HOW CITIES IN INDIA CAN ATTRACT MORE RURAL POPULATION?

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Abstract
The low level of rural to urban migration needs to boost up for a higher rate of urbanization and economic development in India. In this paper, we use cross-section data models to investigate the relevant determinants of rural to urban migration at the city level in India in 2001. City-level analyses show that employment opportunities and availability of infrastructure facilities pull people from rural areas to urban areas; however, a higher level of living cost, poverty, and inequality discourage migration. India's abundant rural resources such as land and labor need to reallocate to the urban areas to increase productivity and economic growth. In this context, we suggest that management of poverty, inequality, job creation, provision of better infrastructural facilities are essential at the city level to promoting rural to urban migration in India.
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1. Introduction

A developing country such as India is going a huge transformation from rural-based economy to industry and service-based urban economy. However, India's urbanization rate though increasing but it is slower than other developed countries such as United States, United Kingdom, the Netherlands, etc. The urbanization rate in India is slower than in other developing countries such as China, Brazil, and the Russian Federation. After independence, the rate of urbanization began to rise continuously; the urban population in India was 17.97 percent in 1961, which increased to 31.16 percent in 2011. Growing urbanization has helped the country to achieve higher economic growth (Tripathi, 2013; Tripathi and Mahey, 2017), which means urbanization is the engine of economic growth in India. In India, the urban population increases due to mainly the natural growth of population which has contributed about 43.8 percent from 2001 to 2011. The rural to urban migration has contributed about 21 percent during the same period. Among the cities, the migrant population in Mumbai was 17.32 percent, 13.82 percent in Delhi, 8.84 percent Kolkata, 4.88 percent in Chennai, and 4.85 percent in Hyderabad, which is quite higher than other million-plus cities in 2001, on a timescale of 10 years and more. This shows that the contribution of rural to urban migration to urbanization in India is very low.

In this backdrop, we try to understand the factors that contribute to rural to urban migration at the city levels in India. We consider large cities, as per the 2001 Census. There are several reasons for the selection of such large cities (750,000 or more inhabitants) as the units of analysis. First, because of the unavailability of city-specific data for a large number of variables used in this study (e.g., city income data), the city district (where the sample city is located) is used as a proxy for the city.[1] Larger cities are a good proxy for a city district as they cover a larger part of a district than the smaller cities. Second, as India's urbanization (i.e., the share of urban population) is mainly centered around Class I cities (population more than 1 lakh). We source data from the Census of India and National Sample Surveys (NSS) conducted by the Government of India. We find that city-level job opportunities,

[1] However, NSS data does not provide information about what proportion of city districts are made up of the cities themselves.

infrastructure facilities, and economic conditions matter for pulling rural people to a large city.

The structure of the paper as follows. The second section highlights the brief review of literature. The third section highlights the empirical framework and estimated results. The fourth section, the conclusions, provides a summary and it suggests the policy implications drawn from the results in section three.

2. Brief review of literature

Various economic theories institute that structural change is an unavoidable component of economic growth. In the Lewis (1954) model, both internal and external agglomeration economies are generated due to structural changes that occur through shifting of the labor force from primitive agriculture sector to manufacturing which triggers growth by generating an investible surplus. Harris and Todaro (1970) described rural-urban migration as a function of income differential adjusted for the probability of finding a job. Harris and Todaro (1970) explained the phenomenon of accelerating rural-urban labor migration despite the existence of positive marginal products in agriculture and significant levels of urban unemployment. Empirical literature such as McCatty (2004) argued that rural to urban migration in developing countries depends on job opportunities, education, medical facilities, high per capita income, transport facilities, and high living standard. Haurin's (1980) model explained that climatic differences with improved area matter for migration. Issah et al. (2005) found that infrastructure matters for migration decisions.

In the context of India, Mitra and Murayama (2009) found that the intrastate migration rate is much higher in magnitude than the interstate migration rate in India. The social and cultural differences in India stand as a major limitation to population mobility. Banerjee (1986) argued that the underlying objective of migration is to maximize the family rather than individual welfares. Bird and Deshingkar (2009) found that circular migration rates are high in remote rural areas, particularly among the chronically poor in India. Chauvin et al. (2017) argued that India's rural-urban migration is limited by strong place-based preferences such as those related to cast-based social networks in India. Moscona (2017) and Jacob (2012) confirmed that the green revolution has adversely affected India's rural to urban migration. Ahuja et al. (2011) found that the National Rural Employment Guarantee Act, 2005 which was launched to create more rural employment could not able to check the rural migration.

Sridhar et al. (2013) argued that an increasing level of education of the migrants acts as the main pull factor for migration in Bengaluru. Banerjee (1984) found that one-half of the surveyed migrants had moved to Delhi after lining up specific jobs. Mitra's (2017) study confirmed that with an increase in the city size, the migration rate rises mainly because employment prospects are better in large cities due to agglomeration effects. Agasty and Patra (2013) stated that migration is mainly based on the lower-income opportunities of the rural worker. It also depends on the debt, poor access to credit, declining access to common property resources, or commodity price crashes [Deshingkar, 2003]. Banerjee and Kanbur (1981) found that migration tends to rise first and then falls as rural income rises. Akram (2015) argued that an increase in per capita Net State Domestic Product tends to decrease the number of out-migrants from the rural areas of that state. Bhagat's (2014) study stated that migrants are more vulnerable and subject to various kinds of exclusions in urban areas.

The above review of literature suggests that though we have a good number of migration studies, however what factors attract city level rural to urban migration are not known. In this paper, we try to fill this gap.

3. Empirical Framework and Results of the Estimation of Determinants: city level

To empirically investigate the determinants of rural to urban migration in large cities in India, the following Ordinary Least Square (OLS) regression model is used for estimation:

$$\text{Migrant} = \alpha_0 + \sum_{i=1}^{19} \alpha_i X_i + \epsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Here, the dependent variable "Migrant" in equation (1) has two different forms: first, it is measured by percentage of rural to urban migration in large cities in India and second, it is

measured in terms of the total number of rural to urban migrants. City-specific percentage migration is defined by the total number of migrants from India's rural areas to a particular city with duration of residency from less than one year to more than 10 years divided by the total population of that city. On the other hand, the total number of migrants from India's rural areas to a particular city with duration of residency from less than one year to more than 10 years is measured as the total number of rural to urban migrants. X_is are independent variables. Based on the review of literature in Section 2, we mainly consider four types of independent variables: employment opportunities, infrastructure availability, economic conditions, and favorable climate. Most of the variables are considered according to availability of data. Based on Palei (2015) and Tripathi (2018), school, colleges, universities, and hospitals are considered as low-level capital-intensive institutional infrastructure. All these factors pull people from rural areas to urban areas. It considers the arguments in support of the proposition that rural to urban migration is a necessary part of the development process and does not necessarily have to result in an adverse impact on rural areas. It is relevant to investigate the pull factors in India rather than the push factors as several policies such as NREGA have tried to hold people in the rural areas rather than inducing them to go to the urban areas.

Cities with 750,000 or more inhabitants are defined as large cities. The report "World Urbanization Prospects: The 2018 Revision" indicates that there are about 61 cities in India in 2010 having this population. However, due to limitation in data availability, we only consider 51 cities for the regression analysis. To measure city-level employment, we consider self-employment, casual workers, and regular wage/salaried employed persons separately for male and female.[2] We use unit- and individual-level NSS data of the 61st Round survey on employment and unemployment situation in India in 2004–05.[3] We expect that better employment opportunities pull excess laborers from rural areas to urban areas. The economic level is measured by per capita income, monthly per capita expenditure, tax and revenue receipt from municipal properties, poverty, and inequality. We consider that better economic conditions attract more rural people to urban areas. The NSS 61st Round survey on consumption expenditure in 2004–05 data is used to measure city-level monthly per capita expenditure, poverty, and inequality. However, as city-specific poverty lines are not available, we use the state-level poverty line to calculate city-level poverty. Chaudhuri and Gupta (2009) also used the state-level poverty line to measure the district-level poverty in India. To measure the effect of infrastructure on rural to urban migration, we consider education facilities measured by colleges and universities, health facilities, electricity connections, and nearest distance to railway stations from the census of India. Finally, average city rainfall and city-wise temperature differences are used to measure the impact of climate on rural to urban migration. We expect a positive effect of climate on rural–urban migration.

Table 1 Description of data used in the regression equation

Variables	Mean	Standard deviation	Mini-mum	Maxi-mum	Coefficient of variation
Dependent variables					
Percentage of rural to urban migration in 2001 (prum)	18.6	12.2	2.7	47.4	65.59
Total number of rural to urban migrants (trum) (in thousands)	383.1	794.9	25.7	4651.5	207.49
Independent variables					
City-wise total self-employed male in 2004–05 (selfm)	328.4	94.6	188.8	615.8	28.81
City-wise self-employed female in 2004–05 (selff)	91.0	71.8	7.4	348.2	78.90

[2]All the definitions of the different class of laborers are followed from NSS.

[3]Though, 55th round for 1999–2000 is available but only this particular round uses different methodology (recall periods) and creates the problem of comparison with other rounds of survey. Also district-level estimations are more reliable only after the 61st Round of NSS survey, which has a different sample survey design. Therefore, we consider NSS 61st Round survey on consumer expenditure in 2004–05.

Variables	Mean	Standard deviation	Mini-mum	Maxi-mum	Coefficient of variation
City-wise total regular wage/salaried employed male in 2004–05 (regularm)	314.05	85.71	132.70	483.90	27.29
City-wise total regular wage/ salaried employed female in 2004–05 (regularf)	82.79	47.26	2.00	196	57.08
City-wise total casual worker male in 2004–05 (casualm)	104.3	60.4	9.3	300.9	57.91
City-wise total casual worker female in 2004–05 (casualf)	37.01	36.10	0.00	138.70	97.54
Level of inequality in 2004–05 (Gini)	0.3	0.1	0.1	0.6	33.33
Per capita city output in 2001, in Indian rupees (ddp)	16597.8	7614.6	797.2	38412.6	45.88
City-wise monthly per capita consumption expenditure in Indian Rupees (mpce)	1471.46	442.64	801.82	2610.36	30.08
City-wise percentage of poverty headcount ratio in 2004–05 (fgt0)	12.2	12.5	0.2	57.8	102.46
City-wise percentage of squared poverty headcount ration in 2004–05 (fgt1)	2.3	3.1	0.0	16.1	134.78
Road distance to railway station from the city in 2001, in kilometers (rail dist)	0.4	1.4	0.0	8.0	350.00
City-wise total number of universities in 2001 (univ)	1.1	1.2	0.0	5.0	109.09
City-wise total number of medical facilities in 2001 (medi)	187.4	213.8	2.0	781.0	114.09
City-wise total number of colleges (ctc) in 2001	41.5	49.0	1.0	195.0	118.07
City-wise total number of electricity connections in 2001 (elect) (in thousands)	461.4	1222.2	0.0	8560.3	264.89
City-wise total receipt through taxes and revenue derived from municipal properties, in lakhs of Indian rupees (trmp) in 2001	14.9	53.2	0.0	380	357.05
City-wise average rain fall in 2001 (rain)	1075.3	570.2	266.0	3053.0	53.03
City-wise temperature differences in millimeter (temp)	20.78	11.00	7.00	43.00	52.94

Source: Author's calculation based on 51 observations/cities.

Appendix Table A1 lists all the cities that are considered for the study. Summarized in Appendix Table A2 are the descriptions, measurements, and data sources of all the variables used in estimation of OLS regression of equation (1). Table 1 explains the means, standard deviations, minimum, maximum, and coefficient of variation (CV) values for the variables used for regression analysis. Most importantly, the CV aims to describe the dispersion of the variables in a way that does not depend on the variable's measurement unit. The higher values of CV for the railway station distance from the city and the total number of electricity connections indicate a greater dispersion in these variables. On the other hand, city-level inequality, city-wise monthly per capita expenditure, and city-wise total number of self-employed males show a lower dispersion in these variables. Table 2 presents the row correlation coefficients. The estimated values of correlation coefficients quantify the direction and strength of the linear association between the variables. The results show that the percentage of rural to urban migration has a higher positive correlation with self-employed females, casual employed females, and total rural to urban migration. On the other hand, it has a negative association with self-employed males, level of inequality, and poverty headcount ratio. It also shows that collinearities among the independent variables are not very high, which is required for proper regression estimation.

Table 3 presents the estimated regression results from equation (1). Regression 1 reports the full model where all the independent variables for OLS estimation are considered. On the other hand, regression models 2–5 represent the parsimonious model by excluding the explanatory variables that did not show statistically significant results due to collinearity of independent variables. Regression models 1–5 consider the robust standard errors (to control for heteroskedasticity).

The significant values of F statistics for regressions 1–5 indicate that the overall model is statistically significant. The higher values of R^2 indicate that regressions 1–4 explain a good percentage of total variation in the dependent variable. The study has also calculated the adjusted R^2, as it adjusts for the number of explanatory terms in a model, i.e., it incorporates

the model's degrees of freedom. The multicollinearity problem does not seem to be troublesome, as the mean variance inflation factors (VIF) values do not exceed 10 for regressions 1–5. Regression results are also free from omitted-variables bias as Ramsey RESET test show the satisfactory results. The p-values of Ramsey RESET test are higher than the usual threshold of 0.05 (95 percent level of significance); therefore, we fail to reject the null hypothesis and conclude that we do not need more variables to explain the determinants of rural to urban migration at the city level.

Table 2 Correlation coefficient of determinants of rural to urban migration in large cities in India

	prum	trum	selfm	self	Gini	rail dist	elect	univ	casualm	ddp	fgt0	fgt1	medi	rain	trmp	ctc	regular	regularf	casualf	temp	mpce
prum	1.00																				
trum	0.39	1.00																			
selfm	-0.16	-0.09	1.00																		
selff	0.33	0.16	0.54	1.00																	
Gini	-0.23	0.08	-0.20	-0.09	1.00																
rail dist	0.03	-0.03	-0.04	-0.22	-0.04	1.00															
elect	0.15	-0.05	-0.16	-0.21	-0.16	-0.07	1.00														
univ	-0.14	-0.15	-0.05	-0.04	-0.06	-0.23	0.11	1.00													
casualm	0.09	0.20	-0.26	0.03	-0.14	-0.19	0.22	0.24	1.00												
ddp	0.04	-0.03	-0.28	-0.22	0.01	-0.01	-0.07	-0.12	-0.03	1.00											
fgt0	-0.11	0.08	-0.10	-0.08	0.17	-0.06	-0.07	-0.13	0.28	-0.18	1.00										
fgt1	-0.05	0.08	-0.18	-0.09	0.15	0.06	-0.05	-0.15	0.30	-0.12	0.93	1.00									
medi	0.06	-0.03	-0.17	-0.23	-0.11	0.29	0.10	0.02	0.04	0.22	-0.08	0.01	1.00								
rain	0.03	-0.19	-0.09	-0.19	0.10	0.06	-0.03	-0.03	-0.21	-0.03	-0.15	-0.14	0.03	1.00							
trmp	0.08	-0.03	0.08	-0.08	-0.16	-0.07	0.27	0.13	0.06	-0.01	-0.06	-0.08	0.32	0.26	1.00						
ctc	-0.03	-0.08	-0.11	-0.19	-0.13	-0.11	0.61	0.17	0.19	0.11	0.02	0.04	0.48	0.04	0.50	1.00					
regularm	0.10	-0.09	-0.51	-0.30	0.21	-0.11	-0.18	-0.05	-0.40	0.42	-0.23	-0.20	0.07	0.26	0.00	-0.09	1.00				
regularf	0.17	0.28	-0.50	-0.22	0.08	-0.20	-0.03	-0.06	0.03	0.54	-0.28	-0.23	-0.05	0.10	0.05	-0.09	0.56	1.00			
casualf	0.30	0.25	0.04	0.39	-0.06	-0.14	0.09	0.08	0.43	-0.21	0.29	0.31	-0.19	-0.06	0.01	-0.07	-0.33	0.02	1.00		
temp	-0.14	-0.07	0.07	0.00	-0.02	-0.01	-0.10	-0.06	0.04	-0.24	0.23	0.15	-0.28	-0.20	-0.17	-0.18	-0.15	-0.22	0.08	1.00	
mpce	-0.02	0.02	-0.13	0.03	0.43	-0.09	-0.07	-0.04	-0.15	0.29	-0.52	-0.49	0.02	0.08	-0.03	-0.11	0.40	0.37	-0.16	-0.21	1.00

Note: See Table 1 for variable definitions. The correlation coefficients are based on 51 observations.

Source: Author

Regressions 1–5 show that better employment opportunities in a city promote higher rural to urban migrations. Regression 1 shows that city-wise total self-employed males have a negative impact on the percentage of rural to urban migration. In particular, a 100 percent increase in city-wise total of self-employed males decreases rural to urban migration by 6 percentage points. However, city-wise total of self-employed females has a positive impact on the percentage of rural to urban migration. This indicates that cities having a higher number of self-employed females attract higher rural to urban migration whereas cities having a higher percentage of self-employed males discourage rural to urban migration. It may be the case that if women have the chance to make them self-employed in the city, more women from rural households may migrate to urban areas to earn more. The possible increases in income of the households make rural to urban migration easier and attractive. But, in case the male workers from rural areas want to be self-employed, they may not choose to migrate from rural to urban areas. Regressions 2–5 show that city-wise regular wage/salaried employed males, regular wage/salaried employed females, casual male workers, and casual female workers have a positive and statistically significant effect on the volume of rural to urban migration. For instance, in regression 4, a 100 percent increase in city-wise total of regular wage/salaried employed males leads to a 5 percent increase in the percentage of rural to urban migration. This clearly indicates that the job opportunity in the city acts as a magnet to pull rural people into urban areas. Therefore, cities need to provide a higher number of regular jobs in the formal sector and casual work to attract a higher level of rural to urban migration. The results support the findings of Iversen (2006), McCatty (2004), and Banerjee (1984).

When economic conditions of the cities are taken into account, the results from regressions 1 to 5 indicate that they have an adverse effect on the percentage of rural to urban migration. The city-wise per capita income does not have any statistically significant effect on the volume of rural to urban migration. Regression 4 shows that city-wise monthly per capita consumption expenditure has a statistically significant (at a 10 percent level) negative effect on the percentage of rural to urban migration. This means that if a city has higher monthly per capita expenditure (i.e., richer city), it discourages rural to urban migration. It therefore indicates that a richer city may be more expensive for a person to migrate from a rural to an urban area. It is very tough to manage daily essential expenditure, housing rent, and other

expenditures by migrant people in the richer city. The estimated result does not support the findings of Arzaghi and Rupasingha (2013).

Table 3: Determinants of rural to urban migration in large cities in India

Independent variables	Dependent variable: Percentage of Rural to Urban Migration						Log of Total Migrants from Rural to Urban
	OLS					IV	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employment opportunities						
City-wise total no. of self-employed male	-0.064**					-0.0651***	-0.00572***
	(0.026)					(0.0194)	(0.00187)
City-wise self-employed female	0.122**		0.084***	0.0739**		0.113***	0.00534*
	(0.0489)		(0.027)	(0.0332)		(0.0388)	(0.00314)
City-wise regular wage/ salaried employed male	0.0182	0.0388		0.0529*			
	(0.0337)	(0.0267)		(0.0280)			
City-wise regular wage/ salaried employed female			0.086**				
			(0.033)				
City-wise casual male worker	-0.0009			0.0503*			
	(0.0346)			(0.0269)			
City-wise casual female worker		0.122**					
		(0.0460)					
	Economic conditions						
City-wise level of inequality	-21.77	-31.68**					-0.803
	(22.82)	(12.26)					(1.559)
City-wise per capita output	0.867	-0.0182					-0.209
	(2.322)	(1.817)					(0.192)
City-wise per capita monthly consumption expenditure	-0.00399		-0.00485	-0.0068*			
	(0.00517)		(0.00454)	(0.0039)			
City-wise poverty headcount ratio	0.0570		-0.162	-0.172	-0.478*		0.000665
	(0.341)		(0.400)	(0.154)	(0.283)		(0.0162)
City-wise squared poverty headcount ration	-0.437		0.659		1.673		
	(1.482)		(1.631)		(1.406)		
Road distance to nearest railway station from a city	0.901					1.489**	0.0538
	(1.061)					(0.658)	(0.0818)
	Infrastructure availabilities						
City-wise total number of universities	-1.458				-1.535		-0.255**
	(1.325)				(1.708)		(0.115)
City-wise total number of medical facilities	0.00732		0.0162*				
	(0.0100)		(0.00917)				
City-wise total number of colleges	-0.078**	-0.0417	-0.077**		-0.061*	-0.0504**	
	(0.032)	(0.0278)	(0.037)		(0.035)	(0.0236)	
City-wise total number of electricity connections	0.357***	0.206***	0.401***		0.255***	0.233**	0.0008
	(0.110)	(0.067)	(0.0818)		(0.062)	(0.0967)	(0.007)
City-wise total receipt through taxes and revenue derived from municipal properties	0.036**					0.0484***	
	(0.016)					(0.00786)	
	Favorable climate						
City-wise average rain fall	0.0016	-0.0002		0.0014			
	(0.0028)	(0.002)		(0.002)			
City-wise temperature differences	-0.0574	-0.157				-0.0888	
	(0.152)	(0.147)				(0.113)	
Intercept	35.33	16.95	9.780	0.591	23.08***	31.32***	14.31***
	(23.49)	(15.15)	(9.738)	(14.30)	(3.467)	(6.325)	(1.098)
No. of observations	51	51	51	51	51	51	51
R^2	0.481	0.249	0.317	0.229	0.112	0.379	0.230
Adjusted R^2	0.2142	0.1061	0.1869	0.1243	-0.009	0.2804	0.0835
F Statistics/ Wald χ^2	7.38***	8.59***	9.81***	2.28*	6.68***	104.92***	1.99*
Mean VIF	3.26	1.36	3.47	1.38	3.64	1.47	1.27
Ramsey RESET test	1.78	0.39	1.07	2.40	0.33		0.96
	(0.17)	(0.76)	(0.37)	(0.08)	(0.80)		(0.42)

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. p-values for the null hypotheses of the Ramsey RESET tests are reported in the parentheses after the values.

Finally, the distance by road to the nearest railway station, which indicates economic potential, does not have any statistically significant effect on the percentage of rural to urban migration. The results indicate that a richer city with a higher level of poverty and inequality does not attract people from rural areas to urban areas. The estimated result does not support the findings of Haurin (1980).

Now, we assess the effect of infrastructure on the percentage of rural to urban migration. The city-wise availability of a higher number of electricity connections has a positive impact on rural to urban migration. Regression 1 shows that a 10 percent increase of total number of electricity connections in the host city increases rural to urban migration by about 3.6 percent. Regression 3 indicates that the city-wise higher number of medical facilities also attracts

people from rural to urban areas. An increase of 100 percent in the total number medical facilities leads to 1.6 percent increase in rural to urban migration. The result indicates that better infrastructure has a positive impact on rural to urban migration. However, the city-wise total number of colleges has a negative impact on the percentage of rural to urban migration, which is not expected. The city-wise number of universities also does not have any impact on rural to urban migration. This indicates that the educational facilities do not much attract people from rural areas to a large city. Or, it may be the case that we need to consider other variables to measure the educational facilities of a city. However, the city-wise total receipt through taxes and revenue derived from municipal properties has a positive effect on the percentage of rural to urban migration. This indicates that a higher amount of taxes and revenue derived from municipal properties, which is basically spent to increase the public services delivered to the city dwellers, attracts more people from rural to urban areas. Overall, the infrastructure has a positive effect on rural–urban migration. The estimated result does not support the findings of Issah et al. (2005). Finally, city-wise climatic conditions, which are measured by average rainfall and temperature differences, have no statistically significant effect on the percentage of rural to urban migration. The result does not support the findings of Haurin (1980). This could be because of the vast majority of movement to urban areas comes from geographically close rural areas (i.e., within state migration is very high), and there is very little variation in climate within a region.

Regression 7 considers the logarithm of the total number of rural to urban migrants as the dependent variable. The regression model represents the log-linear model as the dependent variable, which is assumed to be the logarithmic form. The results show that the city-wise total number of self-employed females have a positive effect and the city-wise total number of self-employed males have negative effects on the total number of rural to urban migrants. The results are consistent with the results of regressions 1–5. The city-wise number of universities has a negative and statistically significant effect on the log of total rural to urban migrants. However, economic conditions do not have any effect on the total number of rural to urban migrants. This result contradicts with the results obtained in regressions 1–5. It shows that job opportunities are more important than economic conditions of city to increase rural to urban total migration. For example, 41 percent of total rural to urban migration in Mumbai happened due to work and employment reasons in 2001.

3.1.1. Robustness check

The causality between rural to urban migration and employment (or economic conditions) is not very important as economic conditions do not have stronger effect on rural to urban migration. On the other hand, urban India has failed to create enough jobs for its increasing rural migrants. However, India's limited urban policies (e.g., JNNURM and Smart city mission) only focused on infrastructure development of the cities, so causality test is important.

A serious concern about the relationship between infrastructure facilities and the volume of rural to urban migration is the question of reverse causality. Does a higher level of infrastructure increase rural to urban migration, or, does higher rural to urban migration increase infrastructure facilities? The answer is possibly a mix of both. By considering this phenomenon, we use instrumental variable (IV) regression model to check the robustness of our regression results.

Although we have measured several variables to assess the impact of infrastructure on rural to urban migration, we consider only city-wise number of electricity connections as endogenous variables for the estimation of IV regression as it has a very consistent and strong effect on rural to urban migration. The suitable instruments are considered in such a way that they have a very strong relationship with the number of electricity connections, which is measured by correlation coefficients (r) but are exogenous, i.e., not anyway associated with rural to urban migrations. Keeping in mind all these issues, we find the following instruments for the estimations: first, the size of city populations that have a strong relationship with the number of electricity connections as a higher level of population demands a higher number of electricity connections, but this may not have anything to do with rural to urban migration. It is important to note here that from 1991 to 2001, the 79 percent increase in urban population was due to natural increase, expansion of boundaries, and net reclassification. The correlation

coefficients of the percentage of rural to urban migration with the size of city populations is about –0.002.

Second, the number of banks city-wise, which have a strong relationship with the number of electricity connections, indicates a higher level of population but it has a very low relationship with the volume of rural to urban migration, as the migrants may have accounts in the rural banks and partially use the urban banks. So rural to urban migration does not necessarily increase the bank branches as they do not become customers of the urban bank branches in the city. The correlation coefficient between the number of banks and the number of electricity connections is 0.62, whereas the correlation coefficient between the number of banks and the percentage of rural to urban migration is 0.04.

We estimated the model using a 2SLS estimator. The regression model 6 in Table 3 presents the estimated results of the parsimonious model as we find that the results are more satisfactory than running the full model. Our instruments work well as first-stage *F* statistics comfortably passes the rule of thumb threshold for strong instrument (Staiger and Stock, 1997) and exceeds the Hausman et al. (2005) threshold values.

The results of regression model 6 show that the city-wise number of self-employed males has a negative effect on the percentage of rural to urban migration. The number of city-wise self-employed females has a positive effect on the percentage of rural to urban migration. These results are statistically significant (at the 1 percent level) and consistent with the regression results of regressions 1–5. Also, a positive effect of the city-wise receipt through taxes and revenues and a negative effect of the city-wise number of colleges on the percentage of rural to urban migration are similar to the results obtained in regressions 1–5. Most importantly, the number of electricity connections has a positive and statistically significant effect on the percentage of rural to urban migration. These results substantiate our earlier claim that electricity connections, which is used as a proxy for infrastructure, increases the percentage of rural to urban migration in India. However, the positive effect of distance by road to the nearest railway station on of rural to urban migration indicates that lower economic potential increases rural to urban migration. This result supports our earlier claim that cities with higher economic conditions do not attract rural people to urban areas.

4. Conclusions and policy implications

This paper attempts to investigate the relevant determinants of rural to urban migration in large cities in India based on the 2001 Census and National Sample Survey data. OLS and IV approach models are used for the analysis.

The city-level OLS and IV regression results show that the city-wise total number of self-employed males has a negative effect on the percentage of the total number of rural to urban migrants in India. But the city-wise self-employed females, regular wage/salaried males, and females, the total number of male and female casual labor have a positive effect on the percentage of rural to urban migration. City-level poverty, inequality, and per capita monthly consumption expenditure have a negative effect on rural to urban migration. However, the total receipt received through taxes and revenue derived from municipal properties has a positive effect on it. The results also show that a favorable climate does not have any effect on rural to urban migration. The results imply that employment and infrastructure remain very important factors behind the city-level rural to urban migration in India.

Based on the analysis we suggest that Indian cities have to provide more job opportunities to facilitate higher rural to urban migration. Indian cities are lacking urban infrastructure facilities. Therefore, improvements in infrastructure availabilities are essential to increase rural to urban migration. Urban poverty and inequality have to reduce so that it rises rural to urban migration. Finally, control of living costs in the cities is important for this purpose. However, how small cities or towns can attract more rural population and consideration of other variables such as family income diversification, social networks, and caste affinities, and employment growth to explain rural to urban migration in the large cities forms the topic for research.

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Appendix

Table A1. Names of Cities Used in Regression Analysis

Agra (Agra), Aligarh (Aligarh), Allahabad (Allahabad), Amritsar (Amritsar), Asansol (Barddhaman), Aurangabad (Aurangabad), Bangalore (Bangalore Urban), Bareilly (Bareilly), Bhiwandi (Thane), Bhopal (Bhopal), Bhubaneswar (Khordha), Chennai (Chennai), Coimbatore (Coimbatore), Delhi,[1] Dhanbad (Dhanbad), Durg-Bhilainagar (Durg), Guwahati (Kamrup), Gwalior (Gwalior), Hubli-Dharwad (Dharward), Hyderabad (Hyderabad), Indore (Indore), Jabalpur (Jabalpur), Jaipur (Jaipur), Jalandhar (Jalandhar), Jamshedpur (Purbi-Singhbhum), Jodhpur (Jodhpur), Kanpur (Kanpur Nagar), Kochi (Eranakulam), Kolkata (Kolkata), Kota (Kota), Kozhikode (Kozhikode), Lucknow (Lucknow), Ludhiana (Ludhiana), Madurai (Madurai), Meerut (Meerut), Moradabad (Moradabad), Mumbai (Mumbai), Mysore (Mysore), Nagpur (Nagpur), Nashik (Nashik), Patna (Patna), Pune (Pune), Raipur (Raipur), Ranchi (Ranchi), Salem (Salem), Solapur (Solapur), Thiruvananthapuram (Thiruvananthapuram), Tiruchirappalli (Tiruchirappalli), Varanasi (Varanasi), Vijayawada (Krishna), Visakhapatnam (Visakhapatnam).

Note: City district (where the sample city is located) is used as a proxy of a city to measure some of the variables used in estimation of regressions by considering urban sample persons of that district. Name in parentheses indicates the name of the district in which the city is located.

[1]Delhi as a whole is considered a proxy of a city district.

Appendix A2: Variable sources and definitions used in city-level regression model

Workforce participation rate (WPR) (as given in National Sample Survey(NSS): The number of persons employed in *usual status* (*principal and subsidiary status*) per 1,000 persons is referred to as the work force participation rate (WFPR) or worker population ratio (WPR).

Self-employed, Regular wage/salaried employee, and casual worker: As defined by NSS.

City-wise per capita output: Per capita non-primary Net District Domestic Product (NDDP) of 2001–02 at 1999–2000 constant prices is taken as a measure of city output. *Source*: Directorate of Economics and Statistics (DES), various State Governments, GoI.

City-level poverty: We use the state-level urban poverty line as suggested by Tendulkar Committee to estimate the city level poverty by considering the urban sample persons of that district. Poverty head count ratios of the large city districts are calculated to measure the city level poverty. *Source*: NSS unit level data on "consumption expenditure" of 61st Round in 2004–05.

City inequality level: Gini coefficient of the large city districts (i.e., the district in which the sample city is located) by considering urban sample persons of that district. *Source*: NSS unit level data on "consumption expenditure" of 61st Round in 2004–05.

City-level monthly per capita consumption expenditure (MPCE): MPCE is taken from the large city districts (i.e., the district in which the sample city is located) by considering urban sample persons of that district. *Source*: NSS unit level data on "consumption expenditure" of 61st Round in 2004–05.

Rainfall: City-wise average rainfall in 2001. *Source*: Census of India.

Temperature: City-wise temperature differences from maximum to minimum (in degrees centigrade) in 2001. *Source*: Census of India.

Medical facilities (Numbers): City-wise Total Number of Hospitals + Number of Dispensaries + Number of Health Centers + Number of Family Welfare Centers + Number of TB Clinics + Number of Nursing Homes + Number of Other Medical Institutions in 2001. *Source*: Census of India.

Total university and colleges (Numbers): City-wise total number of universities and colleges in 2001. *Source*: Census of India.

Electrification (Number of Connections): City-wise Total number of connection by Domestic + Industrial + Commercial + Road Lighting (Points) + Others in 2001. *Source*: Census of India.

Total receipt: Total money (in Rs.) receipts through taxes and revenue derived from municipal properties and power apart from taxation in 2001. *Source*: Census of India.

Railway Station distance: Shortest road distance to nearest railway station (in km) from a city. *Source*: Census of India.