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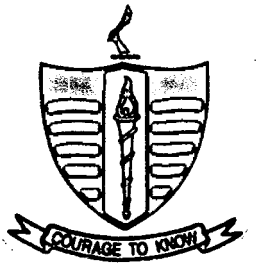

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DEMAND FOR MONEY IN PAKISTAN

By

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Cooley and Leroy (1981), have questioned the authenticity of results of demand for money studies. They contend that authors tend to report only those results that support their theoretical beliefs. The ample proof of a negative relationship between money demand and the rate of interest may thus be because of author bias. A survey of demand for money studies of Pakistan seems to support this contention. The following extracts from two studies reflect the possible theoretical bias of the authors:

Mangla (1979), for example, on reporting a "wrong" sign for the interest rate, adds the footnote:

> "Although two wrongs do not make a right, it is interesting to note that similar unexpected signs of the interest rate coefficient have also been obtained by Abe, Fry, et al." (pp. 28, ff 9).

Ashfaque H. Khan (1980) reports:

> "We also tried rg (the annual yield on govt. bonds). Though it was statistically significant, it possessed the/

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wrong sign. Results of the regression incorporating rg are therefore excluded." (pp. 33, ff. 14)

One reason for conducting this study therefore is to establish the relationship between money demand and interest rate in Pakistan without partiality towards established theory. After all, Pakistan is a developing country, with characteristics different from those of developed countries. Results which are contrary to established theory may indicate the need for a new theoretical framework. Or they may simply indicate the need to modify the function.

The second reason for conducting the study is to try and compare results obtained from different studies to see if results can be corroborated by each other. Previous studies were mainly for the pre-1971 period, using All Pakistan data. Khan (1980) conducted his study for the period 1959-1978, but his results cannot be compared with the earlier studies because he uses data for West Pakistan only, even for the pre-1971 period. Ali (1986) presents estimates for the 1975-86 period, using data for the present Pakistan. The present study uses all Pakistan data for both the pre and break. So its results can be compared with those of the earlier as well as the later studies.

The third reason for this study is to explore the role of inflation in the demand for money function. Empirical evidence in Pakistan is ambiguous, and further research may prove fruitful.

Methodology

The aim of the study is to see whether the most common form of the demand for money function used over the past few

years is suitable for Pakistan. This demand function in its general form is given as under:

$$M^*d = f(Y, r)$$

where M*d are the desired money balances, Y is the scale variable, and r is the opportunity cost variable. Assuming that the actual money balances adjust to the desired level in the same time period, this relation becomes:

$$Md = f(Y, r)$$

where Md are the actual money balances.

Certain issues need to be focussed before we can empirically estimate the function. The first is the question of which definition of money to use, M1 or M2. Since we are exploring the demand for money function, so both the definitions shall be used. For each definition, functions for both nominal and real money balances will be specified.

There are three possible candidates that could be used as the scale variable in the function. These are wealth, permanent income, and current income. There are no wealth series in Pakistan, the choice is between the remaining two. Again, both permanent income (YP) and current income (Y) are used in this study. The statistical series used in GNP at current prices. The Permanent Income series has been generated as:

$$YP = B0 + B1Yt{-}1 + B2Yt{-}2 + B3T$$

where Yt–1 and Yt–2 are lagged values of Y, and T is the time trend. Some studies have imposed declining weights on the

lagged variables, but as Khan (1980) points out, such adhoc imposition of weights is not justified.

Whether the rate of interest is an argument for the demand for money is at the center of this study. Theoretically it has a prominent role in the determination of money demand. Empirical evidence for developed countries seems to support this. Whether the short or long term rate should be used is controvertial. For developing countries, Adekunle (1966) argues a lesser role for interest rates as compared to developed countries. In the studies for Pakistan, both positive and negative relationships have been reported. Basically three rates have been used, RC (the inter-bank call rate), RB (the long term yield on govt. bonds), and RT (the weighted average of interest rates on time deposits). All three of them will be used in this study.

In order to derive the series of real money balances and GNP from nominal values, we need to deflate them with a price index. In this study the consumer price index is used.

Finally, the choice of the data period and frequency of observations. As for the data period, it is from 1957-58 to 1983. As for the frequency of observations, availability constrained the choice to annual data. Consequently the analysis of lags in adjustment were foregone since they would be more meaningful if quarterly or monthly data were available. The functional form most used is:

$$M = A.\, Y^{b}.\, r^{c}.\, u$$

which in the linear form becomes:

$$\text{Ln } M = \text{Ln } A + B \text{ Ln } Y + c \text{ Ln } r + \text{Ln } u$$

Because of the nature of the data for Pakistan. dummy variables have to be used to segregate the pre and post-1971 periods. Although a single dummy could have served the purpose of giving separate coefficients for the two periods, computation in this way cannot give separate t statistics for these coefficients. Consequently we see two dummies, D1 and D2. D1 has a value of one for the period upto 1971, and a value of zero subsequently. D2 has a value of zero upto 1971 and a value of one for the subsequent period. Including the dummies into the equation gives us:

$$\text{Ln M} = a1 + b1Y + c1t + a2 + b2Y + c2r + u$$

where the lower case letters signify that the variables have been expressed in log form. The subscripts 1 and 2 indicate the coefficients for the pre and post-1971 periods.

The use of two definitions of income, and three rates of interest give us the following six specifications for nominal money balances:

1. $\text{Ln M} = a_1 + b_1Y + c_1r_1 + a_2 + b_2Y + c_2r_c$
2. $\text{Ln M} = a_1 + b_1Yp + c_1r_c + a_2 + b_2Yp + c_2r_c$
3. $\text{Ln M} = a_1 + b_1Y + c_1r_1 + a_2 + b_2Y + c_2r_t$
4. $\text{Ln M} = a_1 + b_1Yp + c_1r_t + a_2 + b_2Yp + c_2r_t$
5. $\text{Ln M} = a_1 + b_1Y + c_1r_b + a_2 + b_2Y + c_2r_b$
6. $\text{Ln M} = a_1 + b_1Yp + c_1r_b + a_2 + b_2Yp + c_2r_b$

With two definitions of M, we run each of these regressions twice, giving a total of twelve regressions. For real money balances, each of these specifications is run again, using

deflated values of money stock and GNP. In all therefore to assess the inclusion of the rate of interest in the demand for money function, twenty four regressions are run.

In order to assess the role of inflation in the demand for money function, the variable generally used is expected inflation. Different studies have adopted different methods of generating the series of expected inflation rate. Some, for example Khan (1980), have assumed that expectations are static, implying the use of the current rate of inflation calculated as

$$P = \frac{P - P_{t-1}}{P_{t-1}}$$

in the function as a proxy of expected inflation. Some studies use lagged values to generate the series. These different approaches seem to give different results, and therefore both the current inflation rate and the expected inflation rate have been used in the study.

To generate the expected inflation rate series we have taken lagged values over five years. Instead of imposing declining weights on an adhoc basis, we have used the Almon Method. The values of expected inflation series are estimated by using the weights suggested by this technique (a second degree polynomial was fitted to impose restrictions).

To include the rate of inflation in the demand function involves the modification of the functional form. This is basically because in Pakistan for a couple of years the rate of inflation was negative. This means that logs of this series cannot be taken. The modified functional form is:

$$M = A.\ Y^{b}.\ r^{c}.\ e^{dP+u}$$

which when linearised by taking logs of both sides becomes:

$$\text{Ln } M = \text{Ln } A + b \text{ Ln } Y + c \text{ Ln } r + d\,P + u$$

The inclusion of the dummy variables then gives:

$M = a1 + b1Y + c1r + d1P + a2 + b2Y + c2r + d2P + u$
where all the variables are in log form except the inflation rate.

Again, as in the case of the original specifications, the inclusion of the rate of inflation, along with the different definitions of income and the rate of interest, for each definition of money, both in nominal and real terms gives a set of 48 equations. The findings of the study are reported in the next section.

Empirical Results

In this study, the demand for money has been looked at both in the narrow and the broad sense, as well as in nominal and real terms. It was conducted in two stages, first to see if the conventional demand function is supported by the data, and second to see if the rate of inflation as an explanatory variable was significant. In the first stage, the independent variables were income and the rate of interest. Two definitions of income were used, and three definitions of the rate of interest. These were used to explain two definitions of money demand, namely M1 and M2.

Tables 1 to 4 report the results for nominal and real money balances for each definition of money. The general equation run is:

$$\log M = a1 + b1 \log Y + c1 \log R + a2 + b2 \log Y + c2 \log R + U$$

where in each specification different combinations of the different definitions of Y and R are employed. The coefficients with the subscript 1 are employed. The coefficients with the subscript 1 are the elasticities of the corresponding variables in the pre-1971 period, while those with the subscript 2 indicate the elasticities for the post-1971 period. The results of the different specifications for each definition of money are discussed below.

Looking at nominal M1, Table 1 indicates that for all six specifications the R2 statistic is extremely high, showing that 99% or more of the variation in the data is explained by variations in the independent variables. Secondly, there is no definite indication of either serial correlation or misspecification since the Durbin Watson statistic is in the inconclusive range. The elasticities associated with income are all positive. For the post-1971 period, all income elasticities are high, and also highly statistically significant. For the pre-1971 period only the specifications using RC result in statistically significant income coefficients. All specifications indicate that income elasticities are higher in the second period as compared to the first. Another noticeable thing is that the elasticities associated with current income are consistently higher than those with permanent income, and also generate a higher R2 value. These findings support Adekunle's contention that for developing countries current income is more appropriate as a scale variable. Also the view that in these countries income leasticity is high is uphled.

The evidence regarding the rate of interest is not so clear cut. The specifications using RC give the expected negative signs for the coefficients associated with it. Especially when RC and Y are used, the elasticity in the post-1971 period comes out to be negative and highly significant. The

specification using Y and RT shows that for the pre-1971 era it was negative but insignificant. The use of permanent income with either RC or RT renders all interest elasticities insignificant, again confirming Adekunle's views. The specifications using RBN result in positive interest elasticities which are significant in the post-1971 period. Generally comparing the two periods in terms of interest elasticity, the pattern that emerges is that if the elastiucities have a negative sign, then they are higher in the second period as compared to the first. If the relationship comes out the be positive , then the elasticities are lower in the second as compared to the first period. For nominal M1 therefore, the picture that emerges seems to suggest that the conventional function hatter explains the money holding behavior in the post-1971 period. In this period both income and the interest elasticities have the expected signs and are also statistically significant. In the pre-1971 period only income comes out to be significant, and that too only when RC is used as the interest rate.

The result of the regressions run with nominal M2 as the dependent variable follow an almost identical pattern. The regressions explain 99% or more of the variations in the dependent variable. The Durbin Watson test is inconclusive, giving no indication of serial correlation or misspecification. The coefficients associated with income are correctly signed and highly significant for the post-1971 period. In the pre-1971 period they are significant only in the specification using RC. As in the case of M1, current income has a consistently higher elasticity as compared to permanent income.

The coefficients associated with the rate of interest follow more or less the same pattern as that with M1. RC and RT generate the correct negative sign in the post-1971 period, with the former being highly significant as well. The difference

is that the coefficients associated with RB, although still positive are no longer significant. In general, the elasticities associated with both income and the interest rates are higher in the M2 functions than they were in the M1 functions.

These results again confirm that current income is more appropriate as a scale variable. And also that the conventional form of the demand function best explains the post-1971 period, especially when current income and the short term rate of interest are used as arguments. These results, especially for the post-1971 period support the findings by Khan (1980). He too finds that income is highly significant for both M1 and M2 functions. He too finds that RT and RC yield negative signs while RB results in positive and statistically significant coefficients.

Table 3 and 4 show the regression results of the different specifications involving real money balances. A look at the goodness of fit indicates that one again all specifications have high R2 values and acceptable DW statistics. Real M2 has better statistically fits than real M1, and both have lower R2 values than their nominal counterparts. A general comparison between the results in nominal and in real terms shows that like the relationship between the results of nominal M1 and M2, the coefficients associated with income and interest are generally higher for real M2 than for real M1. A comparison of the coefficients of nominal and real M1 shows that both income and interest elasticities are higher for real than for nominal M1. A similar comparison between nominal and real M2 shows that while interest elasticities are higher, in general income elasticities are lower for real M2 than for nominal M2.

As regards the size, sign and significance of the various coefficients the pattern is almost identical to that in the

nominal demand specifications. For the pre-1971 period the income elasticities are significant only in the specifications using RC. For the pre-1971 period, the interest elasticity is correctly signed, though not significant which employs both current income and RC as its arguments. For the post-1971 period, it is correctly signed for specifications using current income in conjuction with both RC and RT. For real M1 only involving RC it is significant, while for real M2 it is significant in both. Once again specifications involving RB render interest elasticities positive and in some specifications significant.

Apart from Khan (1980), whose results more or less coincide with those of the post-1971 period of this study, two other studies look at the demand for real money balances in the pre-1971 period. Akhtar (1974) found high income and interest elasticities (both for Rc and RB). While income elasticities were statistically significant, those associated with interest rates though correctly signed, were not significant. Fry, et al. found the elasticities to be wrongly signed and insignificant. However both these studies by using additional variables such as the index of industrial production, the rate of inflation, and by using the dynamic adjustment mechanism to allow for lags between desired and actual money balances, achieved good fits giving reasonable and theoretically justifiable size and signs of the important variables. These studies also support the present one in the suggestion that for the pre-1971 period the conventional demand function explains money holding only poorly. Taken in conjuction with Khan's study (which looks at West Pakistan only in both pre and post-1971 periods) these results seem to imply that for the geographical area that was previously West Pakistan the money holding habits of its populace are more or less adequately represented by the conventional function. When data representing East Pakistan is also included, this representation becomes weak. This factor could also be

explained on the grounds that East Pakistan had a very different socio-cultural setup as compared to West Pakistan, and this could well mean that the money holding habits in the two wings were different.

The second part of the study is to explore the role of inflation in the demand for money. Theory suggests that inflation should not be significant since it is represented in the rate of interest. Empirical evidence for developed countries shows that inflation becomes an important variable only when there is hyperinflation. For developing countries it has been suggested that inflation should be an important argument, and has been empirically shown to be so by Adekunle (1966). The studies related to Pakistan, Akhtar (1974), and Fry, et al. (1975), do not find the actual rate of inflation to be significant, although Fry et al., does find expected rate of inflation to be significant. Khan (1980) does not find it significant for the pre-1971 period, but highly significant for the post-1971 period.

In this study therefore both actual and expected rates of inflation are used. The general equation estimated is:

$\ln M = a1 + b1Y + c1r + d1P' + a2 + b2Y + c2r + d2P' + U$ where P' is the rate of inflation and where all variables are in logs. Different specifications for each definition of M use different definitions of each of the explanatory variables. In all there are twenty four equations for each definition of M.

The result corresponding to nominal money balances are given in tables 5 to 7, and those corresponding to real money balances are given in tables 8 to 10. All these tables show a uniform pattern of results. The coefficients associated with the rate of inflation has the expected negative sign in almost all the specifications both for the pre and the post-1971 period. In all

the specifications involving current income this coefficient comes out to be highly significant for the post-1971 period, while for the pre-1971 period it remains insignificant. Almost all specifications using the expected inflation rate yield better results in terms of higher coefficients and almost identical R2 statistics to those generated with the use of actual inflation. In general the introduction of the area of inflation has marginally lowered the elasticities of income and the rate of interest, but for the post-1971 period in the specifications where it is highly significant, its introduction has drastically reduced the interest elasticity which is now not more significant.

The results of this study seem to support earlier findings. Inflation is not significant in pre-1971 Pakistan. It is highly significant post-1971. Expected rate of inflation seems to perform better than actual rate (although the improvement is only marginal). It also supports the contention that only hyper inflation matters, since while in the pre-1971 period prices were very stable (the inflation rate even being negative for a few years), in the post-1971 period the rate of inflation went well into double figures, crossing the 25% mark for a couple of years while remaining above 10% most of the time. Adekunle's contention that the rate of inflation is more important for developing countries does not meet much support since for the pre-1971 period it is not significant, and secondly even the coefficient associated with it is very small (ranging from -0.01 to –0.02). On the other hand, while otherwise the rate of interest is significant and has reasonable (although not high) elasticities, in the case of hyperinflation, the significance as well as the size of interest elasticity diminishes. This indicates that in the case of high inflation, the inflation rate is the more important opportunity cost variable.

Conclusion

In conclusion therefore, the following are the findings of this study. Conventional demand for money function does explain the money holding behavior in Pakistan, though evidence to this effect is slightly stronger for the post rather than the pre-1971 period.

Income elasticities are generally large ranging from 0.7 to 1.23, and are almost always highly significant. Current income seems to generate better results as compared to permanent income. Over the two periods, income elasticities are generally higher in the first rather than the second period.

Interest elasticities vary in size, sign, and significance according to which interest rate is being used. The short term rate of interest generally gives correctly signed elasticities ranging from -0.01 to -0.41. These elasticities are higher for the second than the first period. The use of the interest rate on time deposits also corroborates the above results for some specifications, but for the first period these elasticities are generally positive and sometimes even significant. The use of the Bond rate more or less always gives positively signed and significant elasticities. In general the trend with positive elasticities is that in the second period they are lower than in the first. These findings are common to other studies also and are opposed to conventional theoretical expectations. One possible explanation could be that since time deposits in total M could be responsible for the positive elasticities. But this could only be a possible explanation where demand for M2 is concerned, nor for M1.

As to the rate of inflation, it is uniformly correctly signed varying from 0.00 to -0.02 throughout all the specifications. It is

uniformly highly significant in the post-1971 period and insignificant in the pre-1971 period. Expected inflation generates better results as compared to actual inflation. These findings support the general belief that inflation is an important opportunity cost variable only if it is relatively high. Milk inflation has no effect on money holding.

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Table-1
Nominal M1

	a_1	$b_1 Y_1$	$b_1 YP$	$c_1 R$	a_2	$b_2 Y$	$b_2 YP$	$c_2 R$	R^2	DW
With	-1.27	0.97***		-0.03	-0.37	0.98***		-0.32***	0.996	1.20
RC	0.73		0.78***	0.02	-0.83		0.97***	-0.03	0.986	2.21
With	4.47	0.29		0.99***	-0.77	0.99***		-0.17	0.996	1.19
RT	5.17		0.22	1.05	0.07		0.80***	0.43*	0.988	2.21
With	1.95	0.57		0.71	-0.03	0.85***		0.29*	0.995	1.01
RB	3.01		0.46	0.77	-0.08		0.82***	0.48*	0.988	1.99

RC = Inter bank call money rate RT = Time Deposit rate RB = Annual yield on long term govt. bonds
Y = Current income (GNP) YP = Permanent Income R = Interest rate
Subscripts, 1 2 indicate pre 1971 and post 1971 periods.
* = Significant at 95% confidence level. ** = Significant at 98% level *** = Significant at 99% confidence level.

Table-2
Nominal M2

	a_1	b_1 Y	b_1 YP	c_1 R	a_2	b_2 Y	b_2 YP	c_2 R	R^2	DW
With	-3.85***	1.23***		0.003	-0.22	1.02***		-0.41***	0.996	1.21
RC	-1.41		1.00***	0.07	-0.77		0.01***	-0.11	0.987	2.14
With	2.01	0.53*		1.09**	-0.89*	1.05**		-0.26	0.996	1.30
RT	2.58		0.49	1.04	-0.04		0.86***	0.37	0.989	2.02
With	-2.68	1.08**		0.30	-0.03	0.89***		0.24	0.995	1.01
RB	-1.00		0.93	0.32	-0.14		0.86***	0.43*	0.989	1.93

All Symbols as in Table-1

Table-3
Real M1

	a_1	b_1 Y	b_1 YP	c_1 R	a_2	b_2 Y	b_2 YP	c_2 R	R^2	DW
With	-1.59	1.00***		-0.05	-0.21	0.95***		-0.34***	0.974	1.20
RC	0.11		0.72***	0.01	0.61		0.71***	-0.01	0.922	1.85
With	2.31	0.18*		0.75*	-1.14	1.06***		-0.24	0.969	1.18
RT	3.52		0.07	1.02	1.25		0.50**	0.29*	0.942	1.72
With	-1.01	0.89		0.02	0.37	0.69***		0.16	0.962	1.00
RB	-0.49		0.61	0.19*	1.64*		0.40***	0.47***	0.948	1.45

Y, and YP are in real terms (deflated by Consumer Price Index).
All other symbols are described in Table-1

Table-4
Real M2

	a_1	b_1 Y	b_1 YP	c_1 R	a_2	b_2 Y	b_2 YP	c_2 R	R^2	DW
With	-3.66***	1.37***		-0.01	-0.38	1.06***		-0.41***	0.992	1.29
RC	-1.56		1.02***	-0.05	0.53		0.79***	-0.04	0.942	1.79
With	0.95	0.39		1.00*	-1.50*	1.20***		-0.30	0.978	1.28
RT	1.50		0.30	1.03	1.17		0.57***	0.30*	0.955	1.60
With	-3.11	1.25*		0.14	0.04	0.82**		0.11	0.969	1.06
RB	-2.36		1.20*	-0.16	1.53*		0.47***	0.47***	0.959	1.41

All symbols as in Table-3.

Table-5

Nominal M1 Using RC.

	a_1	b_1 Y	b_1 YP	c_1 R	c_1 P^*	a_2	b_2 Y	b_2 YP	c_2 R	c_2 P^*	R^2	DW
Actual	-1.03	0.94***		-0.02	-0.01	-0.17	-0.93***		-0.08	-0.01	0.997	1.19
P	0.95		0.76**	0.03	-0.01	-0.81		0.96**	-0.01	-0.00	0.986	2.10
Expected	-1.12	0.96**		-0.03	-0.01	-0.30	0.94**		-0.04	-0.01**	0.997	1.06
P	0.83		0.77**	0.02	-0.01	-0.89		0.99***	-0.18	-0.01	0.986	2.01

Nominal M2 Using RC.

Actual	-3.68***	1.22***		-0.01	-0.003	-0.06	0.97**		-0.14	-0.009**	0.997	1.16
$\dot{P}$	-1.23		0.98***	-0.08	-0.06	-0.74		1.00***	-0.07	-0.001	0.988	2.04
Expected	-3.75***	1.22***		0.01	-0.007	-0.21	0.98**		0.11	-0.014**	0.997	1.10
$\dot{P}$	-1.33		0.99***	0.07	-0.01	-0.83		1.04***	-0.26	-0.007	0.989	1.95

Table-6

Nominal M1 Using RT.

	a_1	b_1 Y	b_1 YP	c_1 R	c_1 P*	a_2	b_2 Y	b_2 YP	c_2 R	c_2 P*	R^2	DW
Actual	4.30**	0.31		0.95***	-0.002	-0.36	0.95***		-0.10	-0.009***	0.998	1.51
Ṗ	4.90		0.25	0.98	-0.002	0.33		0.77***	0.49	-0.003	0.989	2.04
Expected	4.21**	0.33*		0.93***	-0.007	-0.16	0.90***		0.07	-0.015***	0.998	1.49
Ṗ	4.64		0.29	0.91	-0.009	0.46		0.75***	0.56*	-0.009	0.989	1.98

Nominal M2 Using RT.

Actual	2.07	0.53***		1.10***	0.000	-0.40	1.00**		-0.17	0.011***	0.999	1.64
Ṗ	2.52		0.50	1.02	0.000	0.33		0.82***	0.45	0.005	0.989	1.94
Expected	1.92	0.57	1.07	-0.002	-0.18	0.95			0.018	-0.017	0.999	1.71
Ṗ	2.24		0.53	0.95	-0.006	0.46		0.79	0.53	-0.008	0.990	1.90

All symbol as in Table 5.

Table-7

Nominal M1 Using RB.

	a_1	b_1 Y	b_1 YP	c_1 R	d_1 P	a_2	b_2 Y	b_2 YP	c_2 R	d_2 P	R^2	DW
Actual	0.98	0.70*		0.44	-0.004	-0.03	0.89***		0.10	-0.0009***	0.997	1.06
$\dot{P}$	2.01		0.60	0.43	-0.005	-0.11		0.81***	0.49*	-0.001	0.988	1.96
Expected	0.69	0.73*		0.37	-0.01	-0.08	0.88***		0.17	-0.013***	0.997	1.07
$\dot{P}$	1.34		0.69	0.23	-0.01	-0.12		0.82***	0.48*	0.002	0.988	1.09

Nominal M2 Using RB.

Actual	-3.40	1.18**		0.10	-0.003	-0.04	0.94***		0.005	-0.011***	0.997	1.02
$\dot{P}$	-1.99		1.06	-0.01	-0.005	-0.12		0.86***	0.42	0.000	0.989	1.87
Expected	-3.61	1.20***		0.05	-0.007	-0.09	0.93**		0.09	-0.016***	0.997	1.12
$\dot{P}$	-2.69		1.16*	0.22	-0.014	-0.14		0.86***	0.43	0.000	0.989	1.85

All symbols as in Table 5.

Table-8

REAL M1 Using RC.

	a_1	b_1 Y	b_1 YP	c_1 R	d_1 P	a_2	b_2 Y	b_2 YP	c_2 R	d_2 P	R^2	DW
Actual	-1.19	0.93***		-0.03	-0.005	0.19	0.83***		-0.14	-0.002**	0.980	1.21
Ṗ	0.44		0.66	0.03	-0.01	1.30		0.54	0.03	-0.01	0.933	1.51
Expected	-1.20	0.93**		-0.03	-0.01	0.09	0.83**		-0.03	-0.01**	0.983	1.05
Ṗ	0.37		0.69***	0.02	-0.02	1.09		0.58***	-0.02	-0.01	0.933	1.62

REAL M2 Using RC.

Actual	-3.53***	1.35***		0.00	-0.002	0.08	0.93***		-0.18	-0.008**	0.986	1.27
Ṗ	-1.33		0.98***	0.07	-0.01	1.30		0.61***	0.22	-0.01	0.950	1.46
Expected	-3.53***	1.35***		0.00	-0.004	-0.06	0.94**		-0.13	-0.009***	0.987	1.19
Ṗ	-1.38		1.00***	0.06	-0.01	1.00		0.67***	0.17	-0.01	0.946	1.63

Y and Yp are in real terms. P* is inflation rate. All other symbol as in earlier tables

Table-9

Real M1 Using RT.

	a_1	b_1 Y	b_1 YP	c_1 R	d_1 P	a_2	b_2 Y	b_2 YP	c_2 R	d_2 P	R^2	DW
Actual	2.62*	0.13		0.79***	-0.007	-3.28	0.92***		-0.16	-0.009***	0.986	1.39
$\dot{P}$	3.41	0.35**	-0.04	0.95	-0.007	2.21**		0.35**	0.36**	-0.009*	0.954	1.44
Expected	3.12*	0.03		0.88***	-0.017**	0.08*	0.82***		0.014	-0.015**	0.989	1.28
$\dot{P}$	3.55*		-0.06	0.99	0.017	2.81***		0.22	0.50***	0.018***	0.962	1.30

Real M2 Using RT.

Actual	1.06	0.37		1.01***	-0.003	-0.54	1.04***		-0.19*	0.011***	0.992	1.52
$\dot{P}$	1.48		0.31	1.00	-0.003	2.30**		0.39*	0.39***	-0.010*	0.966	1.27
Expected	1.38	0.31		1.07	-0.009	-0.11	0.92		-0.33	-0.017	0.992	1.57
$\dot{P}$	1.56		0.30	1.10	-0.011	2.90***		0.26	0.54***	-0.020***	0.970	1.18

All symbol as in Tables 8.

Table-10

Real M1 Using RB.

	a_1	b_1 Y	b_1 YP	c_1 R	d_1 P	a_2	b_2 Y	b_2 YP	c_2 R	d_2 P	R^2	DW
Actual	-0.64	0.82		0.08	-0.01	0.40	0.75**		0.02	-0.01**	0.979	1.09
Ṗ	0.26		0.69	0.03	-0.01	2.09		0.34**	0.46**	0.00*	0.955	1.27
Expected	-0.27	0.74		0.19	-0.01	0.52	0.71**		0.11	-0.01**	0.983	1.00
Ṗ	1.51		0.72	-0.02	-0.02	2.32		0.29	0.52	-0.01	0.959	1.27

Real M2 Using RB.

Actual	-3.00	1.23***		0.16	0.00	0.08	0.89**		-0.06	-0.01**	0.985	1.09
Ṗ	-2.51		1.25*	-0.26	0.00	2.09		0.40**	0.46**	-0.01	0.964	1.23
Expected	-2.86	1.19***		0.20	0.00	0.21	0.84**		0.06	-0.01**	0.986	1.13
Ṗ	-2.59		1.27*	-0.30	-0.01	2.29		0.35**	0.53**	-0.01	0.967	1.27

All symbol as in Tables 8.

PRODUCTION EFFICIENCY IN THE U.S.-CANADIAN AUTOMOBILE INDUSTRY: THE ROLE OF FACTOR PRICES, SCALE ECONOMICS AND TECHNOLOGICAL CHARACTERISTICS

By

TALAT AFZA AND MAHMOOD A. BODLA*

Introduction

The purpose of this article is to analyze the structure of costs, technology and production efficiency of the automobile industry in Canada and the United States by estimating a system of generalized cost function. The parameter estimates from the cost function enables us to separate out the impact of scale economics, technical change and factor prices on the efficiency of the production process.

The productivity of a production process may be defined as the efficiency in the use of inputs to produce a given level of output. The earliest productivity measurement was the ratio of aggregate output to single input, such as labor, i.e., output per man hour. This approach has an advantage of computational simplicity, but the disadvantages include its inability to separate out factor substitution, economics of scale, and technological of facts. The later approach of total factor productivity (TFP), defined as the ratio of aggregate output and total input indexes, may be considered as an improvement over this approach, since

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it recognizes the changes in the quality and quantity of all inputs (see Denison [1967, 1974] and Kendrick [1973]). However, the effects of technical change can not be differentiated from scale economics and factor substitution. Alternatively, Solow (1957) estimates productivity with an econometric production model. He demonstrated that the rate of productivity growth could be identified with the rate of hicks-neutral technical change, assuming constant returns to scale and competitive markets.

The automobile industry in the U.S. and Canada, on the other hand, may be characterized by imperfect competition and increasing returns to scale. The productivity growth of such an industry may be analyzed with the help of an econometric model which is flexible enough to consider these production characteristics.

In attempting to analyze production costs and factor productivity in the automobile industry with flexible functional forms, however, researchers have made two major types compromises. First, most of the studies consider output to be an exogenous variable with respect to total cost. [Fuss and Waverman, 1985, 1986a, 1986b]. Second, the above studies lump the vehicle assembly and the parts sectors together and consider one "aggregative" automobile sector. However, the production structures of both sectors may not be identical.[1] A large share of the automotive parts are produced by the major automobile producers to meet their internal demand. It can be argued that the automotive parts production is dependent on motor vehicle assembly production and therefore their output should be treated as exogenous. On the other hand, the exogeneity assumption of output for assembly sector may not be valid for several reasons. Unlike a regulated industry who has to supply all of the quantities demanded at regulated prices,

automobile producers choose the input combinations to produce the output level which will maximize their profits. Therefore, an increase in input prices will lead to increased cost which in turn will decrease output.

In this article, we therefore argue that the outputs of the assembly sector should be considered as an endogenous variable in the cost function while those of the parts sector should be treated as exogenous. As an empirical issue we test for exogeneity in the context of our econometric specification (see footnote 5). Unlike earlier studies, the present paper disaggregates the motor vehicle industry into assembly and parts sectors and analyse them separately.

On the basis of out theoretical model and the econometric model specified below, we will attempt to contribute to the literature on current questions concerning factor substitution possibilities, elasticity of input demand, factor productivity, capacity utilization, the role of input prices, scale economies and technical change on unit production costs and total factor productivity in the north-American auto industry. In addition, we will test explicitly for several of the implicit assumptions made in earlier econometric studies.

The article proceeds as follows. Section I develops the analytical framework that is used to guide the empirical analysis. Section II describes the database and the estimation procedure. Estimated parameters are reported separately for the Assembly and the Parts sectors in section III. Section IV discusses the relative contribution of factor prices, scale economies and technological characteristics to efficiency in the production process. The paper concludes with a brief summary of our findings.

1. Conceptual Framework

Assume that the production technology of the automobile (vehicle assembly & parts) producers can be described by a product transformation function T(y,X) where y is output and X is a vector of M non-negative inputs, which satisfies all conditions for the existence of a unique dual cost function (McFadden, 1978). The dual cost function can be written as:

$$C_{it} = G_{it}(P_{it}, Y_{it}, T_{it}), \qquad ...[1]$$

where

C_{it} = total cost of production in country i at time t,

P_{it} = vector of factor (labor, material, capital) prices in country i at time t,

Y_{it} = output in country i at time t,

T_{it} = characteristics of production function (capacity utilization, technology) in country i at time t, and

i = represents Canada and United State.

In recent years, a large literature has developed utilizing a wide variety of second-order approximations to estimate the general cost function given in equation (1). In this analysis, we follow Fuss and Waverman (1985) and assume that log C_{it} can be represented by a quadratic approximation in the logarithms of P_{it}, Y_{it}, T_{it} and a country specific dummy variable D, i.e.,

$$\log C_{it} = G(\log P_{it}, \log Y_{it}, \log T_{it}, D). \qquad ...[2]$$

Equation (2) can be written in detail for the ith country as follows:[2]

$$\ln C_{it} = \alpha_0 + \alpha_{0i} D_1 + \sum_{j=1}^{m} (a_j + a_{ji} D_1) \ln P_{jit} \quad ...[3]$$

$$+ (\beta_1 + \beta_{1i} D_1) \ln Y_{it} + \sum_{l=1}^{n} (\theta_1 + \theta_{1i} D_1) \ln T_{it}$$

$$+ \tfrac{1}{2} \sum_{j=1}^{m} \gamma_{jj} (\ln P_{jit})^2 + \tfrac{1}{2} \phi (\ln Y_{it})^2$$

$$+ \tfrac{1}{2} \sum_{j=1}^{n} \mu_{ll} (\ln T_{lit})^2 + \sum_{j=1}^{m} \sum_{j \neq h}^{m} \gamma_{jh} \ln P_{jit} \ln P_{hit}$$

$$+ \sum_{l=1}^{n} \sum_{l \neq r}^{n} \eta_{lr} \ln T_{lit} \ln T_{rit} + \sum_{j \neq h}^{m} \lambda_j \ln P_{jit} \ln Y_{it}$$

$$+ \sum_{j=1}^{m} \sum_{l=1}^{n} \tau_{jl} \ln P_{jit} \ln T_{lit} + \sum_{i=1}^{n} A_l \ln Y_{it} \ln T_{lit} + \epsilon,$$

where i indexes the country, t indexes the time period, j.h index the factors of production, 1,r index the production characteristics, and $D_i = 0$ for Canada and $= 1$ for the United States.

With the use of a dummy variable, it is assumed that only the parameters associated with zero and first order terms are different between Canada and United States and it increases the degrees of freedom of the model.[3] Moreover, the cost function of equation (3) is assumed to be linear homogeneous and nondecreasing in factor prices. Linear homogeneity implies the following conditions.

$$\sum_{j=1}^{m} \alpha_j = 1, \sum_{j=1}^{m} \alpha_{ji} = 0, \sum_{j=1}^{m} \gamma_{jh} = 0, \sum_{j=1}^{m} \lambda_j = 0, \sum_{j=1}^{m} \tau_{jl} = 0. \quad ...[4]$$

The second order approximation of the cost function suggests symmetry, which leads to

$$\gamma_{jh} = \gamma_{jh}, \tau_{lr} = \tau_{rl}. \qquad ...[5]$$

Cost share equations can be obtained by applying the Shephard's lemam to equation (3) as:

$$S_{jit} = \alpha_j + \alpha_{ji} D_i + \gamma_{ij} \ln P_{jit} + \sum_{h \neq j} \gamma_{jh} \ln P_{hit} \qquad ...[6]$$

$$+ \lambda_j \ln Y_{it} + \sum_{l} \tau_{jl} \ln T_{lit} + u_j, \quad j = 1,...,m,$$

where S_j is the cost share of the jth factor of production.

Since linear homogeneity assumption suggests that the sum of cost share equations must add up to unity, equation (3) with j–1 share equations from (6) can be estimated simultaneously using maximum likelihood technique.

The translog cost function of equation (3) is a very flexible functional form which can be used to calculate various elasticities to represent the underlying production structure of the U.S.-Canadian automobile industries. For example Uzawa (1962) showed that under the postulates of cost minimization, the Allen partial elasticities of substitution (AES) between inputs j and h is $\sigma_{ij} = CC_{ij} / C_i C_j$. For the translog cost function AES can be calculated as

$$\sigma_{jj}^{\wedge} = (\gamma_{jj} + S_j^2 - S_j)/S_j^2, \quad \text{for all j.} \qquad ...[7]$$

$$\sigma_{jh}^{\wedge} = (\gamma_{jh} + S_j S_h)/S_j S_h, \quad \text{for } j \neq h,$$

where S_j and S_h are the cost shares of factors j and h in total cost. The AES are not constrained to be constant but may vary with the level of output.

The price elasticity of demand for factor of production, η_{jh}, is conventionally defined as $\eta_{jh} = \partial \ln X_i / \partial \ln P_j$. Allen (1938) has shown that the AES are analytically related to the price elasticity of input demand as follows:4

$$\eta_{jj} = \sigma_{jj} S_j, \qquad \text{for all j,} \qquad ...[8]$$

$$\eta_{jh} = \sigma_{jh} S_h, \qquad \text{for } j \neq h.$$

The Automobile industry is often characterized by increasing returns to scale, which indicates that costs rise proportionately less than increase in output. From the translog cost function of equation (3) the elasticity of cost with respect to output can be calculated as

$$ECY = \frac{\partial \ln C}{\partial \ln Y} = \beta_1 + \beta_{ji} D_i + \phi_{11} \ln Y_{it} + \sum_{j=1}^{m} \lambda_j \ln P_{jit} + \sum_{i=1}^{n} A_l \ln T_{lit}, \qquad ...[9]$$

Scale economies may be obtained as SE = 1 – ECY. Automobile producers will experience increasing returns to scale if the value of SE is greater than zero, whereas a value of Se equal to zero indicates constant returns to scale and a value less than zero represents decreasing returns to scale.

Similarly, elasticity of cost with respect to production characteristics (technological conditions) can be written as:

$$ECT = \frac{\partial \ln C}{\partial \ln Y} = \theta_1 + \sum_{1} \theta_{li} D_1 + \mu_{ll} \ln T_{lit} + \sum_{r=1}^{n} \tau_{lr} \ln T_{rit} \qquad ...[10]$$

$$+ \sum_{j=1}^{m} \tau_{jl} \ln P_{jit} + A_1 \ln Y_{it},$$

where l-capacity utilization, index of time.

The elasticity of cost with respect to capacity utilization represents the cost savings due to an increase in the utilization of existing capacity. A value less than one represents cost increases less than the proportional increase in the capacity utilization, whereas a value greater than one indicates cost increases due to increased capacity utilization.

Elasticity of cost with respect to time represents the effect of technical change and productivity growth due to the factors other than scale economies and capacity utilization, e.g., increased specialization. A negative value of this elasticity indicates cost savings due to increased productivity and specialization, whereas the reverse is true for a positive value.

Efficiency over a period of time may be measured in terms of changes in unit production cost or total factor productivity. The following formula may be used to analyze the average cost differences for each country between time period t and s.

$$\Delta_t \log(C/Q) = \tfrac{1}{2} \sum_{j=1}^{m} [S_{js} + S_{jt}][\ln P_{js} - \ln P_{jt}] \qquad ...[11]$$

$$+ \tfrac{1}{2} [ECY_s + ECY_t - 2]\Delta \ln Y$$

$$+ \tfrac{1}{2} \sum_{i=1}^{n} [ECT_{is} + ECT_{it}][\ln T_{is} - \ln T_{it}].$$

The left hand side of this equation represents a change in average cost and the right hand side shows how factor prices, scale economies, and technological characteristics contributed to this change.

Total factor productivity growth between time period t and s is calculated as the difference between change in factor prices and change in average cost.

$$TFP_{t,s} = \left\{ \Delta \log(C/Q) - \tfrac{1}{2} \sum_{j=1}^{m} \left[S_{js} + S_{jt} \right] \left[\ln P_{js} - \ln P_{jt} \right] \right\} \ldots [12]$$

2. Data and Estimation Procedures

The estimated parameters from the translog cost functions are based on annual data on input costs and prices, output and output prices, and capacity utilization rates for Canada and United States 1960-1984. The main data sources are the Census of Manufactures and Annual Survey of Manufactures for the United States and Statistics Canada for Canada. The study uses a 4 digit SIC (Standard Industrial Classification) data. A brief description of the construction and measurement of variables is follows.

Gross output for automotive parts sector is measured as value added plus cost of intermediate inputs and converted to real output by deflating it with the appropriate price deflator (available in Canada from Statistics Canada, and in the United States from the Bureau of Labor Statistics). The motor vehicle assembly sector's output is replaced with its instrumental variable, projected market demand for automobiles, and converted to real output, using the appropriate price deflator (see footnote 5).

Total compensation of labor, rather than money wages, is considered as the cost of labor. Hours worked for production and non-production workers are calculated following Emerson (1975, pg. 33). The price of labor is calculated as cost of labor per hour and normalized to one for the same base year which is

used for materials, output and capital prices. Share of labor in total cost for each year is obtained as the ratio of each year's cost of labor to current year's output.

The difficulty in the measurement of cost and prices of capital is acknowledged by almost all the empiricists. Following Norsworthy and Malmquist (1983) cost of capital is obtained as the gross product originating in manufacturing (value added) less total compensation for labor. The appropriate price of capital for our purpose is the user cost of capital, which is unavailable at 4 digit SIC. Therefore, a 3 digit capital price series for motor vehicle industry constructed by Jorgenson, Gallop, and Fraumeni (1987) is used for the United States. This series is available up to 1979 and is updated following Moroney and Trapani (1981), i.e.,

$$P_k = \frac{VA - Pl.L}{K}$$

where P_k = price of capital, VA = value added, Pl.L = total labor costs, and K = constant dollar capital stock.

Capital stock and investment data are available for Canadian automotive parts and assembly sectors. Using the transportation equipment industry's implicit price deflator, the data are converted to constant dollar capital stock and investment, Following Emerson 91975, pg. 33), constant dollar capital stock is obtained. The price of capital is calculated again following Moroney and Trapani (1981). The cost share of capital is obtained as the cost of capital divided by current dollar output.

The materials component of cost includes different types of material and intermediate inputs; therefore, the appropriate price of materials should be the weighted average price of

materials. An appropriate proxy for this variable "materials and components for manufacturing price index" is available from Bureau of Labor Statistics for the United States. For the Canadian industries, raw and partly manufactured goods price index is available up to 1978, which is updated using raw materials price index. The share of materials in total cost is obtained as the ratio of cost of materials to current dollar output.

Capacity utilization rates for the United States's motor vehicle industry are taken from various issues of Statistical Abstracts, and for Canada they are obtained from various issues of Bank of Canada Review. Finally, technological change is represented by a time trend variable.

The cost equation (3) and the labor and capital share equations from (6), with restrictions (4) imposed, are estimated simultaneously to increase the efficiency of the estimated parameters. It is assumed that the error terms within equations are uncorrelated but, autocorrelation does exist among the error terms across equations since the factor share equations are obtained by differentiating the total cost with respect to factor prices. Zellner's iterative seemingly unrelated regression (ITSUR) procedure is used to estimate the system of equations. This procedure is chosen for two reasons. First, on the assumption of no autocorrelation within equations, the estimated parameters using Zerller's techniques ar full information maximum likelihood estimates (Kmenta and Gilbert, 1968). Second, estimated parameters are invariant to which equation is deleted from the system of equation (Zeller, 1962).

3. Estimation Results

As pointed out in section 1, output of the assembly sector cannot be assumed to be exogenous, Consequently, an instrument was constructed for that sector's output.[5] Parameter estimates and goodness of fit statistics are reported in tables 1 and 2. The results are reported separately for the Assembly and Parts sectors. Most of the estimated parameters have the expected signs and are statistically significant. The estimated results indicate that the model fits the data very well with R^2 of 0.9971, 0.8337, and 0.5804 for cost, capital share, and labor share equations respectively for the assembly sector. For the parts sector, the comparable figures are 0.9989, 0.7037 and 0.5565 respectively. Since, the data employed in the estimation are pooled time series cross section data, the Durbin Watson test statistic is used to check for serial correlation. The test statistics falls in indeterminate region for all three equations and for both sectors. Therefore, one may conclude that problem of serial correlation may not be present. The first order coefficients of factor prices are positive and highly significant at $\alpha = .05$, indicating that the cost function is increasing in input prices.

The parameter estimates can be used to calculate several measures that pertain to the production structure of the assembly and parts sectors of both economies, including elasticities of substitution, economies of scale, and technical characteristics. Since the Cobb-Douglas production function implies unitary elasticity of substitution among factors of production, it is logical to check whether the underlying production structure is Cobb-Douglas before calculating these elasticities. The Cobb-Douglas cost function can be obtained by restricting all second order parameters of the translog cost function (3) equal to zero.

Table 1

Parameter Estimate

Parameter[a]	Assembly	Parts
	Estimate (Standard Error)	Estimate (Standard Error)
α_0	2.209 (18.397)	2.776 (8.691)
$\alpha_{0,US}$	−8.308 (15.084)	3.496 (6.373)
α_1	0.475 (0.067)	0.470 (0.092)
α_2	0.495 (0.094)	−0.009 (0.091)
α_3	0.029 (0.117)	0.539 (0.092)
$\alpha_{1,US}$	0.111 (0.021)	0.106 (0.034)
$\alpha_{2,US}$	0.065 (0.030)	−0.067 (0.034)
$\alpha_{3,US}$	0.824 (0.036)	−0.385 (0.033)
β_1	1.707 (5.343)	−0.005 (2.495)
$\beta_{1,US}$	1.408 (1.894)	−0.576 (0.772)
θ_1	−0.538 (3.575)	1.101 (0.992)
θ_2	8.285 (5.130)	−2.268 (3.109)
$\theta_{1,US}$	−1.136 (1.314)	0.766 (0.410

Table 1 (Continued)

Parameter[a]	Assembly	Parts
	Estimate (Standard Error)	Estimate (Standard Error)
$\theta_{2,US}$	2.870 (1.600)	−0.996 (1.059)
γ_{11}	−0.013 (0.011	−0.008 (0.012)
γ_{22}	0.032 (0.008)	0.057 (0.008)
γ_{33}	−0.094 (0.174)	−0.138 (0.168)
ϕ_{11}	−0.300 (0.782)	0.201 (0.354)
μ_{11}	−0.025 (0.261)	0.134 (0.082)
μ_{22}	1.363 (1.667)	−1.984 (1.282)
γ_{12}	−0.020 (0.005)	−0.035 (0.008)
γ_{13}	0.034 (0.008)	0.044 (0.012)
γ_{23}	−0.014 (0.011)	−0.008 (0.010)
η_{12}	1.220 (0.533)	−0.513 (0.328)
λ_{11}	−0.049 (0.009)	−0.034 (0.013)
λ_{21}	−0.039 (0.013)	0.032 (0.013)

Table 1 (Continued)

Parameter[a]	Assembly Estimate (Standard Error)	Parts Estimate (Standard Error)
λ_{31}	0.088	0.001
	(0.015)	(0.013)
τ_{11}	0.020	0.014
	(0.005)	(0.008)
τ_{21}	0.006	−0.018
	(0.007)	(0.007)
τ_{31}	−0.026	0.004
	(0.009)	(0.008)
τ_{12}	0.047	0.050
	(0.016)	(0.029)
τ_{22}	0.085	−0.049
	(0.023)	(0.029)
τ_{23}	−0.132	−0.001
	(0.027)	(0.028)
Λ_{11}	0.178	−0.225
	(0.513)	(0.151)
Λ_{21}	−1.269	0.530
	(0.716)	(0.478)

[a] Parameters are indexed as follows:
Input: labor = 1, capital = 2, materials = 3.
Production Characteristics: technological change = 1, capacity utilization = 2.

Table 2
Summary Statistics

Equation	Assembly		Parts	
	R-Square	Durbin-Watson Statistics	R-Square	Durbin-Watson Statistics
Cost	0.9971	1.425	0.9989	1.712
Capital Share	0.8837	1.676	0.7037	2.031
Labor Share	0.5804	0.803	0.5565	1.487

The likelihood ratio test statistics used to test the hypothesis of Cobb-Douglas production structure can be written as:

$$-2\log A = N\,[\log |\hat{\Omega}_R| - \log |\hat{\Omega}_U|]. \qquad ...[13]$$

where $|\hat{\Omega}_R|$ and $|\hat{\Omega}_U|$ are the determinants of estimated variance-covariance matrices for restricted and unrestricted models respectively, and N is the number of observations.

The test statistic of (13) is distributed asymptotically as chi-square with degrees of freedom equal to the number of independent parameter restrictions being tested. The calculated test statistics are 840.04 for the assembly sector and 797.00 for the parts sector whereas the critical χ^2 value at α = .005 is 32.80. Therefore the hypothesis of Cobb-Douglas cost function is rejected. Consequently, researchers such as Emerson (1975) who have used a Cobb-Douglas function to estimate the production structure of automobile industry have misspecified their models.

Allen partial elasticities of substitution are calculated, using equation (7). Table 3(a) and 3(b) present these elasticities along with asymptotic standard errors for Canada and the United States, respectively. As expected, factors own elasticities of substitution (diagonal elements) are all negative and significant at 1 percent level in both economies and for both sectors, except materials elasticity for assembly sector of both economies which is significant at 5 percent level. All of the partial elasticities of substitution (off diagonal elements) are also significant at 1 percent level except labor-materials and are different from one, which also indicate that the underlying production structure is not Cobb-Douglas. Moreover, for both countries, all three factors of production are substitutes

(positive cross Allen elasticities of substitution), a result consistent with that of Fuss and Wavermen (1985).

Table 3A

Allen-Uzawa Elasticities of Substitution Canadian Industry
(Computed at Mean Data Point)

	Assembly			Parts		
	Labor	Materials	Capital	Labor	Materials	Capital
Labor	-8.04	1.39	0.02	-3.02	1.31	0.29
	(0.725)	(0.095)	(0.264)	(0.190)	(0.86)	(0.163)
Materials		-0.58	0.88		-1.28	0.92
		(0.338)	(0.093)		(0.557)	(0.091
Capital			-4.00			-2.65
			(0.300)			(0.222)

Table 3B

Allen-Uzawa Elasticities of Substitution U.S. Industry
(Computed at Mean Data Point)

	Assembly			Parts		
	Labor	Materials	Capital	Labor	Materials	Capital
Labor	-8.27	1.38	0.26	-2.66	1.30	0.37
	(0.762)	(0.093)	(0.326)	(1.59)	(0.084)	(0.145)
Materials		-0.51	0.86		-1.43	0.91
		(0.311)	(0.017)		(0.621)	(0.094)
Capital			-4.72			-2.59
			(0.437)			(0.210)

Factors own and cross price elasticities of demand are calculated using equation (8). Tables 4(a) and 4(b) present these elasticities and their standard errors for both countries. Since cross price elasticities are not necessarily symmetrical, all six

elasticities are reported in these tables. In general, the factors own price elasticities (diagonal elements) are highly significant at $\alpha = .01$. Since elasticities are less than one, all three inputs have inelastic demand. Labor is the most sensitive factor of

Table 4A

Own and Cross-Price Elasticity of Input Demand
Canadian Industry (Computed at mean Data Point)

	Assembly			Parts		
	Labor	Materials	Capital	Labor	Materials	Capital
Labor	-0.98	0.99	0.003	-0.77	0.72	0.56
	(0.089)	(0.068)	(0.042)	(0.049)	(0.047)	(0.031)
Materials	0.17	-0.41	0.14	0.33	-0.7	0.17
	(0.012)	(0.242)	(0.015)	(0.017)	(0.307)	(0.050)
Capital	0.002	0.63	-0.64	0.07	0.51	-0.50
	(0.032)	(0.066)	(0.048)	(0.016)	(0.050)	(0.043)

Table 4B

Own and Cross-Price Elasticity of Input Demand U.S. Industry
(Computed at Mean Data Point)

	Assembly			Parts		
	Labor	Materials	Capital	Labor	Materials	Capital
Labor	-0.99	1.03	0.03	-0.75	0.67	0.07
	(0.091)	(0.069)	(0.043)	(0.045)	(0.044)	(0.029)
Materials	0.16	-0.38	0.11	0.36	-0.74	0.18
	(0.011)	(0.232)	(0.014)	(0.023)	(0.324)	(0.019)
Capital	0.03	0.64	-0.63	0.10	0.48	-0.51
	(0.039)	(0.080)	(0.058)	(0.041)	(0.049)	(0.041)

production to changes in its price, which is not surprising under the highly unionized environment of the automobile industry. Cross price elasticities of demand (off diagonal elements) indicate the possibility of substitution among factors of production for both countries.

One of the advantages of the flexible translog specification is that it can be reduced to some of the more popular restrictive technologies by imposing zero restrictions on selected parameters. For example, a cost function is said to be homothetic if it could be written as a separable function of output and factor prices. The homothetic cost function can be obtained from equation (3) by imposing the following parameter restrictions:

$\lambda_j = A_1 = 0$. Furthermore, a homothetic cost function is restricted to be homogeneous if the elasticity of cost with respect to output is constant. A homogeneous cost function can be obtained from a homothetic cost function by imposing the additional restriction $u_{11} = 0$. Equation (13) is used to test the homotheticity and homogeneity assumptions of the cost function. The calculated test statistic for homothetic cost function is 31.34 for the assembly sector and 19.91 for the parts sector, while the critical x^2 value at $\alpha = .005$ is 14.86. Therefore, the hypothesis of homothetic cost function is rejected. Moreover, the hypothesis of homogeneous cost function is also rejected at $\alpha = .005$ since the calculated values of 31.42 and 18.385 for the assembly and parts sectors, respectively are greater than the critical χ^2 value of 16.75. The result indicates that the elasticity of cost with respect to output varies with level of output.

Cost-output elasticities and scale economies are calculated using equation (9) while equation (10) is used to

estimate the elasticities of cost with respect to technological change and capacity utilization. These elasticities are reported in table 5. Cost-output elasticities for both countries are less than one, indicating that a percentage increase in output leads to a smaller percentage increase in total cost. Therefore, production in both economies can be characterized as increasing returns to scale. Although the Canadian automobile assembly industry represents more economies of scale. Although the Canadian automobile assembly industry represents more economies of scale as expected, the margin between the scale economies of the two countries is wider than expected. One possible explanation for this may be the shut down of inefficient plants and increased utilization of the efficient plants in Canada. It should also be noted that the scale economies for the Canadian parts industry are less than that of the assembly industry, a result consistent with that of emerson (1975). His estimated scale elasticities are 2.0 and 1.36 for assembly and parts industries respectively. Similarly, for the U.S., economies of scale in the parts sector are less than those in assembly.

Table 5

Scale Economics, Cost-Output, Capacity Utilization, and Technical Change Elasticities (Computed at Mean Data Point)

	Assembly		Parts	
	Canada	United States	Canada	United States
Cost-Output Elasticity	0.10	0.56	0.82	0.75
Scale Economies	0.90	0.44	0.18	0.25
Cost-Capacity Utilization Elasticity	0.40	0.28	-0.37	-0.13
Cost-Technical Change Elasticity	0.64	-0.04	-0.12	0.83

Capacity utilization has a cost reducing effect in the parts sectors, in contrast with its cost increasing impact on assembly sectors of both countries.

In addition to examining the size-related economies at a single point in time, it is also useful to consider the degree of technical change and changes in unit production cost over time in both sectors of the industry. Technical change is measured using equation (10). The results indicate that the role of technical change is different in the assembly and parts sector of the U.S.-Canadian automobile industry. For the United States, technical change elasticity for the assembly sector indicates that cost increases less than the proportionate increase in research and development expenditure over time, whereas for the parts sector it has a cost increasing impact. For Canada, technical change has a cost-reducing impact in the case of the parts sector but cost-increasing in the assembly sector.

4. Production Efficiency

We measure production efficiency in the automobile industry in terms of changes in unit production cost and total factor productivity. Equation (11) is used to calculate the percentage contributions of factor prices, scale economies, and technical characteristics to changes in unit cost. Unit cost analysis for the assembly and parts sectors of both economies are presented in tables 6 and 7 respectively. The period under study is divided into five sub-period, i.e., 1962-64, 1967-69, 1972-79, and 1982-84. Three years averaging process is used to smooth out the yearly fluctuations.[6]

In the case of the assembly sector, on the basis of the estimated model it may be concluded that during the period 1962-64 to 1967-69, the U.S. assembly sector was more efficient

Table 6

Unit Production Cost Increase Assembly Sector: Canada and U.S.

Time Period	Percentage Contribution to Increase							
	Unit Cost Increases (%) (Canadian Dollars)	Price of Labor	Price of Materials	Price of Capital	Scale Economies	Technical Change	Capacity Utilization	Estimated Residual
1967-69 vs. 1962-64	25.3	15.8	27.7	39.5	-233.2	197.6	27.7	24.9
	(-5.0	(60.0)	(160.0)	(-20.0)	(-220.0)	(-100)	(-20.0)	(40.0)
1972-74 vs. 1967-69	-20.5	24.4	117.1	21.9	-408.3	170.7	1.0	-26.8
	(17.0)	(33.5)	(151.2)	(-17.6)	(-85.3)	(12.9)	(8.2)	(-2.9)
1977-79 vs. 1972-74	64.2	8.7	54.5	3.9	-36.6	38.9	-10.0	40.6
	(45.0)	(13.3)	(80.0)	(-0.4)	(-13.1)	(6.6)	(-1.5)	(15.1)
1982-84 vs. 1977-79	39.6	10.9	108.6	5.1	-42.9	41.9	-17.7	-5.9
	(22.6)	(17.7)	(94.7)	(53.1)	(-4.4)	(-4.4)	(-70.8)	(14.1)

NOTE: Figures for the U.S. are in parentheses.

Table 7

Unit Production Cost Increase Parts Sector: Canada and U.S.

Time Period	Percentage Contribution to Increase							
	Unit Cost Increases (%) (Canadian Dollars)	Price of Labor	Price of Materials	Price of Capital	Scale Economies	Technical Change	Capacity Utilization	Estimated Residual
1967-69 vs. 1962-64	5.8	120.7	103.4	86.2	-155.2	-155.2	69.0	31.1
	(4.0)	(100.0)	(100.0)	(-25.0)	(-100.0)	(50.0)	(25.0)	(-50.0)
1972-74 vs. 1967-69	14.0	71.4	135.7	42.9	-42.9	-64.3	-7.1	-35.7
	(29.6)	(37.2)	(47.3)	(-13.5)	(-5.4)	(6 8)	(-5.1)	(32.7)
1977-79 vs. 1972-74	60.0	24.0	41.4	21.5	-5.0	-10.9	11.6	17.4
	(55.0)	(24.7)	(44.0)	(5.4)	(-15.6)	(1.8)	(0.7)	(39.0)
1982-84 vs. 1977-79	51.0	17.6	58.8	15.7	-9.8	-7.8	9.8	15.7
	(76.2)	(13.1)	(23.7)	(19.6)	(15.1)	(3.9)	(6.5)	(18.1)

NOTE: Figures for the U.S. are in parentheses.

as compared to its counterpart in Canada. Price of capital, scale economies, technical change and capacity utilization all contributed to the cost decline in the U.S. The cost reducing effect of the price of capital can be justified by the commonly held view of the well organized U.S. financial markets as compared to those of Canada's (Wonnacott and Wonnacott, 1967).

Canadian unit production cost deceased by 20.5 percent during 1967-69 to 1972-74 period with scale economies as the main source of this cost reduction. Unit cost for the U.S. assembly industry, however, increased by 17 percent during the same time period despite cost reducing effect of scale economies and capital price. Technical change, material and labor prices, and capacity utilization are sources of unit cost increase in both countries. Percentage contribution of scale economies to average cost reduction is smaller for the U.S. industry as compared to that of Canadian industry which strongly supports the existence of unexploited scale economies for the Canadian industry prior to the Auto Pact. Capacity utilization has been a source of reduction in unit cost in both countries, probability reflecting an underutilization of existing capacity. During the 1974 to 1984 period, unit cost in both countries showed an increase. Factor prices was a major source of this trend, except for a very small cost-reducing effect of capital price for U.S. industry for the 1972-1970 period.

For the parts sector, on average, the unit cost increases are higher for the United States than for Canada for the entire period under study, reflecting increased efficiency for the Canadian industry as compared to the U.S. This result is consistent with the findings of Emerson (1975) for locational cost analysis. Technical change and scale economies are the major sources of decrease in Canadian unit cost. The finding can

be explained by the production structure of the North American automotive parts sector. The Canadian government encourages the production of certain types of auto parts which provides substantial employment; thus the Canadian parts industry may be realizing the benefits of specialization. The cost reducing effects of scale economies after the Auto Pact, i.e., 1967-69 period, is 50 percent more for the Canadian industry as compared to that of the United States's, which supports the existence of unexploited scale economies in a protective small open economy.

Total factor productivity (TFP) growth is calculated for both countries using equation (12) and the results are tabulated in Table 8. Productivity growth in the assembly sectors of both economies exhibit similar up and down trend, the only difference being that during the 1967-69 to 1972-74 period the growth rate was higher for Canada, while the U.S. assembly sector's performance is better for the rest of the period understudy.

Table 8

Total Factor Productivity Growth (%)

Time Period	Assembly		Parts	
	Canada	United States	Canada	United States
1967-69 vs. 1962-64	4.0	5.7	12.0	3.0
1972-74 vs.1967-69	34.0	12.7	21.0	-8.6
1977-79 vs. 1972-74	-21.1	-3.2	-7.2	-14.2
1982-84 vs. 1977-79	9.7	37.4	-5.0	-33.3

For the parts sector, TFP for the U.S. exhibited a declining trend over the study period. On the other hand, the

Canadian parts sector enjoyed increases in factor productivity growth from 1962 to 1974, declining thereafter. The eventual decline during the 1972 to 1984 period is consistent with the overall slowdown of factor productivity growth in Canadian manufacturing (Stuber, 1986).

Jorgenson *et al.* (1986) calculated the total factor productivity growth rates for the "aggregate" U.S. motor vehicle and equipment industry based on estimated translog production function. Their estimated annual average percentage rates of growth have a declining trend with 1.70, 0.48 and -0.18 for the periods 1960-66, 1966-69, 1969-73 and 1973-79 respectively. Even though the present study estimates the total factor productivity growth rates for the U.S. vehicle assembly separately from parts and other sectors of motor vehicles and equipment industry,[7] a cursory observation of Table 8 reveals that, overall, average productivity for the U.S. auto industry has declined over the study period. Hence our results are also consistent with that of Jorgenson *et al.* (1986).

Also on average, the performance (measured by unit cost increase and total factor productivity growth) of the Canadian parts industry is better than the U.S. industry during the period under study. This result can be supported by the findings of Emerson (1975), that the Canadian parts industry has a locational cost advantage over the U.S. industry.

5. Concluding Remarks

Translog cost functions are estimated for motor vehicle assembly and parts sectors of the Canadian and U.S. economies. The likelihood ratio test rejects the hypothesis of a Cobb-Douglas production structure for both sectors of the automotive

industry. Moreover, Allen partial elasticities of substitution are also different from one, contradicting the hypothesis of a Cobb-Douglas production structure. All three factors of production are substitutes. Both industries of the two economies have inelastic demand for all three inputs. The likelihood ratio test also rejects the hypothesis of homothetic and homogeneous production structure for both industries. Increasing returns to scale are found in both industries in both economies. On average, capacity utilization has a cost reducing effect in the automotive parts sectors, in contrast with its cost increasing impact on the assembly sector. Similarly, the role of technical change is different in the assembly and parts sectors of the U.S.-Canadian automobile industry.

Unit cost increases (decreases) for both industries of the two economies along with the sources of unit cost changes are calculated. Economies of scale play a larger role in reducing unit cost of the Canadian industries than in the U.S. industries. The price of capital has a cost reducing effect in the U.S. industries in contrast with its cost increasing impact on the Canadian industries. Total factor productivity growth rates are also calculated. Canadian assembly sector's total factor productivity increased by 34.0 percent during 1967-69 to 1972-74 period as compared to a 12.7 percent increase of the U.S. assembly sector. On average, during the period 1960 to 1984 the performance (measured by unit cost increases and total factor productivity growth) of the Canadian parts sector is better than its counterpart in the U.S. However, the opposite is true in the case of the assembly sector, except for the 1967-69 to 1972-73 period. While outside the scope of this study, it is probable to consider the Auto Pact 91965) as a possible explanation for the findings.

Footnotes

[1] Recent work by Afza (1988) suggest that the Auto Pact affected the two sectors separately and differently.

[2] The translog cost function of equation (3) is adapted from Fuss and Waverman (1985), (1986 a,b) but the originality of the present study is to use it differently in two ways:

i) For the assembly industry the projected market demand is used as an instrument for the endoneous output variable of the cost function.

ii) A separate cost function for the assembly and parts sectors of the North-American automobile industry is estimated, since it is suspected that the productivity of the two sectors may not follow the same pattern.

[3] The same assumption is used by Denny et al. (1981). Denny and Fuss 91983), Fuss and Waverman (1985), and Fuss and Waverman (1986 a,b).

[4] The elasticities of equation (7) and (8) are nonlinear function of the estimated parameters, thus their standard error cannot be calculated exactly. However, by assuming that cost shares S_j are constant and equal to the means of their estimated value, the asymptotic variance can be obtained as follows [Pindyck, R. 1979]:

$$\text{var}(\sigma_{jj}^{\wedge}) = \text{var}(\gamma_{jj})/S_j^4 \qquad \text{for all j,}$$

$$\text{var}(\sigma_{jh}^{\wedge}) = \text{var}(\gamma_{jh})/S_j 2S_h^2 \qquad \text{for } j \neq h,$$

$$\text{var}(\eta_{jj}) = \text{var}(\gamma_{jj})/S_j^2 \qquad \text{for all j,}$$

$$\text{var}(\eta_{jh} = \text{var}(\gamma_{jh})/S_j^2 \qquad \text{for } j \neq h.$$

[5] The instrument for assembly sector's output was obtained by regressing the output on the following variables: unemployment rate, prime interest rate, outstanding consumer installment credit, price of gasoline, and gross national product. The specification that is obtained by this procedure is basically the projected market demand for automobiles. Finally, the theoretical assertion that the assembly sector's output should be treated as endogenous was tested empirically. Following the idea developed in Hausman's (1978) specification test as well as the J-test of Davidson and Mackinnon (1981), we rejected the null hypothesis of exogenous output at the 5 percent level.

[6] A similar approach is used in Fuss and Wavermann (1985).

[7] Other sector of motor vehicles and equipment industry includes truck and bus bodies, truck trailers and motor homes produced on purchased chassis. These sectors are not included in the present study.

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EDUCATIONAL OPPORTUNITIES AND HIGHER EDUCATION IN PAKISTAN

By

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1. Introduction

Most economists would now agree that material and human resources and technology are the basic determinants of economic growth. In particular, investment in human capital in the form of education is now increasingly being recognized as the most valuable investment owing to the fact that it raises the marginal productivity of workers, lowers population growth, enhances technological development and its adaptation, and leads to attainment of better health and nutrition standards [Psacharopoulos (1988), Tahamarajakshi (1988), Amjad (1987)]. Apart from these benefits education is also considered valuable due to its positive impact on future distribution of income. Education can play an important role in equalizing incomes if it is evenly accessible to all groups in a country. Therefore, governments who aim at long-term redistribution of incomes must consider the role of education. The evidence from developing countries suggests that white collar families benefit disproportionately more from educational facilities as compared with the children of relatively less privileged families [Thamarajakshi (1988), Jiminz (1986), Jallade (1982), Fields (1975), Bhagwati (1973)].

In Pakistan educational facilities have expanded rapidly since 1970s. In this regard, a major policy shift towards primary education can be observed in recent years. For example, Khan *et al.* (1986) have shown that a structural change in educational investment expenditures have taken place in the provinces of Pakistan during the non-Plan period (1972-78) and the Fifth Five Year Plan (1978-83). Particularly, during the Fifth Plan investment in primary education was ranked the highest. However, despite shift in government policy higher education receives a major share from total educational resources in Pakistan. Equal educational opportunities exist, in higher education, at least in the sense that admissions in most educational institutions are conducted on the basis of acquired academic merit. But, the evidence shows that its effective access is not equal to different socioeconomic groups [Burki *et al.* (1988); Zaidi (1987)].

This paper is an attempt to present some further evidence to explore whether the existing delivery system of higher education (which is highly subsidised) ensures equal educational opportunities? The plan of the paper is as follows. Section II gives the data and methodology. Section III presents evidence on access to higher education in Pakistan. And the last section gives the conclusions of the paper.

2. Data and Methodology

The paper is based on data from both primary and secondary sources. Primary data was collected in two separate surveys conducted by the author and associates on M.A./M.Sc. students of Bahauddin Zakariya University, Multan (hereafter BZU) and Quaid-i-Azam University, Islamabad (hereafter QAU) to draw information on income, occupation and educational background of students' families. The enrolment in these

universities gives a representative character to our data set since BZU represents relatively smaller provincial universities while QAU being a federal university represents larger provincial universities.

The survey of BZU was conducted in march-April 1986, in which 203 students were randomly selected for data collection which represent 20 percent of total enrolment in the university during 1985-86 at the master's level. A questionnaire was designed and pre-tested by the author who at that time was on the faculty of BZU. The students were asked to fill this questionnaire in one of their compulsory courses under direct supervision of their class teacher. The survey of QAU students was conducted two years later in 1989. In this survey the required information was drawn from the admission forms of the students who were granted admissions in January 1988 on the basis of academic merit. Out of 434 students admitted in 14 departments, 220 students were randomly picked for data collection representing more than 25 percent of total enrolment in the university.

As a matter of fact both BZU and QAU represent only general universities. There are many professional medical and engineering colleges and universities which are not represented in our surveys. Therefore, to diversify our analysis supplementary evidence from a recent survey of medical students conducted by Zaidi (1987) in 5 medical colleges of Sindh is also presented. His analysis is aimed at determining the class composition and socioeconomic background of medical students. His sample covers 358 students, who were studying in their first and final years of medical college, which represents about 10 percent of total medical enrolment in Sindh. Province wise break up shows that medical colleges of Sindh alone represented 45 percent of the total enrolment in Pakistan. Two

basic variables which he uses in his analysis of class are area of residence, and father's occupation.

This paper primarily uses the technique of percentage distribution comparison to measure the educational opportunities in Pakistan. We will show the proportion of households, measured by their incomes, occupational background and the area of residence, who are represented in the above mentioned universities and medical colleges. They will have equal (unequal) educational opportunity if their representation in the said educational institutions will be (will not be) in proportion to their numbers in total population.

3. Access to Higher Education

The data presented in tables 1 to 4 shows that higher income groups are disproportionately represented in medical colleges and universities. We can see from table 1 that upper and upper middle income groups, who are about 19 percent of the total population, are being over represented in BZU and QAU with their enrolment of 64 percent and 71 percent, respectively. In contrast, households belonging to lower and lower middle income groups, which consist of the remaining 81 percent of Pakistan's population, have a representation of only between 29 to 36 percent in these universities. These results should, however, be interpreted with caution because there appears to be a high response error which may have caused a downward bias in reported incomes in both the surveys. For example, there is a general tendency among the students to under-report their parent's income. Moreover, the reported incomes are not the household incomes because only father's or guardian's income is reported leaving other members of the household. For instance, in a second survey of QAU students in September 1988, 27 percent students confirmed that their

household incomes are higher than the incomes which they reported in their admission forms [Burki *et al.* (1988)]. Therefore, such inconsistencies in reported family incomes create a downward bias in income classification of students in table 1. Thus, the actual representation of upper and upper middle income groups may be expected to be higher still.

To avoid such discrepancies in our analysis we have augmented our data by using some proxies for socio-economic status of families viz., occupation of the father, tenurial classification of agriculture households, and the area of residence. The possibility of mis-reporting by the respondents about these questions seems to be remote. Therefore, table 2 shows income classification of students' households on the basis of their father's occupation.[1] The distribution which we observe from this table shows a consistent pattern of high concentration of upper and upper middle income groups in all three samples. More specifically, in no case the representation of upper income group is less than 50 percent. When we compare this with the proportion of households belonging to this income group in the population of Pakistan, it comes out that their being in small proportion (i.e, 5.2 percent), they are over represented in higher educational institutions. A less severe pattern is observed for upper middle income group. According to Household Income and Expenditure Survey: 1986-87 lower and lower middle income groups together account for more than 81 percent of households in Pakistan. However, they are under represented in our sample at about 20 percent. The problem in this type of subjective grouping is "the diversity within each profession" [Zaidi (1987)]. For example, all doctors, engineers or lawyers cannot be lumped together easily. However, we can safely assume that all of them earn at least as much income that they

1. The income groupings of households on the basis of father's occupation and the area of residence was originally adopted by Zaidi for medical students of Sindh. We have supplemented our own evidence from the B.Z. University and the Quaid-i-Azam University.

qualify for our category of upper income group i.e., Rs. 4500 and above.

Table 1

Income classification of student's families (Percent)

Household Group	Monthly Income (1979)	Monthly Income (1985-86)	Pakistan (1985-86)	BZU (1986)	QAU (1988)
	1	2	3	4	5
Lower income	Upto Rs.600	Upto Rs.1000	25.2	9	5
Lower middle income	Rs.601-1500	Rs.1001-2500	56.1	27	24
Upper middle income	Rs.1501-2500	Rs.2501-4500	13.5	31	36
Upper income	Rs.2501 and above	Rs.4501 and above	5.2	33	35

Sources:

a) Column 1 is based on Government of Pakistan (1983), p.xxvii.

b) Column 2 shows inflation adjusted income ranges for household groups in 1985-86 prices.

c) Column 3 is based on Government of Pakistan (1989), p.xi.

d) Column 4 is based on the author's survey of BZU.

e) Column 5 is constructed for our new income ranges as in column 2, from our survey as reported in [Burki *et al.* (1988)].

Table 2

Income classification of households on the basis of father's occupation

Household Group	Father' Occupation	Medical students of Sindh (%)	QAU (%)	BZU (%)	Pakistan (%)
	1	2	3	4	5
Lower income	Low level servants in government or private sectors, rural and urban workers, subsistence land holders	3.5	5.9	3.1	25.2
Lower middle	Mid-level government servants, school teachers, small business owners, skilled workers, small land holders	16.5	14.2	18.2	56.1
Upper middle	Middle business owners, university/college teachers, mid-level employees in private sector, and middle land holder	22.1	28.1	20.3	13.5
Upper income	Doctors, lawyers, engineers, landlords, large business holders, executives, senior government servants	57.9	51.8	58.3	5.2

Source:
a) Column 2 is based on Zaidi (1987).
b) Column 3 is based on the answers of 192 respondents who reported their father's occupation.
c) Column 4 is based on the survey of BZU.
d) For column 5, see table 1 above.

The tenurial classification of student's families also presents a similar picture. Indeed the pattern of land holding and land tenure system in Pakistan is a complex matter which cannot easily be reconciled with our groupings. Landholding and land operating patterns bring us in the heart of the controversy about land rented-in and rented-out by the families of the students. The number of respondents who reported agriculture as their father's occupation in our sample of QAU are only 14 percent [Burki et al. (1988)]. However, due to rural background of BZU the students who belong to agriculture households in this university have the highest percentage (37 percent) in comparison with all other occupations. Therefore, table 3 presents the enrolment pattern of BZU students belonging to agriculture households by tenure. Columns 2 and 3 summarise our evidence on the proportion of farm and non-farm households in the sample. Column 1 presents the national distribution of rural households by tenure which is compared with our sample results. As shown in column 3, owner cultivator families out number all other categories in table 3. As expected, no student belongs to the class of landless workers who alone account for 53 percent of total rural households in Pakistan. However, owner cultivators, who are only 26 percent of total rural households, emerge as the major beneficiaries of educational opportunities, with their 86 percent representation in university's enrolment.

The access to educational opportunities can also be viewed by classification of student's families in different income

Table 3

Representation of agriculture households by tenure in enrolment in Bahauddin Zakariya University, Multan

Tenure	Percent of rural households by tenure in Pakistan (1986)	Students Belonging to agriculture households (Numbers)	Students attending as percent of total agriculture Households (1986)
	1	2	3
Owner	25.8	56	86.2
Owner-cum-tenants	9.1	6	9.2
Tenants	12.1	3	4.6
Landless workers	53.0		

Sources: a) In column 1, rural households by tenure are reached by first estimating rural population in 1986 on the basis of Population Census estimates of 1981 adjusted for an annual population growth rate of 3.06 percent. Then the number of rural households are estimated on the assumption of average household size of 6.5. This is converted in to our figures in col.1 by using types of households estimates from *Agriculture Census of Pakistan 1980* [Government of Pakistan (1983)].

b) Column 2 in based on the author's survey of BZU.

groups on the basis of their areas of residence. Zaidi (1987) presents such an evidence from the sub-sample of medical

students belonging to Karachi city.[2] In his sample of 358. there were 188 students who belonged to Karachi city. These students also provided information about the locality where they were putting up. Hence, table 4 lists the areas of residence reported by the students and their grouping on income class. This grouping is subjective because it is purely based on Zaidi's "Thorough familiarity with the spatial distribution of the city along socioeconomic lines" [Zaidi (1987)].

Table 4

Classification of medical students of Karachi on the basis of area or residence

Household group	Area of residence	Enrolment of students (Percent)	Pakistan (1985-86)
	1	2	3
Lower income	Liaquatabad, Lyari, Malir, Kcamari and Korangi	12.8	25.2
Lower middle	Gulshan Iqbal, Garden Road, P.I.B., F.B.Area, Saddar, Nazimabad and Drig Colony.	45.7	56.1
Upper middle	North Nazimabad, P.E.C.H.S.	26.6	13.5
Upper income	Clifton, Defence, K.D.A. Flats.	14.9	5.2

Sources: a) Column 1 and 2 are based on Zaidi (1987).
b) For column 3, see table 1.

2. He claims that the classification of income groups on the basis of area of residence is relatively less problematic than the occupation because the income differentials within particular localities will be less severe.

The distributions of students in table 4 substantiates our earlier findings. However, it shows a heavy concentration of middle income groups (both lower and lower middle) in the medical colleges of Sindh. Since the concentration of middle income groups in urban areas like Karachi is much higher than the national average, therefore, it would be naive to compare this with the national distribution. However, to draw rough approximation, table 4 depicts that upper and upper middle income groups are over represented if compared with the national distribution. It implies that this differential would be even greater if compared with the actual distribution of households by income groups in Karachi. Despite being in dominant proportion, the lower and lower middle income groups are under represented which is quite consistent with our findings.

4. Conclusions

This paper presents evidence on access to higher education in Pakistan. It clearly shows that the existing system of higher education works against the lower income groups. The socioeconomic background of households determines their effective access to educational opportunities. The classification of students' families on the basis of their income, occupation, tenurial background and the area of residence consistently shows that upper and upper middle income groups are represented disproportionately more in our higher education system. It appears that lower income groups are systematically eliminated from the education cycle. This social stratification essentially restricts the opportunities for lower income groups to improve their earnings through human resource endowments. Moreover, it also contributes in increasing income in-equalities in the country. An important policy implication of these results is that the government's policy of heavily subsidising higher education needs to be rationalised on a priority basis.

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ECONOMICS OF WHEAT THRESHERS IN D.I. KHAN, NWFP (PAKISTAN)

By

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Although Pakistan's economy has experienced significant structural change which is reflected in a marked shift in the sectoral composition of output and employment from agriculture towards manufacturing, industry and services, agriculture continues to be the pre-dominant sector[1]. Keeping in line with the overall trend of modernisation, our agriculture sector has also come a long way by switching over to new techniques of production where possible. Nevertheless, we are still at the very bottom of the table as far as per acre yield is concerned. Moreover, more than one-third of the cultivable land is not put to use for various reasons. Despite being an agricultural country, we are even today importing basic food items like wheat and sugar. The continuing population pressure may aggravate the situation if any laxity is shown and agricultural development is overshadowed by the developmental policies aimed only at industrialisation.

Mechanisation of course, has become the symbol of modernisation and development of agriculture. It has added importance in view of the labor shortages that develop during

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sowing and harvesting season. However, change in technology is bound to create imbalances. Therefore, proper research on the impact of mechanisation needs to be done on regular basis so that loopholes if any, are plugged at the appropriate stage. Usually, such research is done at national or country level and is supposed to serve as a useful guide to the policy makers. Differences in climate, farm size, quality of land, labor supply and irrigation system etc. in various parts of the country, however, demand that in order to study the social impact of a particular technology under differing agronomic situations, regional studies should be undertaken on various aspects of farm mechanisation. These regional studies should then become the data base for all types of national studies. It might well turn out that appropriate technology for various agronomic situations is different among regions.

Keeping this objective in view, we have selected the area within ten miles radius around Dera Ismail Khan primarily agriculture based, to analyse the economic impact of wheat threshers. Although our emphasis in the present study would be to identify the factors that lead to the increased use of wheat threshers and those responsible for creating obstacles in the adoption of this technology, the economic impact of thresherization in regard to the post-thresherization use of resources like bullocks and manpower is also discussed besides estimating the cost of threshing both with wheat threshers and conventional method.

Methodology

A questionnaire was prepared, pretested and used in collecting does it have any statistical sig information by interviewing 100 zamindars operating in all four directions of D.I. Khan. In all there were 309 zamindars around D.I. Khan

city as reported by local agriculture officials. Stratified sampling technique was adopted. Out of a sample of 100, 68 were thresher users and 32 non-users. More weightage was given to the users because our main concern was with the economic analysis of thresher usage. We tried to determine whether the use of thresher was dependent upon: i) proximity of farm to road, ii) farm size, iii) share of wheat crop iv) onwership pattern, v) irrigation vi) income level vii) education, viii) household labor supply, ix) use of other agricutural machinery, and x) loan facilities. To know the exact relationship of these attributes, Yule's co-efficient of Association was computed. Finally, cost of threshing one maund (40 kg) of wheat both with the use of threshers and conventional method was also worked out.

Analysis

A. Factors Responsible for use or otherwise of Threshers:

i) Location:

No concentration of either users or non users was found in any particular area indicating the absence of demonstration effect.

ii) Distance From Road:

Most of the observations of users was well as non users lie withing a distance of 1-5 km from metalled road. However, the percentage of non users (3 %) was higher for farms away from road (10 km) as compared to users where it was only 1.5 percent. Thus, greater concentration of users within a radius of 1-5 km from road does indicate some negative relationship between the use of threshers and the distance from road, Yule's

coefficient of Association is - 0.10 which also supports the above conclusion (Table 1).

iii) Farm Size:

Percentage of users did increase with the size of the farm (47 % in the case of > 25 acre farm as compared to 17.6 % for 1-12 acre farm). However, percentage of non-users was also high (50 %) in the case of large (> 25 acre) farms. No conclusive relationship between the farm size and use of threshers therefore emerges which is also proved by the low (0.14) value of Yule's coefficient of Association (Table 1).

iv) Share of Wheat Crop:

For a farm where wheat crop had ≥ 75 % share, the percentage of thresher users was 45.6 % and that of non-users 28 percent. Use of threshers was therefore, positively related to the share of the wheat crop in the farm. As generally expected, the technology adopted is crop specific. The value of the coefficient of Association at 0.59 is also significatly positive (Table 1).

v) Ownership Pattern:

There was no influence of ownership pattern on the use or otherwise of threshers because about the same percentage (60 % and 59 % respectively) of users as well as non-users were owner cultivators. Similarly, there was not much difference in the percentage of users and non-users (28% and 25%) who were tenants. This is further testified by an extremly low value (–0.04) of the co-efficient of Association (Table 1).

Table-1

Yule's Coefficient of Association Thresher use viz-a-viz other Factors.

Road distance	Farm size	Share of wheat crop.	Ownership pattern	Irrigation	Incom	Educational Status	Age Distribution	No.of Family Members
Large/ Small	Large/ Small	High Low	Owner/ Tenant	Irrigation/ Un-irrigated	High/ Low	Educated/ Illiterate	Youn/ Old	Large/ Small
-0.10	0.14	0.59	-0.04	0.86	0.25	0.82	-0.17	0.46

vi) Irrigation:

The facility of irrigation on the farm did have a positive relationship with the use of thresher in that about 3/4th of the users had their farms mostly irrigated. One half of the non users had no irrigation facility at all. The coefficient of Association in this case was 0.86 which is significantly positive (Table 1).

vii) Income:

Thresher users were almost evenly distributed over the high and low income groups, their respective shares being 47 and 53 percent. However since 66% of the non-users were in the low income groups, income levels may have some influence amongst the non users. Yet no conclusive evidence is available to suggest that income levels had anything to do with the use of threshers. The value of co-efficient of Association at 0.25 was also not significant enough (Table 1). Similarly, share of income coming from wheat crop did not influence the use of threshers. About the same percetage (97% and 94%) of users and non users had more than half of their income from wheat crop.

viii) Educational Status:

Sixty percent of the thresher users were themselves educated. Among these 25 percent were graduates while 35% Matric and above. In 73.5% of the cases, other members of their families were also educated- 38% being graduates and 35% with Matric and above.

Similarly, amongst the non-users, about 44 percent were themselves illiterates and in 53% of the cases, had family members of below Matric education level. This reveals that the educational status of self and that of the other family members

does have a positive relationship with the use of threshers. High value of Q=0.83 also suports this contention (Table 1).

ix) Age Distribution, Number of Dependents and Family Compositon:

Age factor was not related to the use of threshers in that the majority of thresher users (64%) and non-users (72%) were of the same age group of upto 50 years. In this case, Q=-0.17 was also insignificant. However the family composition and more specifically, availability of own family labor, did influence the use or otherwise of thresher because a significant 59% of the non-users had large family. The value of Q=0.46 was also significantly positive (Table 1).

x) Reasons for Switching over to Thresher:

More than half of the respondents (51.47%) opted for using thresher because it was a time saving device. Thirty seven percent considered it a convenient mode of threshing. A small percentage (11.76%) switched over to the use of thresher for economic reasons. This indicates that most of the thresher users are not fully conscious of the economics of thresher usage (Table 2).

xi) Use of other Agricultural Machinery and Reasons for not Owning Thresher:

Most of the users (69%) also used tractor on their farms. Only nine percent were using other types of agricutural machinery besides tractors and threshers. This shows that majority of the thresher users are tuned to the mechanized farming. However, 22 percent of the users were not using any other machinery except thresher. This means that thresher may also become popular on its own merit.

Table-2

Reasons for Switching over to Thresher and Post Thresher Utilization of Previous sources of Threshing

Reasons for Switch over to Thresher			Post Thresher			Utilization of Bullocks & Manpower			
			Bullocks			Manpower			
Convenient	Economical	Time Saving	Disposed off	Other uses	Idle	Same used with the Thresher	Partly Idle	Idle	Used in other production activities
25	8	35	31	17	20	42	24	10	58
36.76%	11.76%	51.47%	45.58%	25%	29.41%	61.76%	35.29%	14.7%	85.3%

Fifty one percent of the users did not have their own thresher because they thought it to be too costly, while 22% did not have the necessary funds to buy one. As far as loan facilities are concerned, 51 percent of the users did not know anything about the procedure or even the availability of loan. Loan facilities were therefore, not playing any role worth mentioning in regard to the purchase of threshers.

Not owning a thresher however, did not seem to have posed much of a problem for the farmers because most of them (81%) could get the same easily on hire and were, in 54% of the cases, also satisfied with the terms of hire. Generally, as well almost all the thresher users (97%) were satisfied with its service (Table 3).

xii) Reasons For Not using Thresher - by Non-users:

As much as 69 percent of the non-users were not satisfied with the conventional method of threshing. Out of these, 73% thought conventional method time consuming and the rest 27 percent considered it un-economical, indicating very little concern about the economic aspects. This implies that had they the opportunity, a good number of non users would have opted for mechanical threshing. majority of them (78%) said they could not afford to pay its rent, and they thought it was not economical to buy their own thresher with borrowed money (Table 4). That is why as much as 84.37% of the non-users did not even try for loan. However, there were 75% of the non users who wanted to borrow money but could not succeed either because they did not have the necessary collateral or did not know the procedure (Table 5).

Existing loan facilities therefore, do not seem to have any significant role to play. These ought to be made more

Table-3

Use of other Agricutural machinery and Reasons for not owning Thresher.

Use other machinery		Reasons for Not Having Own Thresher				Easy Availability on Rent		Terms of Hire Satis-factory		Satisfied with Thresher	
Yes		No	Too Costly	Lack of Funds	No Knowledge for Loan	Yes	No	Yes	No	Yes	N
Tractor	any other										
47	6	15	35	15	35	55	9	37	22	66	2
69%	9%	22%	51%	22%	51%	81%	13%	54%	32%	97%	3

Table-4

Non-User's Satisfication level with conventional Mode of Threshing and Reasons for not using thresher.

Satisfied		Not Using Thresher	
Yes	No	Can't Afford to Buy	Can't Afford to Hire
11 (34.37%)	22 (68.75%)	4 (12.5%)	25 (78%)

Uneconomical	Time Consuming
6 (27%)	16 (72.7%)

acceptable. Moreover, rental charges need to be reduced so that more farmers can use threshers.

B. Impact on the Composition of Labor Force:

The number of workers at thresher users farms was larger than those of the non-users. In 33 percent of the cases, the users had more than ten farm workers while about 66 percent of the non-user amployed 4-6 workers. Moreover, in 37 percent of family workers was zero and as much as 69 % of the non users had their own family workers. In both the cases, male adults dominated the work force. One can conclude from this that presently, there is no significant change in the composition of labor force as a result of the use of threshers (Table 6).

Table-5

Non-User's Desire for use of Thresher on loan and use of other Agricultural Machinery.

Tried for Loan		Reasons for not Succeeding in getting loan	Use Other Agricultural Machinery		Willing to use Thresher on Loan	
Yes	No	Don't know the Procedure/No Collateral	Yes	No	Yes	No
5 15.6%	27 84.37%	24 75%	30 87.5%	4 12.5%	10 31.25%	23 71.87% Not economic 17 (73.9%).

Table-6

Total farm Workers and their Distribution between Family and Non Family Workers

	Total Workers		Share of Family	Workers in Total
	4-6	> 10	0%	100%
Thresher Users	13	16	25	16
	27%	33%	37%	23.9%
Non Users	19	2	2	22
	65.5%	7%	6%	68.8%

C. *Experience in Thresher use, Ownership Pattern and Mode of purchase:*

In 52% of the cases, threshers were being used for the last 1-3 years whereas 39% of the users were using it for 4-6 years. Thus our sample did have the farmers with fair amount of experience in the use of thresher.

About 71% of the thresher users had hired the thresher while only 29% had their own thresher. Eighty percent of those who did own a thresher had bought it out of their own resources, only 20% borrowed money to buy a thresher (Table 7).

D. *Cost of Threshing:*

a. By using thresher:

There are two ways to use thresher (i) by using electricity and (ii) mechanically operated with the help of a tractor. Then the threshers are either owned by the users themseleves or hired. Cost of threshing one maund (40 Kg) of wheat under varying conditions are summarized below, while details are given in the cost statement: (Annexure I).

Table-7

Experience in Thresher Usage, ownership pattern, and Mode of purchase.

Number of years of Thresher Use		Ownership pattern		Mode of Purchase	
		Self owned	Hired	Self financing	Loan financing
1-3	4-6				
35	26	20	48	16	4
52%	38.8%	29%	70.6%	80%	20%

1. Hired Thresher.

   i) Electricity operated Rs. 7/-

   ii) Diesel (Tractor) operated Rs. 10 70

2. Self owned thresher.

   i) Electricity operated Rs. 3.80 *

   ii) Diesel (Tractor) operated Rs. 5.46 *

* For an output of 10.000 maunds. For an output of 2000 maunds, these costs would be Rs. 7.27 and Rs. 9/- per maund respectively.

b. Conventional Method:

1. Self owned Bullocks. Rs. 15.53

2. Hired Bullocks. Rs. 24.20

Note: cost estimates are based on 1988-89 prices.

Result

Obviously, owning a thresher and using electricity, is preferable for those having large output or can avail the opportunity of renting out the thresher so that it is used for the entire season. Our survey revealed that 70.6% of thresher users had the spare capacity and about 30 percent used it to its full capacity. Sixty two percent of those having spare capacity rented it out fully, another 25 percent had their thresher rented out partly and in 12.5 percent of the cases spare capacity was not used (Table 8). This indicates that in most of the cases, threshers were used to their maximum capacity. For other farmers, hired threshers using electricity are economical. It should be noted however, that in our sample, electric power was available only on 64 percent of the thresher user's farms. Conventional means of threshing are clearly uneconomical.

Table-8

Thresher Users' utilization of Spare Time, Availability & Utilization of Spare Capacity.

Use of Spare Time		Availability of spare capacity		Utilization of Spare Capacity		
				Rent Out		
Idle	Other productive activites	Yes	No	Idle	All	Partly
10	58	48	20	6	30	12
14.7%	85.3%	70.6%	29.4%	12.5%	62.5%	25%

E. Economic Impact of mechanized threshing:

It is a known fact that as a consequence of mechanization, the existing distribution and application of physical and human resources is disturbed and need proper re-

adjustment. It was therefore our endeavour to ascertain the influence of thresherization on resources like bullocks and manpower, the two main arguments in the production function entailing conventional mode of threshing -- the third one being the very simple tools, not considered for obvious reasons.

Bullocks

It was revealed that 46 percent of the bullocks were disposed of, 25 percent were put to other uses and 29 percent kept idle (Table 2). Disposing of 46 percent of bullocks meant adding to the stock of bullocks which will have its own positive effect on the economy.

It was only 29 percent of the bullock power which was reported as having been rendered idle. But that is only for the duration of threshing season which is one and a half month. All in all, there is no significant wastage of bullock power due to the introduction of threshing machines.

Manpower

As regards post thresher manpower utilization, majority of them (61.76%) reported they used the same manpower with the threshers implying no unemployment problem. A little more than 35 percent said their manpower was rendered partly idle.

The number of workers used for threshing with threshers may be the same or even greater than that of the conventional method but in terms of labor hours, less labour is employed because of much shorter duration of mechanical threshing. Therefore, quite a good number of workers may have nothing to do and could be motivated by the agriculture

extension officials to engage themselves in other productive activites. On our enquiry however, it turned out that 85% of the workers were already using their spare time in other productive activites while only 15% remained idle (Table 2).

Summary and Conclusions

An effrt has been made to study the economics of wheat thresher in D.I. Khan. The objective was to identify the factors that were responsible for the adoption or otherwise of mechanized threshing technology, the economic impact of this mode of threshing on conventional resources like bullocks and manpower besides estimating the cost of threshing both with wheat threshers and conventional method. A survey was conducted with the help of a detailed questionnaire and data thus obtained analyzed.

Among the factors that led to the increased use of threshers were proximity to road, larger share of wheat crop on the farm, irrigation facilities, education, family labour, time factor, farm size. Ownership pattern age and income, had no significant effect on the use of threshers. The obstacles in the way of using threshers were high rental charges, and non-availability of loan facilities. On average, the cost of threshing by wheat threshers was one half that of the conventional method.

As far as the economic impact on the conventional resources was concerned, it was found that no significant wastage of bullocks and manpower resources occurred.

On the basis of this study, it can be concluded that mechanized threshing of wheat is surely economical but it needs to be improved by linking the farms with a network of

roads easily accessible and greater loan facilities, electrification of farms and last but not least, establishment of thresher houses in various small towns under the supervision of PASSCO so that spare threshers can be readily made available for renting out and those in need of these machines can get them at reasonable rates without much waiting.

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Statement of Threshing Costs In Rupees Per maund Under Varying Conditions

Output 5 bags (10 maunds/hour)

I. Rented Thresher.

A. Electricity Operated:

i) Thresher Rent (includes one operator only)	4.00
ii) Electricity Charges.	0.20
iii) Labor.	2.50
iv) Transportation.	0.20
Total : Rs.	6.90
say: Rs.	7.00

B. Diesel (Tractor) Operated:

i) Thresher Rent (includes Tractor Charges)	8.00
ii) Labor	2.50
iii) Transportation	0.20
Total : Rs.	10.70

II. Self-owned Thresher.

A. Electricity Operated.

a. Variable Cost in Rupees/maund.

i)	Electricity Charges.		0.20
ii)	Labor		2.50
iii)	Transportation		0.20
	Total :	Rs.	2.90

b. Fixed Cost

i)	Operator		0.105
ii)	Annual maintenance.		0.05
iii)	Depreciation.		0.30
iv)	Interest Income Lost		0.42
	Total :	Rs.	0.875

Total Cost: Rs. 3.775

Note:

1. Should either have own crop of 10,000 maunds or thresher be rented out. In any case, it should be used for the entire season of 1 months - 1000 hours (1080-80 hours allowed for change over).

2. For output of 2000 maunds FC=4.375/maund and th total cost/maund would be Rs. 7.275 about the same as that of a rented thresher. For output of 1000 bags (2000 maunds) owning the thresher is preferable.

B. Diesel (Tractor) Operated:

a. Variable Cost in Rupees/maund.

i) Diesel		1.76
ii) Labor		2.50
iii) Transportation.		0.20
	Total :	4.46
b. Fixed Cost.		
i) Thresher: (Same as that of Electricity operated)		0.875
ii) Tractor:		
1. Annual maintenance:		0.017
2. Depreciation.		0.110
	Total	1.002

Total cost: Rs. 5.462

Difference: (Diesel vs. Electricity operated) 5.462-3.775 = 1.687 say Rs. 1.7.

Result: Rs. 1.7/maund is additional cost for threshing by Diesel (Tractor) operated thresher rather than using electricity.

Note: For an output of 2000 maunds Fixed Cost of Thresher would be Rs. 4.375, and Total Cost Rs. 8.96, say Rs. 9/- maund.

Conventional Method: Cost

Output 5 bags (10 maunds)/day

i) Labor	10.00
ii) Wastage	2.00
iii) Bullocks.	
a. rented	10.00
b. own bullocks, includes unkeep and depreciation.	1.33
iv) Cost of additional Time.	2.20
Total: Rented Bullocks.	24.20/maund
own bullocks	15.53/maund

2. Ahmad, V and Rashid Amjad, The Management of Pakistan's Economy, Karachi 1984, Oxford University Press pp. 172-181.

3. Income ≥ Rs. 31,000 Per Annum were catagorized as High and ≤ Rs. 30,000, as low.

BOOK REVIEW

Perspective on Development Planning in Pakistan*

By

MOHAMMAD ASLAM

Dr. Aslam's latest book "Perspective On Development Planning in Pakistan" is a complement to his earlier work : "Outlines of Economic Planning". The recent work is a valuable contribution to the existing literature on planned economic development in Pakistan.

The process of economic development in Pakistan started almost simultaneously with independence. A planning agency in the form of a 'Development Board' which Dr. Aslam terms as a 'weakling' was constituted in 1953. The planning organisation changed in nature and scope with the passage of time and political changes in the country. The author traces the history and evolution of the planning organisation in the first chapter. The next two chapters deal with the structure of the planning agencies at the federal and provincial level, and the process of plan formulation, implementation and evaluation. The author is of the view that the 'planning process has been adequately institutionalised' and specific institutions created for the purpose of plan preparation have acquired sufficient competency to accomplish the primary task assigned to them.

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* Lahore : Bilal Books, 1991. 378 pp. Price Rs. 100 (Paper Back), Rs. 175 (Hard Back)

However, the 'institutions for monitoring and evaluation of projects have largely failed to come up to expectations.

A comparative study of Pakistan's five year plans with reference to their size, strategies, objectives, sectoral priorities and results has been made in chapter 4. The factors responsible for the difference in the performance of different plans have been carefully analysed. The achievements of each plan have been objectively commented upon.

A long term or perspective plan has special relevance for the L.D.Cs, as it can be addressed to solution of specific long term issues like industrialisation, construction of social overhead capital and balanced development of sectors and regions, etc. Pakistan launched its First Perspective Plan (1965-85) in 1965; but as pointed out by Dr. Aslam in the 6th Chapter, this plan became 'superfluous' after the debacle of 1971. The Second Perspective Plan (1988-2003) was launched with the 7th Plan.

Resource mobilization is not only a pre-requisite for successful planning but a difficult nut to crack for the developing countries. In view of its pivotal role, the resource mobilization has been discussed in three lengthy write-ups : domestic, external and human resource mobilization (chapters 6-8). The failure of the Government to raise tax as a percentage of G.N.P., to keep a lid on its non-development expenditure and to take effective fiscal measures to curb private consumption severely affected the domestic resource mobilization efforts. Low savings not only affected the investment levels, but also led to the widening of saving-investment gap. This gap had to be filled in by foreign aid, thus increasing our dependence on foreign resources. Dr. Aslam rightly concluded that the widening of the S-I gap at substantially low levels of the two 'is

the greatest single failure of planning in Pakistan'. Imposition of an agricultural income tax has been a subject of great controversy in Pakistan. Dr. Aslam comes out with a novel proposal of exacting a surplus for capital formation without resorting to an agricultural income tax. He suggests that the system of deferred payment for a part of value of agricultural produce, purchased under the compulsory procurement scheme, be paid in the form of bonds, N.I.T. Units, Saving Certificates etc. However, the backlash effect of such a payment scheme on the agricultural output may also be considered.

Deficit financing has been widely practiced as a source of capital formation in many of the developing countries and Pakistan has been no exception. The implications of this technique have been highlighted by Dr. Aslam which he terms as 'double edged weapon'. He has also given a fair treatment to the study of monetary and fiscal policies in resource mobilization.

The role of foreign aid as a source of external resource mobilization has been extensively discussed. After giving the rationale of foreign aid for Pakistan, the author has dwelt upon the nature and extent of dependence on it. The discussion of the debt-servicing problem from Pakistan's perspective as well as from that of the Third World Countries, is commendable. The U.S. aid to Pakistan in historical perspective and the aid package of 1987 to 1992 provides an interesting insight to the 'love-hate' relationship with U.S.A. The emphasis on self-reliance by the present government can be understood in a better way in the light of this analysis.

Chapter 8 of the book on Population Problem opens with the conflicting positive and negative role of population growth. After a brief discussion on the demographic transition in the

world in historical perspective, Dr. Aslam focuses attention on the population scenario in Pakistan. As Pakistan faces the population explosion, population planning strategy has received considerable attention. The causes for the failure of the strategy in arresting the population growth have also been hinted upon.

The sectoral planning finds comprehensive treatment. In view of the important role of agriculture in the economy - its development problems have been discussed in chapter (9-12). Though agriculture is the backbone of the economy, it is marred by low productivity. 'It is in the agricultural sector that the battle of long term economic growth will be won or lost! (Myrdal) aptly applies to Pakistan. Besides a well-written chapter on agricultural planning, Dr. Aslam has discussed the issues of Agricultural Pricing Policy, Land Reforms and Green Revolution quite exhaustively.

Another aspect of significance in the book and worthy of emphasis is industrial development. The political leaders and the development planners in L.D.Cs seem to subscribe to Chenery's view 'that industrialisation is the main hope of developing countries'. Though efforts to industrialise started immediately after independence, yet industrial development received a priority in the 2nd Five Year Plan. The strategy to ind strialise through private enterprise paid off. The size of manufacturing sector, its share contribution to G.N.P. and employment showed considerable increase. The country had an industrial bonanza. Yet it also led to the rise of a 'Robber-Baron' Class, concentration of income and powers in 22 families, income inequalities and regional imbalances. The functional inequality strategy was replaced with a policy of distributive justice during 1971-72 to 1977-78. The period also witnessed nationalisation of financial and industrial units. The result was

a sharp decline in industrial output. The various aspects of industrialisation are discussed in chapters (14-16).

Foreign Sector Planning is another section of significance. Like other developing countries, Pakistan has been facing serious problem of chronic B.O.P. disequilibrium. Dr. Aslam has drawn this interesting conclusion from the B.O.P. figures of various years; 'the democratic era' has been generally associated with an improvement in B.O.P., while a dictatorial one has been aligned with a deteriorating one, which according to him, 'may be due to the temptation to live beyond means under dictatorial regime not accountable to the people or parliament'. After discussing the side-lights of the problem, he suggests future strategy.

Chapter 18 discusses the 'Remittances Bonanza'. Besides taking stock of the phenomenal growth of workers remittances, their impact on B.O.P., employment, poverty alleviation, domestic saving and investment and price level have been dilated upon. He is probably right that an opportunity of more profitable use of these remittances has been lost. This reminds us of a previous lost opportunity arising out of the Korean War in early Fifties. The analysis of the phenomenal return of migrants as a result of the Gulf Crisis closes the chapter giving an update touch to the problem of remittances.

In the last chapter (19), the problem of regional planning has been discussed. It was 'the economic disparity' between East and West Pakistan which sparked off the winds of separation. The author on the basis of data compiled and analysed by him observes that economic disparities do exist among the four provinces of Pakistan. He is of the view that regional planning aimed at development of backward areas should form an

integral part of the whole planning exercise and assiduously interwoven into an overall economic plan.

The book is written in a simple and straight forward style. It avoids giving long and difficult to comprehend tables. it puts the development efforts of the country in a proper perspective and contains thoughtful conclusions on basic problems. The bibliography given at the end of the book has added to the utility of the book for the serious minded and research oriented scholars. An index would have further increased its utility.

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