Labor Absorption and Demand in Brazilian Agriculture

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Abstract: This paper examines the determinants of labour demand by the Brazilian farm sector (in particular the role of factor prices, production levels, land use, tractor inventories, and land concentration) to aid understanding of the causes of low rates of farm labour absorption. The research was conducted within the framework of neoclassical models of factor demand, to which the Krishna model of employment decomposition was added. The results show that the positive effects due to neutral technical change and output growth are cancelled by negative effects due to high wages, input subsidies, and rapid expansion of the farm tractor fleet. Inferences for policy and research are drawn.

Introduction

The rate of farm labour absorption in Brazil has been inadequate. During 1970-75, for instance, the rate of growth of real farm output was 11 percent per year. During the same period, effective farm employment grew 2 percent per year. This problem is aggravated by unemployment (estimated to be of the order of 6 percent) in the six major urban centres of the country.

The present study examines the effects of selected factors on farm labour absorption and demand levels. Special emphasis is given to the effects of output levels, relative input prices, land use, capital stock, land concentration, and output profiles. The study is conducted under a neoclassical factor demand scheme. Krishna's decomposition analysis complements the empirical part of the research.

Methodology

A Cobb-Douglas aggregate production function is specified in order to represent production technology of Brazil's farm sector:

$$(1)\quad Q = \alpha M^{\beta 1} L^{\beta 2} T^{\gamma 1} K^{\gamma 2} G^{\gamma 3} e^{\theta 1 D1} e^{\theta 2 D2},$$

where Q is aggregate farm output; M and L are levels of intermediary inputs and labour, respectively; T and K are stocks of fixed factors (land and tractors); G is the Gini index of land concentration; D_1 and D_2 are dummy variables indicating profiles of farm output; α is the intercept of the production function; β_1, β_2, γ_1, and γ_2 are production elasticities; and γ_3, θ_1, and θ_2 are coefficients of the production function shifters.

Under the usual assumptions of firm behaviour and market structure, a farm labour demand function is derived from equation *(1)*:

$$(2)\quad L = \Omega Q^{\delta 1} (p_1/p_m)^{\delta 2} T^{\phi 1} K^{\phi 2} G^{\phi 3} e^{\psi 1 D1} e^{\psi 2 D2} \alpha^{-\delta 1},$$

which is the simplified exponential form of the farm labour derived demand function (Hammermesh, 1976; and Brandt, Oliveira, and Lemos, 1984) where p_1 and p_m are prices of intermediate inputs and wages, respectively. Keeping D_1 and D_2 in the average values and expressing equation *(2)* in logarithmic form:

$$(3)\quad \ln L = \ln \Omega' + \delta_1 \ln Q + \delta_2 \ln (p_1/p_m) + \phi_1 \ln T + \phi_2 \ln K + \phi_3 \ln G,$$

where $\ln \Omega' = \ln \Omega + \psi_1 D_1 + \psi_2 D_2 - \delta_1 \ln \alpha$.

In order to develop a Krishna decomposition model, total differentials of equation *(3)* are obtained by making $P = p_1/p_m$:

$$(4)\quad dL/L = (d\Omega'/\Omega') + \delta_1(dQ/Q) + \delta_2(dP/P) + \phi_1(dT/T) + \phi_2(dK/K) + \phi_3(dG/G) + \ln Q\, d\delta_1 + \ln P\, d\delta_2 + \ln T\, d\phi_1 + \ln K\, d\phi_2 + \ln G\, d\phi_3.$$

For empirical decor. position analysis, the derivatives of equation *(3)* are expressed in discrete form (Krishna, 1975; Kumar, 1982; and Tyagi, 1981).

Parameter estimates of equation *(3)* are obtained after inclusion of an error term with the usual properties. OLS procedures are used. Aggregate state data for 1970 and 1975 and grouped (1970-75) data are the basic information. Current values are deflated (1980=100) by a general price index. Since β_2 is included in both equations *(1)* and *(2)*, separate estimation of equation *(2)* might provide inefficient estimators.

Results

Results from labour absorption and demand analysis are presented in Table 1. Farm labour demand is not sensitive to changes in farm wages or intermediate input prices (also see Taylor *et al.*, 1980). Changes in input subsidies should not be considered with optimism as a tool for increasing farm labour absorption. Farm labour absorption is positive, relatively high, but lower than unity, indicating high returns to labour, rates of employment growth lower than rates of output growth, and

Table 1—Estimated Parameters and Statistics of the Structural Stability Test, Farm Labour Demand, Brazil†

	1970	1975	1970-75
Intercept ($ln\ \Omega$)	-4.1256**	-3.5974**	-3.1058**
	(37.677)	(31.039)	(43.432)
Intercept (Ω)	0.0162	0.0274	0.0448
$ln\ Q$	0.7600**	0.7172**	0.6813**
	(4.524)	(5.152)	(7.194)
$ln\ p_1/p_m$	-0.1243*	-0.0499*	-0.0717*
	(1.084)	(1.352)	(0.926)
$ln\ T$	0.2826**	0.3320**	0.3508**
	(2.373)	(2.941)	(4.728)
$ln\ K$	-0.1776**	-0.2206**	-0.2067**
	(2.325)	(3.297)	(4.308)
$ln\ G$	-0.0561	-0.0748*	-0.1817
	(0.756)	(0.996)	(0.767)
D_1	-0.6069**	-0.5579**	-0.4515**
	(2.620)	(2.338)	(3.171)
D_2	0.8142**	0.8335**	0.7870**
	(3.378)	(3.760)	(5.473)
R^2	0.888**	0.867**	0.883**
Glejser test statistic for heteroskedasticity	1.169	1.135	1.824
Snedecor test statistic	22.586**	18.744**	43.216**
Error sum of squares	0.690	0.865	1.933

[†Values in parentheses are Student *t* statistics. *Significant at the 0.2 probability level. **Significant at the 0.05 probability level. Note: The dependent variable is *ln L*. Source: Brandt *et al.* (1984).]

relatively high potential for farm labour employment. Development of new markets for farm products might contribute to generation of farm labour employment (also see Brandt and Cipriano, 1984). The acreage elasticity of farm labour demand is positive, relatively low, but significant. Opening of new lands is not expected to contribute to massive growth of farm labour employment. This is also suggested by Bernstein and Deans, 1977. Rapid expansion of the farm tractor fleet is one of the major factors affecting farm labour demand. Despite the low absolute value of tractor demand elasticity, the high rates of growth of tractor stock resulted in marked reduction of farm labour demand. For an excellent review of this problem, see Agarwal (1981). Results from land concentration effects on farm labour demand are not conclusive.

Chow's structural stability test (0.243) and the admission that the scale parameter (Ω) changes between periods indicate that, for the present study, $d\beta_1 = d\beta_2 = d\gamma_1 = d\gamma_2 = d\gamma_3 = 0$ and that technical change is of Hicks-neutral type. Results from the decomposition analysis are presented in Tables 2 and 3. The technology effect is 41 percent due to the displacement of the production function and consequent displacement, to the right, of the labour demand function.

The output effect on employment is also high (36 percent), suggesting the relevance of output market development as an employment generation source. The negative and high (-51 percent) effect of relative prices reflects the effects of minimum wage legislation and subsidized credit and exchange policies on farm labour employment. The accelerated expansion of the farm tractor fleet is the second most important (-51 percent) source of farm labour demand decrease. Generous subsidies and favourable exchange policies, *inter alia*, are the major factors behind that change.

Implications

The farm labour absorption and demand model used in this study might be improved by incorporating expected factor and output prices. Another improvement would be to divide the model according to the different types of labour. Still other important omissions that should be overcome in future research are: contract relationships in the labour market, rate of unemployment, types of farm mechanization, labour intensity and qualification, disaggregation of intermediary inputs, modelling in a context of simultaneous equations determination, and inclusion of 1980 farm census data, which were not available at the time this research was undertaken.

Table 2—Rates of Growth and Production Elasticities for Variables Included in the Farm Labour Demand Model, Brazil*

	Production elasticity	r
L (10^6 man years)	0.1052	1.90
Q (10^9 cruzeiros, 1980)	–	11.03
p_l/p_m	†	11.48
T (10^6 ha)	-0.5149	0.70
K (10^3 units)	0.3034	15.04
G (Gini index)	0.2667	-0.39

[*State averages, where r indicates the geometric rate of growth (percent per year) observed during the 1970-75 period.
†Production elasticity of intermediate inputs = 1.3626. Sources: Brandt *et al.* (1984) and Table 1.]

Table 3—Decomposition Analysis of Farm Labour Employment, Brazil, 1970-75

	Component	Distribution (percent)
Total change in employment (observed)	dL/L	9.43
Sources of employment change:		
Technology effect	$-(d\alpha/\alpha)/(\beta_1+\beta_2)$	46.44
Price ratio effect	$-[\beta_1/(\beta_1+\beta_2)]/(dP/P)$	-51.07
Output effect	$[1/(\beta_1+\beta_2)]/(dQ/Q)$	36.06
Land effect	$-[\gamma_1/(\beta_1+\beta_2)]/(dT/T)$	-1.23
Tractor effect	$-[\gamma_2/(\beta_1+\beta_2)]/(dK/K)$	-14.77
Land concentration effect	$-[\gamma_3/(\beta_1+\beta_2)]/(dG/G)$	0.36
Total change due to all effects (calculated)	–	15.79

[Sources: Brandt *et al.* (1984) and Tables 1 and 2.]

Note

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