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LAGRÆKON

Vol 40 Number/Nommer 2
June/Junie 2001



Published by the
Agricultural Economics
Association of South Africa

Gepubliseer deur die
Landbou-ekonomievereniging
van Suid-Afrika

IS AGRICULTURAL SECTOR GROWTH A PRECONDITION FOR ECONOMIC GROWTH? THE CASE OF SOUTH AFRICA

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In this paper a simple growth model is adapted to explain the effect of the agricultural sectors' growth on the non-agricultural sector. The empirical results suggest that for a 1% growth in the agricultural sector, the non-agricultural sector responds by more than 1%. The results also confirm that productivity difference exists, the non-agricultural sector being more efficient in terms of input use. The empirical results supports the argument of President T. Mbeki, that South Africa should follow an "agricultural-led" growth strategy for successful development.

1. INTRODUCTION

The contribution of agricultural growth to economic development has been extensively discussed. Along the same lines President Thabo Mbeki in his State of Nation Address stated that agricultural sector among others requires special attention due its potential contribution to economic growth and job creation. The former secretary of the ANC, Cyril Ramaphosa in 1993 in an address to the "Land Distribution Conference - October 1993" stated "*The development of a productive agricultural sector and viable rural economy is necessary for the economic and well-being of all South Africans*". And recently the honourable Minister of Agriculture, Thoko Didiza made a similar statement in her address to the Economic Committee of the Global Coalition for Africa in May 2001. However, in the literature there are two conflicting views about the economic contribution of agriculture. Development economists support the argument that agriculture has a very important role in the economic development process of a nation, stressing that improving agricultural productivity is the basis for a successful development strategy (Lewis, 1954, Nurkse, 1953, Mellor, 1979 and Rostow, 1960). Lewis (1954) postulates that industrialization depends upon agricultural growth and productivity with both industrial and agrarian revolutions always occurring together. Mellor (1979) argues that agriculture has a major role in the industrialization and modernization of a domestic economy. This is mainly due to the interrelationships and the multiplier effect between food supply, rural

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purchasing power, labor and capital. Adelman (1984) also supports the ideology of "agricultural demand-led industrialization."

The economic historians (Mokyr, 1976, Field, 1978 and Wright, 1979), using the Law of Comparative Advantage suggest that there exist a negative link between agriculture and industrialization. The negative links are due to the fact that factor productivity is low in agriculture and the manufacturing sector competes with the agricultural sector for labor by implying that there is an abundant labor supply which the manufacturing sector can use (Mokyr, 1976). High productivity and output levels in the agricultural sector will choke the manufacturing sector, without changing relative prices.

As pointed out by Matsuyama (1992), the key to understanding these two different views is the level of openness of the economy. Those who hold a positive opinion about agriculture and economic growth base their analysis on the assumption that the economy is closed. Those however, who hold the negative opinion base their analysis on the assumption that the economy is open. A furthermore much-debated issue is when can one assume that the economy is an open system. A common suggestion is that the economy is open when domestic prices are fully influenced by world market prices.

In this paper, without getting absorbed in the issue of openness or closeness of an economy, an empirical model is adapted to estimate the implications of agricultural growth on the non-agricultural sector and to empirically evaluate why President Thabo Mbeki is correct in stating that agricultural sector is a leading sector by providing an impetus for economic growth. The basis of the analysis is that agricultural growth is the precondition for a successful development strategy. This study differs from previous studies that used the Input-Output matrix or the Social Accounting Matrix to calculate impact multipliers. In this paper, a model based on economic theory is derived and subsequently estimated using OLS estimation techniques. The paper is a first attempt following Vink's (2001:158) request in this volume that agricultural economists should revisit the consensus role that the agricultural sector plays in the process of development.

The rest of the study is organized as follows: the next section contains a brief discussion of agriculture's contribution to economic development. A brief review of literature is in section III. The empirical model is derived in section IV. Section V is the Data Source. The empirical results are discussed in Section VI. While section VII summarizes and concludes the study.

2. AGRICULTURE'S CONTRIBUTION TO ECONOMIC DEVELOPMENT

According to conventional views, there are positive links between agriculture and industrialization. The agricultural sector affects the economic growth process, as follows:

- Increases the supply of food and fiber for domestic consumption
- Releases excess labor to the industrial sector
- Increases domestic saving and therefore increases rural purchasing power
- The agricultural sector generates foreign exchanges through exports, or it permits saving of foreign exchange through import substitution. These foreign exchanges create extra capital reserve for a timely import of manufacturing production technology, and improved management and marketing.
- Provides cheaper non-tradable agricultural products thus lowering the wage-goods price, hence increasing real wages, and therefore increasing the demand for domestically manufactured goods.

Increased food production will allow the growing populations' needs to be met. Further more, the increase in agricultural productivity will release labor for industrial employment. The high income generated by the agricultural sector will increase the demand for domestically manufactured goods and increase savings, which will in turn increase capital investment in the industrial sector.

In South Africa agriculture's share of GDP in 1980 was 6.1%, and since then, has decreased to 5.52% in 1998 (Quarterly Bulletin, March 1999). In 1980, more than 1.2 million people were employed in the agricultural sector. It has declined to approximately 914500 in 1996 (Abstract of Agricultural Statistics, 2000). Total agricultural contribution to GDP at factor cost was 2.92 billion rand in 1980 (World Bank Tables-1993) increasing to 14.7 billion rand in 1998, an increase of approximately 400%. The average growth as a percentage of total GDP, which decreased by 0.16%, is also taken into account for the same period. This phenomenon occurred because the output of the non-agricultural sector grew faster than that of the agricultural sector. The non-agricultural sector in 1980 contributed 28.21 billion rand and in 1998, it increased to 143 billion rand, and an increase of 438%.

3. PREVIOUS STUDIES

Van Zyl and Van Rooyen (1990) showed that the agricultural sector contributed 5.3% to the GDP in 1988. Van Seventer, Faux and Van Zyl (1992) focused on the backward and forward linkages of agriculture in an attempt to give some body to the concept of agribusiness in the South African context. Van Rooyen (1989) also used the concept of multipliers and linkages in order to evaluate the contribution of agriculture to the economic growth of South Africa. Due to the restrictive nature of the Input-Output analysis used in both the above studies De Lange and Van Seventer (1986) developed the Social Accounting Matrix for South Africa.

Van Rooyen (1997) argued in his article that the agricultural sector should perform an essential role in the generation of rural incomes, employment and food security, not to mention the transfer of resources efficiently to other sectors of the regional economy. He went on to say that this sector is however not yet performing in an optimal manner to increase rural employment and improve food security. Transformation in this sector needs to take place in order to support the required economic transformation process in the Southern African Region. Kirsten, Townsend and Gibson (1998) showed that effective programs for improving agricultural productivity could have a potentially positive impact on household and child nutritional status. From the results of the above-mentioned studies, it can be concluded that the important role agriculture needs to play is the generation of rural income, employment and food security.

Treating agriculture as a single sector in the national input-output tables might partly obscure the relative importance of agriculture on a regional level. This is because of the possibility that a large number of other production activities, and especially manufacturing sub-activities, are dependent on agriculture as the destiny of their outputs and a source of their inputs. In the next section we derive an equation based on economic theory to evaluate the economic contribution of the agricultural sector to the non-agricultural sector.

4. THE EMPIRICAL MODEL

The South African economy is divided into two distinct sectors. It is assumed that there is optimal resource allocation between these sectors, for example, labor can be transferred to the non-agricultural sector without any hindrance to the production of the agricultural sector. Both sectors produce goods for export and domestic use. Decomposing the total output, into the agricultural sector (A) and the non-agricultural sector (N) one can express total output as:

$$Y = N + A \quad (1)$$

where

$$N = F(K_N, L_N, A), \text{ and } A = G(K_A, L_A)$$

Both sectors use labor and capital. The non-agricultural sector uses inputs from the agricultural sector, i.e.; the total output of the non-agricultural sector is dependent on the volume of agricultural output. This formulation represents the contribution of agriculture to the non-agricultural sector, namely, food, raw materials, development of production efficiency, competitive management and the use of improved production techniques since the non-agricultural sector competes with the agricultural sector for resources. To evaluate the contribution of both sectors in the overall economy equation 1, with certain modifications, is estimated. Most of the time standard analysis incorporates capital (K) and labor (L) as factors of production, then a sectoral output function or even an aggregate production function, such as those used by Poonyth *et al* (1995), is estimated to calculate the contribution of agricultural growth to non-agricultural sector growth. Since the data for input allocation in each sector is not readily available, modifications are required to the above equation (1) for estimation purposes. Following Feder (1968) and Poonyth *et al* (1995) the following equations are derived. If marginal factor productivity differs in each sector, the ratio of the marginal factor productivity can be expressed as

$$\frac{F_K}{G_K} = \frac{F_L}{G_L} = 1 + \alpha \quad (2)$$

If there is no spill over effect, then $\alpha = 0$, which implies that production resources are being optimally used, to maximize total national output. Conventionally, it is believed that the marginal factor productivity is lower in the agricultural sector than in the non-agricultural sector. The reason being that the non-agricultural sector operates in a more competitive environment than agriculture. In general, the non-agricultural sector competes for labor with the agricultural sector and competition creates innovation, which implies that $\alpha > 0$. For a change in total output to occur, the agricultural and the non-agricultural output needs to change,

$$\Delta Y = F_K \Delta K_N + F_L \Delta L_N + F_A \Delta A + G_K \Delta K_A + G_L \Delta L_A \quad (3)$$

If a change in capital is invested, that is $\Delta K = I$ where "I" is the total investment, the above equation becomes:

$$\Delta Y = F_K \Delta K_N + F_L \Delta L_N + F_A \Delta A + G_K \Delta K_A + G_L \Delta L_A \quad (4)$$

and

$$\Delta K = \Delta(K_N + K_A) = (I_A + I_N)$$

Using equation 2, we have

$$F_K = (1 + \alpha) G_K$$

and

$$F_L = (1 + \alpha) G_L$$

Substituting back into equation 4 yields

$$\Delta Y = (1 + \alpha) G_K I_N + (1 + \alpha) G_L \Delta L_N + F_A \Delta A + G_K I_A + G_L \Delta L_A \quad (5)$$

Grouping terms

$$\Delta Y = G_K (I_N + I_A) + G_L (\Delta L_N + \Delta L_A) + F_A \Delta A + \alpha (G_K I_A + G_L \Delta L_A) \quad (6)$$

Dividing equation 6 by Y, and setting $G_K I_A + G_L \Delta L_A = \Delta A$ yields the following:

$$\frac{\Delta Y}{Y} = G_K \frac{I}{Y} + G_L \frac{L}{Y} + F_A \frac{\Delta A}{Y} + \alpha \frac{\Delta A}{Y} \quad (7)$$

Assuming that the agricultural sector affects the production of manufactured goods by a constant elasticity say ∂ , then the manufacturing sector production function becomes

$$N = G(K_N, L_N, A) = A^{\partial} \mathfrak{H}(K_A, L_A) \quad (8)$$

Differentiating equation 8 with respect to A, we have $\frac{\Delta N}{\Delta A} = \partial \frac{N}{A} = F_A$.

$$\frac{\Delta Y}{Y} = G_K \frac{I}{Y} + G_L \frac{L}{Y} + \partial \frac{(Y - A)}{A} \frac{\Delta A}{Y} + \alpha \frac{\Delta A}{Y} \quad (9)$$

Replacing for F_A in equation

where

$$\partial \left(\frac{Y - A}{A} \right) = \partial \left(\frac{1 - A/Y}{A} \right)$$

Hence, equation 9 can be written as

$$\frac{\Delta Y}{Y} = G_K \frac{I}{Y} + G_L \frac{L}{Y} + (\alpha - \partial) \frac{\Delta A}{A} \frac{A}{Y} + \alpha \frac{\Delta A}{A} \quad (10)$$

∂ Measures the inter-sectoral spillover effect of the agricultural sector to the non-agricultural sector. Changing the parameters in equation 10, and including a constant term, we have,

$$Y^r = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{L}{Y} + \beta_3 \nabla \frac{A}{A} \frac{A}{Y} + \beta_4 \frac{\nabla A}{A} \quad (11)$$

All data are annual. The Central Statistical Office of South Africa provided data on labour. *The International Financial Statistics* and *The Balance of Payments Yearbook* provided data for gross domestic product, gross domestic deflator. Agricultural data are from the Abstract of Agricultural Statistics, a publication of National Department of Agriculture.

5. EMPIRICAL RESULTS

Using data for the period 1973-1997 equation 11 is estimated using OLS estimation procedure. The estimated result is reported below.

$$\begin{aligned} \frac{\Delta Y}{Y} = & 0.2825 + 0.0130 \frac{I}{Q} + 0.4007 \frac{\Delta L}{L} - 0.16901 \frac{\Delta A}{A} \frac{A}{Y} = 1.0349 \frac{\Delta A}{A} \\ & (2.475) \quad (0.900) \quad (-1.358) \quad (1.320) \\ & - 0.1732 \text{ DUM95} \quad - 0.2259 \text{ SHIFT94} \\ & (-2.385) \quad (-4.785) \end{aligned}$$

D.W. = 1.721 Adj. R^2 = 0.82 Period: 1973-1997

In the above equation, all the variables have the expected sign. The SHIFT94 variable is equal to one for years before 1994 and zero for years after 1994 to account for change in the political regime in South Africa. A dummy variable DUM95 that is equal to 1 for the year 1995 and zero otherwise is included to capture the effect of the change in regime since confidence in the economy was yet to be established. The investment variable I/Q is statistically significant at 5% level, which implies that investment does affect economic growth in South Africa. Labor is statistically insignificant, it however has the proper sign. This is not surprising because in South Africa some sectors labor productivity is quite low. It should also be noted that the previous regime did not invest in human capital, and restricted access to schooling or professional training to a limited small group of people. The level of significance associated with the agricultural growth variable has the required sign and statistically significant which implies that the agricultural sector contributed significantly to economic growth in the concerned period.

The estimated results indicate that inter-sector externality is substantially significant. Accordingly a 1% increase in the growth rate of the agricultural sector, without drawing resources from the agricultural sector, the non-agricultural sector will expand by 1.035%. Another result that can be deducted from the above estimation is the productivity differential, $\alpha \approx 0.764$ which implies that there is a productivity differential between the agricultural sector and the non-agricultural sector, the non-agricultural sector being more productive. Thus this supports the argument of Mellor (1976), Adelman (1984) and De Janvry (1984), that agriculture will create sufficient demand to stimulate industrialization. In South Africa the underlying argument is that there are significant productive and institutional links between agriculture and the rest of the economy, with agricultural growth producing strong demand incentives and supply incentive which will foster industrial expansion. At the same time, this argument can be supported by the fact that the contribution of agriculture to the GDP of South Africa has declined in comparison with the rest of the economy.

6. SUMMARY AND CONCLUSION

This study empirically supports the argument of development economists that industrialization depends on agricultural improvements. If an economy has a stagnant agricultural sector, it will not show industrial development. With an expansion of the agricultural sector, the industrial sector will follow. Thus in case of South Africa the success of development will depend on growth of the agricultural sector, at least partially. The empirical results suggest that South Africa should follow an "agricultural-led" growth strategy

for successful development. Therefore, policies should be directed at facilitating agricultural growth, as agriculture is not a passive sector but a "leading sector" for economic growth.

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PRODUCTION RISK ADVICE AT WHOLE FARM LEVEL: REPRESENTATIVE VERSUS MEAN FARMS

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Farmers are often faced with research results that are inapplicable to their unique situations. However, using representative farms can change this. In this article representative and mean farms are compared on the basis of the number of farmers that can identify with the respective farms as well as the production risk associated with each. Risk was quantified by means of a whole farm simulation model and presented by means of cumulative distribution functions. Results confirm that a significantly larger number of farmers can identify with representative farms than with a mean farm for their area. Most results obtained with the mean farm procedure reflect more risk than those obtained with the representative farms procedure when compared by means of cash flow, farm profitability and own capital ratio variability, and the probability of realizing a negative value. Significant differences therefore occur despite representative and mean farms being formulated from the same data.

1. INTRODUCTION

Farmers do not always pay attention to the advice of experts, because they regard it as inapplicable to their situation. Much as agricultural economists would like to perform analyses for every individual, it is not practically possible. However, farm situations are so diverse in nature that only one mean analysis is mostly inapplicable for the majority of farmers within a specific group. The middle course is to formulate representative farms (Elliott, 1928). According to Swart (1989) representative farms can, among others, be employed to determine the position of farmers should they adopt a proposed practice. Representative farms also enable one to use research results as a guideline for actual farms in the study area (Meiring, 1994). Feuz and Skold (1991) regard representative farms as the proper tool for whole farm level analyses. Elliott (1928) corroborates that representative farms provide a basis for comparing the relative profitability of different enterprise combinations at varying yields and product and input prices.

It is often assumed that the population is normally distributed with respect to the variable in question. Plaxico and Tweeten (1963) consider this to be a somewhat brave assumption. Besides, large variation exists within agriculture. Elliott (1928) comes to the conclusion that a mean farm is obviously not representative, nor does it accurately describe the whole

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