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The Substitutability of Emigrants and Non-migrants in the Construction Sector of Pakistan

ZAFAR MAHMOOD*

To predict the impact of emigration on labour displacement and factor rewards, a translogarithmic production function has been used. The estimation determined that unskilled emigrants and skilled and unskilled non-migrants have a complementarity with capital. While skilled emigrants and capital are substitutes, they are complementary with unskilled non-migrants. Based on these results, the model predicts displacement of unskilled non-migrants in the short run. Long-run predictions include an increase in wages of all kinds of workers and the adoption of capital-intensive techniques.

I. INTRODUCTION

The desire of a worker to improve his standard of living is hard to accomplish in an environment of limited economic opportunity. Therefore, whenever some economic opportunities arise outside their boundaries, workers opt for emigrating to those areas with the largest wage differential and the lowest entry restrictions.

Since the mid-1970s, a large number of skilled and unskilled workers have been migrating from Pakistan to the countries of the OPEC Cartel. Until 1984 emigrants formed about 7 percent of Pakistan's total labour force. Most of the emigration originated from the construction sector [Government of Pakistan (1986)].

Given the large pool of unskilled workers, it is easy to replace unskilled emigrants with unskilled non-migrants. However, emigration of a large number of skilled workers, in the short run, can create imbalances in the domestic labour market, resulting in some economic loss. Such imbalances require a change in wages to clear the labour market. Subsequently, rising wage costs may force the firms to adopt capital-intensive production techniques.

*The author is Research Economist at the Pakistan Institute of Development Economics, Islamabad.

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Since the mid-1970s, due to labour market imbalances, Pakistan has been observing a sizeable increase in the wages of both skilled and unskilled workers. Rising wage costs have been an important stimulus to the adoption of capital-intensive techniques in the sectors most affected by the emigration [Mahmood (1989)].

Fear of labour displacement is the common concern of various studies dealing with emigration from Pakistan [see Gilani *et al.* (1981); ILO-ARTEP (1984) and Government of Pakistan (1979) and (1986)].[1] These studies emphasized the imperfect substitutability of skilled emigrants with skilled non-migrants and ignored the possibility of substitutability between emigrants, non-migrants, and capital.

To determine the possibility of labour displacement and change in factor prices due to emigration, it is useful to investigate the relationship in production that has historically existed among the skilled and the unskilled, emigrant and non-migrant, and capital. Such a relationship directly addresses the question of the degree of complementarity or substitutability between the factors in production.

The complementarity or substitutability between emigrants, non-migrants, and capital is critical in evaluating the possibility of short-run labour displacement, and of the change in wages in the long-run. A knowledge of the elasticities of substitution and factor prices is, therefore, essential for assessing the impact of any migration policy.

In this paper, we use a Translog Production Function to estimate relationships in the production of construction activities. The resulting estimates can not only be used to derive the elasticities of substitution and complementarity but can also be used to derive the factor price elasticities. To estimate the parameters of the Translog Production Function, we apply Iterative Seemingly Unrelated Regression (henceforth ISURE) technique.

The schematic details of the study are as follows. Section II describes the Translog Production Function technique and its estimation procedure. Data issues are discussed in Section III. In Section IV, we present estimated parameters of the Translog Production Function and the elasticities of substitution and complementarity. The effects of emigration on factor prices are analysed in Section V. Section VI presents the results of a simulation exercise, which deals with the effect of emigration on labour displacement. Finally, Section VII summarizes the results of the study to make some policy suggestions.

II. METHODOLOGY

In order to determine the production relationship among factors we estimate

[1]All of these studies are based on either general observations or small sample surveys and lack an analytical framework.

a Translog Production Function.[2] A production function rather than a cost function is used because a time series of wage data for emigrants while working in the home country are not available; and these may be different from the wage of non-migrants.

We assume a twice differentiable aggregate production function relating the flow of gross output (Q) to the services of unskilled non-migrants (NU), skilled non-migrants (NS), skilled emigrants (ES), unskilled emigrants (EU), and capital (K). Assuming that the production function is characterized by a constant return to scale, a Translog Production Function can be written as,[3]

$$lnQ = ln\,\alpha_0 + \Sigma_i\,\alpha_i\,lnX_i + 1/2\,\Sigma_i\,\Sigma_j\,\gamma_i^j\,lnX_i\,lnX_j \quad \ldots \quad \ldots \quad (1)$$

where, $i, j = eu, es, nu, ns,$ and k, $X_i = EU, ES, NU, NS,$ and K, α and γ refer to parameters.

Assuming perfect competition, and differentiating Equation (1) with respect to the logs of the factors, gives the following factor share equation:

$$S_i = \alpha_i + \gamma_i^{eu}\,lnEU + \gamma_i^{es}\,lnES + \gamma^{nu}_i\,lnNU + \gamma^{ns}_i\,lnNS + \gamma_i^k\,lnK \quad \ldots \quad (2)$$

where, $S_i = W_iX_i/Q$ is the share of the ith factor in the production and W_i is the price of the ith factor, linear homogeneity requires the following conditions to be satisfied:

$$\Sigma_i\,\alpha_i = 1 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$\Sigma_i\,(\overset{i}{\gamma}_{eu} + \overset{i}{\gamma}_{es} + \overset{i}{\gamma}_{nu} + \overset{i}{\gamma}_{ns} + \overset{i}{\gamma}_{k}) = 0 \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

It can be seen that out of the thirty parameters which need to be estimated, only twenty-four are free; the parameter estimates from any of the five equations from Equation (2) can be derived from the parameter estimates of the other four equations. If we eliminate capital equation, then $\overset{K}{\gamma}_{eu}$, $\overset{K}{\gamma}_{es}$, $\overset{K}{\gamma}_{nu}$ and $\overset{K}{\gamma}_{ns}$ do not appear in the four estimating equations. We substitute these parameters in Equation (4), which yields a set of cross-equation symmetry restrictions.

[2]The Translog Production Function is superior to the frequently used Cobb-Douglas or Constant Elasticity of Substitution (CES) functions in several ways. Uzawa (1964), for instance, showed that, in multi-factor Cobb-Douglas and CES functions, the partial elasticities of substitution between all pairs of factors were equal. This rules out the possibility of complementarity between any pairs of factors. The Translog Function, however, is sufficiently feasible to describe the substitution possibilities between all pairs of inputs at every given point, in input or quantity space. Moreover, it can be used to derive factor price elasticities.

[3]The assumption of a constant return to scale implies certain restrictions on the parameters [see Berndt and Christensen (1973); Grossman (1982) and Mahmood (1989)].

The cross-equation symmetry restrictions cannot be imposed using the equation-by-equation OLS method. Because all the shares sum identically to unity, one must expect non-zero contemporaneous covariance between disturbances in different equations, and there is also no *a priori* reason to expect the same disturbance variance in different share equations. However, with the cross-equations summetry restrictions imposed, the system of equations can be estimated by using Zellner's SURE technique (1962 and 1963) or the Three Stage Least Quare (3SLS) method.[4]

Of principal policy interest are the elasticities of factor complementarity or substitution and factor price elasticities implicit in Equation (1). When assuming that factor quantities and not prices are exogenous, the appropriate measure of factor substitutability is the Hicks elasticity of complementarity rather than Allen partial elasticity of substitution.[5]

Berndt and Wood (1975) derived the elasticity of substitution in terms of the Translog parameters,

$$\sigma_i^j = (\gamma_i^j + S_i S_j) / S_i S_j, \quad i, j = eu, es, nu, ns, k, \; i \neq j,$$

$$\sigma_i^i = (\gamma_i^j + S_i - S_i) / S_i, \quad i = eu, es, nu, ns, k.$$

Factors i and j are substitutes if $\sigma_i^j < 0$, and complements if $\sigma_i^j > 0$.

III. DATA ISSUES

Data limitations restrict us to estimate aggregate production relationship only for the construction sector. Construction workers, both skilled and unskilled, constitute the leading group among the emigrants. Out of all the Pakistani emigrants, 24.42 percent entirely comprised of skilled construction workers. Unskilled emigrants, who constitute 40.07 percent of all the emigrants, mostly went from the construction sector [Government of Pakistan (1986)].

We divide total domestic labour force engaged in the construction sector into

[4] The problem with SURE or 3SLS is that the estimates of the translog parameters are no longer invariant to the choice of the equation that is dropped. To overcome this problem Barten (1969) suggested an alternative estimation procedure of Maximum Likelihood, wherein he showed that the Maximum Likelihood parameter estimates are independent of the equation omitted. On the other hand, Kmenta and Gilbert (1968) have shown that if one iterates the SURE (ISURE), the parameter estimates will converge to the Maximum Likelihood Estimates (provided the procedure converged at all). The same is true if we iterate 3SLS (I3SLS).

[5] Sato and Koizumi (1973) showed that the partial elasticity of complementarity, and that of substitution, is positively related to the elasticity of derived demand in the Marshall-Hicks formula.

two categories: skilled workers (which consists of professionals, managers, clerical and skilled production workers) and unskilled workers (which consists of unskilled production workers and service workers). On the other hand, among the emigrants we consider masons, carpenters, and jointers as skilled emigrants, and unskilled production workers as unskilled emigrants. The reason for this classification is that, given the data, it is not possible to identify the industry from where a non-production emigrant went. This procedure may understate the production share of the skilled emigrants and, consequently, would overstate the production share of every other factor. The data for unskilled emigrants are not available by sector. We, therefore, consider total unskilled emigrants as unskilled emigrants belonging to the construction sector. This is a good proxy because the majority of the unskilled emigrants went from the construction sector. The use of this data may overstate the share of unskilled emigrants in the production of construction activities.

To compute the employment costs for the skilled and the unskilled labour, we use the wage data reported in Government of Pakistan (Various Issues).[6] Capital payments are derived by subtracting labour payments from the value-added of the construction sector.

IV. ESTIMATES OF THE TRANSLOG FUNCTION AND THE ELASTICITIES OF SUBSTITUTION

For all the estimated share equations we compute the conventional goodness of fit statistics R^2.[7] The R^2 figures for the regressions are 0.769 for the *EU* equation, 0.966 for the *ES* equation, 0.857 for the *NU* equation, 0.98 for the *NS* equation, and 0.929 for the *K* equation.

All the estimated parameters are reported in Table 1. Most of the estimated parameters are statistically significant with the exception of relations between unskilled emigrants and skilled and unskilled non-migrants.

Elasticities of factor complementarity, by using the estimated parameters reported in Table 1 and the mean value of factor shares reported in Table 2, are reported in Table 3. These elasticities reveal that both skilled and unskilled emigrants are substitutes. This implies that skilled labour is preferred over unskilled labour in international job markets, when there is an excess demand for jobs at given wages. It can also be noted from these elasticities that unskilled emigrants are comple-

[6]Distribution of production and non-production workers in the construction sector is reported in Government of Pakistan (Various Issues). Total employment and value-added data for the construction sector are reported in Pakistan (1985). Data on various categories of emigrants are reported in Pakistan (1986).

[7] Since we got identical results with the use of both ISURE and I3SLS techniques, we, therefore, only report results of ISURE technique.

Table 1

Estimated Parameters of Translog Production Function

Parameters	Estimates		Parameters	Estimates	
γ_{eu}^{eu}	.0052	(.0013)	γ_{es}^{k}	−.0043	(.0007)
γ_{eu}^{es}	−.001	(.0012)	γ_{nu}^{nu}	−.412	(.184)
γ_{eu}^{nu}	−.0027	(.0069)	γ_{nu}^{ns}	.4122	(.1808)
γ_{eu}^{ns}	.0015	(.0069)	γ_{nu}^{k}	−.0183	(.0040)
γ_{en}^{k}	−.0028	(.0019)	γ_{ns}^{ns}	−.342	(.178)
γ_{es}^{es}	.0090	(.0023)	γ_{ns}^{k}	−.0455	(.0058)
γ_{es}^{nu}	.0213	(.0135)	γ_{k}^{k}	.0710	(.0068)
γ_{es}^{ns}	−.025	(.0126)			

Notes: Estimated parameters are from Equation (2) for i = *eu, es, nu, ns, k.*
Standard errors are reported in parenthesis.

Table 2

Means of Factor Shares

Variable	Means
EU	.017
ES	.019
NU	.349
NS	.429
K	.186

Table 3

Elasticities of Factor Complementarities σ_i^j

Wage of	With Respect to the Quantities of				
	EU	*ES*	*NU*	*NS*	*K*
EU	–39.83				
	(4.00)				
ES	–2.10	–26.70			
	(0.83)	(3.91)			
NU	0.55	4.21	–5.25		
	(0.39)	(1.58)	(2.24)		
NS	1.21	–2.07	3.75	–3.19	
	(0.22)	(1.98)	(2.28)	(1.92)	
K	0.11	–0.22	0.72	0.43	–2.32
	(1.48)	(6.14)	(4.61)	(8.13)	(10.44)

Note: Figures in parenthesis are *t*-statistics.

mentary with skilled non-migrants. We observe a rather unusual sign for the relation between unskilled emigrants and unskilled non-migrants, i.e., they are complements.[8] All these parameters, however, turned out to be highly insignificant. Except these relations, all the remaining relations turned out to be statistically significant.

It can be further seen from Table 3 that unskilled emigrants are complementary with capital, which is not counter-intuitive. In contrast to this, we find that skilled emigrants are substitutes with capital. This result has important implications for future employment generation and re-absorption of the returning migrants. The estimation also determined that both skilled and unskilled non-migrants are complementary to capital. Moreover, the results show that capital is more complementary with unskilled non-migrants than with skilled non-migrants, which seems to be contradictory to the Griliches (1969) hypothesis that 'education is more complementary with capital than with unskilled or raw labour'. Our results are, however, in agreement with those of Grant (1979) and Grossman (1982).

Most of the earlier studies dealing with emigration from Pakistan predicted an

[8] In discussions with some construction companies it was revealed that although unskilled emigrants and unskilled non-migrants are not perfect substitutes, they can at least be treated as weak substitutes.

adverse effect of emigration on output. In contrast to the findings of these studies, we predict that since skilled emigrants and skilled non-migrants are strong substitutes, the adverse effect of emigration on output should be ruled out.

Our estimation determines that skilled emigrants are complementary with unskilled non-migrants. This implies that after the emigration of skilled workers, some of the unskilled non-migrants become redundant. The estimation further determines that skilled emigrants are a substitute for capital, while capital is complementary to both unskilled migrants and non-migrants. Therefore, some of the unskilled non-migrants who became redundant with the departure of skilled workers got employment due to the substitution of capital for skilled emigrants.

V. EFFECT OF EMIGRATION ON FACTOR PRICES

Own- and cross-factor price elasticities are reported in Table 4.[9] The coefficient

Table 4

Own- and Cross-price Elasticities

Changes in the Wage of	With Respect to the Quantities				
	EU	*ES*	*NU*	*NS*	*K*
EU	–0.677	–0.040	0.190	0.517	0.021
	(4.000)	(0.833)	(0.391)	(0.220)	(1.481)
ES	–0.036	–0.507	1.470	–0.887	–0.040
	(0.833)	(3.918)	(1.578)	(1.984)	(6.143)
NU	0.009	0.080	–1.832	1.610	0.134
	(0.391)	(1.578)	(2.239)	(2.280)	(4.610)
NS	0.021	–0.039	1.310	–1.368	0.080
	(0.220)	(1.984)	(2.280)	(1.921)	(8.125)
K	0.002	–0.004	0.251	0.184	–0.432
	(1.481)	(6.143)	(4.610)	(8.125)	(10.441)

Note: Figures in parenthesis are *t*-statistics.

[9]Given the output quantity and all other factor inputs, the factor price elasticity, E_i, is conventionally defined as:

$$E_i^j = \partial \ln W_i / \partial \ln X_i = S_i \sigma_i^j$$

of unskilled emigrants in relation to unskilled non-migrants is insignificant. Therefore, we cannot unambiguously infer the impact of the emigration of unskilled labour on the wage of unskilled non-migrants.[10] It is, however, clear from the results that the emigration of skilled labour has resulted in an increase in the rate of return to capital, but the emigration of unskilled workers has led to a decrease in the rate of return to capital. Consequently, the ultimate sign of the rate of return to capital depends on the relative weight of the volume of the two kinds of emigrants, which evidently favours unskilled emigrants. The falling rate of return confirms the findings by Mahmood (1989).

Table 4 reveals both own- and cross-factor price impact of emigration on the wages of non-migrants. Thus, actual increase in the wages of both kinds of non-migrants not only depends on the effect of their own emigration, but also on the cross-effects of substitution between skilled emigrants, capital, and skilled non-migrants, as well as on the complementarity between capital and skilled and unskilled non-migrants. Wage changes through cross relations have a reinforcing impact on the wages of non-migrants.

VI. LABOUR DISPLACEMENT

When an economy experiences emigration, the adjustment may involve various combinations of employment and factor price changes. To study the adjustment process, we examine two extreme situations: a short-run, in which factor prices may be inflexible and the labour market adjustment occurs only through changes in the employment of non-migrants; and a long-run, where adjustment is made totally through factor price changes.

Assuming, as before, a constant-return-to-scale production technology, the minimization of factor costs sets the marginal product of factor i, f_i, equal to factor price, W_i, for all factors. Differentiating these conditions, we get:

$$dW_i = f_i^{nu} dNU + f_i^{ns} dNS + f_i^{eu} dEU + f_i^{es} dES + f_i^{k} dK \quad \ldots \qquad \ldots \qquad (5)$$

where, $i = nu, ns, eu, es, k$.

If all factor prices are assumed to be flexible, which is a long-run situation, then we get results as reported in Table 4. That is, in the long run, all the adjustments are made through factor price changes and no adjustment is made in employment.

[10]While interpreting the results reported in the first two columns of Table 4, one should reverse the signs of the elasticities because the estimates are for potential emigrants. For instance, it is clear that a one-percent increase in the emigration of skilled labour would result in a 0.04 percent increase in the wage of skilled non-migrants because both are substitutes.

In the short run, when all factor prices are inflexible, the solution to the system described in Equation (5) is

$$\frac{dlnNU}{dlnEU} = \frac{S_{eu}(\sigma^{ns}_{nu}\sigma^{nu}_{ns} - \sigma^{eu}_{nu}\sigma^{ns}_{ns})}{S_{nu}\,D},$$

$$\frac{dlnNS}{dlnEU} = \frac{S_{eu}(\sigma^{eu}_{ns}\sigma^{nu}_{nu} - \sigma^{nu}_{eu}\sigma^{ns}_{ns})}{S_{ns}\,D},$$

$$\frac{dlnNU}{dlnES} = \frac{S_{es}(\sigma^{ns}_{nu}\sigma^{es}_{ns} - \sigma^{es}_{nu}\sigma^{ns}_{ns})}{S_{nu}\,D},$$

$$\frac{dlnNS}{dlnES} = \frac{S_{es}(\sigma^{ea}_{ns}\sigma^{nu}_{nu} - \sigma^{nu}_{es}\sigma^{ns}_{nu})}{S_{ns}\,D},$$

and

$$\frac{dlnW_k}{dlnES} = \frac{S_{es}}{D}\,(\sigma^{ns}_{k}\,(\sigma^{es}_{ns}\sigma^{nu}_{nu} - \sigma^{nu}_{es}\sigma^{ns}_{nu}) + \sigma^{nu}_{k}\,(\sigma^{ns}_{nu}\sigma^{es}_{ns} - \sigma^{es}_{nu}\sigma^{ns}_{ns}) + \sigma^{eu}_{k}\,D),$$

$$\frac{dlnW_k}{dlnEU} = \frac{S_{eu}}{D}\,(\sigma^{ns}_{k}\,(\sigma^{eu}_{ns}\sigma^{nu}_{nu} - \sigma^{nu}_{eu}\sigma^{ns}_{nu}) + \sigma^{nu}_{k}(\sigma^{ns}_{nu}\sigma^{eu}_{ns} - \sigma^{eu}_{nu}\sigma^{ns}_{ns}) + \sigma^{eu}_{k}D)$$

where,

$$D = \sigma^{nu}_{nu}\sigma^{ns}_{ns} - (\sigma^{ns}_{nu})^2$$

In the short run, wages of both kinds of non-migrants do not respond after emigration takes place; therefore, the entire adjustments take place through changes in the employment of non-migrants. The simulated values are reported in Table 5.[11] The simulated values of employment due to unskilled emigrants are ambiguous because of their statistically insignificant relation in the production function.

It can be seen from Table 5 that because of the complementarity between skilled emigrants and unskilled non-migrants, employment of unskilled non-migrants has gone down after the emigration of skilled workers. On the other hand, employ-

[11]Examples of this kind of simulation can be found in Grossman (1982); Grant and Hamermesh (1981) and Johnson (1980).

Table 5

Short-run Effects of a One-percent Emigration of Labour

Percentage Changes in	Skilled Emigrants	Unskilled Emigrants
Unskilled Employment	–0.12	–0.08*
Skilled Employment	0.08	0.13*
Wage Rates of:		
Unskilled Non-migrants	–	–
Skilled Non-migrants	–	–
Capital	–0.014	–0.008

Note: *Means that the relationship in the production function is insignificant.

ment of skilled non-migrants has gone up after the emigration of skilled workers because skilled emigrants and skilled non-migrants are substitutes.

It can be noted also from Table 5 that the increased demand for capital due to the substitutability between skilled emigrants and capital could not offset the fall in the price of capital caused by the unemployment of unskilled non-migrants. This result, as we noted earlier, is got because of the stronger complementarity between unskilled non-migrants and capital as compared to the complementarity between skilled non-migrants and capital.

Looking at the magnitude of the elasticities, we can see that, in the short run, emigration does not pose a serious displacement threat to the non-migrants. Although some fall in the employment of unskilled non-migrants can be seen in the short run, yet as soon as the wage becomes flexible, the displaced workers are adjusted.

To conclude, labour displacement and the resulting adverse effect on output can be seen only in the short run because of inflexible wages. In the long run, the labour market adjusts itself and, therefore, no threat to economic growth can be predicted.

VII. CONCLUSIONS

To predict the impact of emigration on labour displacement and factor prices, we used the estimates of a Translog Production Function for the construction sector to derive the elasticities of factor substitutability and factor prices. The estimation determined that unskilled emigrants and, skilled and unskilled non-migrants have a complementarity with capital. On the other hand, skilled emigrants

and capital are substitutes, and skilled emigrants are complementary with unskilled non-migrants.

On the basis of these results, we predict for the short run some displacement of unskilled non-migrants, as they are complementary to skilled emigrants. However, the magnitude of the elasticity suggests that emigration does not pose a serious displacement threat to unskilled non-migrants. On the other hand, skilled emigrants are substitutes for skilled non-migrants and capital. This finding rejects the hypothesis of labour displacement or economic loss. Substitution possibilities between skilled emigrants and skilled non-migrants show the efficiency of the government facilities to acquire the know-how through vocational institutes. However, the increased capital-intensity due to emigration is not in agreement with the country's factor endowment and may affect the competitive position in the international markets. Since the nature of emigration is temporary, the adoption of capital-intensive techniques would create problems for employment generation and re-absorption of the returning migrants. Therefore, incentives should be given to encourage replacement of non-migrant labour with emigrants instead of with capital substitution.

Due to the insignificant relationship between unskilled emigrants and unskilled non-migrants, we could not predict a direct impact of unskilled emigration on the wage of unskilled non-migrants. Yet cross-relationship does show an increase in the wage of unskilled non-migrants.

The analysis, however, shows an unambiguous increase in the wage of skilled non-migrants after the emigration of skilled labour. The results predict a decrease in the rate of return to capital due to unskilled emigration, and a rise in the rate of return to capital due to the emigration of skilled labour. Consequently, the ultimate sign of the rate of return to capital depends on the relative weight of volume of the two kinds of emigrants, which evidently favours the unskilled emigrants. The direction of factor prices in the post-emigration period suggests that all the domestic labour should favour the emigration of labour and the capitalists should oppose it. A liberal migration policy and a comprehensive training programme for the non-migrants would enable the country not only to minimize the detrimental effects of emigration, but would also help in improving the income distribution.[12]

REFERENCES

Barten, A. P. (1969) Maximum Likelihood Estimation of a Complete System of

[12] It is observed that most emigrants went from affluent classes [see Gilani (1981)]. The Government can encourage emigration from the poor classes by extending loans to cover the cost of emigration. Similarly, the Government should set up vocational institutes in small towns and underdeveloped region of the country for a just distribution of benefits from emigration.

Demand Equations. *European Economic Review* 1 : 4 7–73.

Berndt, E. R., and L. R. Christensen (1973) The Translog Function and the Substitution of Equipment, Structures, and Labour in U. S. Manufacturing, 1929–68. *Journal of Econometrics* 1 : 1 81–114.

Berndt, E. R., and D. O. Wood (1975) Technology, Prices, and the Derived Demand for Energy. *Review of Economics and Statistics* 57 : 3 259–268.

Gilani, *et al.* (1981) Labour Migration from Pakistan to the Middle East and its Impact on the Domestic Economy: Part I. Islamabad: Pakistan Institute of Development Economics. (Research Reports Series No. 3)

Grant, J. (1979) Labour Substitution in U. S. Manufacturing. Unpublished Ph.D. dissertation, Michigan State University.

Grant, J., and D. S. Hamermesh (1981) Labour Market Competition among Youths, White Women and Others. *Review of Economics and Statistics* 63 : 3 354–360.

Griliches, Z. (1969) Capital Skill Complementarity. *Review of Economics and Statistics* 51 : 4 465–468.

Grossman, J. B. (1982) The Substitutability of Natives and Immigrants in Production. *Review of Economics and Statistics* 64 : 4 596–603.

ILO-ARTEP (1984) Impact of Return Migration on Domestic Employment in Pakistan – A Preliminary Analysis. Chapter 3.

Johnson, G. E. (1980) Theory of Labour Market Intervention. *Economica* 47 (August) 309–329.

Kmenta, J., and R. F. Gilbert (1968) Small Sample Properties of Alternative Estimators of Seemingly Unrelated Regressions. *Journal of the American Statistical Association* 63 : 1180–1200.

Mahmood, Z. (1989) Emigration, Wages and Labour Displacement in Pakistan (Chapter 4) Unpublished Ph.D. dissertation Columbia University.

Pakistan, Government of (1979) *Survey of Assessment of Training Needs in Pakistan.* Islamabad: Manpower Division.

Pakistan, Government of (1985) *Economic Survey.* Islamabad: Economic Advisor's Wing, Finance Division.

Pakistan, Government of (1986) *Labour Market Adjustment to Emigration in Pakistan.* Islamabad: Manpower and Overseas Pakistanis Division. January.

Pakistan, Government of (Various Issues) *Labour Force Survey.* Karachi: Federal Bureau of Statistics.

Sato, R., and T. Koizumi (1973) On the Elasticities of Substitution and Complementarity. *Oxford Economic Papers* 25 : 1 44–56.

Uzawa, H. (1964) Duality Principles in the Theory of Cost and Production. *International Economic Review* 5.

Zellner, A. (1962) An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias. *Journal of the American Statistical Associa-*

tion 57 : 585–612.

Zellner, A. (1963) Estimators for Seemingly Unrelated Regression Equation: Some Exact Finite Sample Results. *Journal of the American Statistical Association* 58 : 977–992.