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Evidence from Ethiopia

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Restricting Trade and Reducing Variety: Evidence from Ethiopia *

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Abstract

The study of consumption in poor households usually focuses on the costs of the consumption basket rather than its composition. In contrast, we investigate the variety in consumption using data from rural Ethiopia. We examine the loss in variety in remote locations, relying on a purpose-designed longitudinal survey over two years, where villages differ only in distance to the market and are homogenous otherwise. In addition, we exploit a change in policy which resulted in a crackdown on informal or unlicensed traders in the second year but which affected only the more remote set of villages and resulted in a fall in availability in these villages. We examine the welfare impact of the crackdown on traders by calculating the compensating and equivalent variation and find a fall in welfare between 11% and 13% of incomes for households affected by the crackdown, mostly driven by the resultant fall in varieties available. The welfare costs of remoteness are driven by not just the fall in consumption but also the fall in variety in consumption.

Keywords: Variety; Transport costs.
JEL classification: D12, D04, O12, O18.

1 Introduction

Remoteness from markets imposes a variety of costs on rural households, including lower incomes, higher consumer prices and higher input costs in production. There is a large body of evidence to conclude that better access to markets raises incomes and well-being (Stifel et al., 2016; Stifel and Minten, 2017), and that households that are better connected to urban centres see higher consumption and lower poverty (see for instance, Khandker et al. (2009); Dercon et al. (2009); Stifel et al. (2016); Jacoby (2000); Jacoby and Minten (2009); Stifel and Minten (2008); Dihel (2011)). An important reason is that better access in the form of roads and transportation lowers input costs and raises agricultural productivity, potentially raising farm incomes and household consumption.

There is now a substantial literature on the impact of transport costs and remoteness on these dimensions but in what follows we investigate the impact of such costs on *variety* in consumption or the range of goods in the household's consumption basket. Remoteness from markets affects

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both the amount of consumption as established elsewhere but also reduces the choice of varieties available in local markets. Why might remoteness affect variety in consumption? First, if the demand for variety has a positive income elasticity, then remoteness will also be associated with a reduction in variety. Second, high transport costs imply that individual varieties will be more costly in rural areas and this, allied to a fixed cost of varietal marketing, will lead to a reduction in varieties. As is usual in this literature, demonstrating the causal effect of transport costs on outcomes is complicated by the fact that roads and better infrastructure are often placed in areas of higher potential or actual productivity and countering this difficulty is vital (Adam et al., 2018; Donaldson and Hornbeck, 2016). In what follows, we use a purpose designed survey to demonstrate the first effect above, or the income effect on variety. In addition, we also exploit a change in the implementation of regulations requiring retail traders to be licensed and thus are able to demonstrate the effect of the increased fixed costs of varietal marketing as well[1]. The purpose designed survey is identical in spirit to previous work to identify the benefits of rural roads (see Jacoby (2000); Jacoby and Minten (2009)).

We examine the loss in variety of goods in remote locations, relying on a purpose-designed longitudinal survey over two years (see Stifel et al. (2016)), where villages differ only in distance to the market and are homogenous in key dimensions. In particular, the setting offers a large variation in transportation costs over a relatively short distance but similar physical and climatic conditions across the villages surveyed. In addition, we exploit a change in policy which resulted in a crackdown on informal or unregistered traders in the second year but which affected only the more remote set of villages and resulted in a fall in availability there. We are thus able to examine the welfare impact of differences in availability of varieties across distance and furthermore, assess the welfare costs of a sudden, exogenous crackdown on traders to estimate the effects of a fall in availability alone. In brief, we are largely able to counter the difficulty that roads and transport infrastructure might not be randomly placed in assessing the effect of remoteness on variety, and in addition are able to use the crackdown on traders to assess the costs of raising barriers to trade alone. It should be noted that the licensing of traders dealing in different categories of manufactures in Ethiopia is not a policy that is specific to that country.

In a parallel piece, Gunning et al. (2018) use data from a purpose-designed survey of shops and consumers in rural villages and market towns in Ethiopia to understand how remoteness reduces the variety of consumer goods available and the costs to consumers of fading choice. The focus there is on measuring the (loss in) availability of manufactured goods using data on traders who supply periodic markets and retailers in fixed village shops, relative to the full set of goods potentially available in the nearest market town. In contrast, in this paper, we focus on the variety found in the consumption baskets of households. The particular setting we use allows us to measure the varieties actually consumed by households: the villages surveyed are laid out approximately on a line leading away from this market town (see Figure 1). The original survey was conducted by IFPRI in 2011 (see Stifel and Minten (2017) for details on the survey). As they emphasise, there are no roads in the region and the main differences between communities in the region are the transport costs between the villages and the main market town to which villagers travel. Thus, transportation costs differ across villages not because of road placement but because of the physical geography of the region[2]. The aim of that initial survey was to ensure that transportation costs did not confound the causal assessment of market access on outcomes. The households in these villages were re-surveyed, two years later in 2014, after a crackdown on traders who operated without a license to sell manufactured goods came into effect in late 2013, thus allowing us to assess the impact of an exogenous and unexpected change in availability on variety in consumption. In this setting, the changes in variety in

[1] The requirement for traders to obtain licenses (often by type of good, such as clothing, footwear or processed foods of different types) is not specific to this setting. Many countries in sub-Saharan Africa and elsewhere have such regulations in place (See Dihel (2011)).

[2] On average, it takes households in the sample 4.5 hours to travel one-way during the dry season to Atsedemariam (see Stifel et al. (2016)).

the consumption basket are rather more fundamental than an increase in brands of soft drinks; indeed, they are item groups such as processed food such as pasta, drinks including soft drinks and beers, clothing and fabric and so on. In summary, in this paper we focus on the demand side by studying how market access affects variety of household consumption, where market access is measured by travel costs to the central market, captured by travel time. As there are no roads at all, households must walk to the market on foot or with a donkey. Thus, the crackdown on informal traders lowers accessibility to variety of goods available locally.

The paper closest in spirit to this piece is by Li (2017), who documents an Engel curve for variety in food consumption using data from India. He finds that richer households see more variety in their diets, thus escaping diminishing returns to quantity in a monotonous diet. In addition, differences in supply by retailers also affects varieties available. Our approach focuses instead on the role of distance and travel costs to measure accessibility to variety in goods. Furthermore, we concentrate on manufactures and processed goods whose penetration in remote markets depends in good part on such travel costs. The interest in this issue is driven by the importance of examining the role of diversity in consumption in a high growth economy - Ethiopia has seen consistently high growth rates in this period and since 2006 has turned its focus from agriculture to the beginnings of industry. Eighty percent of her population remains in agriculture and assessing the constraints to increasing domestic consumption of industrial goods and extending this market is of great interest.

The paper is organised as follows. In section 2, we present a theoretical model, taken from a parallel paper (Gunning et al. (2018)) to explain how variety supplied by traders decreases with distance to the central market. To test the theoretical predictions, we introduce the data and explain the two quasi-experiments that allow us to identify the effect of distance on variety, followed by the empirical strategy and results. We also present the welfare costs of the crackdown on informal traders that led to lower variety and higher prices - confirming the important conclusion that restrictions on trade in markets affect welfare, even in very poor communities.

2 Theoretical Framework:

2.1 Transport Costs and Availability of Consumer Goods

We sketch 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. We reproduce this from a parallel piece, Gunning et al. (2018) where we also extend this model to allow for heterogeneity in incomes. It is repeated here in order to fix ideas.

We assume Dixit and Stiglitz (1977) preferences:

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

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

The consumer solves:

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

The first-order condition gives:

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

Here λ denotes the Lagrange multiplier of the budget constraint. An immediate implication of (3) is that the price elasticity of consumer demand decreases with the taste for variety: the more the consumer cares about variety the more inelastic demand and the greater therefore the monopoly power of the trader.

We consider transport and trade along a straight line from a market town where all n goods are available at a given price. Distance from this town along the line is measured by s. There are J consumers, identical in terms of income y^* and located at distances s_j from the market town $(j = 1, .., J)$.[3]

Since goods are modelled symmetrically we can drop the index i. (From now on subscripts denote locations rather than goods.) Each trader deals in a good which he buys in the market town at a given price $\overline{p}$, transports along the ray and sells at a distance s_j at the market clearing price p_j. The cost of transporting a quantity q over a distance s is $(\alpha + \beta q)s$. Hence the trader's profits on sales at location j are given by:

$$\pi_j = [p_j - (\overline{p} + \beta s_j)]c_j - \alpha s_j \tag{4}$$

where c_j denotes demand at location j for the good sold by the trader. 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:

$$\begin{aligned} p_j &= (\overline{p} + \beta s_j)(\frac{1}{\theta}) \\ &= [p_{j-1} + \beta(s_j + s_{j-1})](\frac{1}{\theta}) \qquad j = 1, .., J; p_0 = \overline{p}. \end{aligned} \tag{5}$$

This shows that the trader charges a markup over marginal costs $\overline{p} + \beta s_j$ and that this markup is increasing in the taste for variety $1 - \theta$.[4] The trader applies price discrimination across locations. As a result, as indicated by (5), the price p_j is independent of demand at other locations. While the trader will visit each location in turn (as long as his profits are non-negative) the problem decomposes into a series of J problems, one for each location, which can be supplied by buying a quantity c_j at the previous location at the local price p_{j-1} and incurring the transport cost $(\alpha + \beta c_j)(s_j + s_{j-1})$.

The consumer's income is derived from selling a crop such as *teff*. This income is fixed at y^* at $s = 0$ and declines with the distance from the market town, reflecting iceberg transportation costs:

$$y_j = \frac{y^*}{\gamma s_j}. \tag{6}$$

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:[5]

$$n_j = \frac{(1-\theta)y^*}{\alpha\gamma s_j^2}. \tag{7}$$

Equation (7) indicates that at a distance 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, measured in terms of fixed transport costs, $y_j/(\alpha s_j) = y^*/(\alpha\gamma s_j^2)$.

In this model a reduction in transport costs (a lower value of α, β, or γ) increases consumer

[3]These assumptions will be relaxed in the next section.

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

[5]For simplicity we will treat n as a continuous variable.

welfare in three ways. First, from (6), it increases the value of income. Secondly, from (5), it lowers the price of consumer goods. Finally, it increases the distances over which variety falls so that the number of goods available at a consumer's location increases. We call these three effects the income effect, the price effect and the variety effect respectively.

In the Dixit-Stiglitz specification goods are modelled symmetrically so that in equilibrium prices and quantities are the same for all goods consumed. A corollary is that the equilibrium is affected only by market size (total income in a village), not by the way income is distributed. Given the setting of the survey, the relative homogeneity of the characteristics of land and its productivity, this seems a reasonable assumption.

2.2 The welfare effects of loss in variety

We choose to approximate the welfare change using CV and EV mainly because data on prices by item and brand is unavailable and thus the information on prices in this survey relies on unit values. We calculate CV and EV as percentage of overall expenditure for different expenditure categories, where the categories are unprocessed food (where we do not expect to see an impact of the crackdown on traders) and manufatured goods, which includes processed foods.

We use a Taylor series approximation of $c(p^1, u^0)$ and $c(p^o, u^1)$ around $p^1 = p^0$. First order approximation to CV is given as:

$$c(p^1, u^0) \approx c(p^0, u^0) + \frac{\partial c(p^0, u^0)}{\partial p}(p^1 - p^0) \tag{8}$$

$$CV = c(p^0, u^0) - c(p^1, u^0) \approx -\frac{\partial c(p^0, u^0)}{\partial p}(p^1 - p^0) = q^0(p^0 - p^1) \tag{9}$$

$$\frac{CV}{x} = \frac{q^0 p^0}{x} \cdot \frac{p^0 - p^1}{p^0} = w_0 \cdot \frac{p^0 - p^1}{p^0} \tag{10}$$

First order approximation to EV is given as:

$$c(p^0, u^1) \approx c(p^1, u^1) - \frac{\partial c(p^1, u^1)}{\partial p}(p^1 - p^0) \tag{11}$$

$$EV = c(p^0, u^1) - c(p^1, u^1) \approx -\frac{\partial c(p^1, u^1)}{\partial p}(p^1 - p^0) = q^1(p^0 - p^1) \tag{12}$$

$$\frac{EV}{x} = \frac{q^1 p^1}{x} \cdot \frac{p^0 - p^1}{p^1} = w_1 \cdot \frac{p^0 - p^1}{p^1} \tag{13}$$

3 Data and Results

3.1 The effects of distance on variety using a purposeful survey

The data used here comes from the Ethiopia Rural Transport Survey, a longitudinal survey conducted in 2011 by IFPRI (see Stifel et al. (2016)) and repeated in 2014. The aim of the first round of the survey was to assess the benefits of feeder roads and the sample design was purposefully chosen to ensure that the main differences between villages were costs of travel to the nearest market town. They chose an extremely remote area in northwestern Ethiopia, Alefa district, approximately 100 kilometers from the city of Gonder. It is in a rugged terrain, west of Lake Tana and isolated with no roads or access to electricity and mobile telephony and all the households are engaged in farming. The average time to travel to the nearest market town, Atsedemariam, is 4.7 hours. The key point is that the characteristics of land and its productivity are similar across the villages (Stifel et al., 2016) and consequently, the variation in outcomes such as household consumption can be thought to depend largely on behaviour driven by the variation in transport costs rather than the endowment of land. Note that given constraints on migration (households lose their right to land if they migrate), the distribution of households can be described as a (constrained) spatial equilibrium where returns to factors across space are attributable largely to transport costs.

The survey area covers 32 sub-subkebeles or hamlets which belong to 7 sub-kebeles or sub-districts (Chimzen, Audir, Zehas, Dubaye, Garasghe, Avabehova, and Fantaye). All the households are located along the route between Atsedemariam and the most remote hamlet in Fantaye. One hundred and seventy households were surveyed in each of five different distance brackets from the main market town, Atsedemariam and are distributed relatively homogenously over this distance[6]. In all, 847 households were surveyed in 2011, while 775 were re-surveyed in 2014. A map of the survey area can be found in panel A of figure 1.

The household survey gathered rich information on demographics, agricultural production, livestock, consumption, and travel cost. In particular, the survey gathers very detailed information on household food and non-food consumption. For both years there are records on 41 items of food expenditure and 32 items of non-food expenditure. For each item, households were asked about their frequency of purchase, quantity and amount of purchase of goods. Furthermore, detailed questions were asked about travel time with a loaded-donkey to Atsedemariam during both rainy and dry seasons. Information on the cost of renting a loaded-donkey from each respondent's house to Atsedemariam was also collected for both seasons. Other details about data and sampling process can be found in Stifel et al. (2016).

The variable of interest is variety, which is defined as the number of different items purchased by a household in each consumption category, with a focus on manufactured and processed items alone. Our main measure of distance is travel time to Atsedemariam, obtained directly from the information in the questionnaire on how long it takes to travel one way to Atsedemariam in the dry season. Stifel et al. (2016) also offer alternative estimates: to adjust for noise in households' self-reported values, they calculate spatial moving averages of 5 nearest households, and further, also calculate the monetary travel cost of the whole trip to Atsedemariam again based on a spatial moving average of 5 nearest households as yet another measure of travel cost. As households carry goods by donkey and the transportation is rarely conducted by third parties (Stifel et al., 2016), the monetary cost here is a combination of cost of renting a donkey per kilogram and opportunity cost of travel time. The cost of renting a donkey per kilogram is based on the information in the questionnaire on the total cost of renting a donkey for a one-way trip to Atsedemariam and total number of kilograms a donkey carries for each trip. The opportunity cost of time is imputed by using the median harvest-period wage in the village. While we use these alternative measures as a robustness check, we rely on the simple measure of travel time rather than the monetary cost in the main analysis.

The average travel time in the dry season to Atsedemariam in the sample is 4.74 hours. The mean value of monetary cost (including opportunity cost of time) of a round trip is 76.26 birr (or $2.75). The rank order of hamlets in an ascending order of travel cost means that the closet hamlet to Atsedemariam is Mulalit, about 45 minutes away from Atsedemariam by donkey with a round-trip trip cost of 18.8 birr (70 pence including the cost of renting a donkey and opportunity cost of time). The most distant village is Fantaye, at 7.16 hours away on average by donkey, with a round trip cost of 102 birr or $3.70. The data consist of a balanced panel of 717 households in 2011 and 2014,

We examine the changes in consumption and variety both over time and across space. Our

[6]As Stifel et al. (2016) state: "For sampling purposes, an equal number of households was interviewed in five different distance brackets (measured in travel time by donkey) from the market of Atsedemariam. 170 households were interviewed in each category, for a target of 850 households. Households were sampled evenly from subdistricts within each category to assure a relatively homogenous spread of households over the space between Atsedemariam and the most remote household in Fantaye. The sampling objective was to obtain a representation of households in the districts along the route from the market at Atsedemariam to Fantaye."

definition of manufactured goods comprises processed foods such as sugar and cooking oil and non-foods such as batteries, soaps, linens, fabric and ready-made clothing and footwear, all of which are sourced from the main market town. A list of items in each category can be found in table 1. We focus on the consumption bundle of manufactured goods compared to unprocessed food. In the 2011 baseline data, consistent with the theoretical model, both the variety and expenditure decline with distance to Atsedemarim, as evident in figure 2, where we plot variety in consumption against a continuous measure of travel time (unit: hour).

To examine this pattern more formally, we run a regression of the number of varieties or manufactured items consumed against travel time for 2011. Thus, we examine whether variety decreases with travel cost to Atsedemariam, given the purposeful design of the survey and conditional on the demographic chararecteristics of households[7].

The regression specification is as follows:

$$Y_{is} = \alpha + \beta C_{is} + \phi X_{is} + \epsilon_{is} \tag{14}$$

For each household i in hamlet s, Y_{is} is variety in consumption (measured by number of items purchased). As is discussed above, our categories of goods include: (1) manufactured goods; (2) unprocessed food. C_{is} is travel time to Atsedemariam for household i in sub-subkebele s. X_{is} refers to a set of control variables such as household assets (measured by the value of livestock), household size, number of male household members, number of teenagers (5-15 years old), the age of household head and quadratic terms of demographic controls. β is the key parameter of interest. Table 2 reports results of baseline OLS regressions of expenditure and variety of consumption on travel time for manufactured goods, unprocessed food and all items, respectively with 2011 data. The dependent variable is amount of expenditure measured by birr in columns 1-3 and variety of consumption in columns 4-6. The independent variable of interest is travel time to Atsedemariam in all columns. There are a set of control variables, including value of livestock, number of household members, number of male household members, number of teenagers, age of household head and quadratic terms of demographic controls.The amount of expenditure, variety in consumption, travel time to Atsedemariam and value of livestock are in logs so the corresponding coefficients can be interpreted as elasticities.

The total expenditure on consumption and that on manufactured and processed goods in particular decreases significantly with increase in travel time to Atsedemariam, as is shown in columns 1 and 2 in table 2 . A 1% increase in travel time to Atsedemariam is related to 0.42% decrease in amount of expenditure in 2011 and most of it (0.37% or 88% of the overall response) comes from the fall in expenditures on manufactured goods. Expenditure on unprocessed food is not responsive to changes in travel cost, unsurprising since they are largely home grown and not sourced from the market town.

As travel time to Atsedemariam increases, variety in consumption of manufactured goods also decreases significantly, as is shown in column 5. A 1% increase in travel time is associated with 0.05% decrease in variety in 2011 baseline. Again, variety of unprocessed food is not significantly correlated with distance to the central market. In general, we would expect that expenditure on food is less price elastic than manufactured goods; this result tells us that variety is also less elastic in response to changes in prices, proxied here by travel costs.

In sum, both amount and variety of consumption of manufactures fall as travel time to the central market increases, driven by the combination of income, price and variety effects as suggested by the theory. In the next section, we exploit a supply shock that isolates the combined variety and price effects, abstracting from the income effect.

[7] We postpone the examination of variety and travel time in 2014 to the next section, where we also examine the effect of a crackdown on traders.

3.2 The quasi-experimental design: A crackdown on unlicensed traders

As explained earlier (Stifel et al., 2016), the baseline 2011 survey was designed purposefully to examine the role of transport cost on household behaviour. The selected communities are homogeneous in land characteristics and productivity and the primary difference lies in the transport cost to Atsedemariam. Given the difficulties of migration and settlement, the pattern of settlement here has been unchanged for decades and conditional on this pattern, the comparison of variety and expenditures along this steep transport cost gradient can be interpreted as a causal response to distance or travel time.

The survey area is divided by a natural river. At the beginning of 2014, there was a crackdown on informal traders beyond this natural river boundary, effectively a supply shock for remote households relying on traders, both formal and informal. Traders are required to obtain a license to trade in particular goods and traders entering these hamlets from Atsedemariam are relatively easy to monitor. The concern of local authorities was that villages beyond the river boundary appeared to have a number of informal traders, moving goods without a license and also engaged in smuggling fertiliser, an input supposedly controlled by government extension workers. This crackdown meant that households beyond the river boundary and further away from the market were rationed mainly in processed and manufactured goods usually supplied by traders.

As in the baseline 2011 survey, the chosen households possess only a single route to the central market and are randomly distributed along the road, thus this design suggests the increase in travel cost is the only channel through which the ban on informal traders might affect the variety in consumption. The natural river boundary between hamlets which are affected and those who remain unaffected by the crackdown also made monitoring and enforcement easier for the authorities ensuring that the flow of goods was far lower than before. We label the households in these hamlets thus affected as "treated" by the crackdown. Hamlets which were affected by this negative supply shock include Abagedelga, Andaye, Abazonghe, Belweha and Borabor[8], are the treated while the remainder in hamlets closer to the market town are labelled the control. A sketch of treatment and control groups is also shown in the panel b of figure 1. The sample consists of 438 treated and 279 control households.

By definition, the treatment group is farther from Atsedemariam than the control group. The budget share of monetary travel cost (i.e. cost of renting a donkey per kilogram plus opportunity cost of travel time) in expenditure on manufactured goods is 7% for treatment and 4% for control groups. As mentioned earlier Stifel and Minten (2017) find no systematic differences in land characteristics and land productivity in the survey area. We pursue this comparison further across basic demographic variables and the measures of income and assets between the treatment and control groups in table 3. The value of household assets, proxied by value of livestock, does not differ significantly between control and treatment groups in the baseline in 2011. Furthermore, the change in value of livestock[9] after the crackdown on traders suggests that the potential decline in variety of consumption among treatment groups is not driven by the decrease in the underlying income in this group (i.e. the income effect). In fact, the value of livestock increases more in the treatment group between 2011 and 2014, confirming that if variety in consumption decreased more in the treatment than in the control group in 2014, this can be largely ascribed to distance and travel costs.

However, there are demographic differences between control and treatment villages in table 3, household size, number of male household members, age of household head and number of children (between age 5 and 15) in the household differ significantly in 2011 at baseline between treatment and control groups. This is unsurprising and again, this is in line with differences

[8]The corresponding subkebeles are: Ababelewuha and Fantaye. All of these five subsubkebeles are in the kebele Garasghe.

[9]Livestock are the main asset in this context, where alternative savings options are thin and farmers have only user rights to land.

in behavioral outcomes driven by significant differences in transport costs. In what follows, we control for this set of demographic variables across households. More importantly, our difference-in-difference estimates mean that we can control for all time-invariant household and farm characteristics between treatment and control groups. Changes in expenditure patterns and variety can thus be cautiously interpreted as the effect of the supply shock in traders on household consumption through the change in travel cost rather than driven by other differences amongst households.

3.3 Results: The fall in variety after the crackdown on traders

The theoretical framework delivers the predictions that 1) variety in expenditure should drop with increased distance from Atsedamariam; 2) variety of expenditure should drop significantly after the crackdown on traders, the "treatment"; 3) in both cases variety in manufactured goods ought to respond sharply compared to the largely non-traded items in unprocessed food . We have demonstarted the first effect above and now turn to the last two predictions. The 717 households we study over the two years consist of 438 households in the control group and 279 in the treated group, with the treated group by definition, consisting of the remoter hamlets.Table 4 lists the difference by treatment and control villages in the share of households who **do not** consume a particular item in each of the two years. In short, it documents those items where the treatment group had lower variety in items consumed relative to the control group: a negative sign indicates that a higher proportion of households in the treated group do not consume that variety. While there is considerable heterogeneity in the varieties not consumed between the treated and control in 2011, this disappears by 2014; after the crackdown, the share of treated households who do not consume a particular variety rises sharply, wth a difference in their favour only apparent for cigarettes and batteries, both relatively light items that can be carried from Atsedemariam potentially by other households and neighbours going to market. Heavier items such as linens, books, sugar and soft drinks are the items that disappear from the consumption basket of treated households who might have suffered from the crackdown on traders.

A detailed look at changes in variety between 2011 and 2014 in both treatment and control groups is in table 5. From 2011 to 2014, the variety in consumption increases in both groups. However, the increase in variety in the treatment group is significantly smaller than in the control group. In contrast, the difference in unprocessed food between treatment and control groups remains insignificant in both years. Further visual evidence can be found in figure 2 with a continuous measure of travel time to Atsedemariam. The large gap in the change in variety between treatment and control groups is observed in manufactured goods but not unprocessed food.

We explore the impact of the crackdown more formally, using a difference-in-difference specification as below. In equation 15, for each household i in hamlet s in year t, we have:

$$Y_{ist} = \alpha + \beta T_t * D_s + \eta D_s + \gamma T_t + \phi X_{ist} + \epsilon_{ist} \tag{15}$$

As before, Y_{is} is variety in consumption (measured by number of items purchased),C_{is} is travel time to Atsedemariam for household i in sub-subkebele s, while β is the coefficient of interest. T_t equals one for observations in year 2014 and zero in year 2011. D_s equals one (zero) if sub-subkebele s is in the treatment (control) group, while X_{ist} refers to the same set of control variables[10] as before. Since unprocessed foods are less likely to have been affected by the crackdown, we expect to see little or no effect on variety here. Standard errors in all these regressions are clustered at the level of the hamlet.

[10] X_{is} refers to a set of control variables such as household assets (measured by the value of livestock), household size, number of male household members, number of children between 5and 15 years of age, the age of household head and quadratic terms of demographic controls.

The main results from the specification above are in table 6. Columns 1-3 report the effect of the supply shock of traders on the amount of expenditure while the dependent variable in column 4-6 is variety of consumption. Controls on household characteristics such as number of household members, number of male members, number of children, age of household head and their quadratic terms are included in all the columns. We focus on the interaction term between treatment and year for interpretation.

Column 1-3 reveals that the crackdown on traders has no significant effect on the amount of expenditure in all consumption categories, which is consistent with the implication of the theoretical model that the negative shock of the supply of traders does not affect household total income. This is consistent with the potential change in variety in consumption in the treatment group after the policy change being driven by the increase in travel cost rather than a potential decrease in household income. It is also consistent with the patterns in consumption expenditures where expenditure on manufactured goods increases significantly more amongst the control group than the treatment group while the gap in unprocessed food between these two groups is insignificant.

From columns 4-6, we observe that the variety of manufactured goods decreases more in the treatment group than the control group after the crackdown on traders but the gap between treatment and control groups is not observed for variety of unprocessed food. As the variety of goods available to households is directly restricted by existence of traders, the treatment effect affects variety but not expenditure. To quantify the importance of changes in consumption of manufactured goods in the whole bundle, we also look at how much the decline in the variety of manufactured goods can explain the decline in the overall variety of consumption. Comparing corresponding coefficients in column 4 and 5, we find that most of the gap in change of variety between treatment and control groups in the variety of consumption comes from the gap in manufactured goods. For example, the coefficient of the interaction term in column 5 is -0.0701 and the corresponding coefficient in column 4 is -0.0813. In other words, the decrease in variety of manufactured goods explains 86 % of the decline in overall variety. All these results are consistent with our prediction that a crackdown on traders leads to decline in the variety of consumption, in particular manufactured goods.

The analysis above isolates a combined price and variety effect, abstracting from an income effect, since the fall in variety is simply due to the rationing in manufactures. We attempt to extend this to isolate a pure variety effect of the crackdown, by comparing treatment and control households just across the river boundary. Since the difference in travel costs ought to be small here and the income effects negligible by construction, the fall in variety can be ascribed to the crackdown alone. Table 7 shows the difference in the change of variety between treatment and control groups at the hamlets on either side of the border [11]. Compared with table 6, the magnitude of the gap in the change of variety between treatment and control groups is three times larger at the border, which can largely be ascribed to the variety effect alone.

Figure 3 offers a comparison of the loss in welfare both across distance and over time. We calculate the compensating and equivalent variation as a percentage of overall expenditure. In both measures, the welfare loss of the crackdown of traders is larger in the treatment group. Furthermore, as the CV is calculated based on the original budget share while EV is estimated using the new budget share, a comparison of the difference between the two suggests that the change in variety after the regulation contributes largely to the welfare loss. In summary, we find that the the compensating variation required for the treated is 13% larger than the control, while the equivalent variation required is 11% higher than that for the control, as reported in 8.

As a robustness check, we use an alternative measure to capture travel cost. It is the

[11] The "border" is defined as hamlets which are at the bordering areas between treatment and control villages. Bordering hamlets in the treatment group include Abagedelga and Andaye. Bordering hamlets in the control group include Asehra Shiroye and Golemeye.

monetary value of travel time which takes into account the heterogeneity in cost of renting a donkey and wage across different hamlets. It includes the cost of renting a donkey per kilogram and the median harvest-period wage in the village multiplying travel time. We focus only on the amount of expenditure in this section as travel cost is not explicitly included in difference-in-difference regressions. Table 9 replicates the results on baseline regressions of the amount of expenditure by replacing travel time with monetary cost. Consistent with all the results in table 6, the coefficients of monetary travel cost remain negatively significant for overall consumption and manufactured goods but not unprocessed food.

4 Conclusion and discussion

We examine the effect of market access, captured by both travel time to the central market and accessibility to traders, on the variety in household consumption of manufactures in rural Ethiopia. We examine this question in a setting where farm households are homogenous in terms of their main productive asset, land and its productivity but where other outcomes vary, driven largely by the time to travel to the nearest market town. Traders also move goods from town to village and we model their behaviour under conditions of monopolistic competition with free entry. In particular, they incur a fixed cost of a license to carry particular items in addition to the cost of travel from town to village, which serves to reduce availability of variety in remoter areas. We use a purpose-designed survey to counter the difficulty that roads are usually not randomly placed, thus ensuring that we can ascribe the lower variety in consumption baskets in remoter areas to the costs of access to markets in the main.

We find that variety in the consumption of manufactured goods decreases with distance and travel time to the central market. We are also able to use a crackdown on informal traders who have operated without a license, to separate the income effect of remoteness relative to the costs of trading in variety. In 2013, the government enforced the requirement for traders to obtain a license to trade in different categories of manufactures resulting in the decline of informal or unlicensed traders serving the remoter villages. Using a difference-in-difference approach, we find that variety of manufactured goods decreases substantially after the negative supply shock on the accessibility of traders. The welfare effects of the crackdown are substantial. We find that the compensating variation required for the treated villages is 13% larger than the control villages, while the equivalent variation required is 11% higher than that for the control. In brief, the welfare costs of reduced variety matter substantially, even in the context of very poor and remote villages.

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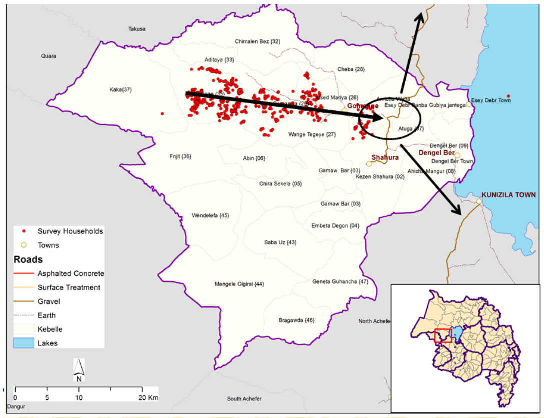
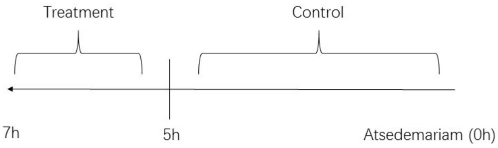


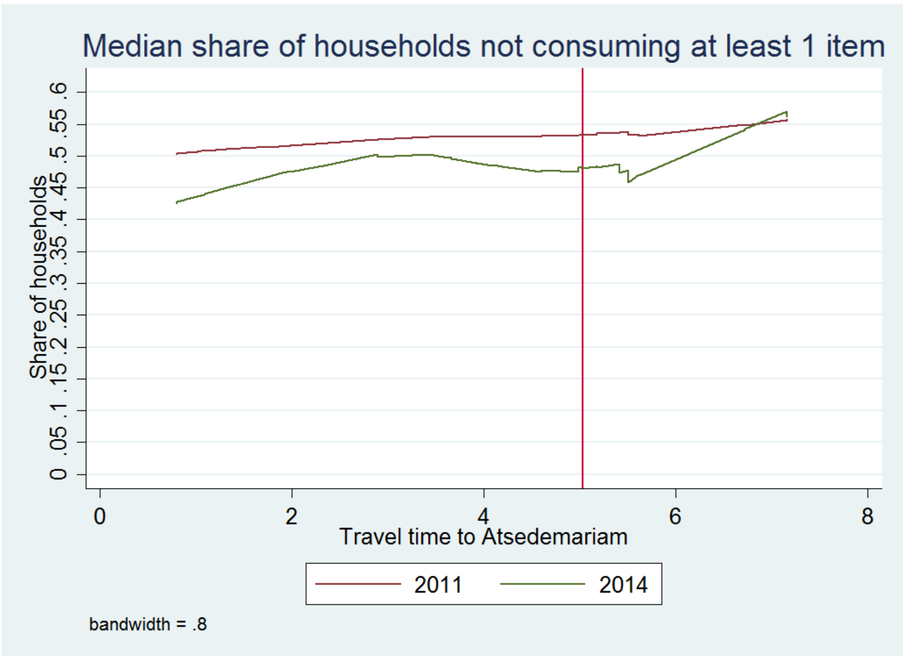
(a) Map of the survey area



(b) Definition of treatment and control groups

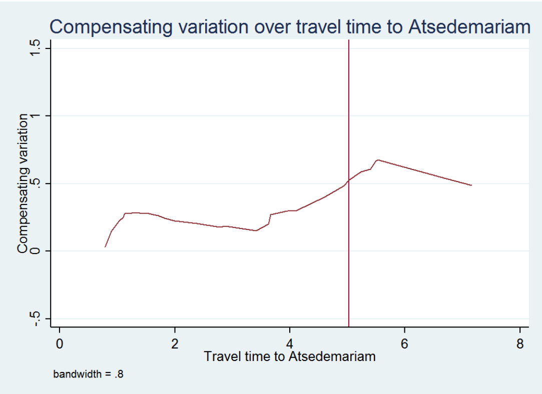
Notes: The left hand side plots the map of the survey area. The red dots are households which are allocated along the road from Atsedemariam. The right hand side shows the definition of treatment and control groups. Treatment group is further away from the Atsedemariam and is divided from the control group by a natural river.

Figure 1. A map of the survey area and the definition of treatment and control groups

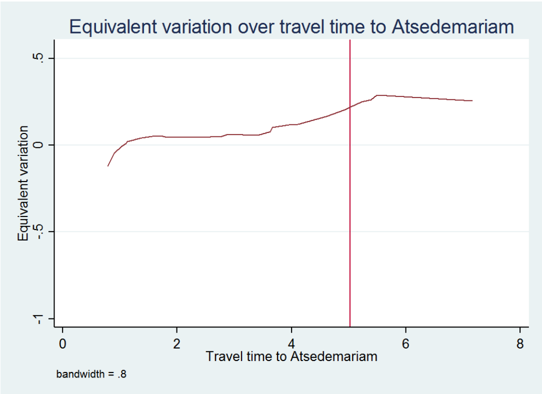


Notes: The figure captures the percentage of household with no consumption in manufactured items (we calculate whether the median household consumes each item in processed food and manufactured goods and average over the whole bundle) over distance to Atsedemariam (measured by travel time, unit: hour) in 2011 and 2014 data.

Figure 2. Median share of households **not** consuming manufactured items by travel time



(a) CV



(b) EV

Notes: These figures capture how the compensating variation and equivalent variation differ by distance (measured by travel time, unit: hour) after the crackdown on licensed traders. The left hand side depicts compensating variation and the right hand side depicts equivalent variation.

Figure 3. CV and EV by travel time

Table 1. Categories of items on the list of expenditure

Category	Item code	Item definition	Item name
Food	1	Processed food	Beer, Soft drinks, Coffee, Sugar
			Salt, Cooking Oil, Macaroni
	2	Unprocessed food	White Teff (grain), Black Teff (grain),
			Wheat, Maize, Sorghum, Millet
			Lentils, Cow Peas, Horse beans
			Milk/Yogurt, Beef, Mutton, Chicken, Eggs, Butter
			Vegetables, Enset, Sweet Potatoes, Karia,
			Bananas, Gesho, Onions, Garlic, Tomato,
			Niger (Oilseed), Pumpkin, Papaya, Gomenzer (Oilseed), Kuche
			Honey, Spices, Tella/Tej
			Potatoes, Chick peas, Barley
Non-food	3	Manufactured non-food	Kerosene, Modern medical treatment, Clothes/shoes/fabric,
			Kitchen equipment, Linens (sheets, towels, blankets), Lamp/torch,
			Alcoholic beverages, Matches, Batteries, Candles,
			Laundry soap, Hand soap,
			Cosmetics, Exercise books, Pens, Pencils, Uniforms
Manufactured goods + processed food	1+3		
Unprocessed food	2		

Note: These are the items listed in the household survey. Community survey only includes Teff, Barley, Maize, Sorghum, Millet, Sesame, Niger, Beans, Salt, Sugar, Cooking oil, Kerosene and Coffee.

Table 2. How expenditure and variety of consumption vary over travel time: 2011

	[1]	[2]	[3]	[4]
	Expenditure		Variety	
VARIABLES	Manufactured + processed food	Unprocessed food	Manufactured + processed food	Unprocessed food
Travel time	-0.509***	-0.425**	-0.0704***	0.0348
	(0.148)	(0.186)	(0.0194)	(0.0638)
Livestock value	0.143***	0.0864*	0.0410***	0.0152
	(0.0317)	(0.0490)	(0.0140)	(0.0152)
No. of household members	0.252**	0.222*	0.0927***	0.0131
	(0.0942)	(0.125)	(0.0246)	(0.0517)
No. of male members	0.0386	-0.0416	0.0570**	0.0334
	(0.0813)	(0.107)	(0.0260)	(0.0370)
Age of household head	0.0149	0.0376	-0.00102	0.0134
	(0.0226)	(0.0321)	(0.00393)	(0.00864)
No. of teenagers	-0.103	-0.210	0.000578	-0.0858**
	(0.108)	(0.132)	(0.0222)	(0.0406)
No. of household members sqr	-0.0132**	-0.0144*	-0.00565***	-0.00145
	(0.00568)	(0.00821)	(0.00170)	(0.00341)
No. of male members sqr	-0.00125	0.00758	-0.00692**	-0.00367
	(0.0109)	(0.0116)	(0.00273)	(0.00449)
Age of household head sqr	-0.000135	-0.000461	-8.50e-06	-0.000186*
	(0.000252)	(0.000322)	(4.11e-05)	(9.14e-05)
No. of teenagers sqr	0.0124	0.0509**	0.00270	0.0160**
	(0.0157)	(0.0227)	(0.00420)	(0.00676)
Constant	5.978***	5.576***	1.906***	1.196***
	(0.725)	(0.808)	(0.171)	(0.182)
Observations	717	717	717	717
R-squared	0.206	0.072	0.301	0.055

Note: The table shows baseline OLS regressions for 2011 of consumption expenditure and variety on manufactured goods (including processed food) and unprocessed food by travel time to Atsedemariam. Column 1 - 2 show the results for expenditures while columns 3 - 4 show the results for variety in consumption. Standard errors are clustered at subsubkebele level. *** p<0.01, ** p<0.05, * p<0.1.

Table 3. A comparison of treatment and control groups before and after the crackdown on traders

	2011				2014				2014-2011			
	Treatment	Control	Diff	P-value	Treatment	Control	Diff	P-value	Treatment	Control	Diff	P-value
Livestock value	12315.71	12488.50	172.79	0.41	22956.79	21842.07	-1114.72	0.19	10641.09	9353.57	-1287.51	0.11
Number of household members	6.17	5.55	-0.61	0.00	6.37	5.73	-0.64	0.00	0.20	0.17	-0.03	0.39
Number of male members	3.28	2.85	-0.43	0.00	3.38	2.92	-0.46	0.00	0.10	0.08	-0.03	0.35
Age of household head	41.64	41.57	-0.07	0.47	44.68	44.58	-0.11	0.46	3.04	3.01	-0.04	0.46
Number of teenage members	1.94	1.61	-0.33	0.00	2.18	1.90	-0.29	0.00	0.25	0.29	0.04	0.32
Travel time	6.43	3.45	-2.98	0.00								
Obs	279	438			279	438			279	438		

Note: The table compares value of livestock, number of household members, number of male members, age of household head, number of teenagers and travel time between treatment and control groups in 2011, 2014 and the change from 2011 to 2014. The difference between treatment and control groups and its p-value are also calculated. Treatment group is defined as the households in subsubkebeles which experienced the crackdown of traders in 2014.

Table 4. Difference in consumption share on specific items between control and treatment groups

	Control - treatment	
	2011	2014
Coffee	5.00%	-0.45%
Birra	0.49%	-6.27%
Soft drink	-1.05%	-7.18%
Sugar	-13.89%	-24.27%
Salt	0.10%	0.33%
Cooking oil	-7.98%	-1.17%
Macaroni	-0.68%	-0.65%
Clothes	0.51%	2.36%
Kitchen equipment	10.21%	-8.74%
Linen	3.79%	-20.86%
Furniture	0.36%	-0.78%
Lamp	-9.48%	-12.81%
Cigarettes	0.00%	0.13%
Alcoholic beverage	2.89%	3.21%
Matches	-3.06%	-0.36%
Batteries	5.82%	3.20%
Candles	0.16%	-1.57%
Laundry soap	2.71%	-0.19%
Kerosene	-16.05%	-6.12%
Medicine	19.68%	0.54%
Books, pens, uniforms	-3.12%	-22.25%
Hand soap	-10.77%	-5.17%
Sendel and matent	0.02%	-22.93%
0% control < treatment in the baseline:	Soft drinks, sugar, cooking oil, marcaroni, lamp, matches, kerosene, books, soap.	
0% increase in 2014 for treatment:	Coffee, birra, soft drink, sugar, cooking oil, macaroni, kitchen equipment, linen, furniture, lamp, matches, candles, soap kerosene, books, cosmetics.	

Note: The first column shows the difference in share of items consumed between treatment and control groups in 2011, while the next column shows how the difference is affected by the crackdown on traders in 2014.

Table 5. Number of items consumed by treatment and control groups across the two years

	2011				2014				2014-2011			
	treatment	control	diff	p-value	treatment	control	diff	p-value	treatment	control	diff	p-value
Manufactured goods + processed food	11.63	11.81	0.18	0.21	12.11	13.26	1.15	0.00	0.48	1.45	0.97	0.00
Unprocessed food	4.29	4.20	-0.08	0.73	5.13	5.87	0.73	0.00	0.85	1.66	0.82	0.00
Obs	279	438			279	438			279	438		

Note: The table compares the total number of varieties of manufactured goods (including processed food) and unprocessed food between treatment and control groups in 2011, 2014 and the change between 2011 and 2014. The treatment group is defined as households in villages which experienced a crackdown on traders in 2014.

Table 6. The effect of the crackdown on traders on different categories of consumption

	[1]	[2]	[3]	[4]
	Expenditure		Variety	
VARIABLES	Manufactured + processed food	Unprocessed food	Manufactured + processed food	Unprocessed food
Treat * year14	-0.193	-0.189	-0.0744**	-0.111
	(0.146)	(0.255)	(0.0339)	(0.161)
Treat	-0.260**	-0.0982	-0.0268	0.0197
	(0.112)	(0.117)	(0.0199)	(0.0707)
Year14	0.530***	0.641***	0.0874***	0.263***
	(0.114)	(0.154)	(0.0313)	(0.0407)
Livestock value	0.106***	0.0733**	0.0327***	0.0137
	(0.0226)	(0.0339)	(0.00988)	(0.0129)
No. of household members	0.218**	0.277*	0.111***	0.0124
	(0.103)	(0.139)	(0.0237)	(0.0476)
No. of male members	0.102	-0.00281	0.0386	0.0553
	(0.0846)	(0.120)	(0.0291)	(0.0407)
Age of household head	0.0267*	0.0220	0.000366	0.00466
	(0.0135)	(0.0158)	(0.00267)	(0.00617)
No. of teenagers	-0.0539	-0.147*	0.00170	-0.0571***
	(0.0698)	(0.0828)	(0.0105)	(0.0191)
No. of household members sqr	-0.0107	-0.0172*	-0.00656***	-0.00130
	(0.00663)	(0.00913)	(0.00155)	(0.00318)
No. of male members sqr	-0.00787	0.00295	-0.00449	-0.00526
	(0.0103)	(0.0134)	(0.00361)	(0.00432)
Age of household head sqr	-0.000267*	-0.000266	-2.84e-05	-8.97e-05
	(0.000149)	(0.000168)	(2.75e-05)	(6.62e-05)
No. of teenagers sqr	-0.00168	0.0262	-0.000340	0.00821**
	(0.0116)	(0.0164)	(0.00189)	(0.00352)
Constant	5.315***	5.052***	1.827***	1.374***
	(0.332)	(0.337)	(0.0949)	(0.0865)
Observations	1,434	1,434	1,434	1,434
R-squared	0.219	0.110	0.313	0.110

Note: The table shows difference-in-difference regressions with data on 2011 and 2014 of expenditure on manufactured goods (including processed food) and unprocessed food over travel cost which is measure by travel time to Atsedemariam. Column 1 - 2 show the results of amount of expenditure while columns 3 - 4 show the results of variety of expenditure. "Treat" is a dummy variable which equals 1 if the household belongs to the treatment group. Treatment group is defined as the households in subsubkebeles which experienced the crackdown of traders in 2014. "Year14" equals 1 if data comes from 2014 survey. $Treat * year14$ is the interaction term between the two which captures treatment effect. Standard errors are clustered at subsubkebele level. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. The effect of the crackdown on traders on manufactured goods and unprocessed food: at the border

VARIABLES	[1] Amount	[2] Variety
Treat * year14	-0.253	-0.229**
	(0.173)	(0.0588)
Treat	-0.242	0.0867*
	(0.121)	(0.0295)
Year14	0.664**	0.187**
	(0.133)	(0.0513)
Livestock value	0.167	0.0568
	(0.0989)	(0.0362)
No. of household members	0.168	0.0687
	(0.124)	(0.0365)
No. of male members	0.422*	0.152
	(0.147)	(0.0719)
Age of household head	0.0410	0.00352
	(0.0195)	(0.00812)
No. of teenagers	-0.0780	-0.0138
	(0.136)	(0.0426)
No. of household member sqr	-0.00308	-0.00403
	(0.00845)	(0.00201)
No. of male member sqr	-0.0584*	-0.0220
	(0.0245)	(0.00949)
Age of households head sqr	-0.000416	-5.19e-05
	(0.000196)	(8.35e-05)
No. of teenagers sqr	-0.0118	0.00723
	(0.0273)	(0.00634)
Constant	4.029***	1.435***
	(0.550)	(0.168)
Observations	326	326
R-squared	0.287	0.380

Note: The table shows difference-in-difference regressions in 2011 and 2014 of expenditure on manufactured goods (including processed food) for the villages at the border of the treatment/control groups. Column 1 shows the results for expenditures while column 2 shows the results for variety in expenditure. Standard errors are clustered at hamlets level. *** p<0.01, ** p<0.05, * p<0.1.

Table 8. Compensating variation and equivalent variation for manufactured goods and processed food

	Treatment	Control	Different
CV	0.42	0.29	0.13
EV	0.21	0.11	0.1

Note: The table shows compensating variation and equivalent variation as a percentage of expenditures for manufactured goods and processed food. We calculate the results for treatment and control groups separately.

Table 9. Robustness check: the effects on consumption using a different measure of travel cost (cost of donkeys plus opportunity cost of time) in 2011

	[1]	[2]	[3]	[4]
	Amount		Variety	
VARIABLES	Manufactured + processed food	Unprocessed food	Manufactured + processed food	Unprocessed food
Travel cost	-0.398***	-0.339**	-0.0517***	0.0493
	(0.110)	(0.147)	(0.0170)	(0.0494)
Livestock value	0.143***	0.0864*	0.0412***	0.0159
	(0.0324)	(0.0497)	(0.0141)	(0.0149)
No. of household members	0.252**	0.221*	0.0930***	0.0151
	(0.0957)	(0.127)	(0.0251)	(0.0516)
No. of male household members	0.0424	-0.0378	0.0573**	0.0312
	(0.0816)	(0.106)	(0.0259)	(0.0365)
Age of household head	0.0149	0.0375	-0.000975	0.0137
	(0.0230)	(0.0324)	(0.00392)	(0.00869)
No. of teenagers	-0.0960	-0.203	0.00130	-0.0882**
	(0.109)	(0.134)	(0.0224)	(0.0402)
No. of household members sqr	-0.0133**	-0.0144*	-0.00568***	-0.00160
	(0.00576)	(0.00828)	(0.00173)	(0.00342)
No. of male members sqr	-0.00240	0.00655	-0.00705**	-0.00337
	(0.0109)	(0.0114)	(0.00273)	(0.00447)
Age of household head sqr	-0.000138	-0.000463	-9.25e-06	-0.000188**
	(0.000257)	(0.000325)	(4.10e-05)	(9.14e-05)
No. of teenagers sqr	0.0114	0.0500**	0.00259	0.0162**
	(0.0160)	(0.0231)	(0.00423)	(0.00670)
Constant	6.822***	6.314***	2.007***	1.030***
	(0.909)	(1.082)	(0.182)	(0.247)
Observations	717	717	717	717
R-squared	0.201	0.070	0.299	0.058

Note: The table shows baseline OLS regressions for 2011 of expenditures and variety in manufactured goods (including processed food) and unprocessed food by travel cost which is measure by cost of renting a donkey plus opportunity cost of time to Atsedemariam. Column 1 - 2 show the results of total expenditures while columns 3 - 4 show the results of variety in expenditure. Standard errors are clustered at village level. *** p<0.01, ** p<0.05, * p<0.1.

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