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A quality-adjusted AIDS model in the study of French imports

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ABSTRACT

To study price and quality competitiveness across 5 exporting regions towards France, we estimate price and quality elasticity on French imports and compare these elasticities between the services and goods sectors using the World Input-Output Database. To estimate these elasticities, we use an Almost Ideal Demand System (AIDS) augmented with a quality variable. The value added of this new AIDS is that it ensures realistic assumptions on individual's preferences on quality are held. We use an original proxy for quality which includes both direct innovation efforts and positive externalities originating from innovation efforts made by other countries and other sectors. Our empirical results confirm that correcting for quality improves the estimation of price elasticities. The results also demonstrate the type of competitiveness across different regions notably developed countries compete in quality while developing countries compete in prices; but BRIC countries are beginning to compete in quality.

1. Introduction

The aim of this paper is to estimate price and quality elasticities of French imports (both goods and services) and examine the type of competitiveness (be it price or quality) across 5 exporting regions (notably Euro zone countries, non Euro zone countries, other developed countries, emerging countries and the rest of the world) in penetrating the French market. For this purpose, we have attempted to address the following issues: (i) account for quality effects inherent in prices; (ii) estimate cross-price and cross-quality elasticities that reveal the type of competition across countries; (iii) better understand the impact of price and quality on both goods and services trade; and (iv) introduce an improved proxy for quality.

Prices influenced by quality effects tend to under-estimate the effect of prices on import demand, thereby producing biased estimates of price elasticities. To correct for this, economists have either corrected for quality effects directly in prices or they have introduced an explicit quality variable into trade models. The advantage of the latter is that it allows one to study the impact of quality on import demand, which is our preferred option. Many authors have introduced a quality variable in the CES (Constant Elasticity of Substitution) model (Crozet and Erkel-Rousse, 2004; Hallak and Schott, 2011; Feenstra and Romalis, 2014). However, the CES model has restrictive assumptions on price and income effects which can be problematic when studying competitiveness across countries. For instance, the CES assumes income elasticity is equal to one but it is plausible that the richer the country, the larger the expenditure share allocated to high-quality products.

As we are interested in studying competitiveness across exporting regions, we have opted to use a more flexible import demand model based on the AIDS (Almost Ideal Demand System) model (Deaton and Muellbauer, 1980). This model has the advantage of

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imposing realistic assumptions on an individual's behavior while not being too restrictive through the use of an individual cost function.¹ Economists such as Deaton (1997), Dong et al. (2003) and Boysen (2012) have used the more flexible AIDS model to estimate price elasticities. But they have used prices corrected for quality effects rather than introduce an explicit quality variable in the AIDS model. Rolle (1992) has included a quality variable in the AIDS model but the model does not ensure that realistic assumptions regarding individuals' preferences for quality are held.

We use an adapted version of the AIDS model to compare competitiveness between different exporting regions, that is, the RSD-AIDS (Restricted Source Differentiated AIDS) model.² To estimate quality elasticities, we build a quality-adjusted RSD-AIDS which explicitly includes a quality variable in a manner that ensures realistic individuals' preferences regarding quality. An additional contribution of our paper is in the field of trade in services where data remains scarce. We use the WIOD (World Input-Output Database) which captures not only goods imports to France from 40 different countries, but also services imports (Timmer, 2014).³ The use of a demand model to study services raises a particular concern over the popular contention that trade in services might not be similar to trade in products. However, from the point of view of an importer, the demand for either products or services can be treated in a similar fashion since the importer is primarily concerned with the product price, its corresponding quality and his income when making a choice whether to import or not to import. Thus, we extend our theoretical model to study trade in services.

Estimating the impact of product quality on import demand remains a challenging feat due to the unobservable nature of quality in products and especially in services. Economists have a choice between using direct measures or indirect measures. Direct measures include consumer surveys and critics' ratings on products (Crozet and Erkel-Rousse, 2004; Crozet et al., 2011). Such measures, despite being extremely precise, are difficult to obtain. Recently, economists use unit values as quality proxies (Hallak, 2006; Fontagné et al., 2008; Fielier, 2012) but this proxy suffers from its correlation with cost production (Khandelwal, 2010; Hallak and Schott, 2011). Indirect measures include R & D expenditures, number of patent citations and human capital variables (Ioannidis and Schreyer, 1997; Anderton, 1999; Eaton and Kortum, 2002; Thanagopal and Le Mouél, 2014) and they have the advantage of being easily available. We base our quality proxy on indirect measures but improve them by including the impact of externalities on the innovation effort incurred by a particular country in a particular sector. Proxies such as R & D expenditures alone tend to underestimate the 'true' impact of an innovation effort on product quality because whenever an innovation effort is implemented in a sector of a country, it enhances the knowledge of all sectors and countries via spillover-effect or externalities (Hall et al., 2009; Tavassoli and Carbonara, 2012). Thus, we create an original quality proxy based not only direct R & D expenditures but also on positive externalities originating from R & D expenditures made by other countries and other sectors.⁴

We estimate our model using a two-way random effect FGLS-SUR model (Feasible Generalized Least Squares Seemingly Unrelated Regression) to account for country and time effects as random unobserved import demand determinants. This technique has been developed by Baltagi (1980) and has been used by Boumahdi et al. (2004) in the study of Lebanese imports. We also correct for endogeneity of expenditures through the use of predicted expenditures.

Our empirical results affirm that correcting for quality effects improves the estimates of the price elasticities. Price elasticities are higher for homogeneous goods than for services and differentiated products while quality elasticities are higher for differentiated goods and services. These results are in line with previous similar studies on the estimation of price elasticities. Our model unlike that of other trade models allows for the estimation of cross-price and cross-quality elasticities which reveals the strength of countries in competing in terms of price and quality. Our estimation of cross-price and cross-quality elasticities reveal the strength of developed countries to be in quality competition while the strength of developing countries to be in price competition. Our results also demonstrate that the BRIC countries are beginning to compete in quality.

The paper proceeds as follows: Section 2 describes our quality proxy. Section 3 introduces quality in the RSD-AIDS model. Section 4 details the database and the estimation methodology. Finally, the results of the estimation are presented in Section 5 with a conclusion in Section 6.

2. A quality proxy which takes into account spillovers

Generally, economists use innovation efforts through R & D expenditures to proxy for quality. We propose an original proxy for quality determined by both direct and indirect innovation efforts, that is, direct R & D expenditures incurred by a particular country in a particular sector and positive knowledge spillovers or externalities from innovation efforts by other countries and other sectors. Knowledge spillovers are an important source of product quality as they fuel new discoveries (Cabellero and Jaffe, 1993). In particular, externalities are important when studying the impact of quality effects in services sectors since many of these sectors tend

¹ Different models have been used to estimate price elasticities: the CES (Constant Elasticity of Substitution) model with few parameters but with restrictive assumptions regarding individuals' preferences, the TRANSLOG model (Christensen et al., 1975), a first-order approximation of every demand function which depends on prices and income and the AIDS model which proposes an interesting compromise between the above two models. The AIDS model is based on a first order approximation of every demand function. Unlike the TRANSLOG model, the number of parameters in the AIDS model has been reduced without an important loss of generality through the addition of realistic assumptions to individuals' behavior like adding-up, homogeneity, Slutsky symmetry and two-stage budgeting.

² Unlike the AIDS, the RSD-AIDS allows for source differentiation, which is important as we assume that the same product originating from different sources is different due to its differing quality, ie, vertical differentiation.

³ Thanagopal was one of the many contributors involved in the creation of the database. Working papers for the US government and the European Commission have produced significant studies on trade in services by using selective data derived from surveys (Hooper et al., 2000; Marquez, 2005; Francois and Hoekman, 2009; Imbs and Méjean, 2010). Acknowledging such data limitations, the WIOD project developed new databases, accounting frameworks and models to increase our understanding of global trade linkages not only in goods but also in services.

⁴ This proxy has already been introduced in two other works by Thanagopal et al. (2012), Thanagopal et al. (2014) but using a CES import demand function.

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