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Nonfarm Income, Inequality, and Land in Rural Egypt

Richard H. Adams Jr.

Policymakers interested in reducing poverty and improving income distribution in rural Egypt should focus on nonfarm income — which not only accounts for almost 60 percent of total income for the rural poor but also favorably affects income distribution. Nonfarm income is an inequality-reducing source of income in a land-scarce setting such as rural Egypt because inadequate land "pushes" poorer households out of agriculture and into the nonfarm sector

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Summary findings

Adams uses household-level data from a nationally representative survey to analyze the impact of nonfarm income on income inequality in rural Egypt. After pinpointing the importance of nonfarm income to the rural poor, Adams decomposes total rural income among five sources: nonfarm, agricultural, livestock, rental, and transfer.

He shows that while nonfarm income represents the most important inequality-reducing source of income, agricultural income represents the most important inequality-increasing source.

A 1 percent marginal increase in nonfarm income will cause the Gini coefficient of overall income to fall by 12.8 percent. But a 1 percent marginal increase in agricultural income will cause the Gini coefficient to rise by 15.8 percent.

The reason for this difference has to do with land, which is distributed very unevenly in this study.

Regression analysis of the determinants of income shows that land ownership is positively and statistically related to the receipt of agricultural income but has no statistical relationship to the receipt of nonfarm income.

This leads Adams to three conclusions:

- If policymakers are interested in reducing poverty and improving income distribution in rural Egypt, they should focus on nonfarm income — which not only accounts for almost 60 percent of total income for the rural poor but also favorably affects income distribution.
- Nonfarm income is an inequality-reducing source of income in a land-scarce setting such as rural Egypt because inadequate land "pushes" poorer households out of agriculture and into the nonfarm sector.
- Agricultural income contributes most to rural income inequality because it is highly correlated with land ownership and with total rural income.

This paper — a product of the Human Development Sector Group, Middle East and North Africa Region — is part of a larger effort in the region to identify the sources of income for the rural poor. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Moira Coleridge-Taylor, room MC3-797, telephone 202-473-3704, fax 202-522-3283, Internet address mcoleridgetaylor@worldbank.org. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/html/dec/Publications/Workpapers/home.html. The author may be contacted at radams@worldbank.org. September 1999. (37 pages)

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In the past many researchers and policymakers have viewed the rural economy of developing countries as being synonymous with agriculture. According to this view, rural households receive most of their income from the production of food and export crops.

In more recent years, this view has begun to change. There is now a growing recognition that rural households receive their income from a diverse portfolio of activities (Ellis, 1998), and that one of the most important of these activities is that connected with the rural nonfarm sector. In some cases the rural nonfarm sector – which includes such diverse activities as government, commerce and services – is now seen as providing the bulk of income to rural households.

This changed view is partly due to the evolving concept of the broader relationship between agriculture, the rural nonfarm sector and the poor. During the 1970s and early 1980s, Mellor and Lele (1972), Mellor (1976) and Johnston and Kilby (1975) emphasized the growth linkages effects of agricultural growth. According to this literature, technological change in agriculture boosts production, thereby increasing the incomes of landowning households. In turn, these landowning households use their new income to buy more labor-intensive goods and services, which are produced by the poor working in small-scale firms in the rural nonfarm sector. Thus, accelerated growth in agriculture produces second- and third-round effects that benefit the rural economy in two ways: first, through production linkages that provide the poor with more food; and

second, through consumption linkages that provide the poor with more employment and income-earning opportunities in the rural nonfarm sector.

While the dissemination of high-yielding varieties of rice and wheat may have had large multiplier effects on the rural nonfarm sector in certain Asian countries (Hazell and Roell, 1983), in many developing countries these multiplier effects have been quite small. For example, de Janvry and Sadoulet (1993) argue that the unequal distribution of land and income in Latin America (and other developing countries) mean that only a handful of landowners benefit from the income effects of agricultural growth. Since these large landowners prefer to buy luxury items produced by imports, they do not demand the type of labor-intensive goods and services which are produced by the poor in the rural nonfarm sector. For this reason, de Janvry and Sadoulet argue that in land-constrained areas of the developing world – like Latin America and certain parts of the Middle East and Asia – focusing directly on the rural nonfarm sector might provide a better way of increasing the income and employment opportunities of the poor. In this view, income earned in the rural nonfarm sector represents the agent of positive change for the poor in the rural economy, rather than income earned from the traditional agricultural sector.

Despite this changed view, there is still no agreement in the empirical literature on two key issues, namely: (a) what is the impact of rural nonfarm income on income inequality?; and (b) what is the link between land, nonfarm income and overall rural inequality? On the one hand, studies by Lanjouw (1998) in Ecuador, Adams (1995) in Pakistan and Chinn (1979) in Taiwan indicate that nonfarm income reduces rural income inequality. According to Adams (1995), nonfarm income benefits the poor because the

share of nonfarm income varies inversely with both size of land owned and total rural income. On the other hand, studies in Africa have generally produced very different results. For instance, Reardon, Delgado and Matlon (1992) in Burkina Faso, Collier, Radwan and Wangwe (1986) in Tanzania and Matlon (1979) in Nigeria find that nonfarm income has a negative impact on rural income distribution because it is mainly large landowners who receive nonfarm income.

Part of this inconsistency may be explained by differences in the key factor noted above, namely, the distribution of land. In other words, in land-scarce, labor rich countries – like Pakistan and much of Latin America – inadequate access to land may tend to "push" poorer rural households out of agriculture and into the nonfarm sector. Thus, in these countries, nonfarm income may have a positive impact on inequality and poverty. The obverse, then, could hold in land-rich, labor-scarce countries – such as Africa – where ample land access may tend to keep most people in agriculture and to "pull" only richer households into the nonfarm sector.

This paper proposes to clarify the impact of nonfarm income and unequal land distribution on rural income inequality by analyzing the results of a new, nationally-representative household survey in Egypt. The paper seeks to make three contributions. First, it uses decomposition techniques to pinpoint the contribution of five different sources of rural income – including nonfarm income – to overall rural inequality. This is useful because few past studies have used disaggregated, household-level income data to analyze the contribution of different types of income to rural income inequality. Second, the analysis shows how small, exogenous changes in income from different sources affects overall rural inequality and welfare. Such information is useful to policymakers,

as they consider specific policy measures to try to improve the distribution of rural incomes. Third, the paper uses regression analyses to identify the role of different factors – including land ownership – in "determining" the level of different sources of rural income. This analysis finds that while land ownership is not significantly related to the determination of nonfarm income, it is positively and significantly related to the determination of agricultural and rental income.

The study proceeds in four further sections. Section I presents the decomposition of the Gini coefficient. Section II presents the household data set from rural Egypt. Section III analyzes the contribution of the various sources of income – including nonfarm income – to overall rural inequality. Section IV analyzes how exogenous changes in various sources of income affect overall inequality and welfare, and Section V discusses how land and other factors determine different types of rural income. Section VI concludes.

I. Decomposition of Income Inequality

At the start of any decomposition exercise, the question arises: what measure of inequality should be used? Several different inequality measures have been proposed in the literature. Following Foster (1985) and others, the chosen measure should have five basic properties. They are: (1) Pigou-Dalton transfer sensitivity; (2) symmetry; (3) mean independence; (4) population homogeneity; and (5) decomposability.

Pigou-Dalton transfer sensitivity holds if the measure of inequality increases whenever income is transferred from one person to someone richer. Symmetry holds if the measure of inequality remains unchanged when individuals switch places in the

income order. Mean independence holds if a proportionate change in all incomes leaves the measure of inequality unchanged. Population homogeneity holds if increasing (or decreasing) the population size across all income levels has no effect on the measured level of inequality.

The property of decomposability allows inequality to be partitioned either over sub-populations or sources. It is the latter type of decomposition that is the subject of this analysis. Ideally, an inequality measure can be regarded as source decomposable if total inequality can be broken down into a weighted sum of inequality by various income sources (for example, nonfarm and agricultural income).

One of the measures of inequality which meets the five preceding properties is the Gini coefficient. The source decomposition of the Gini coefficient can be developed as follows.

Assume that within the chosen group there are n households deriving income from K sources of income. Using notation similar to Shorrocks (1983: 311), let y_i denote the total income of household i, where i = 1, . . ., n and y_{ik} the income of household i from source k, where k = 1, . . ., K. Also, let the distribution of total household income be represented by $Y = (y_1, \ldots, y_n)$ and the distribution of income component k be represented by $Y_k = (y_{ik}, \ldots y_{nk})$.

Using this notation, the Gini coefficient (G) for the distribution of total income within the group can be defined as:

$$G = \frac{(2\,\mathrm{cov}[Y, F(Y)])}{\mu} \qquad (1)$$

where μ denotes the mean household income of the sample and F(Y) the cumulative distribution of total household income in the sample (i.e. $F(Y) = (f(y_1),..,f(y_n))$ where $f(y_i)$ is equal to the rank of y_i divided by the number of observations (n)) (Stark et al., 1986: 259).

Equation (1) can be rewritten and expanded into an expresion for the Gini coefficient that captures the "contribution to inequality" of each of the K components of income:

$$G = \frac{2}{\mu n}\sum_{i=1}^{n}(y_i - E(y_i))(f(y_i) - E(f(y_i))) \qquad (2)$$

$$\Rightarrow G = \frac{2}{\mu n}\sum_{i=1}^{n}\sum_{k=1}^{K}(y_{ik} - E(y_{ik}))(f(y_i) - E(f(y_i))) \qquad (3)$$

$$\Rightarrow G = \frac{2}{\mu}\sum_{k=1}^{K}\mathrm{cov}[Y_k, F(Y)] \qquad (4)$$

$$\Rightarrow G = \sum_{k=1}^{K}\left(\frac{\mathrm{cov}[Y_k, F(Y)]}{\mathrm{cov}[Y_k, F(Y_k)]}\right)\left(\frac{2}{\mu_k}\mathrm{cov}[Y_k, F(Y_k)]\left(\frac{\mu_k}{\mu}\right)\right) \qquad (5)$$

where μ_k is the sample mean of income from source k and $F(Y_k)$ is the cumulative rank distribution of income from source k (i.e. $F(Y_k) = (f(y_{1k}),..,f(y_{nk}))$, where $f(y_{ik})$ is equal to the rank of y_{ik} divided by the number of observation (n)).

Using the notation of Stark et al (1986: 725), the Gini coefficient can be written as:

$$G = \sum_{k=1}^{K} R_k G_k S_k \qquad (6)$$

where:

S_k is the share of source k of income in total group income (i.e. $S_k = \mu_k/\mu$),

G_k is the Gini coefficient measuring the inequality in the distribution of income component k within the group, and

R_k is the Gini correlation of income from source k with total income,[1] defined as:

$$R_k = \frac{\text{cov}[Y_k, F(Y)]}{\text{cov}[Y_k, F(Y_k)]} \qquad (7)$$

Equation (6) shows that the effect of source k income on overall income inequality can be broken down into three components:

(a) the share of income component k in total income (captured by the term S_k);

(b) the inequality within the sample of income from source k (as measured by G_k);

© the correlation between source k income and total income (as measured by R_k).

The larger the product of these three components, the greater the contribution of income from source K to overall income inequality. However, it should be noted that while S_k is always positive and less than one, G_k is always positive and may exceed one (if many of the source incomes are negative), and R_k can fall anywhere on the interval (-1,1). When R_k is less than zero, income from source k is negatively correlated with total income and thus lowers the overall Gini measure for the sample.

Using this decomposition,, it is possible to identify how much of overall income inequality is due to a particular income source. Assuming that additional increments of an income source are distributed in the same manner as the original units, it is also

possible to use this decomposition to ask whether an income source is inequality-increasing or inequality-decreasing on the basis of whether or not an enlarged share of that income source leads to an increase or decrease in overall income inequality. On the basis of equation (6):

$$g_k = R_K \frac{G_K}{G} \qquad (8)$$

where g_k is the relative concentration coefficient of income source k in overall inequality.

From equation (8) it follows that income source k is inequality-increasing or inequality-decreasing according to whether g_k is greater than or less than unity.[2]

II. Data Set

Data come from a single-round, nationally-representative household budget survey that was conducted in 1997 on 2,500 households in 20 different urban and rural governorates in Egypt. This survey – the Egypt Integrated Household Survey – was quite broad, collecting data on such diverse topics as: income, expenditures, education, employment, food consumption, health and nutrition, landownings, migration and rural credit.[3] The sample frame used for selecting households in the survey was supplied by the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS).[4]

The rural portion of this Egypt Integrated Household survey included 1,327 rural households drawn from 17 rural governorates. Of this total, 26 households were excluded because of missing or incomplete data. The analysis is therefore based on data from 1,301 rural households.

The concept of income used in this study is fairly comprehensive, including income received in kind as well as in cash. A money value was imputed to receipts in kind, household consumption or crops and crop by-products, and home-consumed livestock. Because of uncertainty about how to deduct imputed land rent from agricultural income, no values for imputed land rent were calculated. Similarly, because of the thin rental market for housing in rural Egypt,[5] no values were imputed for the rent of owner-occupied housing. Finally, because of uncertainty about how to accurately calculate wage rates for family members, no values were imputed for family labor involved in crop and livestock production.

Total income for each rural household was divided into five sources:

(1) Nonfarm – Includes wage earnings from nonagricultural labor, government and private sector employment plus net revenues from non-farm enterprises;

(2) Agricultural – Includes net income from all crop production including imputed values from home production and crop byproducts plus wages received from agricultural labor;

(3) Livestock – Includes net returns from traded livestock (cows, bullocks, buffalo, goats, sheep) and small animals (chickens, pigeons, rabbits, duck), plus imputed values of home-consumed livestock (meat) and animal products (milk, cheese) plus plowing services;

(4) Transfer – Includes net transfers and net remittances (in cash and in kind) plus interest and dividends received from pensions and savings.

(5) Rental – Includes rents (in cash and in kind) received from ownership of such assets as land, machinery and housing.

Although the reasons for dividing income into these five sources should be apparent, the rationale for distinguishing between agricultural and livestock income may need clarification. On the one hand, some observers may claim that within a rural economy it is artificial (and empirically difficult) to distinguish between agricultural and livestock income, since outputs from one – such as straw and crop residuals from agriculture, and draft power and manure from livestock – are used as inputs in the other. On the other hand, the goal of this study is to disaggregate the sources of income inequality as finely as possible. For this reason, it seems essential to distinguish between agricultural and livestock income, because these two income sources have very different effects on inequality. According to the data, the simple correlation between agricultural income and total income is the highest of all five income sources: 0.844. By contrast, the simple correlation between livestock income and total income is one of the lowest: 0.232.[6]

Table 1 presents summary data for the five sources of income. The table shows quite clearly the importance of rural income other than agricultural income. Agricultural income accounts for less than one-quarter – 24.6 percent – of total rural income. By contrast, nonfarm income is the single most important source, accounting for 42.2 percent of total rural income. Although definitions of nonfarm income vary widely,[7] these percentage figures for nonfarm income are comparable to those recorded in other studies. For example, a recent review of rural household budget surveys in 13 African, Asian and Latin American countries found that nonfarm income accounts for between 13 and 72 percent of total rural household income (Braun and Pandya-Lorch, 1991: Table 13).[8] According to this review, the contribution of nonfarm income to total rural income is

especially high in those countries where unequal land distribution severely limit income-earning opportunities in agriculture.

The Gini coefficient of per capita income for the sample is: 0.532. On the one hand, this Gini is quite a bit higher than the Gini (0.321) which can be calculated from per capita expenditure data for the sample. On the other hand, since income data include savings, it is natural to expect that the Gini coefficient of income will be higher than that for expenditure. Moreover, the Gini coefficient of income from this study seems well within the range of income Ginis recorded for other developing countries. For instance, the income Ginis recorded in the most recent edition of World Development Indicators (1998: Table 2.8) suggest that Gini coefficients of per capita household income range from a low of 0.420 (Bolivia) to a high of 0.601 (Brazil).[9]

In Table 2 the five sources of income in rural Egypt are presented by income quintile group. The results demonstrate the importance of nonfarm income for the poor. The poor – that is, those in the lowest quintile group – receive almost 60 percent of their mean total per capita income from nonfarm income. This figure is 65 percent higher than that received by the poor from agricultural income, and more than ten times that received by the poor from transfer, livestock or rental income.[10] Evidently, the very real land constraints in rural Egypt – 75.7 percent of the households in the sample own no land[11] – force the poor to seek the bulk of their livelihood from outside agriculture.

Table 3 presents another way of showing the dependence of the poor on nonfarm income. In this table households are ranked by size of land owned. Like other studies,[12] the data reveal an inverse relationship between size of land owned and the share of nonfarm income. For the poorest (that is, landless group), non-farm income accounts

for 52 percent of mean total per capita income. Not only do the poor receive over one-half of their total rural income from nonfarm sources, but the poor receive twice as large a share of income from nonfarm sources as they do from any other type of income, including agricultural. By contrast, agricultural income seems more important to the larger landowning groups. After the two lowest landowning groups, the share of agricultural income generally exceeds that of nonfarm.

III. Income Inequality in Rural Egypt, 1997

Decomposing the Gini coefficient provides two ways of measuring the contribution of any income source to overall income inequality. First, it is possible to identify how much of overall income inequality is due to any particular source of income. Second, it can be asked whether inequality in an income source serves to increase or decrease overall income inequality.[13]

Table 4 reports the results of the Gini decomposition. The results show that while nonfarm income has the largest share in total income (S_k), its contribution to overall income inequality is relatively small ($S_kG_kR_k = 0.158$). In percentage terms, nonfarm income contributes only 29.7 percent to overall income inequality. By contrast, agricultural income makes a much larger contribution to overall income inequality ($S_kG_kR_k = 0.214$); in percentage terms, the contribution of agricultural income to overall income inequality is 40.2 percent. In fact, agricultural income makes the largest contribution to overall income inequality, because each of the other three sources of income – transfer, livestock and rental – account for less than 15 percent of income inequality in rural Egypt.

The data in Table 4 can be used to answer the question: Why does nonfarm income make a smaller contribution to rural income inequality than agricultural income? On the one hand, nonfarm income has a larger share in total rural income (S_k) than agricultural income. However, the source Gini (G_k) for nonfarm income is lower than that for agricultural income (0.634 vs. 1.155); this shows that nonfarm income is distributed more equally than that of agricultural income.[14] Moreover, the correlation of source income with total income rankings (R_k) for nonfarm income is lower than that for agricultural income (0.590 vs 0.750). For these reasons then – a low source Gini and a low degree of correlation with total income -- nonfarm income makes a smaller contribution to overall income inequality than agricultural income.

The decomposition results in Table 4 can also be used to distinguish between inequality-increasing and inequality-decreasing sources of income. According to the relative concentration coefficients (g_k) for the various income sources, three sources of income – nonfarm, transfer and livestock – represent inequality-decreasing sources of income. This means that, ceteris paribus, additional increments of nonfarm, transfer and livestock income will reduce overall income inequality. By contrast, additional increments of two sources of income – agricultural and rental – represent inequality-increasing sources of income.

IV. Exogenous Increases in Sources of Income

Using the decomposition formulations in Table 4 it is also possible to measure how much an increase in any particular income source will increase or decrease overall income inequality. Taking household labor and production decisions as given, suppose

there is an exogenous increase in income from source j, by some factor σ_j, such that y_j $(\sigma_j) = (1 + \sigma_j)y_j$. Then following Stark et al (1986: 726):

$$\frac{\partial G}{\partial \sigma_j} = S_j(R_j G_j - G) \qquad (9)$$

Where G is the overall Gini coefficient , and S_j, R_j and G_j denote the income share, Gini correlation and Gini coefficient of income source j. Dividing by G gives

$$\frac{\partial G/\partial \sigma_j}{G} = \frac{S_j G_j R_j}{G} - S_j \qquad (10)$$

Equation (10) states that the relative effect of a marginal percentage change in income source j upon overall inequality equals the relative contribution of source j to overall inequality minus the relative contribution to total income. From equation (10) it follows that a marginal increase in source j will reduce overall income inequality when:

(a) the Gini correlation between source j income and total income (R_j) is negative or zero; or when

(b) income from source j is positively correlated with total income ($R_j > 0$) and $R_j G_j < G$.

By contrast, in order for a marginal increase in source j to increase overall income inequality, it is necessary for $G_j > G$ (that is, the Gini coefficient of income source j is higher than the Gini coefficient for overall income). However, this condition is not sufficient for an increase in source j to raise overall inequality, because the sign of $\partial G/\partial \sigma_j$ will still be influenced by the strength of the Gini correlation between source j income and total income (R_j).

Table 5 shows the effects of a 1 percent increase in a particular income source on overall income inequality. The results underscore those of the previous table, namely, that an increase in agricultural income will lead to the largest increase in overall income inequality. A 1 percent increase in agricultural income will cause income inequality to rise by 0.084, which in percentage terms is equivalent to a 15.8 percent increase in the Gini coefficient. A 1 percent increase in rental income also raises overall income inequality, while increases in all of the other income sources will lower overall inequality. With respect to nonfarm income, a 1 percent increase in this source of income will lead to the largest decrease in overall income inequality: a 1 percent rise in nonfarm income will cause overall inequality to fall by 0.068, which is equivalent to a 12.8 percent fall in the Gini coefficient. From these results it appears that efforts to improve income distribution in rural Egypt should focus on expanding nonfarm income, because a small increase in this income source does the most to improve the overall distribution of income.

In addition to the income change analysis in Table 5, it is also possible to examine how welfare responds to an exogenous change in income source j. Welfare is a slightly broader concept than income because a small increase in source j income will affect overall welfare in two ways: first, by raising source income (income effect); and second, by altering the income distribution within the sample as a whole (distributional effect). The income effect will typically have a positive effect on welfare, but the distributional effect will have a positive or negative effect on welfare depending on whether or not overall inequality has increased.

To capture both the income and distributional aspects of welfare, Stark and Yitzhaki (1982) have proposed a Sen's welfare index of the form:

$$W = \mu\,(1 - G) \qquad (11)$$

Where μ and G, as defined previously, are the mean household income of the sample and the Gini coefficient of overall income inequality. While the welfare weightings in this expression are arbitrary, the framework is still useful for analyzing the average and distributional effects resulting from a small increase in any particular income source.

If there is an exogenous increase in income from source j by factor σ_j, then the sign of the change in welfare (as measured by equation (11)) can be evaluated by taking the derivative of W with respect to σ_j. On this basis, Leibbrandt et al (1996: 24) have shown that the following relation holds:

$$\frac{\partial W}{\partial \sigma_j} = \mu_j(1 - R_j G_j) \qquad (12)$$

where R_j is the Gini correlation of income from source j with total income, and G_j is the Gini coefficient of source income.

Dividing equation (12) through by W, it can be shown that:

$$(\frac{\partial W}{\partial \sigma_j})(\frac{1}{W}) = S_j \frac{1 - R_j G_j}{1 - G} \qquad (13)$$

Where S_j is the share of source j income in total income.

Equation (13) gives a measure of the marginal percentage change in welfare (as measured by the Sen welfare index) resulting from a small exogenous percentage change in income source j. The equation shows that the marginal change in welfare is always

positive. The expression also states that the marginal change in welfare consists of two components: an income effect equal to $S_j/1-G$; and a distributional effect, $\partial W - (S_j/1-G)$. Since in the case under analysis S_j is always positive, [15] the income effect is likewise positive. For the same reasons, in this case, the distributional effect is always negative, because $\partial W < (S_j/1-G)$.

Table 6 shows the effect of a 1 percent increase in a particular income source on the Sen welfare index. The welfare effects vary greatly among the five sources of income. As might be expected, the largest improvements in welfare come from a exogenous increase in nonfarm income. A 1 percent increase in nonfarm income causes the Sen welfare index to rise by 0.56 percent; this is almost three times the percentage increase in welfare that accompanies a rise in income from any other source. For example, a 1 percent increase in transfer income causes the Sen index to rise by only 0.19 percent.

The data in Table 6 show that the income and distributional effects of an exogenous change in source income are different. The 0.56 percent increase in the Sen welfare index resulting from an increase in nonfarm income includes a large positive income effect (0.908) and a large negative distribution effect (-0.345). For the reasons explained above, increases in all five of the income sources in Table 6 have a negative distributional effect on welfare. However, the largest negative distributional effect is recorded by a 1 percent increase in agricultural income. A 1 percent rise in agricultural income causes a negative distributional effect of -.460. This is not surprising, given the fact that agricultural income –as measured by the source Gini (G_j) – is distributed so unevenly.[16]

V. Land and the Determinants of Income Inequality

At this point, one critical question remains to be answered: Why is agricultural income distributed so unequally and why does income for this single source make such a large contribution to overall income inequality? One plausible explanation was broached at the very outset of this paper, namely, the close relationship between agricultural income and land.

In Egypt, as in many developing countries, land is distributed far more unequally than income. Whereas the Gini coefficient for per capita income in this study is 0.532, the Gini coefficient of landownership (including households with no land) is 0.899.[17] In other words, since land is distributed so unevenly, and land is such a vital component of agricultural production, it can be argued that it is the land-agriculture tie that "causes" agricultural income to go mainly to the rich in rural Egypt.

One useful means for investigating the veracity of this hypothesis is to try to quantify the character of the relationship between land and agricultural income in rural Egypt. This can be done by using multivariate regression analysis to identify the "determinants" of the five sources of income – including agricultural income – in this study. The challenge in such an analysis is twofold: first, to identify those exogenous household-level factors (including landownership) which somehow "cause" income to be produced; and second, to pinpoint the relative importance of each of those factors in producing different types of income (such as agricultural and nonfarm income).

In the strictest sense, most of the relevant income-producing variables that can be

identified in this data set reflect a series of endogenous rather than exogenous choices made by the household. However, the management and taste factors that affect such choices should be fixed, and, therefore should not seriously bias the regression estimates.

Following the standard household model, it can be assumed that a rural household maximizes utility by allocating the land, labor and capital of its family members to various agricultural and non-agricultural tasks. From the first-order optimum conditions, we can derive land, labor time and capital service allocation functions to various household tasks that commonly depend on a set of factor prices, technology, personal characteristics of household members, and ownership of land and nonland resources. Factor prices (including land rent and residual return to land) depend on technology and personal household characteristics (such as management ability) that cannot be assumed to be exogenous. For this reason, it is desirable to estimate the factor price and factor allocation functions simultaneously. Unfortunately, this procedure cannot be used here because the quantities and prices of household-supplied factors for most household activities cannot be accurately estimated, either in this or most other household-level surveys. Therefore, in this section we estimate the reduced form income determination functions without distinguishing factor prices and quantities, which depend on technology, ownership of resources, and other household characteristics.

Specifically, in order to identify the determinants of income, we regress each of the five sources of income in this study – nonfarm, agricultural, transfer, livestock and rental – on three types of household-level inputs which are thought to cause income: land (i.e. size of landowned, size of land rented in); labor (i.e. household size, number of males over age 15, education of males); and capital (i.e. value of livestock owned, value

of farm equipment owned, value of enterprises owned). In addition, since the data come from widely scattered rural areas, differences in land, water and other inputs may affect the determination of income. For this reason, 16 governorate-level dummy variables are included in the model. Table 7 reports means and standard deviations for the model.

The results of the model, which are estimated using ordinary least squares, are shown in Table 8. The findings point to the key role that land plays in the determination of agricultural income. Land owned is positively and statistically related to agricultural income; the point estimates suggest that an exogenous increase of one feddan in the amount of land owned by the household will result in a 101 LE increase in per capita household income from agriculture. With the exception of rental income, an increase in household landowning does not have a statistically significant impact on any other type of income, including nonfarm income. In fact, for nonfarm income an exogenous increase in the amount of land owned by the household actually leads to a (statistically insignificant) reduction in per capita household income from nonfarm sources. These results suggest that while agricultural income is positively associated with landownership, which is unevenly distributed in favor of the rich, nonfarm income is not linked with landownership and thus is more important to the poor.

While pointing to the strong links existing between land and agricultural income, the findings in Table 8 do not address the key question of causality. In other words, is it inequality in land ownership which leads to unequal income distribution or is it uneven income distribution which causes the high concentration of land ownership? To adequately answer this question for rural Egypt would require more data, specifically,

panel data on how changes in the distribution of various sources of income are related to changes in the ownership of land.[18]

VI. Conclusion

This study has used decomposition analysis on a nationally-representative data set from rural Egypt to examine the impact of five sources of income – including nonfarm income -- on rural income inequality. Three key conclusions emerge.

First, the study shows that if policymakers are interested in reducing poverty and improving income distribution in rural Egypt then they should focus on nonfarm income. Not only does nonfarm income account for almost 60 percent of the total per capita income of the rural poor (i.e. those in the lowest income quintile group), but it also has a favorable impact on overall income distribution. Of the five sources of income examined in this study, a 1 percent marginal increase in nonfarm income will lead to the largest decrease in overall rural income inequality. A 1 percent increase in nonfarm income will cause overall rural income inequality to fall by 0.068, which is equivalent to a 12.8 percent decline in the Gini coefficient of overall income. By contrast, a 1 percent increase in any other inequality-decreasing source of income – such as transfer or livestock income—will only lead to a 3.2 percent decline in the Gini coefficient of overall income.

Second, as de Janvry and Sadoulet (1993) have suggested, this study affirms the close tie between land, nonfarm income and the poor. Nonfarm income is an inequality-decreasing source of income in a land-scarce, labor-rich setting like rural Egypt because inadequate land access "pushes" poorer households out of agriculture and into the

nonfarm sector. In this study 75.7 percent of households own no land and the Gini coefficient of landownership (0.899) is much higher than the Gini coefficient of income (0.532). For this reason, regression analysis shows that while the amount of household land owned is positively and statistically related to the receipt of agricultural income, household land owned has no statistical relationship with the receipt of nonfarm income. In other words, while agricultural income is positively associated with landownership, which is unevenly distributed in favor of the rich, nonfarm income is not linked with landownership and thus is more important to the poor.

The third and final finding follows directly from the above. Agricultural income, which is the second most important source of income in this study, is an inequality-increasing source of income. For example, a 1 percent marginal increase in agricultural income will lead to the largest increase in overall rural income inequality. A 1 percent rise in agricultural income will lead to a 15.8 percent increase in the Gini coefficient of overall income. Agricultural income makes the largest contribution to overall rural income inequality in this study because it is unevenly distributed and it is highly correlated with total income.

Notes

[1] As noted by Leibbrandt et al (1996: 4), R_k is a form of rank correlation coefficient, because it measures the extent to which the relationship between Y_k and the rank distribution of total income coincides with the relationship between Y_k and its own rank distribution.

[2] This analysis ignores feedback effects, that is, the effects that a change in any source income share might have on distribution within any source income. Of course, such an assumption might be quite unrealistic for large changes in any source income share.

[3] This household survey was conducted by the International Food Policy Institute, working in collaboration with the Egyptian Ministry of Agriculture and the Egyptian Ministry of Trade and Supply.

[4] For more details on this 1997 Egypt Integrated Household Survey, see Datt, Joliffe and Sharma (1998).

[5]According to the data, 90 percent of rural households in the survey own their own house.

[6] Only the simple correlation between transfer income and total income (0.204) is lower than that for livestock income. The simple correlations for the other source incomes are: nonfarm income, 0.362; and rental income, 0.442.

[7] It should be noted that the definition of nonfarm income used here is narrower than those used in other studies. For example, Reardon (1997) includes migration (remittances) income in nonfarm income while Chinn (1979) includes rental income.

[8]For other estimates of the share of nonfarm income in total rural income, see Reardon (1997) on Africa, and Hazell and Haggblade (1993) on Latin America.

[9]It should be noted, however, that these Ginis of per capita household income for Bolivia and Brazil are based on the distribution of overall (that is, urban and rural) incomes, while the income Ginis used in this study are based on rural household income. In theory, one would expect that the distribution of rural household income to be more egalitarian than that of overall household income.

[10] Non-farm income is also important to the poor, when the poor are defined on the basis of expenditure rather than income data. Appendix Table 1, where the quintile groups are based on total per capita expenditures, shows that the poor –those in the lowest quintile group – receive almost 45 percent of their total per capita income from nonfarm income.

[11]There is an active rental market for land in rural Egypt. Thus, while 75.7 percent of the survey households own no land, in terms of land access (that is, land owned plus land rented in) a slightly smaller percentage (61.6 percent) of the survey households have no land access.

[12]For example, on Pakistan see Adams (1994), on India see Walker and Ryan (1990), and on Malaysia see Shand (1986).

[13]In analyzing whether an income source is inequality-increasing or –decreasing, it is assumed that additional increments of that income source are distributed in the same fashion as the original units.

[14]In fact, nonfarm income is the most equally distributed source of income in the study, because it has the lowest source Gini (G_k) in Table 4.

[15]As shown in Table 4, the shares of source income in total income (S_k) are all positive.

[16]According to Table 4, the source Gini (G_k) for agricultural income is 1.155. The source Gini for agricultural income exceeds unity in this table because 16.5 percent of the households have negative agricultural incomes.

[17]Excluding the households with no land, the Gini coefficient of landownership is O.532.

[18]For an interesting effort to use cross-national data to examine the nature of the casual relationship between income and land in a sample of 28 developing countries, see Quan (1989).

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Table 1. Summary of income data from rural Egypt, 1997.

Source of Income	Mean Annual per Capita Household Income[a] in LE[b]	Standard Deviation
Nonfarm	414.09	626.13
Agricultural	241.29	1,161.30
Transfer	150.91	360.84
Livestock	92.60	268.71
Rental	81.26	311.56
Total	980.15	1,480.69

Source: IFPRI Egypt Integrated Household Survey, 1997

Notes: N= 1301 households.

(a) Mean income figures include negative source incomes for some households.

(b) In 1997, 1 Egyptian pound (LE)= US $0.295. All income figures in nominal terms.

Table 2. – Sources of income in rural Egypt ranked by quintile on the basis of total per capita household income

Total Per Capita Income Quintile[a]	Average Total Per Capita Income[b]	Percent of Total Per Capita Income from				
		Nonfarm	Agricultural	Transfer	Livestock	Rental
	(LE)					
Lowest	4.38	59.0	35.8	2.6	5.4	(-2.8)
Second	402.35	52.1	18.7	19.5	8.3	1.4
Third	615.52	51.3	19.4	16.1	10.6	2.6
Fourth	955.25	52.5	20.4	15.1	8.2	3.9
Highest	2455.28	38.4	26.0	16.6	8.6	10.4
Total	980.83	50.0	23.9	14.3	8.3	3.5

Source: IFPRI Egypt Integrated Household Survey, 1997

Notes: N= 1301 households.

(a) Quintile groups based on population (not households) because poorer households tend to be larger.

(b) In 1997, 1 Egyptian pound (LE)= US $0.295. All income figures in nominal terms.

Table 3. Sources of income ranked by size of land owned

Size of Land Owned	Number of Households in Group	Average Total Per Capita Income[a]	Percent of Total Per Capita Income from				
			Nonfarm	Agricultural	Transfer	Livestock	Rental
(Feddans)		(LE)					
0	982	885.94	51.8	23.7	18.5	3.4	2.6
<1	159	879.53	67.2	(-1.5)	(-3.4)	40.8	(-3.1)
1-<3	115	1630.32	23.9	55.4	5.0	2.2	13.5
3-<5	26	1565.59	13.6	41.5	3.2	21.8	19.9
5-<10	10	1383.14	36.8	35.4	1.4	12.4	13.9
≥10	9	2513.01	20.7	24.4	10.4	12.5	32.0
Total	1301	980.83	50.0	23.9	14.3	8.3	3.5

Source: IFPRI Egypt Integrated Household Survey, 1997

Notes: N= 1301 households.

(a) In 1997, 1 Egyptian pound (LE)= US $0.295. All income figures in nominal terms

Table 4. Decomposition of overall income inequality in rural Egypt

Income Source	Proportion of households receiving income source (P_K)	Share in total income (S_K)	Gini coefficient for income source [a] (G_K)	Gini correlation with total income rankings (R_K)	Contribution of income source to overall income inequality ($S_K G_K R_K$)	Relative concentration coefficient of income source ($g = R_K \frac{G_K}{G}$)	Percentage contribution to overall income inequality
Nonfarm	0.607	0.422	0.634	0.590	0.158	0.703	29.7
Agricultural	0.669	0.246	1.155	0.750	0.214	1.628	40.2
Transfer	0.509	0.154	0.848	0.488	0.064	0.778	12.0
Livestock	0.695	0.094	0.935	0.376	0.034	0.661	6.4
Rental	0.317	0.083	0.924	0.805	0.062	1.398	11.7
Total	1.000	1.000	-	-	0.532	-	100.0

Notes: N=1301 households. All estimates are based on annual per capita household Income.

(a). Source ginis are high because they include households with zero and negative incomes from different income sources. Source ginis can exceed unity if many of y_i are negative.

Table 5.–Effects of a 1 percent increase in a source income on overall income inequality

Source of income	Absolute change in overall Gini coefficient by 1 percent change in income source	Percent change in overall Gini coefficient by 1 percent change in income source	Mean annual per capita household income in LE[a]
Non-farm	-0.068	-0.128	414.09
Agricultural	0.084	0.158	241.29
Transfer	-0.017	-0.032	150.91
Livestock	-0.017	-0.032	92.60
Rental	0.018	0.034	81.26

Note: N= 1301 households.

(a) In 1997, 1 Egyptian pound (LE)= US $0.295. All income figures in nominal terms.

Table 6. – Effects of a 1 percent increase in a source income on the Sen Welfare Index

Income source	Percent change in Sen welfare index by a 1 percent change in income source	Income effect	Distribution effect
Nonfarm	0.563	0.908	-0.345
Agricultural	0.070	0.530	-0.460
Transfer	0.193	0.332	-0.139
Livestock	0.131	0.204	-0.073
Rental	0.045	0.179	-0.134

Notes: N= 1301 households.

Table 7 – Means and standard deviations for determinants of rural income regression

	Source of income				
Variable	**Nonfarm**	**Agricultural**	**Transfer**	**Livestock**	**Rental**
Amount of land owned by household (feddans)[a]	0.35 (1.67)	0.65 (2.02)	0.50 (2.11)	0.59 (1.95)	1.24 (2.80)
Amount of land rented in by household (feddans)[a]	0.15 (0.55)	0.29 (0.86)	0.16 (0.73)	0.27 (0.84)	0.38 (1.03)
Household size	6.92 (3.37)	7.48 (3.75)	6.45 (3.59)	7.30 (3.73)	7.96 (4.07)
Number of household males over 15 years	2.02 (1.33)	2.13 (1.39)	1.75 (1.29)	2.06 (1.39)	2.35 (1.51)
Number of household males with preparatory education or higher	0.97 (1.04)	0.85 (1.01)	0.78 (0.98)	0.85 (1.00)	0.98 (1.06)
Value of livestock owned (LE)[b]	945.95 (2045.18)	1778.47 (2531.79)	1106.39 (1895.44)	1733.12 (2496.41)	2388.47 (2785.97)
Value of farm equipment owned (LE)[b]	521.02 (4190.41)	799.25 (4550.99)	626.29 (4358.24)	700.95 (4164.76)	1508.98 (6515.85)
Value of enterprises[c] owned (LE)[b]	1715.26 (8433.54)	842.16 (6515.79)	548.45 (3524.86)	948.74 (6753.13)	1244.07 (8980.19)
N	791	870	663	905	412

Notes: Standard deviation in parentheses. Governorate – level dummy variables are not reported.

(a) 1 feddan = 1.038 acres

(b) In 1997, 1 Egyptian pound (LE)= US 0.295. All income figures in nominal terms.

(c) Enterprises include shops, stores, pharmacies and other business activities.

Table 8 – Regression analysis of determinants of rural income

Variable	Annual per capita household income from: Nonfarm	Agricultural	Transfer	Livestock	Rental
Land					
Amount of land owned by household	-9.149 (-0.622)	101.449 (4.027)**	-1.033 (-0.116)	-0.495 (-0.106)	27.807 (2.994)**
Amount of land rented in by household	-22.848 (-0.498)	-228.729 (-3.993)**	-2.171 (-0.085)	6.955 (0.658)	-24.896 (-1.009)
Labor					
Household size	-68.749 (-7.297)**	-32.324 (-1.774)	-39.023 (-5.767)**	-21.932 (-6.595)**	-42.366 (-4.665)**
Number of household males over 15 years	17.077 (0.619)	24.642 (0.430)	-21.971 (-0.993)	-10.636 (-1.029)	-4.768 (-0.165)
Number of household males with preparatory education or higher	68.375 (2.384)*	-18.311 (-0.296)	13.397 (0.563)	4.651 (0.418)	-18.192 (-0.596)
Capital					
Value of livestock owned	0.002 (0.118)	0.006 (0.308)	-0.007 (-0.684)	0.076 (19.548)**	-0.002 (-0.158)
Value of farm equipment owned	1.136 (0.007)	0.009 (0.796)	0.002 (0.432)	0.005 (2.398)*	0.005 (1.193)
Value of enterprises owned	0.014 (5.001)**	0.001 (0.082)	-0.003 (-0.583)	0.001 (0.803)	0.003 (1.020)
Constant	998.307 (8.444)**	254.012 (0.803)	486.726 (3.242)**	88.875 (1.324)	363.936 (1.990)*
N	791	870	663	905	412
Adjusted R^2	0.152	0.032	0.101	0.345	0.118
F – statistic	6.89	2.19	4.10	20.83	3.28

Notes: Numbers in parentheses are T-statistics (two-tailed).
Governorate-level dummy variables are not reported. The dependent variable is annual per capita household income from the particular income source.

* Significant at the .05 level.
** Significant at the .01 level.

Appendix Table 1. – Sources of income in rural Egypt ranked by quintile on the basis of total per capita household expenditures

Total Per Capita Expenditure Quintile[a]	Average Total Per Capita Income[b]	Percent of Total Per Capita Income from				
		Nonfarm	Agricultural	Transfer	Livestock	Rental
	(LE)					
Lowest	530.21	43.6	34.7	17.0	2.8	1.9
Second	628.00	70.5	(-10.2)	22.2	15.1	2.3
Third	778.34	55.2	11.9	8.6	21.2	3.1
Fourth	949.30	43.6	35.5	10.8	5.6	4.5
Highest	1754.88	40.4	41.6	13.4	(-0.6)	5.5
Total	980.83	50.0	23.9	14.3	8.3	3.5

Source: IFPRI Egypt Integrated Household Survey, 1997

Notes: N= 1301 households.

(a) Unlike Table 2, quintile groups in this table are based on total per capita expenditures (not income). Quintile groups are based on population (not households) because poorer households tend to be larger.

(b) In 1997, 1 Egyptian pound (LE)= US $0.295. All income figures in nominal terms.

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