Impact of Technological Changes and Economic Liberalization on Agricultural Labor Employment and Productivity

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Summary

Egypt has passed dramatic economic changes over the last decades, under the economic reform liberalization program. The objectives of this study were to assess the impacts of such program on technological change, agricultural labor employment and Productivity. The study estimated two crop production functions for rice, the main summer crop, in two periods, before and after the economic reform application. Two sample survey data, over two successive periods were collected from the same region of East Nile Delta. Optimum allocation of inputs implied to decrease the human labor use, even though, under the shadow border price to reach a feasible employment opportunity for human labor. Whereas, the time series data, showed a decrease in agricultural labor employment by 30% over the last decades, results from the estimated production function model showed a 66% decrease in human labor employment was required to maximize the agricultural income. Liberalization of rice inputs and output prices accelerated the agricultural labor unemployment for mechanization Introducing the high yield crop varieties diminished the unemployment in agricultural labor due to expansion in mechanization packages.

To maintain agriculture growing at an economic competitive performance a rural development programs should generate employment opportunities for the excess agriculture lahour, either in agricultural supporting industries or in non-agricultural small industries.

1 Introduction

Although the urban population and industrial sector have grown significantly in Arab countries, regardless the Gulf Oil Countries, the rural population, and agricultural labor forces are still the major portion of their populations, (Baker, et al, 1987). Also, the agricultural development and food security have top priorities of the development programs of these countries. The theme of the agricultural development in the region within the last two decades of the 20th Century focused upon: introducing (1) modern high technological packages (either biological or physical) and (2) liberalization of the input-output prices and marketing system of agricultural products and agricultural land, (Soliman, 1992). However, the magnitude and level of implementation of both components of such strategy are varied among the countries of the concerned region. Biological technology package composed mainly of higher yield varieties, associated with higher level of fertilization and more efficient farming practices. The physical technology composed mainly of the intensification of agricultural machinery and the biological technological was devoted towards introducing high yield varieties of major crops, (Frisch, 1965). Mendola, (2007) conducted a study on agricultural technology adoption and poverty reduction. That study referred to economical definition of technological packages as either labor intensive package or capital-intensive packages (machinery, fertilizers and new varieties of seeds). It seems that there is contradiction between increasing farm income for household poverty reduction of small farm holdings in developing countries and human labor employment rate (Soliman and Imam, 1987). They found that the capital-intensive technology approach is recommended to raise income of small farm household at the expense of human labor employment in agricultural activities.

Egypt is considered as a representative case study to assess the socio-economic impacts of such strategy on agricultural labor employment. The successive three "5-years" development plans in Egypt since 1982 have devoted much concern towards introduction of high yield varieties and mechanization systems, (Soliman, 1994). Up to mid of eighties of 20th century, the program objective was to reach a full mechanization of land preparation and expansion in water pumps irrigation. Up to early years of nineties, the plan aimed at introducing and expansion of the machinery for harrowing, harvesting for rice, wheat and fodder. Up to the 2000 the goals were a full mechanization for major field crops. A major result of such plan was substitutability of a major proportion of human labor, (Soliman, 1995). On the other hand, Since the economic reform and structural adjustment program started in 1986/1987, Egyptian agriculture has passed various dramatic economic changes. Therefore, the objective of this study was to assess the impacts of these technological changes and economic liberalization on agricultural labor employment and productivity.

2 Data Base

To achieve the study objectives, the study depended upon two sample surveys conducted by the author in two different periods. The first was for the agricultural year (1987), i.e. before the boom of the economic liberalization in Egypt and before the great expansion in agricultural machinery intensification and introducing new variety seeds of the major crops. The other sample was conducted for the agricultural year (2001), i.e. more than ten years later; to compare the associated changes occurred in agricultural labor employment and productivity before and after introduction of biological and physical technologies and economic liberalization. The two samples collected from the same districts of "Sharkia Governorate", where the author’s university is in its Capital “Zagazig”. It is located 60 km from Cairo, to the East of the Nile Delta and West of "Sues Canals". The target crop "Rice" is a major exportable crop in Egypt. Sharkia Governorate cultivates 15% of rice area in Egypt (compiled and collected from Ministry of Agriculture, 2015). The first sample included 125 farms, in

1987 while the second sample included 100 farms, in 2001. Each sample represented stratified pattern of the farm size in the conventional village in Egypt, i.e. from one "feddan", ($4200m^2$) to more than 10 feddans per farm.

3 Analytical procedures

Agricultural mechanization was classified as systems, which are identified by crop, by farm operation, and by type of mobility (Self-operated or operated by tractor), as cited by Imam and Soliman, (1982). To assess the level of expansion in agricultural mechanization for farming operations the study applied a Chi-Square test for the cross-tabulation of the relative frequency of the farmers used a certain mechanization system versus those who did not use it, in the two concerned periods. Therefrom, this study investigated the significance of the expansion of such technological packages before and after the applied development program.

A t-test model for the difference between two means was applied to investigate the magnitude of the technological packages intensification per 1-feddan ($4200m^{2)}$ of rice crop in the two concerned periods, i.e. at the onset of applying the economic reform and market liberalization policies and full after implementation of these policies, which were associated with introducing capital intensive technological packages (machinery, new variety seeds and nonorganic fertilizers).

For assessment of labor employment and productivity, the study identified the best fitted model for input-output relations of "rice-production function" for each period. several economic relations and parameters were derived from each fitted model to assess the changes in agricultural labor productivity and employment. The derived estimates included the production elasticity, the value of marginal product, the marginal return to one US$ spent on both machinery and human labor. It is called (the economic efficiency of the input, (Dillon, 1977, Heady, 1978, Soliman, et al, 1994; Soliman, El Shenawy, 1985). The substitution rate and the ISO- quant curve of machinery-labor was derived to estimate the most economically efficient, i.e. the least cost combination of human and machinery labor, at average level of other inputs application per unit of land. The economic efficiency and optimum combination of both inputs were estimated under two distinct scenarios that simulate the economic changes in Egyptian Economy. The first scenario was to investigate the impacts of implementation of the techno-economic development strategy, by comparing the derived indicators of both production functions in 1987 and 2001 under the current prices level.

The second scenario was to investigate the derived indicators of the 2001 production function under the shadow prices of inputs and outputs. The shadow price of rice was the border price of exported rice. It was considered as its opportunity income. The human labor’s wage was measured as man-day. Its shadow price was the wage rate of the worker in the building-construction activities (its opportunity cost in the best alternative use). The machinery work was introduced to the production function model as weighted "horse-power" of all farm operations. The shadow price of such input was derived from the current hired rate without the subsidy value of fuel price (Soliman and Megahed,1994), where the expected increase in fuel price would be 50%" above the market price. Fuel share in the total cost structure of customs service was around 20%. Accordingly, the machinery shadow rent rate, under free price policy of fuel, would be around 10% higher than its current level.

The Cobb-Douglass model's form presented by equation (1)

$Y_{ij} = b_0 x_{1j}^{b_1} x_2^{b_2} x_3^{b_3} x_4^{b_4} x_5^{b_5}$ ………………………. (1).

Where:

Y_{ij} = Estimated rice production of crop I in the year j

b_0 = estimated intercept

x_i = the cumulative level of input i in the year j, i = 1, 2, 3, 4, and 5 and j = 1987 and 2001

$^{b}{}_{i}$ = estimated response coefficient of input i.

The production elasticity was estimated from Equation (2). The Marginal physical product of input X_i was presented by equation (3), the Value of marginal physical product of input X_i was shown by equation (4).

The economic efficiency of input X_i was presented by equation (5). The economic efficiency of an input expresses the marginal return of a given input to one US$ spent on such input. It was estimated as the ratio of the average value of marginal product to the price of the input. If such coefficient of a given input was>1 implied that additional intensification of this input is economically feasible, but if it was<1 implied that it would be feasible to decrease the level of that input to raise the economic efficiency, (Soliman, et al, 1994b)

$$\acute{\varepsilon}_{x1} = (\delta Y_{ji} / \delta X_{ij}) = (b_0 b_1 Y_{ji} X_1^{b1-1} X_2^{b2}) / X_i / Y_{ij} = b_1 \ldots\ldots\ldots\ldots (2)$$

$$(MPP_i) = b_i (\hat{u}_y / \hat{u}_x) \ldots\ldots\ldots\ldots (3)$$

$$(VMPP_i) = P_y (MPP_i) = P_y \ldots\ldots\ldots\ldots (4)$$

$$(VMPP_i) / P_i = (P_y / P_i) [b_i (\hat{u}_y / \hat{u}_x] \ldots\ldots\ldots\ldots (5)$$

Where:

b_i = estimated regression coefficient of input X_i,

$\hat{u}_y$, and $\hat{u}_{xi}$, = the averages of yield per farm and input i, respectively, and

P_y and P_i = the average free market prices of output and input i, respectively

The "Isoquant Curves function" (Equation 6) was derive from the production function (Equation

1). The isoquant curve showed all possible combinations of two inputs quantities (human labor versus machinery work) that can be used to produce a given level of output (rice production). The marginal rate of technical substitution of the two inputs ($MRTS_{(X1,X2)}$ was estimated from the isoquant curve function (Equation 6). The least cost combination of both human labor and machinery labor was estimated, assuming, at all other inputs were at their average levels, (Soliman, 2007). The necessary condition to achieve the least cost combination of both concerned inputs recognized when the ($MRTS_{x_1,x_2}$) equated the given price ratio of the two feed inputs as shown by (Equation 7). From (Equation 7) it was possible to drive the "Isoclines function" which determined the substitution relationship between human labor and machinery work at different price ratio (PR) of both inputs as shown by (Equation 8)

$X_2 = (Y^*/_{b0}X_{b2})1/b_1$ .... (6)

$\Delta X_1/\Delta X_2 = b_1/b_2\ (X_1/X_2) = P_{X_1}/\ P_{X_2}$ .... (7)

$X_2\ (^{/}\ b_1/b_2)\ (PR)$ .... (8)

4 Results & Discussion

For comprehensive presentation and discussion of the results, they were presented under certain specified sections. Each one covered a sub-objective of the present study.

4.1 Expansion in Agricultural Mechanization

Results of Table (1) show that land preparation of farm operations (plowing, leveling and lining) reached full mechanization in 2001 while it was 75% of farms in 1987, calc. χ^2 was significant at $\alpha \leq 0.05$. Even though the level of expansion of the drilling machine and planters for seeds cultivation was low, i.e. covered only 23% of the farms in 1987, it almost doubled over the period in 2001, χ^2 was significant at $\alpha \leq 0.05$. Mechanized weeding was low and had covered only 13% of the farms in 1987 and did not change much in 2001, i.e. still a manual operation; therefore, χ^2 was insignificant at $\alpha \leq 0.05$. To lift water by a pump for irrigation has stayed as a full mechanized operation for all farms since 1987; therefore, χ^2 was insignificant at $\alpha \leq 0.05$. This is probably due to the policy of government to lower the water level in all irrigation canals; to force the farmers bearing higher costs of lifting the water to rationalize the water use for agriculture. Such policy has followed as substitute option for water pricing at its opportunity cost to avoid probable social troubles (Wichelns, 1999).

The number of farms that applied mechanized harvesting raised from about 23% in 1987 to about 37% in 2001. Even though such increase was not so high, but it was statistically significant at $\alpha \leq 0.05$. The main reason behind such conservative increase was due to introducing of the combine machine which decreased the percentage of farms that used, separately a threshing machine and a winnowing machine. The statistically significant expansion in using the tractor for transportation within the villages from about 15% in 1987 to reach 100% in 2001, was due to the significant decrease in custom tariffs of imported tractors (Central Bank of Egypt, 2018). In addition, the development of the local assembly industry of the tractors of the capacity 65hp associated with a big improvement in the infrastructure (roads) in the Egyptian village, had encouraged the farmers to intensify the usage of tractors.

4.2 Technological Changes:

Table (2), shows highly significant, intensification of chemical technology (fertilizers) between 1987 and 2001, as confirmed by t-test. The average density of either phosphorus, potassium or nitrogen fertilizers increased significantly, as indicated by estimated t-value between 1987 and 2001. With respect to biological technology, in terms of introducing new higher yield varieties of rice, the rice grains yield increased from 2.38 ton per feddan in 1987 to 2.98 ton per feddan in 2001. The rice straw increased from 1.16 ton per in 1987, to 1.6 ton in 2001. However, due to high variation in yield within farms the difference in yield was not statistically significant, as t-test result shown in (Table, 2). The mechanization of farm operations was intensified per feddan, i.e. from about 13 hours of mechanical work per feddan in 1987, to about 18 hours per feddan in 2001. However, the increase in machinery use per feddan was not statistically significant at $\alpha<0.05$, (Table, 2). Comparison between the trend of agricultural machinery expansion, shown in (Table, 1) and agricultural mechanization density per feddan, shown in (Table 2) provided evidences that such technological change was mainly in the type of mechanization system rather than the quantity of operating hours. However, the relative increase or change in mechanization systems has associated with statistically significant less human and animal work per feddan. Human Labor work for farm operations of rice decreased from more than 45 man-days in 1987 to about 34 man-days in 2001. Such result is a simple evidence that the technological change in Egyptian agriculture, particularly, mechanization had significant negative impact on human labor employment in agricultural sector of Egypt.

4.3 Estimated Production Function:

Table (3), presents the estimates of the best fitted form of Rice-Crop production function in the two targeted time periods 1987 and 2001 to investigate the impact of technological change in agricultural sector on the human labor employment. The selection of the best fitted form, using "OLS", based upon the magnitude of the estimated coefficient of determination "R^2", the economic logic of the estimates and the statistical significance of these estimates. Therefore, the "Cobb-Douglas" form was the best fitted mathematical form of the concerned crop production function, as it showed the highest value of R^2, and most of the estimates were statistically significant at a probability less than 1% and showed a logical sign that matched the expected behavior of the techno-economic policies followed during the target period. As the estimated R2 showed, while 78% of the variation in the rice production was explained by the introduced inputs (human labor, machinery work, animal work, rice area and nitrogen fertilizers) in the estimated function of 1987, around 85% of the farm production of rice was due to the same introduced inputs in 2001.It was mainly due to the significant response of rice area.

The land input (crop area) response was significant in the 2001 model rather than in 1987 model. The study tried to explain the reasons behind such contradicted results of the production response of the crop area between the two periods. After liberalization of the agricultural land market in 1996, the agricultural holdings distribution has drastically shifted towards larger holdings, associated with free market prices of crops (Hazell, et.al.1995). Therefore, a high proportion of Egyptian farms have potentiality to adopt new technologies. while before 1996, the land market was almost inert for decades due to the effects of the two land reform laws in 1953 and 1969, which ended by limiting the individual agricultural land ownership at maximum of 50 feddans (around 21ha) and made the land rent contracts, almost valid forever, which had led to more fragmentation of the land into very small fragmented holdings as the successive offspring inherited the original rented land, (Seyam, El Bilassi, 1995). Therefore, up to mid of eighties agricultural land fragmentation with obligatory delivery of a large proportion of the major crops at fixed prices to governmental channels, did not provide incentives to most small farmers to adopt modern technological packages, (USAID, 2010) and (Rao, 2002).

The animal work input response was not significant in the 2001 estimated model because its density has become very minor as shown in (Table 3), while it was significant in 1987. Mainly, such change was due to the boom of introducing the agricultural mechanization systems since early in eighties of the last century and to the development of leveled roads network in rural Egypt. Some research work had positive impacts upon the farmers attitudes towards freeing their dairy animals from work field, which was supported by high incentives of meat and milk prices increase over the 80's of 20th century due to high demand for animal products stemmed from a significant increase in per capita income when the open economy policies were applied, (Soliman, El Shenawy1983) and (Soliman, 1992).

Comparison of the magnitude of the intercept of the two estimated production functions showed a significant aggregate technological positive change that shifted up the rice production in Egypt between the two periods. From Table (3), the estimates of the intercept of the 1987 function was 0.05, increased to 0.15 of the function 2001. This change was mainly due to improvements in biological technology (new varieties), (Soliman, et al, 1995) associated with the positive impacts of expansion in agricultural mechanization systems.

AS the estimated regression coefficients of the Cobb-Douglas production function represent econometrically, the average production elasticity of the inputs, the productivity of human labor decreased from 0.4 in 1987 to 0.08 in 2001, (Table, 3), while the agricultural machinery productivity increased from 0.19 to 0.25. The nonorganic fertilizers productivity, slightly, increased from 0.25 in

1987, to 0.27 in 2001.

Therefrom, while 10% increase in machinery work, nonorganic fertilizers and human labor of 1987 response results in an increase in rice production by 1.9%, 2.5%, and 4%, respectively, same increase in the same inputs of 2001 response results in 2.5%, 2.7% and 1%, respectively. It was concluded that whereas the human labor production elasticity was the highest on in 1987, followed by nonorganic fertilizers and the lowest elasticity was of the machinery work, in 2001, production elasticity of nonorganic fertilizers and machinery work were more than double the human labor elasticity, which in turn had decreased to 25% of its estimated value in 1987. It seems that introducing of new varieties of rice and nonconventional mechanization systems, such as Combined harvester and laser land leveling systems, (Soliman, 1997), have provided incentives to increase the productivity of mechanization at the expense of human labor productivity

4.4 Economic efficiency of human labor under current prices

Table (5) shows the estimated economic efficiency ratio (coefficient) of production inputs under the current price level of rice and wage rate. It decreased from about \$2.1 per 1-\$ spent on human labor cost in 1987, to less than \$0.25 in 2001. This coincide with the apparent decrease in human labor intensification per feddan over the period 1987-2001, (Table 2).

On the other hand, the higher productivity of machinery work and its relatively low price per unit (Horse Power), as presented in tables (3) and (4), reflected its high economic efficiency. Such high efficiency provided a good opportunity for mechanization to expand in agriculture, particularly rice. Its economic efficiency, increased from around 1.6 in 1987, to about 2.3 in 2001. This because of the apparent increase in machinery intensification per feddan over the period 1987-2001, (Table 2)

Such result was a resultant of the increase in machinery productivity by 32% and in fertilizers productivity by 8% associated with a decrease in human labor productivity by 80% and animal work by 98%. To wrap up, under current prices the average marginal return` to one US\$ of human labor employed in rice production decreased by 54% between 1987 and 2001, while the same marginal return of machinery work employed in the same activity increased by 40%. Accordingly, the human labor employment should be decreased due to a sharp decrease in its economic efficiency, while the machinery work should be more intensified as its economic efficiency highly increased.

4.5 Economic efficiency of human labor under shadow prices level

As the study concerns the impacts of technological Changes and Economic liberalization on agricultural labor employment and productivity, the current and estimated shadow price were restricted to the current and shadow level of prices of rice, machinery work and human labor for rice production, (Table 3) which were used for investigating the economic efficiency of employment under completely free market prices of both input as shown in (Table 4).

As presented in (Table, 5) Under the shadow (border price) of rice and opportunity cost of human labor in the rice activity in 2001 cannot afford more employment activity for human labor, because its economic efficiency would be about 0.6 instead of 0.96 at current prices, i.ee. it decreased by 40%, i.e. human labor intensity on farms should be decreased. The free price policies would increase the machinery economic efficiency by 13%, i.e. from about 2.3 to about 2.6, implied to intensify more machinery work at the expense of human labor. The estimated least cost combination of both labor substitutes would confirm that in the following section.

4.6 The least Cost Combination of Human and Machinery labor:

Table (6) presented the estimation of the least cost combination of both human and machinery labor per feddan of rice. These estimates were derived from the Isoquant and Isoclines' functions for the two production functions of rice crop, (equations 7 and 8, respectively). The least cost combinations to maximize income were compared with the existing combination over the two successive periods (1987 and 2001), under current prices as well as under shadow prices scenario of the year 2001. The results showed that there was a big waste in existing employment of human labor. Under current price policies there were excess or surplus in human labor employment of about one-half and under shadow prices human labor employment should be decreased by two-thirds.

5 Conclusion and Policy Implications

This study provided evidences that the growth in production and maximization of income depends upon physical and biological technologies (new varieties, fertilizers and mechanization of farm operations) had negative impacts upon agricultural human-labor in Egypt. Application of the statistical inference tests on the time trend of real-life statistics, showed that the employment of human labor has decreased by more than one-fourth due to mainly mechanization of most of farming operations, the implementation of the economic reform program and price liberalization policies, over the last three decades. The normative approach analysis for rice crop, using the production function model to maximize farm income, showed that the optimum allocation of inputs for rice production implies to decrease the human labor use on farms under current price levels by one-half and by two-thirds under the shadow prices of inputs and outputs.

The results derived from the rice model, as the main summer crop could also be applied for wheat the main winter crop in Egypt as both crops are cereals. Both crops occupied most of Egyptian agricultural cropped area. Therefore, the Egyptian agricultural sector cannot provide a wide scope employment opportunity for rural human labor. To reach a maximum income from cropped area much less labor intensity of human labor should be used,

To recover the negative impacts of applying the modern technological packages, associating with market liberalization policies, implies application of an integrated rural development program to generate feasible employment opportunities for the expected excess agriculture human labor. These opportunities should be a combination of establishment of either agricultural related industries and/or nonagricultural small industries in rural towns. These programs would provide feasible allocation of rural labor that in turn, raises farm household income. Higher household income would provide opportunities for more self-investment in agricultural activities which requires further studies.

Table (1): Percentage of farms With and Without Mechanized Farming

Year	1987		2001		Calc. Chi. Square
Farm Operation	With	Without	With	Without	
Land Preparation	75.61%	24.39%	100%	0.0%	25.25*
Cultivation	10.16%	89.84%	22.73%	77.27%	4.87*
Weeding	13.01%	86.99%	12.73%	87.27%	0.022ns
Irrigation	99%	1%	100%	0.0%	0. 25ns
Harvesting	22.76%	77.24%	36/82%	63.18%	4.08*
Transportation	14.84%	85.16%	100%	0.0%	144.85*

*= Statistically Significant at 5%, ns = Not Statistically Significant
Source: Compiled and Calculated from: the two Sample Surveys Data

Table (2) Inputs and Output Density Per Feddan of Rice in 1987 and 2001

Average/Feddan	1987	2001	Cal. T Ratio
Seeds in Kg	83.81	85.56	0.28 ns
Super Phosphate fertilizer	13.78	137.7	9.33*
Urea fertilizer in Kg	64.47	91.04	4.22*
Potassium Sulfate Fertilizer in kg	103.17	179.4	4.08*
Human labor in Man- Day	45.06	**33.67**	2.99*
Machinery Labor in Hours	12.9	17.63	12.11ns.
Animal Work in Days	8.69	**3.45**	2.97*
Rice Grains Yield in Tons	2.38	2.89	0.72ns
Rice Straw Yield in Tons	1.16	1.53	1.5ns

* = Statistically Significant at 5%, n.s. = Not Statistically Significant
Source: Compiled and Calculated from: the two Sample Surveys Data

Table (3) Estimation of Rice Production Function

Variable	Variable symbol	Period	Estimate	SE of Estimate	Cal. t Ratio
Constant	X_0	1987	0.05	0.011	4.40**
	X_0	2001	0.15	0.041	3.61**
Human Labor (Man- Hour)	X_1	1987	0.4	0.0.08	4.46**
	X_1	2001	0.08	0.026	3.02**
Machinery labor (Horse Power)	X_2	1987	0.19	0.05	3.72**
	X_2	2001	0.25	0.086	2.91**
Animal Work (Horse Power)	X_3	1987	0.09	0.04	2.34**
	X_3	2001	0.002	0.07	0.02ns
Nitrogen Fertilizer. (Effective Substance of Nitrogen)	X_4	1987	0.25	0.09	2.67**
	X_4	2001	0.27	0.082	3.29**
Crop Area (feddan =4200m^2)	X_5	1987	0.001	0.2	0.005ns
	X_5	2001	0.11	0.035	3.11**

R2 = 0.78 for estimated function in 1987 and R2 = 0.85 for estimated function in 2001
(**) = Statistically Significant at P< 0.01.
Source: Compiled and Calculated from: the two Sample Surveys Data

Table (4) Price per Unit of inputs and output in USD

Average Price/ unit	1987	2001	
	Current price	Current price	Shadow Price
Labor Wage/ Man- hour	0.18	0.24	0.71
Machinery Rent/ hour	1.03	1.98	2.18
Ton of Grains (Farm price)	119.36	205.21	358.97

Source: Compiled and Estimated from the Sample Survey Data

Table (5): Economic Efficiency of Human and Machinery Labor (marginal return/ USD Spent on an input)

Year	Price Level	Human labor	Machinery labor
1987	Current Price	2.07	1.63
2001	Current Price	0.96	2.27
	Shadow Price	0.58	2.56

Table (6): The least cost combination of Human and machinery Labor per feddan versus the existing combination.

Input	**Man-Day**		**Machinery-hours**	
Year	**1987**	**2001**	**1987**	**2001**
Existing Combination	45.06	33.67	12.6	17.63
Least cost Combination at market Prices	35.4	24.91	19.6	19.12
Least cost Combination at Shadow Prices		12.1		23.23

Source: Compiled and Estimated from the Sample Survey Data

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