Mao's Legacy: Access to Land and Hunger in Modern China*

Robin Burgess
Department of Economics, LSE, BREAD, CEPR and NBER

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Abstract

Mao came to power on the back of radical land reforms. Using household data from a rich and poor province we show that access to land within rural localities remains universal and egalitarian in 1990. Land owned by village governments is allocated to households on the basis of thier demographic composition which is a proxy for nutritional need. This feature distinguishes China from other low income countries. Non-market allocation enables us to study the channels through which access to land influences hunger. Land both generates income and, if food markets are incomplete, serves as a source of cheaper calories relative to the market. We show that this latter own-price effect is empirically important but diminishes with market development. These results indicate that Mao's legacy of universal and egalitarian access to land represents a key means of avoiding hunger. This helps us to understand how China has managed to escape the high levels of hunger which typify low income countries.

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1 Introduction

Mao came to power on back of set of radical land reforms which led to the destruction of feudal power relationships in agriculture. We show that these reforms have had far reaching implications for the manner in which cultivable land is allocated to households in modern China. Using household data from a rich and a poor province in 1990 we illustrate how village governments, which are the *de jure* owners of land, allocate land to households resident in the village. We show that non-market allocation results in universal and egalitarian access to land within localities. This key institutional feature which is a direct legacy of Mao's reforms distinguishes China from most other low income countries.

We then go on to study how access to land affects hunger. We posit that the impact of access to land on calorie consumption will depend on the degree of market incompleteness in food markets. Where food markets are complete, home produced and purchased calories are perfect substitutes and having access to land has no impact on the price households pay for calories. However as the price of home produced calories falls below market prices then having access to land confers a price advantage. In this situation land is valuable both as a source of income but also because it confers a price advantage vis a vis purchasing food in the market.

Non-market allocation enables us to study, in household data for 1990, these different channels through which access to land can affect hunger hunger. To do this we run calorie regressions where we control for income and include land as a right hand side variable. We then interpret the coefficient on land as giving some indication of the importance of the own price effect. We run these regression for the rural sectors of a backward and fast growing area of China. We find that though the own price effect is important in both locations the size of the effect is larger in the backward province. Having access to land confers a substantial additional benefit to households in China by providing them with a cheaper source of calories. However, the importance of this effect diminishes with market development. This is consistent with the idea that having access to land is particularly important in areas where food markets are underdeveloped. To establish the robustness our results we carry out a battery of tests to show the effect of land on consumption is different for food and non-food consumption and for home and purchased calories.

These results indicate that Mao's legacy of universal and egalitarian ac-

cess to land represents a key means of avoiding hunger. This helps us to understand how China has managed to escape the high levels of hunger which typify low income countries.

The paper is organized as follows. Section 2 provides contains an analysis of how land is allocated by nonmarket village level institutions. Section 3 examines the theory of how access to land may affect hunger in complete and incomplete market settings. In section 4 we then test the predictions of the theory in household data to gain insights into the mechanisms through which access to land may be influencing nutritional welfare. Section 5 offers concluding comments and traces out broader implications for policy.

2 Land Allocation in Modern China

Our understanding of the land tenure arrangements in China before Mao's reforms in the 1940s remain patchy. Western visitors to China in the 1920s and 1930s paint a picture where land scarcity is the predominant cause of high levels of hunger and poverty (see Tawney, 1932; Buck, 1937). Famines were widespread and severe and periods of hunger were a fact of life for many Chinese peasants (Tawney, 1932). Ownership of land was highly unequal. The best estimates from this period suggest that, taken together, landlords (who were rich enough to avoid doing agricultural labor) and rich peasants (who did agricultural labor but also relied heavily on tenants and hire labor) typically owned upward of half the land though their share in the population typically did not exceed 10 percent (Moise, 1983). Poor peasants and agricultural laborers who owned little or no land formed the majority of the population (Moise, 1983).[1] It was this group which suffered the worse ravages of hunger and who were viewed by Mao as being exploited by landlords and rich peasants as tenants, hired laborers and via taxes and high interest loans.[2]

[1] Based on a survey carried out in 1936, Moise (1983) reports that 51 percent of farming households were tenants in Sichuan and 30 percent in Jiangsu. These are comparable to tenancy rates found in countries like India.

[2] Communist analysis of rural class structure was based on the notion of exploitation defined as an economic relationship in which one person is able to obtain wealth from another person's labor. Landlord and rich peasants were therefore viewed as exploiters and poor peasants and agricultural laborers as the exploited. Middle peasants who mainly owned and farmed their land niether exploited others or were exploited.

Land reform formed the bedrock of social revolution in China. The rallying call of Mao and the Communist Party was that landlords and rich peasants owned 70 to 80 percent of the land but only constituted 10 percent of the population. Radical land reforms, focused on the confiscation (by force) of land from landlords and rich peasants, were enacted from 1945 to 1953 as the Chinese Communist Party took control of the country. The land reforms took place in northern China during 1945-1948 then spread to southern China between 1949 and 1953 (Moise, 1983). Confiscated land was redistributed to poor peasants and agricultural laborers leading to a significant equalization in land ownership within localities. The idea of the land reform was to destroy the feudal power relationships which existed between landlord and peasant and in the process to create a new political class in the countryside.[3]

Collectivization which took place after 1954 when private ownership and trade of land was banned led to a highly egalitarian distribution of rights to land among households within the same locality. Though successful from a distributional perspective, collectivization was associated with a number of incentive failures which led to its abandonment after 1978 (see Lin, 1992). The household responsibility system (HRS) which gradually replaced collectivization strengthened incentives for production by making households residual claimants to the value-added created on their farms subject to meeting various contractual obligations to the village collective and state. By strengthening individual incentives this institutional change resulted in a large scale increase in agricultural productivity. This system came to be widely adopted after 1978 and was formally recognized by the Central Committee of the Party in 1984 on the condition that land continued to be owned by the collectives (see Wen,1991; Dong, 1995).

Under HRS, village collectives are *de jure* owners of land which previously had been collectively farmed and typically lease land to households on 15 year contracts.[4] Ownership rights imply that they are autonomous in deciding

[3]The first "Land Law of the Chinese Soviet Republic" which was applied in the Jiangxi base area between 1931 and 1934 was inspired by Stalin's reforms called for landlords to be stripped of all thier land and set to doing forced labor and for rich peasants to be left with only some land of inferior quality. Mao Zedong who took power after 1934 moderated this reform so that landlords and rich peasants could retain some limited land to farm as long as they fully supported the revolution. A large number of landlords and rich peasants who were deemed counterrevolutionary were nonetheless killed during the land reforms of 1945-1953 (Moise, 1983).

[4]Small private plots which had been allocated to households to produce fruits, vegeta-

how land will be allocated to households. They also have the power to adjust allocations without incurring contractual penalties. The contract length is typically 15 years. Village collectives retain discretionary power to adjust the overall allocation of land to take account of changing demographics and other factors.[5] Contracts are thus not renegotiation proof and minor adjustments to take account of increasing and declining household sizes or changes in the principal occupation of household members are common.[6] An adjustment tract of land is often maintained to allow village governments to absorb demographic changes without having to change the assignments made to households which have not changed in size.

Land contracting occurs at the level of the natural village which typically had previously been a production team in the collective era. What is referred to as a village in our data is actually an administrative unit which covers a number of natural villages. Land is only contracted to persons registered as permanent members of the village.[7] Registration takes place shortly after birth if a person's mother is registered there and typically is for life. It is both difficult and unusual for registration to switch to another village[8] or to an urban area.[9]

Public meetings are held to discuss land allocation. However, the elected village leader ultimately has discretion over how land is divided (see Wen, 1991; Putterman, 1993)[10] In return for land, households have to comply with

bles, tobacco and produce for feeding chickens and pigs during the collective period are not subject to contracting.

[5] 15 years should therefore be seen as an upper bound (see Wen, 1991).

[6] Given that the aggregate size of the land resource base is typically fixed, this is necessary to uphold the principle of universal entitlement.

[7] The suggestion in the literature is that all permanent members are eligible to contract land from the village government (Wen, 1991; Putterman, 1993; Kung, 1995; Dong, 1995).

[8] A women who is registered as a permanent resident of her mother's village can change registration to her husband's village upon marriage. Movement of husbands to their wife's village is rare and usually only takes place if the wife's father has no sons to farm the family land.

[9] Migrants to urban areas remain registered in their home village. They retain rights of access to village land but the land allocation to the household from which they originate may be reduced during their absence.

[10] Allocation rules are village specific. However, the suggestion in the literature is that there is typically an attempt to equivalise both the areal extent and productivity of land assigned to different households. For example, information on the productivity of different fields may be solicited from farmers (which know the fields) and this information used to classify village land into areas with different productivity levels with households receiving

certain obligations to the state (quota and land taxes)[11] and village collective (land rent). These obligations are divided *pro rata* according to the amount of land contracted and are therefore in essence lump sum taxes. If the household fails to comply with these obligations then the village collective has the power to confiscate land. If land is disregarded and left fallow then land can also be confiscated.

Our study takes place in 1990 twelve years after the onset of rural reforms in 1978. We make use of State Statistical Bureau (SSB) rural household data on two very different provinces. Jiangsu is a rich, coastal province where since 1978 structural change has been pronounced and markets have developed rapidly. In contrast, Sichuan is a poor, inland province where market development has been limited since 1978 and where dependence on agriculture is still pronounced. Table 1 outlines key characteristics of samples drawn from these two provinces.

We can use this data to directly examine how land was allocated in these two very different provinces.[12] To do this we run regressions of the form:

$$A_h = \alpha + \sum_{j=1}^{J} \gamma_j n_j + \lambda n_{c>2} + \delta z + u \tag{1}$$

where A_h is the holding of cultivable land of the hth household, n_j are demographic classes and z are village dummies. The γ shown in Table 2 are therefore interpretable as the marginal area of land (measured in hectares) allocated to an individual of type j. Regressions also include dummies ($n_{c>2}$) for whether a household has more than two children to check whether increments of land associated with additional children decrease beyond this limit. Village dummies (z) are included to control for across village variation in unobservables which may affect the form of the land allocation rule.[13]

plots in each of the areas. As a result, a single household will typically hold a number of spatially separated plots. Dong (1995) reports that the average number of plots farmed by a household in 1990 in China as a whole was 5.52.

[11] Previously these represented obligations of the village which have been decentralised to the household following adoption of HRS and now form part of the contractual agreement between the village government and household. Because it is liable to certain penalties, the village collective still has a role in enforcing these obligations to the state and this may constitute an added incentive to divide land relatively equally among households.

[12] See the Data Appendix for detail on the construction and sources of variables.

[13] Village land quality and parameters of the contractual environment (e.g. grain quotas, land rent rates, land tax rates) can all be absorbed in this manner.

The first striking feature of the data is that there is universal access to land. To be exact, one household in Sichuan and ten households in Jiangsu are without cultivable land. This is a first feature that sets China apart from other developing countries and is a direct consequence of non-market allocation of cultivable land.

Columns (1) and (3) of Table 2 also provides clear evidence that land allocations resemble demogrants - that is transfers which are a function of a vector of demographic characteristics of the household (Deaton and Stern, 1986). Allocation of land is sensitive not only to household size but also to household composition. If land is allocated solely on the basis of household size, then γ coefficients would be roughly equal across demographic classes. F tests carried out to check whether age classes could be pooled in the land allocation regressions rejected the validity of imposing these restrictions in all cases.[14] The hypothesis that land is allocated (solely) on the basis of the number of agricultural labourers in the household (see Wen, 1991) can also be rejected. Table 2 indicates that the young, the old and those engaged mainly in off-farm employment are taken into account in the allocation of land.[15]

The overall form of the land allocation rules are strikingly similar across the two provinces. To aid comparison we can derive a land 'equivalence scale' (M), with allocations to farm adults serving as the reference class which can be normalized to unity. Allocations to children 0-4, 5-9 and 10-14 constitute about 0.23, 0.55-0.6 and 0.75-0.88 of transfers to farm adults respectively.[16] The elderly (55+) also receive similar treatment in the two provinces receiving an average allocation which is about 0.8-0.9 of that to farm adults.[17]

Taken together, these results indicate that village governments allocate land to households in line with nutritional need which is proxied for by demographic composition. Observed allocations reflect the outcomes of a

[14] Land is therefore not being allocated purely on a per capita basis.

[15] F tests reject exclusion of the young, the old and those engaged mainly in off-farm employment. This was even the case where we looked at a more disaggregated age breakdown including very young (0-1) and very old (70+) groups.

[16] This corresponds to individuals aged 0-4, 5-9 and 10-14 receiving 0.016-0.021, 0.041-0.050 and 0.062-0.069 hectares respectively. The lower bounds corresponding to Sichuan where there is lower aggregate availability of cultivable land.

[17] The allocation to the elderly is intermediate between that to children 10-15 and farm adults.

complex bargaining process between village governments and member households. Given limited labour mobility and off-farm employment opportunities, the main concern of households may be to obtain sufficient land to satisfy nutritional needs. The observation of universal access to land suggests that subsistence concerns of all village households are being taken into partly into account in the bargaining process which is a departure from what we typically observe in developing countries.

In Table 2 we observe that the dummies for having more than two children in the household are negative and significant. This is likely to be due to the fact that village governments both allocate land and are responsible for imposing strict family planning policies which limit rural household to having no more than two children. This limits the ability of households to acquire extra land via reproduction.

In columns (2) and (4) of Table 4 we include a dummy for whether the household contains a containing village government official. It is these individuals which control the land allocation process. The dummy is insignificant in both provinces providing a strong suggestion that households have limited ability to affect the amount of land they receive. These results make us more confident that the amount of land a household receives from the village council is outside the choice set of the household. If the amount of land a household receives is determined by the egalitarian allocation rule being implemented by the village governments and not by the actions of household then this provides us with the opportunity to directly study the different mechanisms through which access to land can affect hunger in China.

In Table 3 we array per capita calories, per capita land and per capita expenditure by per capita expenditure (PCE) deciles for rural Sichuan and rural Jiangsu. Non-market land allocation results in a highly egalitarian distribution of land across the distribution of income (see columns (4) and (5)). The egalitarian distribution of land is associated with relatively high levels of calorie availability particularly in the lower deciles. If we take the World Health Organization figure of 2100 calories per capita as our hunger cut-off (see United Nations, 1993) then it is apparent that hunger is mainly a threat to those in the bottom decile in Jiangsu and to those in the bottom two deciles in Sichuan.[18] We contrast the Chinese figures with those taken

[18]We define hunger in this paper in terms of calorie availability that is continuously inadequate to meet dietary energy requirements. Hunger refers specifically to inadequate calorie availability in the same way that poverty refers to inadequate income.

from a similar expenditure survey for the state of Maharashtra in India in 1983 (Subramanian and Deaton 1993, 1996). Calorie availability for the poor appears to be considerably higher in rural China than it is in rural India which in part likely to be due to the fact that even the poorest in China have access to some land (Table 3).[19] In contrast the poorest group in rural India, agricultural laborers, are defined by their lack of land.

Taking this theme forward we see in Table 4 for a range of nutritional indicators China in 1990 clearly outperforms India in 1990 despite similarities in GDP per capita. Indeed in the group of low income countries China is a clear outlier in terms of nutritional indicators and even outperforms the bulk of middle income countries (see World Health Organization, 1997).[20] For example, China dominates *all* low income countries in terms of calorie per capita figures (see World Bank, 1993). Non-market allocation whereby village owned land is allocated to households on the basis of nutritional needs is likely to underpin these achievements. It represents the key means of avoiding hunger for the eight hundred million or so Chinese that reside in rural areas.

3 Access to Land and Hunger

We now turn to the question of how access to land can affect hunger. We trace out two mechanisms. The first is straightforward. Land generates income and therefore, *ceteris paribus,* enables households with access to attain higher calorific intake than those without. The second mechanism works through prices. If food markets are incomplete having access to land will convey an additional nutritional benefit to a household by serving as a cheaper source of calories relative to the market. Households with more land face lower prices for the calories they consume than households with less land.

To look at these linkages in detail we develop a simple agricultural household model. We begin by examining the perfect markets case where home produced produced and purchased calories are perfect substitutes. In this case access to land affects hunger only via the income route. We then go on to examine the imperfect markets case where the prices of these two sources of calories diverge from one another. In this case both income and own price

[19] See United Nations (1993).Undernutrition typically affects the bottom 40% to 50% of the income distribution in India (see Osmani, 1991).

[20] China dominated *all* low income countries in terms of calorie per capita figures

effects operate.

A household is assumed to maximize a utility function:

$$u(x_c, x_m, x_l) \tag{2}$$

where the commodities are calories (x_c)[21], a non-food manufactured good (x_m) and leisure (x_l). Utility is maximized subject to a full income constraint which captures the cash, time and production constraints facing the household:

$$p_c x_c + p_m x_m + w x_l = wT + \pi \tag{3}$$

where $\pi = p_c Q(L, \overline{A}) - wL$ where Q is production of the calories, $\overline{A}$ is land, L is total labour input and T is the aggregate time constraint which is treated as exogenous.[22]

3.1 Perfect Markets Case

Calories and labour are provided by the family and eventually traded on the market. When markets exist for these commodities, they are considered homogenous, with perfect substitutability of domestic and market supply and with an exogenous price $(p_i = \overline{p})$.

The first order condition with respect to labour is:

$$\frac{\partial \mathcal{L}}{\partial L} = \lambda \left[p_c \frac{\partial Q}{\partial L} - w \right] = 0 \tag{4}$$

and therefore:

$$\frac{\partial Q}{\partial L} = \frac{w}{p_c} \tag{5}$$

Therefore labour (L) is independent of the choice of x_c, x_m, x_l. Labour demand is a function of prices (p_c, w), technology and landholding and utility maximization is thus separate from profit maximization (see Benjamin, 1992). Separability between production and consumption decisions is the defining feature of the perfect markets case.

[21] Note that because we are abstacting from commodity heterogeniety concerns in the model, the terms food and calories can be used interchangeably as calories are just equal to food times a fixed conversion factor.

[22] This formulation is derived from the agricultural household model literature (Singh, Squire and Strauss, 1986; de Janvry, Fafcahmps and Sadoulet, 1991; Benjamin, 1992; Goetz, 1994).

As a result, maximized profit (π^*) can be treated as exogenous to the households consumption decisions. Maximizing utility with respect to the full income constraint it follows that demand for calories can be written as:

$$x_c = x_c(p_c, p_m, w, y^*), \text{ where } y^* = \pi^* + wT = y^*(\overline{A}, w, p_c) \tag{6}$$

and the effect of land on calorie consumption can be written as.

$$\frac{\partial x_c}{\partial \overline{A}} = \frac{\partial x_c}{\partial y^*}\frac{\partial y^*}{\partial \overline{A}} \tag{7}$$

This leads to our first result:

Result 1: *Under perfect markets land only has an effect on calorie consumption via its effect on income.*

Signing this effect is straightforward. The first term is positive by virtue of calories being a normal good. Given that T is assumed to be exogenous the second term is equivalent to $\frac{\partial \pi^*}{\partial \overline{A}}$. Writing out maximized profits as:

$$\pi^* = p_c Q[L^*(\overline{A};.), \overline{A}] - wL^*(\overline{A};.) \tag{8}$$

and taking the total differential with respect to land we have:

$$\frac{\partial \pi^*}{\partial \overline{A}} = \frac{\partial L^*}{\partial \overline{A}}[p_c Q_L - w] + p_c Q_A \tag{9}$$

from the first order condition with respect to labour we know that the first term is equal to zero so the overall effect of land on profits is $p_c Q_A$ which is positive. Therefore the overall effect of land on calorie consumption (operating through income) is positive.

3.2 Imperfect Market Case

Household implicitly face shadow prices for the home produced calories they consume (see Neary and Roberts, 1980). In the perfect markets case this is equal to the market prices and home produced and purchased calories are perfect substitutes. However, with imperfections in the calorie market (due to such factors such as quotas, risk associated with uncertain prices and availabilities, transportation costs, merchant mark-ups etc) buying prices (p_c^b)will

tend to lie above selling prices (p_c^s) and shadow prices ($\widetilde{p}_c$) which balance internal supply and demand may diverge from market prices (see Neary and Roberts, 1980; de Janvry, Fafchamps and Sadoulet, 1991). Endogeneity of shadow calorie prices introduces the possibility that they may be affected by household landholding thus introducing an additional own price effect in the relationship between land and calorie consumption.

To see this, consider the limiting case of a household where the calorie market is missing. Such a case may arise, for example, where the shadow calorie price falls between buying and selling prices ($p_c^s < \widetilde{p}_c < p_c^b$). The cost of a transaction through market exchange creates disutility greater than the utility it produces so that the household does not participate in the market. As a result the household has to equate calorie consumption with calorie production, the equilibrating factor being the shadow price of calories:

$$x_c(\widetilde{p}_c, p_m, w; \pi^*(\widetilde{p}_c, p_m, w, \overline{A}) + wT + E) = Q(\overline{A}, L(\overline{A}, \widetilde{p}_c^h, w)) \tag{10}$$

where $\widetilde{p}_c$ is the uncompensated shadow price of calories. Now when we take the differential of calorie demands (x_c) with respect to land:

$$\frac{dx_c}{d\overline{A}} = \frac{\partial x_c}{\partial y^*}\frac{\partial y^*}{\partial \overline{A}} + \frac{\partial x_c}{\partial \widetilde{p}_c}\frac{\partial \widetilde{p}_c}{\partial \overline{A}} \tag{11}$$

Result 2: *In incomplete food market settings access to land can affect calorie demand though two distinct mechanisms: (i) via an income effect, (ii) via an own price effect.*

To sign the second effect we use the fact that at the household's optimum utility level, Marshallian demand will be equal to Hicksian demand ($x_c = x_c^h$) and the compensated shadow price will be equal to the uncompensated shadow price:

$$\widetilde{p}_c^h(p_c^*, p_m, w, T, \overline{A}, \overline{u}) = \widetilde{p}_c(p_c^*, p_m, w, T, \overline{A}, E) \tag{12}$$

Using this equality we have that:

$$\frac{\partial \widetilde{p}_c^h}{\partial \overline{A}} = \left.\frac{\partial \widetilde{p}_c}{\partial \overline{A}}\right|_E + \frac{\partial \widetilde{p}_c}{\partial E}\frac{\partial e'}{\overline{A}} = \frac{d\widetilde{p}_c}{d\overline{A}} \tag{13}$$

where e' is the minimum exogenous income, E, needed to achieve utility $\overline{u}$. To sign the effect of land on the compensated shadow price we know that:

$$x_c^h(w, \widetilde{p}_c^h, p_m, \overline{u}) = Q(\overline{A}, L(\overline{A}, \widetilde{p}_c^h, w)) \tag{14}$$

taking the total differential and rearranging we have:

$$\left(\frac{\partial x_c^h}{\partial \widetilde{p}_c^h} - Q_L \frac{\partial L}{\partial \widetilde{p}_c^h}\right) d\widetilde{p}_c^h = \left(Q_A + Q_L \frac{\partial L}{\partial \overline{A}}\right) d\overline{A} \tag{15}$$

since the term in parenthesis on the left is unambiguously negative while that on the left is unambiguously positive it follows that $\frac{\partial \widetilde{p}_c^h}{\partial \overline{A}} < 0$ and hence that $\frac{d\widetilde{p}_c}{d\overline{A}} < 0$.

Result 3: *In incomplete food market settings the own price effect of having access to land is unambiguously positive. Increasing access to land lowers the shadow price of calories and increases demand for calories.*

We can also look at *cross price* effects. Taking the differential of non-food demands with respect to land we have.

$$\frac{dx_m}{d\overline{A}} = \frac{\partial x_m}{\partial y^*}\frac{\partial y^*}{\partial \overline{A}} + \frac{\partial x_m}{\partial \widetilde{p}_c}\frac{\partial \widetilde{p}_c}{\partial \overline{A}} \tag{16}$$

The first term is the income effect which would be unambiguously positive. The second captures the effect of land which operates through the calorie shadow price. With perfect markets this second effect would not exist and land would only affect non-food consumption via the income effect. With a missing food market, we know that $\frac{d\widetilde{p}_c}{d\overline{A}} < 0$ so that we just need to sign the cross price effect $\frac{\partial x_m}{\partial \widetilde{p}_c}$. To do this we use a Slutsky decomposition:

$$\frac{dx_m}{d\widetilde{p}_c} = \frac{\partial x_m^h}{\partial \widetilde{p}_c} + \frac{\partial x_m}{\partial y^*}x_c \tag{17}$$

the second term is unambiguously positive.[23] The overall sign of compensated non-food demands with respect to the shadow calorie price is ambiguous. If we consider food and non-food consumption to be broadly substitutable then we would expect this effect and hence the overall *cross-price* effect to be positive (see Singh, Squire and Strauss, 1986).[24] This yields the following testable prediction.

[23] Assuming x_m is a normal good.

[24] In this specific case the overall impact of land on non-food consumption will depend on whether the income or subsitution effect dominates.

Result 4: *With an incomplete food market and controlling for the income effect we would expect increasing access to land, which lowers the shadow calorie price, to have a negative impact on non-food consumption and a positive impact on food consumption.*

Similarly, if we were to extend the model to allow for a distinction between purchased calories (x_c^p) and own produced calories (x_c^o) then access to land will affect purchased calorie consumption both through an income effect and by affecting the shadow price of own produced calories ($\widetilde{p}_c$).[25]

$$\frac{dx_c^p}{d\overline{A}} = \frac{\partial x_c^p}{\partial y^*}\frac{\partial y^*}{\partial \overline{A}} + \frac{\partial x_c^p}{\partial \widetilde{p}_c}\frac{\partial \widetilde{p}_c}{\partial \overline{A}} \tag{18}$$

The latter effect would not exist for the perfect markets case. The cross-price effect can again be written as a Slutsky decomposition:

$$\frac{dx_c^p}{d\widetilde{p}_c} = \frac{\partial x_c^o}{\partial \widetilde{p}_c} + \frac{\partial x_c^p}{\partial y^*}x_c^o \tag{19}$$

The second term will be unambiguously positive. Own produced and purchased calories are close substitutes so we would expect the derivative of Hicksian demands for purchased calories to be positive with respect to the shadow or internal price of own produced calories ($\widetilde{p}_c$). This yields another testable prediction.

Result 5: *Controlling for the income effect we would expect increasing access to land, by lowering the shadow price of calorie, to have a negative impact on purchased calorie consumption and a positive effect on own produced calorie consumption.*

4 Empirical Test

In this section we test the validity of the results derived in the previous section.

[25] A household may have a shadow price that falls in the $p_c^s < \widetilde{p}_c < p_c^b$ region but may be forced to purchase some calories because its land endowment (A) is insufficient to meet calorie requirements. This seems to conform with what is observed for households with low land endowments in the Chinese data. Thus it is not that we are ruling out a food market but rather pointing out that a large number of households would not voluntarily choose to participate in such a market.

4.1 Basic Results

Consider a calorie demand equation of the form:

$$\ln(x_c/n) = \alpha+\beta \ln(x/n)+\zeta \ln(A/n)+\eta \ln(n)+\sum_{j=1}^{J-1} \gamma_j(\frac{n_j}{n})+\sum_{k=1}^{K-1} \gamma_k(\frac{n_k}{n})+\delta z+u \tag{20}$$

where x_c is calorie consumption, x is total expenditure, A is cultivable land, n is household size, n_j are demographic classes and n_k are numbers of adults engaged in primary, secondary and tertiary employment and z are village dummies.

Columns (1) and (4) in Table 5 present results for the standard specification where land is not included (see Deaton, 1997). The calorie-expenditure elasticities (0.31 for Sichuan and 0.20 for Jiangsu) are positive and significant and lie in the ballpark of the 0.34 elasticity which Subramanian and Deaton (1996) found using a similar rural expenditure survey from Maharashtra in India. These figures demonstrate that households with higher incomes are less undernourished in China. The fact that the strength of the relationship is weaker in the richer province is also sensible as we would expect calorie-expenditure elasticities to fall with income (see Deaton, 1997).

In columns (2) and (5) we then include land in the regression. Non-market allocation of land in China enables us to separately examine the effects of land and income in the regression. The coefficient on the per capita expenditure term captures the income effect on nutrition whereas the coefficient on land captures the own-price effect.[26] Drawing on Result 1 we would expect that under perfect markets that land only has an affect on calorie consumption via its effect on income. Instead what we observe is that the coefficient on per capita land is positive and significant in both provinces even though per capita expenditure is being controlled for. The coefficient on per capita expenditure is little affected by the addition of land and remains positive and significant. In line with Result 2 this suggests that we are in an incomplete food market setting where access to land can affect calorie demand *via* both income and own price effects. The fact that increasing access to land exerts a positive impact on calorie demand over and above the effect running through income is consistent with interpreting it as an own price effect. Increasing

[26] Consumption from own production is valued at market prices and imputed in the total expenditure term which therefore reflects the opportunity cost of consuming these calories.

access to land lowers the shadow price of calories and increases demand for calories (see Result 3).

Comparing across provinces, we observe that the land effect is larger in the poorer, less market integrated province, Sichuan. In this province, the elasticity of calories with respect to land is 0.13 whereas the corresponding figure for Jiangsu is 0.09. This is in line with the theoretical prediction that the magnitude of the own-price effect will diminish with market development to the point that it no longer exists under perfect markets. As the size of the price band between buying and selling prices diminishes so does the value of having access to land as a source of cheaper calories. Negative correspondence between the magnitude of the effect and degree of market development is again consistent with interpreting the land effect as an own price effect.

One problem we have in interpreting the coefficient on land as an own price effect is that our control income for income (x/n) is a short run measure and is likely to be an imperfect proxy of permanent income. Land may just be picking up the effects of omitted correlates of permanent income on calorie consumption. To circumvent this problem we first regress the variable measured with error (x/n) on a set of variables that are likely to be correlated with the permanent income of the household:

$$\ln(x/n) = \gamma_1 D_h + \gamma_2 E_h + \gamma_3 A_h + \gamma_4 C_h + \epsilon \tag{21}$$

where (D_h) are demographic variables, (E_h) are educational and occupational status variables, (A_h) are stocks of physical assets (including land), (C_h) are community or environmental characteristics such as access to amenities and location dummies.[27] These variables thus represent longer term characteristics of the household which have bearing on the determination of permanent income and are likely to be measured with less noise than current expenditure. Results from this regression are shown in Table A1. The fitted value from this regression, $\ln(\widehat{x/n})$ is used at the second stage in place of $\ln(x/n)$ in a regression explaining calorie intake (see columns (3) and (6) of Table 5). Landholding remains positive and significant at the second stage, the size of the nutrition-land elasticities are largely unchanged with a larger value

[27] This type of formulation is consistent with household production theory where in a rural setting physical asset stocks might include both monetary (e.g. savings) and non-monetary components (e.g. land, grain stocks, housing, household durables, productive assets - see Singh, Squire and Strauss, 1986).

still being recorded for the poorer province, Sichuan, where markets have developed least.[28]

To give a feel for the magnitude of the income and own-price effects of land on nutrition in the two provinces we can carry out the following decomposition of the total effect.

$$\frac{d\ln(x_c/n)}{d\ln(A/n)} = (\frac{\partial\ln(x_c/n)}{\partial\ln(x/n)}) * (\frac{\partial\ln(x/n)}{\partial\ln(A/n)}) + \left.\frac{\partial\ln(x_c/n)}{\partial\ln(A/n)}\right|_{\overline{(\frac{x}{n})}} \tag{22}$$

The product of the first two terms is the income effect and the third term we interpret as the own price effect. The results of this decomposition are shown in Table 6. Column (1) shows that the total elasticity of calories with respect to land is higher in the poorer province Sichuan (0.18) than in the richer province Jiangsu (0.12). In column (3) we see that the effect of land on income is similar in both provinces, however, as we have already pointed out each increment in income exerts a larger impact on calorie demand in Sichuan relative to Jiangsu (see column (2)) implying that the overall effect on land on calories going through income is larger in the poorer province (see column (4)). However, the main contributor to the difference in total effect of land on calories is the difference in own price effect (column (5)) which is higher in the poorer province (0.13 compared to 0.09). Of the 6 percent difference in the total effect of land on calories (column (1)) we see that 2 percent is due to the income effect being higher in Sichuan and 4 percent to the own-price effect being higher.

Table 6 allows us to map out the different channels through which access to land affects nutrition in China. Land exerts an influence on income (column (3)) which in turn affects calorie availability (column (2)). The size of the overall income effect (column (4)) is larger in Sichuan because the calorie-expenditure elasticity is larger (column (2)). Additional increments in income from land generate a larger impact on calorie availability in the poorer province. The dominant route through which access to land affects calorie availability is through the own-price effect (column (5)). Land in rural China is of value to nutritional welfare primarily by acting as a source of cheaper calories relative to the market. In both provinces the magnitude of the own-price effect is around three times of the income effect and accounts for around three-quarters of the total effect of land on calorie availability. This is likely, in part, to reflect the fact that China is a transition econ-

[28] The elasticity is 0.15 for Sichuan and 0.10 for Jiangsu.

omy where rural food markets are both underdeveloped and distorted by the procurement system. In this situation households with more land face lower calorie prices than households with less land as they can rely more on own-production to satisfy calorie requirements. And it makes sense that the own price effect would be larger in inland Sichuan where since the onset of rural reforms in 1978 rural markets have developed much less rapidly than in coastal Jiangsu.

4.2 Robustness Checks

Under complete markets prices are exogenous and land only affects consumption *via* income. Incomplete external food markets lead to an internal food market where the calorie price is endogenous and thus generate another route through which land can affect consumption. Results 4 and 5 from the theory section demonstrate how this effect will be different depending on whether consumption is directly linked to production from land. Thus if the land effect we observe in the regressions where income is separately controlled for is to be interpreted as an own price effect then we would expect its sign to be different for food and non-food consumption (Result 4) and home produced and purchased calorie consumption (Result 5). In contrast, if land is just picking up omitted wealth or status variables which affect food or calorie consumption but which are not captured in income then we would expect the sign of land effects on different types of consumption to be the same. Breaking out consumption into these elements provides us with a clean way of distinguishing between these hypothesis and provides us with another battery of robustness checks for the main results reported in Table 5.

Results are shown in Table 7 for a specification where income is controlled for using log per capita expenditure. In columns (1) and (5) we see that in both Sichuan and Jiangsu the coefficient on land is positive and significant for the food expenditure equation. This is consistent with households shifting towards food consumption as growing access to land makes food cheaper. In contrast in columns (2) and (6) we observe that the coefficient on land is negative and significant for the non-food expenditure equation. Expanding access to land thus appears to increase food consumption per capita *via* an own price effect and decrease non-food consumption *via* a cross price effect. This is consistent with us being in an imperfect food market setting as neither of these price effects would operate in a perfect markets setting. They also jointly suggest that land is not picking up omitted wealth effects which would

act to increase both food and non-food consumption. These results are in line with Result 4. With an incomplete food market and controlling for income effect we would expect increasing access to land, which lowers the shadow calorie price, to have a negative impact on non-food consumption and a positive impact on food consumption.

In columns (3) and (4) for Sichuan and in columns (7) and (8) for Jiangsu we take the relatively homogenous grain category and contrast land effects on home produced and purchased calorie consumption respectively. Again we control for income using log per capita expenditure. We find that the sign of the land effect switches, being positive for home produced grain calories and negative for purchased grain calories. This is in line with Result 5 – we would expect in an incomplete market setting that increasing access to land, by lowering the shadow price of calories, to have negative impact on purchased calorie consumption via the cross-price effect and a positive effect on own produced calorie consumption via the own price effect.

Exactly the same pattern of results obtain when we use instrumented total per expenditure as our income control or include quadratic terms for either uninstrumented or instrumented per capita expenditure in the regressions. Although the left hand side variables in these regressions have no welfare interpretation, the pattern of effects observed bolsters our confidence that the land effect in the main calorie regressions reported in Table 5 can be interpreted as an own price effect.

5 Conclusion

The effect of Mao's radical land reforms is clearly felt in the land allocation system that we observe in China today. As we have shown using household data land is allocated on the basis of the demographic composition of households which serves as a proxy for nutritional need. The system results in universal and egalitarian access to land. It is this institutional feature that sets China apart from the bulk of poor countries.

The fact that universal and egalitarian access to land has persisted during a period of rapid economic development is a striking finding of the paper. We find that the allocation rules are very similar across Sichuan and Jiangsu in 1990. This suggests that universal and egalitarian access to land within localities is a stable, political equilibrium. This is likely to be the result of two sets of factors. First, the fact that the population has become used to equal

treatment as regards access to land since the Mao land reforms of 1945-1953. This egalitarian norm has proven itself to be highly persistent. Second, the bulk of rural Chinese households rely strongly on agriculture and have limited access to off-farm opportunities. Support for maintaining egalitarian access to land will therefore be strong. Even where off-farm diversification is taking place it tends to occur within households with some members continuing to farm. Egalitarian access thus acts as a form of subsistence insurance for rural households faced with uncertain income prospects from sources other than agriculture.

The system of nonmarket allocation of land in China enabled us to map out the different pathways through which access to land can affect hunger. Land exerts an influence on income which in turn affects calorie availability. We found that the size of the overall income effect is larger in Sichuan because the calorie-expenditure elasticity is larger. However we found that the dominant route through which access to land affects calorie availability is through the own-price effect. Land in rural China is of value to nutritional welfare primarily by acting as a source of cheaper calories relative to the market. In both provinces the magnitude of the own-price effect is around three times of the income effect and accounts for around three-quarters of the total effect of land on calorie availability. This is likely, in part, to reflect the fact that China is a transition economy where rural food markets are underdeveloped. In this situation households with more land face lower calorie prices than households with less land as they can rely more on own-production to satisfy calorie requirements. And it makes sense that the own price effect would be larger in inland Sichuan where since the onset of rural reforms in 1978 rural markets have developed much less rapidly than in coastal Jiangsu.

The policy implications of these findings are intriguing. Where markets are underdeveloped having access to land enables households to avoid hunger both by providing them with a source of income but also by providing them with a 'cheaper' source of calories relative to the market. From the perspective of low income countries with inegalitarian distributions of land these results would suggest that improving access to land via either land redistribution or improving the functioning land rental markets (which allow land rich and land scarce households to trade) could significantly contribute to the Millenium Development Target of halving the proportion of people suffering from hunger between 1990 and 2015. As markets develop the magnitude of the own price advantage diminishes and hence the value of having access to

land. Therefore attempts to develop rural markets through, for example, investments in infrastructure and the removal of compulsory procurement would also help reduce hunger particularly in households with limited access to land.

China's achievements in avoiding hunger can thus be linked to the operation of a particular set of village land institutions. The fact that these nonmarket institutions, under incomplete or missing markets settings and with limited intervention by central government, have managed *via* localized redistribution to produce a record in terms of the prevention of hunger that exceeds that of all low income countries is another striking finding of the paper.

The village level institutions which guarantee universal and egalitarian access to land are a direct legacy of the Mao land reforms and are unlikely to emerge in other contexts. Nonetheless the key message that emerges from the paper is that access to land has immense value in terms of enabling household to avoid hunger. And providing access is of particular value in situations where food markets are highly incomplete. A situation which is likely to be relevant in the rural parts of many developing countries. How access to land can be improved in situations where land is bought, sold or rented in the market is an important policy question which is attracting renewed attention in policy circles. Indeed improving access to land for the poor in rural areas is seen as critical for achieving the Millenium Hunger Target. The China example underlines the importance of providing access but has less clear-cut answers in terms of providing guidance on how access can be improved.

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6 Data Appendix

The data used in this paper are drawn from two provincial sub-samples of the Rural Household Sample Survey conducted by the State Statistical Bureau (SSB) of the People's Republic of China.[29] Given scarcity of household data on rural China during the transition period they are of considerable interest. The data request to the SSB was designed to allow us to contrast a rich, coastal province where markets have developed rapidly (Jiangsu) with a poor, inland province where market development is restricted and dependence on agriculture is still pronounced (Sichuan) (see Table 1). If we rank the rural sectors of Chinese provinces according to per capita expenditure (PCE), Jiangsu is located near the top of the distribution whilst Sichuan is located in the lower half of the distribution.

As is evident from Table 1, sampling is multistage in design. One third of the counties in a province are sampled, ten villages are drawn from each county and ten households from each village. Statistical inference needs to take this into account and all regressions are reported with Huber standard errors which have been corrected for the effects of clustering (see Deaton, 1997).

A fairly unique feature of the data set is that there are separate, highly detailed series on both income and consumption which are collected throughout the course of the entire year. This feature combined with the fact that daily data entry in household log books is closely monitored by a resident village enumerator and subjected to a rigorous system of cross-checks by SSB officials at different levels is also likely to add to the robustness of the results.Two major corrections to the original consumption data are worth

[29]The data sets were obtained as part of a joint research programme between the SSB and LSE financed by the Ford Foundation. We are grateful to the Ford Foundation and the SSB for their assistance in providing the data.

mentioning here. (i) State instead of market prices had been used to value non-marketed home production of grain. Given that rural residents did not have access to grain at subsidised state prices this important element of consumption has to be revalued using the free market price of grain in that locality. (ii) To remove some of the noise in consumption expenditure which is our preferred welfare measure, durable consumption is imputed as 6% of value of the durable stock based on plausible ranges of interest and depreciation rates for a given year. Similar corrections have not been made for housing as there is no significant housing market in rural China to serve as a basis for valuation (see Chen and Ravallion, 1995).

Information on food consumption consists of consumption both from own production and from purchases. Own produced food consumption has been valued using local market prices (see Ravallion and Chen, 1995). The survey distinguishes between seventeen different kinds of food, including three categories of cereal, and fourteen non-cereal foods. Information on cereal consumption is obtained from a schedule in the survey on household grain balances. This schedule records additions to and withdrawals from the household stock of grain.[30] Grain in this context refers to quantities in an unhusked as opposed to directly edible form and proper account must be taken of this difference in the conversion to calories. Non-cereal items are obtained from the schedule on food consumption which records quantities of directly edible food consumed. The calorie figures were obtained from the food quantities using food composition tables for China translated into English by Ershow and Wong-Chen (1990).

Land in the SSB survey is divided between cultivable land and hilly field. Cultivable land typically refers to irrigated, agricultural land located in relatively flat areas where grains and other key crops are produced. Hilly field refers to rainfed, marginal land located on the slopes of hills and used for pasture, forestry or marginal non-grain crop production (e.g. fruit trees).[31] Given the large quality differentials between the two types of land and because we are mainly interested in looking at the allocation of land for crop

[30] Historically, grain balance was the primary measure of living standards in rural China but it is rapidly being replaced by monetary measures of welfare (e.g. per capita expenditure) as the rural economy becomes increasingly market oriented.

[31] Hilly land is of negligible importance in Jiangsu which is a relatively flat province where it constitutes 2% of total land. In Sichuan which has extensive hilly and mountainous regions hilly field constitutes 25% of total land but this land contributes very little to aggregate *crop* production.

production we have chosen to focus in our regressions only on cultivable land.[32]

[32] We have run *all* regressions in the paper which include land using total land and this does not change any of the main results. The main effect of introducing hilly field is to reduce the precision of the coefficient estimates, in particular in the case of Sichuan.

Table 1: Sample Characteristics, Rural Sectors, 1990

	Sichuan	Jiangsu
Rural PCE (yuan)	569	953
Rural industry/ rural output (%)	26.9	60.4
Location	Central inland	East coastal
Climate	Subtropical	Subtropical
Main food crop	Rice	Rice
Household size	4.35	4.15
Sample size {counties} [villages] <household> (persons)	{54} [538] <5380> (23416)	{34} [336] <3364> (13920)

Source: SSB Rural Household Surveys. China Statistical Yearbook (1991).

Table 2: Land Allocation and Nutritional Need
Dep. Var: Household Cultivable Land (hectares)

	Rural Sichuan		Rural Jiangsu	
	(1)	(2)	(3)	(4)
Intercept	0.060 (6.64)	0.060 (6.64)	0.083 (7.09)	0.083 (7.09)
Cadre dummy		0.007 (1.31)		-0.009 (0.89)
0-4N	0.016 (5.07)	0.016 (5.09)	0.021 (3.62)	0.021 (3.61)
5-9N	0.041 (13.33)	0.041 (13.31)	0.050 (9.73)	0.050 (9.72)
10-14N	0.062 (20.76)	0.062 (20.66)	0.069 (12.92)	0.069 (12.90)
15-54N Farm	0.070 (31.17)	0.070 (30.98)	0.092 (25.71)	0.092 (25.68)
15-54N Off-farm	0.056 (20.72)	0.056 (20.35)	0.054 (15.66)	0.054 (15.68)
55+N	0.064 (23.03)	0.064 (22.96)	0.076 (15.06)	0.076 (15.06)
Dummy for >2 children	-0.022 (2.24)	-0.022 (2.22)	-0.024 (2.21)	-0.023 (2.21)
Sample size	5379	5379	3354	3354
Adj. R^2	0.8170	0.8172	0.7358	0.7358

Notes: All regressions are reported with robust (Huber) standard errors. Absolute t statistics in parenthesis. N indicates that demographics are expressed in terms of numbers of people in the different age groups. Adults (15-55) are divided according to whether they list their primary employment as being on or off-farm. Regressions also contain dummies for 537 villages (clusters) in Sichuan and 336 villages (clusters) in Jiangsu.

Table 3: Calorie Availability by Per Capita Expenditure (PCE) Decile: China and India

PCE decile	Per capita calorie availability			Per capita cultivable land		Per capita expenditure means	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	RS	RJ	RM	RS	RJ	RS	RJ
1	1772	2046	1429	0.066	0.083	284	347
2	2024	2245	na	0.068	0.091	354	473
3	2170	2450	na	0.073	0.092	400	555
4	2301	2479	na	0.072	0.091	442	633
5	2393	2513	na	0.078	0.090	485	714
6	2480	2612	na	0.074	0.095	532	804
7	2624	2675	na	0.077	0.094	586	920
8	2683	2787	na	0.082	0.097	654	1081
9	2834	2784	na	0.079	0.097	769	1321
10	3140	3057	3167	0.081	0.087	1156	2556
All	2442	2565	2120	0.075	0.092	566	941

Notes: Calorie availability for rural Sichuan (RS) and rural Jiangsu (RJ) is computed from SSB Rural Household Surveys, 1990. The source of the calorie figures for rural Maharashtra (RM) is Subramanian and Deaton (1993); na means not available. Per capita land refers to the mean per capita land holding for households in the relevant decile or deciles. Land is measured in hectares. PCE is measured in 1990 yuan. The computations are based on 5379 households for Sichuan and 3354 households for Jiangsu.

Table 4: Welfare Indicators in China and India, 1990

	CHINA	INDIA
GNP per Capita	410	370
Daily calorie supply	2630	2238
Children 0-5 below -2 s.d. weight for age	17.4	63.9
Children 0-5 below -2 s.d. height for age	31.4	62.1
Infant mortality rate	31	97

Source: World Bank (1993), United Nations (1993), World Health Organisation (1997).

Table 5: Access to Land and Nutritional Status: Basic Results

	Rural Sichuan			Rural Jiangsu		
	log per capita calories	log per capita calories	log per capita calories	log per capita calories	log per capita calories	log per capita calories
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	IV	OLS	OLS	IV
log per capita land		0.131 (12.09)	0.148 (11.61)		0.092 (6.45)	0.098 (6.10)
log per capita expenditure	0.311 (27.48)	0.298 (27.30)		0.198 (20.31)	0.189 (19.48)	
instrumented log per cap exp			0.231 (14.88)			0.153 (8.96)
log household size	-0.119 (13.10)	-0.100 (11.31)		-0.195 (14.80)	-0.184 (14.20)	
Adj. R^2	0.741	0.757	0.648	0.619	0.630	0.562
no. obs.	5379	5379	5379	3354	3354	3354

Absolute t statistics in parenthesis based on robust (Huber) standard errors clustered at the village level. Regressions also contain controls for the occupational status and demographic composition of households and dummies for 537 villages (clusters) in Sichuan and 336 villages (clusters) in Jiangsu.

Table 6: Decomposition of Land Effect on Calorie Availability

Province	Total Effect (A) x (B) + (C) $d$lnPCCAL/ $d$lnPCLAND	(A) ∂nPCCAL/ ∂nPCE	(B) ∂nPCE/ ∂nPCLAND	Income Effect (A) x (B)	Own-Price Effect (C) ∂nPCCAL/ ∂nPCLAND (PCE constant)
	(1)	(2)	(3)	(4)	(5)
Sichuan	0.18	0.31	0.16	0.05	0.13
Jiangsu	0.12	0.20	0.16	0.03	0.09

Column (2) is from columns (1) and (4) of Table 5. Column is from a regression of log per capita land on log per capita expenditure which contains the same controls as Table 5. Column (5) is from columns (2) and (5) of Table 5.

Table 7: Access to Land and Consumption: Robustness Checks

	Rural Sichuan				Rural Jiangsu			
	log per capita food exp	log per capita non-food exp	log per capita own prod grain cal	log per capita purch grain cal	log per capita food exp	log per capita non-food exp	log per capita own prod grain cal	log per capita purch grain cal
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
log per capita land	0.075	-0.084	0.285	-0.264	0.087	-0.060	0.328	-0.887
	(6.50)	(5.14)	(10.67)	(2.55)	(5.84)	(3.18)	(9.69)	(5.55)
log per capita expenditure	0.549	1.560	0.141	0.524	0.443	1.447	0.066	0.292
	(32.83)	(104.37)	(9.33)	(7.63)	(20.23)	(65.52)	(3.49)	(2.80)
log hh size	-0.108	0.133	-0.041	-0.309	-0.200	0.178	-0.165	-0.502
	(8.65)	(10.10)	(2.58)	(4.03)	(12.36)	(9.20)	(5.95)	(3.43)
Adj. R^2	0.830	0.883	0.718	0.525	0.750	0.912	0.683	0.424
no. obs.	5359	5359	5343	4224	3339	3339	3324	1919

Notes: Absolute t statistics in parenthesis based on robust (Huber) standard errors clustered at the village level. Regressions also contain controls for the occupational status and demographic composition of households and dummies for 537 villages (clusters) in Sichuan and 336 villages (clusters) in Jiangsu.

Table A1 : First Stage for 2SLS Estimation of Land-Nutrition Relationship
Dependent Variable: Ln (PCE)

	Rural Sichuan		Rural Jiangsu	
	Estimate	t	Estimate	t
Intercept	2.943	3.761	6.010	17.465
Household characteristics				
Ln household size	-0.320	8.138	-0.241	3.834
F0-4p	-0.277	4.723	-0.543	5.637
M0-4p	-0.195	3.391	-0.470	4.885
F5-14p	0.074	1.516	0.047	0.540
M5-14p	0.083	1.773	0.068	0.846
M15-54p	-0.044	1.360	0.048	0.824
M55+p	-0.037	0.723	0.030	0.348
M55+p	-0.160	3.474	-0.111	1.600
Primaryp	-0.108	3.319	0.007	0.145
Secondaryp	0.203	3.847	0.092	1.562
Tertiaryp	0.312	5.307	0.222	2.979
No. wage earners	0.134	4.096	0.508	0.508
Characteristics of household head				
Sex	0.039	2.511	0.030	0.968
Age	1.422	3.341	-0.083	0.459
$(Age)^2$	-0.185	3.191	0.010	0.388
Education	0.018	5.853	0.011	2.2129
$(Education)^2$	-0.001	5.974	-0.001	2.249
Housing characteristics				
House purchase	0.504	24.128	0.661	25.871
Electricity	0.035	2.304	0.078	3.168
Ln houses PC	0.002	2.306	0.002	0.939
Ln floor area PC	0.001	0.474	-0.001	0.531
Proportion concrete	0.169	5.522	0.062	1.706
Ownership of durables				

Ln Bicycle PC	0.178	5.687	0.086	2.122
Ln Sewing machine PC	-0.022	0.515	0.011	0.214
Ln Clock PC	0.097	1.877	0.133	2.733
Ln Watch PC	0.136	7.567	0.177	4.988
Ln Fan PC	0.232	5.889	0.157	3.802
Ln Washing machine PC	0.084	0.748	-0.040	0.442
Ln Fridge PC	0.086	0.174	0.838	3.364
Ln Motorcycle PC	0.467	1.337	-0.012	0.068
Ln Furniture PC	0.058	8.188	0.021	1.685
Ln Radio PC	-0.024	0.655	0.048	0.980
Ln B/W TV PC	0.398	10.257	0.265	4.493
Ln Colour TV PC	0.576	3.483	0.399	2.972
Ln Tape recorder PC	0.138	2.611	-0.056	0.758
Ln Camera PC	-0.387	1.163	0.480	1.734
Access to land/water				
Ln land PC	0.094	8.446	0.137	7.864
Ln hilly field PC	0.000	0.056	0.000	1.831
Ln water PC	0.001	2.562	0.001	1.811
Productive assets				
Ln Motor vehicle PC	0.095	2.242	0.089	0.427
Ln Tractor PC	-0.020	1.247	-0.012	0.012
Ln Thresher PC	0.039	1.884	0.020	1.473
Ln Cart PC	-0.005	0.394	0.001	0.810
Ln Pump PC	-0.011	0.948	-0.012	0.584
Ln Motor boat PC	-0.664	2.155	-0.021	0.717
Ln Draught animal PC	0.005	3.242	-0.000	0.057

Notes: All regressions corrected for heteroscedasticity (Huber standard errors). All variables which are not in proportions are expressed in log form.