



**AGRICULTURAL PRODUCTIVITY GROWTH,
EMPLOYMENT AND POVERTY IN EGYPT**

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Abstract

The purpose of this paper is to investigate the importance of agricultural productivity growth for generating employment and alleviating poverty in Egypt. Specifically, it attempts to answer the following questions: How important is agriculture for *income and employment generation* in rural Egypt? What is the relationship between agricultural productivity and poverty reduction? What are the main linkages between agricultural and non-agricultural activities in rural areas? And finally, what needs to be done to increase the contribution of agriculture to poverty alleviation? To answer these questions, the paper draws on the Agricultural Farm Income Survey 2003/2004 (AFIS) database constructed from a survey conducted by the Egyptian Ministry of Agriculture and Land Reclamation (MALR) and on the latest Household Income and Expenditure Consumption Survey 2004/2005 compiled by the Central Agency of Public Mobilization and Statistics (CAPMAS). To conclude, the paper points out the importance of formulating and implementing a comprehensive strategy that strengthens farm/non-farm linkages; such a strategy is more likely to yield better results in terms of employment, income generation and hence poverty alleviation.

ملخص

تهدف هذه الدراسة إلى بحث أهمية نمو الإنتاجية الزراعية لتوفير فرص العمل والتخفيف من حدة الفقر في مصر. وتحدد، تتناول الدراسة بالتحليل مدى أهمية الزراعة لتوليد الدخل وفرص العمل في الريف، والعلاقة بين الإنتاجية الزراعية وتخفيض الفقر، والروابط الرئيسية بين الأنشطة الزراعية وغير الزراعية في المناطق الريفية، وأخيرا تطرح مقترحات من شأنها زيادة مساهمة القطاع الزراعي في تخفيف حدة الفقر. وتستند الدراسة في ذلك إلى قاعدة البيانات من واقع مسح الدخل المزرعي الزراعي الذي أعدته وزارة الزراعة واستصلاح الأراضي المصرية عن عام ٢٠٠٣/٢٠٠٤؛ وكذلك إلى مسح الدخل والإنفاق والاستهلاك للأسرة لعام ٢٠٠٤/٢٠٠٥ الذي قام بإعداده الجهاز المركزي للتعبئة العامة والإحصاء. وفي النهاية، تؤكد الدراسة على أهمية صياغة وتطبيق إستراتيجية شاملة من شأنها تقوية الروابط بين الأنشطة المزرعية وغير المزرعية، الأمر الذي سيعود بنتائج إيجابية من حيث زيادة التشغيل والدخل ومن ثم التخفيف من حدة الفقر.

1. INTRODUCTION

There is increasing consensus that supporting the agricultural sector is necessary to boost productivity and reduce poverty in rural areas (Christiansen, Demery and Kühl 2006). Results from China, India and other Asian countries showed that agricultural growth is more important than manufacturing growth for poverty reduction (Ravallion and Datt 1996; Ravallion and Chen 2004; Timmer 2005). Even if manufacturing growth matters more for overall growth, growth in agriculture through increased agricultural productivity is necessary for both employment growth and poverty reduction. However, the contribution of growth in agriculture, given the already labor-intensive nature of agricultural production in Egypt, is not likely to generate sizable additional agricultural employment, but it is more likely to generate demand for non-agricultural goods and services produced by local micro and small enterprises (MSEs) and home-based activities in rural areas. These firms would respond to improved demand from the agricultural sector by having their existing laborers work longer and harder, thus reducing under-employment. Large and sustained increase in demand would lead, *with a time lag*, to additional job creation, resulting in enhanced rural employment in non-agricultural activities (Gavian et al. 2003).

The purpose of this paper is to investigate the importance of agricultural productivity growth for generating employment and alleviating poverty in Egypt.

Based on the Agricultural Farm Income Survey 2003/2004 (AFIS) database constructed from a survey conducted by the Egyptian Ministry of Agriculture and Land Reclamation (MALR) and on the latest Household Income and Expenditure Consumption Survey 2004/2005 compiled by the Central Agency of Public Mobilization and Statistics (CAPMAS), the paper attempts to address the following questions:

1. How important is agriculture for *income and employment generation* in rural Egypt?
2. What is the relationship between agricultural productivity and poverty reduction in Egypt?
3. What are the main linkages between agricultural and non-agricultural activities in rural areas?
4. What needs to be done to increase the contribution of agriculture to poverty alleviation?

The paper includes six sections. An overview of Egyptian agriculture is first presented in the next section. Section 3 considers various sources of income and employment in the rural economy. Section 4 addresses the relationship between agricultural productivity and poverty reduction. Section 5 analyzes linkages between agricultural growth and the rural economy. Section 6 concludes and presents some policy recommendations.

2. OVERVIEW OF THE AGRICULTURAL SECTOR

Agriculture, although declining in terms of contribution to gross domestic product (GDP), remains the single largest component of Egypt's GDP, contributing on average over the past three years 14.7 percent of total GDP and 17 percent of GDP excluding petroleum. It provides more than 27.8 percent of employment (Ministry of State for Economic Development). Agricultural production growth resulted in an increase in self-sufficiency rates of basic agricultural crops.¹ The share of agriculture in exports is also substantial, accounting for 11.8 percent of total export of goods earnings and 20.5 percent of non-petroleum exports. With a weight exceeding 42.6 percent in the consumer price index, food prices are closely linked with inflation. Any adverse shock on agriculture could have serious cumulative effects on the economy. Furthermore, agriculture has strong forward and backward linkages, it provides essential intermediate inputs to the two single most important manufacturing activities in Egypt (food, and textiles and clothing, which contribute respectively 4 percent and 1.8 percent of GDP, and provide 18.4 percent and 29.2 percent of industrial employment) (Ministry of Trade and Industry). Finally, it is also the main user of fertilizers, pesticides and agricultural machinery.

There are three main cropping seasons in Egypt: winter, summer and nili. In addition, there are permanent crops such as sugarcane, dates, citrus and mango. All crops may be categorized into traditional and non-traditional. The first group is classified into fodder (berseem and yellow corn or summer maize) and non-fodder (barley, horse beans, cotton, summer and nili maize, rice, wheat, ...). The second is composed of fruit (including citrus), vegetables, and aromatic, medicinal and oil plants (AMO).

¹ Self-sufficiency in wheat production rose from 39 percent in 1981/1982 to 58 percent in 2005/2006, while complete self-sufficiency in traditional crops such as maize and rice, and non-traditional crops (vegetables and fruit), as well as in dairy products (milk), eggs and fish has been achieved (Ministry of State for Economic Development 2007, p.4).

Egyptian agriculture in *old lands* is characterized by small landholdings, and is classified by the Ministry of Agriculture and Land Reclamation (MALR) into four categories: extra small (less than one feddan), small (one to three feddan), medium (three to less than five feddan) and large (five feddan and above). The distribution of farms by size of landholdings differs significantly for Lower (north) and Upper (south) Egypt, as indicated in Table 1.

Table 1. Percentage Distribution of Farms by Size of Landholding in Lower and Upper Egypt (Percent)

Region	Size of Landholding (Feddan)			
	<1	1 to <3	3 to <5	≥ 5
Lower Egypt	29.28	31.99	11.76	26.96
Upper Egypt	42.31	35.89	10.96	10.85

Source: Calculated from AFIS 2003/2004.

Landholdings appear to be more evenly distributed among various sizes in Lower Egypt. In contrast, extra-small landholdings account for more than 42 percent of the total number of farms in Upper Egypt; both extra small and small landholdings represent more than 78 percent of farms in that region. The majority of farmers with extra small landholdings practice subsistence agriculture.

In addition to old lands covered by AFIS, Egypt has a smaller *modern agricultural sector on newly reclaimed lands*, which is characterized by relatively larger farms (exceeding 10 feddans) and relatively less labor-intensive pattern of production. Producers in new lands appear to be better connected to processing and marketing firms and have better access to international markets. Old lands represent over 85 percent of

cropped area whereas new lands represent the rest (Annex Table A.1). The focus of this study is on old lands of the Nile valley and the Delta.²

In old lands, important differences, mostly attributable to variations in the structure of production systems and factor endowments between Upper and Lower Egypt have been identified.

Upper Egypt, typically dominated by producers with extra small and small farm size, is mainly engaged in cultivation of traditional crops. Farmers in this region are likely to experience shortage in essential factors of production, primarily capital and material inputs, compared to Lower Egypt farmers. According to the AFIS 2003/2004, total variable costs³ of production per feddan in Upper Egypt (LE 1367.8) exceed total costs per feddan in Lower Egypt (LE 1263) by around 8.3 percent. This difference arises mainly because of differences in cropping pattern, in quality and accessibility of other factors of production as well as in prices of other intermediate inputs.

Egyptian agriculture is characterized by low share of owned *physical capital* stock. Farmers usually rent the services of pumps, tractors, threshers and other equipment, either against cash payments, or exceptionally exchanging machinery services for human labor services. Capital expenditures in Upper Egypt are higher, reflecting relative scarcity of capital. Rural capital shortage is mainly explained by credit shortage and imperfect credit markets. Most *formal loans* are provided through the Principal Bank for Development and Agricultural Credit (PBDAC), which requires land ownership—rather than tenancy contract—as collateral. *Informal loans* are usually extended by rich farmers to poorer landowners and tenants in exchange for part of their crops. There is also evidence, according to the AFIS sample that Upper Egypt farmers are given loans at a higher interest rate than northern farmers. To make up for this

² The Government of Egypt (GOE) is projecting over the sixth five-year plan (2007/2008-2011/2012) a growth rate of the agricultural sector of 3.9 percent as compared to a 7.9 percent overall growth rate of GDP. The expected share of the sector in total investments is 4.8 percent amounting to LE 61.6 billion. These investments are to reclaim around one million feddans and to create 400 villages in the hinterland; in addition to supporting and enlarging the agricultural infrastructure in irrigation and drainage, increasing the production of high value added crops, developing high yielding varieties (HYVs), particularly non-traditional crops and altering the cropping pattern by reducing the rice area, keeping constant the sugarcane area and increasing that of sugar beet. The sixth five-year plan is also projecting the creation of 522 thousand job opportunities in agricultural activities leading to a corresponding increase in agricultural wages by LE 3.1 billion (Ministry of State for Economic Development 2007). Although the new five-year plan did not explicitly differentiate between investments in old and new lands, it is clear that it emphasizes horizontal development of agriculture rather than agriculture in *old lands*, which is the concern of this paper.

³ Variable costs include labor, machinery and other costs (fertilizers, pesticides, seeds, etc.).

shortage, Upper Egypt farmers depend more on human and animal labor inputs (Moursi, El-Mossallamy, and Reda 2004).

Irrespective of cropping pattern, farmers adopt *labor-intensive* techniques, which involve extensive use of household labor endowments provided by the extended family. On average, approximately 39 percent of farmers in Lower Egypt are family workers (over 18 percent are unpaid workers according to HIECS, 2004/2005) whereas, they represent an even bigger participation in Upper Egypt, reaching 46 percent of labor (around 22 percent are unpaid workers according to HIECS) in this region. Larger farms in both Upper and Lower Egypt would tend to have relatively larger amounts of waged workers to complement (and/or substitute) scarce family labor. In spite of smaller farm size, Upper Egypt farmers seem to utilize scarce agricultural land more efficiently than Lower Egypt's, although land quality in Lower Egypt may be, on average, superior. Hence, *relative land scarcity and smaller holdings appear to contribute to raising land productivity for farmers with smaller landholdings* (Moursi, El-Mossallamy, and Reda 2004).

Draft *animal* power is a substitute for human labor in both Lower and Upper Egypt. However, southern farmers apply animal inputs more intensively in production than northern farmers; daily wages for animal labor are also noted to be relatively lower in the south.

Irrigation water is usually accessible to all arable land. It is a non-cash factor of production in Egyptian agriculture, and is uneconomically used by flooding the cultivated fields, a practice that has to be revised in light of expected water scarcity.

Purchased inputs vary between the two regions. Unit price of materials appears to be higher in Lower than in Upper Egypt. Yet, higher prices of materials may proceed from quality differentials which favor the north and result in a reduction in the quantity used per feddan relatively to Upper Egypt (Moursi, El-Mossallamy, and Reda 2004). Agricultural cooperatives are still prevalent in the distribution of inputs.⁴

⁴ Agricultural cooperatives are still widespread (as many as 6000). They have been established in the 1960s to distribute subsidized agricultural inputs and collect and market outputs. Although agriculture has been liberalized since the end of the 1980s, the cooperatives have retained their role in the distribution of inputs. They provide other services as well, such as marketing of agricultural produce and extension services. Most farmers still consider them as state agencies and their performance is mixed. They further compete with the Principal Bank for Development and Agricultural Credit (PBDAC) in delivering inputs, in an unfair environment as PBDAC receives preferential quotas of inputs in short supply (World Bank 2006).

Furthermore, it appears that farmers who grow non-traditional crops are more capable of raising their income. Almost 92 percent of cropped area in Upper Egypt under traditional crops yields only 85 percent of the region's net farm income (NFI), while around 8 percent of cropped area in Upper Egypt under non-traditional crops generates almost 15 percent of NFI (see Table 2). Similarly, expansion in production of non-traditional crops in Lower Egypt improves the chances of farmers in this region to raise their share in aggregate net farm income. Non-traditional crops (mostly fruit and vegetables) easily perish, particularly in the absence of appropriate transport and storage. Transportation and storage problems for perishable products are aggravated with increase in distance between production location and consumption centers and with market segmentation. The distance between major consumption centers of these products—particularly Cairo and Alexandria—and Upper Egypt limits the expansion of fruit and vegetables production in this region. Integrating agricultural producers of the south in major consumption markets of the north is thus necessary, but this requires considerable capital investments (Moursi, El-Mossallamy, and Reda 2004).

Table 2. Area and NFI Shares for Traditional and Non-Traditional Crops in Lower and Upper Egypt (Percent)

	Area		NFI	
	Lower	Upper	Lower	Upper
Traditional Crops				
Fodder	13.02	20.01	12.06	20.65
Non-Fodder	49.83	71.70	42.73	64.63
Total	62.85	91.71	54.79	85.28
Non Traditional				
Fruit	21.28	2.32	22.83	5.73
Vegetables	8.18	2.80	14.03	6.87
AMO	7.70	3.17	8.35	2.12
Total	37.15	8.29	45.21	14.72

Source: Calculated from AFIS 2003/2004.

Finally, Upper Egypt farmers allocate a considerable amount of agricultural resources to livestock production in order to benefit from high returns from this rewarding activity without significant change in the pattern of farming system.

In sum, the agricultural farm income survey suggests that prudence of Upper Egypt farmers raises their net farm income and their productive efficiency from both plant and livestock production relatively to Lower Egypt farmers.

3. SOURCES OF INCOME AND EMPLOYMENT IN THE RURAL ECONOMY

Preliminary results of the 2006 Population Census indicate that around 57.3 percent of Egypt's population lives in rural areas (more than 41.6 million people). The rural sector consists of two sub-sectors: *the farm or agricultural sector* and *the non-farm or non-agricultural sector*. The first consists of landholdings of various sizes producing staple food and commercial goods. The share of subsistence agriculture declines as the size of landholdings increases. This sector consists of self-employed farmers engaging other family workers, or employing salaried workers. The small, medium and large size farms provide employment to a significant number of the landless. The second sub-sector consists of non-farmers engaged in micro, small and medium enterprises or in home-based activities producing goods or services for the local market as well as local government employees and social services providers (teachers, local doctors, ...).

One way to assess the contribution of agriculture to poverty is to look at its share of total household income and at its share of employment in rural Egypt.

In what follows, we examine the shares of various sources of rural incomes as well as the distribution of employment by expenditure quintiles (as a proxy for income quintiles) paying special attention to the effect of activity of employment (agricultural or non-agricultural) and type of employment (wage worker or self-employed).

3.1. Sources of Income

Non-farm income from either wages or self-employment, in rural Egypt contributed, on average, about 47 percent of total income (Table 3), compared to about 40 percent from agricultural wages and self-employment and 13 percent of other income sources such as rent, pension, transfers and remittances. It is clear that non-farm activities represent an important source of income, even at this highly aggregated level. Examining the contribution of farm/non-farm (agricultural/non-agricultural) sources to total income across different per capita expenditure quintiles indicates that agricultural income is more important than non-agricultural income for the lowest two quintiles, where the contribution from agricultural sources exceeds 45.5 percent of their total income. The share of agricultural income, for the highest quintile, is lower than that for the poorest two quintiles by more than 12 percentage points. Taking all non-farm income sources together, the evidence in Table 3 suggests that the importance of non-farm income is also unevenly spread across quintiles. The shares of non-farm

sources of income and other sources to total income increase as per capita expenditure (income) rises, where the shares for the highest quintile exceed by about 14 percentage points those for the lowest quintile. The importance of non-agricultural income as a way out of poverty is again suggested by the observation that across quintiles, the share of total income from non-agricultural activities and from other sources revolves around an average of 60 percent. It rises sharply with living standards from 53 percent for the first quintile to 66.7 percent for the fifth.

Table 3. Income Shares by Quintile, Sources of Income and Employment Status in Rural Egypt, 2005 (Percent)

Quintiles	Agriculture				Non-agricultural Activities				Other Sources
	Wages	Self-Empl.	Empl. Others	Total	Wages	Self-Empl.	Empl. Others	Total	
1	13.75	25.47	7.59	46.81	33.61	3.58	6.79	43.98	9.21
2	8.79	30.50	6.23	45.52	34.17	4.40	6.87	45.44	9.04
3	5.73	32.53	5.93	44.19	34.99	4.82	6.10	45.91	9.90
4	4.04	30.28	5.88	40.20	35.24	6.90	6.09	48.23	11.57
5	2.01	27.04	4.21	33.27	32.36	9.53	6.42	48.31	18.42
Total	5.40	29.09	5.55	40.04	33.87	6.70	6.39	46.96	13.00

Source: Calculated from HIECS, 2004/2005.

When farm and non-farm incomes are further disaggregated into wages and self-employment income, and employing and not employing other workers, it appears that farm income from self-employment, not engaging any workers, is clearly the most important source of income, accounting for close to 30 percent of total income in the sample. This reflects the small sized landholdings, which provide the main source of livelihood to a large section of rural population, with a relatively higher share of income for the middle three quintiles of the distribution. Farm income from self-employment, employing other workers, represents 5.6 percent of total income in rural Egypt, declining consistently from 7.6 percent for the lowest income quintile, to 4.2 percent for the highest, suggesting, at higher levels of income, the possibility of increased reliance on non-wage workers or other patterns of land exploitation, such as crop sharing. Finally, income from agricultural wage contributes around 13.8 percent of income for the poorest quintile, while its share for the richest quintile is as small as 2 percent. This indicates a relatively higher dependence on wage income from farm work for the poorer section of rural population.

Overall, the share of non-farm wage income is the highest exceeding that of farm self-employed not engaging workers, it reaches 33.9 percent of income, although it tends to be higher for the three middle quintiles of income distribution. The share of

non-farm income from self-employment not engaging others is for rural Egypt around 6.7 percent of income, but tends to rise steeply from 3.6 percent for the lowest quintile to 9.5 percent for the highest.

This implies that the better off in rural areas are relatively more engaged in non-farm self-employment than those in other lower quintiles. The share of income from non-farm activities for self-employed employing others hovers around 6.4 percent, without significant differences between various income quintiles.

In sum, although agriculture does not provide the only source of income to the rural poor, it remains the most important source, followed by wages earned in off-farm activities. Agriculture remains an important source of income even for households deriving a significant proportion of their income from non-farm sources, as reflected by its contribution to income of the highest quintile (one third against two thirds generated off-farm).

Considering income shares by sources of income, quintiles and employment in Lower and Upper rural Egypt, as reflected in Table A-2, agriculture appears to be a more important source of income in Upper rural Egypt (44.7 percent) compared with its share in Lower rural Egypt (37 percent). Non-agricultural activities provide almost half the incomes earned in Lower Egypt, as opposed to a share of 42.3 percent in Upper Egypt. The shares of other sources of income are almost equal in the two regions (around 13 percent). In both regions, agriculture has a relatively higher contribution to incomes in the lowest three quintiles with a share significantly higher in Upper than in Lower rural Egypt, confirming the higher poverty rates prevailing in the south.

3.2. Distribution of Rural Employment

Consideration of distribution of rural employment by activity and working status gives further insights into the importance of agriculture for the rural sector and its relation to poverty. As reflected in Table 4, agriculture provides around 58 percent of total employment in rural areas. This implies that on average, earnings in agriculture are lower than in off-farm activities, as agriculture generates only 40 percent of rural income (Table 3). Moreover, the importance of agricultural activities as providers of employment persistently declines from 64 percent for the lowest income quintile to around 51 percent for the highest quintile. Non-wage work is the most prevalent working status (around 20 percent). It is slightly higher for the three middle quintiles

and is the least for the fifth quintile. This suggests the importance of unpaid family work and the prevalence of family farming. The percentage of those employed as wage workers in agriculture is the least overall (8 percent) although it is significantly more important for the poor (16.2 percent in the first quintile) than for the non-poor (3.4 percent for the fifth quintile). The self-employed and those employing others represent overall 15.9 percent and 14.3 percent of those employed in agriculture, but the pattern of their distribution differs significantly over different income quintiles. Self-employed individuals in agriculture represent a comparable percentage over various quintiles, while those employing others represent an increasing share of the employed as the level of income increases (from 11.7 percent for the first quintile, rising to 16 percent for the fifth).

As for employment in non-agricultural activities, it rises consistently from 36.2 percent for the first quintile to 49.3 percent for the fifth, implying higher education and skills as income quintiles rise, hence providing the members of higher quintiles with relatively more employment opportunities in off-farm activities.

Table 4. Distribution of the Employed by Activity, Working Status and Expenditure Quintiles in Rural Egypt, 2005 (Percent)

Quintiles	Agriculture					Non-agricultural Activities				
	Unpaid Workers	Wage Workers	Self-Empl.	Empl. Others	Total	Unpaid Workers	Wage Workers	Self-Empl.	Empl. Others	Total
1	19.66	16.24	16.27	11.67	63.84	1.00	28.03	5.28	1.85	36.16
2	22.27	10.67	15.06	13.65	61.65	1.04	30.03	5.19	2.10	38.36
3	22.99	7.07	15.37	14.61	60.04	1.07	31.82	4.63	2.45	39.97
4	20.08	5.32	16.38	14.55	56.33	1.25	34.30	4.56	3.58	43.69
5	15.16	3.37	16.14	16.01	50.68	1.29	37.80	5.27	4.96	49.32
Total	19.85	7.94	15.85	14.28	57.92	1.15	32.83	4.97	3.13	42.08

Source: Calculated from HIECS, 2004/2005.

Note: Row sums may not add up to 100 due to rounding errors.

Wage workers in off-farm activities represent 32.8 percent of rural workers varying between 28 percent in the lowest quintile to 37.8 percent in the highest. An important portion of these workers is engaged in government jobs in local administrations, the rest is engaged in micro and small enterprises and in home-based activities producing goods or providing services to others. Overall, self-employed and those employing others represent around 5 percent and 3 percent of those working in rural areas. The self-employed not employing others are randomly spread over various quintiles while those employing others rise consistently from less than 2 percent in the

first quintile to around 5 percent in the upper quintile. Unpaid workers in non-agricultural occupations represent a modest percentage of around 1 percent.

Overall, agriculture provides a high share of employment in rural Egypt exceeding 57.9 percent. Around 20 percent of the workers are engaged in unpaid farm activities. Off-farm activities provide work opportunities to 42.1 percent of the employed. Their importance as a source of employment increases with the level of income of rural employment. Comparing the distribution of employment and the shares of income by quintile confirms that poverty incidence is higher in agricultural occupations.

Comparing the distribution of employed by activity in Lower and Upper rural Egypt, as shown in Table A.3, it appears that agriculture represents a more important field of employment in the south (62.4 percent) than in the north (54.8 percent), yet the shares of income generated in agriculture are much lower, confirming further the higher poverty prevalence in agriculture compared with other economic activities. Unpaid workers are mostly concentrated in farming activities, they are believed to have the highest rates of poverty, as reflected by the high incidence of poverty among them, particularly in Upper rural Egypt (36 percent), a much higher rate than the national rate of 19.6 percent. Unpaid workers in Lower rural Egypt, also, have a poverty incidence of 22.9 percent exceeding the national rate. However, one should not infer that all unpaid workers are poor, as a significant percentage of unpaid family workers are found in the upper two expenditure quintiles of the distribution of employment in both Lower (17.8 percent and 13.2 percent) and Upper (24.5 percent and 20.0 percent) rural Egypt. Nevertheless, the relatively high concentration of the poor employed in the two regions in farming activities, justifies the focus on the agricultural sector, if poverty reduction is targeted.

3.3. Does the Pattern of Rural Employment Differ by Gender?

Comparing the pattern of employment by economic activity and by work status reveals significant differences by gender as reflected in Table 5.

Table 5. Distribution of Employment by Economic Activity, Work Status and Gender in Rural Egypt, 2005 (Percent)

Gender	Agriculture					Non-agricultural Activities				
	Unpaid Workers	Wage Workers	Self-Employed	Empl. Others	Total	Unpaid Workers	Wage Workers	Self-employed	Empl. Others	Total
Males	10.54	11.10	1.78	19.88	43.30	1.23	44.84	5.96	4.66	56.69
Females	35.93	2.49	40.15	4.60	83.17	1.01	12.10	3.24	0.47	16.82
Total	19.85	7.94	15.85	14.28	57.88	1.15	32.83	4.97	3.13	42.08

Source: Calculated from HIECS, 2004/2005.

Note: Row sums may not add up to 100 due to rounding errors.

Agriculture provides employment to 83.2 percent of females, who are mostly engaged in non-wage work (35.9 percent) or as farm self-employed (40.2 percent); smaller percentages are engaged in agricultural wage work (2.5 percent) or are employing other farm labor (4.6 percent). Conversely, less than half rural males are engaged in agriculture (43.3 percent), predominantly as on-farm self-employed employing others (19.9 percent), or as wage workers (11.1 percent) or unpaid family workers (10.5 percent). A minute percentage of males (1.8 percent) are self-employed in their own farms.

Non-agricultural activities, on the other hand, provide employment to more than half of rural males (56.7 percent), mostly as wage workers (44.8 percent), and to a far lower extent as self-employed working alone (6 percent) or engaging other workers (4.7 percent). Unpaid workers in off-farm activities are sparsely found (1.2 percent). Females in off-farm activities are relatively scarce (16.8 percent). They are mostly engaged in wage work (12.1 percent).

In sum, females are highly concentrated in farm activities, unlike males in rural areas who are mostly engaged in off-farm wage work (44.8 percent) and to a lower extent in farm activities (43.3 percent).

Finally, having confirmed that prevalence of poverty is higher in agricultural occupations, it remains to investigate the relationship between *agricultural productivity and poverty reduction*.

4. AGRICULTURAL PRODUCTIVITY AND POVERTY

When evaluating the performance of a production unit or activity, it is common to use productivity (output per unit of input) as indicator. Productivity may be measured in partial terms, such as labor productivity (output per worker) or yield (output per feddan)

for its relative ease in calculation and interpretation. Alternatively, productivity may be measured in terms of total factor productivity (TFP).

Output per agricultural worker is an important indicator of the standard of living and welfare, as it is a main determinant of income of agricultural workers and hence of their ability to acquire sufficient food and other non-food necessities. *Output per unit of land*, on the other hand, is commonly preferred by agricultural scientists to assess the success of new production processes and practices. Land productivity is also used by policy makers to assess the capacity of agricultural production to meet national goals of exports, food security and provision of intermediate agricultural inputs. *Total factor productivity* represents gains in net output due to improvements in efficiency of utilizing physical inputs including motivation of agricultural workers, health and living standards of farmers, acquisition and application of improved seeds and agricultural technology, improved soil quality, as well as measurement and other unknown errors in output or input data.

In this section, we examine the proposition that agricultural productivity has a direct impact on poverty incidence. The methodological approach is first presented, followed by the presentation and discussion of results.

4.1. Methodology

The relationship between agricultural productivity and poverty has been investigated for a cross-section of countries (Thirtle et al. 2001; Irz et al. 2001). The same methodology is applied here to assess the impact of agricultural productivity in various *marakez* (*markaz*) in both Lower and Upper Egypt on poverty incidence within the same markaz. Measures of agricultural productivity and poverty incidence have been successively estimated using the previously mentioned AFIS for 2003/2004 and the 2004/2005 HIECS.

As it is not clear whether labor or land productivity or rather total factor productivity (TFP), should be considered as the explanatory variable in the regression explaining poverty incidence P_0 ,⁵ several models have been tried, following the methodology of Thirtle et al. (2001).

Consider the following identity:

⁵ P_0 is defined as the percentage of individuals per markaz spending less than a specific level of expenditures covering the basic food and non-food needs, calculated from the HIECS, 2004/2005.

Labor productivity \equiv land productivity \times land/labor

where labor productivity = value added/number of workers; land productivity = value added/area of the farm; and land/labor represents the land to labor ratio in each farm. Note that value added measures agricultural output as gross output net of costs of intermediate inputs. The previous identity decomposes labor productivity into the product of land productivity, or yield per feddan, and the land/labor ratio, which reflects the primary factor endowments per farm.

Based on this identity, three simple models are estimated:

1. $\ln P_0 = \alpha_1 + \beta_1 \ln (\text{labor productivity}) + \varepsilon_1$
2. $\ln P_0 = \alpha_2 + \beta_2 \ln (\text{land productivity}) + \varepsilon_2$
3. $\ln P_0 = \alpha_3 + \beta_3 \ln (\text{land productivity}) + \gamma \ln \left(\frac{\text{land}}{\text{labor}} \right) + \varepsilon_3$

where α , β and γ are the parameters to be estimated, and ε is a random error.

Alternatively, following Fan, Hazell and Thorat (1999), the poverty incidence indicator will be regressed on total factor productivity (TFP), which reflects the part of value added unexplained by various factor inputs: labor, land and capital (both material capital and animal inputs), namely:

4. $\ln P_0 = \alpha_4 + \beta_4 \ln \text{TFP} + \varepsilon_4$

The methodology and data used are further elaborated in the Annex.

4.2. Estimation Results

The estimated results are reported in Table 6.

These models give significant results at varying degrees of confidence both in linear and in log-linear forms. They have been estimated by using average values of the variables at the markaz level (49 markaz) and by using the values of variables per farm (3556 farms).⁶ The estimates using farm level data are reported in a log-linear form which is

⁶ The total sample covered by AFIS 2003/2004 included 57 markaz and 4216 farms, geographically distributed as follows: 26 markaz and 1863 farms in Lower Egypt; 23 markaz and 1693 farms in Upper Egypt; and 8 markaz and 660 farms in border governorates. Border governorates have been excluded from the analysis due to their misrepresentation of poverty incidence (P_0) in these governorates in the HIECS and hence the unreliability to establish a sound relationship between P_0 and productivity indices.

easier to interpret. Main features of the sample used and related indicators are highlighted in Table A-5.

Model 1 reflects that the labor productivity coefficient is significantly different from zero. The poverty elasticity with respect to this variable is -1.377. This means that higher farm labor productivity would result in lower incidence of poverty, i.e., lower percentage of the population engaged in agriculture living at levels below the poverty line; and that a 1 percent increase in farm labor productivity would reduce the percentage of those living below the poverty line by 1.377 percent.

Table 6. Impact of Agricultural Productivity on Poverty Incidence in Rural Egypt

Variables	Expected Sign	Estimated Coefficients				
		Model 1	Model 2	Model 3	Model 4	Model 5
VA/Labor	Negative	-1.377				
VA/Land	Negative		-0.585	-1.227	-1.038	
Land/Labor	Negative			-1.464	-1.569	
Gini	Positive				1.620	
TFP*	Negative					-0.241
Constant		8.440	7.694	6.875	4.033	5.644
Sample size		3556	3556	3556	3556	3556
F		804.666	79.664	409.898	322.218	272.033

Source: Calculated from the AFIS, 2003/2004 and the 2004/2005 HIECS.

Notes: 1. All parameters shown in the table are significant at the 99 percent confidence level.

2. * TFP has been calculated as follows:

$$\ln \text{TFP} = \ln \text{VA} - 6.538 - 0.2296 \ln \text{labor} - 0.0533 \ln \text{capital} - 0.7582 \ln \text{land}$$

$$(0.1599) \quad (0.0235) \quad (0.0165) \quad (0.0209)$$

where all coefficients appear to be significant at the 99 percent confidence level as reflected by the respective standard errors in parentheses under each parameter.

Model 2 indicates that improvements in yields per feddan decrease the incidence of poverty by a much lower percentage than increases in labor productivity, suggesting that the benefits of higher yields per feddan do not benefit the poor as much as labor productivity improvement does.

Model 3 separates the two terms composing labor productivity, namely yield per feddan and the land/labor ratio. It appears that a one percent increase in land/labor ratio with no change in yield per feddan results in a decline in poverty incidence of 1.464 percent that is higher than the effect of the land productivity term, which indicates that a 1 percent improvement in yields with no change in land/labor ratio decreases the percentage of the population living in poverty by relatively less (1.227 percent).

These results suggest that agricultural growth in old lands driven by yield gains alone are not as effective in fighting poverty as labor productivity improvements. More

emphasis should be given to relieve the pressure of excessive labor on the limited area of cultivated land, thus increasing on-farm land/labor ratios. Generation of off-farm activities to provide productive occupations to agricultural labor is to be given serious consideration.

Model 4 adds to the previous model the Gini coefficient which is an index of inequality varying from 0 that refers to perfect equality of distribution of landholdings, to unity that indicates complete inequality. The literature suggests that greater inequality prevents growth in productivity from reducing poverty. Hence higher inequality would lead to higher poverty, implying a positive coefficient for the inequality indicator. The results show that a one percent increase in land/labor ratio would decrease poverty incidence by 1.569 percent; a one percent rise in land productivity would reduce poverty incidence by relatively less (1.038 percent); and a one percent increase in the Gini index would increase poverty by 1.62 percent.

Finally, Model 5 introduces as a measure of productivity the calculated Total Factor Productivity (TFP). It appears that a one percent increase in TFP would reduce poverty by 0.241 percent. TFP refers to all unobserved factors affecting agricultural value added after accounting for factor input changes.

In conclusion, the results presented suggest that agricultural labor productivity, land/ labor ratio and TFP in agriculture are important determinants of poverty and that increasing such variables are more effective in reducing P_0 and in lifting a large number of individuals out of poverty than increasing land yields alone.

The same models have been re-estimated including regional dummies to test for regional differences in Lower and Upper rural Egypt. The results are reported in Table A.4 of the Annex. Regional dummies have been introduced into equations 1 to 4 to account for regional differences in elasticity of poverty with respect to various productivity measures and with respect to land/labor ratios as well as in the constant term. All estimates are highly significant with the expected sign, except for the elasticity of P_0 with respect to land yields in Upper Egypt which appeared to be insignificant, although having the right sign. *This confirms the importance of raising labor productivity in both regions to reduce poverty incidence. Raising on-farm land/labor ratios are also expected to reduce poverty.* Elasticity of poverty with respect to labor productivity and to land/labor ratios is respectively higher, in absolute terms, in Upper

rural Egypt (1.614, 1.625 and 1.771) than in Lower rural Egypt (0.665, 0.377 and 0.335).

The issue now is whether agricultural activities are likely to contribute significantly to employment generation as agricultural output grows. Based on the observed outcome of growth in agriculture over the period 1990/1991 to 2004/2005, it appears that output growth, in addition to being relatively slow (2.5 percent per year on average in agriculture) has not significantly contributed to agricultural employment growth (1.1 percent on average). Elasticity of agricultural employment with respect to growth in agricultural value added has been estimated over this period at 0.287 while elasticity of agricultural employment with respect to overall GDP growth is around 0.282. This implies that agricultural employment would rise by 0.29 percent or by 0.28 percent in response to a one percent increase in agricultural output growth or a one percent increase in GDP growth respectively. These results suggest that growth in agricultural output and in GDP is not likely to highly stimulate agricultural employment. However, the presence of farm/non-farm and other linkages may stimulate off-farm growth, which in turn contributes to further employment generation and poverty reduction in rural areas.

5. CONTRIBUTIONS OF AGRICULTURAL GROWTH TO EMPLOYMENT AND POVERTY REDUCTION

Based on theoretical foundations, agricultural growth contributes to poverty reduction and employment through various channels. Furthermore, it has been shown that although agriculture is a main source of income in rural areas, it is not the most important one particularly for male workers. Hence, to reduce poverty and enhance employment, contributions of agriculture to off-farm activities have to be investigated. Such contributions may be classified at three levels: the farm level, the rural economy and the national economy.

5.1. The Farm Level

Within the farm economy, agricultural growth contributes to general welfare through generating higher incomes for farmers, and through its impact on the labor market. However, the impact of this growth on poverty is not unconditional.

Two conditions affect *the influence of agricultural growth on poverty*. First, how higher farmers' incomes affect the poor depends very much on the extent to which the latter are engaged in farming activities. Data from the latest HIECS for Egypt show that 41.1 percent of Lower rural Egypt's population and 64.7 percent of Upper rural Egypt's population live in poverty or close to it. Both regions include more than three quarters of Egypt's poor (77.5 percent). Nevertheless, this does not necessarily mean that these poor are engaged in farming. Poverty incidence by economic activity of individuals highlights that it is by far the highest in agriculture where poverty incidence is 26.8 percent compared to a national average of 19.0 percent,⁷ implying that agriculture is a major sector to emphasize in the struggle against poverty.

The second condition is the extent to which output growth raises incomes. Should increased output drive product prices down or costs of production up, as demand for inputs increases, the expected rise in gross margins may be modest. Empirical evidence from Egypt is limited. However, episodes of relatively better performance in agriculture (1987/88-1990/91 and 1995/96-1999/2000) have been associated with relative reduction in national poverty as reflected by successive HIECS.

Furthermore, poverty incidence is affected by the cropping pattern and the volatility of both domestic and international prices of various agricultural commodities. Agricultural prices are exposed to shocks related to climatic conditions as well as external market demand shifts. Price fluctuations significantly affect poor farmers' income and may affect their poverty status, which has been shown to be shallow in Egypt, reflecting that marginal income changes may easily lift households out of poverty or conversely push them below the poverty line.

The other contribution of agricultural growth within the farm economy is through its *impact on the labor market*. This impact depends largely on the degree to which the poor are engaged in agricultural employment. In all Egypt, 55.3 percent of the labor force engaged in agriculture is poor; furthermore, around two thirds of rural laborers in agriculture (63 percent in rural Lower and 64 percent in rural Upper Egypt respectively) are poor. Greater agricultural production is likely to boost demand for farm labor. There

⁷ In Lower rural Egypt poverty incidence for all individuals is 16.7 percent compared to 19.2 percent in agriculture in this region, while it is 36.5 percent in Upper rural Egypt compared to 37.5 percent in agriculture within the same region, confirming further the higher engagement of the poor in farming (Kheir-El-Din and El-Laithy 2006).

is also evidence that agricultural growth driven by yield increases and higher cropping intensity may raise demand for farm labor (Lipton and Longhurst 1989).

However, labor displacing technical change (machinery, herbicides, etc.) may reduce labor demand per feddan. This has not been observed in Egypt's agriculture in old land, which is characterized by highly fragmented landholdings, thus limiting the adoption of such technologies, and concentrating on adopting modern varieties of traditional crops and/or shifting to non-traditional crops (fruit, vegetables and AMO). Yet a move to livestock may reduce labor per unit of output.

Finally, the impact of agricultural growth on labor earnings is difficult to establish, as agricultural wage rates are determined by factors within and outside agriculture. Increased demand for agricultural labor may be mitigated by rural labor supply factors such as: population growth, rural–urban migration, availability of non-farm jobs and initial land/labor ratios.

5.2. The Rural Economy

Increased agricultural production impacts other off-farm activities in the rural economy through various channels. They include:

Production linkages both upstream and downstream. The farm demands physical inputs and services for agricultural output as well as for services to process, store and transport its produce to the market.

Consumption linkages. Farmers and farm labor spend their increased incomes on goods and services produced in the local rural economy, thus transferring growth to other production activities within the local community.

These linkages are likely to expand with the availability of rural infrastructure and with rural population density. The more perishable farm produce is, the higher the need for immediate local processing. These linkages depend also on the tradability of farm output and of goods and services in the local rural community. Local linkages are especially strong when demand is for non-tradables. This is particularly applicable to rural Upper Egypt where markets are small and more isolated than in Lower Egypt.

Increased jobs and incomes at the farm level lead to *gains in welfare and in human capital*. These increments allow better nutrition, better health and increased spending on education amongst the rural population leading directly to improved

welfare and indirectly to higher labor productivity in the rural economy and hence higher income.

A further linkage may result from a more dynamic farm sector to *social capital formation*. Increased interactions between farmers, commodity inputs and service providers, processors and banks generate contacts and confidence to start new non-agricultural businesses. This enhances SMEs and home-based non-agricultural activities, reduces underemployment and provides new employment opportunities for rural labor.

Increased agricultural output and incomes may generate more tax revenues, allowing *more public investment in infrastructure*, the demand for which would be stimulated by growth of the farm sector. This linkage, mentioned for other countries, may not be of direct relevance to the Egyptian case as local tax revenues are very limited and the central government allocations to rural localities are not necessarily driven by local demands.

The last impact on the rural economy is that of *reducing food price*. This effect is likely to be more important if the rural economy is more isolated from national and international markets (Irz et al. 2001).

5.3. The National Economy

At the national level, an increase in agricultural output tends to drive down the *price of food*, benefiting consumers and net purchasers of agricultural products. Since the poor in both urban and rural areas spend a greater proportion of their incomes on food than the better-off households, they benefit relatively more. The strength of this effect depends on the degree to which farm production is tradable and on the elasticity of demand for the commodities considered. The more inelastic the demand, the higher the fall in price and hence the higher the share of benefits accruing to consumers. Where rural markets are poorly integrated and infrastructure underdeveloped, farm products become effectively non-tradable and increased farm output is likely to be associated with substantial price falls with consequent gains to consumers (and to the poor) and more modest gains to farmers.

Agricultural growth can contribute to national growth and to poverty reduction. The dual economy model (Lewis 1954; Fei and Ranis 1965) emphasizes the importance of capital formation and wage costs for development. Agricultural growth can facilitate

development by allowing *transfer of resources* from agriculture to the rest of the economy either by giving incentives to voluntary savings or by taxing agriculture directly or indirectly.

Growth of output of tradable farm commodities makes a positive *contribution to net foreign exchange* earnings either by substituting food imports or increasing exports.

Finally, growth of agricultural productivity per unit of labor at a higher rate than agricultural production can permit the *release of labor to other sectors with higher productivity jobs*. This transfer is important to stimulate overall economic growth, although it may not be warranted in case of high unemployment rates in the economy.

6. CONCLUSION AND REQUIRED EFFORTS TO PROMOTE AGRICULTURAL AND RURAL DEVELOPMENT

While agriculture plays a major role as a source of income and provider of employment to the poor, as reflected by its high share of both income expenditure and rural employment in the lower quintiles of the respective distributions, the poverty problem in rural Egypt cannot be solved by promoting agricultural growth in old lands alone. In addition to expansion to new lands and encouraging rural labor to move there, more attention should be given to the promotion of non-farm activities, particularly those that are linked to the agricultural sector (Gavian et al. 2003). A strategy that focuses on strengthening farm/non-farm linkages in old lands is more likely to yield better results in terms of employment and income generation.

Agricultural incomes are constrained by land, information and capital constraints, as well as inadequate transportation and storage facilities. Such constraints have to be relaxed through public policies and investments. However, given the limitations on old lands availability in the Nile valley and the Delta, these limited cropped areas are not likely to provide employment to all rural labor force. Other non-agricultural activities have to be developed to absorb the available labor force and provide them with adequate sources of income. Global experience suggests that the main ingredients for agricultural and rural development are based on three main pillars: providing comprehensive farmer support services, strengthening farm/non-farm linkages and promoting rural SMEs. The government should play a leading role in supporting such pillars. Achieving *decentralization* and *strengthening local governments* are required. Also necessary is

the *involvement of civil society* in monitoring progress and identifying gaps in implementation.

Comprehensive Farmer Support Services

Various farmer support services have to be provided simultaneously. They include:

Investing in human development. Human capital formation, through improved health services and relevant education, is essential for raising labor efficiency and productivity.

Investing in agricultural research and technological innovation and diffusion. This would involve developing modern high yielding varieties of seeds, improving fertilizer and other chemical inputs application, identifying best practices and optimal inputs combinations in various agro-climatic conditions (differentiating between Lower and Upper Egypt). To support such activities, developing a well-targeted program of *extension services* is compelling. It is necessary to decentralize such services to the local level, to identify the knowledge gaps and needs in various localities and specific agro-climatic settings and to ensure appropriate response of extension agents through effective incentives including fee-for-service arrangements (World Bank 2006).

Investing in infrastructure. High transaction costs are a major factor constraining growth and profitability of agriculture—particularly for small holdings and for Upper Egypt—and this can be largely attributed to poor infrastructure. Provision of good infrastructure is a requirement for achieving higher level of agricultural productivity and profitability. The green revolution experience of Asian countries reveals that physical infrastructure (irrigation, roads, storage ...) was a key element in the success achieved. Old lands in Egypt rely on *irrigation* through flooding the fields with irrigation canals water. This is a very uneconomic practice particularly that Egypt is starting to suffer from water scarcity. Additionally, the high underground water table in the Delta and inappropriate drainage cause salinity and water-logging. This requires introducing modern water saving irrigation techniques that involve investment, training and increasing awareness of farmers.

Improving *access to remunerative markets* is also necessary through investment in post harvest activities. Constructing and maintaining roads, provision of cooling and packaging facilities for perishable products (fruit and vegetables), proper storage as well as developing trucking and railways facilities are all required. Upper Egypt is at a

disadvantage with respect to Lower Egypt due to its geographic distance from the main consumption centers in Metropolitan governorates and to its infrastructural deficiencies.

Agricultural credit should also be made available to small farmers through the widespread network of branches of public sector banks as well as the Principal Bank for Development and Agricultural Credit (PBDAC). The organizational aspects and lending policies and practices of PBDAC should be revised.

Supporting farmers' organizations through reforming the current agricultural cooperatives and supporting farmers' associations. Agricultural cooperatives are still widespread (as many as 6000). A comprehensive restructuring process to transform cooperatives into economic enterprises with optional membership and international cooperative principles is underway. However, the outcome of the reform is unclear. By contrast, farmers' associations are few (less than 100). They are mainly concerned with providing marketing services to their members. They may also play an advocacy role such as recommending the use of local inputs to reduce costs of production or advocating to improve output quality through organic and safe farming. In some cases, with NGO support, they were able to gain access to international markets (World Bank 2006).

Strengthening Farm/Non-farm Linkages

Promotion of farm/non-farm linkages has received little attention in supporting rural growth. Yet, strengthening these linkages has proved effective in generating employment and income (Machethe, Reardon, and Mead 1997; and Gavian et al. 2003). It has been shown that agro-industrial business in rural areas would generate employment and income by providing inputs to small farmers and adding value to the products of small holdings through processing and distribution. The potential for such agro-industrial activities is largely based on the production of horticultural and livestock products. This is particularly important for Upper Egypt's farmers who lose 20 percent of their fruits and 40 percent of their vegetables in the process of transporting their produce from the farm to wholesalers due to the lack of appropriate cooling and packaging facilities (World Bank 2006).

It should be emphasized again that decentralization of decision making and diversification of strategies are required, as farming areas are not homogeneous, hence they need specific measures of assistance to reach their agricultural potential.

Promoting Rural SMEs

Promoting rural SMEs also requires multidimensional interventions, mainly:

Facilitating *access to credit*, at market terms, with minimum collateral requirements, through various micro-finance institutions (NGOs, commercial banks, the Social Fund for Development and other government sponsored schemes).

Disseminating information about market opportunities through working with local chambers of commerce to provide small businesses and farmers with access to information about market prices in major Egyptian markets; to facilitate linkages between small rural firms and large firms to supply inputs (and possibly credit to support outsourcing and subcontracting arrangements; and to identify local rural small scale industry options to supply larger corporations or local needs).

Devoting public investment to *ensure that small and isolated markets*, particularly in Upper Egypt, *are better connected to larger markets*. This would benefit both farmers and rural entrepreneurs to access processing and marketing firms in more remunerative markets.

Strengthening SMEs through *business development services*, including technological, managerial and marketing services. Currently, there is no network available of agricultural-related SMEs to support the development of supply chains in horticulture and animal products (World Bank 2004).

Appendix

Table A.1. Cropped Area 2004/2005

	Old Lands		New Lands		Total	
	Feddan	Percent	Feddan	Percent	Feddan	Percent
Winter Crops	5495402	47.44	1111187	55.16	6606589	48.58
Summer Crops	5558263	47.99	827748	41.09	6386011	46.96
Nili Crops	529971	4.58	75714	3.76	605685	4.45
Total	11583636	100.01	2014649	100.01	13598285	100.00
Percent	85.18		14.82		100.00	

Source: ARE/MALR, Study of indicators of agricultural statistics, 2005. Economic Affairs Sector, Central Administration for Agricultural Economics, 2, June.

Table A.2. Income Shares by Quintiles, Sources of Income and Employment Status in Lower and Upper Rural Egypt, 2005 (Percent)

Quintiles	Agriculture				Non-agricultural Activities				Other Sources
	Wages	Self-Empl.	Empl. Others	Total	Wages	Self-Empl.	Empl. Others	Total	
Lower Rural									
1	12.99	5.40	27.37	45.76	38.25	5.98	3.11	47.34	6.90
2	9.37	4.69	29.48	43.54	38.61	5.89	4.17	48.67	7.79
3	6.17	5.39	30.15	41.71	38.51	5.92	4.89	49.32	8.97
4	4.42	5.67	28.04	38.13	37.35	5.97	7.67	50.99	10.88
5	2.07	3.95	24.94	30.96	33.26	6.32	10.51	50.09	18.95
Total	4.87	4.81	27.36	37.04	36.17	6.09	7.60	49.86	13.10
Upper Rural									
1	13.69	8.30	24.65	46.64	32.05	7.22	3.84	43.11	10.25
2	8.09	7.73	31.18	47.00	30.18	7.86	4.66	42.70	10.30
3	5.05	6.85	36.27	48.17	29.26	6.30	4.72	39.28	12.55
4	3.33	6.26	34.67	44.26	31.07	6.33	5.21	42.61	13.13
5	1.84	4.80	33.00	39.64	29.24	6.37	6.88	42.49	17.87
Total	6.12	6.65	31.93	44.70	30.30	6.79	5.20	42.29	13.01

Source: Calculated from HIECS, 2004/2005.

Table A.3. Distribution of Employed by Activity, Working Status and Expenditure Quintiles in Lower and Upper Rural Egypt, 2005 (Percent)

Quintiles	Agriculture					Non-agricultural Activities				
	Unpaid Workers	Wage Workers	Self-Empl.	Empl. Others	Total	Unpaid Workers	Wage Workers	Self-Empl.	Empl. Others	Total
Lower Rural										
1	22.63	15.00	14.03	11.34	63.00	0.75	30.00	4.68	1.59	37.02
2	22.11	10.80	14.03	12.51	59.45	1.02	32.84	4.72	1.97	40.55
3	21.47	7.41	15.81	13.03	57.72	0.91	34.48	4.48	2.41	42.28
4	17.83	5.72	16.87	13.31	53.73	1.44	36.63	4.23	3.96	46.26
5	13.15	3.35	17.05	14.58	48.13	1.28	39.88	5.21	5.50	51.87
Total	18.43	7.03	15.99	13.31	54.76	1.15	35.89	4.67	3.53	45.24
Upper Rural										
1	18.47	16.49	17.07	11.84	63.87	1.13	27.40	5.61	2.00	36.14
2	22.29	10.42	16.18	14.77	63.66	1.08	27.32	5.69	2.25	36.34
3	25.65	6.50	14.63	17.32	64.10	1.31	27.15	4.91	2.53	35.90
4	24.49	4.51	15.38	17.19	61.57	0.87	29.48	5.29	2.79	38.43
5	19.96	3.39	14.62	19.53	57.50	1.29	32.07	5.47	3.68	42.51
Total	21.86	9.09	15.73	15.69	62.37	1.13	28.50	5.42	2.57	37.62

Source: Calculated from HIECS, 2004/2005.

Note: Rows may not add up to 100 due to rounding errors.

Table A.4. Regional Differences of Impact of Agricultural Productivity on Poverty in Lower and Upper Rural Egypt

Variables	Expected Sign	Estimated Coefficients				
		Model 1	Model 2	Model 3	Model 4	Model 5
Lower Egypt						
VA/Labor	Negative	-0.665				
VA/Land	Negative		-0.720	-0.820	-0.733	
Land/Labor	Negative			-0.377	-0.335	
Gini	Positive				0.915	
TFP	Negative					-0.226
Constant		5.221	8.343	7.629	6.613	8.003
Upper Egypt						
VA/Labor	Negative	-1.614				
VA/Land	Negative		-0.0935*	-1.890	-1.697	
Land/Labor	Negative			-1.625	-1.771	
Gini	Positive				0.915	
TFP	Negative					-0.268
Constant		9.754	4.220	11.932	9.251	8.926
Sample Size		3556	3556	3556	3556	3556
F		797.938	544.515	490.832	420.375	666.438
Adjusted R ²		0.402	0.314	0.408	0.414	0.360

- In all regressions, the dependent variable is $\ln P_0$, the natural logarithm of poverty incidence.

- All estimated coefficients are significant at the 99 percent confidence level except that for yield per feddan for Upper Egypt, marked * in Model 2.

Table A.5. Distribution of the Sample and Some Related Indicators

		Number of Farms Growing Traditional Crops	Number of Farms Growing Non-traditional Crops	Total Number of Farms	% of Farms Growing Non-traditional Crops	Average Farm Size (in Feddan)	GINI	Yield per Feddan (in L.E.)	Productivity per Worker (in LE)	Feddan per Worker	P ₀
							Index				(%)
Lower Egypt											
Alexandria	Khorshed5	10	5	10	50	3.66	0.26	4187.15	53.46	0.01	9.42
	El-Amereya6	27	38	48	79.16	3.41	0.46	4682.28	95.57	0.02	7.07
	Borg El Arab7	59	67	79	84.81	5.76	0.27	6219.06	142.60	0.02	4.46
El-Dakahlia	Aga1	47	23	60	38.33	1.73	0.64	2944.57	50.94	0.02	6.00
	Bilqass2	79	13	79	16.45	2.87	0.43	2821.23	44.65	0.02	7.74
	Talkha8	98	10	98	10.20	1.48	0.49	2898.56	36.70	0.01	4.99
El-Sharkia	Bilbeiss4	77	8	80	10	1.56	0.69	3518.09	60.65	0.02	24.61
	Diarb Negm1	80	0	80	0	1.46	0.60	3258.12	53.34	0.02	30.40
	Faqouss3	90	19	100	19	2.36	0.61	3635.26	62.12	0.02	26.60
	Mashtoul El-Souq2	60	0	60	0	1.39	0.64	3824.88	63.62	0.02	42.77
Kafr El-Sheikh	Kafr El-Sheikh1	60	19	60	31.66	2.41	0.52	3276.12	50.59	0.02	8.90
	Sidi Salem2	58	15	79	18.98	4.01	0.50	1393.01	44.67	0.03	20.50
	El-Hamoul3	86	39	99	39.39	9.39	0.54	2732.44	52.52	0.02	21.19
El-Gharbia	El-Mehalla4	45	0	45	0	2.78	0.69	3520.34	62.02	0.02	5.16
	Bassioun5	45	14	45	31.11	1.65	0.55	2795.61	41.25	0.01	27.24
	Zefta6	42	6	45	13.33	1.78	0.60	2873.64	52.58	0.02	1.10
El-Menoufia	Shebin El-Kom3	80	2	80	2.5	1.30	0.54	3071.34	41.23	0.01	15.52
	Ashmoun2	76	22	80	27.5	1.78	0.59	3388.80	56.33	0.02	17.07
	Qoesna4	75	11	80	13.75	1.49	0.52	2704.97	51.67	0.02	15.16
El-Beheira	Damanhour2	80	3	80	3.75	2.39	0.41	3354.45	50.72	0.02	16.22
	Hosh Eissa4	80	23	80	28.75	3.27	0.49	2619.61	46.43	0.02	20.60
	Kom Hammada1	49	50	77	64.93	7.91	0.50	2314.55	54.83	0.02	23.15
	El-Rahmaneya3	79	2	80	2.5	1.63	0.41	3564.93	53.65	0.02	21.14
El-Ismailia	El-Ismailia1	62	65	80	81.25	3.17	0.69	2715.85	61.17	0.02	10.56
	El-Tal El-Kebir2	78	29	80	36.25	1.57	0.54	4184.51	56.00	0.01	8.57
	Kantara Gharb3	60	47	79	59.49	4.21	0.52	3831.31	93.75	0.02	4.61

Table A.5. Distribution of the Sample and Some Related Indicators (Cont.)

Upper Egypt											
Beni-Suef	El-Fashn	100	20	100	20	1.63	0.45	3867.74	39.02	0.01	52.64
	Ehnassia	74	3	75	4	2.84	0.64	3258.58	45.90	0.01	55.38
	Naser	56	30	60	50	1.90	0.59	3178.29	45.41	0.01	51.31
El-Fayoum	Ettsa2	80	7	80	8.75	3.03	0.52	3870.61	69.54	0.02	10.23
	Sanoures1	61	22	80	27.5	1.83	0.55	3697.31	73.33	0.02	16.03
	Tameya3	80	9	80	11.25	3.73	0.65	3446.74	68.70	0.02	7.86
El-Menya	Beni Mazar2	79	42	80	52.5	1.64	0.47	3823.60	36.53	0.01	44.07
	Samaloot3	79	28	80	35	1.64	0.57	3094.85	43.74	0.01	31.29
	Mallawy1	79	3	80	3.75	1.35	0.58	2751.71	39.16	0.01	53.65
Assiut	Abnoub11	43	2	43	4.65	1.65	0.50	3652.68	58.04	0.02	70.50
	Abu Teig6	45	6	45	13.33	1.99	0.57	2732.14	44.17	0.02	69.65
	El-Badary2	45	2	45	4.44	1.24	0.55	3420.53	54.51	0.02	70.60
	El-Kossia5	45	3	45	6.66	1.79	0.51	3364.33	45.67	0.01	52.09
Sohag	Akhmiem3	55	13	60	21.66	0.95	0.55	3436.02	33.15	0.01	40.43
	El-Maragha2	79	11	80	13.75	1.26	0.58	2704.36	38.40	0.01	52.81
	Gergal	100	1	100	1	1.18	0.55	2690.52	51.32	0.02	47.98
Qena	Armant2	80	14	80	17.5	2.27	0.55	3536.30	42.31	0.01	53.41
	Naga Hamady3	100	0	100	0	1.57	0.57	2902.85	50.38	0.02	16.46
	Kaft1	60	0	60	0	1.62	0.53	2845.81	44.62	0.02	54.72
Aswan	Edfu1	100	21	100	21	8.17	0.83	2383.04	76.29	0.03	28.86
	Kom-Ombou3	60	1	60	1.66	1.99	0.52	3018.52	50.75	0.02	13.07
	Draw2	80	15	80	18.75	1.26	0.54	3446.48	53.74	0.02	43.57
Luxor	Luxor1	80	29	80	36.25	2.31	0.64	2734.30	46.80	0.02	7.90

Source: Compiled by the authors from AFIS 2003/2004 and HIECS 2004/2005.

MORE ABOUT METHODOLOGY

The methodology applied in this paper involves a microeconomic analysis of the linkage between the incidence of rural poverty and agricultural productivity based on the results of two surveys: AFIS for 2003/2004 and the 2004/2005 HIECS. AFIS provides information on agriculture and animal production of 3,556 farms in both Lower (1,863 farms) and Upper (1,693 farms) Egypt. These farms grow 89 crops in Lower Egypt and 70 crops in Upper Egypt. Data cover value and quantity of every crop (sold or consumed) as well as all material inputs such as fertilizers and seeds. Days of work and the corresponding wage rates—disaggregated by unpaid family workers and wage workers and by gender and age—were also provided. Data also include cost of machinery and animals used in the production process. Four models were estimated, see equations (1) to (4) in the text. The first three equations were estimated using OLS whereas the last equation was estimated in two stages: first total factor productivity (TFP) was estimated (see equation 5 below), and then the natural logarithm of the poverty rate was regressed on the estimated ln TFP. In the four models, the dependent variable is ln poverty incidence, where the poor are defined as households whose consumption levels are below the household specific poverty line.⁸

$$1. \quad \ln P_0 = \alpha_1 + \beta_1 \ln (\text{labor productivity}) + \varepsilon_1$$

$$2. \quad \ln P_0 = \alpha_2 + \beta_2 \ln (\text{land productivity}) + \varepsilon_2$$

$$3. \quad \ln P_0 = \alpha_3 + \beta_3 \ln (\text{land productivity}) + \gamma \ln \left(\frac{\text{land}}{\text{labor}} \right) + \varepsilon_3$$

$$4. \quad \ln P_0 = \alpha_4 + \beta_4 \ln \text{TFP} + \varepsilon_4,$$

$$5. \quad \ln \text{value added} = \alpha_5 + \beta_5 \ln \text{labor} + \beta_6 \ln \text{capital} + \beta_7 \ln \text{land},$$

and $\text{TFP} = \text{observed value added} - \text{predicted value added using the estimated equation}$.

Definitions and derivation of the variables used in the four models are as follows:

1. *Productivity* is measured by value added generated by various crops within each farm;

⁸ The poverty line is estimated as the cost of food and non-food requirements per household. It varies according to the place of residence and age and gender composition per household.

Value added for each crop and for each farm= value of all (main and secondary) output–value of all inputs.

2. In order to estimate *productivity of labor*, all labor inputs should be transformed into the same unit of measurement: man labor/day. We assumed that:

- a- The ratio between level of effort of female to male labor = ratio of daily wage of female to that of male.
- b- The ratio between level of effort of child to male labor = ratio of daily wage of child to that of male.

The median wage for males, females and children within each markaz was calculated, and used in the transformation. In certain districts, there were no reported wages, especially for women and children, thus we used median price at the governorate level. All kinds of human capital were converted into male equivalent, that is, we transformed female and child days of work into their corresponding male days of work and a male equivalent number of days for each crop were calculated.

3. *Capital* variable includes cost of machinery and animals used in the production of each crop.

4. *Productivity of labor* is calculated by dividing value added by the number of working days of male equivalent labor, and similarly productivity of land or *yield per feddan* is calculated by dividing value added by area in feddan.

5. The *land/labor ratio* is calculated as the size of landholding per farm divided by the number of working days on farm.

6. Gini index explains inequality of landholdings among farms for each markaz.

Table A.5 presents averages of the variables used in the regression analysis. It shows that poverty incidence agreed to a great extent with productivity variables. Analysis of the results is presented in the main text.

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