ conditional on entry is:

$$f(\gamma|\delta_c = 1) = [1 - e^{-\Pi_c \gamma}] \frac{f(\gamma)}{P_c}.$$

It follows that a firm's expected sales in market c conditional on entry are:

$$E[X_c|\delta_c = 1] = \overline{X}_c \int_0^\infty e^{\epsilon\gamma} f(\gamma|\delta_c = 1) d\gamma = \frac{\overline{X}_c}{P_c} [M(\epsilon) - M(\epsilon - \Pi_c)]. \tag{4}$$

Note that with $\epsilon = 0$, (meaning no correlation between a firm's ability to enter a market and its ability to sell a lot in the markets it enters) $E[X_c|\delta_c = 1] = \overline{X}_c$, which is why we think of $\overline{X}_c$ as a market size parameter.

Among the firms that enter market c, we can distinguish between those that enter only market c and those that enter other markets as well. The probability that c is the only market a firm enters is:

$$P_{c0} = \int_0^\infty [1 - e^{-\Pi_c \gamma}] e^{-\Pi_{-c}\gamma} f(\gamma) d\gamma = M(-\Pi_{-c}) - M(-\Pi^*), \tag{5}$$

where $\Pi^* = \sum_{k=1}^{C} \Pi_k$ and $\Pi_{-c} = \Pi^* - \Pi_c$. The associated density of $\gamma(j)$ conditional on entry into only market c is thus:

$$f(\gamma|\delta_c = 1; \delta_{c'} = 0, c' \neq c) = [1 - e^{-\Pi_c \gamma}] e^{-\Pi_{-c}\gamma} \frac{f(\gamma)}{P_{c0}}.$$

Note that the likelihood ratio,

$$\frac{f(\gamma|\delta_c = 1)}{f(\gamma|\delta_c = 1; \delta_{c'} = 0, c' \neq c)} = e^{\Pi_{-c}\gamma} \frac{P_{c0}}{P_c},$$

is increasing in γ, implying (not surprisingly) that the proclivity to export of a firm selling to market c stochastically dominates the proclivity of a firm selling only to market c. It follows that expected sales of a firm selling to market c will exceed expected sales of a firm selling to only market c if and only if $\epsilon > 0$. The actual expression for expected sales of a firm selling only to market c is:

$$E[X_c|\delta_c = 1; \delta_{c'} = 0, c' \neq c] = \frac{\overline{X}_c}{P_{c0}} [M(\epsilon - \Pi_{-c}) - M(\epsilon - \Pi^*)]. \tag{6}$$

Among firms entering market c and at least one other market, we can distinguish between different subsets of markets. A simple example is market c and c'. The probability $P_{cc'}$ of a firm entering two markets c and c' exceeds the product of P_c and $P_{c'}$ since a firm that enters market c is likely to have a large γ, so will be more likely to enter c' as well. More formally,

$$
\begin{aligned}
P_{cc'} &= \int_0^\infty [1-e^{-\Pi_c\gamma}][1-e^{-\Pi_{c'}\gamma}]f(\gamma)d\gamma = P_c\int_0^\infty [1-e^{-\Pi_{c'}\gamma}]f(\gamma|\delta_c=1)d\gamma \\
&> P_c\int_0^\infty [1-e^{-\Pi_{c'}\gamma}]f(\gamma)d\gamma = P_cP_{c'},
\end{aligned}
$$

where the inequality follows from the fact that $f(\gamma|\delta_c = 1)/f(\gamma)$ is increasing in γ. Thus, as mentioned above, when we integrate over firm heterogeneity the resulting unconditional entry probabilities imply a positive correlation between entry into different markets. In terms of the moment generating function of $\gamma(j)$, we get the following expression:

$$
P_{cc'} = M(0) - M(-\Pi_c) - M(-\Pi_{c'}) + M(-(\Pi_c+\Pi_{c'})). \tag{7}
$$

The associated distribution of $\gamma(j)$ conditional on entry into market c and c' is:

$$
f(\gamma|\delta_c=1;\delta_{c'}=1) = [1-e^{-\Pi_c\gamma}][1-e^{-\Pi_{c'}\gamma}]\frac{f(\gamma)}{P_{cc'}}.
$$

We can apply the likelihood ratio argument above to show that expected sales of a firm selling to market c and c' exceeds expected sales of a firm selling to market c if and only if $\epsilon > 0$. The expression for expected sales of a firm selling in these two markets is:

$$
E[X_c|\delta_c=1;\delta_{c'}=1] = \frac{\overline{X}_c}{P_{cc'}}[M(\epsilon)-M(\epsilon-\Pi_c)-M(\epsilon-\Pi_{c'})+M(\epsilon-(\Pi_c+\Pi_{c'}))]. \tag{8}
$$

4.2 Aggregation and the Link to Firm Statistics

Since the number of French firms J is large, the fraction selling in market c will, by the law of large numbers, closely approximate the probability that any one of them

exports there, P_c given in equation (3). The average sales among firms exporting to country c will correspond closely to the associated expectation: $E[X_c|\delta_c = 1]$, given by equations (4).

In the data we observed the variance of the log of the number of French firms exporting to a country far exceeding the variance in the log of average exports by firms exporting to a country. This finding reflects the magnitude of the variance in market access Π_c relative to the variance in market size $\overline{X}_c$. We also found a positive correlation between the log of the number of French firms exporting to a country and the log of average exports of those that did. With $\epsilon = 0$ this correlation would be due to a positive correlation between market size and market access. With $\epsilon > 0$ it would also arise from a positive correlation between $[M(\epsilon - \Pi_c) - M(\epsilon - \Pi_c)]/[M(0) - M(-\Pi_c)]$ and $[M(0) - M(-\Pi_c)]$.

Total exports of French firms to country c, X_c^E are the product of the number of potential French exporters, the fraction that export to c, and the expected sales of those that do. As a share of total French exports X^E, exports to c are:

$$\frac{X_c^E}{X^E} = aP_cE[X_c|\delta_c = 1] = aP_c\overline{X}_c \frac{M(\epsilon) - M(\epsilon - \Pi_c)}{M(0) - M(-\Pi_c)} = a\overline{X}_c[M(\epsilon) - M(\epsilon - \Pi_c)],$$

where $a = 1/\sum_{k=1}^{C} \overline{X}_k[M(\epsilon) - M(\epsilon - \Pi_k)]$. This expression allows us to relate the theory to our regressions of the log of the number of French firms exporting to a country on the log of total French exports to that country.

4.3 Estimation

We have set out the theory without taking a stand on the density of $\gamma(j)$ other than that it has a well defined moment generating function. A particularly convenient functional form for estimation is the gamma distribution:

$$f(\gamma) = \frac{1}{\Gamma(\alpha)\alpha^{-\alpha}}\gamma^{\alpha-1}e^{-\gamma\alpha},$$

where $\alpha > 0$. The unusual parameterization imposes the normalization $E[\gamma(j)] = 1$. Other properties of this gamma distribution are $Var[\gamma(j)] = 1/\alpha$ and $M(t) = (1 - t/\alpha)^{-\alpha}$ for $t < \alpha$. The special case of $\alpha = 1$ is the exponential distribution.

As noted above, we equate the fraction of French firms exporting to country c to the theoretical probability that a French firm sells there:

$$\frac{n_c^E}{J} = P_c = 1 - \left(1 + \frac{\Pi_c}{\alpha}\right)^{-\alpha}.$$

The observed number of French manufacturing firms may exceed J if some are not even potential exporters. Hence, we treat J as an unknown parameter. Inverting this equation yields:

$$\frac{\Pi_c}{\alpha} = \left(1 - \frac{n_c^E}{J}\right)^{-1/\alpha} - 1.$$

We denote the number of French firms exporting to c and nowhere else, by n_{c0}^E. Conditional on the total number of French firms exporting to c, the number exporting only there has a binomial distribution with parameters n_c^E and P_{c0}/P_c (the probability of exporting nowhere else, conditional on exporting to c). Since n_c^E is typically a large number while P_{c0}/P_c is close to zero, the poisson distribution provides a close approximation to the binomial. The parameter of the poisson is:

$$\lambda_{c0} = n_c^E\left(P_{c0}/P_c\right) = JP_{c0} = J\left[\left(1 + \frac{\Pi_{-c}}{\alpha}\right)^{-\alpha} - \left(1 + \frac{\Pi^*}{\alpha}\right)^{-\alpha}\right].$$

Noting that $\frac{\Pi^*}{\alpha} = \sum_{k=1}^{C}\left[\left(1 - \frac{n_k^E}{J}\right)^{-1/\alpha} - 1\right]$ and $\frac{\Pi_{-c}}{\alpha} = \sum_{k\neq c}\left[\left(1 - \frac{n_k^E}{J}\right)^{-1/\alpha} - 1\right]$ the vector of poisson parameters (λ_{c0} for $c = 1, ..., C$) depend on only two unknown

parameters, J and α. These two parameters can be estimated by maximum likelihood. In a limiting case, as J gets large and α gets small, but with $\omega\alpha = b$, we get

$$\lambda_{c0} = b\left\{\ln\left[1+\sum_{k=1}^{C}\left(e^{n_k^E/b}-1\right)\right]-\ln\left[1+\sum_{k\neq c}\left(e^{n_k^E/b}-1\right)\right]\right\},$$

which involves only one unknown parameter, b. Initial estimation yielded $b = 10$.

5 Conclusion

TBA

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A Data Appendix

Our empirical work combines macro–level observations on trade and production with micro–level statistics calculated from observations of individual French manufacturing firms. We limit the analysis to manufactures in the year 1986.

For each of 112 trading partners of France we gather data on production, total exports, and total imports. These data are presented in Table 1. Production, Q_c in the paper, is measured as gross manufacturing output in country c, available from UNIDO (1999). (If data from UNIDO was unavailable, we used data on manufacturing value added from the World Bank, scaled by an estimate of the ratio of gross production to value added.) Expenditure (i.e. absorption), Y_c in the paper, is measured as Q_c plus imports of manufactures less exports of manufactures. Exports and imports are from Feenstra et. al. (1997).

The firm-level data report 254 countries as either destinations for French exports or sources of French imports. The reasons for dropping 142 countries (nearly all of them tiny) are as follows:

- 17 countries were dropped because they were aggregates of smaller countries.
- 79 more countries were dropped in the process of merging the firm-level data with the aggregate data described above.
- An additional 31 countries were dropped because their population was less than 1 million in 1986.
- France was dropped since we are only considering foreign sources and destinations.

- Yemen and the United Arab Emirates were dropped due to lack of firm-level data.

- 9 more countries did not have data on gross output and 3 more did not have export data.

Table 2 presents some statistics on exports of French firms to different destinations. Table 3 presents statistics on imports of French firms from different destinations.

After merging the aggregate and firm-level data, we can measure French exports using either a country's imports from France as reported in the aggregate bilateral trade figures in Feenstra et. al. (1997) or by aggregating French exports as reported in the firm-level data. The first measure, divided by expenditure on manufactures, is shown in the last column of Table 1 while the second measure, divided by expenditure on manufactures, is shown in the last column of Table 2. The close relationship between these two measures of S_c^I is shown in Figure A1. In the paper we use the measure of S_c^I based on aggregating the firm-level data.

We can measure a country's exports to France using either the aggregate bilateral trade figures in Feenstra et. al. (1997) or by aggregating French imports as reported in the firm-level data (here we look at total imports in the firm-level data rather than distinguishing between final goods and intermediates). Dividing either one by production yields a measure of S_c^E, the share of country c's production exported to France. The relationship between these two measures is shown in Figure A2. The two are highly correlated, but not as tightly as for the export data.

Table 1: Aggregate Production and Trade (continued on the next 2 pages)

#	Country	Gross Output ($ mill.)	Total Imports ($ mill.)	Total Exports ($ mill.)	Total Absorp. ($ mill.)	French Share (% abs.)
1	AFGHANISTAN	438	464	62	840	1.56
2	ALBANIA	1805	183	88	1900	0.28
3	ALGERIA	18488	7726	139	26076	9.06
4	ANGOLA*	1680	980	6	2654	5.08
5	ARGENTINA	64622	3962	4744	63840	0.43
6	AUSTRALIA	71626	22658	9278	85005	0.66
7	AUSTRIA	54679	23146	21787	56037	1.82
8	BANGLADESH	2489	1607	803	3293	0.59
9	BELGIUM-LUXEMBOURG*	61536	55490	59245	57780	15.25
10	BENIN*	229	368	14	583	19.82
11	BOLIVIA	879	615	130	1363	0.46
12	BRAZIL*	188268	10489	17314	181443	0.39
13	BULGARIA	51123	3145	1691	52576	0.23
14	BURKINA FASO*	693	243	34	903	12.58
15	BURUNDI	208	113	16	305	5.89
16	CAMEROON*	3045	1737	304	4479	16.70
17	CANADA	211126	69315	77536	202905	0.56
18	CENTRAL AFRICAN REP	112	113	68	156	37.18
19	CHAD*	295	89	5	379	10.53
20	CHILE	11166	2491	2866	10791	0.85
21	CHINA	244565	36471	17439	263597	0.26
22	COLOMBIA	16618	3372	968	19022	0.83
23	COSTA RICA	2811	993	396	3408	0.58
24	COTE D'IVOIRE*	3864	1386	683	4567	12.27
25	CUBA	13861	1740	496	15105	0.35
26	CZECHOSLOVAKIA (fmr)	53061	9622	18942	43741	0.41
27	DENMARK	34764	19670	18421	36012	3.03
28	DOMINICAN REPUBLIC*	1857	1393	960	2290	1.19
29	ECUADOR	3636	1702	836	4502	0.51
30	EGYPT	22085	7989	517	29556	3.14
31	EL SALVADOR*	1580	674	158	2096	0.31
32	ETHIOPIA	1424	876	31	2269	0.81
33	FINLAND	43829	11852	15482	40199	1.67
34	GERMANY (East)	233400	4647	6071	231977	0.14
35	GERMANY (West)	652126	142270	234151	560245	3.14
36	GHANA	1066	588	328	1326	2.84
37	GREECE	18534	8697	4132	23099	2.94
38	GUATEMALA	1384	788	261	1911	0.68
39	HONDURAS	1658	583	169	2071	0.76
40	HONG KONG	29225	29365	35200	23390	2.07

Explanatory notes are at the bottom of the table.

#	Country	Gross Output ($ mill.)	Total Imports ($ mill.)	Total Exports ($ mill.)	Total Absorp. ($ mill.)	French Share (% abs.)
(Continued from above)						
41	HUNGARY	24541	6873	7545	23869	0.77
42	INDIA	94258	12307	7355	99210	0.75
43	INDONESIA	21240	9019	5311	24948	1.17
44	IRAN	9506	6735	619	15621	0.57
45	IRAQ	7106	6434	124	13416	3.63
46	IRELAND	19300	9720	11170	17850	2.27
47	ISRAEL	17729	7417	6485	18662	1.98
48	ITALY	279679	71108	92816	257971	4.48
49	JAMAICA	1676	683	509	1850	0.60
50	JAPAN	1505008	66823	218393	1353439	0.12
51	JORDAN	2082	1828	362	3548	2.52
52	KENYA	5288	1359	243	6404	3.26
53	KOREA (South)	104312	22424	35091	91646	0.79
54	KUWAIT	5311	4876	357	9830	2.98
55	LIBERIA*	112	1928	366	1674	5.83
56	LIBYA*	3051	3825	103	6773	2.88
57	MADAGASCAR	365	295	54	606	20.25
58	MALAWI	301	219	29	490	1.88
59	MALAYSIA	16435	9498	9309	16625	1.32
60	MALI*	279	290	27	542	21.13
61	MAURITANIA*	225	305	219	312	34.27
62	MAURITIUS	1042	482	433	1091	9.61
63	MEXICO	35097	11209	5638	40668	0.52
64	MOROCCO	7348	2671	1520	8500	10.86
65	MOZAMBIQUE	471	301	88	684	3.13
66	NEPAL	636	233	121	748	0.53
67	NETHERLANDS	100161	61865	68333	93693	5.01
68	NEW ZEALAND	17512	5242	4616	18138	0.56
69	NICARAGUA*	1913	526	43	2396	1.44
70	NIGER	359	183	231	311	30.47
71	NIGERIA*	4167	4260	16	8412	5.73
72	NORWAY	34325	18043	10733	41634	1.96
73	OMAN*	645	2304	193	2757	3.00
74	PAKISTAN	10516	4239	2860	11896	1.33
75	PANAMA	1769	5286	253	6802	0.39
76	PAPUA NEW GUINEA	606	780	390	996	0.60
77	PARAGUAY*	1202	672	108	1767	0.96
78	PERU	12501	2230	1380	13352	0.68
79	PHILIPPINES	12138	3411	2747	12803	0.49
80	PORTUGAL	19465	6851	6600	19717	4.40

Explanatory notes are at the bottom of the table.

#	Country	Gross Output ($ mill.)	Total Imports ($ mill.)	Total Exports ($ mill.)	Total Absorp. ($ mill.)	French Share (% abs.)
(Continued from above)						
81	ROMANIA	61081	2264	4316	59029	0.26
82	RWANDA	242	157	8	391	6.53
83	SAUDI ARABIA*	12744	18644	1917	29470	3.59
84	SENEGAL*	1128	702	440	1390	20.90
85	SIERRA LEONE	42	132	102	72	12.10
86	SINGAPORE	17169	19015	14983	21201	1.94
87	SOMALIA	89	298	7	380	1.80
88	SOUTH AFRICA	38906	8514	8879	38540	1.05
89	SPAIN	128553	25540	22733	131360	3.25
90	SRI LANKA	1849	1409	610	2648	0.89
91	SUDAN*	3138	768	50	3856	0.78
92	SWEDEN	73328	27458	35265	65520	2.47
93	SWITZERLAND	85834	37173	37069	85938	4.93
94	SYRIAN ARAB REP	9149	1932	538	10543	1.77
95	TAIWAN	97101	18020	40041	75079	0.42
96	TANZANIA	861	711	68	1504	0.98
97	THAILAND	19082	7044	6728	19397	1.77
98	TOGO*	184	390	16	558	20.60
99	TRINIDAD & TOB	1542	1176	399	2319	0.49
100	TUNISIA*	3402	2177	1215	4364	16.47
101	TURKEY	36912	8233	5219	39926	1.41
102	UGANDA*	568	256	14	810	0.65
103	UNITED KINGDOM	345105	105041	95720	354425	2.78
104	UNITED STATES	2245270	320830	200594	2365506	0.38
105	URUGUAY	3599	670	1018	3252	0.81
106	USSR (fmr)	1066813	35511	13703	1088621	0.10
107	VENEZUELA	30786	7107	1343	36550	0.95
108	VIETNAM*	18963	492	192	19264	0.17
109	YUGOSLAVIA (fmr)	70767	8939	9554	70151	0.66
110	ZAIRE*	1937	1067	1083	1921	6.79
111	ZAMBIA*	902	389	715	575	4.25
112	ZIMBABWE	3261	749	476	3534	0.90

All data are for the manufacturing sector in 1986. For most countries, gross output is measured as gross production in manufacturing from UNIDO. For countries marked with a *, gross output is derived by scaling up value added in manufacturing, as published by the World Bank. Trade data are from Feenstra(1997). Manufacturing absorption is gross output + total imports - total exports. French share is a country's imports from France as a percentage of its total absorption.

Table 2: Exports of French Firms (continued on the next 2 pages)

#	Country	French Exports (FF mill.)	French Exporters (# firms)	Exports per Firm (FF mill.)	French Share (% abs.)
1	AFGHANISTAN	86.86	53	1.64	1.49
2	ALBANIA	19.64	66	0.30	0.15
3	ALGERIA	9198.37	3857	2.38	5.09
4	ANGOLA*	573.01	476	1.20	3.11
5	ARGENTINA	1621.94	828	1.96	0.37
6	AUSTRALIA	2822.34	2289	1.23	0.48
7	AUSTRIA	5373.69	4213	1.28	1.38
8	BANGLADESH	161.79	156	1.04	0.71
9	BELGIUM-LUXEMBOURG*	43287.93	18614	2.33	10.81
10	BENIN*	502.11	1239	0.41	12.42
11	BOLIVIA	26.4	89	0.30	0.28
12	BRAZIL*	3837.13	980	3.92	0.31
13	BULGARIA	634.92	458	1.39	0.17
14	BURKINA FASO*	320.13	1209	0.26	5.12
15	BURUNDI	78.22	280	0.28	3.69
16	CAMEROON*	2473.67	4167	0.59	7.97
17	CANADA	5191.92	4564	1.14	0.37
18	CENTRAL AFRICAN REP	177.58	1066	0.17	16.34
19	CHAD*	109.78	515	0.21	4.17
20	CHILE	513.29	746	0.69	0.69
21	CHINA	2488.92	597	4.17	0.14
22	COLOMBIA	889.07	542	1.64	0.67
23	COSTA RICA	97.7	178	0.55	0.41
24	COTE D'IVOIRE*	2087.92	3903	0.53	6.60
25	CUBA	253.91	223	1.14	0.24
26	CZECHOSLOVAKIA (fmr)	878.68	587	1.50	0.29
27	DENMARK	5395.96	3843	1.40	2.16
28	DOMINICAN REPUBLIC*	99.83	202	0.49	0.63
29	ECUADOR	132.33	295	0.45	0.42
30	EGYPT	3907.82	1413	2.77	1.91
31	EL SALVADOR*	55.61	106	0.52	0.38
32	ETHIOPIA	101.68	210	0.48	0.65
33	FINLAND	3678.33	2630	1.40	1.32
34	GERMANY (East)	1307.12	330	3.96	0.08
35	GERMANY (West)	88531.3	15327	5.78	2.28
36	GHANA	152.15	131	1.16	1.66
37	GREECE	3360.74	3127	1.07	2.10
38	GUATEMALA	76.32	151	0.51	0.58
39	HONDURAS	2962.69	112	0.56	0.44
40	HONG KONG	2453.87	2190	1.12	1.51

Explanatory notes are at the bottom of the table.

#	Country	French Exports (FF mill.)	French Exporters (# firms)	Exports per Firm (FF mill.)	French Share (% abs.)
(Continued from above)					
41	HUNGARY	1004.28	789	1.27	0.61
42	INDIA	5104.3	1132	4.51	0.74
43	INDONESIA	1453.73	579	2.51	0.84
44	IRAN	459.16	322	1.43	0.42
45	IRAQ	2296.99	605	3.80	2.47
46	IRELAND	1988.41	1991	1.00	1.61
47	ISRAEL	1779.17	2444	0.73	1.38
48	ITALY	58949.04	11064	5.33	3.30
49	JAMAICA	63.91	105	0.61	0.50
50	JAPAN	6562.59	3313	1.98	0.07
51	JORDAN	440.72	824	0.53	1.79
52	KENYA	1210.75	376	3.22	2.73
53	KOREA (South)	3690.28	970	3.80	0.58
54	KUWAIT	1636.05	1316	1.24	2.40
55	LIBERIA*	391.51	153	2.56	3.37
56	LIBYA*	927	287	3.23	1.97
57	MADAGASCAR	386.71	1012	0.38	9.20
58	MALAWI	65.9	61	1.08	1.94
59	MALAYSIA	619.82	693	0.89	0.54
60	MALI*	324.88	1038	0.31	8.64
61	MAURITANIA*	400.78	720	0.56	18.53
62	MAURITIUS	352.5	867	0.41	4.66
63	MEXICO	1383.04	740	1.87	0.49
64	MOROCCO	4484.61	4106	1.09	7.61
65	MOZAMBIQUE	107.05	161	0.66	2.26
66	NEPAL	21.91	44	0.50	0.42
67	NETHERLANDS	24478.4	8558	2.86	3.77
68	NEW ZEALAND	474.26	854	0.56	0.38
69	NICARAGUA*	149.03	98	1.52	0.90
70	NIGER	271.68	1104	0.25	12.59
71	NIGERIA*	1862.07	630	2.96	3.19
72	NORWAY	4490.4	2946	1.52	1.56
73	OMAN*	436.27	512	0.85	2.28
74	PAKISTAN	978	612	1.60	1.19
75	PANAMA	370.15	396	0.93	0.79
76	PAPUA NEW GUINEA	24.08	70	0.34	0.35
77	PARAGUAY*	110.14	223	0.49	0.90
78	PERU	559.27	424	1.32	0.60
79	PHILIPPINES	489.28	387	1.26	0.55
80	PORTUGAL	4803.75	3863	1.24	3.52

Explanatory notes are at the bottom of the table.

#	Country	French Exports (FF mill.)	French Exporters (# firms)	Exports per Firm (FF mill.)	French Share (% abs.)
(Continued from above)					
81	ROMANIA	739.54	344	2.15	0.18
82	RWANDA	101.38	318	0.32	3.74
83	SAUDI ARABIA*	4981.8	2692	1.85	2.44
84	SENEGAL*	1173	2887	0.41	12.17
85	SIERRA LEONE	38.33	91	0.42	7.67
86	SINGAPORE	1872.94	1730	1.08	1.27
87	SOMALIA	11.73	68	0.17	0.45
88	SOUTH AFRICA	2286.55	1678	1.36	0.86
89	SPAIN	24323.04	7476	3.25	2.67
90	SRI LANKA	119.46	233	0.51	0.65
91	SUDAN*	99.37	244	0.41	0.37
92	SWEDEN	8373.47	4219	1.98	1.84
93	SWITZERLAND	20027.4	15135	1.32	3.36
94	SYRIAN ARAB REP	646.48	688	0.94	0.88
95	TAIWAN	1573.56	989	1.59	0.30
96	TANZANIA	49.64	127	0.39	0.48
97	THAILAND	2551.74	754	3.38	1.90
98	TOGO*	450.12	1683	0.27	11.62
99	TRINIDAD & TOB	43.44	152	0.29	0.27
100	TUNISIA*	2789.69	3254	0.86	9.22
101	TURKEY	2961.38	1136	2.61	1.07
102	UGANDA*	28.31	53	0.53	0.50
103	UNITED KINGDOM	47946.62	10079	4.76	1.95
104	UNITED STATES	42778.45	7873	5.43	0.26
105	URUGUAY	178.98	419	0.43	0.79
106	USSR (fmr)	3617.97	595	6.08	0.05
107	VENEZUELA	1770.3	775	2.28	0.70
108	VIETNAM*	112.34	108	1.04	0.08
109	YUGOSLAVIA (fmr)	2709.3	1132	2.39	0.56
110	ZAIRE*	627.72	973	0.65	4.71
111	ZAMBIA*	85.25	120	0.71	2.14
112	ZIMBABWE	80.77	188	0.43	0.33

All data are for the manufacturing sector in 1986. All the figures (except for manufacturing absorption which is taken from Table 1) are aggregated from data on individual French firms. French share differs from that reported in Table 1 because total French exports to a country as reported by French firms may differ from total French exports as reported by the importing country in aggregate trade statistics.

Table 3: Imports of French Firms (continued on the next 2 pages)

#	Country	French Imports (FF mill.)	French Importers (# firms)	Imports per Firm (FF mill.)	Export Share (% prod.)
1	AFGHANISTAN	3.37	15.00	0.22	0.11
2	ALBANIA	31.27	24.00	1.30	0.25
3	ALGERIA	73.86	51.00	1.45	0.06
4	ANGOLA*	0.90	7.00	0.13	0.01
5	ARGENTINA	259.09	292.00	0.89	0.06
6	AUSTRALIA	2083.80	292.00	7.14	0.42
7	AUSTRIA	2113.08	2579.00	0.82	0.56
8	BANGLADESH	18.14	26.00	0.70	0.11
9	BELGIUM-LUXEMBOURG*	13549.68	11935.00	1.14	3.18
10	BENIN*	4.84	6.00	0.81	0.30
11	BOLIVIA	143.46	3.00	47.82	2.36
12	BRAZIL*	2008.98	602.00	3.34	0.15
13	BULGARIA	39.33	59.00	0.67	0.01
14	BURKINA FASO*	9.40	10.00	0.94	0.20
15	BURUNDI	59.31	3.00	19.77	4.10
16	CAMEROON*	382.83	102.00	3.75	1.81
17	CANADA	1983.31	786.00	2.52	0.14
18	CENTRAL AFRICAN REP	34.53	27.00	1.28	4.45
19	CHAD*	5.66	14.00	0.40	0.28
20	CHILE	165.08	75.00	2.20	0.21
21	CHINA	507.30	753.00	0.67	0.03
22	COLOMBIA	247.88	57.00	4.35	0.22
23	COSTA RICA	40.16	29.00	1.38	0.21
24	COTE D'IVOIRE*	789.59	160.00	4.93	2.95
25	CUBA	25.98	12.00	2.16	0.03
26	CZECHOSLOVAKIA (fmr)	169.66	207.00	0.82	0.05
27	DENMARK	1069.75	1626.00	0.66	0.44
28	DOMINICAN REPUBLIC*	33.51	9.00	3.72	0.26
29	ECUADOR	29.09	35.00	0.83	0.12
30	EGYPT	25.06	58.00	0.43	0.02
31	EL SALVADOR*	5.27	16.00	0.33	0.05
32	ETHIOPIA	65.69	36.00	1.82	0.67
33	FINLAND	1229.46	1002.00	1.23	0.40
34	GERMANY (East)	334.20	293.00	1.14	0.02
35	GERMANY (West)	39954.35	19322.00	2.07	0.88
36	GHANA	14.02	14.00	1.00	0.19
37	GREECE	574.29	372.00	1.54	0.45
38	GUATEMALA	45.66	30.00	1.52	0.48
39	HONDURAS	3247.13	13.00	3.63	0.41
40	HONG KONG	285.10	753.00	0.38	0.14

Explanatory notes are at the bottom of the table.

#	Country	French Imports (FF mill.)	French Importers (# firms)	Imports per Firm (FF mill.)	Export Share (% prod.)
(Continued from above)					
41	HUNGARY	144.00	260.00	0.55	0.08
42	INDIA	203.26	371.00	0.55	0.03
43	INDONESIA	409.23	191.00	2.14	0.28
44	IRAN	26.61	50.00	0.53	0.04
45	IRAQ	5.22	18.00	0.29	0.01
46	IRELAND	1717.69	844.00	2.04	1.28
47	ISRAEL	424.33	345.00	1.23	0.35
48	ITALY	18234.34	17120.00	1.07	0.94
49	JAMAICA	0.90	5.00	0.18	0.01
50	JAPAN	3540.86	2557.00	1.38	0.03
51	JORDAN	11.40	9.00	1.27	0.08
52	KENYA	27.65	25.00	1.11	0.08
53	KOREA (South)	258.54	467.00	0.55	0.04
54	KUWAIT	1.78	11.00	0.16	0.00
55	LIBERIA*	171.48	36.00	4.76	22.05
56	LIBYA*	1.43	2.00	0.72	0.01
57	MADAGASCAR	167.73	70.00	2.40	6.62
58	MALAWI	14.48	6.00	2.41	0.69
59	MALAYSIA	569.48	192.00	2.97	0.50
60	MALI*	31.17	20.00	1.56	1.61
61	MAURITANIA*	342.18	11.00	31.11	21.92
62	MAURITIUS	52.62	72.00	0.73	0.73
63	MEXICO	121.99	149.00	0.82	0.05
64	MOROCCO	509.52	315.00	1.62	1.00
65	MOZAMBIQUE	6.64	12.00	0.55	0.20
66	NEPAL	0.73	16.00	0.05	0.02
67	NETHERLANDS	6718.35	5785.00	1.16	0.97
68	NEW ZEALAND	400.94	121.00	3.31	0.33
69	NICARAGUA*	38.23	27.00	1.42	0.29
70	NIGER	2.24	12.00	0.19	0.09
71	NIGERIA*	27.17	26.00	1.04	0.09
72	NORWAY	844.79	629.00	1.34	0.36
73	OMAN*	0.03	2.00	0.02	0.00
74	PAKISTAN	110.26	169.00	0.65	0.15
75	PANAMA	9.21	15.00	0.61	0.08
76	PAPUA NEW GUINEA	11.21	10.00	1.12	0.27
77	PARAGUAY*	43.29	33.00	1.31	0.52
78	PERU	421.22	60.00	7.02	0.49
79	PHILIPPINES	102.99	132.00	0.78	0.12
80	PORTUGAL	845.07	950.00	0.89	0.63

Explanatory notes are at the bottom of the table.

#	Country	French Imports (FF mill.)	French Importers (# firms)	Imports per Firm (FF mill.)	Export Share (% prod.)
(Continued from above)					
81	ROMANIA	135.35	122.00	1.11	0.03
82	RWANDA	41.59	5.00	8.32	2.47
83	SAUDI ARABIA*	96.56	64.00	1.51	0.11
84	SENEGAL*	143.12	44.00	3.25	1.83
85	SIERRA LEONE	25.47	4.00	6.37	8.69
86	SINGAPORE	125.36	176.00	0.71	0.11
87	SOMALIA	0.55	5.00	0.11	0.09
88	SOUTH AFRICA	739.03	228.00	3.24	0.27
89	SPAIN	4321.80	5583.00	0.77	0.49
90	SRI LANKA	47.84	78.00	0.61	0.37
91	SUDAN*	56.23	68.00	0.83	0.26
92	SWEDEN	2593.93	1929.00	1.34	0.51
93	SWITZERLAND	7490.84	6853.00	1.09	1.26
94	SYRIAN ARAB REP	20.85	13.00	1.60	0.03
95	TAIWAN	452.29	992.00	0.46	0.07
96	TANZANIA	10.20	13.00	0.78	0.17
97	THAILAND	219.28	196.00	1.12	0.17
98	TOGO*	254.57	22.00	11.57	19.91
99	TRINIDAD & TOB	0.52	3.00	0.17	0.00
100	TUNISIA*	325.31	184.00	1.77	1.38
101	TURKEY	293.04	240.00	1.22	0.11
102	UGANDA*	128.11	12.00	10.68	3.25
103	UNITED KINGDOM	8985.62	7679.00	1.17	0.38
104	UNITED STATES	12016.97	5603.00	2.14	0.08
105	URUGUAY	60.66	49.00	1.24	0.24
106	USSR (fmr)	247.08	183.00	1.35	0.00
107	VENEZUELA	153.06	21.00	7.29	0.07
108	VIETNAM*	5.18	8.00	0.65	0.00
109	YUGOSLAVIA (fmr)	281.67	284.00	0.99	0.06
110	ZAIRE*	278.59	51.00	5.46	2.08
111	ZAMBIA*	18.11	9.00	2.01	0.29
112	ZIMBABWE	39.38	42.00	0.94	0.17

All data are for the manufacturing sector in 1986. French imports include only intermediate and capital goods. Export share is French imports from a country as a percentage of the country's gross output. All the figures (except for manufacturing output which is taken from Table 1) are aggregated from data on individual French firms.

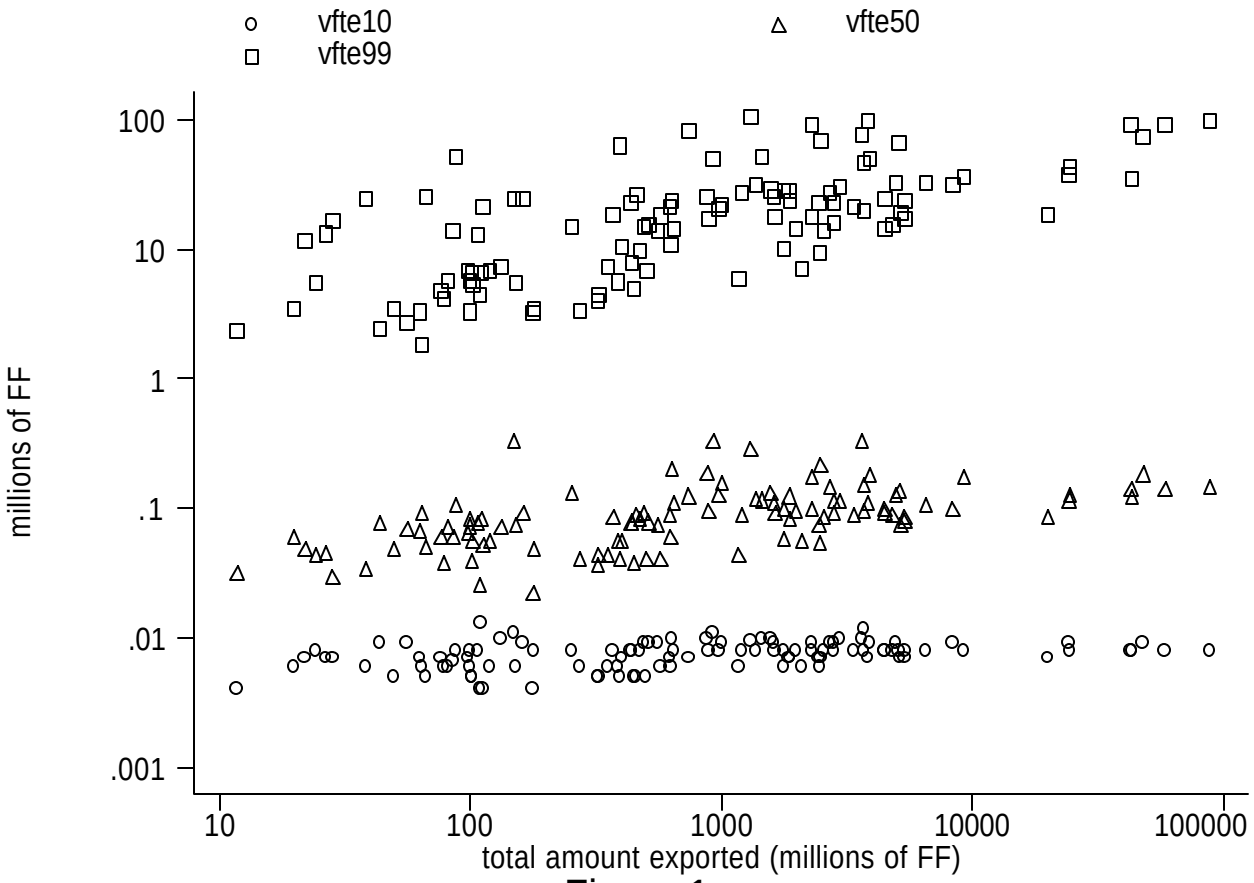
vfte10
vfte50
vfte99
100
10
1
.1
.01
.001
millions of FF
10
100
1000
10000
100000
total amount exported (millions of FF)

Figure 1

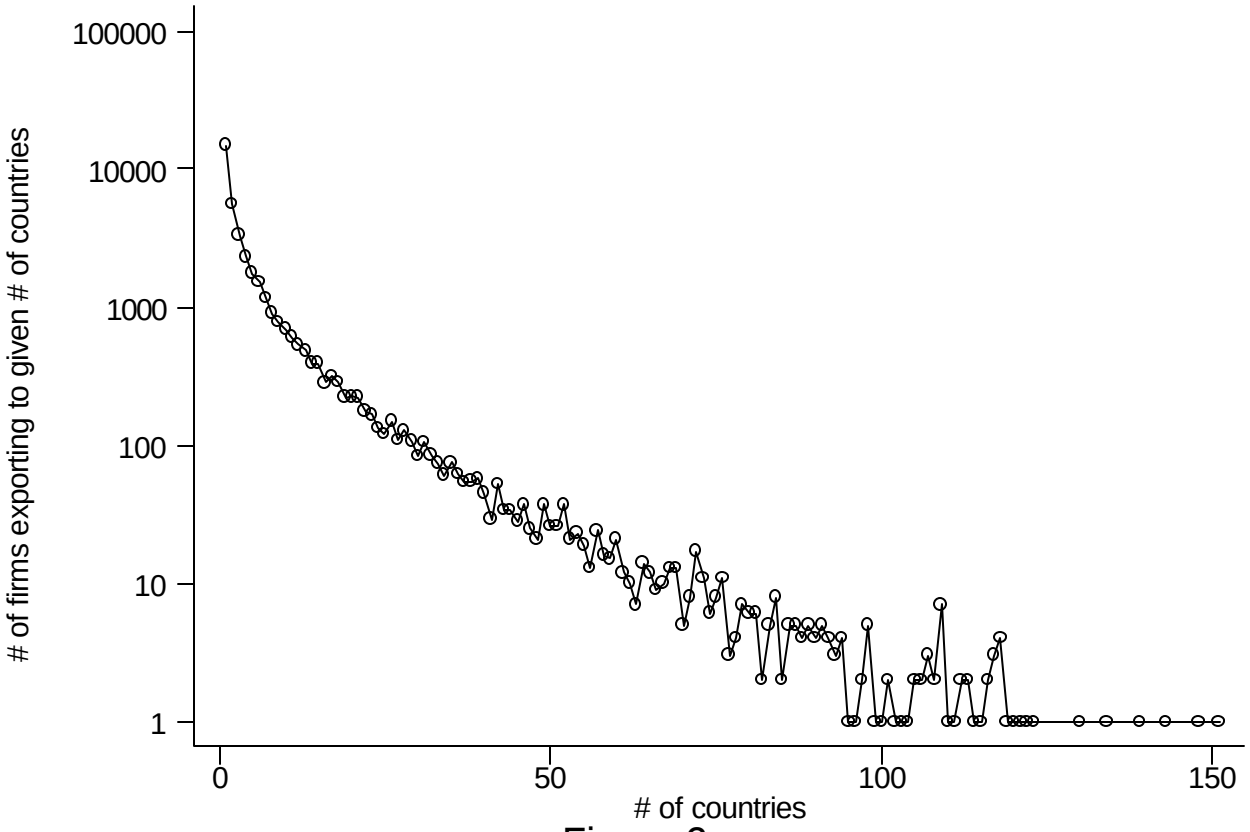
100000
10000
1000
100
10
1
# of firms exporting to given # of countries
0
50
100
150
# of countries

Figure 2

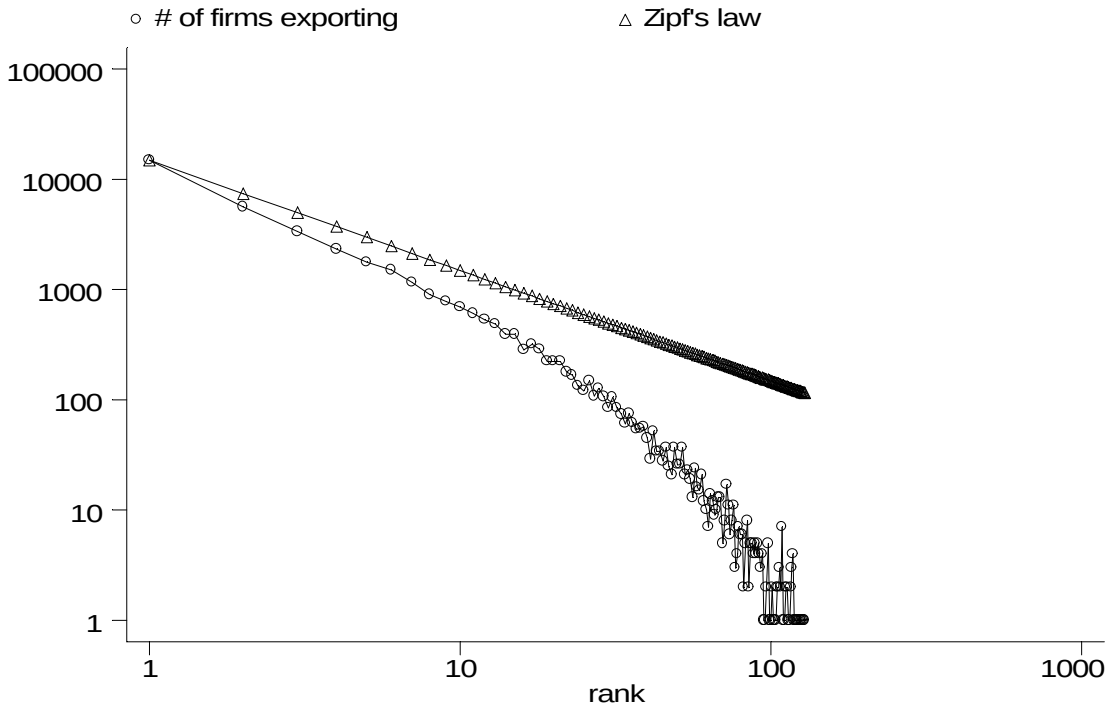
○ # of firms exporting
△ Zipf's law
100000
10000
1000
100
10
1
1
10
100
1000
rank

Figure 2b

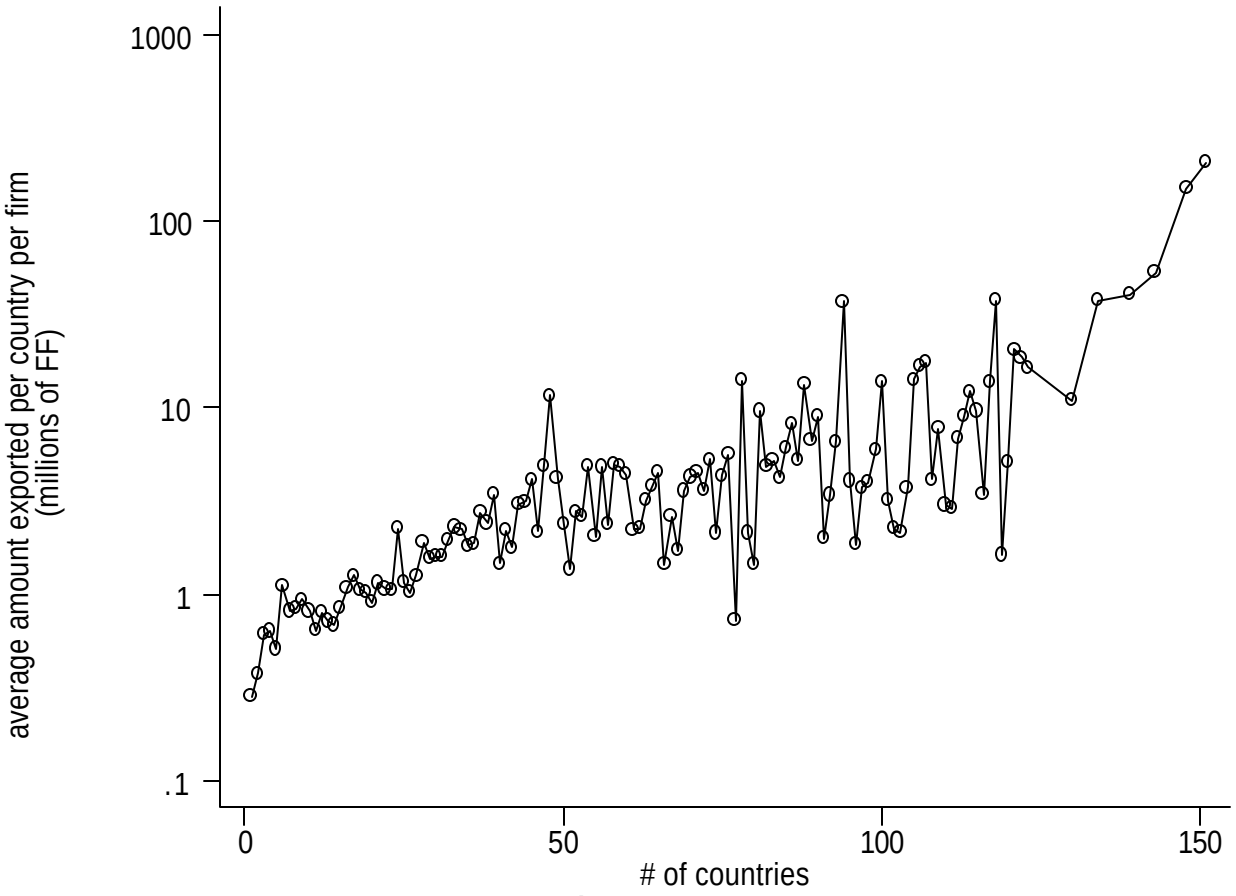
1000
100
10
1
.1
average amount exported per country per firm
(millions of FF)
0
50
100
150
# of countries

Figure 3

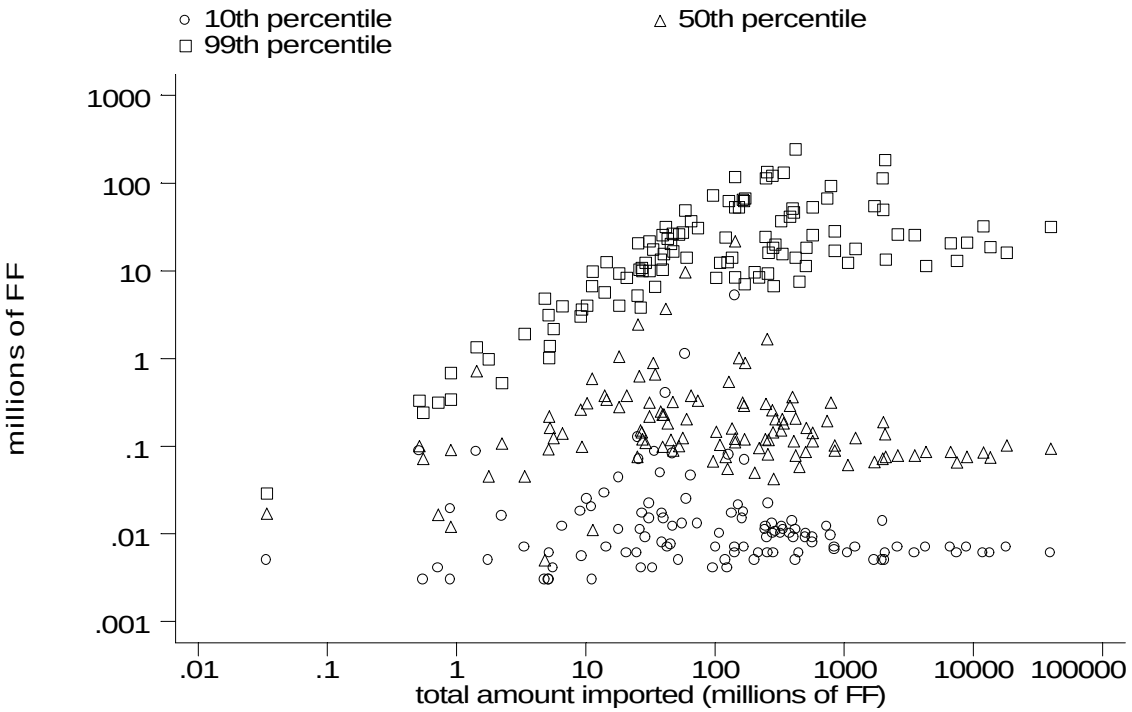
10th percentile
50th percentile
99th percentile
millions of FF
1000
100
10
1
.1
.01
.001
.01
.1
1
10
100
1000
10000
100000
total amount imported (millions of FF)

Figure 4

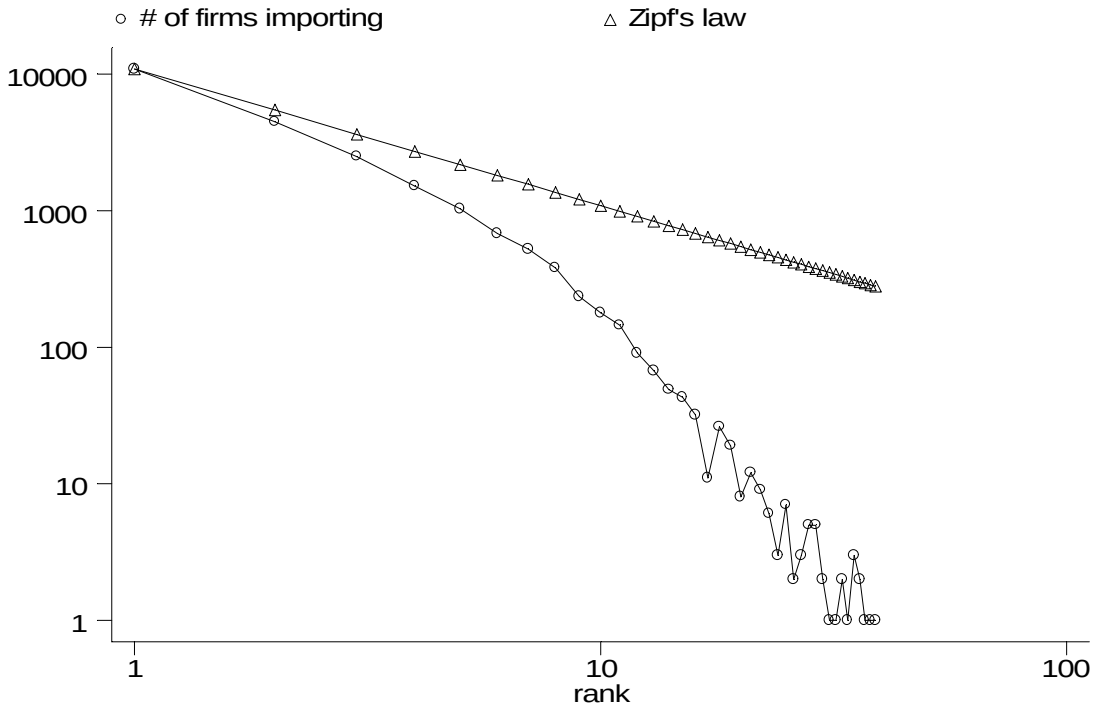

Figure 4b

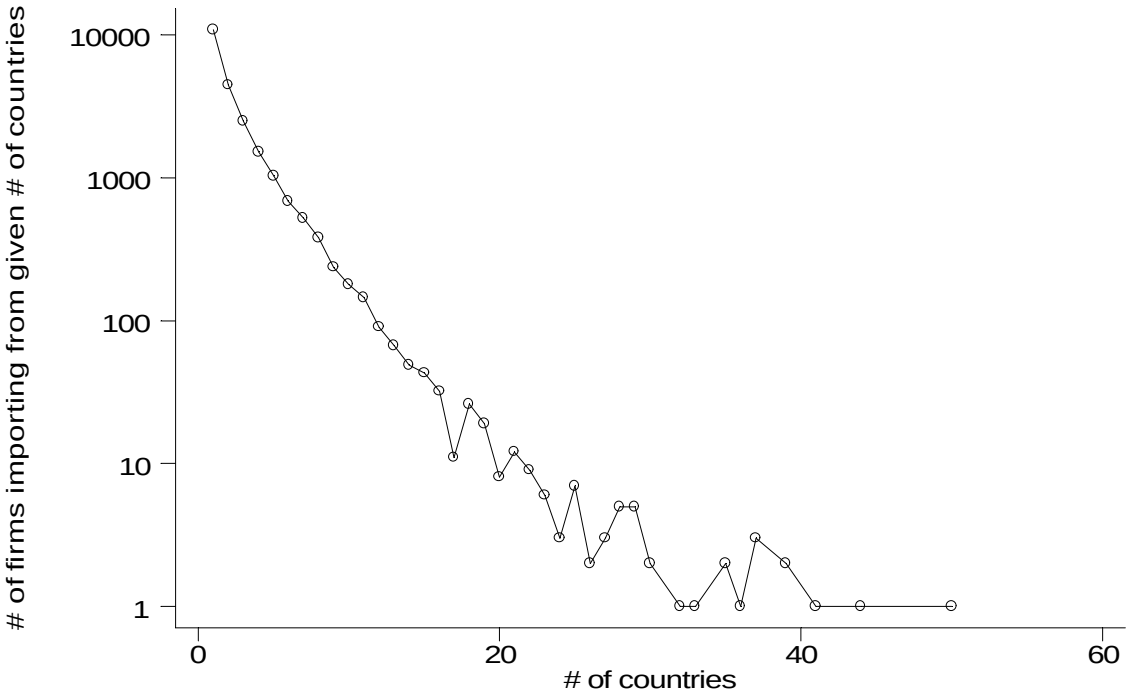
# of firms importing from given # of countries
10000
1000
100
10
1
0
20
40
60
# of countries

Figure 5

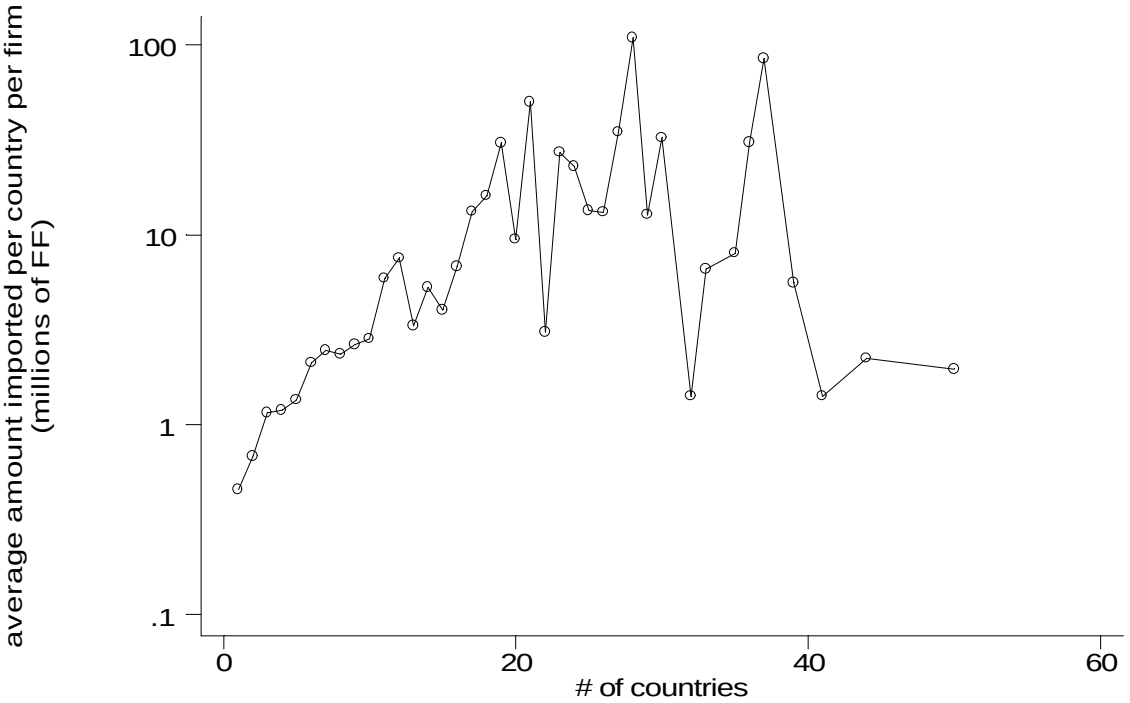
average amount imported per country per firm
(millions of FF)
100
10
1
.1
0
20
40
60
# of countries

Figure 6

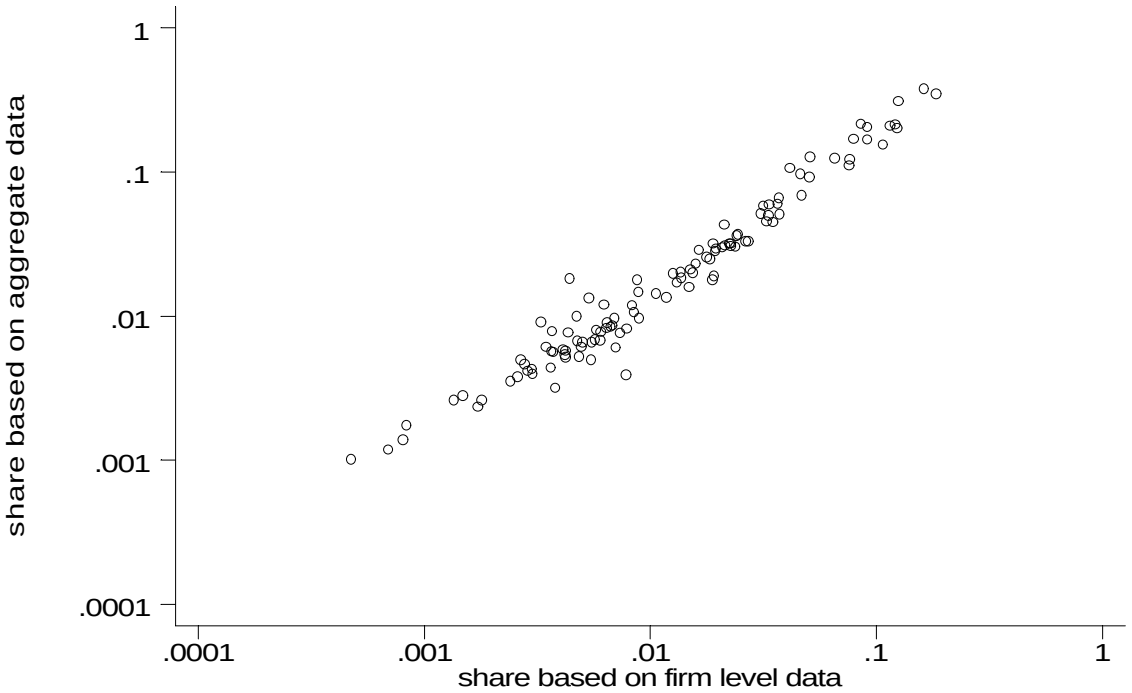
share based on aggregate data
1
.1
.01
.001
.0001
.0001
.001
.01
.1
1
share based on firm level data

Figure A1

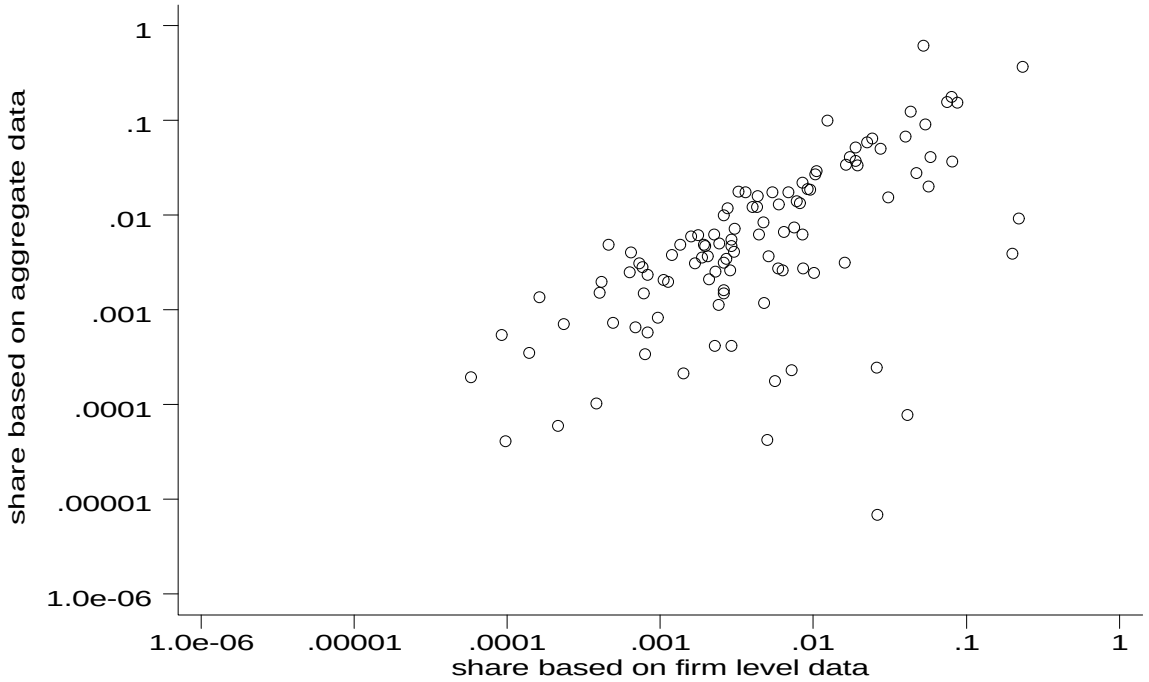

Figure A2