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Abstract

We examine the spatial variation in variety of manufactured goods to study how choice fades with distance. We use data from a purpose-designed survey of shops and consumers in villages in Ethiopia and prices of matched source and destination goods to estimate similar tastes for variety across space. Our estimates suggest that the average mark-up in prices between source and destination is between 10%-15%, while the welfare effects of falling variety average 15% of consumer expenditures on manufactures, but rising as high as 40% across space. We attribute about 44% of the total loss in welfare across space to the loss in variety, with the remainder due to prices.

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Fading Choice:Transport Costs and Variety in Consumer Goods*

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Abstract

We examine the spatial variation in variety of manufactured goods to study how choice fades with distance. We use data from a purpose-designed survey of shops and consumers in villages in Ethiopia and prices of matched source and destination goods to estimate similar tastes for variety across space. Our estimates suggest an average mark-up of 10-15% and a n average welfare cost of at 15% measured as the compensating variation in income. The welfare costs rise sharply with loss of variety, rising as high as 40%.

1 Introduction

Transport costs reduce consumer welfare not only through lower incomes and higher prices but also through reduced variety: choice fades with distance. Studies of market development typically focus on the spatial integration of markets as measured by price wedges for goods

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traded across space (see Fackler and Goodwin (2001) for a review). In contrast, the literature on spatial variation in product variety is sparse. Our focus is on the choice of varieties in of imanufactured consumer goods available in domestic markets in contrast to most studies of the extensive margin which examine variation across countries. We use data from a purpose-designed survey of shops and consumers in rural villages in Ethiopia to understand how remoteness reduces the variety of consumer goods available and the consequent costs to consumers of fading choice.

Why might remoteness affect product variety? First, in remote areas, previous research (Jacoby and Minten (2009), Jacoby (2000), Minten and Kyle (1999), Minten et al.(2013), Stifel and Minten (2008), Dercon et al. (2009) and Khandker et al. (2009)) has shown that productivity is low and poverty is more intense. In the case of Ethiopia for instance, the costs imposed on farm households due to remoteness alone lower incentives to use potentially profitable inputs: Minten et al.(2013) show that incentives for fertiliser use decline quickly over space because output to input price ratios drop by half. Dercon et al. (2009) report that access to all-weather roads increases consumption growth by 16 percentage points and, reduces the incidence of poverty by 7 percentage points. Thus, if the demand for variety has a positive income elasticity[1], then remoteness will be also be associated with a reduction in variety. Second, high transport costs imply that individual varieties will be more costly in rural areas. With any fixed cost of varietal marketing, this will give rise to a reduction in the set of varieties. And third, the pricing power of retailers in remote areas, where the market size may be too small to support much competition, may imply that shopkeepers prefer to restrict the set of varieties in order to focus on products with high margins. We investigate the effects of transport costs, incomes and market size on the variety of products available across space in what follows below but before we do so we turn to a brief summary of the related literature.

While the literature on product variety within countries is thin, the effects of fixed costs and scale, incomes and market size have been extensively examined in the literature on trade across countries. The theoretical literature on the effect of scale economies in international trade (e.g. Krugman (1991)) has inspired a large empirical literature on the extensive margin or variety in

[1] Li (2011) examines the Engel curvey for variety in India, with positive estimates of the elasticity of variety in food consumption.

trade. Hummels and Klenow (2005), for example, find that larger and wealthier countries trade more, and that 60 percent of the difference in aggregate trade flows comes from differences in the number of goods traded[2]. Smaller countries will have less variety in consumption as a result of fixed costs, both in production and in international trade. This literature suggests that there is a strong response of the extensive margin to changes in trade barriers or country size (Broda and Weinstein (2006), Eaton et al. (2011), Chaney (2008)). Relatively little is known, however, about the variety in domestic trade. For the U.S.A., Handbury and Weinstein (2014) examine detailed barcode data on purchase transactions by households in 49 U.S. cities and find that biases in spatial price measurement due to heterogeneity in quality and the availability of variety are large: correcting for these, they find food prices lower in bigger cities. Handbury (2012) finds systematic variation in the living costs faced by consumers in different income classes and demonstrates that these differences are driven by cross-city variation in product variety rather than prices. Conventional price indices compare only the prices of goods common to locations and ignore differences in variety across locations thus fail to account for such differences in living costs.

Indeed, as far as we are aware, this is one of the few papers to document the spatial variation in variety and to examine the role of local demand and transport costs in explaining it[3]. We examine the number of varieties available by location to understand the local retail environment and use data on local availability of varieties to understand the variation in varieties across villages. We define variety in two was in what follows: the first as consumer items within broadly define item groups and then a further dis-aggregation of brands of items. For instance, jeans is an example of an item, within the general category of clothing, while a particular brand of jeans would constitute a specific item, defined by the brand. (Appendix A offers a full list of item-groups, items and brands within them.) We also collected data on the prices (by brand) of items in both village and market town. We use these prices to examine the price differentials across space; these data also allow us to construct a simple welfare index based on a standard CES consumption function and the Dixit-Stilglitz framework to understand price

[2]Broda and Weinstein (2006) estimate welfare gains from variety growth in imports alone as 2.8 percent of GDP.

[3]Hillberry and Hummels (2008) show that the spatial frictions strongly affect the extensive margin of trade within the U.S.A. Unlike the patterns documented in this paper, they show that spatial frictions affect the trade in intermediate inputs rather than manufactures.

variation across space.

Li (2011) offers a complement to the discussion in this paper: using data on variety in food consumption across India, he documents an Engel curve for variety. He discovers substantial welfare effects in food consumption over time with welfare gains accruing largely to rich and urban households and points to the association between consumption diversity, economic development and urbanisation. Two other fascinating and complementary pieces examine the role of reducing trade and transport costs via the expansion of e-commerce in China. Fan et al. (2016) documents the fall in domestic trade costs through the rise of e-commerce in China: using data from the e-retailer Alibaba, they examine the implications of falling costs in reducing spatial consumption inequality. Staying in China, Couture et al. (2018) combine an experiment with survey and administrative microdata to provide evidence that e-commerce leads to a significant reduction in cost of living via lower prices and increased product variety.

Differences in prices of goods traded within developing countries have attracted more attention than variety[4]. Atkin and Donaldson (2015) use spatial price differences from official price surveys in Nigeria and Ethiopia as a proxy for trade costs within developing countries. Van Leemput (2016) quantifies the size of internal versus external trade barriers in India and finds that reducing internal trade barriers across states within India offers twice the welfare gains compared to reducing international barriers in terms of price integration.

Perhaps the main reason why the literature on the differences in variety across space is sparse is that household and other surveys typically do not obtain information on availability at retail outlets. The second reason is the difficulty in matching of goods at destination with their origin. This concern, the matching of origin and destination in the supply of goods required that we do so by designing the survey so that the local market town is the only supplier of consumer goods and can thus serve as a benchmark for local availability. This is explained in detail later in this paper. In addition, by sampling up to three villages in the same district we focus on within district variation, thus accounting to a degree for placement of roads at the level of the district. Accounting for the variation across districts allows us to concentrate

[4]For developed countries there are also some estimates, e.g. Handbury and Weinstein (2014) and Handbury (2012) for the US. Handbury (2012) finds that price differences for different income groups are driven entirely by variety differences across cities.

on the relationship between the local (within district) supply of variety in goods and local transportation costs and local market size.

We conducted a survey of 296 villages in 100 districts across the four main regions of Ethiopia. We focus on manufactured consumer goods: this covers about 11 item groups from processed foods, drinks, garments, footwear, cosmetics to kitchen ware, hardware and small electronics. Within these groups there are specific items such as pasta, beers, soaps, plastic tableware, linens, notebooks, and batteries and we can further dis-aggregate many of these by specific brands, for a total of 13,000 unique items. To summarise, we have three categories: the item group such as processed foods, items within these such as bottled beer and brands within these such as St. George Table A.1. Data were collected in shops in the market towns closest to the villages and in shops and periodic markets (served by traders) in villages with the aim of achieving a census of all manufactured consumer goods at the level of the item and its brand. Village officials and six households in each village were surveyed. We explain the details of the survey below but the aim was to obtain data that allow us to examine how travel time and the size of the local market affect the fraction of items available in a remote village compared to its nearest market town. We also examine the role of local incomes and its distribution and local amenities in affecting the variety available. We also use the data to estimate the welfare impacts of living in remote areas.

Our main contribution, arising from our results on the availability of variety across space, is to show that the loss of variety can lead to a substantial welfare losses for households who live far from market towns. In particular, we complement the discussion on the effect of variety in domestic trade which has focused on the impact on prices across space(Atkin and Donaldson (2015) Handbury and Weinstein (2014), Handbury (2012) and Glaeser et al. (2001)) and extend this to the impact of space on variety. We find that the average compensating variation of the welfare costs of remoteness (in both variety and prices), is about 15% of incomes, of which just under half comprises the costs of losing variety in items.

The paper is structured as follows. We begin with a description of the purposive survey and the data obtained and describe the rationale for the design. In Section 3 we present our empirical results on the relationship between local village availability of items and that in the nearest

town, and document the evidence on how variety fades with travel time and also examine the variation with market size and local incomes. Section 4 describes the variation in prices across space, relying on a standard CES framework to estimate the tastes for variety and consequent mark-ups. We use these estimates in Section 5 to calculate the compensating variation in incomes due to the loss of variety and spatial variation in prices Section 6 concludes.

2 Data and Survey Design

Ethiopia offers a useful setting for examining the role of transport costs and other wedges in market development. It is landlocked which affects external trade while internal trade costs are strongly affected by its particular physical geography. It has a mean elevation of over 1000 metres and the bulk of the population lives on the high plateau, a terrain bisected by mountains. The terrain has also meant that Ethiopia has one of the lowest road densities in the world. While this potential bottleneck to market development has been recognised and resulted in substantial investment in new roads over the last decade[5], it is still the case that vast swathes of rural Ethiopia are dependent on travel to market using mules on country tracks or on foot. Road density in Ethiopia has risen from 0.46 km per 1000 people to 0.57 km, which compares very poorly with the average in sub-Saharan Africa of 3.9 km/1000. With low urbanisation rates at 17 percent (compared to a sub-Saharan average of 33 percent) both physical and human geography in Ethiopia mean that remoteness from markets is fundamental to describing market access.

The data used here come from a purposive survey of 295 villages in 100 districts across the four main regions of Ethiopia. The survey was designed to address two potential concerns in examining the fall in variety across space. First, it was to ensure that the local market town was the only supplier of consumer goods and could thus serve as a benchmark for local availability. The villages were chosen such that they were linked directly only to one market town within the district. We also interviewed district officials and questioned them on the list of villages

[5]The Ethiopian Government embarked on a major programme of investment in roads with a 10-year Road Sector Development Program in 1997 (RSDP 1997-2007). The first phase of the RSDP (1997-2002) focused on the rehabilitation of the main road network and since then has worked on an investment programme for new roads. See The Ethiopian Road Authority Manual (2015).

within districts and picked a subset of the remoter villages which had only one road or transport connection to the nearest market town. The aim was to ensure that the supply of goods to the village was only possible via the market town and hence the availability of goods in the market town would serve as the benchmark for the range available in the village albeit by separate roads. Each market town is linked to the village by a single road or track (and no other point of natural entry or exit); there are an average of three villages linked to the same market town. Figure 1 provides an illustrative map, based on two of the four sampled regions. Market towns are indicated in shades of blue, denoting differences in travel time to the farthest of the three villages they are connected to, while the black dots denote the villages. Table 1 examines our sampling frame: about 73% of villages within districts are connected to just one market town directly and thus not not unusually situated given the hilly terrain; we confine our sampling of villages to this group. Our sampling strategy thus produces villages that are connected by a single track or road to the main town. Secondly, by sampling three villages on average in the same district, we focus on within district variation. Accounting for the variation across districts allows us to concentrate on the relationship between local supply of variety in goods and local transportation costs, local (average) incomes and local heterogeneity in incomes. In the analysis that follows, we thus control for district fixed effects and base our identification of the relationship between variety available at the village level and travel time and local demand, entirely on the variation between villages within a district.

Data were collected in shops in the market towns closest to the villages and in shops and periodic markets (served by traders) in villages. Key village officials were interviewed about village characteristics, amenities and endowments. In addition, in each village, six households were interviewed, three chosen from the lower and three from the upper end of the wealth distribution, again with local consultation. The households were interviewed on their basic characteristics, consumption of consumer goods in terms of both variety and expenditures and their incomes (both from agriculture and outside agriculture if relevant). It should be emphasised that the household survey was of necessity rather light and we do not have detailed data on consumption behaviour; it was designed simply to assess the reliability of data on availability obtained from the local shop or local trader.

We obtained data on the infrastructure, population, public goods, local incomes and production and most important, detailed data on transport infrastructure, travel times and quality of roads in each village. The data were collected both from district (woreda) officials and local village (kebele) representatives. The main part of the survey involved the survey of shops in the nearest local market town on a full list of potential consumer goods across different categories of consumption from processed foods, household goods, toiletries to clothing and shoes. The next stage involved the collection of data on consumer goods available in the village. Depending on the village, there were small fixed local shops and periodic markets where traders bring consumer goods to the village[6]. Almost all villages have (no more than) a single fixed retailer but the variety of goods offered varies considerably. The items sold are largely durable consumer goods such as batteries, plastics (mugs and buckets), toiletries, notebooks and so on. These fixed retail stalls are complemented by periodic markets, the date fixed by custom and rotated across villages but usually designed not to conflict with the market day in the nearest town. This also made it relatively simple for the logistics of the survey: since periodic markets are fixed by custom, enumerators were able to attend the market on the specific day of the week and combine this with a visit to the fixed retail shop. Periodic markets have a larger variety in consumer goods and include clothing for men, women and children, footwear (including plastic footwear), kitchen items like crockery and hardware. We surveyed both kinds of outlets on the variety (including brands) of goods and their prices, with additional questions on whether items from the list of goods available in the local market town were usually available even if they were not on sale on the day we visited them. This was to ensure that stockouts did not get noted as a lack of availability in general - but as noted in Table 2a and Table 2b, the share of stockouts is small. Six percent of items were recorded as only available sometimes - while only in 1% of cases was it recorded as rarely available.

The key issue in the design of the survey as explained above was to ensure that the we were able to compare(local) source and destination availability and prices. We do not ascribe a causal relationship relationship between travel time and the availability of goods and it is possible that better roads are more likely to be placed in villages that are also wealthier and more likely to

[6]In a series of articles, Skinner (1964) describes the role of periodic markets in rural China where itinerant traders bring goods to villages. This is a similar setting and as in China Rozelle et al. (2003), fixed stores co-exist with periodic markets.

attract a wider range of goods. However, our focus on the variation between 3 villages within the same district while not eliminating this issue, does serve to minimise it. It should be noted that the our discussion below does not hinge on a causal interpretation[7].

We present two sets of descriptive statistics. Table 3 describes households' perceptions of the effects of travel costs on consumer goods variety. We show this separately for households in the bottom and top of the village income distribution. The households were identified thus by village officials and it is useful to note that their incomes and assets tally with the description[8]. Poor and rich households differ sharply in their perceptions of the constraints posed by travel costs and distance. Just over half the poor but over 80% of rich households faced constraints in the set of manufactured goods available locally. Similar percentages said they would produce more for market and would travel more frequently if travel were easier. However, both groups were equally inclined to say that the rationale for travelling to town was to both sell produce and buy goods - even if the transactions of the rich are likely to be larger than the poor, as the first set of answers suggest.

What are the items that do not make the last mile into the village? Here there is consensus across households and this is reassuring because it describes a general lack of choice in particular item categories. Clearly, both rich and poor households face a lack of variety in similar item categories even if the rich are expected to spend more within them. The main sets of goods with items unavailable locally are clothing and linens followed by processed foods.

Table 4 describes the main characteristics of the villages in the survey. We begin with a

[7]The Ethiopian Road Authority supposedly uses five main criteria during the preliminary selection of new road projects which unsuprisingly target potentially more productive and populated regions. These are: i) Roads providing access to areas with economic development potential (20%);ii) Roads leading to areas with surplus food and cash crop production (20%);iii) Roads that link existing major roads (20%); iv) Roads providing access to large and isolated population centers (30%);v) Roads that bring balanced development amongst the regions in the country and that provide access to emerging regions (10%). However, the targeting is effectively in two stages: the first, at the regional level and the second, within regions, at the district level - vitiating concerns about targeting at the level of the village. Shiferaw et al. (2012) (p. 11) discuss these criteria and argue that while they suggest a degree of targeting to the district, it is not borne out in the data. They conclude that "Regressing our road infrastructure variables on district-level (or woreda) control variables, we find that most of the variation in road accessibility is captured by the year dummies and the region fixed effects." Our data also support this; when we examine the relationship between the type of village road, whether a surfaced road (tarmac or stone) or a dirt track and village-level variables. Consistent with the description above, in over half the sample, controlling for the district fixed effect completely explains the type of road in the village, while for the remainder, there is no correlation between type of road and observable village characteristics.

[8]We obtained data on total monthly expenditures, agricultural and off-farm incomes and values of livestock. Uniformly, for poor households these values are at most a third of those of the rich households within villages. Note that the distribution of income across villages varies substantially.

discussion of the extensive margin of variety available: on average, villages have about half the items available in town and within these items, a third of all brands available in town. Seventy percent of towns are connected by a road made of tarmac or of stone to town (labelled a "good road"), while the remainder are served by a track or worse. The average distance to town is about 22 kilometres while the average time to travel to town by the most common form of transport is about an hour and 45 minutes. If the village hosts a periodic market, about 7 local hamlets around the village, and often spoken off as the "larger village" are likely to participate; this is also our proxy for market size in the regressions below[9]. We did collect data on population size and the number of households in the village as a whole but this numbers were rather noisy and so this proxy is used in preference, but the results remain similar if they are used instead. The villages host about 65 households per square kilometre on average, which is higher than the Ethiopian average since it does not include pastoralist areas, but is about average for East Africa. We also use a proxy measure of whether the village is relatively poor compared to other villages in the sample by checking whether the village is covered by the Productive Safety Net Program (PSNP). This program is targeted to the poorer villages within poor districts [10]. If the village is part of the PSNP, we checked village records to discover how many households in the village receive such support . Forty-two percent of the sampled villages are in the government's safety net: furthermore in half of these villages, over a third of households are covered by the programme. The share of households in each village who are in the PSNP is thus used as proxy for capturing the level of poverty in a village, which in turn allows us to compare relative poverty across villages. Finally, in terms of amenities in the village, most villages have a health centre and a primary school but access to pharmacies and secondary schools is low. About a quarter of the sample have reliable electricity (which means a reliable supply for 3 days a week or more) and 40% report a reliable cellphone connection in the same vein [11].

[9]The market size is at least 1 by construction since we count the main village as participating in the periodic market. Only 4% of villages have no surrounding hamlets. Alternative measures for market size include the population and village officials' estimate of the average number of shoppers at the periodic market.

[10]Forty percent of the country's 710 districts (*woredas*) are covered by the PSNP and the programme supports about 8 million people or 10% of the population (IFPRI (2013)).

[11]This may seem at odds with the reliability of the electricity connection; the mobile telephones are often deposited with a shopkeeper in town to be charged, or with the local shop if they have better access to electricity since households have poor access in general. The median access to electricity (and cellphones) is 0.

3 Results

We now turn to the empirical analysis. We first investigate to what extent these factors such as transportation costs, market size and income distribution affect the distribution of variety across space. We then use data on prices both from our survey for small market towns and the villages and separately from the National Price Surveys that focus on the 118 larger market towns and urban centres across Ethiopia, to estimate price mark-ups across space, with the latter simply as a robustness check. Finally, we use these estimates to examine the implications of remoteness on the welfare costs of falling variety. We describe these costs across space in our sample and also for the median urban consumer if faced by less variety, akin to being moved to a remote location. The basic intuition for the empirics derives from the standard trade framework (Melitz (2003)). If we imagine a firm or trader selling a variety in partial equilibrium and each village as a market, then the set of varieties shipped to each village ought to depend positively on market size and negatively on the trade costs (including the costs of transport) in the presence of a fixed cost per variety or trader. Such costs are particularly salient in this setting as we discovered upon interviewing traders. These costs include licences (by either items or groups of items), payment to village authorities [12], and the costs of own transport and accommodation for itinerant traders as well as inventory and storage costs. Table 5 offers a summary of why traders specialise in items: 38% of traders quote licences required as the reason for not trading other items, 33% quote lack of capital while 20% claim that the lack of demand in remoter areas dissuades them from carrying more items.

Prices will also depend on the trade costs, but will not depend on the market size unless there are pro-competitive effects (Melitz and Ottaviano(2008)). As explained above, there is no more than one fixed retail outlet in the majority of villages and traders in periodic markets usually carry different varieties, thus making competition unlikely. We outline a simple version of this narrative using a standard Dixit-Stiglitz model with CES preferences to fix ideas but also to deliver a basic equation to estimate mark-ups, that we employ to calculate the welfare costs of

[12]The existence of fixed lump sum fees per trader is attributed to a combination of land regulation and tax policy. Rozelle et al. (2003) *pg 18* describe similar difficulties facing itinerant traders in rural China: "Local officials clearly understand how difficult it is to collect taxes from itinerant peddlers. As a consequence, officials spend little time trying to collect value-added taxes, relying instead on simple taxation methods such as collecting stall fees or negotiating lump sum fee payments."

remoteness. We will describe this further below but we first turn to a description of the data.

To measure the extent of variety in manufactured consumer goods available we use a simple count of all items and brands available locally in village markets, across 10 different categories of items. Figure 2 presents a picture of the fall in availability of items across space, while Figure 2 displays the share of items (and brands) available relative to the nearest market town and demonstrates the decline in average shares as travel times to town increase. Clearly, travel time alone does not determine variety: we would expect that population and market size, median incomes and other village attributes might affect this as well. To understand these effects, we turn to our empirical specification.

We model the probability that a village i with characteristics vector, X_i, (which includes transport times to the nearest market town, local market size, income distribution captured as a mean-preserving spread, and village-level amenities), has available exactly Y_i items. We use a count data specification, with a generalised negative binomial (GNB) model below. The advantage of the GNB specification is that, in contrast to the Poisson, it allows for the variance to be different from the mean, thus accounting for the overdispersion[13] in the data which is captured here through the introduction of regional fixed effects.

The main specification[14] includes the time to travel to town using the most common form of transport[15] and a measure of market size, proxied by the number of more remote hamlets that shop in the local sampled village[16] or the periodic market located there.[17] As an additional measure of market size we use (household) population density: the number of households per square kilometre. Finally, it is clear that some measure of local incomes is required. As explained above, we also surveyed six households in each village, where three households

[13]We conducted tests for over dispersion, contrasting the Generalised Negative Binomial with the Poisson and the Negative Binomial distribution. The goodness-of-fit tests strongly reject the hypothesis of constant variances: Deviance goodness-of-fit =1728, with Prob $> \chi^2(201) = 0.00$ and the Pearson goodness-of-fit = 1759.24 with Prob $> \chi^2(201) = 0.00$. Introducing non-linearities does not affect the outcome and the Generalised Negative Binomial seemed the most appropriate alternative.

[14]The number of items/brands available in the nearest market town is treated as the exposure variable, since the counts of availability are better understood as a fraction of the availability in town.

[15]An alternative is to use the distance between village and town, together with controls for quality of road, by season. The results do not differ if these were included instead.

[16]Rozelle et al. (2003) describe similar periodic markets in China.

[17]An alternative measure is the community officials' estimate of the averge number of people who shop at the local periodic market. These are strongly correlated but the number of hamlets is the less noisy measure and thus preferred.

were drawn from the bottom of the distribution and the remainder from the top, as identified privately by local village officials. The households were interviewed on their average monthly consumption on manufactured goods, their income from both agriculture and other sources and their own assessment of their income, within three categories of rich, comfortable and poor. The measure of incomes and expenditures is noisy, given the light nature of the questionnaire and the usual difficulties of obtaining reliable estimates in one short interview. Instead of relying on any single measure, we construct a weighted average of all these measures, as a standardised normal variate, to proxy the distribution of income within villages. We use the bottom 20% and the top 20% (effectively, the income of the poorest and the richest households sampled), to capture the range of incomes or the mean-preserving spread, with the mean being standardised at zero[18]. However, the distribution of incomes thus measured only captures variation within a village, and the proportions of poor and rich are likely to differ across villages. To anchor this income distribution, we use the share of households that receive support from the government's Public Safety Net Programme, which is only targeted to villages deemed poor.

Table 6 presents the first set of estimates, using the total number of items available in the first 3 columns and then brands (across all item categories) in columns 4-6 as the dependent variable. Availability is strongly affected by travel times and the size of the local market. We report the coefficients in the table: the coefficients on the (ln) variables can be read as elasticities[19]: a 1% increase in travel time, results in a fall of 0.07 - 0.09% in item varieties available locally. Thus, for an average village, a fall of an hour in travel time is associated with an increase of about 9 items or 18 brands on average. Market size matters too: we measure market size as the number of hamlets (comprising the village and any smaller clusters situated further down the track) using the local periodic market and so an extra hamlet added to the size of the local market (a 10% increase) would be associated with 12 extra items or 18 extra brands being available. Columns 2 and 3 (and 5-6) include measures of the measure of inequality (mean-preserving spread) and amenities (captured by reliable electricity and cellphone access). Inequality also plays a significant role here,and an increase in the spread from the median to the highest decile would raise availability by 3 items or 5 brands; while the introduction of reliable access to

[18]We could also use estimates of village-level incomes as estimated by village officials. These were far noisier (even if correlated with the estimates obtained from the households), hence our reliance on the measures based on the survey of the households.

[19]We use the ln(travel time) given the concave relationship between availability and travel time.

amenities raises availability by 7 items or 9 brands. Note that apart from transport costs and market size, we are describing an association here rather than causal effects. It is more useful to examine the impact on the coefficients of these key variables when controlling for amenities and it is reassuring that those effects remain similar in size and significance.

Figure 4 demonstrates the heterogeneity of the relationship between variety available across space and the types of items. Heavier, bulkier goods are more likely not to make the last mile: processed foods (which include bottled drinks here), clothing and footwear exhibit sharp declines within 30 minutes of travel time from the nearest market town. The results in Table 5 hides this heterogeneity and disaggregating this relationship by item groups suggests much sharper effects of remoteness for some groups compared to others.

3.1 Prices, Markups and Remoteness

We now turn to examining the difference in prices between town and village. The data we gathered were meant to capture the extensive margin, i.e. whether a good is available in a market or not. As a result, the data have limitations in terms of their use for analysing the impact of distance on prices. First, given our focus on availability, we include a large number of generic brands - for instance, as long as a pair of jeans branded as 'Made in China' is available, and sold as different from another pair of jeans, it is treated as a different "item". However, this is a generic brand in that we cannot distinguish it as a specific brand like Levi's or Gap. Second, even when the brands are clearly defined (for instance, as a particular brand of flour), the unit of measurement used at point of sale could vary across areas, making comparison between origin and destination difficult in terms of prices. We deal with these difficulties in two ways. First, we examine the difference in prices between source town and village for branded items that can be compared in identical weight or volume units. We use 1380 observations on such matched price-brand pairs. This includes largely processed foods (sugar, pasta), beverages (bottled drinks and beer), ready-made clothing of particular brands, cosmetic and hygiene (soaps, detergents, toilet paper), household items (matches, batteries) and educational items (branded notebooks and pens). Second, we carried out a separate second survey of prices alone in half the sample (115 villages and 43 market towns) for specific item-brand pairs obtained from this survey to

control for any measurement error in the first survey. This is also a more restricted set of items that does not include clothing or footwear. Note that restricting the matched item-brand pairs across villages in the first survey results in a smaller set of observations because in many cases units were missing or were different.

As explained earlier, any standard model of trade should deliver predictions for variety and prices. If we consider the trader selling a variety in the village, then the set of varieties shipped to each village will depend positively on market size and negatively on the trade costs in the presence of a fixed costs per variety/trader. Prices will also depend on the trade cost,s but will not depend on the market size unless there are pro-competitive effects. In this vein, we use a standard Dixit-Stiglitz framework of monopolitically-competitive traders and consumers with CES preferences, which delivers a model of price markup across space. The model is outlined in Appendix A but we summarise the main implications below.

In sum, the profit maximisation conditions yield a mark-up equation for prices. Appendix A presents a one-level CES for simplicity but this is easily generalised to two levels, the first, top-level for item-groups and the second, lower level for items within item-groups. The CES utility function assumes a (global) taste for variety, denoted by $1-\theta$, across item-groups, and an item-group specific parameter to describe the taste for variety within groups, denoted by $1-\theta_i$. The basic model allows that each trader charges a markup over marginal costs $\overline{p}+\beta s_v$ and that this markup is increasing in the taste for variety $1-\theta$ where $\overline{p}$ denotes the price in the market town and βs_v captures trade costs, with s_v denoting the travel time to town [20].

$$p_v^* = \frac{\overline{p}+\beta s_v}{\theta}. \tag{1}$$

This is the key equation that we employ to estimate θ. Indexing these parameters by i for each item-group, then allows us to estimate the parameter θ_i.Our interest in estimating these parameters lies in calculating the welfare costs of fading choice. Before we turn to doing so, we describe the global mark-up, obtained from the estimate of Equation 1 above.

[20]Note that for $\theta \to 1$ the markup vanishes: if consumers have no taste for variety then marginal cost pricing is, of course, optimal.

We report the regression of prices paid in the village on prices paid in town and travel time in Table 7 using two surveys described earlier: the first, based on the prices recorded when we were collecting data on varieties of items and brands in town and village, while the second was a focused attempt to carefully check prices of identical goods, by brand and by unit. The regression examines the variation of prices across space for these matched pairs and also offers an estimate of the taste for variety, $1-\theta$, as in Equation 1, which gives us two estimates, ranging from 0.09 to 0.13, which in turn give us estimates of a markup between 10.3% and 14.6%, where the markup is defined as $1/\theta$. In the next section, we use these estimates to construct the welfare costs of the loss of variety with remoteness. As we will see, these costs are very sensitive to the estimated taste for variety and the consequent estimates of elasticities of substitution.

We also offer yet another estimate of the estimate of the taste for variety, θ, using data on prices across Ethiopia collected by the Central Statistical Authority to establish the CPI. The results we obtain are similar whether we use the data on price differentials over relatively short distances, as in our surveys as reported above or between source town and 118 market towns, in the National Price Surveys collected by the Central Statistical Authority. We use their data on prices of a set of 13 branded products collected monthly since 2010, where the 13 products are chosen such that we can map the source and destination prices accurately. We also obtain the travel time in minutes between the source and destination towns, using data from IFPRI. for 2010 and relying on the fact that until 2015, there was little new investment in these roads. The last column of Table 7 provides the estimate of the taste for variety using these data and this provides similar estimate as above, of a taste for variety of 0.12 and a markup of 14.4%. This last set of estimates is thus a check on the data we collected in our surveys.

The fact that we obtain similar estimates of the taste for variety over both remote locations and their small market towns, as well as the larger urban centres and their source towns (like the capital Addis Ababa), suggests that the taste for variety is similar across space. But the price wedge also depends on transport costs: the estimates in the last column of Table 7 suggest that the marginal transport cost (the estimate of β) is far lower between say, Addis Ababa and an urban centre than it is between a small market town and a remote village. The rapid

investment in regional road infrastructure over the past twenty years has paid off for the urban consumer.

Finally, we also obtain estimates of the taste parameter by item-groups Table 8. Note that the tastes for variety do not vary substantially; household items, fabric and linen show slightly higher tastes for variety than processed foods for instance.

4 Welfare Costs of Remoteness

To estimate the welfare cost of remoteness we use a simplified two-level CES utility function. We do so to capture the description offered in Figure 4, where we observed that the fall in variety varies substantially by item categories. Unsurpisingly, bulkier and heavier items are also more likely to vanish faster across space, where the costs of transportation bite strongly. However, in what follows, we are forced to make the considerable simplification of symmetry at both levels. Very simply, we have no data on consumption shares either by item-group category or within item-groups[21] which would have allowed a more elegant decomposition, capturing asymmetry across consumption categories[22]. This lack of data on consumption shares also deters us from being able to have different degrees of substitutition within an item-group. With this caveat, we derive welfare costs in terms of compenating variation and descrbe the loss both in aggregate across item-groups - but also by different item-grows to examine heterogeneity across groups. Clearly, if the weights by item-groups differ, so will the calculation of total welfare but the simplification of equal weights allows an assessment of the cost. The upper level utility function capturing utility across groups is as below, where θ denotes the taste for variety across item-groups, denoted by i and n the number of groups that are available.

[21] This would have required an extensive consumption survey while the data collected here was focused on the survey of retailers. The survey of households was a lighter touch survey of 6 households, to confirm incomes, travel times and local attributes of the village.

[22] We tried to obtain proxies for these shares from the Household Consumption and Expenditure Surveys (HICE) undertaken every five years in both urban and rural centres. However, while there is considerable dis-aggregation of consumption by food groups, data on consumption of manufactures is far more aggregate and does not lend itself to the construction of shares consistent with the item-groups or items and brands we would require. In addition, the HICE is a a smple survey that doesnot overlap with the kebeles and markets we included in this paper.

$$u = \left(\sum_{i=1}^{n} (\widetilde{c}_i)^{\theta} \right)^{1/\theta} \tag{2}$$

We begin with the lower level (items j within groups i), where c_{ij} denotes consumption of item j within group i, n_i the number of items of group i that are available within item-group i and θ_i denotes the taste for variety across items within group i.

$$\widetilde{c}_i = \left(\sum_{j=1}^{n_i} (c_{ij})^{\theta_i} \right)^{1/\theta_i} \tag{3}$$

with corresponding unit cost

$$\widetilde{p}_i = (\Sigma_{j=1}^{n_i} p_{ij}^{1-\sigma_i})^{1/(1-\sigma_i)} \tag{4}$$

where $\sigma_i = 1/(1-\theta_i)$ and $0 < \theta_i < 1$. Then the compensating variation (as a fraction of y_i), as we move from town to village, with a fall in availability, coupled with an increase in prices, is given by

$$1 + CV_i = (\frac{\widetilde{p}_i'}{\widetilde{p}_i}) \tag{5}$$

At the upper level, again with symmetric CES utility to describe the taste for variety at the level of groups:

$$u = (\Sigma_{i=1}^{n} \widetilde{c}_i^{\theta})^{1/\theta} \tag{6}$$

with corresponding unit cost

$$\widetilde{p} = (\Sigma_{i=1}^{n} \widetilde{p}_i^{1-\sigma})^{1/(1-\sigma)} \tag{7}$$

and $\sigma = 1/(1-\theta)$ and $0 < \theta < 1$.

In this form $\widetilde{p}_i$ is unobservable but Sato(1975) and Vartia (1976) have shown that changes in $\widetilde{p}$ can be written in terms of observables, giving us the total loss in welfare across groups as:

$$(1 + CV) = \frac{\widetilde{p}^1}{\widetilde{p}^0} = \Pi_{i=1}^{n} (\frac{\widetilde{p}_i^1}{\widetilde{p}_i^0})^{(1/n)} \tag{8}$$

Note that $\widetilde{p}_i$ can be calculated from observed prices p_i using (2), provided one has an estimate

of σ_i. Since at the upper level availability remains unchanged (n is constant) the usual Feenstra (1994) correction term does not appear. In the literature the changes are typically calculated over time, from $t = 0$ to $t = 1$, while we consider changes in location, from market town to village.

If we allowed for asymmetry at either or both levels, the compensating variation can be described as the (weighted) product of the compensating variation due to availability (a function of the share of items available, weighted appropriately) and that due to variation in price (a function of prices, again weighted appropriately). The weights will depend upon a function of the share of group i in total expenditure on the groups considered, if for instance, we were to consider asymmetry at the upper level. Since we have no information on these shares, we offer illustrative description using the properties of symmetry. Symmetry allows us to derive a simple decomposition of the total loss in welfare, which can be written as below, where n_m denotes availability in the market town and n_v, that in the village:

$$1 + CV = (1 + CV_a)(1 + CV_p) \tag{9}$$

$$\text{where: } 1 + CV_a = \Pi_{i=1}^{n} \left(\frac{n_{mi}}{n_{vi}}\right)^{(1/n)\times\left(\frac{1}{\theta_i}-1\right)} \tag{10}$$

Given $1 + CV$ in Equation Equation 8, this allows us to decompose the total compensating variation by both prices and availability. In Figure 5a, we describe the rise in welfare cost across space due to the fall in the number of available items controlling for prices. In addition, we also describe the welfare loss due to decreased variety by item groups. Figure 6a and Figure 6b describe the welfare loss by travel time to town for the four main item groups as in Figure 4. The average loss is highest for beverages and processed foods as compared to household goods.

Similarly, Figure 5b describes how the welfare loss due to change in price, controlling for availability, varies across space. And Figure 7a and Figure 7b describe the welfare loss due to price increase by item group.

The decomposition of welfare loss shows that about slightly above half (56%) of the welfare

costs arise from the rise in price and the rest (44%) is due to fall in variety.

5 Conclusion

We have documented how consumers are affected by the costs of travel, not only through changes in prices, but also through changes in the set of available goods. We do so using data collected in a purpose-designed survey of villages in Ethiopia, each served by a single larger market at the district level. We find that variety declines sharply with the time to travel to town. It is also strongly affected by the size of the local market and the distribution of income.

While the new economic geography has led to a large number of empirical studies on the effect of international trade on variety, there is comparatively little empirical work on the effect of domestic trade on the number of varieties available to consumers and only so for developed countries. This is likely to be a much more important issue in developing countries where transport costs are very much higher. This is one of the few papers that addresses the loss in variety in consumption with remoteness: consumer choice fades away with distance in developing countries. The magnitude of the effects we found in Ethiopia suggests that when comparing incomes across space within countries it is not sufficient to correct for price differentials, keeping the basket of goods fixed. That ignores the availability effect which according to our results dramatically affects the options open to consumers in distant locations. Travel time reduces welfare not only by inducing a deterioration of the terms of trade of a village trading with a market town but also reduces the number of goods that will be available to consumers in the village. The size of the welfare effects we find depend both on domestic trade costs within countries and the spending on consumer goods - for instance, the Nigerian case (see Atkin and Donaldson (2015)) where both intra-trade costs and consumer spending are far higher offers a sharp contrast to Ethiopia.

What do these results tell us? First, they demonstrate that there are significant welfare losses to low variety in manufactures and that intra-trade costs (both mark-ups and travel costs) matter in affecting this margin. Second, the average costs to consumers of about 15% of consumer expenditures on manufactures suggests that the costs of losing items across space is

substantial, despite the fact that Ethiopian consumers are poor and their share of spending on manufactures is low. These costs will increase with rising incomes unless domestic trade costs fall as well. It should also be emphasized that the items lost are usually part of a basic set of necessary consumption items, even in a poor setting, comprising basic clothing, footwear, hygiene, kitchen and housewares and even educational items. It should be noticed that these costs, which are universally ignored in welfare calculations, are large relative to the price effects for which poverty and other measures are meticulously adjusted.

We have shown how variety in manufactures fades with distance and associated travel costs. Reductions in travel costs increase consumer welfare through higher incomes, lower prices - and increased variety. This also has implications for welfare measurement: poverty is underestimated since people in remote places have little to choose – but equally, when changes such as infrastructure investments raise availability, rates of decline in poverty will be underestimated too.

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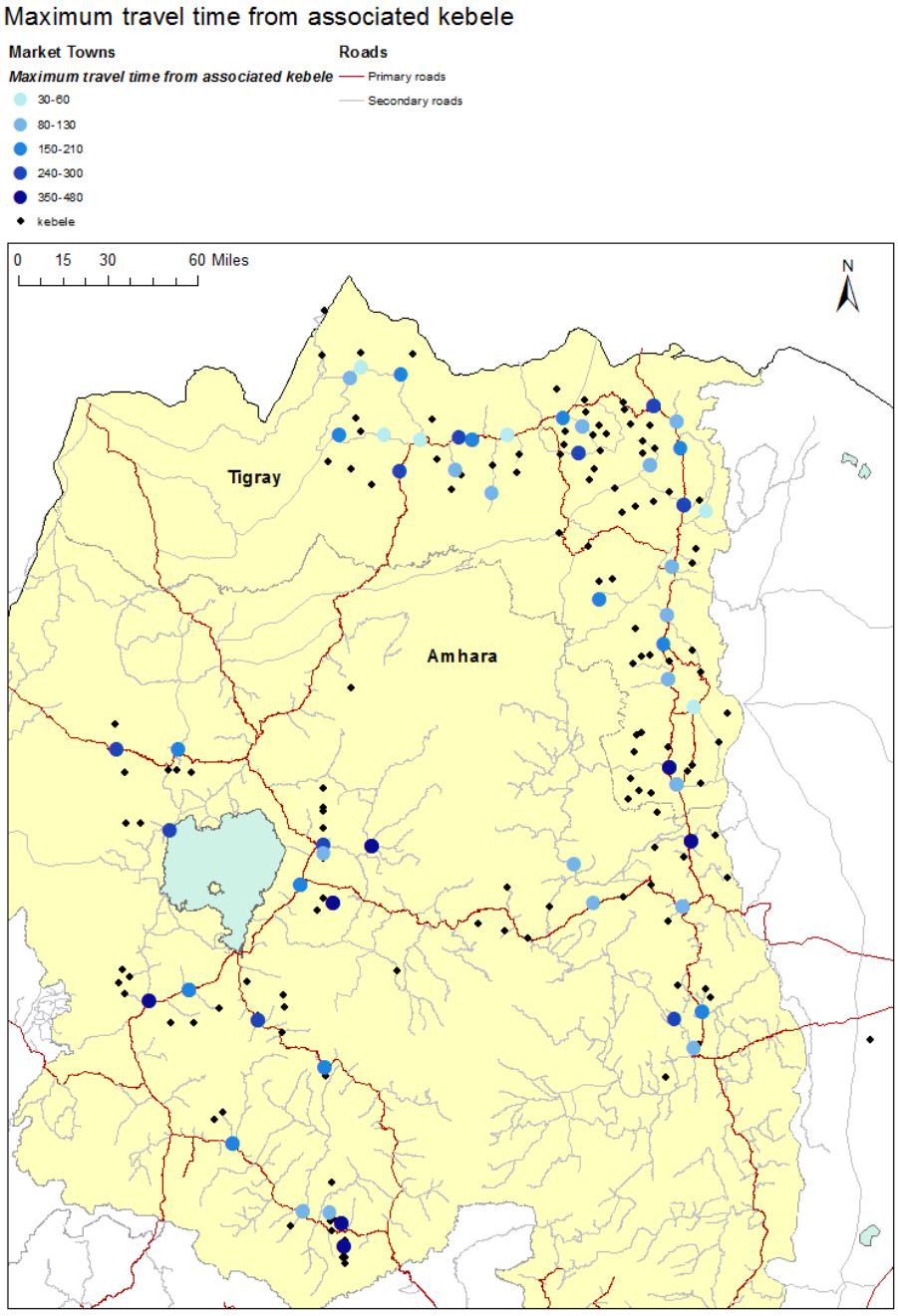
Figure 1: Map of sampled villages and associated market towns for two regions



Notes: The map represents locations of market towns and the associated villages by distance in two of the four surveyed regions, the Amhara and Tigray regions in Ethiopia.

Table 1: The sampling frame for villages by connections to town

Number of villages	Mean	SD	Max
In district	10.1	6.7	42
Directly connected to one town	7.4	5.7	30
Directly connected to more than one town	2.6	3.2	17
% connected to one town	73	28.7	100

Notes:These summary statistics are based on the first round survey conducted to list all the market towns and villages linked by one road

Table 2a: Frequency of stockouts

Availability of Items	frequency
Always/mostly available	93%
Sometimes available	6%
Rarely available	1%

Notes: We ask shoppers whether an item is available when they need to buy. The numbers above are simple averages of the number of people who gave each answer accross items.

Table 2b: Item Groups where items are sometimes or rarely available (7% of all items)

Item-Group	Examples of Key Items	Share (%)
Processed Foods	Edible Oil/Sugar	29
Beverages	Beer/Sodas	9
Fabric	Shawls/Cloth	6
Ready Made Clothing	Adult Male Clothing	19
Footwear	Adult Men Footwear	11
Household and Kitchen	Cooking pots/Plates/Bulbs	14
Educational Materials	Exercise Books	4
Miscellaneous	Hardware, Cosmetics etc	8

Notes: We ask shoppers whether an item is available when they need to buy. The numbers above are simple averages of the number of people who gave each answer for each item group.

Table 3: Household Characteristics by Income Group

	Poor	Rich
% saying yes to whether?		
Difficulty obtaining consumer goods in last year	55	83
Would produce more for market if travel easier	57	86
Would travel more frequently if travel easier	66	87
Main reasons to travel to town (%)		
Buy inputs and sell produce	10	10
Buy consumer goods	15	15
Both	75	75
Main items reported unavailable locally (item group) (%)		
Clothing and linens	48	44
Processed foods	30	34
Leather goods, footwear (plastic)	12	14
Household goods, kitchenware	8	8
Household characteristics		
Mean household size	5.7	7.9
Annual median income (birr)	5500	40,000
Male household head %	80	94
Number of households	906	908

Notes: The data here come from the survey of six households in each village, chosen so that three were deemed to be representative of poor households in the villages and the other three deemed relatively rich. This was in consultation with village-level officials.

Table 4: Summary of Village Characteristics

Variable	Mean	Standard Deviation
Items available in village	45.00	22.00
Items available in nearest town	97.00	20.30
Brands of items available in village	73.3	39.92
Brands of items available in town	206.64	74.26
Distance to town in kms	22.94	12.43
Travel time in minutes by most common transport	117.24	93.37
Whether Tarmac/Stone road	.69	-
Number of villages using local market	6.84	5.34
Household density	65.32	68.47
Share of poor households	.13	.21
Reliable electricity	.26	-
Reliable cellphone	.40	-

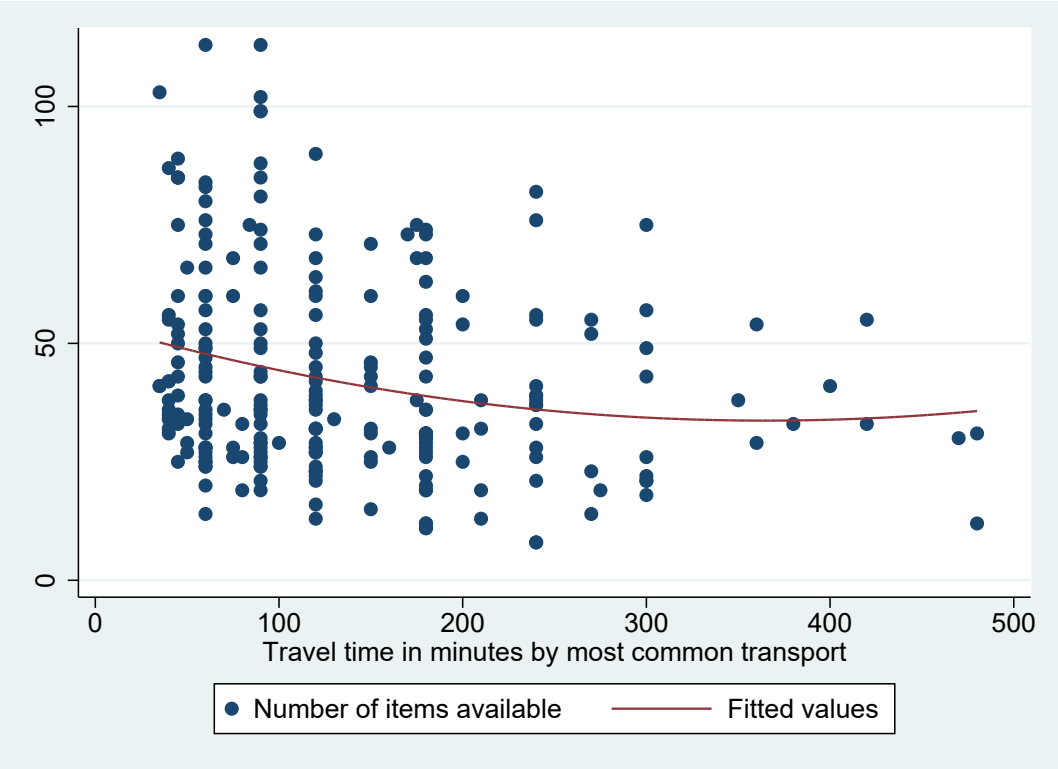
Note:We do not report standard deviations for binary variables.

Table 5: Why do traders trade in particular items?

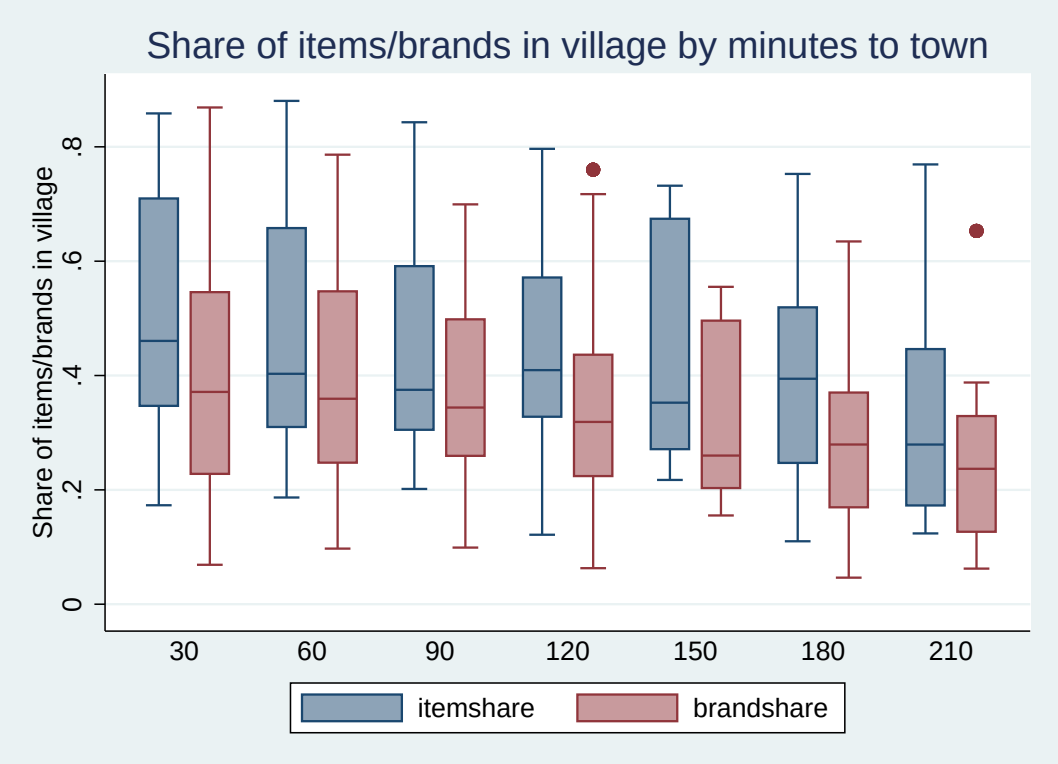
Reasons for not trading in extra items	%
License regulations	38
Capital constraints	33
Low demand	20
Transport costs	5
Other miscellaneous	4

Notes: Data are from traders interviewed in 150 villages. They were asked how many items they carry and why they do not carry any other items, even within the same category such as processed foods or clothing.

Figure 2: Fading choice: Number of items available by travel time to nearest town



Notes:The figure shows a scatter plot and a quadratic fit of the total count of items available in each village relative to the time taken to travel (in minutes) to the nearest market town.



Notes: The figure shows the number of items (and brands of items where known) relative to the total number of items and the total number of brands of items available in the nearest market town by minutes of travel to the town.

Figure 3: Share of items and brands in village relative to town by travel time

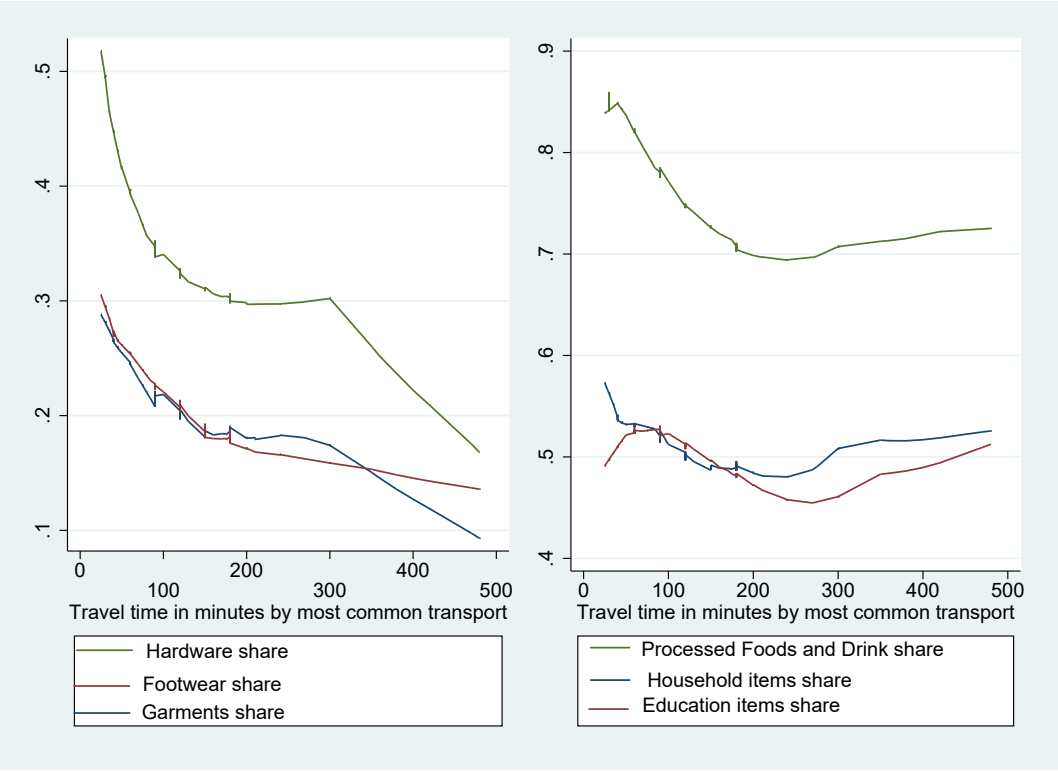
Table 6: Generalised negative binomial estimates by items and brands in village

	Items available			Brands available		
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Travel time to Town)	-0.092***	-0.092***	-0.069***	-0.117***	-0.119***	-0.093***
	(0.0239)	(0.024)	(0.026)	(0.027)	(0.029)	(0.028)
Household Density	-0.0001	0.0000	-0.0001	-0.0000	0.0001	0.0000
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0004)
ln(Market Size)	0.255***	0.255***	0.231***	0.249***	0.247***	0.223***
	(0.042)	(0.041)	(0.042)	(0.044)	(0.0448)	(0.047)
Share of Poor Households	-0.172	-0.205	-0.164	-0.142	-0.353	-0.325
	(0.164)	(0.192)	(0.182)	(0.209)	(0.261)	(0.248)
Income Spread		0.233***	0.218***		0.193**	0.165**
		(0.067)	(0.066)		(0.089)	(0.0840)
Income Spread*Share of Poor		0.112	0.0251		0.357	0.285
		(0.192)	(0.182)		(0.314)	(0.277)
Reliable electricity			0.146***			0.155**
			(0.057)			(0.062)
Reliable cellphone			0.0226			0.078
			(0.048)			(0.052)
Constant	-0.743***	-0.864***	-0.940***	-0.861***	-0.945***	-1.095***
	(0.162)	(0.167)	(0.172)	(0.299)	(0.304)	(0.296)
Variables for overdispersion						
Region=3	0.717*	0.726*	0.895**	0.484	0.487	0.651**
	(0.418)	(0.423)	(0.404)	(0.317)	(0.317)	(0.306)
Region=4	-0.421	-0.380	-0.358	-0.976***	-0.932***	-0.918***
	(0.462)	(0.451)	(0.463)	(0.340)	(0.328)	(0.315)
Region=6	-0.270	-0.386	-0.550	-0.436	-0.478	-0.605
	(0.475)	(0.515)	(0.571)	(0.413)	(0.435)	(0.471)
Constant	-3.115***	-3.160***	-3.257***	-2.383***	-2.407***	-2.49***
	(0.326)	(0.332)	(0.319)	(0.245)	(0.243)	(0.231)
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	292	285	285	292	285	285
Pseudo R^2	0.121	0.125	0.129	0.113	0.115	0.119

p-values are in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Market size is measured as the number of nearby hamlets (including the main village sampled) that use the periodic market and fixed shops in the village. The share of poor households is obtained from the number of households in the village who are part of the PSNP programme targeted at poor villages, while income spread measures the difference in incomes between the richest and poorest households in the sample, with the mean standardised to zero, a mean-preserving spread.

Figure 4: Availability across space by item group



Notes: The graph displays lowess graphs of shares of items available in the village relative to the associated market town, disaggregated by item group to examine heterogeneity in the fall in variety over travel time. Heavier, bulkier items such as processed food and drink and hardware display a sharper fall in availability by travel time.

Table 7: Prices between source town (P) and destination (P_j)

$P_j = \frac{\overline{P}}{\theta} + \frac{\beta S_j}{\theta}$	Variety survey (2016) Prices in village	Price Survey (2016) Prices in village	National Price Survey (2010-16) Prices in 118 market towns
Source price (town)	1.146***	1.103***	1.144***
Coeff=$\frac{1}{\theta}$	(0.0213)	(0.009)	(0.007)
Travel time (minutes)	0.007***	0.005***	0.003***
	(0.002)	(0.0006)	(0.0007)
Year-Month fixed effect			Yes
Item fixed effect			Yes
Observations	1370	1971	32,212
Adjusted R^2	0.978	0.991	0.956

p-values are in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

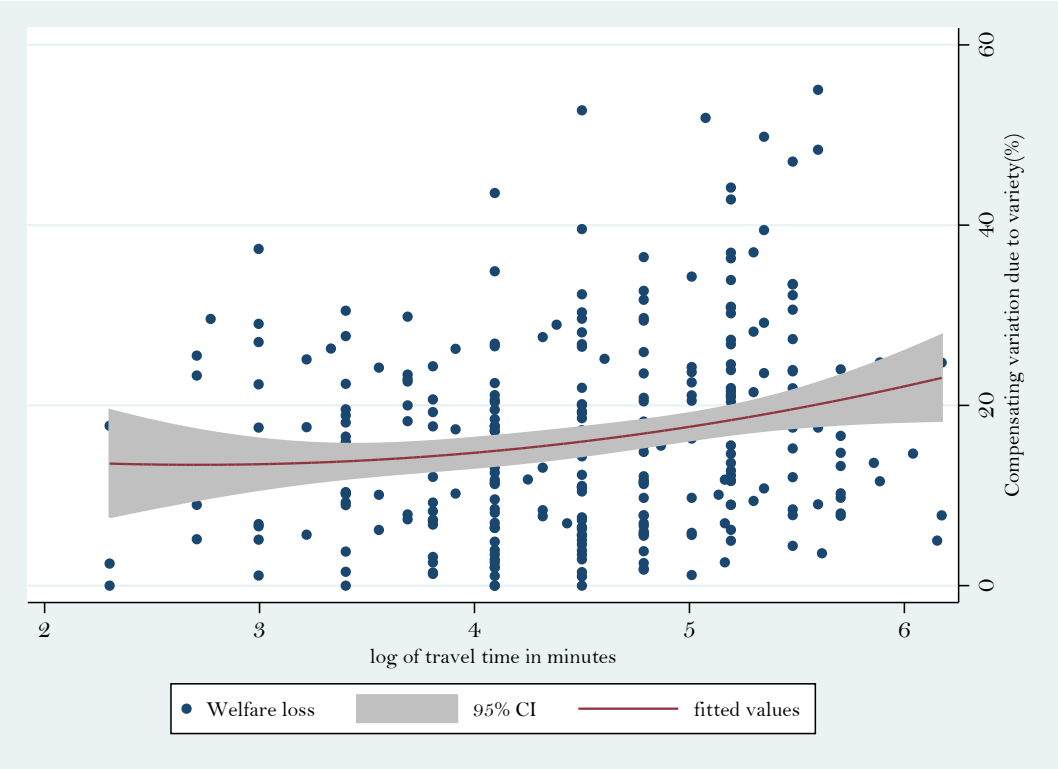
Notes: Column (2) uses the prices of branded items in village and associated towns in identical weight or volume units from the availability survey with data from 187 villages and 77 market towns. Column (3) uses similar prices on branded items from a follow-up survey on prices alone in 115 villages and 43 market towns as a consistency check. Column (4) uses data (on 13 items whose source town is established) from the National Price Survey conducted by the Central Statistical Authority in 118 market towns from 2010-2016. We use these years since the road quality (and thus travel time) between source town and market town can be assumed to be unchanged. Note that this last set of prices reflects national differences rather than within-district variation in as in Columns 2 and 3.

Table 8: Measures of the taste for variety by item group

Item group	Theta
Processed foods	0.91
Beverages	0.95
Household items-kitchen	0.97
Other household items	0.93
Cosmetic and hygiene	0.97
Educational materials	0.94
Building and electronics	0.92

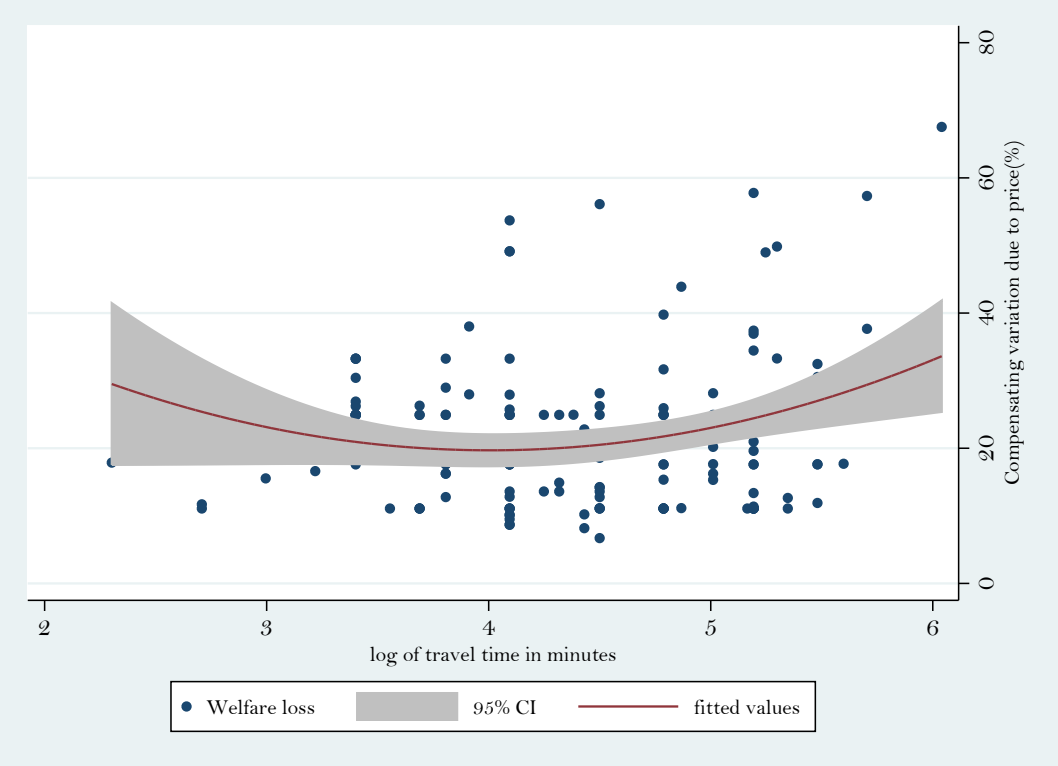
Notes: Substitution parameters derived from the price regression in equation A.6 in the appendix.

Figure 5a: Welfare cost of remoteness due to decrease in variety



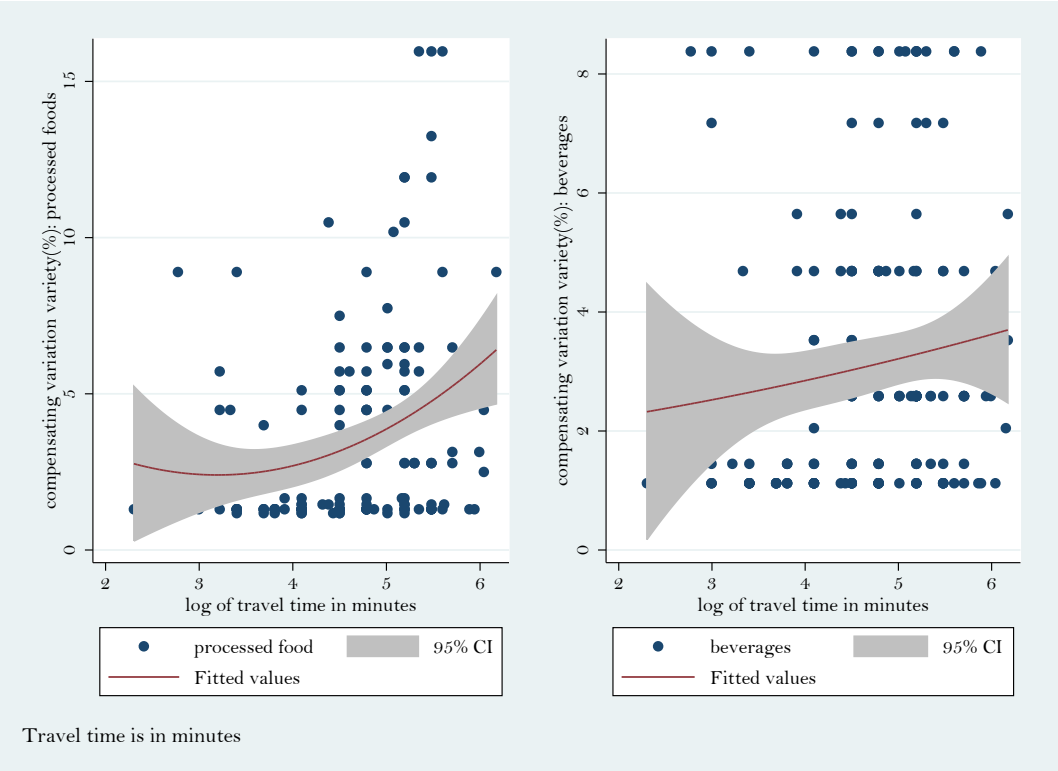
Notes: The graph above describes the loss in welfare due to lower number of varieties of items in the village compared to market town.

Figure 5b: Welfare cost of remoteness due to an increase in price



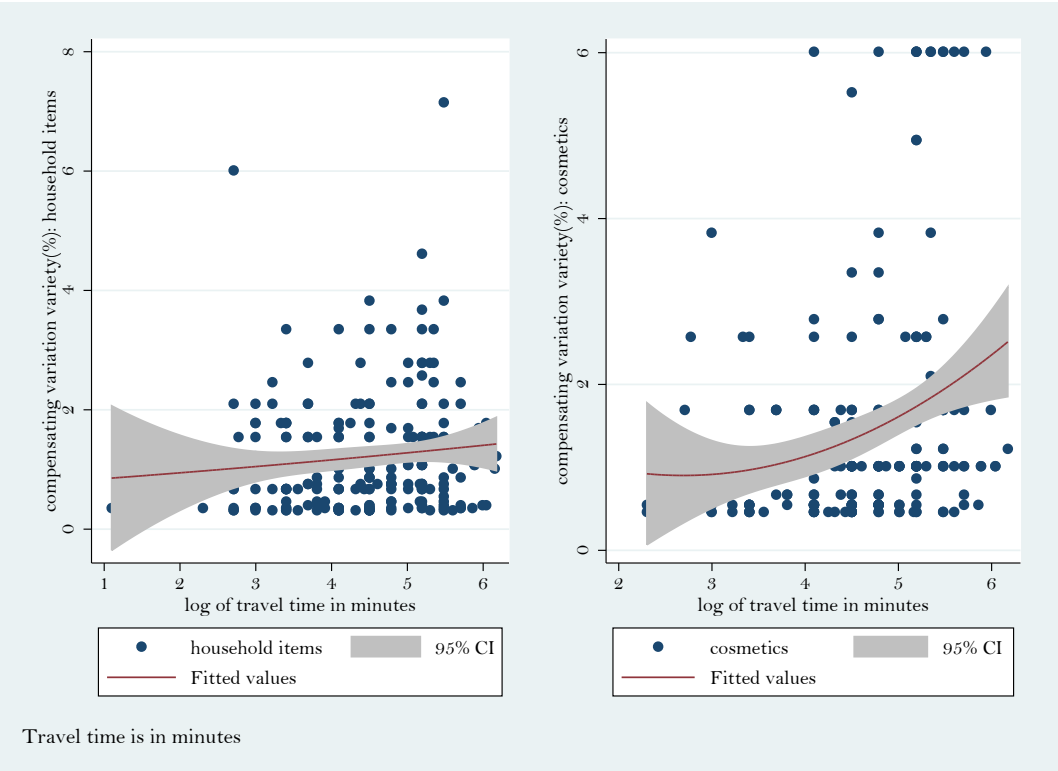
Notes: The graph above describes the loss in welfare due to higher price in the village compared to the market town.

Figure 6a: Welfare cost of remoteness by item-group, variety effect: processed foods and beverage



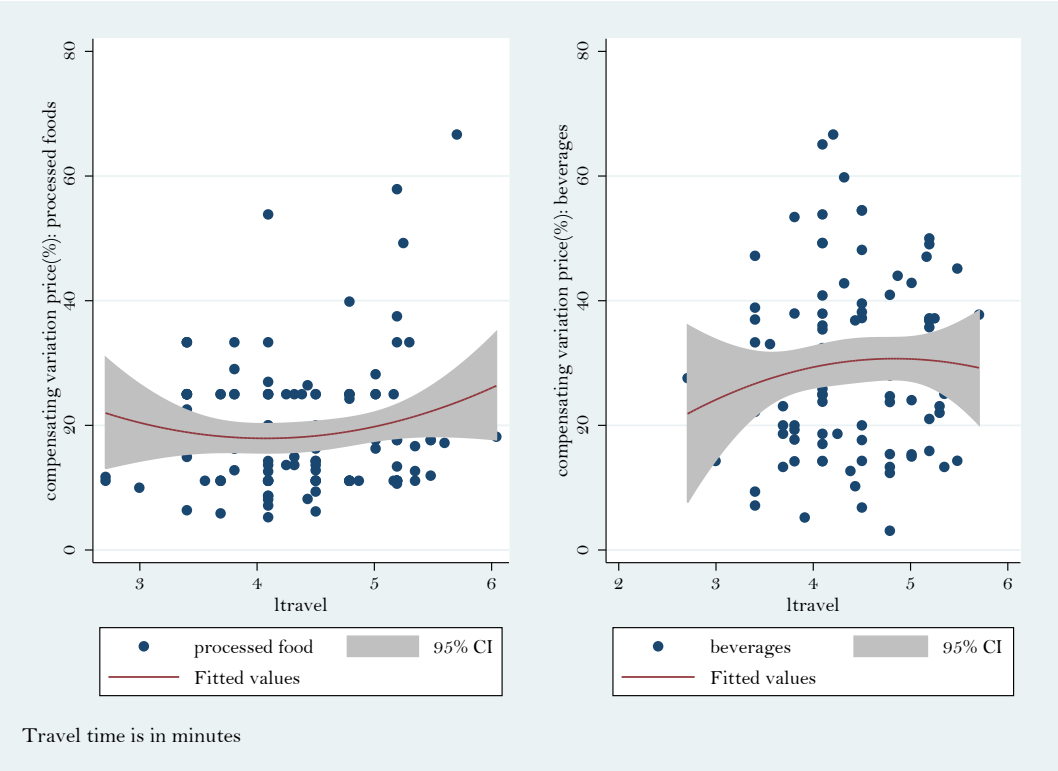
Notes: The graph above describes the loss in welfare due to lower number of varieties of items in the village compared to market town.

Figure 6b: Welfare cost of remoteness by item-group, variety effect: cosmetics, hygiene, and household items



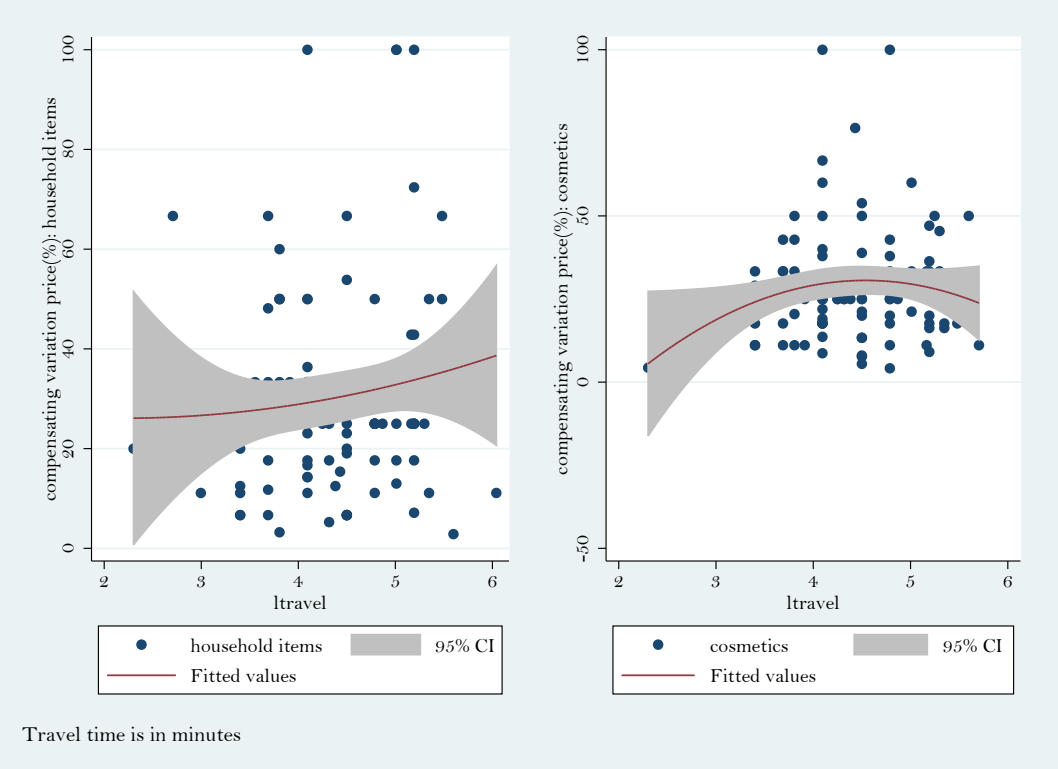
Notes: The graph above describes the loss in welfare due to lower number of varieties of items in the village compared to market town.

Figure 7a: Welfare Costs of Remoteness by Item-groups, Price effect: processed foods and beverages



Notes: The graph above describes the loss in welfare due to lower number of varieties of items in the village compared to market town.

Figure 7b: Welfare Costs of Remoteness by Item-groups, Price effect: cosmetics, hygiene, and household items



Notes: The graph above describes the loss in welfare due to lower number of varieties of items in the village compared to market town.

Appendices

A Model of Transport Costs and Availability of Consumer Goods

We outline a very simple model of trade and transport to investigate how consumers are affected by transport costs, not only through changes in prices, but also through changes in the set of goods they can buy. This also delivers a standard prediction for prices as a function of travel costs that in turn allows us to estimate welfare costs of fading choice. Note that for clarity, we present a one-level CES function, but the implications (particularly the profit maximising price function that delivers the taste for variety easily generalises to two levels, with symmetric price markup equations by both item-group and items within them).

We assume Dixit and Stiglitz (1977) preferences:

$$u = \sum_{i=1}^{n} c_i^{\theta} \qquad 0 < \theta < 1 \tag{A.1}$$

where c_i denotes consumption of good i, the consumer takes the number of available goods n as given, and $1 - \theta$ is a measure of the consumer's taste for variety and y denotes income. For $\theta \to 1$ the consumer treats different goods as close to perfect substitutes, for $\theta \to 0$ as complements.

The consumer solves:

$$\max_{c_1,..,c_n} \sum_{i=1}^{n} c_i^{\theta} \text{ subject to } \sum_{i=1}^{n} p_i c_i = y. \tag{A.2}$$

The first-order condition gives:

$$c_i = \left(\frac{\theta}{\lambda p_i}\right)^{\frac{1}{1-\theta}} = \frac{y}{n p_i}. \tag{A.3}$$

Here λ denotes the Lagrange multiplier of the budget constraint. We consider transport and trade to V villages ($v = 1, .., V$), each connected by its own road to a market town where all n goods are available at a given price. The travel time between village v and the town is s_v. Each village has m consumers whose income is derived from selling a crop. This income is

fixed at y^* at $s = 0$ and declines with the travel time from the market town, reflecting iceberg transportation costs:

$$y_v = \frac{y^*}{\gamma s_v}. \tag{A.4}$$

Each trader deals in a single good which he buys in the market town at a given price $\overline{p}$ and transports to a subset of the villages where the good is sold at the price p_j^*. The cost of transporting a quantity q over travel time s is $(\alpha + \beta q)s$. Hence the trader's profits on sales at j are given by:

$$\pi_v = [p_j^* - (\overline{p} + \beta s_v)](m.c) - \alpha s_v. \tag{A.5}$$

Traders are engaged in monopolistic competition. Hence each trader sets a profit maximising price taking into account the demand curve (3). From (3) and (4) this gives for locations that are served:

$$p_v^* = \frac{\overline{p} + \beta s_v}{\theta}. \tag{A.6}$$

This shows that each trader charges a markup over marginal costs $\overline{p} + \beta s_v$ and that this markup is increasing in the taste for variety $1 - \theta$.[23][24]. This is the key equation that we employ in subsection 3.1 to estimate θ. Note that by separability and symmetry, we obtain a similar price equation for each item-group i, which allows us to estimate θ_i for each of the 6 item-groups in the data.

Free entry drives profits to zero and this determines the number goods available at a particular location. From (3)-(5) and the budget constraint this implies:·

$$n_v = \frac{(1-\theta)my^*}{\alpha\gamma s_v^2}. \tag{A.7}$$

Equation (7) indicates that at a travel time s_j from the market town the number of goods available is increasing in the taste for variety and in the size of the market (my_j), measured in terms of fixed transport costs, $my_v/(\alpha s_v) = my^*/(\alpha\gamma s_v^2)$.

[23] Note that for $\theta \to 1$ the markup vanishes: if consumers have no taste for variety then marginal cost pricing is, of course, optimal.

[24] Benassy (1996) points out that this formulation locks the taste for variety to the elasticity of demand and suggests an alternative formulation that would separate the two parameters. While this is theoretically appealing, it is clear that the taste for variety parameter thus separated affects only unobservable variables, namely welfare and the number of optimal varieties (see Section 6 in Benassy (1996)) and hence is unidentifiable in a fundamental sense.

Table A.1: Sub-set of items and brands by item-group for illustration

Item-group	Item	Brand quantity/Unit	
Processed Foods	Sugar	FINCHA	1 Kg
Processed Foods	Sugar	METEHARA	1 kg
Processed Foods	Sugar	WONJI	1 kg
Processed Foods	Salt	ENAT IODIZED	1 kg
Processed Foods	Salt	ERMON	1 Kg
Processed Foods	Biscuits	AMARE	1 packet
Processed Foods	Biscuits	BABY	1 packet
Processed Foods	Biscuits	BANANA	1 packet
Processed Foods	Pasta	VERA	500 gram
Processed Foods	Pasta	PRIMA	500 gram
Processed Foods	Pasta	CHERALIA	500 gram
Beverages	Soft drinks (sodas)	PEPSI	330 ml
Beverages	Soft drinks (sodas)	SPRITE	330 ml
Beverages	Processed Juices	RANI	200 ml
Beverages	Processed Juices	JOLY JUICE	1 litre
Beverages	Processed Juices	PRIGAT JUICE	500 ml
Cigarettes	Cigarettes	DELIGHT	1 packet
Cigarettes	Cigarettes	ROTHMANS	1 packet
Cigarettes	Cigarettes	NYALA	1 packet
Fabric	Polyester	MANCHINI	1 meter
Fabric	Polyester	HAWASSA	1 meter
Fabric	Polyester	INDONESIA	1 meter
Male Adults	Jeans	FASHION JEANS	1 piece
Male Adults	Jeans	LUCKY (CHINA)	1 piece
Male Adults	Jeans	CLASSIC (CHINA)	1 piece
Footwear adult women	Leather shoes	KANGAROO	1 pair
Footwear adult women	Leather shoes	DURSEN	1 pair
Footwear adult women	Leather shoes	LINSTAR	1 pair
Household Items Kitchen	Washing Container	K.B. PLASTIC	1 piece
Household Items Kitchen	Washing Container	MODERN PLASTIC	1 piece
Household Items Kitchen	Washing Container	TIGER PLASTIC	1 piece
Household Items Kitchen	Coffee/tea cups	QUEEN	1 piece
Household Items Kitchen	Coffee/tea cups	OASIS	1 piece
Household Items Kitchen	Coffee/tea cups	ROYALEX	1 piece
Household Items Kitchen	Thermos	GIANT	1 piece
Household Items Kitchen	Thermos	EVER NICE	1 piece
Other household Items	Electric bulb	HIDASE	1 piece
Other household Items	Electric bulb	CLEAR BULB	1 piece
Other household Items	Batteries	ABYSSINIA	1 pair
Other household Items	Batteries	DURATA	1 pair
Other household Items	Matches	KANGAROO	1 packet
Other household Items	Matches	SCISSORS	1 packet
Other household Items	Flash light	TIGER	1 piece
Other household Items	Flash light	SUPER BRIGHT	1 piece
Detergent	Powder	ZAHARA	300 gram
Detergent	Powder	CROWN	200 gram
Cosmetics and Hygiene	Toothpaste	COLGATE	1 piece
Cosmetics and Hygiene	Toothpaste	SIGNAL	1 piece

Notes: These are choosen to illustrate the types of items and brands included in our survey.