EXPLAINING DISAGGREGATED TRADE DATA with RICARDIAN TRADE MODEL

A Master's Thesis

by
HALİL İBRAHİM KORKMAZ

Department of
Economics
İhsan Doğramacı Bilkent University
Ankara
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To whom I spend less time with in this
process..

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Graduate School of Economics and Social Sciences
of
İhsan Doğramacı Bilkent University

by

Halil İbrahim KORKMAZ

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I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Asst. Prof. Ayse Özgür Pehlivan
Supervisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Assoc. Prof. Fatma Taşkın
Examining Committee Member

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Asst. Prof. Nil İpek Şirikçi
Examining Committee Member

Approval of the Graduate School of Economics and Social Sciences

---

Prof. Dr. Erdal Erel
Director

ABSTRACT

Explaining Disaggregated Trade Data with Ricardian Trade Model

Korkmaz, Halil İbrahim

M.A., Department of Economics

Supervisor: Asst. Prof. Ayse Özgür Pehlivan

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The aim of this thesis is to explain how disaggregated-product level trade data fits into Eaton and Kortum (2002) type Ricardian trade model. In their paper, Eaton and Kortum (2002) explain the effect of geographical barriers and technological differences on trade between countries using data at aggregate level. Their model with perfect competition and constant marginal costs actually implies that the countries who have the lowest cost in supplying a particular good to a particular destination should capture the entire demand for that good in that destination. However, this is not what is observed in disaggregated bilateral trade data even in the least aggregated level. In this thesis, we propose alternative explanations such as capacity constraints and increasing marginal costs to reconcile Eaton and Kortum (2002) setup with disaggregated bilateral trade data. Our aim is to investigate why one seller is not able to win the entire market. The results suggest that costs are not increasing with trade quantities thus constant marginal costs is still possible. To explain multiple sellers for each good and the

fact that each exporter sells at a different unit price. It could be the case that exporters are bounded by capacity constraints for each good in a given market. We report relative productivities of exporters at each destination where we report to a destination with a low trade cost even low productive firms can compete but for destinations with a high trade costs only most productive firms export.

Keywords: Ricardian trade model, bilateral trade, total factor productivity, increasing marginal costs.

ÖZET

İndirgenmiş Ticaret Verisini Ricardo Ticaret Modeli ile Açıklama

KORKMAZ, Halil İbrahim

İktisat Bölümü, Yüksek Lisans

Tez Danışmanı: Yard. Doç. Dr. Ayşe Özgür Pehlivan

Eylül 2015

Bu tezin amacı, indirgenmiş ürün seviyesindeki ticaret verisinin Eaton and Kortum (2002) tipi Ricardo ticaret modeline ne kadar uyduğunu açıklayabilmektir. Eaton and Kortum (2002), coğrafi bariyerlerin ve teknolojik farklılıkların ülkeler arasındaki ticarete olan etkisini toplulaştırılmı ticaret verisi ile açıklıyor. Onların modeli aslında bir üründe en düşük maliyete sahip ülkenin o ürün iin tüm piyasaya hakim olması gerektiğini, en düşük fiyat ile tek satıcı durumunda olacağını işaret ediyor. Ancak bu çıkarım bizim indirgenmiş ticaret verisinde gözlemlediğimiz bir durum değildir, aksine bir ürünü aynı piyasada farklı fiyattan satan birden fazla ihracatçı mevcuttur. Bu tezde biz söz konusu duruma indirgenmiş ikili ticaret verisi ve Eaton-Kortum (2002) modeli ile badaştırıcı alternatif bir açıklama getiriyoruz. Bu açıklamalar ise ülkelerin dolayısıyla firmaların artan marjinal maliyetlere veya kapasite kısıtlarına sahip olmasıdır. Böylece bir satıcının neden tüm piyasaya hakim olamadığını göstermeye çalışıyoruz. Bulgularımıza göre ülkelerin ihraç ettikleri miktara kadar artan bir maliyete sahip olmadıklarını,

sattıkları malın fiyatının miktardan bağımsız olduğunu gözlemledik. Bu sonuçtan yola çkarak firmaların sabit marjinal maliyetlere sahip olduğunu ancak kapasite kısıtlaması ile sınırlandırılmış olduklarını söyleyebiliriz. Bu kısıtları ise aynı piyasayadaki farklı birim fiyattan farklı miktarda ithal edilmiş ürünleri gözlemleyerek ortaya çıkarabiliyoruz.

Anahtar kelimeler: Ricardo ticaret modeli, ikili ticaret, toplam faktör verimliliği, artan marjinal maliyetler.

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CHAPTER I

INTRODUCTION

In this thesis we explain how disaggregated-product level trade data fits into well accepted Eaton and Kortum (2002) type Ricardian trade model. If we track the evolution of Ricardian trade theory of today we find David Ricardo's Principle of Political Economy(1819).In a two good two country and one factor of production economy he showed that productivity differences are the main source of trade. Ricardo showed that even if one country, which was England in his famous example, has the absolute advantage in all goods, both countries can still benefit from trade if countries specialize in production of the good in which they have a comparative advantage. In other words, each country should produce the good in which they have the lowest labor input cost compared to the other good so that the supply for both goods in world economy can be maximized. By specialization on each good, produced levels will be more than before in total supply and if countries trade after they specialized both will be better off.

Shortly after 1900s neo classical era, Eli Heckscher and Bertil Ohlin of the Stockholm School of Economics developed the Heckscher Ohlin(HO) model, later with an extension by Paul Samuelson as sometimes called as HOS model and by

Jaroslav Vanek as sometimes referred as HOV model.This model was built on factor endowment differences of countries and it mainly says that each country will export the good that uses its abundant factor intensively. With this setup of trade it was the differences in endowments of countries which were taken as the source of trade instead of Ricardian explanation of the different technologies of two countries. With HO model more than one factor of production capital, land, labor entered into the equation but technological differences fade away. However, the model itself brought more questions even paradoxes with itself. As first pointed out by Leontief in 1954, US was exporting labor intensive goods while it has the capital as its abundant factor. In many other studies also showed that HO theory has lots of inconsistencies with data. Please see Baldwin(1972),Bowen Leamer and Sveikauskus (1987) and others for a more detailed discussion.

While HO framework was still dominant in international trade literature in 1971 Dornbusch, Fischer and Samuelson (DFS) extended two country two good Ricardian model to account for many goods as it was one the major drawbacks of Ricardian framework. In DFS(1971) they assume there is a continuum of goods. However it was still for two countries. This was also problematic if one would like to apply Ricardian model to real world data since in the real world we have more than two countries.

In 2002 Eaton and Kortum wrote their seminal paper "Technology,Geography and Trade" in which they extended DFS model to n-countries. They introduce a Ricardian trade model with multiple countries, multiple goods and multiple factors of production. They also introduce geographic barriers, where iceberg trade costs pose a resisting power for trade.They use aggregated manufacturing bilateral trade data for 19 OECD countries and their model is able to explain gains from trade, impact of changes in technology and trade barriers on trade.With

Eaton and Kortum's seminal paper along with the realization of how important technological differences can be in explaining trade flows, a whole new Ricardian trade literature emerged.

Eaton and Kortum (2002) and many variants use aggregate trade data and thus explain trade among countries at aggregate level within a perfect competition framework where goods are homogeneous and firms/countries have constant marginal costs with no capacity constraints. This actually implies that the country that has the lowest cost in supplying a particular good to a particular destination should win the entire market for that good in that destination. However, as Pehlivan and Vuong (2015) pointed out, this implies that one country should be the only supplier in that destination remaining other countries with zero exports for that given good. However, this is not what we observe in disaggregated bilateral trade data which consists of only trade value and traded quantities between countries. There are multiple countries with positive export values for the same good at a given destination even when we check for the least aggregated level. In addition in disaggregated bilateral trade data when we look at the ratio of trade value to traded quantity, we actually observe that for a given good and for a given destination these ratios differ across exporters/countries.

In Table 1, we report bilateral trade data for USA when they import copper waste and scrap. We have trade value, traded quantity and trade value/traded quantity ratios in this transaction table.

Table 1: Import Data for USA on Good "Copper waste and scrap"

Reporter	*Partner*	*Trade Value*	*T. Quantity*	*Tr.Value/Tr.Q*
USA	Norway	14163	15312	0.925
USA	Portugal	138927	104945	1.324
USA	Japan	508820	274562	1.853
USA	Canada	184462662	86233187	2.139
USA	United Kingdom	478454	177953	2.689
USA	Italy	35822	11937	3.001
USA	Netherlands	1333914	436125	3.059
USA	Finland	591520	161000	3.674
USA	Germany	781322	208667	3.744
USA	France	1576650	201972	7.806

What we observe is USA imports this very homogeneous good from many exporters with very different prices. This is what we observe for all other destinations and goods as well. To account for these two features, Pehlivan and Vuong (2015) used an auction setup for explaining multiple sellers and multiple trade value to traded quantity ratios(multiple unit prices) in a given destination for a given good,In this auction kind setup they assume for each unit (batch) of a good a separate auction is conducted.

In Eaton and Kortum(2002) type Ricardian trade models countries,exporters draw productivities for each good from same probability distribution. Pehlivan and Vuong(2015) refers to this as probabilistic representation of technologies setup and we will also have a similar setup.In their paper Pehlivan and Vuong(2015) assume that for each auction countries/exporters draw a new productivity draw so it is possible that for some countries some country wins for other auctions some others. This way they are able to explain both the multiple sellers and multiple quantities.

Starting from a similar perspective with Pehlivan and Vuong (2015) to reconcile Eaton and Kortum (2002) framework with disaggregated bilateral trade data instead of assuming each unit is sold at a separate auction, we offer alternative explanations. We introduce capacity constraints and non-constant(increasing) marginal costs into Eaton and Kortum(2002) type Ricardian trade model to explain for the existence of multiple sellers and multiple unit prices

What is in the literature about increasing costs is usually it is the case where there are additional trade costs as destination/ market size increases thus trade exhibits limits for individual suppliers.Regarding non-constant(increasing) marginal costs, Arkolakis (2008)brought some insight to explain why there are multiple exporters of the same good. In his setup, exporter firms face a market penetration cost like advertisement to reach an additional consumer from a single market. Increasing market share in a specific destination have increasing costs thus when it becomes less profitable to reach additional consumer in a given destination, firm chooses to export to a different market or sell in domestic country instead. With this setup he was able to bring an explanation to why a firm cannot dominate the whole market.

Increasing costs of exporting more to a market could be a reasonable explanation. Instead we want to check production side of the exporters and find a possible explanation to existence of multiple sellers for the same good j. We offer two possible explanations for multiple sellers and different unit values. As said one is increasing marginal costs that prevents one supplier to win entire market or that is if their costs are not increasing with increased production they might have been limited by some internal factor that is what we call "capacity constraints".

With our model we get an estimate of marginal costs productivities for each product category for each destination and exporter. These productivity estimates can be used to gain some insights about which sectors are more productive for a certain exporter at a given destination or for a given good at a given destination which exporter/country is the most productive or for a given good for a given exporter whether the productivity of that exporter differs a lot across destinations. These insights will be important regarding several policy issues such as export subsidies, welfare gains from trade etc.

The organization of this thesis will be as follows: Section 2 introduces our mode. We will our data in Section 3 and in Section 4 we will be conducting our estimation. In Section 5 we will report our estimation results and we will make our concluding remarks at section 6. In the appendix we enclose summary statistics and regarding data to explain our estimation results.

CHAPTER II

MODEL

We will start with the Eaton and Kortum (2002) setup but we will incorporate capacity constraints and non-constant marginal cost form to account for different sellers and different prices for a given good in a given destination.

Index i refers to source/exporter, i=1,..,N; index n refers to destination/importer, n=1,..,N; and j refers to the good, j=1,..,J. As it is in Eaton and Kortum(2002), country i's productivity in producing good j when they export to country n will be the realization of a random variable Z_{ni}^{j}. where Z_{ni}^{j} is an i.i.d draw from productivity distribution $F_{ni}(.)$ for any good j for a given destination n and source i, i.e

$$Z_{ni}^{j} \sim F_{ni}(.) \; for \; all \; j. \tag{1}$$

For a given destination n, these productivity distributions are assumed to be independent across i, i.e across all exporters.

Marginal cost of producing q^{th} unit of good j in country i for country n is

$$MC^{j}_{ni}\left(q\right) = \frac{w_i d^{j}_{ni}}{Z^{j}_{ni}} b\left(q\right) \tag{2}$$

for any i, n, q and j where $b(q)$ is a continuous function.Let Q^{j}_{ni} denote the quantity of good j country n buys from country i. Let X^{j}_{ni} denote expenditure of country n on good j coming from country i. Then we can formulate our two main features in the data with the following notation

$Feature\ 1; (F^1)$

$X^{j}_{ni} > 0 \ \ \& \ \ Q^{j}_{ni} > 0$ for more than one i for a given good j and a given destination n.

This is the main motivation of this thesis, we would like to explain multiple exporters of any given good j for destination n. As mentioned before Eaton and Kortum(2002) and variants did not focus on this since they use aggregate data.

$Feature\ 2; (F^2)$

For any given destination n and any given good j, the unit price across exporters differ, i.e

$$\frac{X^{j}_{ni}}{Q^{j}_{ni}} \neq \frac{X^{j}_{ni'}}{Q^{j}_{ni'}}$$

for all $i{\neq}i'$

As in Eaton and Kortum(2002) there is perfect competition thus there will be marginal cost pricing where supply curve for country i when they export good j to country n is

$$P^{j}_{ni}\left(q\right) = MC^{j}_{ni}\left(q\right) = \frac{w_i d^{j}_{ni}}{Z^{j}_{ni}} b\left(q\right) \tag{3}$$

Let $\bar{P}_{ni}^{j,clear}$ denote the market clearing price which equates total supply of good j in country n is to total demand for good j in country n. Equilibrium quantities, Q_{ni}^{j}'s, will be determined where

$$Q_{ni}^{j} = \left(P_{ni}^{j}\right)^{-1}\left(\bar{P}_{ni}^{j,clear}\right) \tag{4}$$

for all i, n and j.

If we allow for discriminatory pricing then $\frac{X_{ni}^{j}}{Q_{ni}^{j}} \neq \frac{X_{ni'}^{j}}{Q_{ni'}^{j}}$ for any i such that $i \neq i'$ which is consistent with what we observe in the data then X_{ni}^{j} can be written as

$$X_{ni}^{j} = \int_{0}^{Q_{ni}^{j}} P_{ni}^{j}\left(q\right).dq = \int_{0}^{Q_{ni}^{j}} \frac{w_i d_{ni}^{j}}{Z_{ni}^{j}} b\left(q\right).dq \tag{5}$$

Now we will consider the following two main cases

2.1 Constant Marginal Costs with Capacity Constraint

First, we will have constant marginal costs i.e. $b(q) = \bar{b}$. When there is constant marginal costs then unit price of the goods will not change with the quantity traded and this unit price will be equal to marginal costs. Then the ratio $\frac{X_{ni}^{j}}{Q_{ni}^{j}}$ will give us prices for each i any given good j exported from country i to country n. For any given destination n and for any good j we will rank these $\frac{X_{ni}^{j}}{Q_{ni}^{j}}$ for each i thus we will have unit prices from lowest to highest. Then since there is marginal cost pricing these ratios except for the highest one will give us the marginal cost of country i. [1]

[1]Footnote: Constant Marginal Cost i.e. $b(q) = \bar{b}$ with no capacity constraint case is the model worked on Eaton and Kortum (2002) which cannot account for the multiple sellers and multiple unit prices.

$MC_{ni}^{j}=\frac{X_{ni}^{j}}{Q_{ni}^{j}}$ and the associated Q_{ni}^{j} will give the capacity constraint because with constant marginal cost pricing there exists internal capacity constraints that limit exporters to produce and sell infinite amounts. Thus Q_{ni}^{j} is the capacity of exporter/country i when trading to destination n for good j.

$$MC_{ni}^{j}=\frac{X_{ni}^{j}}{Q_{ni}^{j}}=\frac{w_i d_{ni}^{j}}{Z_{ni}^{j}}\bar{b} \tag{6}$$

2.2 Non-Constant(Increasing)Marginal Costs

2.2.1 Increasing Linear Marginal Costs

Suppose $b(q)$ is such that $\frac{\partial b(q)}{\partial q}=\beta_1$ where β_1 stands for any positive number. Suppose $b(q)=\beta_1 q$ where $\beta_1>0$. Then the corresponding expenditure equation will be

$$X_{ni}^{j}=\int_{0}^{Q_{ni}^{j}} P_{ni}^{j}\left(q\right).dq=\int_{0}^{Q_{ni}^{j}}\frac{w_i d_{ni}^{j}}{Z_{ni}^{j}}\beta_1 q.dq \tag{7}$$

$$=\left[\frac{w_i d_{ni}^{j}}{Z_{ni}^{j}}\frac{\beta_1 q^2}{2}\right]_0^{Q_{ni}^{j}} \tag{8}$$

$$=\frac{w_i d_{ni}^{j}}{Z_{ni}^{j}}\frac{\beta_1 {Q_{ni}^{j}}^2}{2} \tag{9}$$

This is the linear cost case where cost of producing any good j increases constantly by q at a constant rate β_1

2.2.2 Increasing Convex Marginal Costs

Suppose $b(q)$ is such that $\frac{\partial b(q)}{\partial q} > 0$ and $\frac{\partial^2 b(q)}{\partial q} > 0$

Suppose b(q)=$\beta_2 q^2 + \beta_1 q + \beta_0$ where $\beta_2 > 0$, $2\beta_2 + \beta_1 > 0$ Then the corresponding expenditure equation will be

$$X_{ni}^{j} = \int_{0}^{Q_{ni}^{j}} P_{ni}^{j}(q) .dq = \int_{0}^{Q_{ni}^{j}} \frac{w_i d_{ni}^{j}}{Z_{ni}^{j}} (\beta_2 q^2 + \beta_1 q + \beta_0).dq \tag{10}$$

$$X_{ni}^{j} = \frac{w_i d_{ni}^{j}}{Z_{ni}^{j}} (\beta_0 Q_{ni}^{j} + \frac{\beta_1}{2}(Q_{ni}^{j})^2 + \frac{\beta_2}{3}(Q_{ni}^{j})^3) \tag{11}$$

These expressions above provides a link between our model and data. As explained in the next section we observe $X_{ni}^{j}, Q_{ni}^{j}, w_i$ and we have estimates of d_{ni}'s hence we can estimate relevant coefficient of b(q) and Z_{ni}^{j}. We will explain our tools for estimation and then test for our hypotheses.

CHAPTER III

DATA

3.1 Trade Data

In our work we will using bilateral trade (import)data for the 19 OECD countries which are used in EK(2002) model but we will not aggregate them instead we will work within disaggregated level. We are using SITC rev 2 5-digit bilateral trade data coding for manufacturing trade data for the 19 OECD countries that are chosen in the Eaton and Kortum(2002).

Table 2: 19 OECD Countries Reported in Eaton and Kortum (2002)

Australia
Austria
Belgium
Canada
Denmark
Finland
France
Germany
Greece
Italy
Japan
Netherlands
New Zealand
Norway
Portugal
Spain
Sweden
UK
USA

For each importer country we have trade value that is our X_{ni}^j and trade quantity Q_{ni}^j for each good that are coming from exporting countries.

3.2 Wage

For the wage variable that is used in our marginal cost equation we use Eaton and Kortum (2002)'s manufacturing wages reported by OECD as annual compensation per worker . They take those as local currencies and convert them to US dollar with current exchange rates and make them relative to US wages where $w_{USA} = 1$.

3.3 About Iceberg Trade Costs D_{ni}

In our original model we allow iceberg trade costs d^j_{ni} to vary across goods. For this particular application we assume $d^j_{ni} = D_{ni}$ for all j, i.e. it does not vary across goods. We believe this is quite a restrictive assumption. However this is beyond the scope of this thesis and would like to drop it in the future.

We obtained Eaton and Kortum(2002)'s iceberg trade costs through their estimation results. They reported that corresponding relative trade costs for each importer country is

$$lnD_{ni} = d_k + b + l + e_h + m_n + \delta_{ni} \tag{12}$$

where d_k is the coefficient of the dummy variable for the distance. Note that they took distance as a dummy where each distance belongs to either of 6 dummies. Those distances are [0,375],[375,750],[750,1500],[1500,3000],[3000,6000] and [6000,maximum]. b is the dummy for a shared border which is available as well as l the language dummy where there are English,French and German languages spoken commonly by some countries and m_n as a destination effect which is reported by EK(2002). For the trade union dummy e_h and l the language dummy we had to create matrices of $19x19$ and convert them into $342x1$ matrices. We took the year 1990 for the existence of a trade union and reported two different union dummies which are EC and EFTA where EC is the European Community which is replaced by European Union in a year after and EFTA is the European Free-Trade Area co-existed with EC for some time but by 1995 it lost most of its members to EU. At the end we made a system of equations of 342 x 6 and obtained lnd_{ni}.

CHAPTER IV

ESTIMATION

4.1 Estimation Process

In order to test for the form of the cost function let;

$$b(q) = (\beta_0 + \beta_1 q + \beta_2 q^2) \tag{13}$$

Then equation (4) becomes;

$$X_{ni}^j = \int_0^{Q_{ni}^j} P_{ni}^j(q) \, .dq = \int_0^{Q_{ni}^j} \frac{w_i.d_{ni}}{Z_{ni}^j}(\beta_0 + \beta_1 * q + \beta_2 * q^2).dq \tag{14}$$

That is then X_{ni}^j will become

$$X_{ni}^j = \frac{w_i d_{ni}}{Z_{ni}^j}(\beta_0 Q_{ni}^j + \frac{\beta_1}{2}(Q_{ni}^j)^2 + \frac{\beta_2}{3}(Q_{ni}^j)^3) \tag{15}$$

Before proceeding further to our estimation we need to point out an important issue about measurement units. We have different measurements for the traded quantity Q_{ni}^{j}'s in our sample. Expenditure is made on US dollars however quantities recorded are in terms of several units like liters,kilograms,per units or area squares. To make our quantities comparable we need them in terms of dollar values as well. To do so we use previous year 1989's average world prices for good j and unit type a.

Here unit type is the quantity measure that is taken by the importer country which varies for several countries for the imported goods. *e.g* Australia records non-alcoholic beverages as volume in liters while USA records as weight in kilograms. To reconcile with the different unit measures we took average world prices in terms of each unit type. So that we have an average world price for each good and each unit type like non-alcoholic beverages in liters and in kilograms. In table 1 we report different λ_j^a's for some commodities. There we can observe how much unit of measurement differs for different units.

In table 3 we report several goods with different types of measurement.

$$\lambda_j^a = \frac{\sum_{n=1}^{N} \sum_{i=1}^{N} X_{ni}^{j}}{\sum_{n=1}^{N} \sum_{i=1}^{N} Q_{ni}^{j}} \tag{16}$$

Once we have the average world prices for each good and each unit type then we use those average world prices to find average world values, that is

$$A_{ni}^{j,a} = \lambda_j^a Q_{ni}^{j} \tag{17}$$

Table 3: Different Measurements in Data

CommCode	***CommodityDescription***	***Unit***	***lambdax***
11242	Spirits obtained by distilling wine	Volume in liters	4.502
11242	Spirits obtained by distilling wine	Weight in kilograms	8.930
21201	Mink skins, raw	Number of items	24.652
21201	Mink skins, raw	Weight in kilograms	203.645
21209	Other furskins, raw	Number of items	9.988
21209	Other furskins, raw	Weight in kilograms	35.995
24402	Cork, natural, in blocks, plates	Volume in litres	0.811
24402	Cork, natural, in blocks, plates	Weight in kilograms	3.130
27311	Slate, roughly worked	Area in square metres	4.806
27311	Slate, roughly worked	Weight in kilograms	0.114
29271	Cut flowers and flower buds	Number of items	0.941
29271	Cut flowers and flower buds	Weight in kilograms	5.016
34131	Liquefied propane and butane	Volume in litres	1.024
34131	Liquefied propane and butane	Weight in kilograms	0.144
51124	Xylenes, chemically pure	Volume in litres	16.305
51124	Xylenes, chemically pure	Weight in kilograms	0.545
58242	Polyamides; in the forms of plates	Area in square metres	0.162
58242	Polyamides; in the forms of plates	Weight in kilograms	6.186
61181	Chamois-dressed leather	Area in square metres	9.988
61181	Chamois-dressed leather	Weight in kilograms	26.856
62599	Tires, nes, tire cases, interchangeable	Number of items	69.615
62599	Tires, nes, tire cases, interchangeable	Weight in kilograms	2.270
63301	Articles of natural cork	Number of items	0.071
63301	Articles of natural cork	Weight in kilograms	10.812

CommCode	***CommodityDescription***	***Unit***	***lambdax***
64283	Trays, dishes, cups, etc, of paper pulp	Number of items	0.047
64283	Trays, dishes, cups, etc, of paper pulp	Weight in kilograms	3.234
65221	Cotton gauze, bleached, printed, etc	Area in square metres	0.492
65221	Cotton gauze, bleached, printed, etc	Weight in kilograms	10.159
66245	Glazed ceramic setts, flags and paving	Area in square metres	8.092
66245	Glazed ceramic setts, flags and paving	Weight in kilograms	0.582
66493	Clock and watch glasses etc	Number of items	1.018
66493	Clock and watch glasses etc	Weight in kilograms	14.623
69606	Spoons, forks, ladles, and similar	Number of items	2.940
69606	Spoons, forks, ladles, and similar	Weight in kilograms	14.322
72845	Machines for treating metals, nes	Number of items	1328.386
72845	Machines for treating metals, nes	Weight in kilograms	21.570
74141	Non-domestic refrigerators	Number of items	1013.565
74141	Non-domestic refrigerators	Weight in kilograms	10.172
74522	Packaging, bottling, etc machinery	Number of items	1921.641
74522	Packaging, bottling, etc machinery	Weight in kilograms	29.501
77323	Electrical insulators of ceramic	Number of items	0.031
77323	Electrical insulators of ceramic	Weight in kilograms	5.728
85101	Footwear with outer soles	Number of pairs	17.489
85101	Footwear with outer soles	Weight in kilograms	11.068
87454	Thermometers, hydrometers	Number of items	6.222
87454	Thermometers, hydrometers	Weight in kilograms	67.797
89985	Combs, hair-slides and the like	Number of items	0.287
89985	Combs, hair-slides and the like	Weight in kilograms	24.705
95102	Artillery weapons	Number of items	15223.433
95102	Artillery weapons	Weight in kilograms	77.896

Now with our average world values, that is $A_{ni}^{j,a}$'s instead of different type of quantities Q_{ni}^{j} we insert $A_{ni}^{j,a}$ into equation (14) and we have the following equation

$$X_{ni}^{j} = \frac{w_i d_{ni}}{Z_{ni}^{j}}(\beta_0 A_{ni}^{j} + \frac{\beta_1}{2}(A_{ni}^{j})^2 + \frac{\beta_2}{3}(A_{ni}^{j})^3) \tag{18}$$

Taking natural logarithm of the equation, we get

$$ln\frac{X_{ni}^{j}}{w_i d_{ni}} = ln(\beta_0 A_{ni}^{j} + \frac{\beta_1}{2}(A_{ni}^{j})^2 + \frac{\beta_2}{3}(A_{ni}^{j})^3) - lnZ_{ni}^{j} \tag{19}$$

As mentioned before we use Eaton and Kortum(2002)'s trade cost estimate d_{ni} instead of our work for d_{ni}'s. Where Z_{ni}^{j} will be treated as the error term of the equation. Note that we assumed Z_{ni}^{j}'s are independent across j for a given destination n and for a given source i. Hence we will use nonlinear least squares estimation to estimate $\hat{\beta}_0, \hat{\beta}_1, and\hat{\beta}_2$. From the residuals of the nonlinear least squares estimation we will obtain relative productivities as well.

4.2 Estimation Results

We estimate (14) using nonlinear least squares estimation for any given destination n and for any given source i. For all our ni pairs we found $\hat{\beta}_0$ statistically significant. Whereas $\hat{\beta}_1$ is statistically significant in 265 pairs out of 273 and $\hat{\beta}_3$

is statistically significant for 98 pairs out of 273. [2]

Table 4: Coefficient Report

	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$
Statistically Significant # observations	273	265	95
As percentage	100%	97%	35%
# of observations	273		

However both $\hat{\beta}_1$ and $\hat{\beta}_2$ values are very close zero for all significant observations. These results suggest that marginal costs do not vary much with quantity, supporting traditional constant marginal cost assumption.

We estimate productivities for all goods for all those ni pairs (Z^j_{ni}) as the residuals suggested by our model.Since our results do not show support non-constant(increasing) marginal costs we believe multiple sellers and multiple prices could be explained using our capacity constraint argument

To exemplify this we pick a very homogeneous good "Copper waste and scrap" with Code of SC-28821.In table 5 we report trade entries for this good for two countries where Finland as an exporter country which has specifically different trade costs to rest of the world and USA as the importer country who imports this homogeneous good with different prices. We can see that Finland exports to 9 different destinations while each importer observes a different price. Here we use unit prices because from our estimation results we have found that only a constant cost exists thus unit prices will not be changing with additional quantities. Now when we look from the exporters side we can analyze why they cannot win entire

[2] Why 273 observations instead of 342 total observations (19x18)?We aimed to have maximum number of common goods exported to each destination thus we picked the exporters who trade maximum number of common goods for each destination. Therefore we estimated equation (14) for 273 ni pairs.

market. Finland has one of the lowest unit price which is 0.121 when trading to Spain. Then our questions are

Why Spain is not importing entirely from Finland? Or why Finland is selling cheaper to Spain,Denmark and Australia while they could trade to Sweden or USA with higher prices thus higher profits?

To analyze this we enclose whole trade statistics for this good,table 6, with cross checking we can bring some insight to our results.

First we check USA and try to understand why Finland does not export entirely to USA. Reason is on the graph for USA. USA imports this good from whatever available source which is cheaper and as its unable to import more from cheaper sources they import from next supplier which is more expensive. As its seen in the table for USA, Finland is an expensive supplier for USA thus USA imports only a fraction of its total trade for this good. Then our first questions comes to place. Why countries do not import entirely from their cheapest source? E.g why Spain does not import entirely from Finland?

If we check Finland's statistics and we observe that the suppliers with lowest price trade a small quantity compare to rest of Finland's exporters and compare to importer countries' import volumes, so their size is not enough to supply for the whole Spain. If we think the highest productive ones with similar unit prices at home are one entity, one firm so to say we can claim that in Finland there are several firms operating and they export to different destinations.

We can observe that they choose to export to Spain Denmark and Australia where their prices are most competitive. We can say that even though we report them as the most productive exporters they are limited by their size power thus they have to compete with the very large exporters through lower prices. If we check for the importer countries in a common fashion we observe that supplier exporting with higher quantities charge higher prices than most like Germany and France in this example. Here we can say that they use their size power to meet the total demand in destinations with higher prices while smaller producers face capacity constraints.

In the next part, table 7 we report summary statistics for all goods among country pairs as an average. By this we can analyze the destination effects. For each destination we picked exporters who supply maximum number of common goods, thus for each destination there are several missing entries but comparison is healthier in the sense that for a specific destination with a specific common bundle of goods there are different constant costs and different productivities.

Whole table is added for full comparison but as an example we can pick first destination *Australia*. One can directly observe that New Zealand has the highest marginal cost while being the lowest productive exporter among others. First one is directly a result of our estimation which includes D_{ni}'s to explain trade between countries. Here since New Zealand incurs the lowest trade costs, the estimation gives higher constant marginal costs for New Zealand. Since weight of goods traded are different even though goods are same we do not add additional information to β_0's. Then what about different productivities? Average productivities reported here is for each exporter country for the common goods, an average productivity for their entire transactions.

We explain this difference in productivities with trade costs in place(Trade costs for exporters).Only highly productive firms can export to that destination and be competitive. Here, Denmark incurs a high trade cost thus this causes Denmark to exist in the Australia market only with its most productive firms. Whereas for New Zealand which incurs lowest trade costs, even the lowest productive firms can operate in Australia market competitively for those common goods.

In the table 8 we report average productivity estimates for all countries relative to USA where US=1. Since this averages includes all goods which are not common this is not a very precise result but this is the average productivity results if we do not impose any restrictions on our estimation such as destination.

CHAPTER V

CONCLUSION

In this thesis we show how certain features of disaggregated bilateral trade data an be incorporated into an Eaton and Kortum(2002) type Ricardian trade model. In bilateral trade data we observe multiple sellers and different unit prices. We offer an alternative explanation to account for those features of data. We propose capacity constraints and increasing marginal cost alternative explanations.

Our estimations showed that marginal costs are not increasing with quantity, we obtained constant marginal costs through our estimations. And with that result we showed different unit prices among exporters of a source country i and different unit prices in an importer country n. We observe that for a source country there exists multiple exporters for different destinations and those different exporter/firms have capacity constraints thus they cannot win an entire market. Hence because of capacity constraints an importer cannot buy every quantity from the same partner even if it is a very homogeneous good like in our copper waste example.

In our estimation we observe that Eaton and Kortum (2002) iceberg trade cost estimate d_{ni}'s do not vary much. For oversea countries like USA Japan and

Australia we use same d_{ni} values since their distances belong to same over 6000 km distance dummy. Thus same trade costs for different countries prevent us from observing relations between productivity unit prices and trade costs fully.

We propose an alternative estimation for iceberg trade costs. In our future work, we will obtain better d_{ni} estimates using sea distances and good specific cost of sea transport values reported by OECD. By this we will be able to estimate d_{ni}^{j} where each good has its own cost of trading which is reasonable in many senses. We will use distances between major trade ports instead of ground distances between capitals. United Nations International Maritime Organization(IMO) reports that 90% of the worlds trade is carried by sea and its the cheapest way of transporting goods and materials around the world. Thus we will be estimating trade costs for each good in a completely different base than others.

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APPENDIX

Additional Tables

Table 5: An Example for good SC-28821 “Copper waste and scrap”

Reporter	***Partner***	***Dni***	***TotExp***	***Quantity***	***uprice***	***Prod.***
Spain	Finland	1.542	19887	164035	0.121	5.680
Denmark	Finland	1.386	47109	128058	0.368	4.310
Australia	Finland	2.192	10542	21000	0.502	4.400
Netherlands	Finland	1.489	362286	301312	1.202	2.831
UK	Finland	1.489	1078376	709000	1.521	2.710
Germany	Finland	1.386	3874000	2079812	1.863	2.476
Belgium-Lux	Finland	1.489	3209404	1618375	1.983	2.453
Sweden	Finland	0.997	4849045	1870437	2.592	2.092
USA	Finland	2.053	591520	161000	3.674	1.867
Reporter	***Partner***	***Dni***	***TotExp***	***Quantity***	***uprice***	***Prod.***
USA	Norway	1	14163	15312	0.925	3.196
USA	Portugal	1	138927	104945	1.324	1.390
USA	Japan	1.139	508820	274562	1.853	2.429
USA	Canada	0.108	184462662	86233187	2.139	0.073
USA	UK	0.858	478454	177953	2.689	1.694
USA	Italy	1	35822	11937	3.001	1.727
USA	Netherlands	1	1333914	436125	3.059	1.974
USA	Finland	1	591520	161000	3.674	1.867
USA	Germany	1	781322	208667	3.744	1.751
USA	France	1	1576650	201972	7.806	1.069

Table 6: Summary Statistics for good SC-28821 "Copper waste and scrap" for all countries

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
Australia	Canada	1.613889	7193	22000	0.33	4.60
Australia	Finland	1.755556	10542	21000	0.50	4.40
Australia	U.K	1.613889	42148	49000	0.86	3.45
Australia	USA	1.613889	358324	320000	1.12	3.54
Australia	New Zealand	0.911111	3890068	2276000	1.71	2.04
Australia	Netherlands	1.755556	37762	22000	1.72	3.06
Austria	Netherlands	1.483333	44511	49800	0.89	3.54
Austria	Japan	2.15	719	699	1.03	3.61
Austria	Germany	1.102778	26894320	16086101	1.67	3.67
Austria	USA	2.15	375604	191398	1.96	3.24
Austria	France	1.483333	481352	241398	1.99	2.83
Austria	Spain	1.586111	2254524	963812	2.34	2.29
Austria	Italy	1.4	1409167	561187	2.51	2.32
Austria	Norway	1.436111	127329	50300	2.53	2.56
Austria	Belgium-Lux.	1.341667	119866	46500	2.58	2.40
Austria	U.K	1.586111	4585	1000	4.59	1.75
Belgium-Lux.	New Zealand	1.511111	16651	21699	0.77	3.07
Belgium-Lux.	Austria	0.563889	1281505	1558312	0.82	2.59
Belgium-Lux.	Sweden	0.808333	554286	403187	1.37	2.61
Belgium-Lux.	Denmark	0.694444	1641499	1059625	1.55	2.24
Belgium-Lux.	Canada	1.372222	2112680	1360312	1.55	3.05
Belgium-Lux.	Norway	0.705556	666314	428000	1.56	2.38
Belgium-Lux.	Greece	0.797222	2685299	1665875	1.61	1.72
Belgium-Lux.	Germany	0.611111	63687044	36971200	1.72	3.36

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
Belgium-Lux.	Italy	0.694444	9411327	5109500	1.84	2.37
Belgium-Lux.	Netherlands	0.455556	53703672	27967898	1.92	2.88
Belgium-Lux.	U.K	0.538889	48353084	24860700	1.94	2.77
Belgium-Lux.	Finland	0.808333	3209404	1618375	1.98	2.45
Belgium-Lux.	France	0.313889	61168108	30253700	2.02	2.54
Belgium-Lux.	Portugal	0.797222	33842	14812	2.28	0.61
Belgium-Lux.	Australia	1.511111	1300016	496000	2.62	2.15
Belgium-Lux.	Spain	0.797222	2743052	969375	2.83	1.41
Belgium-Lux.	USA	1.372222	7815851	2324125	3.36	2.51
Belgium-Lux.	Japan	1.372222	83735	16000	5.23	1.54
Canada	USA	0.6	80472031	60977066	1.32	3.48
Canada	Germany	1.491667	24071	16503	1.46	3.07
Canada	U.K	1.35	343071	155000	2.21	2.34
Canada	France	1.491667	732533	298500	2.45	2.64
Canada	Japan	1.630556	142552	42980	3.32	2.17
Denmark	Netherlands	1.147222	278228	1552875	0.18	5.09
Denmark	Sweden	1.002778	3286405	10572718	0.31	5.10
Denmark	Finland	1.158333	47109	128058	0.37	4.31
Denmark	Norway	1.002778	1100714	1795812	0.61	3.83
Denmark	Germany	0.908333	3048323	3915000	0.78	3.62
Denmark	Belgium-Lux.	1.147222	271438	309687	0.88	3.35
Denmark	Austria	1.158333	133848	102339	1.31	2.66
Denmark	U.K	1.147222	617395	419750	1.47	2.62
Denmark	Italy	1.25	23444	2187	10.72	0.68
Finland	Sweden	0.997222	133720	78414	1.71	2.56
Finland	Netherlands	1.488889	96487	40003	2.41	2.55

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
Finland	Norway	1.236111	140918	37785	3.73	2.02
Finland	Germany	1.386111	19359	4812	4.02	1.98
Finland	Denmark	1.386111	574	97	5.92	1.45
Germany	Japan	1.405556	20000	35800	0.56	3.80
Germany	Portugal	0.830556	1154000	690875	1.67	1.05
Germany	Sweden	0.738889	1427000	853187	1.67	2.38
Germany	Austria	0.5	17678000	10556101	1.67	2.40
Germany	Netherlands	0.488889	92837000	52715500	1.76	3.04
Germany	Greece	0.830556	566000	310125	1.83	1.47
Germany	Finland	0.738889	3874000	2079812	1.86	2.48
Germany	Canada	1.405556	3917000	2091875	1.87	2.97
Germany	Denmark	0.488889	35277000	17917000	1.97	2.61
Germany	U.K	0.727778	80430000	40322700	1.99	3.16
Germany	USA	1.405556	54171000	27087100	2.00	4.05
Germany	Australia	1.544444	835000	409125	2.04	2.41
Germany	Italy	0.644444	21772000	10511699	2.07	2.49
Germany	Belgium-Lux.	0.502778	39010000	18370500	2.12	2.71
Germany	Norway	0.738889	6303000	2949500	2.14	2.40
Germany	France	0.644444	111991000	49176300	2.28	3.16
Germany	Spain	0.830556	7489000	2548125	2.94	1.58
France	Canada	1.622222	25590	17800	1.44	3.12
France	Belgium-Lux.	0.705556	12052499	7418199	1.62	2.88
France	Netherlands	0.788889	10186769	5797898	1.76	2.80
France	Portugal	1.047222	80638	43101	1.87	1.08
France	Spain	0.861111	11488582	6040699	1.90	2.34
France	Greece	1.047222	42160	22000	1.92	1.61

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
France	USA	1.622222	339859	176898	1.92	2.98
France	Germany	0.861111	25912184	13481898	1.92	3.20
France	Australia	1.761111	83400	40000	2.09	2.47
France	Denmark	0.944444	1457567	687500	2.12	2.19
France	U.K	0.788889	25793250	11677601	2.21	2.67
France	Italy	0.861111	3388839	1500125	2.26	2.05
Greece	USA	2.338889	86700	36878	2.35	3.13
Greece	Netherlands	1.763889	56399	20460	2.76	2.59
Greece	Belgium-Lux.	1.763889	96308	34000	2.83	2.57
Greece	Germany	1.763889	3013	296	10.18	1.29
Italy	Austria	0.913889	3907376	5315640	0.74	3.52
Italy	Denmark	1.088889	545304	341562	1.60	2.57
Italy	Norway	1.1	337589	203777	1.66	2.73
Italy	USA	1.663889	25373744	14455039	1.76	4.07
Italy	Greece	0.986111	564481	314875	1.79	1.66
Italy	Canada	1.663889	1935083	1071000	1.81	3.06
Italy	Netherlands	1.088889	11274911	6200824	1.82	3.12
Italy	Belgium-Lux.	0.986111	9397363	5138859	1.83	2.95
Italy	U.K	1.088889	46692608	24857944	1.88	3.51
Italy	Germany	0.902778	96278824	48632408	1.98	3.59
Italy	France	0.902778	106397448	51334912	2.07	3.57
Italy	Japan	1.802778	42923	18875	2.27	2.65
Italy	Spain	1.088889	439808	145468	3.02	1.55
Italy	Sweden	1.1	82525	22941	3.60	1.90
Japan	New Zealand	1.241667	220427	113000	1.95	1.96
Japan	Belgium-Lux.	1.241667	225073	105000	2.14	2.51

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
Japan	Australia	1.241667	11632063	5398000	2.15	2.62
Japan	Sweden	1.241667	21284	9000	2.36	2.44
Japan	Canada	1.380556	2213044	893000	2.48	2.53
Japan	USA	1.380556	114260750	45047000	2.54	3.87
Japan	Germany	1.241667	419583	142000	2.95	2.20
Japan	U.K	1.241667	2259622	742000	3.05	2.01
Netherlands	Norway	0.738889	21007	34332	0.61	3.31
Netherlands	Italy	0.830556	669213	722062	0.93	2.81
Netherlands	Canada	1.405556	146326	154371	0.95	3.41
Netherlands	Finland	0.841667	362286	301312	1.20	2.83
Netherlands	Germany	0.488889	41533520	32297562	1.29	3.40
Netherlands	Belgium-Lux.	0.488889	26520180	19002402	1.40	3.12
Netherlands	Australia	1.544444	237035	164246	1.44	2.72
Netherlands	Portugal	0.830556	1339396	884062	1.52	1.17
Netherlands	Denmark	0.727778	336322	212625	1.58	2.16
Netherlands	France	0.572222	8587864	5252718	1.63	2.58
Netherlands	Greece	0.830556	122838	72140	1.70	1.50
Netherlands	USA	1.405556	1977470	1108750	1.78	3.03
Netherlands	U.K	0.572222	7742511	3656125	2.12	1.91
Netherlands	Spain	0.830556	957139	412312	2.32	1.57
Netherlands	Sweden	0.738889	101474	40867	2.48	1.88
New Zealand	Canada	1.661111	28393	18363	1.55	3.07
New Zealand	USA	1.661111	89598	52867	1.69	3.11
New Zealand	Australia	0.958333	1310964	715375	1.83	2.08
Norway	Sweden	0.905556	348700	393437	0.89	3.16
Norway	Denmark	1.138889	46807	45023	1.04	3.00

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
Norway	USA	1.961111	1777137	805062	2.21	3.12
Norway	U.K	1.294444	409928	166910	2.46	2.19
Norway	Canada	1.961111	54551	21359	2.55	2.74
Norway	Germany	1.294444	824	128	6.44	1.44
Portugal	Belgium-Lux.	1.444444	10003	21460	0.47	4.18
Portugal	USA	2.019444	161561	100585	1.61	3.37
Portugal	Canada	2.019444	33445	19667	1.70	3.17
Portugal	Sweden	1.508333	37290	21820	1.71	2.96
Portugal	U.K	1.444444	343771	197253	1.74	2.65
Portugal	Italy	1.444444	34987	19988	1.75	2.64
Portugal	Norway	1.508333	73645	41378	1.78	2.96
Portugal	Netherlands	1.444444	199528	109238	1.83	2.81
Portugal	Spain	1.102778	147509	78253	1.89	2.02
Portugal	France	1.444444	490526	183589	2.67	2.51
Spain	Denmark	1.430556	30575	300750	0.10	5.59
Spain	Finland	1.494444	19887	164035	0.12	5.68
Spain	U.K	1.430556	1206363	3587687	0.34	4.66
Spain	Canada	2.005556	31521	60175	0.52	4.35
Spain	Sweden	1.494444	62100	107179	0.58	4.05
Spain	Italy	1.430556	798589	1325687	0.60	3.86
Spain	Australia	2.144444	13837	21429	0.65	3.83
Spain	USA	2.005556	277788	335500	0.83	4.06
Spain	Belgium-Lux.	1.430556	3779176	3676125	1.03	3.78
Spain	Austria	1.441667	49255	47421	1.04	3.10
Spain	Netherlands	1.430556	625077	403812	1.55	3.01
Spain	France	1.244444	26249612	15936808	1.65	3.86

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
Spain	Germany	1.430556	5507942	3227437	1.71	3.23
Spain	Portugal	1.088889	10864476	5144140	2.11	1.52
Sweden	Norway	0.633333	1048015	980312	1.07	2.72
Sweden	Denmark	0.866667	1208320	900437	1.34	2.59
Sweden	Italy	1.125	57128	28039	2.04	2.23
Sweden	U.K	1.125	4888102	2349125	2.08	2.48
Sweden	Canada	1.688889	240116	107777	2.23	2.74
Sweden	Netherlands	1.022222	5579643	2277000	2.45	2.43
Sweden	Belgium-Lux.	1.125	252852	101894	2.48	2.27
Sweden	Germany	1.022222	821728	330812	2.48	2.20
Sweden	Finland	0.716667	4849045	1870437	2.59	2.09
Sweden	France	1.125	5363163	2048812	2.62	2.50
Sweden	USA	1.688889	15895494	3129187	5.08	2.38
U.K	New Zealand	1.455556	113840	219000	0.52	3.45
U.K	Japan	1.458333	101163	177000	0.57	3.84
U.K	Belgium-Lux.	0.625	239714	214000	1.12	2.49
U.K	Norway	0.791667	488766	331000	1.48	2.54
U.K	Portugal	0.883333	112633	76000	1.48	1.15
U.K	Finland	0.894444	1078376	709000	1.52	2.71
U.K	France	0.625	3797286	2277000	1.67	2.39
U.K	Netherlands	0.625	1626754	728000	2.23	1.86
U.K	Germany	0.780556	2450319	1078000	2.27	2.12
U.K	Sweden	0.894444	71430	31000	2.30	2.14
U.K	Australia	1.455556	514940	220000	2.34	2.19
U.K	Canada	1.316667	4910771	1902000	2.58	2.56
U.K	Spain	0.883333	500493	177000	2.83	1.41

Reporter	***Partner***	***Dni***	***Tot.Exp***	***Quantity***	***U.pr***	***Prod.***
U.K	Italy	0.883333	1511661	499000	3.03	1.66
U.K	Denmark	0.780556	1189376	326000	3.65	1.41
U.K	USA	1.316667	5559979	66210	83.97	-1.02
USA	Norway	1	14163	15312	0.92	3.20
USA	Portugal	1	138927	104945	1.32	1.39
USA	Japan	1.138889	508820	274562	1.85	2.43
USA	Canada	0.108333	184462662	86233187	2.14	-1.73
USA	U.K	0.858333	478454	177953	2.69	1.69
USA	Italy	1	35822	11937	3.00	1.73
USA	Netherlands	1	1333914	436125	3.06	1.97
USA	Finland	1	591520	161000	3.67	1.87
USA	Germany	1	781322	208667	3.74	1.75
USA	France	1	1576650	201972	7.81	1.07

Table 7: Cross Country Estimation Results

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Australia	Belgium-Lux.	1.76	4.5	1.69
Australia	Canada	1.61	7.26	1.78
Australia	Denmark	1.76	3.71	2.7
Australia	Germany	1.76	117.45	1.52
Australia	France	1.76	20	1.96
Australia	Italy	1.76	90.32	1.57
Australia	Japan	1.62	5.21	1.86
Australia	Netherlands	1.76	5.13	1.66
Australia	New Zealand	0.91	124.38	1.03
Australia	Spain	1.76	46.27	1.07
Australia	Sweden	1.76	4.82	1.78
Australia	United Kingdom	1.61	47.21	1.89
Australia	USA	1.61	117.61	1.23
Austria	Belgium-Lux.	1.34	1.99	1.13
Austria	Canada	2.15	4.49	1.61
Austria	Denmark	1.48	1.75	1.34
Austria	Finland	1.44	1.47	1.19
Austria	Germany	1.48	239.16	0.92
Austria	France	1.1	20.74	1.14
Austria	Italy	1.4	29.54	1.11
Austria	Japan	2.15	6.59	0.97
Austria	Netherlands	1.48	27.73	1.15
Austria	Norway	1.44	1.46	1.44
Austria	Spain	1.59	4.37	0.87

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Austria	Sweden	1.44	1.82	1.19
Austria	United Kingdom	1.59	25.98	1.35
Austria	USA	2.15	7.13	0.82
Belgium-Lux.	Austria	0.56	8.4	0.39
Belgium-Lux.	Canada	1.37	4.97	1.64
Belgium-Lux.	Denmark	0.69	3.99	1.63
Belgium-Lux.	Finland	0.81	6.24	0.78
Belgium-Lux.	Germany	0.31	118.5	0.6
Belgium-Lux.	France	0.61	34.27	0.36
Belgium-Lux.	Italy	0.69	253.08	0.58
Belgium-Lux.	Japan	1.37	9.43	0.73
Belgium-Lux.	Netherlands	0.46	6340.51	0.51
Belgium-Lux.	Norway	0.71	11.26	0.85
Belgium-Lux.	Portugal	0.8	6.42	1.4
Belgium-Lux.	Spain	0.8	3.31	1.45
Belgium-Lux.	Sweden	0.81	5.56	0.83
Belgium-Lux.	United Kingdom	0.54	71.04	1.15
Belgium-Lux.	USA	1.37	114.08	0.43
Canada	Austria	1.49	3.02	0.99
Canada	Belgium-Lux.	1.49	5.4	1.28
Canada	Denmark	1.49	5.27	2.14
Canada	Germany	1.49	1.81	1.28
Canada	France	1.49	113.78	1.35
Canada	Italy	1.49	42.4	1.01
Canada	Japan	1.63	101.23	1.26
Canada	Netherlands	1.49	3.61	1.29

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Canada	Spain	1.49	45.48	1
Canada	Sweden	1.49	1.87	1.23
Canada	United Kingdom	1.35	6.66	0.68
Canada	USA	0.6	146.62	0.95
Denmark	Austria	1.16	4.14	1.44
Denmark	Belgium-Lux.	1.15	1.53	1.05
Denmark	Finland	1.16	24.55	1.19
Denmark	Germany	1.15	6.64	0.93
Denmark	France	0.91	38.41	0.93
Denmark	Italy	1.25	6.29	0.96
Denmark	Japan	1.83	2.55	1.01
Denmark	Netherlands	1.15	6.6	1.1
Denmark	Norway	1	1.78	1.24
Denmark	Portugal	1.3	5.51	0.39
Denmark	Spain	1.25	2.78	1.46
Denmark	Sweden	1	7.82	1.36
Denmark	United Kingdom	1.15	11.53	1.82
Denmark	USA	1.83	3.64	0.82
Finland	Austria	1.34	2.49	1.35
Finland	Belgium-Lux.	1.49	20.76	1.32
Finland	Canada	2.05	4.78	1.72
Finland	Denmark	1.39	23.45	0.89
Finland	Germany	1.49	10.77	0.89
Finland	France	1.39	3.37	1.48
Finland	Italy	1.49	1.6	1.01
Finland	Japan	2.05	1.89	1.14

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Finland	Netherlands	1.49	1.65	1.52
Finland	Norway	1.24	4.92	1.16
Finland	Spain	1.54	4.63	1.52
Finland	Sweden	1	46.63	0.9
Finland	United Kingdom	1.49	10.61	1.42
Finland	USA	2.05	1.5	0.87
Germany	Austria	0.81	154.66	0.35
Germany	Belgium-Lux.	0.71	291.24	0.5
Germany	Canada	1.62	4.77	1.03
Germany	Denmark	0.94	17.34	0.45
Germany	Finland	1.06	16.94	0.72
Germany	France	0.86	253.92	0.61
Germany	Greece	1.05	6.87	0.37
Germany	Italy	0.86	141.69	0.46
Germany	Japan	1.76	186.23	0.7
Germany	Netherlands	0.79	82.39	0.55
Germany	Norway	1.06	7.96	0.77
Germany	Portugal	1.05	28.47	0.22
Germany	Spain	0.86	11.81	0.48
Germany	Sweden	1.06	13.52	0.66
Germany	United Kingdom	0.79	5.1	0.93
Germany	USA	1.62	26.84	0.45
France	Austria	0.5	12.31	0.61
France	Belgium-Lux.	0.5	0.7	1
France	Canada	1.41	35.12	1.38
France	Denmark	0.49	4.6	0.7

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
France	Finland	0.74	2.06	0.96
France	Germany	0.64	1497.04	0.75
France	Italy	0.64	23.16	0.77
France	Japan	1.41	11.22	0.82
France	Netherlands	0.49	72.39	0.79
France	Norway	0.74	2.39	1.16
France	Portugal	0.83	18.84	0.35
France	Spain	0.83	89.24	0.63
France	Sweden	0.74	7.49	0.99
France	United Kingdom	0.73	17.38	1.11
France	USA	1.41	10.01	0.53
Greece	Austria	1.78	2.86	1.15
Greece	Belgium-Lux.	1.76	1.27	1.6
Greece	Denmark	1.76	4.6	1.4
Greece	Germany	1.76	8.57	1.35
Greece	France	1.76	6.82	1.32
Greece	Italy	1.66	5.83	1.23
Greece	Japan	2.34	7.95	1.68
Greece	Netherlands	1.76	1.32	1.55
Greece	Spain	1.76	4.7	0.93
Greece	Sweden	1.78	1.96	1.76
Greece	United Kingdom	1.76	1.33	2.1
Greece	USA	2.34	3.8	1.08
Italy	Austria	0.91	9.95	0.65
Italy	Belgium-Lux.	0.99	121.07	0.88
Italy	Canada	1.66	5.01	1.63

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Italy	Denmark	1.09	1.62	1.51
Italy	Finland	1.1	5.23	1.01
Italy	Germany	0.9	79.26	0.71
Italy	France	0.9	18.29	0.84
Italy	Greece	0.99	4.72	0.51
Italy	Japan	1.8	2.2	0.87
Italy	Netherlands	1.09	10.37	0.98
Italy	Portugal	1.09	22.12	0.37
Italy	Spain	1.09	62.87	0.64
Italy	Sweden	1.1	81.03	0.95
Italy	United Kingdom	1.09	19.26	1.19
Italy	USA	1.66	7.59	0.64
Japan	Australia	1.24	10.91	0.61
Japan	Austria	1.24	11.87	0.36
Japan	Belgium-Lux.	1.24	12.03	0.72
Japan	Canada	1.38	10.31	0.85
Japan	Denmark	1.24	10.34	0.54
Japan	Finland	1.24	9.57	0.67
Japan	Germany	1.38	380.5	0.55
Japan	France	1.24	61.05	0.59
Japan	Italy	1.38	57.31	0.54
Japan	Netherlands	1.24	25.89	0.75
Japan	Spain	1.38	18.87	1.48
Japan	Sweden	1.24	3.03	0.68
Japan	United Kingdom	1.24	86.03	0.83
Japan	USA	1.38	278.16	0.51

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Netherlands	Austria	0.74	2.81	0.63
Netherlands	Belgium-Lux.	0.49	50.65	0.6
Netherlands	Canada	1.41	6.26	1.15
Netherlands	Denmark	0.73	5.83	1.34
Netherlands	Finland	0.84	8.06	0.82
Netherlands	Germany	0.57	34864.72	0.52
Netherlands	France	0.49	14.01	0.57
Netherlands	Italy	0.83	29.68	0.7
Netherlands	Japan	1.41	4.7	0.7
Netherlands	Norway	0.74	2.04	0.86
Netherlands	Portugal	0.83	25.78	1.35
Netherlands	Spain	0.83	7.08	0.58
Netherlands	Sweden	0.74	7.8	0.68
Netherlands	United Kingdom	0.57	29.07	1.1
Netherlands	USA	1.41	185.84	0.4
New Zealand	Australia	0.96	10.73	0.56
New Zealand	Belgium-Lux.	1.8	4.9	1.5
New Zealand	Canada	1.66	4.94	2.21
New Zealand	Germany	1.8	61.34	1.3
New Zealand	France	1.8	3.44	1.82
New Zealand	Italy	1.8	29.53	1.55
New Zealand	Japan	1.66	78.85	1.17
New Zealand	Netherlands	1.8	1.26	1.98
New Zealand	Sweden	1.8	8.14	0.95
New Zealand	United Kingdom	1.66	4.83	1.41
New Zealand	USA	1.66	56.21	1.61

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Norway	Austria	1.25	9.73	1.76
Norway	Belgium-Lux.	1.29	3.73	1.67
Norway	Canada	1.96	2.71	1.42
Norway	Denmark	1.14	3.7	1.16
Norway	Finland	1.14	19.53	1.36
Norway	Germany	1.4	18.34	1.09
Norway	France	1.29	41.41	1.31
Norway	Italy	1.4	42.69	1.19
Norway	Japan	1.96	2.47	1.55
Norway	Netherlands	1.29	2.53	1.47
Norway	Spain	1.4	11.39	0.83
Norway	Sweden	0.91	228.71	1.19
Norway	United Kingdom	1.29	74.78	1.86
Norway	USA	1.96	1.46	1.18
Portugal	Austria	1.46	2.71	1.59
Portugal	Belgium-Lux.	1.44	46.56	1.5
Portugal	Denmark	1.5	6.2	1.85
Portugal	Finland	1.51	3.6	1.29
Portugal	Germany	1.44	31.21	0.99
Portugal	France	1.44	8.74	1.22
Portugal	Italy	1.44	5.06	0.99
Portugal	Japan	2.16	3.19	1.49
Portugal	Netherlands	1.44	7.47	1.42
Portugal	Norway	1.51	1.83	1.64
Portugal	Spain	1.1	2.27	0.75
Portugal	Sweden	1.51	6.46	1.66

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Portugal	United Kingdom	1.44	10.77	1.51
Portugal	USA	2.02	36.72	0.94
Spain	Austria	1.44	30.37	0.77
Spain	Belgium-Lux.	1.43	6.72	1.44
Spain	Canada	2.01	6.61	1.84
Spain	Denmark	1.43	38.19	1.19
Spain	Finland	1.49	15.82	1.62
Spain	Germany	1.24	7.12	1.22
Spain	France	1.43	5.85	1.2
Spain	Italy	1.43	51.61	1.23
Spain	Japan	2.14	6.02	1.33
Spain	Netherlands	1.43	71.07	1.76
Spain	Norway	1.44	4.03	1.39
Spain	Portugal	1.09	5.39	0.48
Spain	Sweden	1.49	5.72	1.42
Spain	United Kingdom	1.43	9.65	1.76
Spain	USA	2.01	19.89	1.01
Sweden	Austria	0.98	3.89	1.51
Sweden	Belgium-Lux.	1.13	1.9	0.97
Sweden	Canada	1.69	1.58	1.5
Sweden	Denmark	0.87	91.77	0.7
Sweden	Finland	0.72	2.45	0.76
Sweden	Germany	1.13	6.65	0.82
Sweden	France	1.02	23.17	0.76
Sweden	Italy	1.13	147.2	0.74
Sweden	Japan	1.69	2.79	0.83

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
Sweden	Netherlands	1.02	1.75	0.88
Sweden	Norway	0.63	9.95	0.83
Sweden	Portugal	1.18	11.22	0.32
Sweden	Spain	1.18	2.76	0.61
Sweden	United Kingdom	1.13	9.36	1.08
Sweden	USA	1.69	2.52	0.72
United Kingdom	Australia	1.46	2.9	1.03
United Kingdom	Austria	0.89	126.52	0.77
United Kingdom	Belgium-Lux.	0.63	140.34	0.63
United Kingdom	Canada	1.32	8.38	1.27
United Kingdom	Denmark	0.78	52.29	0.66
United Kingdom	Finland	0.89	6.66	1.1
United Kingdom	Germany	0.63	1990.44	0.69
United Kingdom	France	0.78	22.51	0.64
United Kingdom	Greece	0.88	14.31	0.64
United Kingdom	Italy	0.88	5884.87	0.77
United Kingdom	Japan	1.46	167.17	0.84
United Kingdom	Netherlands	0.63	7.59	0.64
United Kingdom	New Zealand	1.46	2.37	2.08
United Kingdom	Norway	0.79	73.59	0.89
United Kingdom	Portugal	0.88	18.1	0.36
United Kingdom	Spain	0.88	172.32	0.69
United Kingdom	Sweden	0.89	87.55	0.91
United Kingdom	USA	1.32	7.46	1.12
USA	Australia	1	5.26	0.67
USA	Austria	1	37.58	0.78

Reporter	***Partner***	***Dni***	$\hat{\beta}_0$	***Av. Prod.***
USA	Belgium-Lux.	1	41.71	0.9
USA	Canada	0.11	1461.42	0.2
USA	Denmark	1	39.74	0.84
USA	Finland	1	18.93	1.02
USA	Germany	1	101.39	0.79
USA	France	1	163.67	1.14
USA	Italy	1	244.12	0.9
USA	Japan	1.14	366.33	0.86
USA	Netherlands	1	100.73	1.25
USA	New Zealand	1	6.75	1.54
USA	Norway	1	5.85	1.39
USA	Spain	1	11.93	0.83
USA	Sweden	1	61.45	1.24
USA	United Kingdom	0.86	168.56	0.65

Table 8: Average Productivities

Partner	***Relative Productivities***
Australia	0.859
Austria	0.768
Belgium-Luxembourg	0.760
Canada	1.008
Denmark	0.968
Finland	0.827
Fmr Fed. Rep. of Germany	1.052
France	0.752
Greece	0.787
Italy	0.720
Japan	0.832
Netherlands	0.838
New Zealand	0.989
Norway	0.842
Portugal	0.445
Spain	0.700
Sweden	0.877
USA	1.000
United Kingdom	0.670