Speech Helsinki - 20 minutes

Beyond the icerberg hypothesis

**Slide 0**

The paper I will present to you is entitled “Beyond the iceberg hypothesis: opening the black box of transport costs”. It has been written with Guillaume Daudin, from University Paris Dauphine, and Jérôme Héricourt, from the University of Lille, in France. This is a work in progress, and this is actually the first time we present the paper. So I apologize in advance for not being clear enough, don’t hesitate to interrupt me in any case, and of course, any comment is more than welcome.

**Slide I: Motivation**

Let’s start with the motivation of the paper. At the basis of our paper, is the question of trade costs. It is a surprise for no one here that trade costs have long been playing a central role in international economic analysis. They are thus considered as a major obstacle to international economic integration and international trade flows, as notably shown by Jacks et al (2008). Trade costs have yet shown a substantial decrease over the second half of the 20 th century, as documented by Novy (2013) (among others).

This is far from meaning that trade costs have fully disappeared though. Anderson and Van Wincoop in 2004 thus estimate that international trade costs represent a 74% markup over production costs. This remains substantial.

Now, what is exactly behind the term “trade costs”? Trade csosts are usually split into transaction costs[[1]](#footnote-1), trade-policy costs, time costs and transport costs per se. This last dimension is sizeable. According to Anderson and Van Wincoop, they represent a 21% markup over production costs (within the 74% made of total trade costs). Another piece of evidence of the importance of transport costs is brought by Behar and Venables (2011), which estimate that the elasticity of trade with respect to freight costs is about -3

This conveys the following picture: If much trade policy barriers have been removed over the last decades, the transport cost component of trade costs remains sizeable. This as accordingly the focus of the paper.

**Slide 2: Motivation (cont’)**

How to model trade costs now? Following the seminal paper by Samuelson (1954), the literature in international trade has usually modeled trade costs as an ad-valorem equivalent, that is, as a constant percentage of the producer price per unit traded, what we commonly refer to as the “iceberg cost”. Yet, this is a debated question. Over the recent years in particular, the question arises of trade costs rather having an additive structure. This question of the structure of transport costs (additive vs iceberg) is far from being anecdotal.

On the positive side first, the Alchian & Allen conjecture (1964) points out that additive costs implies that the relative price of two varieties of different qualities will depend on the level of trade costs as long as they are additive. In this respect, additive trade costs will affect the patterns of trade flows. [[2]](#footnote-2)A number of empirical papers provide strong empirical support of the existence of additive trade costs (Martin, 2012; Hummels and Skiba, 2004)[[3]](#footnote-3)

Beyond the positive aspect, some related papers point out the normative implications of additive costs. In particular, Sorensen analytically shows that the welfare gains from reducing trade barriers are much larger when it occurs through a reduction of the additive costs than for the iceberg cost.

All these elements suggest that trade costs are likely to display an additive component. However, not much is known on the quantitative side. Precisely, by how much? One objective of the paper is thus to provide an answer to this question.

**Slide 3 “Our paper”**

What do we do exactly in the paper? Our paper provides an empirical decomposition of the structure of transport costs over time, by explicitly distinguishing between ad-valorem and additive parts. More precisely, we quantitatively assess the size and the importance of the additive component in international transport costs. To di so, we exploit the differences between the import and the export prices (by transport mode, ocean or air), using the US imports flows, on a yearly basis from 1974 to 2013.

How is our paper connected, and contributes to the literature? Our results confirm the literature about the importance of the additive component of international trade costs. One important contribution is that we are able to quantify it (focusing on international transport costs). Further, we exploit information over a large time span, from 1974 and 2013, and also making the distinction between the transport mode, air or ocean. In this respect, our paper delivers a broad view of the magnitude of additive costs in international trade over time.

**Slide 4 “Three questions, three answers”**

More precisely, our findings can be summarized in three answers, to three questions.

**First question**, what is the size of the iceberg and the additive transport costs? We provide a quantitative measure of both components. As mean values over 1974-2013, we obtain that the iceberg cost (the famous tau in the related literature) amounts to 2.5% of the export price in air, 3.2% in ocean shipping; the additive cost amounts to 1.8% and 2.9% of the export price.

**Second question**, what do we lose by skipping the additive part of transport costs? We provide various elements of answer to this question, that all point out to the same answer: We lose much. In particular, we obtain that, when additive costs are included, the estimate of the iceberg component reduces by a factor of 2. As well, all our goodness of fit measures show that the quality of fit is substantially bette in presence of additive costs.

**Third question**, how have international transport costs evolved over time? We provide an answer to this question by exploiting the time dimension of our database. I would like to emphasize two main points on this aspect. First, we show that the reduction of transport costs per se starts in 1985, and amounts to approximatively 40% between 1985 and 2013. Second, we find that the pattern of this decrease is not much different between ocean and air transport as long as the additive costs are included. This result stands in contrast with other related papers, such as Hummels (2007) and Behar and Venables (2011); again, it confirms the importance of the additive component in accounting for international transport costs.

**Slide 5 : Plan of the talk**

The plan of the talk will be the following. First, I will briefly present the data sources. Then, I will explain our empirical methodology, before turning to the results, following the order I just made in my Introduction, before a brief word to conclude.

**Slide 6 : Data Sources**

Our measure of transport costs consists in exploiting the difference between the export and the import prices.

We build this measure by exploiting information of the US Imports of Merchandise database. With this database, we obtain the export price, or in more technical term the free-alongside price, or price, that basically consists of the price for one kg of merchandise at the origin country export gate. This is denoted ptilde in the following slides. We will also make use of the import price, that corresponds to the cif price, meaning costs, insurance freights included. This corresponds to the price of the same good, but at the entry of the US this time. This price is denoted p.This database makes theses series available on a yearly basis, over the period 1974-2013, at the very disaggregated HS 10 level, and distinguishes by transport mode of the product, air or ocean.

Accordingly, our measure of international transport costs is based on the ratio p over ptilde. Even if the data is available at a more disaggregated level, we use sectorial data at the 3-digit classification level. This is for computational reasons. As I will detail later, we use a non-linear estimator, that makes the computation of the estimates extremely burdensome, especially given the long period of time we want to cover. Confronted to this arbitrage, we have retained the 3-digit level as our benchmark classification. However, we ensure of the robustness of our results by running estimations ate the 4-digit level on some selected years.

Depending on the year considered, this leaves us with around 200 products (at the 3-digit level), from approximatively 200 countries of origin.

**Slide 7: Empirical specification**

I start this section about the empirical specification, by explaining the equation we will estimate.

Our objective is to provide estimates over time of the size of the ad-valorem and the additive components of transport costs. To do so, we start from the equation that expresses the import price p as a function of the producer price, or the export price ptilde, given both per-kg, or additive transport cost, denoted t, and the ad-valorem, or iceberg cost, denoted tau, according to this equation (which is fairly standard)

P = tau ptilde + p

Denoting I the origin country dimension and k the product dimension, we transform the above equation to obtain the following equation, that is at the root of our estimation

Note that this equation is in fact also time-specific (in annual frequency) and mode-specific (air or vessel), even if we do not identify these two dimensions to not complicate the notations.

**Slide 8 Empirical specification (2)**

Let me now say a few words on the estimation strategy

First thing to say, we follow Irrarazabal et al by making two assumptions on the specification of transport costs. First, we assume that both types of costs are separable between the origin country I and the product k dimensions. Second, we model this separability in a multiplicative manner for the iceberg cost, and an additive manner for the per-kg cost, as specified here.

We also have to take ino account the fact that the observed cif-fas price ratio is higher than 1 (by construction, the cif price cannot be lower than the fas price). Taking into this constraint implies that the error term is always positive, which we ensure by specifying the estimated equation as follows,

With epsilon ik following a normal law centered on 0.

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Taking the log of the above equation, we thus estimate the following equation 1

Where ti, tk, taui, tauk are the parameters to be estimated, that is, fixed effects specific to each country of origin and each sector k (by year, by transport mode, app. 800 fixed effects);

As you see, this equation is non linear (due to the additive costs). Accordingly, we use the non-linear least squares estimation method.

A key question we ask in the paper, is how to characterize the importance of additive, relative to ad-valorem costs? A natural way to answer this question is to perform the estimation constraining t to be 0, and compare the estimated results and the fitting properties of both models.

Accordingly, for each year and transport mode, we estimate two equations, when additive costs are included, as specified in Equation (3)

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And, when only ad-valorem costs are modeled, the estimated equation (4)

After conducting these estimations, we rebuilt a measure of each component that is country and product specific (always by year and by transport mode). Last step, we take the average over the product and country dimension, using the value of each trade flow (ik specific) over total trade flows as a weighting scheme.

We thus obtain a synthetic indicator of each type of transport cost, tau add, tau ice and t, by year and transport mode.

**Compléments**

**On the literature review.**

The Alchian and Allen conjecture (Alchian and Allen, 1964), that points out that the relative price of two varieties of some good will depend on the level of trade costs, does rely on the existence of additive costs: The relative demand for more expensive/higher quality product goods should increase with trade cost (“shipping the good apples out").

Lashkaripour (2016) challenges this view. He finds supporting evidence for the ad-valorem assumption by taking into account the fact that more expensive goods are systematically heavier and hence more costly to transport. One can yet be concerned by the generality of this result. By nature, his study is restricted to goods that are enumerated by items in the statistics (they represent 60% of US imports). Furthermore, while the positive correlation between weight and price seems reasonable for goods from the second industrial revolution like cars, it is dubious in the case of ITC goods which importance has been rising since 1994 (the end point of Lashkaripour's study).

Besides, a number of empirical papers provide a strong empirical support to the role of additive costs in international costs. Based on a firm-product-level database of French exporters, Martin (2012) finds that firms charge higher fas unit values on exports to more remote countries, in contradiction with the ad-valorem hypothesis. Hummels and Skiba’s (2004) estimates imply that doubling freight costs increases average fas export prices by 80-141 percent, consistent with high quality goods being sold in markets with high freight costs. These findings deliver strong empirical support in favor of the Alchian-Allen conjecture.

**Revoir Hummels and Skiba, pas clair**

**Sur les aspects normatifs, revoir ce que montrent exactement Irrarazabal et al.**

Calibrating on Norwegian firm-level data for 2004, Irarrazabal et al. (2015) find that an additive import tariff reduces welfare and trade by more than an identically-sized ad-valorem tariff. While these results suggest that important welfare gains can be achieved by reducing additive trade costs, not much progress has been done in quantifying such gains.

Par rapport au papier de Irrarazabal et al: Closely related to our paper is the work by Irarrazabal et al. (2015), which develops a structural framework for inferring additive trade costs from firm-level trade data. Based on Norwegian exports in 2004, they \_nd that additive costs are about 14% of the median consumer price. Our paper complements their findings in many respects. While they study trade costs in general, our database implies that we focus on international transport costs. Similarly to them, our various results emphasize the important role of the additive component of international transport costs. Further, our empirical analysis allows us to provide a quantitative measure of the levels of both the iceberg and the additive trade costs. Last, we exploit exhaustive information about the imports ows of the US, over a large time span from 1974 to 2013. In this respect, our results deliver a broader view of the magnitude of additive costs in international trade over time.

Par rapport à la littérature sur les time trends of transport costs : By exploiting the time coverage of our

database, our paper is also related to the international trade literature that studies the

patterns of trade costs over time, such as Hummels (2007) and Behar and Venables (2011).

We also share in common with these papers to investigate the time trends of transport costs by transport mode (i.e., air or sea). Many argue that transport costs have substantially decreased with technological advance in transportation, infrastructure development and new communication technologies (seeLafourcade and Thisse, 2011). Glaeser and Kohlhase (2004) \_nd that, over the twentieth century, the cost of moving goods have declined by over 90% in real terms. However, Hummels (2007) shows that the bulk of price declines in transportation comes from air transport, where average cost per ton-kilometer shipped dropped by 92% between 1955 and 2004. Concerning ocean shipping, which represents the major part of world trade, decline in trade prices are much less obvious, a conclusion in accordance with the studies reviewed by Behar and Venables (2011). Our paper contributes to this debate. In particular, we show the importance of taking into account the additive component in characterizing the time trends of international transport costs.

1. Information costs, contract enforcement costs, costs associated to the use of different currencies, … [↑](#footnote-ref-1)
2. Avoir en tête la référence « shipping the goods apples out. Revoir les arguments sur le papier de Lashkaripour et la réponse qu’on peut faire. [↑](#footnote-ref-2)
3. Idem, avoir en tête ce qu’ils trouvent. Voir compléments en fin de speech [↑](#footnote-ref-3)