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RURAL DEVELOP
MENT RESEARCH
PROJECT

The Regional Analysis of Agricultural
G.D.P. and its Relevance to East Africa

1. Antecedents
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A draft paper for seminar presentation only.
NOT TO BE CIRCULATED except to seminar participants.

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1. Antecedents

Initial concern with distinctions in cost definition as used in accounting and in economics. Fixed costs - overhead costs; variable costs - operating costs; costing with respect to one year in accounts and cost classified by variable time periods in economics;- concern over the influence of accounting practice on the agricultural economic analysis of twenty-five years ago. Search to avoid unchartered accountancy- influences of the direction of Ashby who asked what we obtained in the way of economic direction from a series of cost reports of production, and of J.D. Black who emphasised the need to clarify the degree of fixity in the cost structure because of its relationship to elasticity of supply in agriculture in the short and long run. Led to a paper on the classification of costs in agriculture which in turn directed my attention to the input data published by Canada for farming by Provinces, on an annual basis from 1926 onwards. First work on this data was to detect changes in cost structure, bearing in mind how technical change in input structure could affect long-run and even short-run supply response. Data published as revenue from sale of crops and livestock, and expenses, on purchased inputs, hired labour, debt financing and upkeep and repairs. The base for the construction of the data is the census of agriculture available every five years. This enables a fairly accurate estimate of input of tractors, trucks, combines, milking machines, etc. Initially, to these, average operating costs were applied for gas, oil grease, repair parts etc. Records were available later to show sales of gasoline to farms, fertilizer to farms and the use of insecticides and pesticides. Bit by bit the estimate of inputs was made more accurate and could therefore be used in a wider way within an input-output table for the whole economy. On the receipts side good records were available of the sales of major crops and annual sample surveys provide estimates of both acreage and yield for the major crops sold. Data on livestock marketing also gives estimates of slaughter for sale. The checks on production data available within the Bureau of Statistics showed that a good degree of internal consistency was maintained.

Further changes in direction were brought about under the influence of work on the measurement of productivity by Kendrick and by Cochrane on the nature of supply response in agriculture. This latter work presented an aggregative hypothesis that technology acted as a push to a short-run inelastic supply curve in agriculture, thrusting it forward over an inelastic demand curve. This resulted in a drastically reduced price level

in agriculture. When this was combined with the built in dependence on industrial inputs, deteriorating terms of trade for agriculture countered physical productivity/were zero or negative. Cochrane was proposing in fact something approaching a long-run cobweb theorem for the aggregate of agricultural output in the United States. I believed that his thesis was supportable only under support prices for agriculture. I set about trying to test it for the Canadian economy with the data assembled for cost structure study. In the final analysis the results were not a refutation of the Cochrane thesis but showed indications that adjustments within agriculture to changing terms of trade did take place in the short run. These had regional implications in Canada, at any rate. A world surplus of grain, for example, forced the western Canadian farmer to feed hogs and to compete with his eastern counterparts who had less technological adaptability and were pushed back on poultry and dairying. Eventually, the overall effects of falling terms of trade in agriculture, was to create regional pockets of unadjustable poverty on the technological fringe of Canadian agriculture, namely in the Atlantic Provinces and Quebec and in Upper Ontario. Thus the problem was not a simple aggregative hypothesis justifying a public utility as Cochrane advocated. Rather it was one of the pace of adjustment and the factors affecting that adjustment when faced with regional differences in the quality and quantity of factor inputs in the way of educated labour, flexible capital and the size of the farming unit.

2. Precedents

The data on Canada have been used in two ways by the writer. The first is to measure the changes in productivity that have occurred through the substitution of purchased inputs for factor inputs and through the substitution of capital for labour. The second is to relate these physical changes in output per unit of input to prices received by farmers and costs incurred by farmers (terms of trade) and to compare the income that results from physical productivity increases combined with falling terms of trade to the wage level of alternative occupations in the economy

This latter approach was broken down further to compare the regional impact of productivity and terms of trade on levels of return to factors of production within and between geographic regions of Canada

/increases and left the agricultural producers in a position in which the rewards for increased productivity

We will now examine these two approaches briefly.

Measurement of Productivity

The purpose of productivity measurement is not to determine a single relationship between output and input per se, but rather to determine differences between two or more relationships i.e. differences in the same agricultural sector or sub-sector as between successive periods and between similar agricultural sectors in different countries or regions during the same period. It may also be important to make comparisons between the agricultural sector and the national economy as a whole.

Concepts of Output and Input:- Gross Output = total amount of final product turned out-- what is a final product depends on the breadth of demarcation of the sector:-

Net factor output = Gross Output - all inputs of a non agricultural origin i.e. net value added in national accounting terms.

Similar definitions can exist on the input side. E.g., total inputs is the aggregate of factor inputs and purchased inputs (there are pricing and statistical problems in this aggregation which cause the writer to avoid using the total input concept.)

Thus productivity is measured using symbols as follows:

Input categories

L = Labour

C = Capital (interest)

S = Land

M = Intermediate products including capital consumption or depreciation.

Output

O = total output of final agricultural products

O_{fn} = net factor output of agricultural sector

a = agricultural sector

b = non-agricultural sector.

subscript i = 1st period subscript 2 = 2nd period.

$L_a + C_a + S_a = \text{total net factor input} = F_a$

The sum of inputs of non-agricultural stages of production is

$L_b + C_b + S_b = F_b$; the aggregate value = M

$$P_{fn} = \frac{O_{t_2} - M_2}{F_{a_2}} : \frac{O_{t_1} - M_1}{F_{a_1}} = \frac{O_{pn_2}}{F_{a_2}} : \frac{O_{fn_1}}{F_{a_1}}$$

e.g. Productivity Changes in Canadian Regions 1951-1966 at 1947-51 prices in index form with 1951 = 100.

		Maritimes	Que.	Ont.	Prairies	B.C.	Canada
O_{fn}	1951	100.0	100.0	100.0	100.0	100.0	100.0
	1966	83.6	78.8	125.1	126.5	128.6	118.6
F_a	1951	100.0	100.0	100.0	100.0	100.0	100.0
	1966	55.4	55.3	69.3	82.2	104.2	72.8
P_{fn}	1951	100.0	100.0	100.0	100.0	100.0	100.0
	1966	150.9	142.4	180.5	153.8	123.4	162.9

Measurement of Terms of Trade.

Implicit price indices can be obtained for O_t , F_b and O_{fn} by dividing current values into constant values at base prices thus:

Implicit price indices of Gross output, non-factor inputs and net value added using 1947-51 as price base.

Canada & Regions

		Maritimes	Que.	Ont.	Prairies	B.C.	Canada
1949-53 Av.	O_t	109.1	106.5	109.5	100.6	109.0	104.2
	F_b	114.6	114.5	114.8	115.2	116.3	115.0
	O_{fn}	105.6	101.3	105.9	95.8	105.3	99.2
1964-68 Av.	O_t	118.5	119.4	114.6	102.7	120.8	110.1
	F_b	143.1	132.7	138.4	144.0	131.3	138.5
	O_{fn}	98.8	96.8	93.0	85.0	113.1	90.5

Combining Terms of Trade and Productivity for Canada only, one can show.

$$P_{fn} \frac{1966}{1951} = 162.9 \times P_{O_{fn}} \frac{1966}{1951} 82.2 = 133.9$$

The implication is that net return to all factors in agriculture rose from 1951-1966 by 34% through a productivity rise of 62.9%

In this period the general cost of living in Canada rose by approximately 50% so that real buying power of Canadian farmers in 1966 was of the order of 66% of that in 1951 despite a 62.9% increase in productivity.

Prospects and Relevance to East Africa

If gross output data by regions can be built and priced, and if reasonable estimates of inputs can be made, there are several directions of usefulness, analytically and for planning purposes.

Some of these are 1) Regional changes in productivity within agriculture. 2) Relative income (imputed or cash) between peasant and commercial agriculture and between regions concentrating on different forms of agriculture.

3) The percentage composition of agricultural gross income. 4) The varying use of, and percentage importance of non-agricultural inputs.

5) The impact of transforming traditional agriculture on rates of productivity, terms of trade, level of real income and demand for non-agricultural products.

6) The information made available in the planning process of the likely points of impact of e.g. intensifying or commercialising the livestock economy on the exchange between regions within agriculture and between agriculture and non-agriculture (e.g. demand for fertiliser, insecticides, processed feed, transport, processing facilities etc.)

These are but a few of the directions in which the basic information can be pushed.

But, the present stock of information with respect to the size of, and changes in, peasant agriculture is grossly insufficient to proceed very far in the directions outlined.

Without the F.A.O. promoted census of the 1960-63 period, progress would be impossible. With the basic information it yields on acreage and output some progress is possible. How much? Perhaps very little at the moment. It looks as if we may only substitute an index of acreage change as a measure of gross output for one based on per capita diet-- a step in the right direction but a crude one in the light of the potentiality of the data.

The outcome of this research will almost certainly result in a plea for a middle ground to be established between the macro planner and national income accountant who reach into the rarified atmosphere for aggregate indicators, and the agricultural economist who is too much engaged with the micro unit. I suggest that one form in which the transposing of technique from developed world to underdeveloped world is

hindering the gathering of basic data is the effort to build sophisticated farm management in an agriculture which has very simple managerial problems, and the effort to construct imposing national accounts which depend for their accuracy on a developed exchange system that has yet to emerge.

If East African countries were to set themselves the task of a five year sample census in agriculture, and if agricultural economists were to concentrate on sample surveys, particularly in primitive exchange areas, to see what crops are exchanged and in what amounts, the beginning of a fully fledged and fully planned transformation of traditional agriculture could emerge from information and planning rather than by haphazard injections of techniques with no knowledge of the width of spread, or the resource re-allocation that may result.

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