HOW DOES THE LEVEL OF URBANIZATION MATTER FOR POVERTY REDUCTION?

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Abstract

This paper attempts to analyze, both theoretically and empirically, the effect of urbanization level on poverty reduction outcomes by considering multi-dimensions of the concepts of poverty. The theoretical model represents an optimal level of urbanization on infrastructure and incomes for the poor, with assumptions of shifting proportional inequality. To estimate the optimal level of urbanization, we use the instrument variable (IV) approach in the context of the generalized method of moments (GMM) for the human development index (poverty reduction) and the dynamic panel GMM approach for a series of the FGT index (pro-poor growth). We also investigate the robustness of the effect of the optimal urbanization level by looking at its effect on various basic channels of poverty reduction outcomes. Our results suggest that there is the optimal level of urbanization with strong and statistically significant level to promote poverty reduction. Furthermore, we examine the effect of urbanization on poverty reduction outcomes in different regions to see the different magnitude of urbanization effects among regions.

Keywords: urbanization, infrastructure, poverty reduction, pro-poor growth

JEL Codes:

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1. Introduction

For many recent decades, a transitory pattern of economic development has transformed and shifted the economic and other activities from rural to urban areas. This causes rapid growth of the urbanization process occurring around the four corners of the world. The simple objective of this phenomenon for individuals is to seek a better human well-being from their existing living conditions. One of these living characters may be penetrated as poverty. Poverty is depicted as a level of economic development, which concerns about the low condition of human well-being. The urbanization process comes theoretically along with agglomeration effects in production and consumption that are central forces in shaping any economy and with a more efficient way to deliver basic public services whereas poverty reduction can generally be considered as the by-product of the urbanization process. However, there is considerable controversy among academic researches regarding this issue whether the urbanization process that reduces poverty will increase poverty or not.

Regarding to the urbanization process, there are two aspects to concern: urbanization itself and urban concentration (the degree of public resource allocations among urban areas). Many literatures have examined and have been concerned about the effect of urban concentration on poverty while our paper has paid attentions to establish a relationship between urbanization and poverty. As reflected in Ravallion et al. (2007), although, in cases, poverty would shift its incidence from rural to urban population as urbanization increases, urbanization still soothes poverty incidence both urban and rural areas. This state of relationship should be expected to have further implications on economic and infrastructure development.

Our goal in this paper is to analyze, both theoretically and empirically, the impact of urbanization level on poverty reduction outcomes by using a number of poverty indexes through different estimation perspectives. We also further examine the urbanization effect on channels of poverty reduction outcomes, which can be robust outcomes in a broader sense. This analysis allows us to derive the optimal level of urbanization and deepen our understanding of the role of urbanization on poverty reduction. From the policymaker's perspective, if the controlled level of urbanization leads to a better improvement for the poor and public resource allocation for poverty reduction, then the planning efforts should also be focused on urbanization.

The rest of the paper is organized as follows: Section 2 represents working concepts of poverty, pro-poor growth, the urbanization process and a brief review of the literature on urbanization and poverty. Section 3 shows a simple model linking urbanization, infrastructure and income for the poor. Section 4 describes the empirical estimation method and the data. Section 5 discusses the results and Section 6 concludes the paper.

2. Working Concepts and Literature Review

2.1 Conceptual Frameworks

Poverty has very broad definitions that link to a situation of being poor in a variety of dimensions. Its multi-dimensions can be simply defined and measured in many ways. First, poverty can be reviewed from objective and subjective perspectives. The objective approach involves normative judgments while the subjective approach attempts to place a premium on people's preferences so as to how much they value goods and services. Second, poverty measures can capture physiological deprivations such as food and clothing; and sociological deprivations such as risk and vulnerability. In other words, this poverty measures can be considered as causes of poverty. Finally, we review a dimension as absolute and relative poverty. Poverty can be evaluated from the absolute level to the relative level. The former shows how a person makes at least a living for a human life, while the latter expresses how a person maintains as good as a standard of living for a daily life. For instance, a person is absolutely poor if his/her income is less than the defined income poverty line, while that person is relatively poor if he/she belongs to a lowest income strata, say, the poorest 10 percent of the population. Note that the poverty line has been constructed by the Work Bank to cut-off a state of poverty and non-poverty based on consumption ability. The value of poverty line varies different regions such as Africa is usually set at $1 (1993 PPP$) a day per person or $2 (1993 PPP$) a day per person for Latin America.

Furthermore, measuring poverty can not only be identified the monetary dimensions (quantitative information), but also non-monetary dimensions (qualitative information). The brief discussions are as follows:

(1) Monetary Dimension

This approach of poverty measurement considers circumstances on which both individuals and households are impoverished; that is, if their consumption or income falls below a certain threshold level, which are usually defined as a minimum, social acceptable level of well-being by a group of population. From the existing empirical evidences, if the survey had done enough on households' consumption data, consumption would tend to provide a more accurate condition of poverty (Kakwani, Khandker and Son 2004; Kraay 2006). The common measures for this dimension are:

- Headcount Index (HI): The HI is simply the proportion of population that is poor as the percentage of the population living below the certain threshold, i.e. people with their income or consumption below the poverty line or, in short, the incidence of poverty.

- Poverty Gap (PG): The PG index measures the degree of how the mean aggregate income or consumption of the poor differs from the established poverty line, i.e. the depth of poverty.

- The FGT index of poverty: Foster, Greer and Thorbecke (1984), hereafter FGT, propose another alternative index that combines the properties of the two previous indices and also adds the severity of poverty, a new consideration of poverty, into FGT index. The formula of FGT is as follows:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{z-y_i}{z}\right]^\alpha$$

where y_i is the income of the i individual ranked in increasing value of income; q is the number of poor; n is the total population; and α is the aversion coefficient for poverty.

An increase of α means that more weight is given to the poorest, those further away from the poverty line. Note that when $\alpha = 0$, P_α is H; when $\alpha = 1$, P_α is PG; and when $\alpha = 2$, P_α is Square Poverty Gap (SPG). The SPG index means that the distributional measure captures differences in income levels among the poor, i.e. the severity of poverty is to reflect inequality among the poor.

(2) Non-monetary Dimension

Non-monetary indicators are crucial to assess poverty in terms of the level of human well-being. This dimension of measuring poverty is based on the outcomes with human achievements. From several non-monetary indicators, we can briefly recognize three important poverty aspects: (i) Health and nutrition poverty (ii) Education poverty (iii) Composite indices of wealth such as civil rights or vulnerability. The commonly used measures of non-monetary indicators are the Human Development Index (HDI), the Human Poverty Index (HPI), the Gender-related Development Index (GDI), and the Gender Empowerment Measure (GEM). In brief, we will rather discuss only the HDI.

- The Human Development Index (HDI): The HDI developed in 1990 by the United Nations Development Programme (UNDP) is a comparative measure of average achievements of human development for a country. The index relatively rating from zero to one is based on equally weighting (one- third weight) of the following basic elements: (i) Basic Health (ii) Basic Education (iii) A decent standard of living assessed by the Gross Domestic Product (GDP) per capita at Purchasing Power Parity (PPP) in US Dollars..

2.2 Pro-poor Growth

Pro-poor growth has been recently brought into the discussion of economic development policies. Pro-poor policies reflect the concept of pro-poor growth such that the poor are paid attention in the policies and programs seeking to alleviate inequalities and facilitate income and employment generation. Recent papers such as Kakwani and Pernia (2000); Ravallion and Chen (2003); Ravallion (2004) have discussed the definitions of pro-poor growth to identify the links and benefits from growth to effective growth for the poor. Even the characteristic of pro-poor growth is very broad; briefly speaking, growth is pro-poor if and only if the poor are promoted to have a higher growth rate of incomes than those of the non-poor. Kakwani (1993) and Kakwani and Pernia (2000) point out that the source of pro-poor growth is only when the incomes for the poor increase relatively to average incomes. Kakwani et al. (2004) have conceptualized pro-poor growth by introducing the Poverty Equivalent Growth Rate (PEGR). The PEGR will result in the same level of economic growth but not accompany with any change of inequality. This pro-poor growth measure similarly follows the analytical analysis in

Kakwani and Pernia (2000). Kraay (2006) analogously represents the sources of pro-poor growth and how to measure pro-poor growth, i.e. what kind of growth can reach and help the poor. There are two sources of pro-poor growth: the first is direct economic growth that increases incomes of the poorest group in the income distribution and the second is from the poverty sensitivity to growth, for example if the income of the poorest grows faster (i.e. more sensitive) than average incomes, then poverty will fall faster.

2.3 The Process of Urbanization

Rural-urban migration is the main cause of the urbanization process. The relationship between rural and urban areas is correlated to each other by this migration and the nature of their productions. Rural-urban migration represents both costs and benefits regarding to both economic and financial aspects. A movement towards increasing productivity and economic efficiency reflects the beneficial results for the urbanization process. Another necessary and crucial component of development is the costs of urban growth because there are the fiscal burdens for a government to invest in infrastructure to meet the rapidly changing basic needs such as sanitation and electricity (Linn 1982; Richardson 1987).

The gradual pace of urbanization process may allow time to properly develop for political and economic institutions and market instruments, which are essential for an efficient urbanization process to suit for proper economic development. But along with the rapid urbanization process, undesirable effects can be found in the forms of both social and economic problems. In particular, the urbanization process can not only lead to an uneven income distribution either among urban population or between rural and urban populations such as poor vs. non-poor, formal (skill) vs. informal (non-skill) labors), but also produce an uneven city-size distribution either among cities or between rural and urban areas.

However, from the beneficial sides, the process of urbanization may not only contributes to economic development by increasing efficiency and output (economic growth), but also has the potential to sustain an indispensable interaction among urban areas (large, medium, small cities) and between rural and urban areas (rural and non-rural products) in the short run and long run. The benefits from economies of urbanization are the “localized” and “urbanized” external economies of scale. In the short run, efficiency is embraced through shifting unproductive rural labors to a city, firm or cluster, and then realizing the first benefit of scale economies of urbanization. The location advantage generates the consumption and production needs and leads to the higher productivity that will allow higher wages to be paid to the new urban labor force. Rural areas also are benefited from a higher demand of rural goods and release of unproductive labor force. Furthermore, the agglomeration of clusters in one urbanized area will diversify many specializations and productivities from different clusters. The labor pooling and intermediate goods and services are produced to serve economic development as the second benefit of scale economies of urbanization. This benefit also spills over to rural areas such as utilizing a new technology to upgrade rural productivities. These above spatial effects of scale economies of urbanization will sustain the natural link and important roles between rural and urban areas as mentioned earlier.

2.4 The Existing Literature on Urbanization and Poverty

In brief, the theoretical literatures find that urbanization has the direct effect to raise peoples' incomes. A variety of urbanization channels to increase incomes can be recognized such as the migration process that equilibrates wage differentials between rural and urban areas (Tadaro 1969; Harris and Tadaro 1970); an increase of technology and labor skills to enhance productivity and the positive effects of urbanization on economic growth that tends to increase per capita income (Tolley and Thomas 1987; Faria and Mollick 1996; Bertinelli and Black 2004; Polèse 2005). Also urbanization helps to reduce national incidence of poverty drawn by Ravallion (2001) and Ravallion et al. (2007). The empirical studies that have reviewed the relationship between urbanization and economic growth (monetary poverty dimension) show somewhat mixed results (Jones and Kone 1996; Easterly 1999; Fay and Opal 2000; Davis and Henderson 2003). Most of these papers confirm that there are more or less positive effects of urbanization on economic growth. One possible explanation of mixed results is that the different empirical models and the data (the cross-country and time periods) are used in studies.

In accordance with non-monetary poverty dimension, some of the reviewed papers explain theoretically how different available infrastructure and amenities between rural and urban areas for basic needs and services interact with urbanization (Pham 2001; Issh et al. 2005). Other empirical papers also show the significance of urbanization effect positively associates with the enhancement of basic needs and services (Dreze and Murthi 2001; Ramadas et al 2002; Liu et al. 2003; Issh et al. 2005) as well as efficient infrastructure provisions (Jayasuriya and Wodon 2002).

3. The Theoretical Model

In this section we present a theoretical model that explores the relationship between poverty outcome conditions and urbanization. Poverty is modeled in the context of overall social welfare, which in turn is identified by the growth rate of consumption and the standard of living provided by available basic infrastructure. Both aspects are regarded as the trickle-down effects to help the poor. The growth rate of consumption implies the growth rate of income so as to achieve all basic needs whilst provisions of infrastructure from government public investments consist of the universal stock of sanitization, electricity, transportation, and health and education facilities.

The first model in this section is based on Devaranjan et al. (1996) and we modify it into three fundamental ways to analyze the effect of urbanization on growth and infrastructure. First, we introduce an urbanization variable (defined by the urban percentage or the ratio of urban population to national population). This variable represents the urbanization process in the production function. As in Faria and Mollick (1996), we assume that the level of urbanization has a positive effect on total output such that per capita GDP moves in the same direction as the industrial and service sectors, which only occur in urban areas. Second, to capture long-run growth, we also introduce a composite of efficiency- enhancing term as the product of technological level from urbanization to the production function (as in Henderson 1988). Third, we introduce rural and urban infrastructure variables into the production function and modify the budget constraint for the government role by substituting the infrastructure expenditures in urban and rural areas whereas Devaranjan et al. use the productive and unproductive sectors. We also assume that the government is the only provider for basic infrastructure (as in Issah, et al. 2005). Government infrastructure in urban and urban areas are defined as public education and health systems, sanitation, electricity and other basic facilities for daily living.

In the second model, we link the first model analysis to another analytical framework, which is based on the traditional compositions of pro-poor growth sources developed by Kakwani and Pernia (2000); Ravallion and Chen (2003); Kraay (2006). Therefore, the combination of these two theoretical analyses will focus on poverty reduction outcomes through urbanization for the poor (basic infrastructure and income)

3.1 The Behavior of Production Unit

We assume that the per capita production function (y) is in the form of a Cobb Douglas production function. It include: private capital stock (k), urbanization (N), two types of government infrastructure (*Urban:* G_u and *Rural:* G_r). We also include the product of technological level (A) with the shift factor ($g(N)$). The specification of N is presumed as external agglomerative economies and the shift factor is subjected to the degree of scale economies as a concave function of urbanization. We hypothesize that there is a positive effect on output from a larger magnitude of N , G_u and G_r . Thus, the functional form is expressed below:

$$y = Ag(N) f(k, N, G_u, G_r) = Ag(N)(k^{\alpha} N^{\gamma} G_u^{\beta} G_r^{\theta}) \tag{3.1}$$

Where $\alpha \geq 0, \gamma \geq 0, \beta \geq 0, \theta \geq 0$; $\alpha + \gamma + \beta + \theta = 1$; $0 \leq N \leq 1$; A is positive and

constant; and $f_k > 0$; $f_N > 0$; $f_{G_u} > 0$; $f_{G_r} > 0$; $g_N > 0$; $g_{NN} < 0$

Following Devaranjan, et al. (1996), the budget constraint for the government is balanced and finances the infrastructure expenditures through a flat rate tax. The budget constraint is:

$$\tau * y = G_u + G_r = G \tag{3.2}$$

Where G is the total government infrastructure expenditures and τ is the flat tax rate.

Let us now assume that the share (λ) of total government infrastructure expenditures to shift government spending into urban area is a linear function of urbanization (N). Thus, the new budget constraint is given below:

$$\tau * y = G_u + G_r = (\lambda(N))G + (1-\lambda(N))G = G \qquad (3.3)$$

Where $0 \le \lambda(N) \le 1$; $\lambda_N > 0$.

3.2 The Consumption Behavior

The preference utility of an agent for consumption, $u(c)$, over time is given by

$$U = \int_0^\infty u(c)e^{-\rho t}dt \qquad \text{Where } u_c > 0,\ u_{cc} < 0 \qquad (3.4)$$

Subject to the growth rate of private capital stock with respect to time $(\dot{k})$:

$$\dot{k} = (1-\tau)y - c \qquad (3.5)$$

Where c is consumption and ρ is the rate of time preference; both are strictly positive.

A higher rate of time preference means that an agent increases the weight given to consumption onto the current utility rather than the future utility[1].

We substitute Equation (3.1) and (3.3) into Equation (3.5) to obtain the new budget constraint:

$$\dot{k} = (1-\tau)Ag(N)k^{\alpha}N^{\gamma}(\lambda G)^{\beta}((1-\lambda)G)^{\theta} - c \qquad (3.6)$$

To analyze the system, we specify the common utility function as the isoelastic (Constant Relative Risk Aversion: CRRA) utility function. The function is the constant elasticity of marginal utility expressed in the following form:

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma} \qquad \text{Where } 0 < \sigma < 1 \qquad (3.7)$$

Where σ is the constant elasticity of substitution between consumption at any two points of time.

We set up and solve the Hamiltonian system by using the utility function (3.7) and then maximizing the preference utility function (3.4) subject to the new budget constraint (3.7). The final result yields the following[2]:

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[1] See Blanchard and Fischer (1989)

[2] The proof is available upon request.

$$\mu = \frac{\dot{c}}{c} = \frac{\alpha(1-\tau)Ag(N)k^{\alpha-1}N^{\gamma}(\lambda G)^{\beta}((1-\lambda)G)^{\theta}}{\sigma} \quad (3.8)$$

Where μ is the marginal value as of time zero of an additional unit of consumption.

Equation (3.8) is the long-term rate of growth in consumption or the long-term steady-state growth rate (hereafter, the growth rate).

3.3 The Effect of Urbanization (N) on the Growth Rate (μ)

In accordance with Equation (3.8), the growth rate is a function of urbanization (N), government infrastructure expenditures (G_u and G_r) and the shift factor ($g(N)$) . The total government infrastructure expenditures are also a function of urbanization. Therefore, we can obtain the functional form as follows:

$$\mu = h(N, G_u, G_r, g(N)) \quad (3.9)$$

From Equation (3.8) and (3.9), we are able to evaluate the impact of urbanization on the growth rate by derivative the growth rate respect to urbanization:

$$\frac{d\mu}{dN} = \frac{\alpha(1-\tau)Ak^{\alpha-1}G^{\beta+\theta}\lambda^{\beta}(1-\lambda)^{\theta}}{\sigma}\left[N^{\gamma}g_N + g\gamma N^{\gamma-1} + g\lambda_N N^{\gamma}\left\{\frac{\beta}{\lambda} - \frac{\theta}{1-\lambda}\right\}\right] \quad (3.10)$$

What we are interested in is the sign of Equation (3.10). The common factor term is always positive. Then the three terms in the RHS bracket affect the growth rate through urbanization. The first term represents the effect of enhancing the level of technology through urbanization (external agglomerative economies) on the long-run growth rate. The second term represents the direct effect of urbanization on the growth rate. An increase of urban population will augment the agglomeration of production by itself and its elasticity of substitution at a diminishing rate. Note that the sign of the first and second terms are always positive. The third term represents the indirect effect of urbanization on the growth rate through the “economic infrastructure effect”. This effect will be subject to economies of scale as well as depending on the level of efficiency that can deliver basic needs. Basically, if its effect is positive, a higher urbanization with better infrastructure will increase the growth rate. To understand this better, we rearrange Equation (3.10) to derive the following:

$$\frac{d\mu}{dN} = B\left[g_N + g\frac{\gamma}{N} + g\lambda_N\left\{\frac{\beta}{\lambda} - \frac{\theta}{1-\lambda}\right\}\right] \quad (3.11)$$

Where $B = \dfrac{\alpha(1-\tau)Ak^{\alpha-1}G^{\beta+\theta}\lambda^{\beta}(1-\lambda)^{\theta}N^{\gamma}}{\sigma} > 0$

Since the first two terms in the RHS bracket and the term λ_N are always positive, the sign of $\dfrac{d\mu}{dN}$ is determined by the term: $\left\{\dfrac{\beta}{\lambda} - \dfrac{\theta}{1-\lambda}\right\}$.

Recall that $\dfrac{d\mu}{dN}$ is continuous and differentiable, we can find that at the optimal N, N^*, leading to at the point $(N^*, G_u{}^*, G_r{}^*, g^*)$ will satisfy $\dfrac{d\mu}{dN} = 0$. Also satisfies $\dfrac{\frac{d\mu}{dN}}{dG_u} \neq 0$, $\dfrac{\frac{d\mu}{dN}}{dG_r} \neq 0$ and $\dfrac{\frac{d\mu}{dN}}{dg} \neq 0$. Then G_u, G_r and g can be expressed as a function of N. Thus, we can apply the implicit function theorem to examine the interior conditions (or the effects) of urbanization on the growth rate and the effect of urbanization on urban and rural infrastructures.

By doing so, firstly, we equalize Equation (3.11) to zero, and then we can determine the sign of $\left\{\dfrac{\beta}{\lambda} - \dfrac{\theta}{1-\lambda}\right\}$ as follows:

$$g_N + g\frac{\gamma}{N} + g\lambda_N\left\{\frac{\beta}{\lambda} - \frac{\theta}{1-\lambda}\right\} = 0 \text{ and then } N = N^* = -\frac{g\gamma}{g_N + g\lambda_N\left\{\frac{\beta}{\lambda} - \frac{\theta}{1-\lambda}\right\}} \qquad (3.12)$$

Equation (3.12) represents the optimal level of urbanization that leads to the maximum rate of growth (Mills and Becker, 1986 and in the context of urban concentration by Williamson, 1965; Henderson, 1988 and 2003). We know that N, g, g_N, γ and λ_N are always positive. We can obtain the condition:

$$\left|\frac{\gamma}{N}\right| < \left|\lambda_N\left(\frac{\beta}{\lambda} - \frac{\theta}{1-\lambda}\right)\right| \qquad (3.13)$$

When $\left\{\dfrac{\beta}{\lambda} - \dfrac{\theta}{1-\lambda}\right\} < 0$ (3.14)

We arrange Equation (3.14) and obtain the condition:

$$\frac{\beta}{\theta} < \frac{\lambda}{1-\lambda} \qquad (3.15)$$

Regarding to the condition (3.15), the relative proportion of infrastructure spending on urban area to rural area, $\frac{\lambda}{1-\lambda}$, is larger than the relative ratio of output elasticities, $\frac{\beta}{\theta}$. The share of infrastructure spending that is shifted from rural to urban areas will be up to a point of the steady-state growth rate. On the other hand, the substitution of resources from rural to urban areas also increases urban populations. This dynamic pattern leads people to be more urbanized and involves the source of the growth rate. The urbanization process will take place as the transition of economic development has changed. The initial share of infrastructure spending (λ) plays an essential role to stimulate the concentration of population. Nevertheless, the initial share of infrastructure spending cannot alone guarantee this process unless the components of rural and urban infrastructure are not complementary to the output production, i.e. the relative ratio of output elasticities is too large.

Suppose that the condition (3.15) holds, then we are able to investigate the interior conditions of urbanization on the growth rate. We attempt to place the two values of N that the first value close to zero and the other value close to one, into Equation (3.10):

$$\left.\frac{d\mu}{dN}\right|_{N\sim 0} = \frac{\alpha(1-\tau)Ak^{\alpha-1}G^{\beta+\theta}}{\sigma}\left[N^{\gamma}\lambda^{\beta}(1-\lambda)^{\theta}g_N + g\lambda^{\beta}(1-\lambda)^{\theta}\gamma N^{\gamma-1} + g\lambda^{\beta}\lambda_N N^{\gamma}(1-\lambda)^{\theta}\left\{\frac{\beta}{\lambda}-\frac{\theta}{1-\lambda}\right\}\right]$$

Where $C = \frac{\alpha(1-\tau)Ak^{\alpha-1}G^{\beta+\theta}}{\sigma} > 0$

When we insert $N \sim 0$ into the equation, the interior conditions is $\left.\frac{d\mu}{dN}\right|_{N\sim 0} > 0$. This means that the effect of urbanization on the growth rate is positive for low levels of N. In other words, an increase of urbanization leads to increase the growth rate. Using the same comparison, when we place $N \sim 1$ into the same equation, the interior conditions when $N \sim 1$ is $\left.\frac{d\mu}{dN}\right|_{N\sim 1} < 0$. This implies that a further increase in urbanization decreases the growth rate. However, it is important to note that the interior conditions depends on the magnitude of N^*. For instance, if an economy is able to reach a higher value of N^*, possibly close to or equal to 1, the maximum rate of growth will accordingly act to the higher N^*.

Secondly, note that this optimization provides a standard first order condition for an interior solution. To give concavity of the growth rate function, the second order condition must be negative to satisfy. Thus, according to Equation (3.10), we can derive the second order derivative of the growth rate with respect to urbanization as follows:

$$\frac{d^2\mu}{dN^2}=\frac{\alpha(1-\tau)Ak^{\alpha-1}G^{\beta+\theta}}{\sigma}\frac{d}{dN}\left[N^\gamma\lambda^\beta(1-\lambda)^\theta g_N+g\lambda^\beta(1-\lambda)^\theta\gamma N^{\gamma-1}+gN^\gamma(1-\lambda)^\theta\beta\lambda^{\beta-1}\lambda_N-gN^\gamma\lambda^\beta\theta(1-\lambda)^{\theta-1}\lambda_N\right] \tag{3.16}$$

Therefore, we can conclude that Equation (3.16) is negative[3]. In sum, the function of the rate of growth (μ) is represented as concavity with respect to urbanization; that satisfies: $\frac{d\mu}{dN}=\phi>0$ and $\frac{d^2\mu}{dN^2}=\frac{d\phi}{dN}<0$.

3.4 The Effect of Urbanization (N) on Infrastructure (G)

Applying the implicit function theorem, the effect of urbanization on urban and rural infrastructure is the following:

$$\frac{dG_u}{dN}=-\frac{\frac{d\phi}{dN}}{\frac{d\phi}{dG_u}}=-\frac{-}{?} \text{ and } \frac{dG_r}{dN}=-\frac{\frac{d\phi}{dN}}{\frac{d\phi}{dG_r}}=-\frac{-}{?} \tag{3.17}$$

The sign of $\frac{dG_u}{dN}$ and $\frac{dG_r}{dN}$ is determined by the denominator $(\frac{d\phi}{dG_u})$ and $(\frac{d\phi}{dG_r})$, respectively. Recall Equation (3.10) and the budget constraint $G=G_u+G_r$, the equation of $\frac{d\phi}{dG_u}$ and $\frac{d\phi}{dG_r}$ are:

$$\frac{d\phi}{dG_u}=\frac{\beta G_u^{\beta-1}\alpha(1-\tau)Ak^{\alpha-1}G_r^\theta N^\gamma}{\sigma}\left\{g_N+g\frac{\gamma}{N}+g\lambda_N\left[\frac{\beta}{\lambda}-\frac{\theta}{1-\lambda}\right]\right\} \tag{3.18}$$

$$\frac{d\phi}{dG_r}=\frac{\theta G_r^{\theta-1}\alpha(1-\tau)Ak^{\alpha-1}G_u^\beta N^\gamma}{\sigma}\left\{g_N+g\frac{\gamma}{N}+g\lambda_N\left[\frac{\beta}{\lambda}-\frac{\theta}{1-\lambda}\right]\right\} \tag{3.19}$$

[3] The proof is available upon request.

The sign of $\frac{d\phi}{dG_u}$ and $\frac{d\phi}{dG_r}$ depends on the term: $\left\{\frac{\beta}{\lambda}-\frac{\theta}{1-\lambda}\right\}$. Suppose that the condition (3.15) holds, we will get the value of N^* as Equation (3.12). Let consider 3 propositions:

Proposition 1*:* At the point when urban population is smaller than the optimal urban population $(N < N^*)$, Equation (3.18) and (3.19) is positive. This means that Equation (3.17) is $\frac{dG_u}{dN} > 0$ and $\frac{dG_r}{dN} > 0$.

Proposition 2*:* At the point of optimal urbanization $(N = N^*)$, $\frac{d\phi}{dG_u} = 0$ and $\frac{d\phi}{dG_r} = 0$. The effect of urbanization on urban and rural infrastructures is equivalent to zero. This means that Equation (3.17) is $\frac{dG_u}{dN} = 0$ and $\frac{dG_r}{dN} = 0$.

Proposition 3: At the point when urban population is greater than the optimal urban population $(N > N^*)$, Equation (3.18) and (3.19) is negative. This means that Equation (3.17) is $\frac{dG_u}{dN} < 0$ and $\frac{dG_r}{dN} < 0$.

Each possible proposition presents different signs. Each of three propositions depicts that the magnitude of N produces the same sign of urbanization effects on infrastructure for both rural and urban areas such that results of infrastructure in rural areas yield the same result as those in urban areas.

The analytical reasoning can be shown that, at the initial state of economic development, increasing urbanization will have the large effect. As urbanization increases, provisions of infrastructure for both urban and rural areas increases according to Equation (3.18) and (3.19) when $N < N^*$. One reason that explains this situation is that a government allocates more spending to invest in urban infrastructure and urban areas are delivered by new, sufficient and efficient infrastructure when people get urbanized, while rural areas also receives better services from existing rural infrastructure and newly invested rural infrastructure when people get less tightening. This implies that the standard of living such as health or education services will be delivered more both in urban and rural areas, i.e. the allocation of infrastructure can be better provided to people in cities and countryside. When an increase of urbanization approaches to the optimal level, provisions of infrastructure will increase at a decreasing rate.

Once it has reached the optimal level, there should be no increase of infrastructure provisions. We would say that the level of infrastructure to serve people is going to transform from economies of scale to diseconomies of scale. In other words, the basic needs and services can be subjected to the congestion. Beyond the optimal level, rural and urban infrastructures will decrease. Under this higher congestion condition, provisions of infrastructure in urban areas cannot be efficiently delivered for every urban person or the level of services is lower than the optimal standard. At the same time, rural infrastructure provisions will lower the quantity of services partly because the government budgets are shifted more for urban infrastructure, partly because the efficiency to provide the standard basic services is lower and partly because provisions of the standard basic services are more difficult from causes such as geography or more scatter living locations. The co-move between urban population and infrastructure express the adjustment to proficient equilibrium, which is basically the same mechanism as Tiebout's model (1956) expecting a self-directive equilibrium of city systems.

3.5 The Effect of Urbanization (N) on Incomes of the Poor

As we realized that growth basically is accompanied with urbanization, in this subsection our interest focuses onto how the effect of urbanization impacts on the poor passing through pro-poor growth that directly helps the poor. We assume that the incidence of poverty is a non-increasing function in urbanization (N) as in Ravallion (2001). Based on Kraay (2006), we start deriving the sources of growth that affect on poverty into three components: growth in average incomes, the sensitivity of poverty to growth in average incomes and changes in relative incomes as follows:

$$\frac{\dot{P}_t}{P_t} = \mu \int_0^{H_t} \eta_t(p)dp + \int_0^{H_t} \eta_t(p)\left(g_t(p) - \mu\right)dp \tag{3.20}$$

Kakwani et al. (2004) stated that "the Lorenz curve can change in an infinite number of ways and thus the ex-ante analysis of change in poverty is not possible under general situation. However, we can make an ex-post analysis of changes if we have household surveys for at least two periods." Thus, before we investigate the effect of urbanization on poverty, we need to make an assumption on the inequality effect of poverty because the inequality effect of poverty reduction was expressed by the Lorenz curve. In this analysis, we necessarily assume that the change in inequality proportionally shifts in the Lorenz curve at all points, i.e. the poor and the non-poor benefits from the shift of average incomes proportionally (the inequality effect of poverty is zero.)

Recall Equation (3.20), we, therefore, can obtain

$$\frac{\dot{P}_t}{P_t} = \mu \int_0^{H_t} \eta_t(p)dp \tag{3.21}$$

Where $\frac{\dot{P}_t}{P_t}$ is the growth rate in average incomes for the poor (pro-poor growth); μ is the growth rate in average incomes (or the actual growth) and also the function of urbanization (from Equation (3.8)); $\eta_t(p) = \frac{df(y_t(p))}{dy_t(p)} \frac{y_t(p)}{P_t}$ is the elasticity of the poverty measure with respect to the income of the p^{th} percentile; and $H_t = H_t(N)$ is the fraction of the national population below the poverty line, z (or the poor) and the non-increasing function of urbanization $(\frac{dH_t}{dN} < 0)$.

Secondly we start to investigate the effect of urbanization on pro-poor growth by differentiating with respect to N and derive as follows[4]:

$$\frac{d\frac{\dot{P}_t}{P_t}}{dN} = \frac{d\left(\mu\left(-\frac{z}{P_t.(\theta+1).y_t'(p)\big|_{p=H_t}}\right)\right)}{dN} \tag{3.22}$$

We can obtain the final equation:

$$\frac{d\frac{\dot{P}_t}{P_t}}{dN} = -\left(\frac{z}{P_t(\theta+1)y_t'(H_t)}\frac{d\mu}{dN}\right) = -\left(\frac{z}{P_t(\theta+1)z}\frac{d\mu}{dN}\right) = -\frac{1}{P_t(\theta+1)}\frac{d\mu}{dN} \tag{3.23}$$

[4] The proof is available upon request.

Since $\frac{1}{P_t(\theta+1)}$ is always positive, the sign of Equation (3.23) is determined by the sign of $\frac{d\mu}{dN}$, i.e. the effect of urbanization on the growth rate in average incomes. Recall the optimal level of urbanization, N^*, from Equation (3.12) and the effect of urbanization on the growth rate, $\frac{d\mu}{dN}$, from the first subsection.

3.6 The Summary of the Theoretical Model

The first model, we demonstrate explicitly and theoretically that the urbanization directly impacts on basic infrastructure that can improve the standard of living in cities and country side, especially for those who are poor. Our model shows that infrastructure-enhancing provisions go along with the level of urbanization up to some point. Regarding to the optimal urbanization level, urbanization itself will increase the standard of rural and urban livings through infrastructure such as basic education or health care in the low urbanization state much more than those in the higher urbanization state. The optimal level of urbanization is determined and also responds according to the initial level of an economy composition and the budget allocations; however the level of infrastructure provisions is still subjected to the congestion at the optimal level of urbanization.

Under the proportionate benefits from growth, the second model explicitly shows the effect of urbanization on the poor who are below the poverty line. The model shows that an increase in urbanization will reduce an overall number of the poor. Furthermore, the second model also discovers the relationship between the urbanization level and the rate of poverty changes. A change in a number of the poor reflects to poverty reduction outcomes. A larger number of the poor can escape from beneath of the poverty line at the optimal state of urbanization than those in either the too-high or too-low urbanization state.

4. Empirical Estimation Method

4.1 Urbanization and Poverty

In this section we discuss the effects of urbanization on poverty reduction outcomes. This analysis is crucial for three main reasons. First, by our theoretical section, urbanization needs to be treated as an explanatory variable in the quadratic form to examine the relationship between urbanization and poverty reduction outcomes. Establishing this type of relationship suggests that the effects via urbanization would reflect the best degree of urbanization to promote poverty reduction outcomes. Second, a number of studies have shown a direct relationship between urbanization and monetary dimensions, especially economic growth, (Jones and Kone 1996; Handerson 2003). All these studies treat urbanization as not strictly exogenous. Our goal is to look forward to the effect of the best degree of urbanization directing to the poor and establishing the link between urbanization and incomes for the poor.

Finally, economies of scale based on the optimal degree of urbanization enable to analyze provisions of infrastructure, which not only promote the economic growth to raise the level of consumption for the poor, but also adequately deliver the basic needs to reduce poverty If a link between urbanization and the human well-being levels is established, then resources could be better used that would in turn lead to a more appropriate allocation of given a country's socioeconomic patterns between rural and urban areas to alleviate overall poverty situations.

Therefore, the general form of the relationship between urbanization and poverty reduction outcomes is

$$Poverty_{it} = f(Urban_{it}, Urban_{it}^2, X_{it}) + u_{it} \quad (4.1)$$

For the panel GMM-IV estimation[5]

$$Poverty_{it} = \beta_0 + \beta_1 Urban_{it} + \beta_2 Urban_{it}^2 + \beta_j X_{it} + u_{it} \quad (4.2)$$

$$Poverty_{it} = \beta_0 + \beta_1 Urban_{it} + \beta_j X_{it} + u_{it} \quad (4.3)$$

$$\begin{aligned} Poverty_{it} &= \beta_0 + \beta_1 Urban_{it} + \beta_j X_{it} + u_{it} \\ &\quad + \beta_2 UrbanEASIA + \beta_3 UrbanMENA + \beta_4 UrbanLAC \end{aligned} \quad (4.4)$$

For the dynamic panel GMM estimation[6] (the growth model)

$$Povertyg_{it} = \beta_0 + (\alpha - 1) iPoverty_{it} + \beta_2 Urban_{it} + \beta_3 Urban_{it}^2 + \beta_j X_{it} + u_{it} \quad (4.5)$$

[5] See details in Baum et al. (2003)
[6] See details in Bond (2002) and Bond et al. (2003)

Where $Poverty_{it}$ is a poverty indicator; $Povertyg_{it} = \ln Poverty_{it} - \ln Poverty_{i,t-1}$ is the rate of changes of a poverty indicator; $iPoverty_{it} = Poverty_{i,t-1}$ is the initial level of a poverty indicator; $Urban_{it}$ is urbanization; $Urban_{it}^2$ is the squared value of urbanization; X_{it} is a set of control variables; and $u_{it} = n_i + \nu_{it}$ is a composite error of unobserved country-specific effects (η_i) and a vector of idiosyncratic disturbances (ν_{it}). The interaction terms between urbanization and the regional dummy variables are introduced into Equation (4.3): East Asia (*UrbanEASIA)*, Middle East and North Africa *(UrbanMENA)* and Latin America and the Caribbean *(UrbanLAC)*. Note that Sub-Saharan Africa is the omitted region as reflected in Fay and Opal (2000). A set of control variables consists of economic and socio-demographic variables, and government institutional variables depending on estimations of each poverty indicator.

If a poverty indicator used is human-being improvement measures (less poverty) such as the HDI, the working hypotheses are that the collection of terms multiplying for $Urban$ is positive ($\beta_1 > 0$) and for $Urban^2$ is negative ($\beta_2 < 0$) and vice versa. In Equation (4.2) and (4.5), the best (optimal) degree of urbanization is, therefore, given by[7]

$$Urban^* = -\frac{\beta_1}{2\beta_2} \qquad (4.6)$$

However, the standard panel data estimations (fixed and random effects) in our analysis have in fact a potential of endogeneity[8]. When regressors are endogenous, the parameter estimators will be inconsistent. We adopt the instrumental variable (IV) estimation to correct endogeneity problems. For instance, random shocks such as economic crisis in a country may have an impact on rural-urban migration. Higher unemployment or job-seeking uncertainty is likely to affect the patterns of migration. Urban population would select to migrate to their native rural areas for jobs in

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[7] For example, this expression is simply derived by taking the partial derivative of Equation (4.2) with respect to urbanization ($Urban$): $\frac{\partial HDI}{\partial Urban} = \beta_1 + 2\beta_2 \overline{Urban}$, where $\overline{Urban}$ represents the mean value of urbanization in our sample.

[8] The error process is correlated with some right-hand-side variables. Some unobserved factors might include economic shocks or unexpected political events.

agricultural sectors or to move to a country's geographic neighbors if there is a free trade area or no alien barrier. Economic crisis may also influence on other economic and socioeconomic variables. The composition of random shocks has very high potential source of endogeneity such that the right-hand-side (RHS) variables would be correlated with the error term and then became endogenous regressors. Hence, the IV approach is called for this econometric issue using an appropriate set of instruments[9].

It is important to note that that the standard errors of the IV parameters would suffer from the presence of heteroskedasticity[10] of unknown form in a given estimate. This causes concerns of parameter inconsistency and invalid of any statistical inference. To ease these concerns, we further estimate our poverty model by using the IV approach in the context of the GMM.

4.2 Data

The data used in the empirical estimations are based on the unbalanced panel data set[11]. For all models, an overall number of countries in this study is about 143 countries for the cross sections and varies between a series of 6-time periods and 9-time periods for the time series (every 5 years covering from 1960 to 2005). Urbanization is shown by urban population as a percent of total population or urban percentage obtained from the World Urbanization Prospects: The 2005 Revision, the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. The HDI obtained from the 2006 Human Development Report (HDR), UNDP. Note that in this study we use the 2004 HDI for the 2005 HDI in the estimations. The Foster-Greer-Thorbecke (FGT) generic class of additive poverty indicators comprises of Headcount Index (HI); Poverty Gap (PG) and Square Poverty Gap (SPG). The poverty line in this study used to evaluate the poor is set at $1 (1993 PPP$) a day per person. This data set is obtained from the World Bank's *PovCalNet.* For education outcomes, the primary school net enrollment data set is obtained from the Barro and Lee (2000) data set on education attainment across countries. We also use the youth literacy rate obtained from the 2007 World Development Indicator (WDI) CD-ROM, the World Bank as well as for health

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[9] See discussions of the appropriate set of instruments in the empirical results section.

[10] A vector of random variables is heteroscedastic if the random variables have different variance in the regression errors.

[11] See more details in Appendix A

outcomes (the infant mortality rate and life expectancy at birth) and for decent standard of living outcomes via agricultural (agricultural value added per worker) and non-agricultural outputs from industry and service (the non-agricultural percentage of GDP).

The 2007 WDI CD-ROM also provides the source of data sets: GDP per capita (the constant 2000 US dollars per person), openness (ratio of import and export to GDP), Official Development Assistance (ODA: the form of aids from other countries and shown as a percentage of Gross Nation Income), inflation, agricultural share of GDP, government consumption share of GDP, the national population density. Note that for the donor countries, we will substitute the zero value of ODA for these donor countries. The national road density data are between 1963 and 1989; and 2005 (used 2004 data) obtained from the World Road Statistics (WRS), the International Road Federation (IRF); and between 1990 and 2000 obtained from the 2007 WDI CD-ROM. The variable freedom is calculated by a simple average of the index of political rights and the index of civil liberties. The source of data set is the “Freedom in the World Country Ratings” compiled by Freedom House.

Data on schooling years are obtained from the Barro and Lee (2000). Agricultural labor force as a percent of total labor force data set is obtained from the Food and Agriculture Organization (FAO), the United Nations. Data on the yearly long run average rainfall in each country are constructed by the Tyndall for Climate Change Research. The International Monetary Fund (IMF) CD-ROMs: the 1972-1989 historical Government Finance Statistics (GFS) and the 2007 GFS, provide the data of the share government expenditures on health and education of the total expenditures and the degree of decentralization.

5. Empirical Results

This section reports the results of the empirical analysis conducted to investigate the testable hypotheses implied in earlier sections of paper. First, we present results on the effect of urbanization on poverty reduction outcomes. Second, we report and discuss empirical findings regarding the effect of urbanization on pro-poor growth. In the last sub-section we present results of the channeled effects of urbanization on channels of poverty reduction outcomes.

5.1 Urbanization and Poverty Reduction Outcomes

In Table 1, our analysis uses the model specification based on Equation (4.2) - (4.4) where the dependent variable is the HDI representing poverty reduction outcomes. Note that the improvement of the HDI for a country indicates better poverty reduction outcomes (or less poverty). Results on fixed and random effects estimations are reported in Column (1) and (2).The coefficients of urbanization and squared urbanization variables show the concave shape and both are statistically significant at 1% level. In general, these results support that there is an optimal degree of urbanization for poverty reduction outcomes.

As discussed in the previous section for endogeneity and heteroskedasticity problems, we call for the IV in the context of the GMM by using the lag value of the independent variables as internal instruments in this estimate[12]. Column (3)[13] in Table 1 presents the results from the GMM estimation. The optimal level of urbanization is (0.466/2x0.343) = 0.679 with strong and significant coefficients. From the optimal level of urbanization, a one-standard deviation (0.203) increase in urbanization leads the HDI to be 0.014 (or 1.4 percentage point) less over five years, ceteris paribus[14]. However, it is important to note that the optimal degree of urbanization should vary with the level of development as discussed in the theoretical section.

In Table 1, Column (4) and (5) examine the linear relationship between urbanization and poverty reduction outcomes (the HDI). Column (4)[15] reports that the marginal effect of urbanization on the HDI is positive and statistically significant at 5% level. The economic interpretation of urbanization is that a one standard deviation increase in urbanization (0.203) is associated with (0.048x0.203) = 0.010 percentage

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[12] See Wooldridge (2002) pp 282-283 for the Wooldridge autocorrelation test. Note that Drukker (2003) provides simulation results showing that the test has good size and power properties in reasonably sized samples. He has also proposed a user-written program, *xtserial*, to perform this test in STATA. The test for autocorrelation in panel data yields the following results: $F(1, 34) = 2.805$, $Prob > F = 0.1032$. This means that the hypothesis that there is no first-order autocorrelation in the data cannot be rejected at 10% significance level.

[13] We also test the presence of heteroskedasticity for the IV approach in column whether we will look for GMM or IV by using *ivhettest* in STATA. The results are Pagan-Hall general test statistic = 7.765, *p*-value = 0.0053. This means that the hypothesis that the disturbance is homoskedastic can be rejected at 1% significance level.

[14] The figure 0.014 is the difference of amount derived by substituting the different levels of urbanization in the quadratic form of urbanization. That is $0.014=\{(0.466x0.679)-(0.343x0.679^2)\}-\{(0.466x0.882)-(0.343x0.882^2)\}$, where one standard deviation (0.203) is obtained from the descriptive statistics based on the sample in this estimation.

[15] For this model specification, we also test for autocorrelation in panel data yields the following results: $F(1, 34) = 3.167$, $Prob > F = 0.0841$. This means that the hypothesis that there is no first-order autocorrelation in the data cannot be rejected at 5% significance level.

points increase in the HDI level, all else constant. A country with higher urbanization will have a higher level of standard of living leading to a better outcome of poverty reduction. In Column (5), we include the interaction dummies for different regions to measure the difference effects of urbanization on the HDI. The results report that the coefficients of urbanization and those interaction terms are statistically significant at 1% level. The positive effect of urbanization on the HDI varies and depends on regions and the level of development. Holding other things constant, we start from East Asia that in this region, one percentage point increase in urbanization, increase the HDI by (0.100-0.093) = 0.007 percentage point. Second, when urbanization increases one percentage point in Middle East and North Africa, the HDI will increase by (0.100–0.091) = 0.009 percentage point. The last region for Latin America and the Caribbean, one percentage increase in urbanization, the HDI will increase by (0.100–0.064) = 0.036 percentage point. This evidence supports our hypothesis that the positive patterns of urbanization effect on poverty reduction outcomes are different by regions. These may be explained by the background of countries and socioeconomic development across countries and within each region.

5.2 Urbanization and Pro-poor Growth

In this subsection, we report the findings based on Equation (4.5). These findings are shown in Table 2 using the dynamic panel GMM-system estimations by the two-step approach. The results based on the two-step dynamic panel GMM-system estimate are likely to be superior when compare with the one-step approach[16]. The concern about endogeneity problems is also addressed by the GMM-system estimations. The GMM-system estimator uses "internal instruments" for the endogenous variables in the persistent dependent variable, i.e. incomes growth of the poor and there may not have none of instruments that suits for most of the independent variables in an estimated equation. We, therefore, treat the 2-lagged value and earlier of potential endogenous variables as well as the dependent variable as a set of instrumental variables.

[16] According to Arellano and Bond (1991) and Blundell and Bond (1998), although the two-step approach is asymptotically more efficient, the two-step standard errors tend to be severely downward biased. Roodman (2006) proposed a user-written program on STATA, *xtabond2*, to compensate this disadvantage and to make available a finite-sample correction to the two-step covariance matrix derived by Windmeijer (2005). This can make the two-step approach robust more efficient than one-step robust leading to more accurate inference.

In Table 2, Column (1) – (3) report the results from the two-step dynamic panel GMM-system estimations for a series of the FGT index: Headcount Index (HI), Poverty Gap (PG) and Square Poverty Gap (SPG), respectively. It is important to note that the data for this subsection are a number of the poor in low-income countries, i.e. there is no developed countries in this sample for estimations. Since pro-poor growth is always negative, we can derive the optimal level of urbanization that maximizes (in fact less poverty) the pro-poor growth rate. Column (1) uses the HI growth as pro-poor growth. By taking derivative with respect to urbanization, the optimal degree of urbanization is (15.354/2x15.650) = 0.491 with strong and significant coefficients at 5% level. From the optimal level of urbanization, a one-standard deviation (0.190) increase in urbanization leads the HI growth rate to be 0.565 percentage point less over five years, ceteris paribus. This reveals that a number of the poor who can escape from being below $1 income/consumption per day is much less than those at the optimal urbanization.

In Column (2), we employ the PG growth as poor-pro growth. The results report that both coefficients for urbanization are statistically significant at 10% level. The optimal level of urbanization is (12.990/2x13.739) = 0.473 implying that a one-standard deviation (0.190) increase in urbanization leads the PG growth rate to be 0.496 percentage point less over five years, all else constant. Recall that the PG index measures how deep of the mean aggregate income or consumption of the poor from the established poverty line, i.e. the depth of poverty. This means that at an optimal urbanization, the poor will on average keep better raising their income/consumption closed to the $1 poverty line than the below or beyond optimal urbanization.

In Column (3), we utilize the SPG growth as pro-poor growth. Remind that the SPG index is the distributional measure that captures differences in income levels among the poor, i.e. the severity of poverty is to reflect inequality among the poor. Both urbanization coefficients are statistically significant at 10% level. Thus, the optimal level of urbanization is (29.685/2x29.684) = 0.500. A one-standard deviation (0.190) increase in urbanization leads the SPG growth rate to be 1.072 percentage points less over five years, all other things constant. This means that inequality among poor will on average keep greater reducing than that of the below or beyond optimal urbanization.

5.3 Urbanization and Channels of Poverty Reduction Outcomes

In this subsection, we discuss and report the channeled effects of urbanization on potential channels of poverty reduction outcomes as follows:

5.3.1 The Basic Education Outcomes

We estimate the effect of urbanization for the basic education channel based on Equation (4.2). We utilize the primary school net enrollment and the youth literacy rate as independent variables to capture the basic education channels with a quadratic form to urbanization and a set of control variables.

It is important to note that endogenous regressors that may cause potential endogeneity problems from random shocks such as GDP per capita, public expenditure on education and urbanization are treated by a set of appropriate instruments[17] used in the literatures (Pritchett and Summer 1996; Filmer and Pritchett 1997): for income by whether or not a country's primary export is oil; for public expenditure on education by education spending as the share of total expenditure of a country's geographic neighbors. For urbanization, we adopt the same idea of instruments for public expenditure on education by presuming that rural-urban migration in one country would correlate with the level of urbanization in neighborhood countries. For example, economic shocks affect on urban employment in a country, and then investments would move to another country's urban areas according to similar economic factors. The pattern of rural-urban migration in a neighborhood country would be stimulated by feasible investment mobility. Hence, we use urbanization of a country's geographic neighbors as a set of instruments for urbanization.

Column (1) and (2) in Table 3 report the results of the effect of urbanization on the basic education channels. Column (1) presents the results from the IV estimations by using the primary school net enrollment. The optimal level of urbanization is (3.379/2x2.730) = 0.619. From the optimal level of urbanization, a one-standard deviation (0.225) increase in urbanization leads the primary school net enrollment to be 0.138 (or 13.8 percentage point) less over five years, ceteris paribus. Column (2) also reports the results from the IV estimations by using the youth literacy rate. The optimal

[17] The test for autocorrelation in panel data yields the following results: F (1, 30) = 621.914, Prob > F = 0.0000. This means that the hypothesis that there is no first-order autocorrelation in the data can be rejected at 1% significance level. Their internal lag values are not an appropriate set of instruments for the GMM-IV estimation.

level of urbanization is (2.813/2x1.788) = 0.787. A one standard deviation (0.205) increase in urbanization is associated with the youth literacy rate to be 0.075 (or 7.5 percentage point) less over five years, all else constant. potential channels of poverty reduction outcomes as follows:

5.3.2 The Basic Health Outcomes

For health outcomes, we employ the infant mortality rate and life expectancy at birth to capture the basic health channels with a quadratic form to urbanization and a set of control variables based on Equation (4.2).

Like the basic education channels, the econometric issues from our random error terms are necessary to be concerned. Specifically, potential endogeneity problems may cause biased and inconsistent estimators. A set of appropriate instruments[18] is called for dealing with endogeneity problems. These instrument variables for health outcomes are similar to those of education outcomes. We use health spending as share of total expenditure, instead of share of education spending. The estimation results are reported in Table 4.

Column (1) and (2) in Table 4 present the results of the effect of urbanization on the basic health channels. Both estimations are tested the IV heteroskedasticity and yield that the presence of heteroskedasticitiy can be excluded from these outcomes. Column (1) presents the results by using the infant mortality rate as a channel of health outcomes. Since the infant mortality rate is expressed as a child dying between birth and the age of one per 1,000 live births, the optimal urbanization will minimize the infant mortality rate for the convex function. The optimal level of urbanization is, therefore, (455.392/2x366.150) = 0.622. From the optimal level of urbanization, a one-standard deviation (0.212) increase in urbanization leads the infant mortality rate to be 15.108 infants per 1,000 live births more over five years, holding other things constant. Column (2) reports the results of health outcomes by using life expectancy at birth. By taking derivative, we enable to calculate the optimal level of urbanization that is (66.275/2x48.945) = 0.677. A one standard deviation (0.206) increase in urbanization leads life expectancy at birth to be 2.077 years less over five years, all else constant.

[18] The test for autocorrelation in panel data yields the following results: F (1, 40) = 48.290, Prob > F = 0.0000. This means that their internal lag values are not an appropriate set of instruments for the GMM-IV estimation.

5.3.3 The Potential Productivity Channels

For In this subsection, we apply the dynamic panel GMM-system estimation based on Equation (4.5) to capture the channeled effect of urbanization on the productivity growth rate. The potential productivity channels are agriculture value added per worker and non-agricultural outputs per GDP. It is important to mark that in this estimation we instrument for all time varying RHS variables, which are treated all as potentially endogenous by random shocks. A set of appropriate instruments are the two periods and earlier of the lag values of potential endogenous variables and the persistent dependent variable. The estimation results of the channeled urbanization effects on potential productivity outcomes are presented in Table 5.

Column (1) in Table 5 reports the estimations using agriculture value added per worker as a channel of productivity outcomes. As we hypothesized, the coefficients of both urbanization variables exhibit the concave function to the optimal level of urbanization. By taking derivative with respect to urbanization, the optimal degree of urbanization is (2.345/2x2.214) = 0.529 with strong and significant coefficients at 1% level. From the optimal level of urbanization, a one-standard deviation (0.235) increase in urbanization leads the agriculture value added per worker growth rate to be 0.122 less over five years, ceteris paribus. As discussed earlier for the convergence hypothesis, the initial value of agriculture value added per worker associates with the growth rate negatively and strongly as well as that of non-agricultural output per GDP.

6. Conclusion

In this paper, we explored the effect of urbanization on poverty reduction outcomes using a panel data set from a sample of 143 countries for a variety of the periods of 1965-2005[19]. We employed the different estimation approaches for different poverty measures and for basic channels for poverty reduction outcomes because poverty is the state of multi-dimensions for being without the basic living necessities. First, we adopted the Human Development Index (HDI) that takes into account for basic human well-being achievements, to estimate the non-monetary poverty measure using the instrument variable (IV) related to the generalized method of moments (GMM). We also

[19] The sample sizes and time periods are different in each regression.

attempted to examine how the impact of urbanization for particular regions is relatively different to the rest of the world. Second, we investigated the effect of urbanization on the growth rates of the three monetary poverty measures: Headcount Index (HI), Poverty Gap (PG) and Square Poverty Gap (SPG), using the dynamic panel GMM estimation. Last we examined potential transmission channels for the urbanization effect through the basic education channels, the health channels (both by the IV estimation) and the potential productivity channels (by the dynamic panel GMM estimation).

Our estimated threshold for optimal urbanization to promote the best outcomes of poverty reduction based on our theoretical model ranges from 47.3% to 78.7% of national population. We also find that the performance of urbanization in different regions gives various magnitudes of the impact on poverty reduction outcomes. The optimal level of urbanization will maximize a number of the poor can earn more income/consumption to escape from having less than the $1 poverty line. Furthermore, our empirical analysis also confirms that the effect of urbanization on poverty reduction outcomes is panelized into basic need provisions (education and health) and the productivity outputs by a significant non-linear relationship. The poor in rural and urban areas would enjoy or lack of public provisions depending on whether a country is under or over urbanization.

Our findings could have implications to the appropriate policies, especially in developing countries. First, it could help to design the short and long term urban policies. The trend of urbanization, which is inevitably happening, will have a significant impact on poverty. Second, the link between the role of rural and urban areas is unconnected. If either too high or too low urbanization affects the performance of poverty reduction, how a government should properly determines public resources for both areas can keep well delivering the basic needs for the poor and sustain poverty reduction outcomes.

Table 1: Estimates of Urbanization and Poverty Reduction Outcomes

Dependent Variable	**Human Development Index (HDI)**				
Independent Variable	**Quadratic form**			**Linear form**	
	(1) FE	**(2) RE**	**(3) GMM**	**(4) GMM**	**(5) GMM**
Urbanization	0.237 **	0.452 **	0.466 *	0.048 *	0.100 **
	(0.059)	(0.130)	(0.189)	(0.022)	(0.029)
Urbanization^2	-0.248 **	-0.333 **	-0.343 *		
	(0.025)	(0.089)	(0.140)		
GDP per Capita [a]	0.069 **	0.070 **	0.050 **	0.056 **	0.062 **
	(0.006)	(0.006)	(0.012)	(0.008)	(0.007)
Degree of Decentralization	0.032 *	0.034 *	0.068 #	-0.038	-0.076 *
	(0.016)	(0.015)	(0.041)	(0.033)	(0.033)
Openness	-0.002	0.003	0.045 *	-0.012	0.006
	(0.005)	(0.005)	(0.022)	(0.011)	(0.011)
ODA	0.033	-0.104	-0.223	-0.161	0.216
	(0.118)	(0.098)	(0.362)	(0.193)	(0.203)
Freedom	0.0004	0.0003	-0.004	-0.005	0.0004
	(0.001)	(0.001)	(0.005)	(0.004)	(0.004)
Population Density [a]	0.077 **	0.006	0.011	-0.014 **	-0.001
	(0.016)	(0.005)	(0.014)	(0.004)	(0.005)
Road Density [a]	0.001	0.004	-0.004	0.012 *	-0.006
	(0.002)	(0.003)	(0.012)	(0.006)	(0.007)
Urbanization x EASIA Dummy					-0.093 **
					(0.027)
Urbanization x MENA Dummy					-0.091 **
					(0.028)
Urbanization x LAC Dummy					-0.064 **
					(0.017)
Hansen Test (*p* -value)			0.5195	0.1401	0.2342
Time Dummies	Yes	Yes	Yes	No	No
No. of observations	232	232	142	116	116
R-squared	0.9443 (Within)				

** significant at 1%; * at 5%; # at 10%

[a] The variable is in the form of logarithm.

Numbers in parenthesis are robust standard errors.

Hausman Specification Test (1) vs (2) : chi(15) = 68.81 and Prob>chi2 = 0.0000

The null hypothesis of Hansen Test is that the instruments used are not correlated with the residuals.

Table 2: Estimates of Urbanization and Pro-poor Growth

Dependent Variable (Growth Rate)	Headcount Index (HI)	Poverty Gap (PG)	Square Poverty Gap (SPG)
Independent Variable	**(1)**	**(2)**	**(3)**
Urbanization	-15.354 *	-12.990 #	-29.685 #
	(6.619)	(7.676)	(18.064)
Urbanization^2	15.650 *	13.739 #	29.684 #
	(6.994)	(7.425)	(15.981)
Initial Level of Dependent Variable	-0.543 **	-0.426 #	-1.122 **
	(0.113)	(0.244)	(0.259)
Inflation [b]	-0.077	0.176	0.259
	(0.290)	(0.450)	(0.395)
Openness [a]	-0.066	-0.529	-0.272
	(0.485)	(0.374)	(1.121)
Agricultural Share [a]	0.994 *	1.223 #	1.980 #
	(0.491)	(0.729)	(1.042)
Schooling	0.035	0.142	0.058
	(0.113)	(0.108)	(0.253)
Government Consumption Share [a]	0.177		1.041
	(0.390)		(0.748)
Hansen Test (*p* -value)	0.990	0.989	0.994
Serial Correlation Test (*p* -value)	0.748	0.301	0.643
Time Dummies	Yes	Yes	Yes
No. of observations	117	117	117

** significant at 1%; * at 5%; # at 10%

[a] The variable is in the form of logarithm.

[b] The variable is in the form of logarithm (1+variable).

Numbers in parenthesis are robust standard errors.

The null hypothesis of Hansen Test is that the instruments used are not correlated with the residuals.

The null hypothesis of Serial Correlation Test is that the errors difference regression shows no second-order serial correlation.

Table 3: Estimates for Urbanization and Education Outcomes

Dependent Variable	Education Outcomes	
	Primary School Net Enrollment (% aged >15)	Youth Literacy Rate (% aged 15-24)
Independent Variable	**(1) IV [b]**	**(2) IV [c]**
Urbanization	3.379 *	2.813 #
	(1.596)	(1.519)
Urbanization^2	-2.730 *	-1.788 #
	(1.261)	(1.086)
GDP per Capita [a]	-0.013	-0.067
	(0.043)	(0.113)
Population Density [a]	-0.023 #	0.022
	(0.012)	(0.037)
Education Expenditure Share	0.208 #	-0.380
	(0.123)	(0.348)
Hansen Test (*p* -value)	0.6028	0.6250
Time Dummies	Yes	Yes
No. of observations	116	81

** significant at 1%; * at 5%; # at 10%

[a] The variable is in the form of logarithm.

Numbers in parenthesis are robust standard errors.

The null hypothesis of Hansen Test is that the instruments used are not correlated with the residuals.

[b] The IV heteroskedasticity test yields *p* -value = 0.916. The hypothesis that the disturbance is homoskedastic can not be rejected.

[c] The IV heteroskedasticity test yields *p* -value = 0.374. The hypothesis that the disturbance is homoskedastic can be rejected.

Table 4: Estimates of Urbanization and Health Outcomes

Dependent Variable	Health Outcomes	
	Infant Mortality Rate	Life Expectancy at Birth
Independent Variable	**(1) IV [b]**	**(2) IV [c]**
Urbanization	-455.392 *	66.275 *
	(204.355)	(39.140)
Urbanization^2	336.150 #	-48.945 #
	(187.948)	(29.263)
GDP per Capita [a]	-7.647	1.788
	(6.004)	(1.387)
Schooling	-0.608	0.226
	(2.959)	(0.438)
Health Expenditure Share	-26.733	-19.080
	(109.713)	(14.952)
Freedom	0.238	-1.019 **
	(1.620)	(0.333)
Hansen Test (*p* -value)	0.1172	0.1006
Time Dummies	Yes	Yes
No. of observations	115	112

** significant at 1%; * at 5%; # at 10%

[a] The variable is in the form of logarithm.

Numbers in parenthesis are robust standard errors.

The null hypothesis of Hansen Test is that the instruments used are not correlated with the residuals.

[b] The IV heteroskedasticity test yields *p* -value = 0.124. The hypothesis that the disturbance is homoskedastic can not be rejected.

[c] The IV heteroskedasticity test yields *p* -value = 0.494. The hypothesis that the disturbance is homoskedastic can not be rejected.

Table 5: Estimates of Urbanization and Productivity Outcomes

Dependent Variable (Growth rate)	Productivity Outcomes: Agriculture Value Added Per Worker	Productivity Outcomes: Non-Agricultural Outputs per GDP
Independent Variable	**(1)**	**(2)**
Urbanization	2.345 **	0.889 **
	(0.768)	(0.212)
Urbanization^2	-2.214 **	-0.681 **
	(0.842)	(0.214)
Initial Level of Dependent Variable	-0.401 **	-0.560 **
	(0.113)	(0.500)
Agricultural Labor Force [a]	-0.606 **	-0.035
	(0.145)	(0.021)
Openness [a]	0.041	0.078 **
	(0.077)	(0.019)
Schooling	0.038	0.005
	(0.029)	(0.534)
Precipitation [b]	0.043	
	(0.030)	
Hansen Test (*p* -value)	1.000	1.000
Serial Correlation Test (*p* -value)	0.309	0.977
Time Dummies	Yes	Yes
No. of observations	515	532

** significant at 1%; * at 5%; # at 10%

[a] The variable is in the form of logarithm.

[b] The values of this variable are normalized by calculting into the unit of metre.

Numbers in parenthesis are robust standard errors.

The null hypothesis of Hansen Test is that the instruments used are not correlated with the residuals.

The null hypothesis of Serial Correlation Test is that the errors difference regression shows no second-order serial correlation.

APPENDIX A

THE DESCRITIONS AND SOURCES OF DATA

Table A1: The Descriptions and Sources

Variable	Variable Description	Data Source
A) Measures of Poverty		
Human Development Index (HDI)	An index of a country ranges between 0 and 1. Its calculation is based on 3 components: Health through life expectancy at birth, Education through the adult literacy rate and the gross schooling enrollment rate, and Income through a decent standard of living measured by GDP per capita. A higher rating of index indicates that a country has the higher human development.	The 2006 Human Development Report; The United Nations Development Programme (UNDP)
Headcount Index *	The proportion of population that is poor as the percentage of the population living below the certain threshold, i.e. people with their income or consumption below the established poverty line or, in short, the incidence of poverty.	*PovCalNet*; The World Bank (accessed May 2007)
Poverty Gap *	The degree of how the mean aggregate income or consumption of the poor differs from the established poverty line, i.e. the depth of poverty.	*PovCalNet*; The World Bank (accessed May 2007)
Square Poverty Gap *	The distributional measure captures differences in income levels among the poor, i.e. the severity of poverty is to reflect inequality among the poor.	*PovCalNet*; The World Bank (accessed May 2007)
B) Measures of Urbanization		
Urban Percentage	A country rating on a scale of 0 to 1. The index means that urban population as a percent of total population is the proportion of a country's total national population that resides in urban areas. Any person not residing in an area classified as urban is counted in the rural population. Definitions of urban populations vary slightly from country to country. A country with a relatively higher urban percentage indicates that there are more urbanized people living in urbanized areas than those in the other country.	The World Urbanization Prospects: The 2005 Revision; Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (accessed May 2007)

Variable	Variable Description	Data Source
C) Channels of Poverty Reduction Outcomes		
Primary School Net Enrollment *	The primary school net enrollment ratio defined as the total primary school enrollment (both sexes) of the official primary school age group expressed as a percentage of the population from the same age group. In this study, we use the net enrollment educational attainment of the total population aged 15 and over.	Barro, J. Robert and Jong-Wha Lee, 2000 (accessed May 2007)
Youth Literacy Rate *	The percentage of the population aged 15-24 years who can both read and write, with comprehension, a short, simple statement regarding their everyday life	The 2007 World Development Indicators CD-ROM; The World Bank
Infant Mortality Rate *	The probability of a child dying between birth and the age of one, expressed per 1,000 live births. The indicator is used as a measure of children's well-being and the level of effort being made to maintain child health.	The 2007 World Development Indicators CD-ROM; The World Bank
Infant Mortality Rate *	The probability of a child dying between birth and the age of one, expressed per 1,000 live births. The indicator is used as a measure of children's well-being and the level of effort being made to maintain child health.	The 2007 World Development Indicators CD-ROM; The World Bank
Agricultural Value Added per Worker *	A measure of agricultural productivity is in terms of constant 2000 US$. Value added in agriculture measures the output of the agriculture sector less the value of intermediate inputs. Agriculture comprises value added from forestry, hunting and fishing as well as cultivation of crops and livestock production.	The 2007 World Development Indicators CD-ROM; The World Bank
Non-agricultural Outputs per GDP	A measure of non-agricultural outputs as percentage share of GDP. Non-agricultural sectors comprise of occupations in industry and service sectors.	The 2007 World Development Indicators CD-ROM; The World Bank

Variable	Variable Description	Data Source
D) Other Explanatory Variables		
GDP per Capita*	GDP per capita is gross domestic product divided by mid-year population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in 2000 constant U.S. dollars.	The 2007 World Development Indicators CD-ROM; The World Bank
Degree of Decentralization	An indicator is as a percentage of a sub-national share of expenditures of the total expenditures. The indicator is on scale of 0 to 1.	The 1972-1989 historical and the 2007 GFS CD-ROMs; The International Monetary Fund (IMF) and The World Bank Decentralization Thematic Group
Openness	Openness is calculated from the summary of import and export as a percentage of GDP. This indicator exhibit how a country has openness to international trade.	The 2007 World Development Indicators CD-ROM; The World Bank
Official Development Assistances (ODA) *	ODA is as a percentage of GNI that is the percent of a country's Gross National Income (GNI) received in the form of aid from other countries. The ratio is based on between 0 and 1. Gross National Income or GNI (formerly GNP) is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property incorporation).	The 2007 World Development Indicators CD-ROM; The World Bank
Population Density	A number of population per squared kilometer	The 2007 World Development Indicators CD-ROM; The World Bank
Road Density	A length of road per squared kilometer	The World Road Statistics (WRS); the International Road Federation (IRF: accessed May 2007) and the 2007 World Development Indicators CD-ROM; The World Bank

Variable	Variable Description	Data Source
Freedom	A simple average of the index of political rights and the index of civil liberties by the author. Political rights measure a country rating on a scale of 1 to 7 that indicates the degree of political rights in regard to existence of free and fair elections, competitive parties or other political groupings, an opposition that plays a significant role in political decision-making, and the rights of minority groups to self-government. A rating of 1 indicates highest level of political rights (closest to the ideals) suggested in the survey. Civil liberties measure a country rating on a scale of 1 to 7 that indicates the degree of civil liberties in regard to aspects such as the degree of freedom of expression, assembly, association, education, religion, and an equitable system of rule of law. A rating of 1 indicates the highest level of civil liberties.	Freedom in the World 2005; Freedom House (accessed May 2007)
Inflation	The index refers to a general rise in prices for goods and services measured against a standard of purchasing power	The 2007 World Development Indicators CD-ROM; The World Bank
Agricultural Share of GDP	The percentage share of agriculture of GDP	The 2007 World Development Indicators CD-ROM; The World Bank
Years of Schooling	A measure of education attainment in terms of the average years of schooling for the total population over the age of 15 years	Barro, J. Robert and Jong-Wha Lee, 2000 (accessed May 2007)
Government Consumption Share of GDP *	The percentage share of general government final consumption expenditure of GDP This consumption includes all government current expenditures for purchases of goods and services (including compensation of employees)	The 2007 World Development Indicators CD-ROM; The World Bank
Education Expenditure Share	The percentage share of education spending of the total expenditure	The 1972-1989 historical and the 2007 GFS CD-ROMs; The International Monetary Fund (IMF)
Health Expenditure Share	The percentage share of health spending of the total expenditure	The 1972-1989 historical and the 2007 GFS CD-ROMs; The International Monetary Fund (IMF)

Variable	Variable Description	Data Source
Agricultural Labor Force	The percentage share of agricultural labor force of the total labor force	Food and Agriculture Organization (FAO); the United Nations (accessed May 2007)
Precipitation	The yearly long run average rainfall	The Tyndall for Climate Change Research (accessed May 2007)
E) Country Classifications		
List of countries' primary export is oil.	Whether a country in our sample is a member of the Organization of the Petroleum Exporting Countries (OPEC) or not.	The Organization of the Petroleum Exporting Countries (accessed May 2007)
Classifications of countries by income level and region	Whether a country in our sample is a member of high income countries and which region a country is categorized.	The World Bank (accessed May 2007)

* Definitions based on the World Development Report; The World Bank.

Table A2: Descriptive Statistics for Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
A) Urbanization and Poverty Reduction Outcomes (83 countries, 7 time periods: 1975-2005)					
Human Development Index (HDI)	513	0.748	0.155	0.256	0.965
Urbanization	513	0.603	0.203	0.063	0.973
GDP per Capita (1000$US)	512	7.860	9.420	0.111	52.182
Degree of Decentralization	286	0.250	0.164	0.004	0.642
Openness	497	0.745	0.419	0.115	2.939
Official Development Assistances (ODA)	471	0.025	0.054	0	0.654
Population Density	513	104.998	131.880	1.219	1,023.404
Road Density	391	0.936	3.081	0.023	41.474
Freedom	494	2.902	1.773	1	7
B) Urbanization and Pro-poor Growth (89 countries, 5 time periods: 1980-2000)					
Headcount Index (HI)	236	0.158	0.185	0	0.741
Poverty Gap (PG)	236	0.0565	0.082	0	0.411
Square Poverty Gap (SPG)	236	0.029	0.050	0	0.288
Urbanization	236	0.491	0.190	0.050	0.905
Inflation	217	1.847	5.515	0.972	75.817
Openness	231	0.696	0.368	0.132	1.988
Agricultural Share of GDP	232	0.204	0.121	0.023	0.563
Years of Schooling	179	5.556	2.133	0.670	10.500
Government Consumption Share of GDP	229	0.138	0.051	0.042	0.294

Variable	Obs	Mean	Std. Dev	Min	Max
C) Urbanization and Primary School Net Enrollment (66 countries, 6 time periods: 1975-2000)					
Primary School Net Enrollment	381	0.370	0.152	.005	.759
Urbanization	381	0.563	0.225	.032	.971
GDP per Capita (1000$US)	374	7.777	8.846	0.086	37.164
Population Density	381	103.640	125.580	1.808	946.490
Education Expenditure Share	228	0.138	0.066	0.009	0.429
D) Urbanization and The Youth Literacy Rate (69 countries, 7 time periods: 1975-2005)					
Youth Literacy Rate	448	0.873	0.182	0.146	0.999
Urbanization	448	0.516	0.205	0.032	0.964
GDP per Capita (1000$US)	408	3.106	3.838	86.026 3	26.178
Population Density	448	100.248	147.136	0.924	1097.327
Education Expenditure Share	202	0.145	0.056	0.015	0.367
E) Urbanization and The Infant Mortality Rate (83 countries, 7 time periods: 1975-2005)					
Infant Mortality Rate	561	37.882	35.74708	2	155.400
Urbanization	561	0.578	.2116523	0.032	0.973
GDP per Capita (1000$US)	534	7.253	8.843	86.026	3.997
Years of Schooling	433	6.245	2.648	0.350	12.050
Health Expenditure Share	298	0.110	0.079	0.003	0.489
Freedom	519	3.071	1.866	1	7

Variable	Obs	Mean	Std. Dev.	Min	Max
F) Urbanization and Life Expectancy at Birth (83 countries, 7 time periods: 1975-2005)					
Life Expectancy at Birth	522	68.71599	9.008231	35.158	81.237
Urbanization	522	0.593	0.206	0.043	0.973
GDP per Capita (1000$US)	499	7.683	9.038	0.086	39.968
Years of Schooling	398	6.585	2.562854	0.890	12.050
Health Expenditure Share	284	0.114	0.082	0.003	0.489
Freedom	484	2.983	1.867	1	7
G) Urbanization and Agriculture Value Added per Worker (105 countries, 8 time periods: 1965-2000)					
Agriculture Value Added per Worker (1000$US)	665	4.606	8.043	0.074	47.225
Urbanization	665	0.468	0.235	0.023	0.949
Agricultural Labor Force	659	0.424	0.281	0.018	0.947
Openness	656	0.634	0.363	0.053	2.289
Years of Schooling	612	5.034	2.859	0.170	12.050
Precipitation	665	1.159	0.791	0.0229	3.726
H) Urbanization and The Non-agricultural Share of GDP (105 countries, 9 time periods: 1960-2000)					
Non-agricultural Share of GDP	698	0.218	0.164	0.007	0.931
Urbanization	698	0.456	0.240	0.024	0.949
Agricultural Labor Force	647	0.430	0.284	0.018	0.947
Openness	681	0.634	0.363	0.053	2.289
Years of Schooling	638	4.953	2.909	0.170	12.050

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