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Drag effects of urban-rural digital divide on urbanization: evidence from China's panel data

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Abstract: The aim of this study is to gauge the drag of China's urban-rural digital divide (URDD) on urbanization. The study, drawing on Romer's thought concerning growth drag, employing the Cobb-Douglas production function and an urbanization equation derives the drag equation of URDD's impact on urbanization. Using the co-integration methodology, unit root tests, and the panel data of provinces in China over the period from 2000-2009, this study documents an existence of drag and calculates its value of 6.38%, indicating that the velocity for China's urbanization declines 6.38% in the case of drag, relative to without the drag limitation. The study also finds that in the knowledge-based digital epoch, digital techniques and awareness need to be cultivated and enhanced for rural residents, specifically the digital qualifications, with an objective of accelerating the urbanization process and achieving an equilibrium development for urban-rural areas. The study concludes with limitations and fields for future research.

Keywords: Drag, Urbanization, Information, Urban-rural Digital Divide

1. Introduction

The conception with regard to growth drag was proposed by Northhaus in 1992, comparing the impact on true national income in a "limited" case in which resources are constrained with an "unlimited" case in which resources are superabundant but not free. The 'growth drag' is then the difference between the unlimited and the limited cases. On this basis, Romer pointed out (2001) that the "growth drag" from resource and land limitations is the difference between growth in this hypothetical case and growth in the case of resource and land limitations. Likewise, for urban-rural digital divide, it equalizes the gap concerning economic expansion rate under digital divide and no digital divide

circumstances.

This paper is directed at resorting to drag theories and methodology to deal with drag effects of urban-rural digital divide on the Chinese urbanization with the view to putting forward sober strategies and countermeasures for advancing urbanization development and accordingly making suggestions and furnishing theoretic foundations for figuring out three agricultural problems within China, which pose a severe challenge to sustainable growth for this nation.

2. Urban-Rural Digital Divide and Urbanization

Diffusion of Internet across China is suffering a severe challenge arising from the immense digital divide owing to urban-rural and regional imbalanced development. URDD is getting so protuberant that it has been taken as the forth gap inside China, in the wake of the three gaps in urban-rural incomes, industry-agriculture, and brain-physical labour, having had an adverse effect on urbanization. Firstly, URDD, hindering economic and income growth in rural areas, has turned into a choke point of economic urbanization. Larianidis and Kalogeressis (2006) investigated 996 enterprises in 10 European rural areas by virtue of questionnaires, finding that the existence of URDD shall induce a shortage of information and competitiveness of rural firms so as to exert an unfavourable clout on rustic economic expansion. James (2008) explored the relation between China's URDD and the urban-rural income gap over the period from 1998-2004. His conclusion is that URDD extends the gap between cities and countryside, obstructing the improvement of living standards for rural dwellers. Secondly, URDD may impede telecommunications technology modernization in rural areas and countrymen's civilized progress in socially living modes. Inkinen (2006) divided Tampere in Finland into three types of areas: regional capital, small cities, and rural areas, and examined the stance with reference to inhabitants utilizing information-telecommunications technology via questionnaires, concluding that metropolitan citizens have more advantages in using information-telecommunications technology to gain access to information and to socialize than countrymen. Warren (2007) studied the procedure of Internet popularization in the UK countryside to have discovered that agricultural inhabitants are easily excluded from and marginalized in a digital society seeing that URDD exerts an obstacle impact on modernization of rural communications skills and civilized stride of rustic life style. Finally, URDD shall prevent rural population from shifting into cities and thus hindering urbanization development. Taubenbook et al (2009) probed into the varying impacts relating to the popularization degree of information technology in

urban-rural regions, with the conclusion that an information occlusion and a low information prevalence rate contribute to a loss of opportunities for countrymen to be transferred into cities for employment in the Indian countryside as urban job information is not available to these countrymen in due course. Brunckner's research on 41 African nations (2012) suggested that extremely poor Internet popularization and utilization in rural areas provoke a large quantity of remaining labour forces to be stockpiled in the countryside and failure for them to figure for employment chances via Internet whereas there are a certain quantity of working vacancies that have not been filled in urban areas, giving rise to a lower employment rate than projected in theory.

3. Model

Urbanization in economics is a form of economic transformation process in the special system, characterized by the growing number of people in a society living in urban areas, or cities, signifying spatial scale and density of settlement as well as business and other activities in the area. Both population and economy converge in metropolises as a joint result of accumulation and scale economies: economic expansion cannot but trigger a high level of urbanization and meanwhile high urbanization undoubtedly accelerates economic growth. As a result, there must be the existence of a close relation between urbanization and economic development. Notably, the non-linear relationship is emphasized and confirmed by some researchers like Chenery and Syrquin(1975) and Davis and Henderson (2003), who found that urbanization has a concave curve connection with economic development, but Davis and Golden(1954), Graves and Sexton(1979), and World Bank (2000) argued that urbanization follows a S-formed curve.

In the case of China, Zhan and Huang (2010) had the argument that urbanization progress lags behind economy growth while Jian and Huang (2010) held that the current urbanization pace of China is modest. Furthermore, Zhou (1995) employed econometrics ideas and methodology to survey the nexus between urbanization and economic expansion, finding that their connection is a semi-logarithm curve rather than linearity or hyperbola.

From the current literature, urbanization drag of urban-rural digital gap can be derived below and the reasoning procedure is omitted for limited pages:

$$Dg = \frac{\beta n}{(1-\alpha)\lambda}$$

For estimation of Dg, the paper firstly tests unit roots of panel data; then identifies which panel data model is suitable; afterwards, computes elasticity

λ of urbanization to output, elasticity β of URDD to economic growth, and elasticity α of capital to growth; finally, coupled with the labor growth rate, calculates the drag via the equation (1).

4. Empirical Analysis

4.1 Data Origin

Data on variables associated with GDP per capita, fixed asset investment, and labor are extracted from China Statistics Yearbook. The origin of Information index data is China Information Index 2009 by yang et al. Urbanization level data are calculated as per the formula of the ratio of urban to total population. Our team calculates URDD data. The sample period spans from 2000 to 2009. In consequence of fluctuations of variable serials of GDP per capita, fixed assets, and labor, we take the logs. Furthermore, for the sake of preserving uniformity variable dimensions, we normalize all the variable serials, making each value for a variable in series falling into the interval with the maximum being 10 and minimum 0.

4.2 Calculation of Drag

Testing results show that all the time series comprise the root unit process, suggesting they are non-stationery, but the series of their first–order difference are stationery. By kao's homogeneity and Pedeoni's heterogeneity panel tests, we reject the null hypothesis: without co-integration, demonstrating an existence of at least a co-integration relationship among GDP per capita, fixed assets, labor, and URDD, and also a co-integration relationship between urbanization process and GDP per capita. More details on co-integration tests are reported on the table1. In model one, GDP per capita is the dependent variable and capital, labor, and URDD are explainable variables. Model 2 covers one dependent variable, urbanization level, and one explainable variable, economic development level, proxies by average GDP. If F1<F, it suggests that the specification is suitably a variable intercept one and F2>F implies that it accords with an individual effect-fixed model as well. Consequently, an individual effect-fixed panel data specification is taken to calculate parameters. The test of model type and parameter estimators are represented on tables 2 and 3. For models 1 and 2, cross section residuals are used as weights in model evaluation.

Introduce $\alpha = 0.7774$, $\beta = 0.1905$, $\lambda = 1.0554$, n= $\sqrt[9]{I_{2009}/I_{2000}} - 1 = \sqrt[9]{79812/73992} - 1$ =1.0787-1=0.0787 into the formula to generate Dg=0.0638.

The urbanization drag of URDD in China is at 0.0638, demonstrating that the Chinese urbanization velocity declines by 6.38% because of the existence of the city-countryside digital gap. Therefore, the divide has exerted a considerable impact on urbanization development. The main reason for this delay is that an enlarging of the gap gives rise to a negative outcome that although part of inhabitants are in the favorable side of the gap, other large number of population are in the unfortunate side. And this contributes to an insufficiently effective demand curbing an increase of aggregate entire supply. Along with high growth of urbanization, a deepening of digital divide between urban and rural regions provokes population's isolation and delaminating in digital information competence. Notwithstanding the country enjoying a high network expansion on the whole, its high-speed dissemination and application are mainly performed in cities whereas vast rural areas, located at the poor extreme of digital divide, have a substantial population of digital poverty. This may provoke not only the Matthew effect: the rich get richer while the poor get poorer, but also a deteriorating of city-countryside gap and a curbing of urbanization improvement against the background with digitalization that has defined a significant feature of a modern metropolitan area.

Table.1. Co-integration Test (Five variables)

Kao test			Pedroni test			
	ADF	P		ADF	Statistics	P
H_0: No co-integration $(\rho = 0)$	-5.99	0.00^{*}	H_0: $\rho_i = 1$ H_1: $(\rho_1 = \rho) < 1$	Panel v Panel rho Panel pp Panel ADF	2.00 -3.41 -5.99 -7.84	0.04^{***} 0.02^{**} 0.00^{*} 0.00^{*}
			H_0: $\rho_i = 1$ H_1: $(\rho_1 = \rho) < 1$	Group rho Group PP Group ADF	6..423 -6.89 -7.29	0.00^{***} 0.00^{*} 0.00^{*}
H_0: No co-integration $(\rho = 0)$	-5.74	0.00^{*}	H_0: $\rho_i = 1$ H_1: $(\rho_1 = \rho) < 1$	Panel v Panel rho Panel pp Panel ADF	-1.93 1.52 -3.33 -2.69	0.06^{***} 0.06^{***} 0.00^{**} 0.01^{**}
			H_0: $\rho_i = 1$ H_1:	Group rho Group PP Group ADF	2.38 -4.76 -2.65	0.02^{**} 0.00^{*} 0.01^{*}

			$(\rho_1 = \rho) < 1$			

* ** *** denote significant at level of 1%, 5% and 10% respectively.

Table 2. Model Type

	F_1	$F_{0.05(15,36)}$	$F_{0.05(5,48)}$	Conclusion	F_2	$F_{0.05(5,52)}$	$F_{0.05(5,54)}$	Conclusion
Model 1	2.17	2.22		Variable intercept	9.68	4.44		Individual fixed effects
Model 2	4.21		4.44	Variable intercept	6.99		4.44	Individual fixed effects

Table.3. Parameter Value

	FIXEDASSETS	LABOR	URDD	PCGDP	c	R-squared	D-W
PCGDP	0.7774	0.0666	0.19054		-0.0154	0.9922	1.70
URBAN				0.9475	0.5247	0.9846	1.50

5. Concluding Remarks and Suggestions

5.1 Conclusions and Implications

This study was actuated by the need for investigation which can result in a better understanding of drag effect of URDD on urbanization. An empirical study has been made by using the panel-data fixed specification, unit root tests, and co-integration, and scientific essence from Romer's growth drag theory. The major findings are that a unit gap can delay a 6.38% of urbanization and places the considerable restriction on urbanization growth. Thus, it is challenging to China on how to get rid of the positive impact from URDD for promoting urbanization in the information-based era.

We suggest that it is of utmost importance to offer farming residents with training opportunities to develop their intellectual qualifications including technological level and information-based capability as the low scientific and cultural level in the countryside has been proved to be a bottleneck of progress. High quality human sources will set in motion a rapid economic pace, an industrial upgrading and optimizing. And this ultimately will expedite urbanization process for China.

5.2 Limitation and Future Research

The study has shortcomings given our concentration on urbanization drag. A measurement of drag depends on the type of production function, hypothesis, and econometrics methodology for parameter estimations. Additionally, this

study selects the time sphere from 2000-2009, hinting a not very excellent data degree of freedom. Due to above limitations, future research will concentrate on a more pioneering specification and methodology for gauging drag and collecting more complete panel data for an empirical analysis.

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