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The power of the vegetable patch: How home-grown food helps large rural households achieve economies of scale & escape poverty

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ABSTRACT

This paper explores how the household's capacity to grow food impacts their ability to achieve economies of scale in food consumption and how this impacts the geographic distribution of poverty across rural and urban areas. An accurate understanding of consumption economies of scale is vital for comparing poverty levels across households of varying size. Using Sri Lankan data on home-grown food consumption, we empirically confirm that such economies of scale exist and that large households tend to consume relatively more home-grown food than smaller households. The magnitude of these scale economies are found to be larger than those in market purchased food, but smaller than those found in housing expenditure. Consuming more home-grown food is also found to be positively correlated with per-capita calories consumed. Taking these effects into account in poverty estimates leads to a 15 per cent decline in the number of household who fall below the poverty line in rural regions.

1. Introduction

It is universally accepted that as the size of a household increases, the per-capita costs for maintaining a given standard of living tends to fall because large households achieve economies of scale in consumption (Nelson, 1988). Accurately estimating the magnitude of these falls is crucial for accurately measuring poverty levels and making inter-household comparisons of welfare (Deaton and Paxson, 1998; Gibson, 2002; Yu and Abler, 2016). In spite of this consensus, how precisely large households achieve economies of scale in consumption is not well understood. To date, the two main ways that have been discussed include the consumption of public goods that can be shared within the household and use of bulk purchases through which large household realize discounts on necessities (Nelson, 1988; Lanjouw and Ravallion, 1995).

We investigate whether a third possible avenue for achieving economies of scale in consumption lies in the tendency for large households to consume home-grown food. In the developing world, food expenditure is the crucial as its overall share of expenditure is large, especially among the poorest households (Banerjee and Duflo, 2007). Studies have found that economies of scale in food consumption exist (Kakwani and Son, 2005; Logan, 2011) and appear to be greater in developing countries (Deaton and Paxson, 1998). Small-scale vegetable farming is a common feature of rural life in developing countries through which families can supplement their monetary income by growing their own food. The International Fund for Agricultural Development estimates that 75% of the world's 1.2 billion poor live in rural areas (IFAD, 2011). Of these, an estimated 50% are food producing small-hold farmers (Morton, 2007). This pervasiveness suggests that if home-grown food is a source of economies of scale in food consumption, then both poverty estimates and the distribution of poverty across rural and urban areas could be severely biased (Sabates et al., 2001). Developing countries typically possess both a large rural population and a agricultural sector that enable many households to learn about food cultivation (Hassan and Babu, 1991; Coale and Hoover, 2015; Hickey et al., 2016). Because of its time-intensive nature, it seems intuitive home-grown food could be one way through which large households that have more labour at their disposal achieve economies of scale in consumption.

We seek evidence for this conjecture by using Sri Lanka household expenditure data to quantify the extent to which home-grown food delivers economies of scale. After estimating the magnitude of these economies of scale and comparing it to economies of scale in other areas of consumption, we also verify whether large households utilize this option by studying how the ratio of home-grown food to purchased food varies with household size. Thirdly, we check whether the per-capita observed reductions in costs really do reflect lower living costs

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for larger households. Lower per-capita expenditure on food could also occur if members of large households consumed less food than their counterparts in small households. We rule out this possibility by estimating the calories consumed for each household based on their food expenditure and empirically exploring how the household's decision to grow food at home impacts on per-capita calories consumed.

In terms of policy implications, we show how taking into account this phenomenon has important implications in rural poverty estimates and the number of rural households found to be below the poverty line in Sri Lanka. If policymakers want to accurately target the poorest, it is vital to take into account the effects in order to obtain an accurate picture of the geographical distribution of poverty across rural and urban areas. In this regard, our results suggest that current poverty estimate in rural Sri Lanka are overestimated by 15 per cent. Secondly, it also underlines the potential effectiveness of policies that support the capacity of large households to grow their own food in rural areas. Several studies have found evidence that home gardening increases food security and nutritional diet in developed economies (Kortright and Wakefield, 2011; Gray et al., 2014; Taylor and Lovell, 2014; Jayasuriya et al., 2013; Korale-Gedara et al., 2012).

We also make a small contribution to resolving the 'Deaton-Paxson' paradox in developing countries. Deaton and Paxson (1998) argued that if food is a private good, the presence of economies of scale should cause large households to consume more food per-capita. Paradoxically, they observe that precisely the opposite is the case - large households tend to consume less food per-capita. It seems counterintuitive that large households who are better off consume less food on a per-capita basis, assuming that food is a private good and not a public good that can be shared (Gan and Vernon, 2003). Elsewhere, Deaton and Paxson acknowledge that certain aspects of food may not be private in nature, such as the time spent on preparing food (Deaton and Paxson, 2003). In their view, this deepens the paradox since the reductions in cost associated with food preparation time at home should lead to larger households consuming more food. Yet this would only be true if food preparation time and food expenditure are complements. If they are substitutes such that households who spend more time preparing their own food tend to spend less on purchased food, then large households who prepare their own food will reduce their spending on food and use the saving to spend on non-food luxuries (Vernon, 2005). In the case of home-grown food, we argue that the act of growing food at home is another type of time-intensive substitute for purchased food (such as restaurant meals or precooked meals) that large households can switch towards and thereby reduce their reliance on food purchased from the markets. If confirmed, this would suggest that an answer to observing the Deaton-Paxson paradox in rural areas in developing countries is that while large households in rural areas may be *spending* relatively less on food, they are not necessarily *consuming* less food, as more of their consumed food may be home-grown in nature, which does not tend to be captured in most household expenditure surveys in developing countries.

The Sri Lankan household survey data was chosen for this study as it is one of the few surveys in the developing world that contains data on the consumption of home-grown food. Household food consumption is captured in very fine detail: a total of 249 food and beverages items are recorded in the data that belong to 18 sub-categories. This exhaustive list of sub-categories include cereal, prepared food, pulses, vegetables, yams, meat, fish, dried fish, eggs, coconuts, condiments, other foods, milk and milk products, fats and oils, sugar, fruits, confectionery and non-alcoholic beverages. Such detailed coverage helps ensure we attain a comprehensive picture of how home-grown food is consumed by households. In addition, the food diary recording period in Sri Lanka lasts only one week, while most survey record data for two weeks. This shorter period help reduce measurement bias related to recall error, which is likely to occur especially among large households (Deaton and Grosh, 2000).

In terms of our methodology, this paper focuses on estimating Engel equivalence scales (economies of scale in food consumption) because our research question is focused on how food consumption patterns change across households of varying size. While other methods have since been developed that take into economies of scale in other areas of household consumption, food expenditure is still the most important expenditure item among the poor (Banerjee and Duflo, 2007) and Engel equivalence remains by and large the dominant method for devising welfare-related policies (Sabates et al., 2001; Hasan, 2016; Chang et al., 2016; Chiappori, 2016; Perali, 2002).

The paper is structured as follows. Section 2 presents a model of household behavior that highlights how the presence of economies of scale in homegrown food alters food spending patterns of large households. Section 3 discusses the data and Section 4 discusses the empirical methodology. Section 5 presents the results and Section 6 discusses the implications for estimating poverty and policy implications. Section 7 concludes.

2. A model of economies of scale

This Section presents a simple stylized model of household that conceptualizes the household's decision to grow food at home versus purchasing food from the market. The basic argument here is that if economies of scale in home-grown food exist, then we expect to find a positive correlation between household size and the per-capita consumption of home-grown food and a decline in the per-capita consumption of market purchased food. This is a modified version of the household production model presented in Vernon (2005). The basic starting assumption of the current model is that home-grown food is a labour intensive substitute for market-purchased food. For example, household can choose to devote labour to grow their vegetables or buy them from the market. Larger households endowed with more labour will therefore choose to grow more food at home, thereby reducing expenditure on market-purchased food. A household is comprised of n identical individuals, who derive utility by consuming three goods, denoted by, where $i = 1, 2, 3$. Let $i = 1$ denote market-purchased food, $i = 2$ denote home-grown food and $i = 3$ denote non-food items. Total household consumption of these items is denoted by x_i. Per-capita consumption is x_i/n. The presence of economies of scale is represented by the ϕ_i parameter, which is a function of the household size $\phi_i(n)$. The household utility function U is:

$$U = n.\, u\left(\frac{x_1}{\phi_1(n)}, \frac{x_2}{\phi_2(n)}, \frac{x_3}{\phi_3(n)}\right) \tag{1}$$

Economies of scale may be present in each of these three goods. Economies of scale in market-purchased food (i.e. $\phi_1(n)$) may arise if larger households spend less per-capita expenditure on purchased food ingredients to consume the same amount of food as smaller households. This may occurs as a result of the larger households being able to save more from bulk purchases, quantity discounts, and substitution of home-produced meals for expensive food-away-from-home (Nelson, 1988). Economies of scale in home-grown food (i.e. $\phi_2(n)$) may occur as a result of increasing returns to scale in agricultural production (Paul and Nehring, 2005). Economies of scale arising from the consumption of non-food items (i.e. $\phi_3(n)$) may occur as a result of the joint consumption of household public goods (Nelson, 1988). The scale of these consumption economies is given by:

$$\phi_i(n) = n^{(1-\sigma_i)} \quad i = 1,2,3 \tag{2}$$

Here $0 \leqslant \sigma_i \leqslant 1$ is the scale elasticity of the ith commodity within household. If $\sigma_i = 0$ then $\phi_i(n) = n$. This implies that the good is a private good that cannot be shared and must be replaced if all members in the household are to enjoy the good to the same degree as a single person household.[1] If $\sigma_i = 1$ then $\phi_i(n) = 1$, implying that the good is a pure public good that can be enjoyed by any number of household members, without diminishing the enjoyment of others in the

[1] In other words, this is the same as x_i/n.