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Who's Getting Globalized? Intra-national Trade Costs and World Price Pass-Through in South Asia and Sub-Saharan Africa*

David Atkin†, Dave Donaldson‡

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Abstract

This paper uses a newly collected dataset on the prices of narrowly defined goods across many dispersed locations within multiple developing countries to address the question, *How integrated with the global economy are households in developing countries?* In order to estimate trade costs we utilize price gaps over space—but we do so across trading locations only by drawing on unique data on the location of production of each good. These trade costs contain two elements: intermediaries' marginal costs (due, for example, to poor infrastrucure) and intermediaries' mark-ups (due, potentially, to their market power). We estimate, separately by location and commodity, the pass-through rate between the port price of each imported good and the prices paid by inland consumers of the good; in doing so we exploit variation induced by exchange rate shocks. Our estimates imply incomplete pass-through, which is evidence for intermediaries' market power. We show that the estimates of total trade costs and pass-through rates are sufficient to infer the primitive relationship between marginal transportation costs and distance (which is ordinarily obscured by the way in which mark-ups vary over distance), as well as the distribution of surplus (here, the gains from trade) among inland consumers and intermediaries.

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1 Introduction

Recent decades have seen substantial reductions in the barriers that impede trade between nations—a process commonly referred to as 'globalization'. But trade does not start or stop at national borders. The trading frictions faced by many households, especially those in developing countries, include not only the international trade costs that have fallen in recent times, but also the intra-national trade costs that separate these households from their nearest port or border. Such costs could potentially be high because the intermediaries who carry out intranational exchange face high marginal costs (due, for example, to poor infrastructure) or because these intermediaries charge high mark-ups. If these costs are significant then it is possible that, from the perspective of many of the world's poor, globalization has barely even begun. While a great deal has been written about whether households in developing countries are helped or harmed by access to global markets, an important and primitive empirical question has not yet been answered: *Just how integrated with the global economy are households in developing countries?*

The goal of this paper is to shed new empirical light on this question by studying the size and nature of intranational trade costs within a group of developing countries. Our approach draws on a substantial new dataset that we have collected on the distribution of retail prices across space in our sample of eight countries in South Asia and Sub-Saharan Africa. Using this new dataset on several hundred products in over one thousand local markets going as far back in time as 1970 we address four questions:

1. *How large are intranational trade costs?* We define intranational trade costs as the total price a final goods consumer would pay to an intermediary to purchase goods from another location (such as, but not restricted to, a factory, port or border post) within her own country. Total trade costs can be decomposed into intermediaries' marginal costs and mark-ups. This total trade cost is, by definition, equal to the price gap between the source location and the final destination. Using a large sample of raw CPI data on extremely narrowly identified consumer products (with equivalent to bar code-level identifiers), as well as unique data on the production source location (domestic factory site or import source location) of each

product, we measure trade costs as the gap in prices among pairs of locations that are actually trading, the only pairs that are informative of trade costs. Using this approach we find that trade costs rise strongly with distance and with the weight of the good shipped.

2. *Do the prices paid by remote households for imported goods respond to border costs, such as exchange rates or tariffs?* The two components of intra-national trade costs—marginal costs and mark-ups—respond differently to foreign price changes (such as tariff, shipping rate or exchange rate changes). Marginal costs are presumably fixed in the short-run while mark-ups are a choice variable that an intermediary is, in general, free to adjust (or not) in response to foreign price developments. (As we discuss below, whether or not the intermediary adjusts his mark-up depends on both the demand curve of the inland consumer and the degree of competition the intermediary is facing.) That is, if intranational trade costs consist primarily of marginal costs of domestic trade (for example, due to poor roads), global price changes will pass-through fully into the prices paid by domestic consumers. By contrast, if intranational trade costs consist primarily of mark-ups, and demand conditions are such that the intermediary will adjust these mark-ups, global price changes may not pass through one-for-one to the prices paid by inland domestic consumers. We estimate pass-through rates separately by location and product and find that, on average, remote locations experience lower levels of pass-through because of lower levels of competition among intermediaries.

3. *How do the marginal costs of intra-national trade depend on distance and other characteristics such as transportation infrastructure?* Any answer to this question is potentially confounded by the fact that, if pass-through is anything but complete, mark-ups will depend on the level of marginal costs, and hence on characteristics such as distance. But by combining our pass-through estimates from Step 2 with estimates of how the price gap estimated in Step 1 varies with distance, we infer the primitive relationship between marginal trade costs and distance (as well as how this varies over time and across countries). Applying this methodology, and given that pass-through is increasingly incomplete in remote locations, we find that the marginal costs of distance are even larger than in standard estimates (obtained

through estimates like that in our Step 1).

4. *What share of the gains from trade in developing countries accrue to consumers and to intermediaries?* The two steps above suggest that the presence of intermediary market power can significantly reduce the gains from trade available to consumers in remote areas. However, empirically separating marginal costs from markups is notoriously difficult (Pakes, 2008). In a developing country context, a further difficulty arises: as quantity data is generally not available across many distinct locations for narrowly defined goods, estimating the demand parameters required to quantify markups is a heroic task. Fortunately—by an extension of the analysis in Weyl and Fabinger (2011)—in order to study the question of who is capturing the gains from trade, the rate of pass-through (which we estimate for each location and product in Step 2 above) is a sufficient statistic, so estimates of mark-ups are unnecessary. Using this result we find that intermediaries in remote locations capture a considerable share of the gains from trade.

This work relates to a number of different literatures. First, as described above, a large literature surveyed by Anderson and van Wincoop (2004) uses aspects of spatial price dispersion in order to identify trade costs. One strand of this literature argues that inter-spatial arbitrage is free to enter and hence that inter-spatial price gaps place lower-bounds on the marginal costs of inter- or intra-national trade, where these lower bounds are binding when trade occurs. See, for instance, Eaton and Kortum (2002), Simonovska and Waugh (2011), Fackler and Goodwin (2001), and Donaldson (2011). A distinguishing feature of our approach is the use of both narrowly defined goods (analogous to bar code identifiers) and information on the location of production in which goods are equally narrowly defined. A second strand of this literature considers, as we do, the possibility that producers or intermediaries have market power (that is, arbitrage is not free to enter) and hence that firms may price to market. (See, for example, Goldberg and Knetter (1997), Goldberg and Hellerstein (2008), Nakamura and Zerom (2010), Li, Gopinath, Gourinchas, and Hsieh (2011), Burstein and Jaimovich (2009), and Atkeson and Burstein (2008)). In common with our approach, many of these papers exploit exchange rate shocks to identify the degree of price pass through. Third, papers such as Engel and Rogers (1996), Parsley and Wei (2001), Broda and Weinstein (2008) and Keller and Shiue (2007a) use inter-spatial price gaps to infer trade costs yet do not have data on whether trade occurs along particular routes, and so the estimates of trade costs are likely to be biased by the inclusion of many non-informative observations when applying the arbitrage-equation based approach. Finally, several papers have used consumer scanner data from the US and Canada in order to work with extremely narrowly identified goods—see Broda and Weinstein (2008), Burstein and Jaimovich (2009) and Li, Gopinath, Gourinchas, and Hsieh (2011). However, this work typically lacks information on the region or country of origin so inferences of trade costs are not the focus.

Second, our work relates to the rapidly growing literature on intermediation in international trade, including (Ahn, Khandelwal, and Wei, 2011; Antras and Costinot, 2011; Bardhan, Mookherjee, and Tsumagari, 2011; Chau, Goto, and Kanbur, 2009). This work aims to understand hen international trade is conducted via intermediaries rather than by producers directly. Our work is instead focused on the consequences of intermediaries, who potentially possess market power, for intra-national barriers to trade, the pass-through of world price changes, and the distribution of the gains from trade.

The remainder of this paper proceeds as follows. Section 2 describes the new dataset that we have constructed for the purposes of measuring and understanding intra-national trade costs in our sample of developing countries. Section 3 outlines a theoretical framework in which intranational trade is carried out by intermediaries who potentially enjoy market power. Section 4 describes the empirical application of our theory. Section 5 estimates trade costs by careful exploitation of spatial price gaps. Section 6 estimates pass-through rates by exploiting exchange rate shocks which plausibly affect marginal costs but not transport costs or demand. Section 7 uses the estimated trade costs and pass through rates to explore the the primitive relationship between marginal trade costs and distance. Section 8 utilizes combines the theoretical results with the pass-through estimates to determine the distribution of the gains from trade. Section 9 concludes.

2 Data

Monthly price data is collected by most national statistical agencies in the process of computing the consumer price index. The raw data usually contains descriptions of the commodities on which prices were collected; these descriptions can be used to narrowly identify goods for the purposes of this study. Thus, in addition to knowing what *type* of commodity a particular price in a given time period corresponds, it is possible to identify the specific item brand in some cases. Thus, we can determine the price for, say Elephant cement (as opposed to generic "cement") through various time periods in Nigeria. Price data on the following countries was obtained for the time periods described below:[1]

- Nigeria (1970-2010): Data for Nigeria is available over a period spanning forty years, composed of three separate tranches of data. The first tranche, stretching from 1970 to 2000, covers close to 100 branded goods over 36 town markets, with one market per state. The second tranche of data runs from 2001 to 2006, also covering 36 town markets over the various Nigerian states and close to 100 commodities, of which around 30 are narrowly identifiably. Finally, the third tranche of data runs from 2007 to 2010 and contains data from 1000 town, village and roadside markets for 700 commodities, of which 40-50 can be identified as specific brands. In addition, the data from 2007-2010 contains information on the type of retailer from which the price observation was recorded. At present, manufacturing information for 10 branded goods has been acquired.
- Ethiopia (2001-2010): The Ethiopian data covers 103 towns in 100 districts and includes over 400 commodities, with 30-40 brand-name goods. Some manufacturing information is known for 21 of these commodities. Trade survey data from Ethiopia in 2008 provides information on the retail structure of the various districts in the country.
- Philippines (2000-2010): The geographic spread of the Philippines data covers all the provinces and major cities of the country (89 unique geographic points in total) for over 6000 goods,

[1]At present, only the data from Nigeria (2001-2010), Ethiopia and the Philippines has been prepared for analysis. Please see the Commodity Appendix for the complete list of commodities for which currently have data.

of which manufacturing information has been obtained for 8 branded goods. Efforts are currently underway to expand the list of branded goods for which we know the locations of factories and points of import.

- India (1985-2010): The Indian price data covers over 650 villages distributed across the 28 states of India. It includes price data from 250 goods, 100 of which are narrowly identifiable by brand. Some of these goods vary by state and region, while others are present across the various states.
- Rwanda (2009-2011): Although the data in Rwanda covers a shorter time period, it is rich in depth, covering 48 towns over 5 regions (4 of which are further split into urban and rural centers, thereby giving us 9 unique geographic points) and 300 commodities. Out of these commodities, 60 are narrowly identifiable by brand.
- Senegal (2006-2010): The price data in Senegal covers 300 commodities over 5 town markets; 20-30 of these commodities are narrowly identifiable. In addition, as with the Nigerian data from 2007-2010, the data in Senegal includes information on the type of retailer at which a particular price observation was noted, giving us a handle on the retail structure within each market.
- Zambia (1996-2005): The long panel in Rwanda covers over 150 branded commodities, of which 60-70 are narrowly identifiably brands. Prices cover 48 different district centers in the country and also include information on the typical quantity of sale, and the characteristics of the product (weight, volume, etc.).
- Bangladesh (2004-2010): Bangladesh's data covers all 64 districts of the country, each of which is further divided into an urban and rural center (thereby giving us 128 unique geographic data points.) The number of commodities in the data vary between rural and urban centers, from 30-50 commodities. In addition, the data contains well defined information on the type of retailer at which the price observation was made, as well as the weight and quantity of a typical unit of the good sold.
- In addition to the countries noted above, we have acquired price data on Guinea-Bissau and efforts are underway to acquire similar price data from other countries including Pakistan,

Mexico and Ghana.

The Maps Appendix includes maps showing price locations and geographic spread of the data for the first four data sets were collection efforts and data cleaning are almost complete.

Having identified a subset of goods for which the brands are identifiable in each country, we contacted the manufacturers and distributors to ascertain manufacturing locations for the goods; in the case of goods that are imported into the country, the port of import is also ascertained. It is thus possible to identify a narrowly defined commodity from its point of manufacture right down to the retail level. Efforts are currently underway to obtain wholesale prices for these narrowly defined commodities as well, in order to determine the price of the goods at various points along the distribution chain. Further to the price data, data has also been procured on waterbodies, density of road and rail networks, road types, cost-weighted distance, major languages and ethnicity.

3 A Model of Intermediated Intra-national Trade

In this section we describe a model of intra-national trade carried out by intermediaries who (potentially) enjoy market power. This framework is useful because it illustrates how spatial price data can be used to estimate the size of intra-national trade costs, the intra-national pass-through of global price changes, and the distribution of the gains from trade between consumers and intermediaries.

3.1 Model Setup

We assume that there are $d \in D$ isolated locations[2] and that there are $k \in K$ goods potentially on sale in any of the markets d. Each good k is produced at a unique factory location, $o \in O$. (Note the mnemonic: o for origin and d for destination.) Goods are sold in unlimited quantities at a known wholesale price P_{ko} at the factory gate, or in the case of an imported good, at the port.

There is a stock of M identical domestic intermediaries who possess the ability to purchase a good in bulk, transport that good at a cost between locations, and then sell it to consumers there.

[2]Locations are isolated in the sense that consumers do not travel to economies other than their own to purchase items. More generally, we simply require that intermediaries' marginal costs are sufficiently low (relative to consumers' travel costs) that consumer always buy goods locally from an intermediary rather than traveling themselves to other locations to make their purchases.

This stock of potential intermediaries may or may not be constrained by credit constraints, reputation issues, caste or ethnic traditions etc. Each intermediary can only trade a single good. In order to enter the intermediary market in any given period, traders must pay a fixed cost F (e.g. for rental of a vehicle).

Intermediaries play a series of static two-stage games. In the first stage, each intermediary chooses which product to purchase and which location to deliver it to. In the second stage, all the intermediaries who have chosen to sell the same good at the same location compete to sell their product to consumers (or potentially to local retailers).

For expositional purposes we focus initially on a single destination market d, commodity k and time period so we remove, for now, all subscripts referring to these identifiers.

3.2 Consumer Demand

For the time being we simply assume an inverse demand function that is decreasing in total quantity, Q, and twice continuously differentiable: $P = P(Q)$.[3] In the analysis that follows, the price elasticity demand, $e \equiv \frac{dP}{dQ}\frac{Q}{P} < 0$ and the elasticity of the slope of demand, $E \equiv \frac{Q}{\frac{dP}{dQ}}\frac{d\frac{dP}{dQ}}{dQ} = 1 + \frac{1}{e} + \frac{Q}{e}\frac{de}{dQ}$, will play crucial roles.

3.3 Firms

We assume that each intermediary, i, in a single market-product pair has a total cost function, C, that is the sum of fixed costs of entry into the distribution sector, F, and per-unit costs denoted by $t_i q_i$ where $q_i$is the quantity traded by intermediary i and $t_i = t(P_o, q_i, \mathbf{X}, \mathbf{A})$ is the marginal cost of trading, where P_o is the factory gate price of the good (the price the intermediary pays for the good at the origin), $\mathbf{X}$ is a set of marginal cost shifters specific to the route from origin to destination (such as distance or road quality), and $\mathbf{A}$ is a set of marginal cost shifters specific to the commodity shipped. This is a completely general approach to modeling intermediary costs. Note that marginal costs could either be specific (ie charged per unit of good shipped) or ad valorem (per value of good shipped) or a combination of these

[3] In our preliminary analysis we ignore all issues of substitutability across commodities and treat each commodity in isolation.

two extremes. Note also that marginal costs could be a function of the quantity shipped.

The intermediary maximizes profits by choosing the amount he or she purchases q_i, holding constant the production choices of all other intermediaries (summarized by the vector $\mathbf{q_{-i}}$), defined by

$$\Pi_i = P(q_i, \mathbf{q_{-i}})q_i - C(q_i, P_o, \mathbf{X}, \mathbf{A}, F), \tag{1}$$

The essential strategic interaction across intermediaries is the extent to which an intermediary's actions (his quantity choice, q_i) affect other intermediaries' profits through the aggregate quantity $Q \equiv \sum_i q_i$. We follow the 'conjectural variations' approach and assume that this relationship is summarized, in equilibrium, by the parameter $\theta_i \equiv \frac{dQ}{dq_i}$. The case of symmetric Cournot oligopoly corresponds to $\theta_i = 1$, the case of a pure monopolist corresponds also to $\theta_i = 1$, while perfect competition corresponds to $\theta_i = 0$. Given this notation, the first order condition for firm i is as follows:

$$\frac{d\Pi_i}{dq_i} = P(Q) + \theta_i \frac{\partial P(Q)}{\partial Q} q_i - \frac{dC(q_i, P_o, \mathbf{X}, \mathbf{A}, F)}{dq_i} = 0.$$

Under the further assumption that all m intermediaries are identical, the system of first order conditions simplifies to:[4]

$$P(mq) + \theta \frac{\partial P(mq)}{\partial mq} q - \frac{dC(q, P_o, \mathbf{X}, \mathbf{A}, F)}{dq} = 0. \tag{2}$$

With this simple machinery in place we now go on to explore how prices, quantities and profits respond to changes in the port price, P_o.

3.4 The short run: m exogenously given

Initially we take the number of intermediaries m as fixed. In section 3.8 we go on to explore the potentially endogenous entry decision of a firm. However, at this stage we calculate pass

[4]These conditions are only necessary for an equilibrium. The second order condition is $\theta^2 q \frac{\partial^2 P(Q)}{\partial Q^2} + 2\theta \frac{\partial P(Q)}{\partial Q} - \frac{d^2 C(q, P_o, \mathbf{X}, \mathbf{A}, F)}{dq^2} < 0$, and the stability conditions are $(m+\theta)\frac{\partial P(Q)}{\partial Q} + \theta Q \frac{\partial^2 P(Q)}{\partial Q^2} - \frac{d^2 C(q, P_o, \mathbf{X}, \mathbf{A}, F)}{dq^2} < 0$ and $\theta \frac{\partial P(Q)}{\partial Q} - \frac{d^2 C(q, P_o, \mathbf{X}, \mathbf{A}, F)}{dq^2} < 0$. See Seade (1980) for further discussion.

through rates for short-run shocks to P_o in a similar vein to Seade (1985). With m fixed we can totally differentiate (2) and solve for $\frac{dq}{dP_o}$, $\frac{dP}{dP_o}$ and $\frac{d\Pi}{dP_o}$ in short-run equilibrium:

$$\frac{dq}{dP_o} = \frac{\frac{\partial^2 C(q,P_o,\mathbf{X},\mathbf{A},F)}{\partial q \partial P_0}}{(m+\theta)\frac{\partial P(Q)}{\partial Q} + m\theta q\frac{\partial^2 P(Q)}{\partial Q^2} - \frac{\partial^2 C(q,P_o,\mathbf{X},\mathbf{A},F)}{\partial q^2}} \tag{3}$$

$$\frac{dP}{dP_o} \equiv \rho = m\frac{\partial P(Q)}{\partial Q}\frac{\partial q}{\partial Po} = \frac{m\frac{\partial P(Q)}{\partial Q}\frac{\partial^2 C(q,P_o,\mathbf{X},\mathbf{A},F)}{\partial q \partial P_0}}{(m+\theta)\frac{\partial P(Q)}{\partial Q} + m\theta q\frac{\partial^2 P(Q)}{\partial Q^2} - \frac{\partial^2 C(q,P_o,\mathbf{X},\mathbf{A},F)}{\partial q^2}} \tag{4}$$

$$\frac{d\Pi}{dP_o} = \frac{(m-\theta)q\frac{\partial P(Q)}{\partial Q}\frac{\partial^2 C(q,P_o,\mathbf{X},\mathbf{A},F)}{\partial q \partial P_0}}{(m+\theta)\frac{\partial P(Q)}{\partial Q} + m\theta q\frac{\partial^2 P(Q)}{\partial Q^2} - \frac{\partial^2 C(q,P_o,\mathbf{X},\mathbf{A},F)}{\partial q^2}} - \frac{\partial C(q,P_o,\mathbf{X},\mathbf{A},F)}{\partial P_0} \tag{5}$$

Note that we have defined the pass-through rate, the response of equilibrium prices (P) to a change in the factory gate location price (P_o) as $\rho \equiv \frac{dP}{dP_o}$. This is a critical equlilibrium object in what follows below.

3.5 Distribution of the Gains from Trade

We now are now in a position to derive the distribution of surplus between middleman surplus (denoted MS) and consumer surplus (CS). In this derivation we assume that $F = 0$, or has been sunk:

$$\frac{MS}{CS} \equiv \frac{[P(Q) - c(Q)]Q}{\int_0^Q [P(\phi) - P(Q)]d\phi}.$$

Since $\frac{dCS(Q^*(P_0))}{dP_0} = -Q^*\frac{dP(Q^*)}{dQ}\frac{dQ}{dP_0}$ the denominator is:

$$CS = \int_{P_o}^{\infty} -Q^*(\phi)\rho(\phi)d\phi.$$

The expression for $\frac{d\Pi(q^*(P_0))}{dP_o}$ from equation (5) can be multiplied by m and integrated. Hence,

$$MS = \int_{P_o}^{\infty} -Q^*(\phi)[1 + \frac{dt(P_o, q^*(\phi), \mathbf{X}, \mathbf{A})}{dP_0} - \frac{(m-\theta)}{m}\rho^*(\phi)]d\phi.$$

Finally, $\frac{MS}{CS}$ simplifies as follows:

$$\frac{MS}{CS} = \frac{\int_{P_o}^{\infty} Q^*(\phi)(1 + \frac{dt(P_o, q^*(\phi), \mathbf{X}, \mathbf{A})}{dP_0})d\phi}{\int_{P_o}^{\infty} Q^*(\phi)\rho^*(\phi)d\phi} + \frac{\theta}{m} - 1.$$

Note that while this expression for $\frac{MS}{CS}$ computes the entire social surplus from a good available at the factory gate or port/border price, P_o, one can easily alter it to compute surplus in other settings. For example, we may also be interested on knowing how the gains from a tariff cut or, equivalently, a drop in P_o from P_o^1 to P_o^2, are split between middlemen and consumers. We can simply change the limits on the integral to answer this question:

$$\Delta\left(\frac{MS}{CS}\right) = \frac{\int_{P_o^2}^{P^1} Q^*(\phi)(1 + \frac{dt(P_o, q^*(\phi), \mathbf{X}, \mathbf{A})}{dP_0})d\phi}{\int_{P_o^2}^{P^1} Q^*(\phi)\rho^*(\phi)d\phi} + \frac{\theta}{m} - 1.$$

3.6 The case of specific trade costs with constant returns to scale

In order to simplify the analysis, we focus on the case of constant returns to scale in the activity of intermediation or trading (ie $\frac{dt(P_o, q, \mathbf{X}, \mathbf{A})}{dq} = 0$) and trade costs that are of the 'specific' (or per unit shipped) form, such that $t = \gamma_0 + \gamma_\mathbf{1}\mathbf{X} + \gamma_\mathbf{2}\mathbf{A}$. In this case equation (4) simplifies considerably to

$$\frac{dP}{dP_o} \equiv \rho = \frac{1}{1 + \frac{(1+E)\theta}{m}} \tag{6}$$

From this expression it is easy to see that pass-through is complete or one-for-one (ie $\rho = 1$) in the case of perfect competition (ie if $\theta = 0$). More generally, equilibrium pass-through depends on both the demand system (via E) and the nature of competition (via $\frac{\theta}{m}$). An attractive feature of equation (6) from an empirical perspective, which we exploit below, is that with an estimate of E, an estimate of equilibrium pass-though provides an estimate of the extent of competition, $\frac{\theta}{m}$.

This case also simplifies the result for the distribution of surplus. With $\frac{dt(P_o, q^*(\phi), \mathbf{X}, \mathbf{A})}{dP_0} = 0$, as is the case with specific trade costs under constant returns, we have:

$$\frac{MS}{CS} = \frac{\int_{P_o}^{\infty} Q^*(\phi)d\phi}{\int_{P_o}^{\infty} Q^*(\phi)\rho^*(\phi)d\phi} + \frac{\theta}{m} - 1.$$

Note that the change in pass through with distance is as follows:

$$\frac{d^2P}{dP_o dx_{od}} = \frac{1}{m(1+\frac{1+E}{m})^2}\gamma_1[\frac{1+E}{m}\frac{dm}{dt} - \frac{dE}{dQ}\frac{dQ}{dt}].$$

The first term within the square brackets captures the change in competition, with $\frac{dm}{dt} < 0$ generally (conditions to be shown later). If $1+E > 0$, $\frac{dP}{dP_o} < 1$ and pass through will be incomplete and even more so in the interior. If $1+E < 0$, $\frac{dP}{dP_o} > 1$ and pass through will be more than 100 percent and even more so in the interior. The second term within the square brackets captures any demand differences due to different gradients at various points along the demand curve, with $\frac{dQ}{dt} < 0$ generally. However, $\frac{dE}{dQ}$ is ambiguous, and will depend on whether more inelastic consumers are being selected due to the higher interior prices for example.

The first order condition, equation 2, pins down prices and profits:

$$P = \frac{t+P_o}{[1+\frac{e}{m}]},$$
$$\Pi = -\frac{e}{m}Pq - F = -\frac{e}{m^2}\frac{t+P_o}{[1+\frac{e}{m}]}Q - F.$$

3.7 The case of constant pass-through (Bulow-Pfleiderer) demand

So far we have placed no restrictions on consumer demand. To make further empirical progress, however, we exploit the convenient properties of a flexible demand curve in which pass-through is constant. Inverse demand is of the constant pass-through class first identified by Bulow and Pfleiderer (1983) and extended in Weyl (2008), and is a generalization of isoelastic demand. Indeed, Bulow and Pfleiderer (1983) prove that the only demand system with constant pass-through is the class introduced here. The price P depends on total demand Q in the following manner:

$$Q(P) = \begin{cases} (\frac{a-P}{b})^{\frac{1}{\delta}} & \text{if } (P \leq a,\, b > 0 \text{and } \delta > 0) \text{or } (P > a,\, b < 0 \text{and } \delta < 0) \\ 0 & \text{if } P > a,\, b > 0 \text{and } \delta > 0 \\ \infty & \text{if } P \leq a,\, b < 0 \text{and } \delta < 0 \end{cases}$$

with $a \geq 0$. Accordingly, inverse demand is:

$$P(Q) = a - bQ^{\delta}.$$

For this demand system we have $e = \delta[1 - \frac{a}{P}] \leq 0$ and $E = \delta - 1$. Then from equation (6) pass-through is equal to $\frac{dP}{dP_o} \equiv \rho = \frac{1}{1+\frac{\delta\theta}{m}}$ and is constant, by design, in the short-run when $\frac{m}{\theta}$ is fixed. Pass-through can be 'incomplete' (ie $\rho < 1$) for $\delta > 0$ and 'more than complete' (ie $\rho > 1$) with $\delta < 0$. Hence nothing in this class of preferences restricts whether pass-through will rise or fall with the remoteness of locations within a country; the only restriction is that pass-through is constant. Note that the case of $a = 0$ reduces to the familiar case of isoelastic (CES) preferences. With these two elasticities, the price, pass through and markups (ie price minus marginal costs, or $P - [t + P_o] \equiv \mu$) can be easily calculated for the oligopolistic case as:[5]

$$\begin{aligned} \frac{dP}{dP_o} &\equiv \rho(m) = \frac{m}{m+\delta}, \\ P &= \frac{t + P_o}{[1 + \frac{\delta[1-\frac{a}{P}]}{m}]} = \rho[t + P_o] + [1 - \rho]a, \\ P - P_o &= \rho t + [1 - \rho][a - P_o], \\ P - [t + P_o] &\equiv \mu = [1 - \rho][a - t - P_o] \\ \frac{MS}{CS} &= \frac{\Delta MS}{\Delta CS} = \frac{1}{\rho} + \frac{1}{m} - 1. \end{aligned}$$

[5]The second order condition is $\delta > 1 - 2m/\theta$, and the stability condition is just $\delta > -m/\theta$.

3.8 Endogenizing the steady-state number of middlemen (Preliminary)

In the previous analysis, m was fixed at some exogenous value. However, in the two stage game described in section 3.1, intermediaries were free to choose which markets they served. Therefore, we now extend the model and treat m as the outcome of endogenous entry when P_o and the other parameters are fixed at their pre-P_o-shock levels. Again we focus on the case constant returns to scale, specific trade costs, and constant pass-through (Bulow-Pfleiderer) preferences. In addition, for simplicity we focus on the case of Cournot oligopoly (such that $\theta = 1$).

We ignore the integer problem and assume free entry so that profits are competed down to some level Π^* determined by the outside option or by the total supply of intermediaries:

$$\Pi^* = [P - t - P_o]\frac{Q}{m^*} - F = [1 - \rho(m^*)][a - t - P_o]\frac{\left(\frac{\rho(m^*)[a-t-P_o]}{b}\right)^{\frac{1}{\delta}}}{m^*} - F. \tag{7}$$

If Π^* is known, this equation pins down m^*, the equilibrium number of intermediaries m. If $\Pi^*$is not known, but the total supply of intermediaries, M, is known, $\sum_k \sum_d m^*_{kd} = M$ plus the $k \times d$ profit conditions for each market-good pair pin down Π^* and hence each m^*_{kd}.

However, we can explore how the number of entrants varies with the marginal costs of trade, t. In order to achieve this, we totally differentiate $\Pi(m,t) = \Pi^*$, equation (7), assuming that the parameters in the demand system (a, b and δ) are unrelated to t and obtain:[6]

$$\begin{aligned}
\frac{dm}{dt} &= -\frac{d\Pi}{dt}/\frac{d\Pi}{dm},\\
\frac{d\Pi}{dt} &= -\frac{Q}{m}[\frac{1+\delta}{m+\delta}] < 0 \,\text{unless}\; -m < \delta < -1,\\
\frac{d\Pi}{dm} &= -\frac{Q}{m}\mu[\frac{2m+\delta-1}{[m+\delta]m}] < 0 \,\text{unless}\; -2m+1 < \delta < -m,\\
\frac{dm}{dt} &= -\frac{1}{\mu}\frac{m[1+\delta]}{[2m+\delta-1]} < 0 \,\text{unless}\; -2m+1 < \delta < -1.
\end{aligned}$$

However, for the Cournot equilibrium to be stable, $\delta > -m$ (see footnote 5), hence $\frac{d\Pi}{dm} < 0$

[6]The assumption that the demand parameters are uncorrelated with remoteness will be relaxed in the empirical work below.

and the only admissible range for $\frac{dm}{dt} > 0$ is $-m < \delta < -1$. This result goes back to Seade (1985) who first noted that cost increases raise profits for symmetric Cournot oligopolists under any demand system where $E < 2$.

The relationship between marginal transport costs and the various expressions in section 3.7 (pass-through, markups and the distribution of surplus) can now be easily calculated. Ceteris paribus, if demand parameters are such that pass-through is incomplete (ie $\delta > 0$, such that $\rho < 1$), pass-through will be more incomplete the higher are marginal costs t; that is, remote consumers will face even lower pass-through and hence will be even less exposed to global price changes.

4 Empirical Implementation

We now return to the many many good k, many location d, many period s model and re-introduce subscripts to identify these cases. We assume that the key demand parameters and the number of intermediaries (a^k_{ds}, δ^k_{ds} and m^k_{ods}) are potentially good-location-time specific, and that intermediary entry is potentially endogenous, $m^k_{ods} = m^k_{ods}(t^k_{ods}, P^k_{os})$. Our goal here is to demonstrate how one can use the model outlined above to estimate the ingredients needed to understand the extent to which households in developing countries are integrated with world markets.

We introduce the following additional assumptions in order to map the model into the data and these assumptions can be relaxed in future work:

Assumption 1. *We define the 'long-run' as a time period T that is made up of several shorter time periods s. (An example would be where T is a year and s is a month.)*

Assumption 2. *Let the marginal costs of intra-national trade, t^k_{ods}, be comprised of a constant and a linear function of distance (denoted x_{od}) and the weight of the commodity k shipped (denoted w^k). While these determinants of marginal cost are clearly fixed over time, we allow the effects of these determinants on marginal costs to change across long-run periods T. That is, $t^k_{ods} = \gamma^T_0 + \gamma^T_1 x_{od} + \gamma^T_2 w^k + \gamma^T_3 x_{od} w^k$.*

Assumption 3. *The key demand parameter, the good-specific pass-through rate δ^k_T , does not* *vary within long-run periods T by location d. However, all other demand-side parameters in the Bulow-Pfleiderer class, a^k_{ds} and b^k_{ds}, are free to vary across time, location and goods.*

Assumption 4. *Within each long-run period T the number of intermediaries serving market d from source o,m_{odT}, is fixed over time (that is, it is fixed in the short-run) and is destination-specific. That is, the number of intermediaries in a location in a long-run time period is equal across commodities.*

Assumption 5. *Entry is exogenous such that m_{ods} is uncorrelated with distance.*

Under these assumptions we have that

$$\begin{aligned} P^k_{ds} &= \rho^k_{odT} P^k_{os} + \rho^k_{odT} t^k_{odT} + [1 - \rho^k_{odT}] a^k_{ds}, \\ \rho^k_{odT} &= \frac{m_{odT}}{m_{odT} + \delta^k_T}. \end{aligned}$$

This implies that a regression of prices (P^k_{ds}) on port or factory gate prices (P^k_{os}) reveals the pass-through rate (ρ^k_{odT}) inherent to each origin-destination market, commodity and long-run time period. This suggests a two-stage strategy that is useful for all that follows. In stage 1 we regress destination prices on origin prices in the time-series,

$$P^k_{ds} = \alpha^k_{dT} + \phi^k_{odT} P^k_{os} + \varepsilon^k_{ds}, \tag{8}$$

which reveals a series of consistent estimators ($\widehat{\phi^k_{dT}}$) of each pass-through rate (ρ^k_{odT}). In stage 2 we then estimate the following regression from the cross section:

$$\frac{P^k_{ds} - P^k_{os}}{\widehat{\phi^k_{odT}}} = \alpha^k + \alpha_d + \alpha_s + \beta^T_1 x_{od} + \beta^T_3 x_{od} w^k + u^k_{ds}, \tag{9}$$

where $\widehat{\beta^T_1}$ is a consistent estimator of γ^T_1 and the terms α are fixed effects.

A natural concern with the estimation of equation (8) is that a^k_{ds} or t^k_{odT} (both of which are in the error term, ε^k_{ds}) are correlated with the regressor P^k_{os}. For example, there may be national demand shocks to which factory gate producers react. In this scenario, we require an instrument for P_{os}^k in equation (8) that is uncorrelated with a_{ds}^k or t_{odT}^k but correlated with P_{os}^k. For imported goods, we can use the exchange rate between the country of origin O and the destination D, $e_{O/D,s}^k$. If this exchange rate variation is induced by changes in the foreign country and is uncorrelated with the oil price, exchange rate variation should be independent of a_{ds}^k or t_{odT}^k.

In order to estimate the distribution of surplus, we also require an estimate of the number of intermediaries, m_{odT}. However, under the assumptions above, this estimate can be easily retrieved by first noting that pass-through and m_{odT} are closely related:

$$\ln(\frac{1}{\rho_{odT}^k} - 1) = \ln \delta_T^k - \ln m_{odT}.$$

That is, a regression of our consistent estimate $(\widehat{\phi_{dT}^k})$ of the pass-through rate obtained from equation (8) above on a series of fixed effects reveals an estimate of m_{odT}. That is, in the regression

$$\ln(\frac{1}{\widehat{\phi_{odT}^k}} - 1) = \lambda_{odT} + \kappa_T^k + \nu_{odT}^K$$

where λ_{odT} is a origin-destination market pair- and long-run time period-specific fixed effect, and κ_T^k is a commodity- and long-run time period-specific fixed effect, an estimator of m_{odT} is $e^{\widehat{\lambda_{odT}}}$. Armed with this result the estimated distribution of surplus for each market pair, long-run time period and commodity can be written as:

$$\widehat{\left(\frac{MS}{CS}\right)}_{odT}^k = \frac{1}{\widehat{\phi_{odT}^k}} + \frac{1}{e^{\widehat{\lambda_{odT}}}} - 1 \tag{10}$$

Note that the predicted m_{odT} can be compared against outside estimates by using survey evidence on the density of workers employed in the trading sector at various locations..

To conclude, using the methodology outlined here we can obtain answers to the four questions posed in the Introduction:

1. *How large are intranational trade costs?* Among the pairs of markets that are actually

trading goods, that is between origin and destination market pairs, these trade costs (for any good, market pair and point in time) can be identified simply as the price gap, $P^k_{ds} - P^k_{os}$. The level of intranational trade costs among non-trading pairs cannot be identified using this methodology. However, our answer to question 3 below can be used to obtain estimates of the observable shifters of trade costs along any route.

2. *Do the prices paid by remote households for imported goods respond to border costs, such as exchange rates or tariffs?* Our answer to this question is embodied directly in our estimates of pass-through for each (trading) market pair location, commodity and long-run time period, ie our estimates $\widehat{\phi^k_{dT}}$ of the pass-through rate ρ^k_{odT}. In addition there is a close connection between pass-through rates and the number of intermediaries serving a market (pass-through rises as the number of intermediaries rises) and hence our estimates shed light on the extent of competition in each market.

3. *How do the marginal costs of intra-national trade depend on distance and other characteristics such as transportation infrastructure?* Our answer to this question comes directly from estimates of equation (9) above. After purging the price gap variation of variable mark-ups, exploiting the pass-through parameter estimates discussed above, using price gap estimates to estimate the effect of characteristics like distance on the marginal costs of intra-national trade is straightforward.

4. *What share of the gains from trade in developing countries accrue to consumers and to intermediaries?* Finally, calculating the relative amounts of social surplus (gains from trade in the case of imported goods) captured by intermediaries and consumers is, as argued above, straightforward in the case of constant pass-through demand. As described above we first estimate the pass-through parameter (as used to answer questions 2 and 3 above), we then estimate the number of intermediaries serving each market, and finally we substitute them into the simple formula in equation (10) above to calculate the share of gains going to each side of the market.

5 Estimation of Trade Costs

As outlined in the previous section, estimating trade costs allows us to answer the question *How large are intranational trade costs?* Before answering this question, we briefly discuss the existing literature surveyed in Anderson and van Wincoop (2004) that uses three distinct methods to measure trade costs.

The first method aims to directly measure barriers to trade. The direct costs of transportation can be elicited by surveying firms on how much they paid to transportation firms in exchange for transportation services. Alternatively, price quotes can be obtained from shippers or transportation firms, or data can be extracted from existing sources, such as customs data or bills of lading, which in some cases separate transportation costs from the value of the shipment.[7] However, the central challenge is that it is extremely difficult to observe every component of transport costs. For example, organizing transportation utilizes resources beyond simply paying a transportation firm. Even if collecting all this information were possible, placing all the components in comparable units presents a further difficulty. For example, shipping takes time which is hard to cost in dollars.

The second method leans heavily on tractable general equilibrium trade models. After fully specifying the supply and demand sides of all markets, it is possible to compare observed trade to predicted trade. An additional transportation friction is inserted into the model. If the model is correctly specified, trade barriers are equal to the size of the friction that equalizes predicted and actual trade flows.[8] However, given the simplified demand and supply conditions required to make the model tractable, the estimates obtained from this methodology are often unrealistic.

The third method is the one which we pursue in this paper. Under a single theoretical restriction, a no-arbitrage condition, price gaps will be informative about trade barriers between any two trading locations. The key theoretical restriction, which is also implicit in the second methodology above, is that intermediaries will not leave profits on the table. Hence price gaps are

[7] World Bank (2009), Hummels (1999), Hummels, Lugovskyy, and Skiba (2009), Limao and Venables (2001) and Djankov and Sequeira (2010) are prominent examples of this approach.

[8] Examples of this strategy are Head and Ries (2001), Novy (2008), Irarrazabal, Moxnes, and Opromolla (2011).

driven down to the size of the effective trade barriers that lie between producers and consumers of a good.[9] Note that this assumption does not preclude the possibility that traders have market power, although in section 8 when we asses the welfare implications of these transport costs, we will impose the further assumption that intermediaries are maximizing profits.

Compared to the majority of the existing literature that uses price gaps to infer trade costs, we present three innovations. First, we are careful to compare exactly the same commodities over space. Second, we collect information on whether trade actually occurs along a given route, knowledge that is essential for applying this approach yet is rarely known. Third, we take seriously the possibility that there is imperfect competition in the trading sector.

Before proceeding to the estimation, we lay out the theory of free arbitrage and discuss these innovations in more detail. Suppose that arbitrage—buying good k in market i and selling it in market j—is free to enter (i.e. perfectly competitive). However, to perform this arbitrage activity costs t_{ij}^k per unit of the good, a "barrier to trade". Then the first order conditions for optimality in arbitrage sector require that the following conditions hold in equilibrium:

$$\begin{aligned} P_j^k - P_i^k &= t_{ij}^k \qquad \text{if} \qquad trade_{ij}^k > 0, \\ P_j^k - P_i^k &< t_{ij}^k \qquad \text{if} \qquad trade_{ij}^k = 0. \end{aligned}$$

This is an extremely powerful and parsimonious model of how trade costs affect equilibrium outcomes. For example, the model is true under any supply or demand assumptions. However, there are two obstacles that confront a researcher trying to take this model to the data. First, it is crucial that 'good k' is exactly the same thing at markets i and j. Second, in many applications it is difficult to obtain data on $trade_{ij}^k$ (especially for narrowly defined goods k). We discuss these two obstacles in turn:

Obstacle #1: "Exactly the same good k": There are often large quality differences even within homogenous goods due to spatial income differences (for example see Subramanian

[9]Examples of this approach are Engel and Rogers (1996), Parsley and Wei (2001), Broda and Weinstein (2008), Keller and Shiue (2007b).

and Deaton (1996) on rice). Hence comparing prices of a seemingly homogenous good in two locations may in fact be confounding transportation costs and quality differences. This issue appears to matter in our context. For example Broda and Weinstein (2008) carry out the classic Engel and Rogers (1996) border price regressions using barcode-level data instead of CPI aggregates and no longer find a "Border puzzle". We therefore work primarily with a very small sample of products that are narrowly defined. For example a can of tuna fish of a particular type and weight made by a particular brand. Naturally, the drawback is that our sample is no longer representative of the CPI.

Obstacle #2: "Data on $trade_{ij}^k$ is important": The theory of free arbitrage above does *not* say that, for *all* market pairs i, j:

$$P_j^k - P_i^k = t_{ij}^k$$

For such a condition to hold, $trade_{ij}^k > 0$ for all $i - j$ pairs, which is not (usually) an equilibrium. However, almost all of the price gap literature assumes this.[10]We navigate this obstacle in the simplest possible way. We find data on whether there are positive trade flows along any route. As there is typically little data on intranational trade flows of very specific goods, as described in section 2, we find the source of production of good k or the location at which the good entered the country. If there is a unique source of production, and we observe that the good is available at another location, it must have traveled between the two locations and so $trade_{ij}^k > 0$. This approach becomes more more challenging when there are multiple sources of production, and so in general we omit those products. Once we know $trade_{od}^k$, we can simply calculate $P_j^k - P_i^k = t_{ij}^k$ on origin-destination pairs only (ie those with $trade_{od}^k > 0$). If we are interested in the determinants of these arbitrage costs, $t_{ij}^k = f(x_{ij}, w^k, ...)$, we can posit a linear or log linear relationship between potential determinants such as distance, x_{od} or unit weight, w^k, and arbitrage costs

[10]For example Engel and Rogers (1996), Keller and Shiue (2007a), Broda and Weinstein (2008); Fackler and Goodwin (2001) survey. Parsley and Wei (2001) use a slightly different approach and use the standard deviation of price gaps as a measure of trade costs arguing that this variance is a measure of the size of the arbitrage band.

and run the following regression on origin-destination pairs only (ie those with $trade^k_{od} > 0$):[11]

$$P^k_j - P^k_i = \gamma_1 x_{od} + \gamma_2 w^k + \varepsilon^k_{od}. \tag{11}$$

Up to this point, we have implicitly been assuming that the arbitrage sector was perfectly competitive. In reality this assumption is unlikely to hold. However, with a little relabeling, the above logic carries through. Assume that there is imperfect competition in distribution sector along any (o-origin, d-destination) route. Firm first order conditions imply a very similar set of arbitrage equations:

$$\begin{aligned} P^k_d - P^k_o &= t^k_{od} \quad + \mu^k_{od} && \text{if } \ trade^k_{od} > 0, \\ P^k_d - P^k_o &< t^k_{od} && \text{if } \ trade^k_{od} = 0. \end{aligned}$$

where μ^k_{od} is a trading sector markup, t^k_{od} is a marginal costs of transport. The inequality in the second equation holds as at least one intermediary will serve the route od if there is any profit to be had. Hence, if no one serves that route there must be zero profit to be made. Of course this assumes that there are no opportunity costs for these intermediaries, as there would be if there was a fixed cost of entry. In this case:

$$\begin{aligned} P^k_d - P^k_o &= t^k_{od} \quad + \mu^k_{od} && \text{if } \ trade^k_{od} > 0, \\ P^k_d - P^k_o &< t^k_{od} \quad + \mu^k_{od} && \text{if } \ trade^k_{od} = 0. \end{aligned}$$

Therefore, in the presence of imperfect competition, log price gaps for trading pairs only tell us total "trade barriers", $\tau^k_{od} \equiv t^k_{od} + \mu^k_{od}$, which include both trading sector markups and marginal costs of transportation. The γ coefficients on distance in equation 11 should therefore

[11] Additional characteristics of interest are geographic features (e.g. topography, temporary flooding, rural/urban status), transportation infrastructure facilities (e.g. roads by type, railroads and rivers) and intra-national policy-based trade barriers (e.g. administrative borders, road blocks, checkpoints).

be interpreted as the impact of distance of both marginal costs and markups. In section 7 we present a methodology for extracting the true relationship between the marginal costs of transportation and distance.

Results for both approaches, for many countries, time periods and goods will be available soon.

6 Estimating Pass Through

Estimating pass-through rates allows us to directly answer the question *Do the prices paid by remote households for imported goods respond to border costs, such as exchange rates or tariffs?* Incomplete or more than complete pass-through also provides evidence of imperfect competition in transportation sector, the existence of which motivates the subsequent sections of the paper. In order to estimate pass through rates, we investigate how the prices of imported goods respond to exchange rate movements. For expositional purposes, we take the example of a good imported into Nigeria from China via the port at Lagos. The price equation for an imported good is as follows:

$$P^k_{ds} = \underbrace{mc^k_{Ch,s} e^k_{Ch/Ni,s}}_{P^k_{os}} + \underbrace{t^k_{ods} + \mu^k_{ods}}_{\tau^k_{ods}},$$

where $mc^k_{Ch,s}$ is the Chinese producers marginal cost of producing the good and shipping it to the port in Lagos. Therefore, as discussed in section 4, the China-Nigeria exchange rate $e^k_{Ch/Ni,s}$ provides a suitable instrument for port prices as long as the exchange rate is independent of domestic demand shifters (the a^k_{ds} contained in μ) or intranational transport costs (components of t^k_{ods}). Repeating equation (8), we can estimate pass through rates through the following instrumental variables regression:

$$P^k_{ds} = \alpha^k_{dT} + \phi^k_{odT} P^k_{os} + \varepsilon^k_{ds},$$

where P^k_{os} is instrumented by the China-Nigeria exchange rate $e^k_{Ch/Ni,s}$. It is straightforward to see that $\phi^k_{odT} = 1$ if $\mu^k_{ods} = 0$ or $\mu^k_{ods} = constant$ and $\phi^k_{odT} < 1$ if $d\mu^k_{ods}/dP^k_{os} < 0$. Note that$abs(1 - \phi^k)$ gives us lower bound on μ^k_{ods}.

In the introduction we hypothesized that ϕ^k depends on distance due to the endogenous location of intermediaries on more profitable routes. Before exploring this hypothesis in detail in the next section, we can run the following reduced form regression, where once more P^k_{os} are instrumented by $e^k_{Ch/Ni,s}$:

$$P^k_{ds} = \phi^k_{1odT} P^k_{os} + \phi^k_{2odT}(P^k_{os} \times x^k_{od}) + \gamma^k x^k_{od} + \varepsilon^k_{ds},$$

where $\phi^k_{2odT} \neq 0$ if pass-through changes with distance. In particular, our theoretical prediction was that $\phi^k_{2odT} < 0$ if pass through is incomplete ($\phi^k_{odT} < 1$) and $\phi^k_{2odT} > 0$ if pass through is more than complete ($\phi^k_{odT} > 1$).

Results for imported goods for many countries, time periods and goods are not yet available.

7 The Primitive Effect of Distance on the Marginal Costs of Transportation

In this section we address the question *How do the marginal costs of intra-national trade depend on distance and other characteristics such as transportation infrastructure?*

To be completed.

8 The Welfare Costs of Remoteness

In this section we address the question *What share of the gains from trade in developing countries accrue to consumers and to intermediaries?*

To be completed.

9 Conclusion

To be completed.

Tables

To be completed.

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A Commodities

For the purposes of this paper, we restricted our analysis to those commodities that could be narrowly identified by brand and origin of location. The consumer price data obtained provides the necessary level of detail for a subset of the commodities contained therein; this is supplemented by information from the surveys. Below is an example from the price questionnaires for India:

The complete list of commodities used in the analysis at present is as follows:

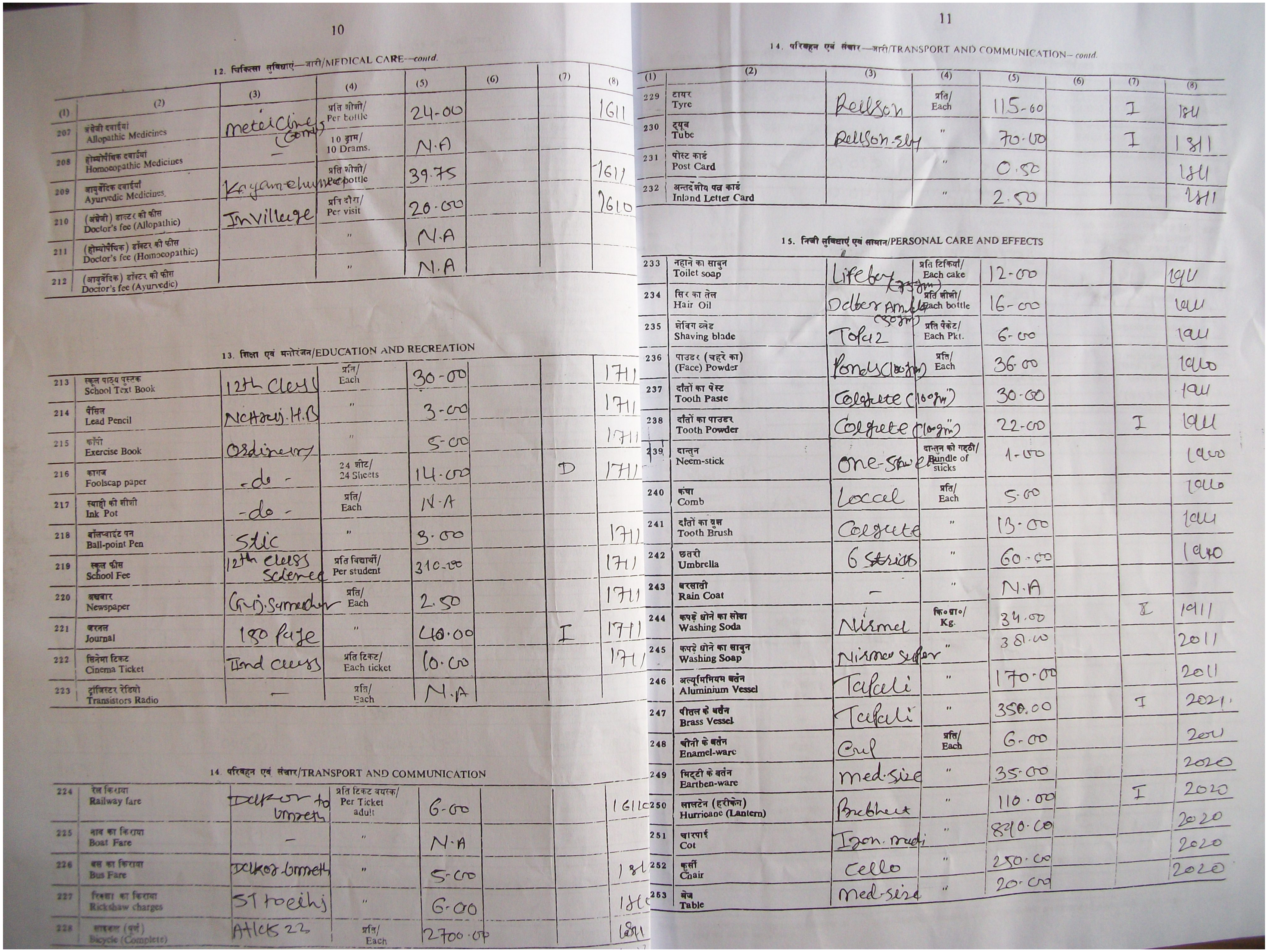
Nigeria:

- Bournvita
- Elephant Cement
- Cerelac
- Omo Detergent
- Philips (dry type) Electric Iron (Made in China)
- Lipton Tea
- Blue Band Margarine
- Panadol
- Titus Sardines (Made in China)
- Singer (foot powered) Sewing Machine (Made in China)

Ethiopia:

- National (2 speaker) Tape Recorder (Imported over the Galafi Border)
- Philips 40/60 W Electric Bulb (Imported over the Galafi Border)
- Saris Wine
- Meta Abo Beer
- Croft Men's Leather Shoes
- Zahira Detergent (Imported over the Galafi Border)
- Lux Soap (Imported over the Galafi Border)

Figure 1: Indian Sample Price Questionnaire



10

12. चिकित्सा सुविधाएं—जारी/MEDICAL CARE—contd.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
207	अंग्रेजी दवाईयां Allopathic Medicines	medicine (Comis)	प्रति शीशी/ Per bottle	24-00			1611
208	होम्योपैथिक दवाईयां Homoeopathic Medicines	—	10 ड्राम/ 10 Drams.	N.A			
209	आयुर्वेदिक दवाईयां Ayurvedic Medicines.	Kayamchurna	प्रति शीशी/ Per bottle	39.75			1611
210	(अंग्रेजी) डाक्टर की फीस Doctor's fee (Allopathic)	Invillage	प्रति दौरा/ Per visit	20.00			1610
211	(होम्योपैथिक) डॉक्टर की फीस Doctor's fee (Homoeopathic)		"	N.A			
212	(आयुर्वेदिक) डॉक्टर की फीस Doctor's fee (Ayurvedic)		"	N.A			

13. शिक्षा एवं मनोरंजन/EDUCATION AND RECREATION

213	स्कूल पाठ्य पुस्तक School Text Book	12th Class	प्रति/ Each	30-00			1711
214	पैंसिल Lead Pencil	Nataraj H.B	"	3-00			1711
215	कॉपी Exercise Book	Ordinary	"	5-00			1711
216	कागज Foolscap paper	-do-	24 शीट/ 24 Sheets	14-00		D	1711
217	स्याही की शीशी Ink Pot	-do-	प्रति/ Each	N.A			
218	बॉलप्वाइंट पन Ball-point Pen	Stic	"	3.00			1711
219	स्कूल फीस School Fee	12th class Science	प्रति विद्यार्थी/ Per student	310.00			1711
220	अखबार Newspaper	Guj.Samachar	प्रति/ Each	2.50			1711
221	जरनल Journal	180 Page	"	40.00		I	1711
222	सिनेमा टिकट Cinema Ticket	IInd class	प्रति टिकट/ Each ticket	10.00			1711
223	ट्रांजिस्टर रेडियो Transistors Radio	—	प्रति/ Each	N.A			

14. परिवहन एवं संचार/TRANSPORT AND COMMUNICATION

224	रेल किराया Railway fare	Dakor to Umreth	प्रति टिकट वयस्क/ Per Ticket adult	6-00			1611
225	नाव का किराया Boat Fare	—	"	N.A			
226	बस का किराया Bus Fare	Dakor Umreth	"	5-00			181[illegible]
227	रिक्शा का किराया Rickshaw charges	ST to[illegible]	"	6-00			181[illegible]
228	साइकल (पूर्ण) Bicycle (Complete)	Atlas 22	प्रति/ Each	2700.00			1811

11

14. परिवहन एवं संचार—जारी/TRANSPORT AND COMMUNICATION—contd.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
229	टायर Tyre	Ralson	प्रति/ Each	115-60		I	1811
230	ट्यूब Tube	Ralson-sby	"	70.00		I	1811
231	पोस्ट कार्ड Post Card		"	0.50			1811
232	अन्तर्देशीय पत्र कार्ड Inland Letter Card		"	2.50			1811

15. निजी सुविधाएं एवं सामान/PERSONAL CARE AND EFFECTS

233	नहाने का साबुन Toilet soap	Lifebuoy (125gm)	प्रति टिकिया/ Each cake	12-00			1911
234	सिर का तेल Hair Oil	Dabur Amla (50gm)	प्रति शीशी/ Each bottle	16-00			1911
235	शेविंग ब्लेड Shaving blade	Topaz	प्रति पैकेट/ Each Pkt.	6-00			1911
236	पाउडर (चहरे का) (Face) Powder	Ponds (100gm)	प्रति/ Each	36.00			1910
237	दाँतों का पेस्ट Tooth Paste	Colgate (100gm)		30.00			1911
238	दाँतों का पाउडर Tooth Powder	Colgate (100gm)		22.00		I	1911
239	दातुन Neem-stick	One-Stick	दातुन की गड्डी/ Bundle of sticks	1-00			1910
240	कंघा Comb	Local	प्रति/ Each	5.00			1910
241	दाँतों का ब्रुश Tooth Brush	Colgate	"	13.00			1911
242	छतरी Umbrella	6 Sticks	"	60.00			1910
243	बरसाती Rain Coat	—	"	N.A			
244	कपड़े धोने का सोडा Washing Soda	Nirma	कि०ग्रा०/ Kg.	34.00		I	1911
245	कपड़े धोने का साबुन Washing Soap	Nirma Super	"	38.00			2011
246	अल्यूमिनियम बर्तन Aluminium Vessel	Tapeli	"	170.00			2011
247	पीतल के बर्तन Brass Vessel	Tapeli	"	350.00		I	2021
248	चीनी के बर्तन Enamel-ware	Cup	प्रति/ Each	6.00			2011
249	मिट्टी के बर्तन Earthen-ware	Med.size	"	35.00			2020
250	लालटेन (हरीकेन) Hurricane (Lantern)	Prabhat	"	110.00		I	2020
251	चारपाई Cot	Iron. medi	"	810.00			2020
252	कुर्सी Chair	Cello	"	250.00			2020
253	मेज Table	Med.size	"	20.00			

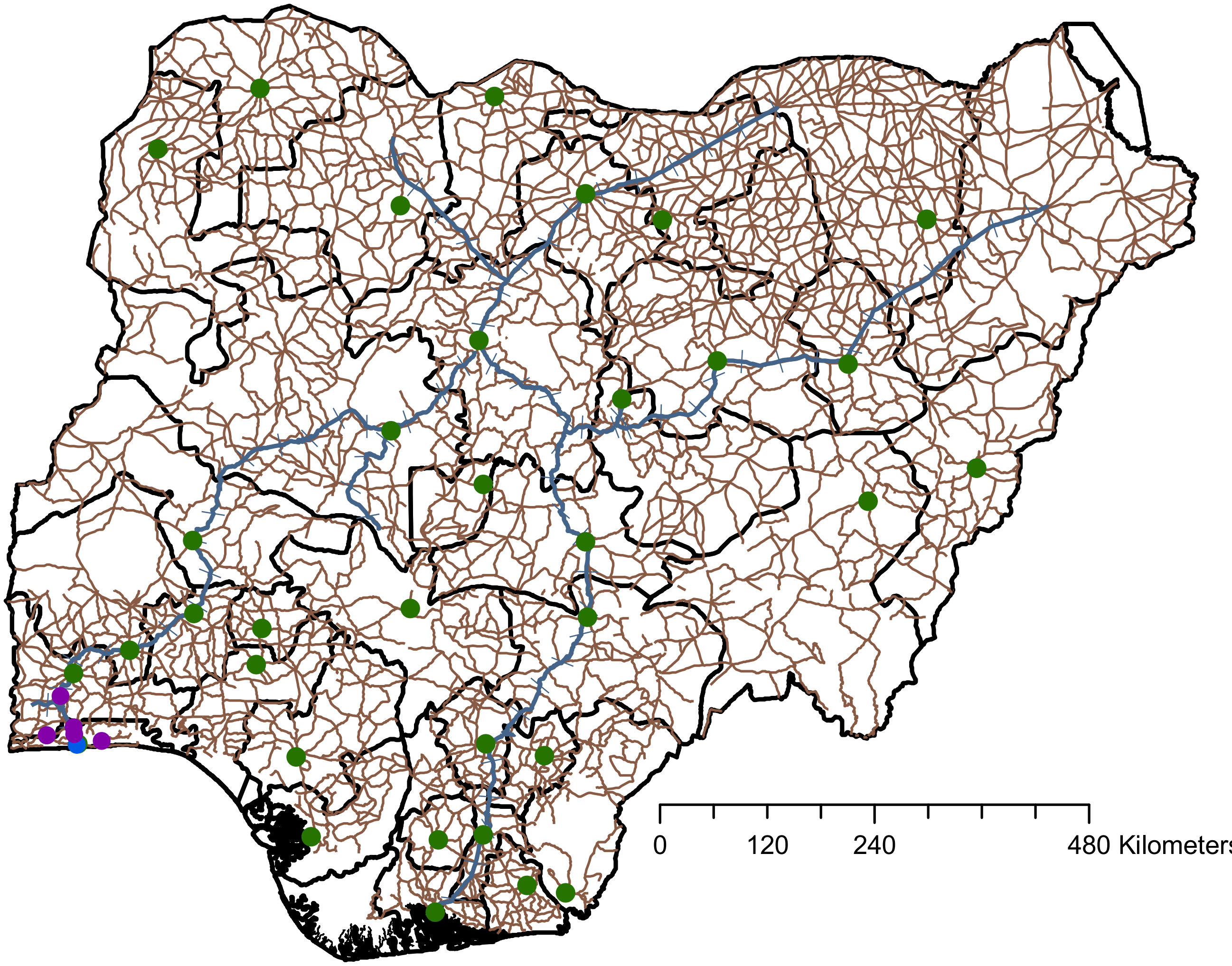
- Coca Cola
- Eveready Drycell Battery (Imported over the Galafi Border)
- Rothmans Cigarettes (Imported over the Galafi Border)
- Philips (3 Band) Radio Set (Imported over the Galafi Border)
- Ambo Mineral Water
- Harar Beer
- Zenith Hair Oil
- Mobil Motor Oil
- Pepsi
- Seiko (21 jewels) Automatic Watch (Imported over the Galafi Border)
- Philips (21 inches) Color TV Set (Imported over the Galafi Border)
- Bic Ballpoint Pens (Imported over the Galafi Border)
- Bedele Beer

Philippines:

- Magnolia Ice Cream
- Marlboro Cigarettes
- Ginebra San Miguel Gin
- Nescafe Coffee
- Nestle Milo

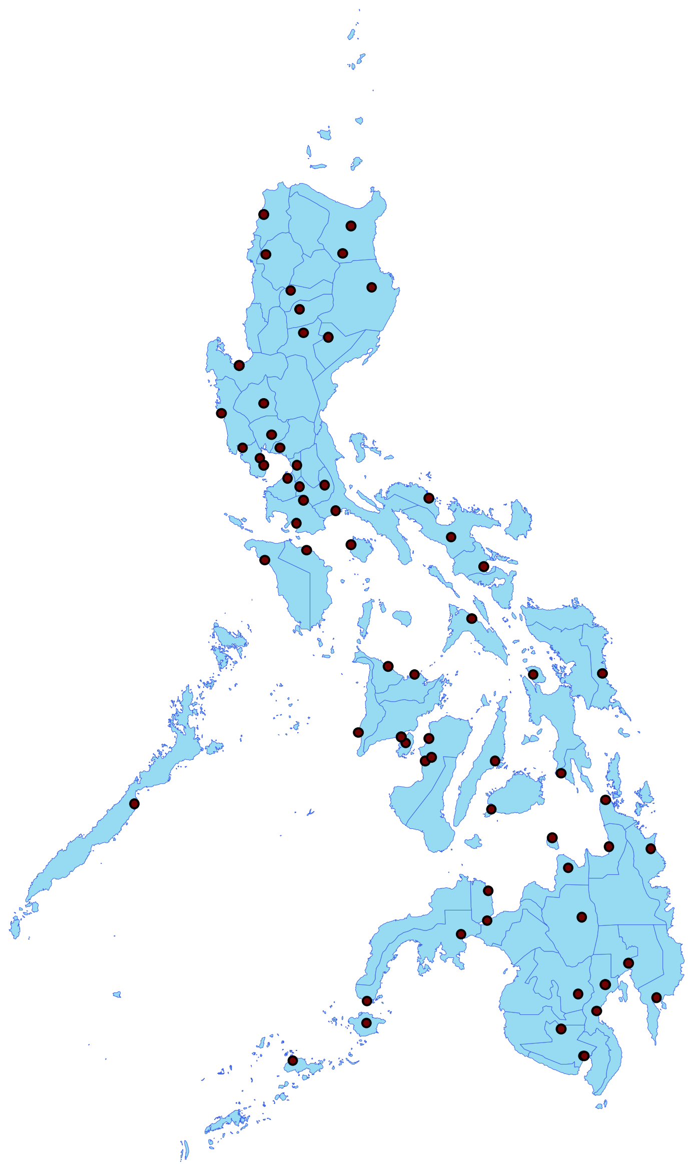
B Maps Appendix

Figure 2: Nigeria



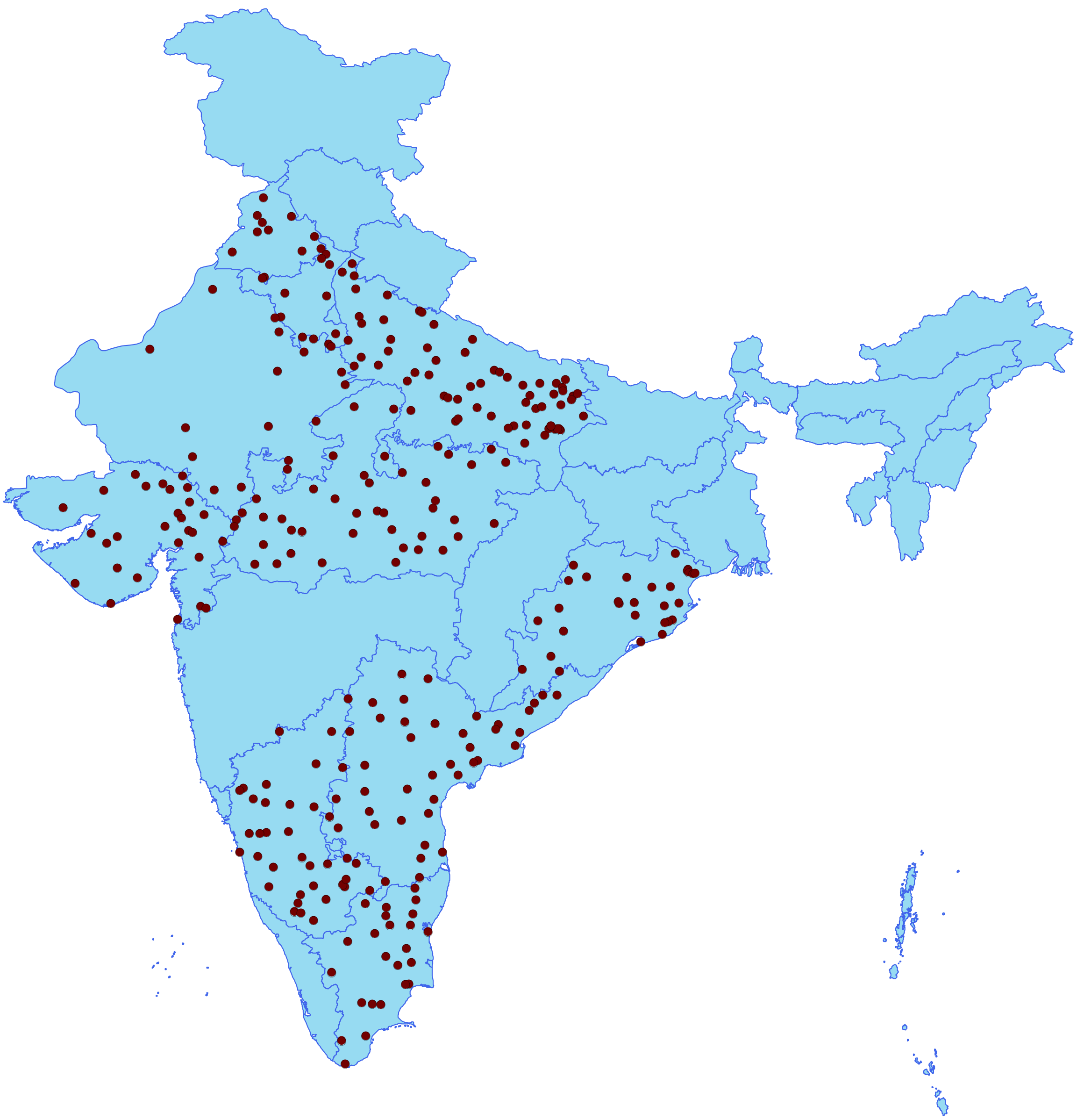
Note: Purple points mark production locations, blue points mark port locations, green points mark price locations.

Figure 3: Philippines



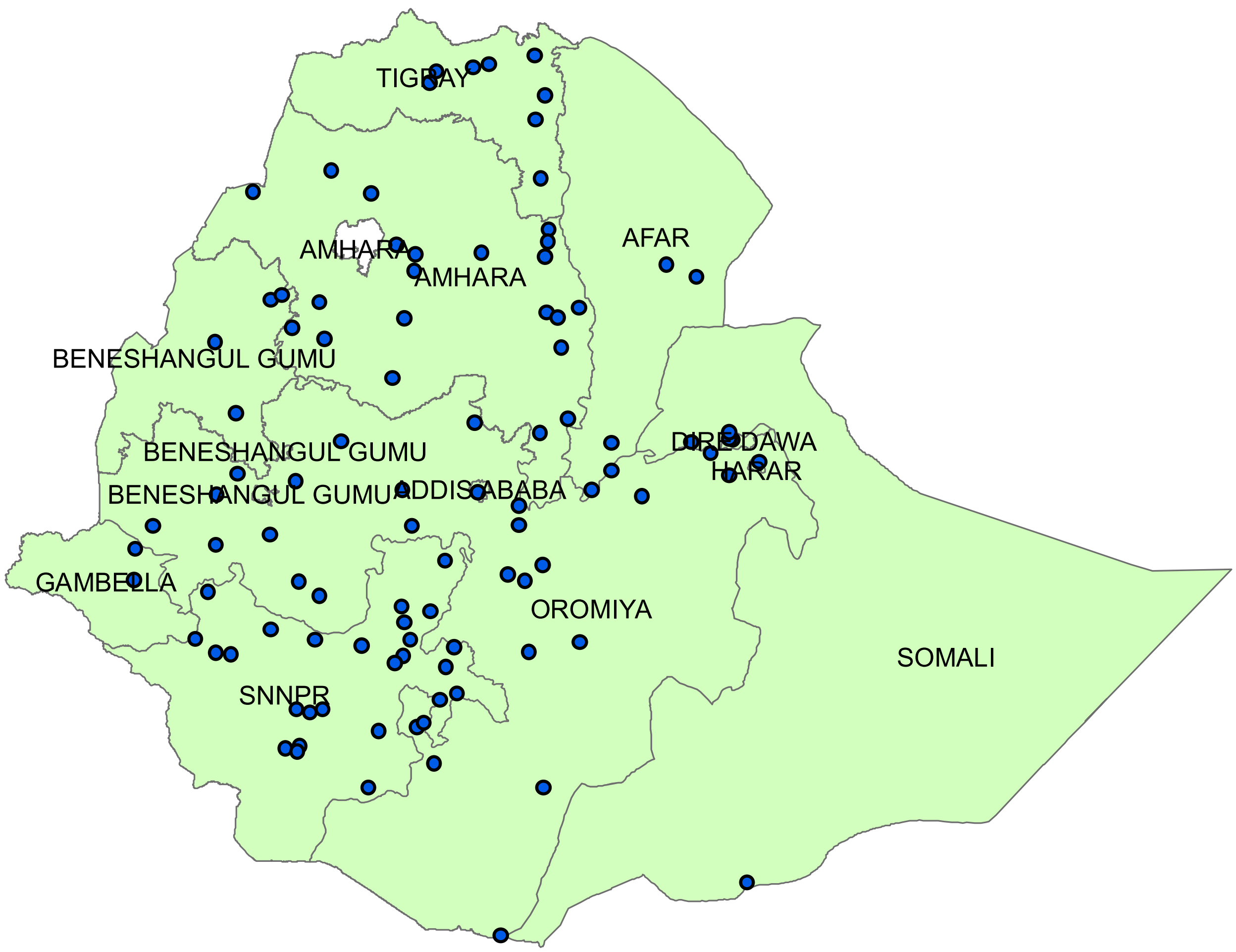
Note: Points mark price locations.

Figure 4: India



Note: Points mark price locations that have been verified. Work is underway to determine the geographic coordinates of other locations for which price data has been obtained.

Figure 5: Ethiopia



Note: Points mark price locations.

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