



Explaining import quality: The role of the income distribution[☆]

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ABSTRACT

We examine a generalized version of Flam and Helpman [Flam, H., Helpman, E., 1987. Vertical Product Differentiation and North-South Trade. *American Economic Review*, 77, 810–822.] in which consumption prices for quality differentiated goods are rising in household income. We provide propositions for aggregating this relationship across heterogeneous households to map cross-country differences in income distributions to cross-country differences in import price distributions. The theoretical predictions are examined and confirmed using disaggregated data on prices of traded goods and micro data on household income from the Luxembourg Income Study. Country pairs with more similar income distributions have more similar import price distributions, whether similarity is measured by 1st–4th moment statistics, population and consumption shares within world income and product price quantiles, or income and price dis-similarity indices.

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1. Introduction

There is a large literature examining how international trade affects a nation's income distribution, but there is relatively little empirical work examining the reverse channel. This is in large part because trade models commonly rule out income effects in order to focus attention on supply considerations such as factor endowments or scale economies. To the extent that richer demand structures with non-homothetic preferences are employed they operate at the level of broad industries, for example, allowing poor countries to devote relatively large income shares to commodity foodstuffs.³ In this paper we investigate how the distribution of income within and across countries shapes patterns of consumption and international trade in quality differentiated varieties within narrow product categories.

Our starting point is Flam and Helpman's (1987) model of quality differentiation in trade and we focus on the model's demand side implications linking consumer income to quality choice. As in Flam and Helpman (1987), goods can be quality differentiated at some cost so that higher prices reflect higher quality, and consumers use marginal income to buy higher qualities rather than higher quantities of a differentiated good. This provides an equilibrium mapping in which prices of goods consumed are rising in household income.

This prediction is consistent with household evidence on consumer durables purchases. Bils and Klenow (2001) use survey data for the US that reports household income and purchase prices and estimate positive price-income slopes (or, "Quality Engel Curves"). Our interest lies in cross-country comparisons where household consumption choices are unobservable. We show that the model can be written in terms of national income and price distributions which are, with some effort, observable. This requires aggregating heterogeneous household income and consumption decisions into national income and price distributions and providing propositions linking the two.

There are many ways to empirically characterize a national price or income distribution. However, the particular statistics used to appropriately characterize these distributions and the linkage between them depends on the functional relationship between income and product prices at the household level.

Assuming identical technologies we derive a linear mapping between income and consumption prices at the household level. When aggregating, linearity preserves a tight positive correlation between the corresponding moment statistics (e.g. mean, standard deviation, skewness and kurtosis) of national price and income distributions. That is,

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³ See Markusen, 1986; Hunter, 1991; Mitra and Trindade, 2005; Reimer, 2005; Dalgin et al., 2008.

countries whose income distributions exhibit higher means (or standard deviation, skewness, kurtosis) will have product price distributions with higher means (or standard deviation, skewness, kurtosis).

We also extend Flam and Helpman (1987) to the case of multiple differentiated goods and multiple countries with different technologies. In this case the mapping between income and consumption prices at the household level is monotonic, but not linear. As a consequence, there is no longer a clear-cut relationship between the corresponding moment conditions of national income and price distributions. (A country with higher mean income could have lower mean product prices.) However, we can still establish a linkage between national income and price distributions through probability and cumulative distribution functions. Country pairs with more similar population shares in a given world income quantile will have more similar consumption shares in the corresponding world price quantile. When we examine the probability distribution functions along the entire support, we find that country pairs with more similar income distributions have more similar product price distributions.

To examine these predictions we employ internationally comparable household income data from the Luxembourg Income Study (LIS) for 26 countries in the year 2000. The LIS provides us with household income data at percentile increments from which we construct income distributions for cross-country comparisons. We construct our price distributions using international trade data at the level of 6-digit Harmonized System (HS) products from COMTRADE for 1999–2001. Previous authors have shown that prices vary substantially across exporters and covary with exporter characteristics such as per-capita income and per worker supplies of capital and skilled labor (Schott, 2004; Hummels and Klenow, 2005). Further, countries with high export prices have larger, not smaller, shares of the markets in which they sell (Hallak, 2006). These facts point to the primacy of quality differentiation, as opposed to measurement error, as an explanation for measured price variation. For each product we observe from which exporters an importer buys, along with each exporter's quantity and value of trade, and from these construct price (= unit value) distributions for each importer and product.

Our findings are consistent with the model. The differences in importers' price distributions are correlated with differences in their income distributions, both within individual quantiles of the distributions and along the whole support. In addition, key statistics related to the 1st–4th moments (mean, median, standard deviation, coefficient of variation, inter-decile range, skewness and kurtosis) of the income distribution are positively correlated with those of the import price distribution. In other words, countries with high incomes consume goods with high prices; countries with a greater variability in incomes over households have greater variability in prices for a particular good; and countries whose income distributions have fat or skewed tails also have price distributions with fat or skewed tails.

Our work relates most closely to a relatively new literature on the role of quality differentiation in trade. Most of the empirical work in this literature has focused on linking price variation to exporter characteristics. Some authors have provided correlations with importer characteristics, showing that within product categories, countries with high mean income per capita buy goods with higher mean prices (Hallak, 2006; Hummels and Skiba, 2004). We differ in that we provide explicit propositions showing how a correlation between income and prices at the level of heterogeneous households will aggregate to correlations between national income and price distributions. This allows us to demonstrate which are the appropriate statistics to use in linking these distributions, and to examine higher moments of income and price distributions, their individual quantiles, and differences along the entire support.

The paper proceeds as follows. Section 2 provides the theory linking a country's income and import price distributions. Section 3 discusses our empirical specifications. Section 4 explains the

construction of our income and price distribution data in detail. Section 5 presents the empirical results and Section 6 concludes.

2. The model

Flam and Helpman (1987) provide a model in which heterogeneity in household income is mapped into heterogeneity in optimal quality choice. We extend their model to a multi-country, multi-good setting, with an analysis motivated by and focused on empirical feasibility. In an international context we are unable to observe the qualities and prices of goods consumed at the household level. However, we can observe a country's income distribution, as well as the distribution of prices for imported goods. We show how to aggregate heterogeneous household income and consumption decisions to construct national income and price distributions and provide propositions linking differences in importers' income distributions to differences in import price distributions.

We start with a model with one differentiated good and identical technologies across countries. This model's restrictive assumptions on technology and preferences imply a linear monotonic relationship between household income and the price that household will pay for a quality differentiated product. Given linearity we show that, across countries, each moment of the consumption price distribution is positively correlated with the corresponding moment of the income distribution. We then extend our analyses to multiple goods and different technologies so that the price-income relationship is monotonic but non-linear. In this case, there need not be a cross-country correlation between the corresponding moments of the price and income distributions. However, we show that there is a relationship between cross-country differences in probability distribution functions (pdfs) for prices and income. This relationship holds when examining the integral of the pdf along the entire support, or when examining sub-sets of the support, i.e. bins corresponding to "high" and "low" priced goods. To save space we post rigorous proofs of all propositions on our websites.⁴

2.1. Identical technologies and one differentiated good

There are two goods, a homogeneous numeraire good and a vertically differentiated good. There are C countries. Each country c has population N_c , with income I distributed exogenously⁵ according to the pdf $g_c(\cdot)$ and cumulative distribution function (cdf) $G_c(\cdot)$ with support S_c^I .

A consumer with income I chooses quantities of the numeraire, y , and the desired quality, $z \in [0, 1]$, of a single unit of the differentiated good in order to maximize

$$u(y, z) = ye^{\alpha z} \quad \text{s.t.} \quad y + p(z) \leq I, \quad (1)$$

where $\alpha > 0$, αz is the elasticity of utility with respect to quality, $p(z)$ is the price of the differentiated good with quality z , and the price of the numeraire is set to 1. We assume that income is sufficiently high so that every consumer consumes the differentiated good.

We initially assume that all countries produce using an identical technology. The marginal cost of producing quality is

$$MC(z) = e^{\gamma z} w \quad (2)$$

w represents the cost component that is common to all the quality levels. $e^{\gamma z}$ represents the cost component that is unique to quality z and implies that the marginal cost increases exponentially with z . γz is the elasticity of the marginal cost with respect to quality. We assume that there are no trade costs, and that there are perfectly competitive markets at each quality level so that consumers in all

⁴ See links at <http://www.mgmt.purdue.edu/faculty/hummelsd/research.htm>.

⁵ This assumption allows us to focus on the role of national and world income distributions in determining quality demand, but we abstract from the feedback channels through which trade affects income, as in Flam and Helpman's (1987) seminal work.

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