A Regression Model on Urban Migration and Agricultural Labour Force in India from 2012 to 2022 and the Impact on Rural Sector

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Abstract: The objective of the study is to find the importance of increasing Socio-economic development in rural areas of India. Data reveal that urban migration has reduced even the agricultural labour force in the rural sector. The share of rural economy has been falling. Rural people have been facing challenges because of low income, low standard of living and inadequate job opportunities. The urban migration is increasing.

Rural areas have been brought under some important Government projects. But there exist challenges related to basic services like medical, education and recreation too. Real developmental gap between the rural and urban areas has been widening.

Excessive migration to-wards urban areas should be checked. For this necessary infrastructure support is desirable in rural areas. Investment opportunities including non-agricultural sectors are important. This will reduce the existing gap in development and thereby migratory trends will move backwards.

Aim of the Study:

Under the above circumstances, certain features have already cropped up which may call for the necessity of rural socio-economic infrastructural issues as an imperative for reducing the gap between the rural and urban economies. The primary aim is to highlight the importance of using the resources in the rural economy in order to ensure balanced development across the sectors concerned.

Methodology:

The study deals with statistical data, regression calculation, diagram, calculation of Standard Error and that for accepting the model (hypothesis testing). Data have been collected from published sources. As for symbolized residual, ϵ (epsilon) has been mentioned ($\epsilon = y-\hat{y}$) to show the difference between the dependent variable (Y) and predicted value ($\hat{y}$) from the regression model. The negatively slopped regression line shows a decline in y-values, while x-values are increasing.

Hypothesis:

Migration of labour force from Agricultural sector has resulted socio-economic challenges for the rural sector in India.

Drawback of the study:

The matters under consideration are based on the availability of statistical data. However current data for sub-sectors under the Indian agriculture sector are somewhat lacking, in the study. So there may be a gap related to data. Besides, the detailed information in respect of the reasons of urban migration is also lacking in the study. Thus micro level impacts were not studied.

I. INTRODUCTION

Urban migration is a complex matter for it depends on various factors such as socio-economic, natural calamities or even community conflicts, clashes and so on [1]. The heterogeneity of reasons of migration may also affect differently depending upon the time and space.

II. LITERATURE REVIEW:

Earlier studies such as the Lewis model (1954), showed rural-to-urban migration as a transitional aspect transferring surplus labour sector to modern industrial sector in urban areas [2]. In a seminal paper Ranis and Fei (1961) contributed in a model of urban migration also as the movement of surplus labour from rural to urban sector, 'emphasizing the interconnectedness' between the said two sectors [3]. A new approach the Harris – Todaro model of migration in 1970 showed that income differentials between the rural and urban sectors have created the pull forces emanating from the urban sector[4]. Modern approach on urban migration in developing countries focuses on the complex interplay of economic, social and political factors which push people to move towards the urban sector from the rural sector[5]. In India the rural population had been declining since 1981-91 while it was increasing in urban areas [6] during the same period. However, number of urban areas (towns, statutory towns and census towns) increased [7]. And urban population increased at a slightly higher in number compared to that in rural areas (91 million and 90.4 million respectively) during 2001-11 census period [8]. However in 2024 nearly 35%-37% of Indian population lived in urban areas and the remaining (nearly 64%) lived in rural areas [9]. The spurt in the growth of urban population during 2001-11

was said to be 'due to migration, natural increase as well as inclusion of new area s under urban' [10]. However, urbanization rate was slightly lower and the there was a rise in agricultural labour force during covid-19 (Table-1)

Available data [11] show the degree of urbanization and distribution of working force (in percentage) across the economic sectors in India. Here is an attempt to exercise a regression model using least square method from 2012 to 2022[12]. Percentage of urbanization and that for the workforce in agricultural sector in India have been used for this model (Table-1).

➤ *The Regression Model:*

The model is an attempt to show the decline in percentages of agricultural labour force while urbanization (urban migration) has increased from 2012 to 2022 in India. The least square [13][14] method shows the trend line with the following equation.

$$Y = a + bx + \epsilon,$$

where a is the y intercept, b is the Slope and ϵ(epsilon) is a random variable [15]

➤ *Assumptions:*

- Agricultural labour force means all labourers engaged in cultivation, fishery, forestry sectors.
- Urbanization means an increase in the number of population in the urban areas,
- Urbanization increased because of increasing urban migration including agricultural labour force.

Table 1 Degree of urbanization and agricultural lab force

Year	Urban Population	Agricultural Lab Force	
	(x)	(Y)	
2012	31.16	47.09	Σx = 369.79
2013	32.00	46.20	Σy = 481.88
2014	32.38	45.24	
2015	32.78	44.27	x̄ = 33.62
2016	33.18	43.24	ȳ = 43.80
2017	33.60	42.27	
2018	34.03	41.30	
2019	34.47	40.65	
2020	34.93	44.68	
2021	35.39	44.08	
2022	35.87	42.86	

Data Source: Statista, 30May 2025
Wikipedia: (for 2012)

$\Sigma x^2 = 12453.25$

$\Sigma y^2 = 21149.29$

$\Sigma xy = 16181.43$, n=11

$y = a + bx$

$$b = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

$$= \frac{(11 \times 16181.43) - 369.79 \times 481.88}{(11 \times 12453.25) - (369.79)^2}$$

$$= \frac{177995.73 - 178194.40}{136985.75 - 136744.64}$$

$$= \frac{-198.67}{241.11}$$

$$= -0.82$$

$$a = \bar{y} - b\bar{x}$$

$$= 43.80 – (–0.82) \times 33.62$$

$$= 43.80 + 27.57$$

$$= 71.37$$

$$\hat{y} = a + bx, \text{ in this case, } b = -0.82$$

The equation may be written as,

$$\hat{y} = 71.37 – (–0.82)x$$

$$\text{or } –0.82x + 71.37$$

The result, the slope (- 0.82) shows that for every unit increase or additional point, the average number of work force in agricultural sector declined by (-)0.82 point.[16][17][18] This means that the decline in work force in agricultural sector is closely related to the growth of urbanization rate.

Let's show the geometric concept. For estimating $\hat{y} = - 0.82x + 71.37$, we may take x=31.16, $\hat{y}$ (the expected labour force) = 45.82. The mean of y value, $\bar{y}$, to estimate the observed value of y from the mean, it would be 3.29(=y- $\bar{y}$),

Now of the deviation

$$\hat{y} - \bar{y} = 45.82\text{-}43.80 = 2.02(\text{explained})$$

$$\underline{y\text{-} \hat{y} = 47.09\text{-}45.82 = 1.27 \text{ (unexplained)}}$$
$$\text{Total} \qquad 3.29$$

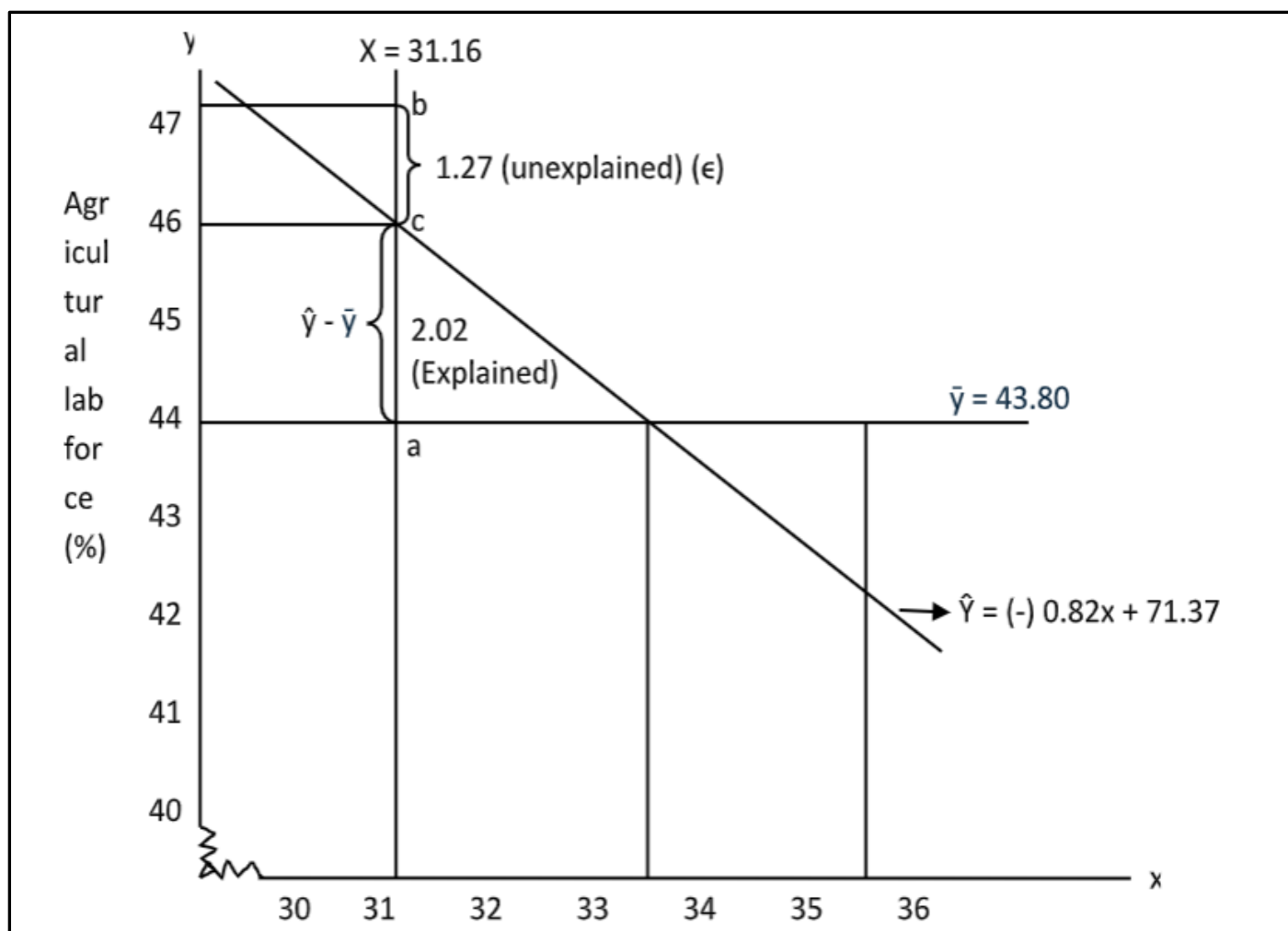That is $\frac{2.02}{3.29} = 0.61.40$ explained and 1-0.61.40=38.60 unexplained

Fig 1 Urban Population

Fig 1 shows that labour force in agricultural sector has declined with the rise in urban migration. This means a negative impact on agricultural labour force because of urban growth over time.

➢ *Calculation of Standard Error:*

$$\hat{Y} = -0.82x + 71.37$$

Table 2 Calculation of Standard Error

Error	
Y- Ŷ	**(Y- Ŷ)²**
47.09 – 45.82 = +1.27	1.61
46.20 – 45.13 = +1.07	1.14
45.24 – 44.81 = +0.43	0.18
44.27 – 44.49 = -0.22	0.05
43.24 – 44.16 = -0.92	0.84
42.27 – 43.82 = -1.55	2.40
41.30 – 43.46 = -2.16	4.66
40.65 – 43.10 = -2.45	6.00
44.68 – 42.72 = +1.96	3.84
44.08 – 42.35 = +1.73	2.99
42.86 – 41.96 = +0.90	0.81
	24.52

S_b = Standard error of a coefficient which tells, how precisely the estimated value of a specific coefficient is measured.

$$S_b = \frac{S_e}{\sqrt{\Sigma x^2 - n\bar{x}^2}}$$

$$= \frac{1.65}{\sqrt{12453.25 - 11 \times 1130.30}}$$

$$= \frac{1.65}{\sqrt{12453.25 - 12433.30}}$$

$$= \frac{1.65}{\sqrt{19.95}}$$

$$= \frac{1.65}{4.46}$$

$$= 0.37$$

Where $\Sigma x^2 = 12453.25$

n=11, $\bar{x}^2 = 1130.30$

$$S_e = \sqrt{\frac{\Sigma(y - \hat{Y})^2}{n-2}}$$

$$= \sqrt{\frac{24.52}{9}}$$

$$= \sqrt{2.72}$$

$$= 1.65$$

Where $\Sigma x^2 = 12453.25$

n=11, $\bar{x}^2 = 1130.30$

➢ *Accepting the Model:*
The random variable b is a normal distribution with mean B.

An estimate of V(*b*) is given by,

Therefore, $\frac{b-B}{S_b}$ is a t distribution with (*n*-2) degree of freedom

H₀ : B = 0   (There is no linear relationship)

H₁ : B < 0   (There is a negative relationship)

At α = 5% the rejection is t₉ > 1.83

$$\frac{b-B}{0.37} = \frac{1.65}{0.37} = 4.45 \geq 1.83$$

Therefore, we reject the H₀. There is a negative relationship. The model is accepted. Result shows for one unit increase in urban growth there is (-) 0.82 fall in agricultural labour force.

➢ *Challenges Before Rural Sector:*
As the investment opportunities were localized in the urban areas followed by rapid growth thereof, the rural areas gradually faced challenges to keep pace with the urban areas. This fact generated urban migration among the labour force from the agricultural sector. It may be evident that labourers engaged in different jobs, skilled, unskilled even day labourers migrated to urban areas. The list of migrants is perhaps large and comprised business class, artisans, educated youths, middle class families, daily workers and even retired persons. Some workers left their family jobs and acclamatised in the new job market in urban sectors. Falling sizes of both labour and commodity markets are very likely to affect the rural economic growth. However, all these depend on the environmental factors of the village locality concerned in the whole country.

Various studies reveal that rural areas face challenges in respect of poverty, unemployment and agrarian distress.[19,20,21]. The GVA (Gross Value Added) in rural areas has reduced shaply from 56% in FY 1994 to 40% in FY 2022. In turn, this has increased from 44% to 60% in urban

areas during the same period.[22] Secondly, growth of agro-output is uneven and averaging only 3.43%, while it was 7.9% and continuous in trade sector (mostly localized in urban areas) during 2011-12 to 2022-23.[23] Thirdly, the standard of living is low in rural areas because of differences in percapita income and consumption pattern (MPCE) from the urban areas.[24,25] Rate of increase in income is also higher in urban areas.[26,27] Perhaps the greatest challenge is the increasing dependency on urban areas for social infrastructures (medical, education and entertainment). India is mostly rural because only 3.1% of land area belongs to urban aggromeration with 36% of her population.[28] This implies almost 97% of land belongs to rural sector with 64% of population. The disparity between these two sectors may be a big challenge to the nation.

Major government projects for rural development include MGNREGA, PMay-G, PMGSY along with so many other projects.[29,30] But the challenges are big enough which may call for socio-economic development in Indian rural sector.[31] This is necessary for reducing the excessive dependency on urban sector.

III. CONCLUSION

Urban migration can be attributed to the pull forces from urban sector and push forces from the rural sector. The former sector is known for high rate of socio-economic growth, while the latter is facing challenges for increasing gap from the urban sector. It is perhaps necessary to reduce the gap. It appears that if there is transformation of socio-economic activities in rural sector, there may develop value judgment among the probable migrants.

Alternative job opportunity in rural sector can be opened up. This will reduce the propensity for migration and ultimately the challenges in rural economy may largely be met successfully.

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