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EXPLORING THE TRADE–URBANIZATION NEXUS IN DEVELOPING ECONOMIES: EVIDENCE AND IMPLICATIONS

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Abstract

Developing countries have seen a rapid rise in population urbanization in the past decades. At the same time, they have participated actively in the process of globalization. However, possible interlinks between population urbanization and trade openness in developing economies have been ignored by present literature. This paper firstly proposes a simple framework explaining the cereals trade–population urbanization nexus, showing how cereals supply constrains population urbanization and how international trade can change this constraint. Then, it presents historical evidence, empirical tests, and case studies from the People's Republic of China and India further highlighting the critical role of cereals trade in population urbanization in developing economies. Policy suggestions that may help developing countries achieve more inclusive and sustainable urban development are discussed in the final section of this paper.

JEL Classification: Q17, O18, R11

Contents

1. INTRODUCTION

Modern humans have been increasingly concentrated in cities. The United Nations forecasts that 60% of the world's population will live in urban areas by 2030. Ever since 2007, when the world's urban population exceeded its rural counterpart for the first time, the development community has shifted some of its focus to urban areas. Urbanization was a central theme of the *World Development Report 2009* by the World Bank. Regional multilateral institutions such as the Development Bank of Latin America and the Asian Development Bank have also stepped up their efforts to support the urban sector, and have begun to collaborate on comparative studies of urbanization.

Urbanization is a broad term that includes a wide range of issues such as spatial distribution of cities, architectural design, labor migration, and size distribution of cities. In urban economics, urban development has a threefold meaning: population urbanization, urban primacy, and urban concentration (Moomaw and Shatter 1996). In the empirical literature, urban primacy is usually measured by the share of the largest city's population in a country's total urban population; urban concentration is usually measured by the population share of big cities (generally being defined as those with more than 1 million population) in total urban population; and population urbanization is measured by the share of urban population in total population.

For developing economies, population urbanization is often the starting point of discussion or research on urban development. However, it is believed that population urbanization in developing countries does not differ fundamentally from the experience of developed countries (Moomaw and Shatter 1996). Henderson (2005) states that urbanization is a transient phenomenon, implying that attention should be focused on urban primacy and urban concentration. These arguments or statements are only applicable to the urbanized countries or regions, not developing economies where the level of population urbanization has risen rapidly and will continue to rise in the decades to come. As shown in Table 1, from 1960 to 2011, the population in the world rose from 3.04 billion to 6.97 billion, an increase of 129.28%, while the total urban population increased 257.43% from 1.01 billion to 3.61 billion, and the total population of cities with over 1 million residents increased 257.22% from 395 million to 1.41billion. These figures show that the growth rate of urban population in the world (especially the population in larger cities) is much faster than the growth rate of the world's total population in the past half-century.

Table 1: Population Statistics (1960–2011)
(millions)

	1960	1970	1980	1990	2000	2010	2011
World							
Total population	3,040	3,690	4,450	5,300	6,120	6,890	6,970
Population in cities	1,010	1,340	1,740	2,260	2,840	3,540	3,610
Population in metropolises	395.32	530.11	684.10	862.03	1,107.02	1,379.65	1,410.84
Developing countries							
Total population	2,297	2,857	3,538	4,321	5,070	5,760	5,830
Population in cities	543	777	1,098	1,550	2,054	2,654	2,715
Population in metropolises	213.97	305.23	429.38	577.61	791.86	1,028.47	1,055.69

Note: Metropolises are cities with population of more than one million.

Data source: World Bank World Development Indicators.

Against the rising importance of population urbanization, little has been published on the determinants of population urbanization in developing economies. One of the determinants is openness, particularly for Asia, where many economies adopt export-oriented policies and international trade plays an increasingly important role. Recognizing the shortage of research on the linkages between international trade and urban development in developing countries, this paper will examine the effects of international trade on urban development, especially focusing on the interlinkages between international trade and population urbanization.

Our contribution is related to the United Nations Sustainable Development Goals (SDGs). Goal 11 of the SDGs is to make cities inclusive, safe, resilient, and sustainable. However, urbanization can be accompanied by unemployment and poverty, malnutrition, ghetto houses, and so on. For example, if the speed of population urbanization is too fast, but the agrarian sector cannot provide enough food to feed the population, malnutrition would appear. If a developing country does not adopt efficient trade policies, even if it has enough food to feed the urban population, rapid population urbanization may result in a high urban unemployment rate, or other problems of over-urbanization. One may ask whether international trade encourages urbanization and consequently enhances inclusiveness or unsustainability. In this paper, we will show that international trade, cereals or non-cereals trade, and population urbanization spur economic development with structural transformation. This indicates that the governments of developing economies should allocate more resources to providing roads, transportation, housing, and basic services to the urban population.

2. LITERATURE REVIEW

In this section, we will first review the literature on the relationship between international trade and urban concentration and urban primacy, and then summarize studies on the role of international trade in the process of population urbanization.

2.1 International Trade, Urban Concentration, and Urban Primacy

Early research on the determinants of urban concentration comes from Williamson (1965). He argues that urban concentration will initially increase and then decline with economic growth. This is confirmed by some studies (Wheaton and Shishido 1981; Rosen and Resnick 1980). More recently, Ades and Glaeser (1995) show that total population and the share of the nonagricultural labor force are positively correlated with urban concentration. They also explain that government policies and politics play an important role in the process of urban concentration, i.e., government may adopt biased policies to favor residents in the country's largest city because this can help governments survive. As a result, dictatorship and political instability encourage urban concentration. Davis and Henderson (2003) find that investments in interregional infrastructure and strengthened fiscal decentralization can reduce urban concentration.

Another stream of literature focuses on the interlinkages between trade openness and urban concentration, including the neoclassical urban systems theory and new economic geography (NEG) theory.

Henderson (1982) develops the framework of neoclassical urban systems under the neoclassical assumptions. He constructs a general equilibrium model to explain the formation of urban systems in a small open economy. Relying on this model, Rauch (1989) derives that trade liberalization could encourage urban concentration. As

Henderson (1996) points out, trade changes the output structure of an economy, causing changes in the number of different types of cities, which affects urban concentration. Monfort and van Ypersele (2003) argue that international trade leads to urban concentration. However, Henderson (1996) indicates that the impact of trade liberalization on urban concentration depends on country-specific geographic characteristics, for example, the spatial heterogeneity between coastal cities and inland cities. Based on a multisector Ricardo trade model, Rauch (1991) shows that when the cost of domestic trade does not change, trade liberalization promotes the growth of coastal or border cities. Without considering other geographic characteristics, the size of cities monotonically decreases when moving from coastal or border areas to inland areas, because trade liberalization facilitates labor migration from inland cities to coastal or border cities that have better accessibility to foreign markets. Likewise, Brülhart, Crozet, and Koenig (2004) show external liberalization leads to urban agglomeration of the border areas.

Krugman (1991) pioneered the NEG theory where transportation cost, as a dispersion force, plays an important role in determining a firm's incentive to concentrate into some area with other firms. As regional integration and trade liberalization can help reduce transaction costs, they encourage agglomeration of economic activities. Following Krugman (1991), Monfort and Nicolini (2000) construct a two-country, four-region model where populations can migrate freely inside a country, but cannot cross the border. They find that regional integration inside a country and international trade encourage agglomeration. Haaparanta (1988) sets up a standard NEG model, taking inequality of factor endowments into account, and finds that trade liberalization causes spatial production agglomeration to regions with comparative advantages. If some industries exogenously depend on some special regions, specialization of those industries with comparative advantages would encourage the agglomeration in these regions. Similarly, Paluzie (2001) believes that trade would encourage agglomeration.

However, other NEG models show the opposite conclusion (e.g., Krugman 1996; Krugman and Livas Elizondo 1996; Moncarz 2004; Behrens et al. 2007). Krugman and Livas Elizondo (1996) explain that a closed economy tends to promote large metropolises with huge and relatively affluent population concentration, which offer the best market access (backward linkages) to manufacturing firms that serve the domestic market. Meanwhile, huge cities can offer better access to inputs including labor and intermediate inputs from other firms (forward linkages). For these economies, implementing import-substitution and trade liberalization policies will promote the relocation of firms that serve foreign markets to areas with better access to foreign consumers and intermediate products from abroad, decreasing concentration in metropolises. Behrens et al. (2007) draw a similar conclusion by developing a monopolistic competition model and assume two centrifugal forces, one from the inability of farmers to migrate freely and the other from a competition effect in regions with a high concentration of firms.

The different conclusions can be attributed to different assumptions that are made regarding how decreasing trade costs affect centrifugal forces (Behrens et al. 2007; Crozet and Koening 2004). They can also be attributed to a country's industrialization level relative to that of the rest of the world. For example, Alonso-Villar (2001) argues that for those developing countries with low levels of industrialization, firms might choose locations closer to domestic markets to avoid fierce international competition, leading to urban concentration.

Empirical studies on the relationship between international trade and concentration do not arrive at same conclusions. The traditional view maintains that only those large cities that serve as hubs and are of concern to foreign trade partners can benefit from trade openness, and consequently trade openness increases the concentration or primacy of these cities (Linsky 1965; Berry 1961). However, others find that international trade reduces urban concentration (Frankel and Romer 1999; Karayalçin and Yilmazkuday 2014). Moomaw and Shatter (1996) show that higher export orientation significantly reduces urban concentration and urban primacy. Yet, some other studies find that the effect of trade on urban concentration is insignificant (Ades and Glaeser 1995; Nitsch 2006; Junius 1999).

Finally, the impact of international trade on urban concentration may also depend on different geographical features or the components of trade. For example, De Ferranti et al. (1998) assert that international trade may reduce urban concentration in Colombia because specialization in agricultural exports might reduce spatial disparities through an increase in farmers' income in particular regions. Henderson (2000) finds that trade increases urban concentration in port cities, but decreases urban concentration if the primate city is not a harbor city. Using panel data from Colombia, Guevara (2015) assesses the effect of regional trade openness on agglomeration within regions and finds that the effect of trade on urban concentration varies across regions. On the one hand, trade has positive effect on spatial agglomeration within regions with large home market and location advantages. On the other hand, trade has negative effect on agglomeration within regions that lack access to international trade or historical advantage. Gaviria and Stein (2000) find that trade liberalization hinders the growth of major cities in inland areas, but it has little effect on the population growth of port cities or cities located near ports. After controlling the endogeneity in regression models, Grajeda and Sheldon (2015) find that trade liberalization reduces the size of the primate city, but helps increase the size of non-primate cities.

Based on the above literature review, it appears difficult to derive a general conclusion about the nexus between international trade and urban concentration. What can be stated is that if a highly industrializing economy adopts export-oriented strategies, and the world market is big enough, trade liberalization will encourage the concentration of harbor cities or border cities because they provide better access to the world market.

2.2 Effect of International Trade on Population Urbanization

The literature on population urbanization can be at least dated back to the dual economy models, which explore the determination of rural–urban migration, urban wages, rural–urban wage gaps, and urban unemployment (Lewis 1954; Ranis and Fei 1961; Harris and Todaro 1970). According to Harris and Todaro (1970), urban unemployment could be a normal phenomenon in developing economies since many migrants are attracted by high expected rather than real income in urban sectors. Some studies find that in many Asian economies, the speed of population urbanization is faster than the speed of industrialization, resulting in over-urbanization (Davis and Golden 1954). Pandey (1977) and Bairoch (1988) attribute over-urbanization in some Asian economies to rural–urban migration pushed by too-fast population growth and the increasing pressure of population on agricultural land.

Other literature empirically tests the determinants of population urbanization. For example, Davis and Golden (1954) and Graves and Sexton (1979) find an S-shaped relationship between gross domestic product (GDP) per capita and population urbanization in preindustrial and developing countries. That is to say, as GDP per capita rises, the rate of population urbanization in the early period increases slowly,

then accelerates before slowing down. Similarly, Moomaw and Shatter (1996) find that population urbanization is positively correlated with GDP per capita and industrialization. Using state-level panel data from India, Pandey (1977) finds that industrialization is positively correlated with population urbanization, while cropping intensity being a proxy for agricultural development is negatively correlated with it. Brueckner (1990) finds that the rural–urban income ratio, the ratio of commuting costs to urban income, and the ratio of agricultural land rent to urban income have significant effect on city size in developing economies. Davis and Henderson (2003) show that government policies, such as price controls and industrial protection, have indirect effect on population urbanization through affecting industrial structures.

Very few empirical studies test the effect of international trade on population urbanization in developing economies. Moomaw and Shatter (1996) find that population urbanization rises with increases in export orientation based on cross-country panel data. Jedwab (2013) investigates the effect of crop exports on population urbanization in Ghana and the Ivory Coast, and finds that the rate of population urbanization increases with exports. However, using a panel of Asian countries, Hofmann and Wan (2013) find that international trade (share of import and export to GDP) is not significant in all regression models on population urbanization. The mixed findings could be caused by the use of different components of international trade. Using panel data of developing Asia during 1993–2010, Zhang and Wan (2015) provide evidence that international trade is generally negatively correlated with the level of population urbanization. However, cereals and non-cereals trade have different correlations with population urbanization: the former is positively correlated while the latter is negatively correlated with population urbanization. Similarly, Glaeser (2014) finds that after the 1960s, there has been an explosion of poor megacities in developing countries. He shows that agricultural prosperity can lead to more population urbanization in a closed economy, but that population urbanization increases with agricultural desperation in an open economy. In the latter case, importing agricultural products while exporting nonagricultural products may be a key driver of population urbanization in poor countries.

An important question to be answered is whether the international trade of agricultural products and manufactured goods have different effects on population urbanization. So, the next section will examine the interlinkages between different components of international trade and urban development, especially focusing on the interlinkages between cereals trade and population urbanization.

3. THE NEXUS OF TRADE–POPULATION URBANIZATION

In this section, a simple framework is first constructed to show that grain imports and exports can affect population urbanization by changing the constraints of domestic grain surplus on urbanization. Evidence from economic history, the People's Republic of China (PRC), and India is then provided to highlight the theoretical hypotheses of this framework.

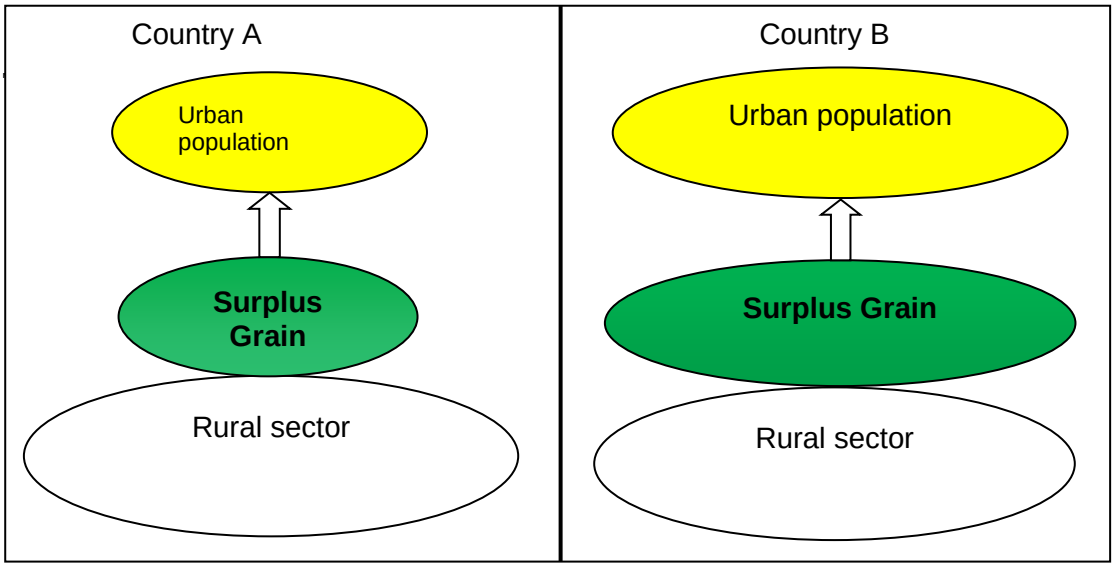
3.1 A Simple Framework on Cereals Trade–Population Urbanization

In a closed economy, the share of the population that can live in urban areas is basically determined by the surplus of grain and food produced by peasants because

the urban sector can only be fed by the agriculture sector. For example, if each peasant can feed one other person, then the share of urban population in the long run could be 50% only; if each peasant can feed two other persons, then the share of urban population could be as high as 75%. That is to say, the share of surplus grain generally equals population urbanization in the long term. This equilibrium in a closed economy has been realized and discussed by anthropologists, economic historians, and development economists (Skinner 1977; Zhao 1992; Zhang 1992; Johnson 1997, 2000).

Figure 1 illustrates such an equilibrium where two closed economies have the same population but the agricultural productivity of country B is higher than that of country A. Thus, country A has lower population urbanization than country B.

Figure 1: Equilibrium between Grain Surplus and Urbanization in Closed Economies

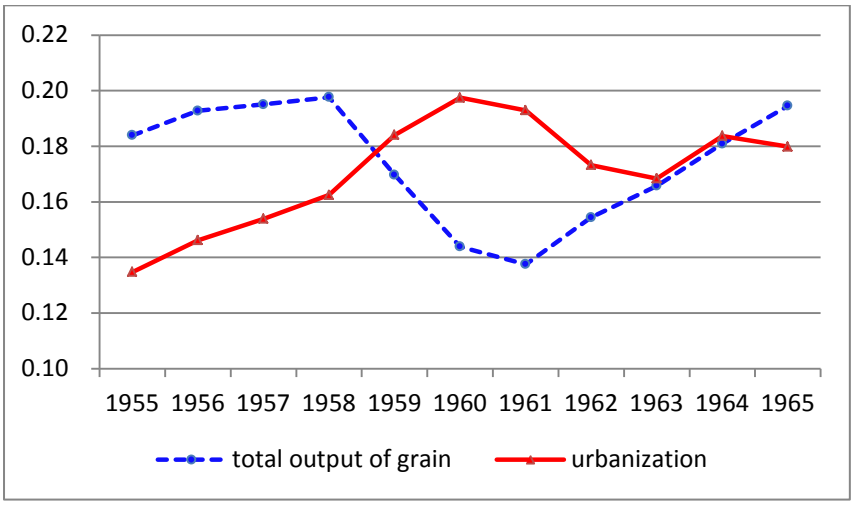


Source: Author.

We provide historical evidence from the PRC to illustrate such equilibrium. In its early development stage, the PRC, the world's most populous country, experienced a grain shortage and could not sustain population urbanization. Especially in the "Three Years of Economic Hardship" from 1958 to 1960, the urban population sharply increased while national grain output decreased dramatically, leading to tens of millions of deaths due to starvation.

In order to deal with this problem, *Nine Measures to Reduce the Urban Population and Urban Food Consumption* was issued by the Central Committee Work Conference on 16 June 1961. It required that the urban population be reduced by at least 20 million in the following 3 years. In May 1962, the central government further issued the *Decision to Further Cut Down Staffing and Reduce the Urban Population* (Sun 2013) to ease the tension between urban population growth and food shortage. Shanghai had also encountered food shortage before that period. In response, the Shanghai government encouraged migrant peasants to go back to their hometowns and join agricultural production, and organized urban unemployed workers to go to Jiangxi Province and other rural areas to take part in wasteland reclamation. According to Chen (2011), from 1955 to 1956, more than 5 million urban citizens were dispatched from Shanghai.

Figure 2: Total Grain Output and Urbanization in the People's Republic of China (1955–1965)



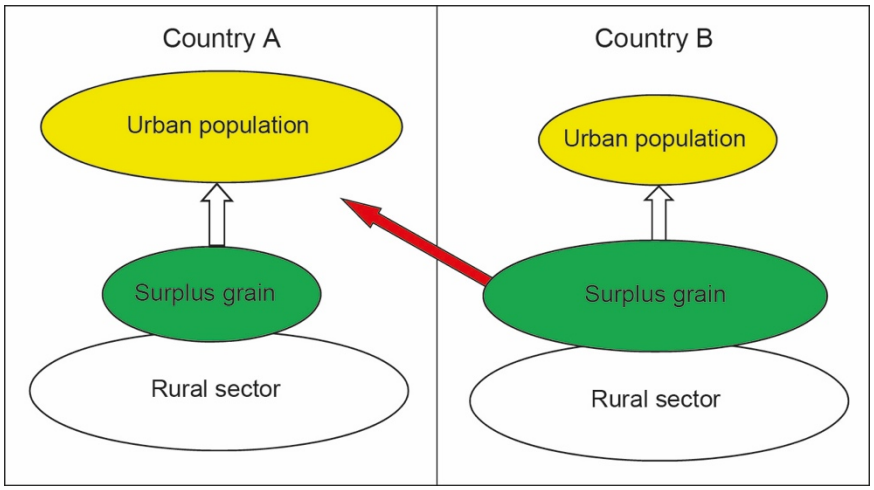
Note: The unit of measurement is trillion tons for total output of grain and % for urbanization.

Source: National Bureau of Statistics of the People's Republic of China, www.stats.gov.cn.

In an open economy, the equilibrium could be changed by international trade. In this case, the share of urban population could be higher or lower than the ratio of surplus grain to total grain output produced by domestic peasants. For example, Glaeser (2014) argues that globalization radically changes the process of urbanization. Trade liberalization means that Port-au-Prince, for example, can be fed with imported American rice. Urban growth can still take place even in the face of rural deprivation, as in Kinshasa today. His model shows population urbanization without improvement of agricultural productivity. He also finds a sharp decline in the connection between local agricultural productivity and urbanization between 1961 and 2010, which is compatible with the hypothesis that global food supply has reduced the need to develop a domestic agricultural surplus before building cities. Here, a new equilibrium is attained when the ratio of surplus grain to total grain output produced domestically plus net import of food equals to the share of urban population. This equilibrium applies not only to cities like Port-au-Prince, but also to economies like the PRC; Hong Kong, China; Japan; Singapore; and those that do not have enough cultivated land or cannot produce enough food to feed their citizens. Another side of the coin is that in countries such as Brazil, Canada, France, and United States, the ratio of surplus grain to total grain output produced domestically is higher than the share of urban population. Their international trade involves exporting surplus grain to feed other countries' population urbanization.

Figure 3 illustrates the new equilibrium in countries A and B, which are now open economies. In this case, although agricultural productivity of country A is lower, it still has a larger urban population than country B. This is because country A can now import grains produced by country B.

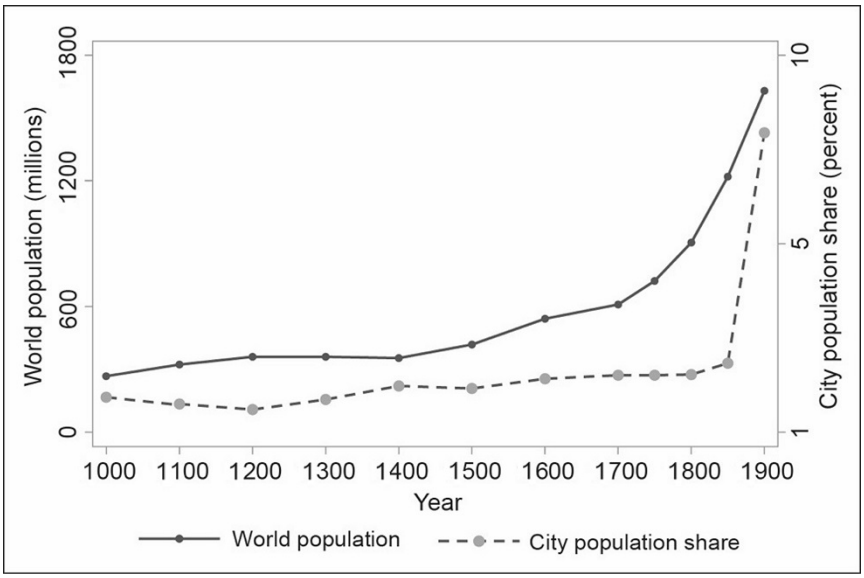
Figure 3: Equilibrium between Grain Surplus and Urbanization in Open Economies



Source: Author.

A good example is illustrated in Figure 4, where between 1000 and 1900 the global share of urban population more than quadrupled, increasing from 2% to over 9%, and the increase occurred mostly during 1800–1900.

Figure 4: Total Population and Urbanization of the World (1000–1900)



Source: Nunn and Qian (2011).

Nunn and Qian (2011) attribute such an increase partly to the introduction of potatoes from South America to Europe. Potatoes are native to South America and were widely adopted as a field crop in Europe toward the end of the 17th century and the beginning of the 18th century before spreading to the rest of the Old World (i.e., the entire Eastern Hemisphere), mainly by European sailors and missionaries. Compared with other European staple crops, potatoes provide more calories, vitamins, and nutrients per unit of output. As a result, the introduction of potatoes led to rapid growth of population and cities (Salaman 1949; von Fürer-Haimendorf 1964; Moomaw and Shatter 1996). Using country-level data on population and population urbanization,

Nunn and Qian (2011) find in their empirical testing that the introduction of potatoes from the New World to the Old World is responsible for approximately one-quarter of the growth in Old World population and urbanization between 1700 and 1900.

What is not shown in Figure 3 is that country B can import nonfarm products from country A after exporting food items. These imports and exports entail equilibrium between rural and urban sectors in both countries. Cross-border trade enables country A to increase its population urbanization at the expense of country B's urbanization potential. Meanwhile, nonfarm exports of country A will help sustain its urban sector and contain country B's population urbanization. Based on these arguments, the following two hypotheses can be proposed:

- Hypothesis 1: Cereals and non-cereals trades have different effects on population urbanization.
- Hypothesis 2: Net imports of cereals increases the importer's population urbanization.

In the next section, we will test these two hypotheses using panel data of 1993–2010 from 40 developing countries in Asia.

3.2 Empirical Evidence

Table 2 lists the definition of variables. Here "urbanization" is the independent variable, measured by the share of urban population in total population. Trade openness is measured by the share of imports and exports in GDP. In order to investigate the different effects of different components of trade on population urbanization, shares in GDP of imports and exports, cereals imports and exports, non-cereals imports and exports, cereals imports, cereals exports, and net cereals imports will be controlled in the regression models. GDP per capita, structure of GDP (share of primary industry in GDP, share of secondary industry in GDP), average cereals yield, total population, land area, and time trend are also controlled in the models. The last two in Table 2 are instruments that will be employed in the two-stage least squares estimation.

Table 2: Definition of Variables

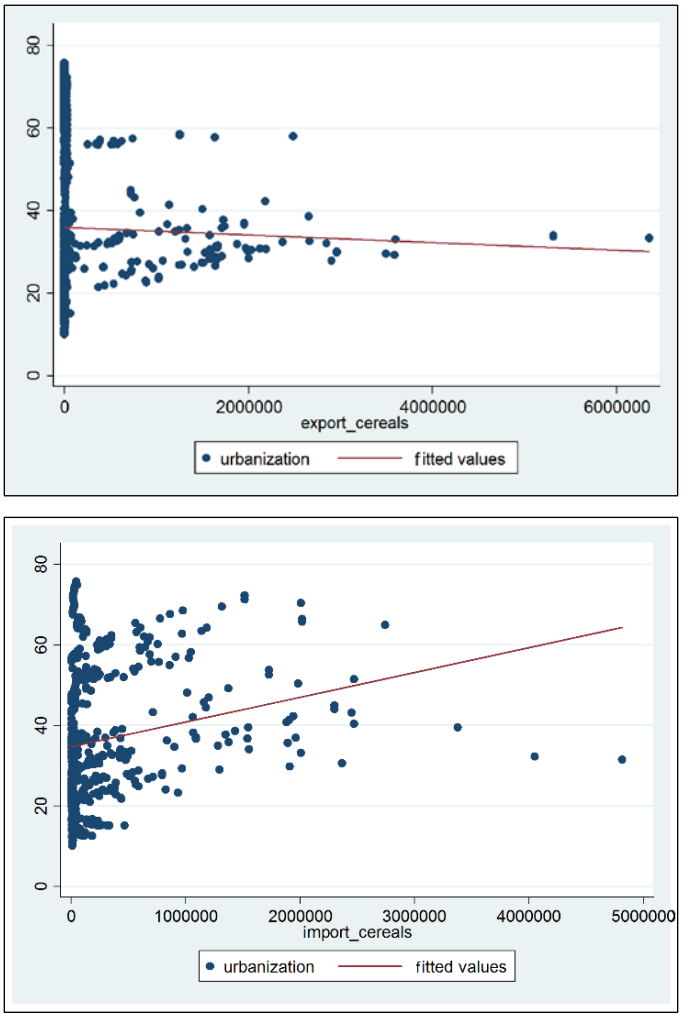
Variable	Definition
urbanization	Share of urban population (%)
trade	Share of imports and exports in GDP (%)
trade_cereals	Share of cereals imports and exports in GDP (%)
trade_other	Share of non-cereals imports and exports in GDP (%)
impt_cereals	Share of cereals imports in GDP (%)
expt_cereals	Share of cereals exports in GDP (%)
netimp_c	Share of net imports of cereals in GDP (%)
avgdp	GDP per capita ($; log)
avcereals	Average cereals yield (m ton; log)
totpop	Total population (person; log)
surface	Surface area (km; log)
gdp1_share	Share of primary industry in GDP (%)
gdp2_share	Share of secondary industry in GDP (%)
trend	Time trend
neighbor_trade	Average level of openness of neighboring countries (%)

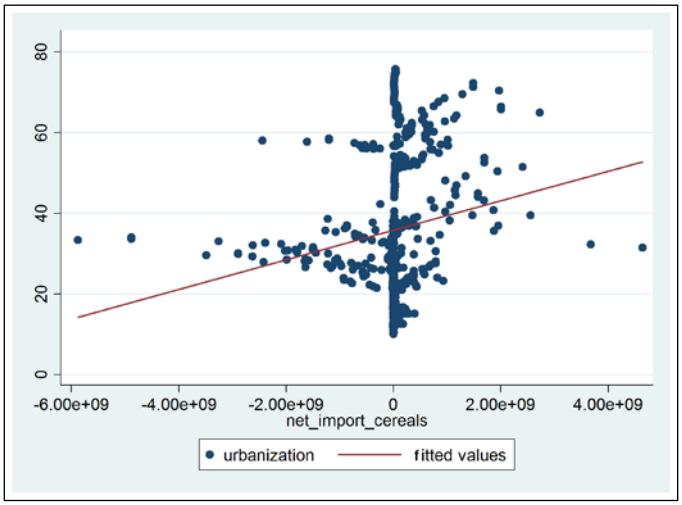
top5cereals	Total cereals output in Brazil, Canada, France, Russia, and United States (kg; log)

GDP = gross domestic product.
Sources: World Bank World Development Indicators; Food and Agriculture Organization of the United Nations.

Before running regression models, Figure 5 plots import, export, and net import of cereals and population urbanization. It is clear that cereals export is negatively correlated with population urbanization, while import and net import are positively correlated with population urbanization.

Figure 5: Cereals Trade and Population Urbanization in Asia





Note: The unit of measurement is % for urbanization and ton for cereals.

Sources: World Bank World Development Indicators; Food and Agriculture Organization of the United Nations.

Following the literature, the following regression model is specified:

$$\text{Urbanization}_{i,t} = \beta_0 + \beta_1 \text{trade}_{i,t} + \sum \beta_2 X_{i,t} + \beta_3 m_i + \beta_4 n_t + v_{i,t}$$

where subscript *i* denotes country, *t* denotes year, $trade_{i,t}$ denotes international trade and its components, m_i and n_t denote fixed effects, and $X_{i,t}$ denotes control variables. The share of secondary industry in total GDP measures industrialization level.

Regression results of the ordinary least squares models are presented in Table 3. Consistent with Krugman's theoretical prediction that there is a negative correlation between international trade and urbanization in developing countries, the coefficients of trade openness are significant and negative in four models.

Table 3: Effect of International Trade on Population Urbanization

	1	2	3	4
trade	–0.0299***	–0.0299***	–0.0286***	–0.0282***
	(0.0079)	(0.0079)	(0.0079)	(0.0080)
avgdp	0.318	0.318	0.507	0.511
	(0.555)	(0.555)	(0.570)	(0.571)
avcereals	0.291	0.291	0.209	0.216
	(0.290)	(0.290)	(0.296)	(0.297)
totalpop	18.90***	18.90***	18.05***	18.05***
	(3.448)	(3.448)	(3.496)	(3.501)
surface		–33.01***	–31.47***	–31.40***
		(6.156)	(6.244)	(6.258)
gdp1_share			0.0442	0.0427
			(0.0314)	(0.0319)
gdp2_share				–0.00904
				(0.0315)
trend	0.193**	0.193**	0.223***	0.224***
	(0.0839)	(0.0839)	(0.0864)	(0.0866)

constant	–701.0***	–281.4	–348.4*	–350.9*
	(114.1)	(177.8)	(183.8)	(184.3)
Country Fixed Effect	YES	YES	YES	YES
Observation	343	343	343	343

Note: The numbers in parentheses are standard errors, where *, **, and *** indicate significance levels of 10%, 5%, and 1% respectively.

Sources: World Bank World Development Indicators; Food and Agriculture Organization of the United Nations.

Also, the coefficient of average cereal yield has positive effect on population urbanization, as expected. The coefficients of GDP per capita and total population are positive, indicating their positive correlation with population urbanization. The coefficient of "surface" is negative in all models, which indicates that larger land surface area results in lower population urbanization.

What about the effects of cereals and non-cereals trade on population urbanization? Regression results of the OLS models are reported in Table 4, from which three conclusions may be drawn. First, the coefficient of "trade_cereals" is significant and positive in models 1 and 4, whereas that of "trade_other" is significant and negative in all models. This is consistent with the first hypothesis. Second, after controlling for the non-cereals trade, the coefficient of "impt_cereals" is significant and positive in models 2 and 5, which indicates that cereals imports can improve population urbanization, as predicted by the theoretical hypothesis. Third, after controlling for the net import of cereals in models 3 and 6, "netimpt_c" is significantly positive, which suggests that the higher the net imports of cereals, the higher the population urbanization. This is also consistent with the second theoretical hypothesis.

Table 4: Effect of International Trade Components on Level of Urbanization

	1	2	3	4	5	6
trade_cereals	0.435**			0.464**		
	(0.195)			(0.190)		
trade_other	–0.0307***	–0.0308***	–0.0309***	–0.0317***	–0.0319***	–0.0323***
	(0.0080)	(0.0081)	(0.0081)	(0.0078)	(0.0079)	(0.0079)
impt_cereals		0.446**			0.480**	
		(0.206)			(0.201)	
expt_cereals		0.360			0.359	
		(0.489)			(0.486)	
netimpt_c			0.309*			0.343*
			(0.185)			(0.181)
avgdp	0.503	0.497	0.456	0.374	0.369	0.308
	(0.567)	(0.569)	(0.569)	(0.550)	(0.552)	(0.551)
avcereals	0.190	0.177	0.115	0.247	0.229	0.163
	(0.295)	(0.305)	(0.303)	(0.288)	(0.299)	(0.297)
totpop	14.71***	14.65***	15.74***	15.08***	14.99***	16.14***
	(3.748)	(3.770)	(3.704)	(3.718)	(3.743)	(3.677)
surface	–25.54***	–25.37***	–26.81***	–26.19***	–25.93***	–27.51***
	(6.681)	(6.774)	(6.716)	(6.637)	(6.738)	(6.676)
gdp1_share	0.0315	0.0311	0.0336			
	(0.0320)	(0.0322)	(0.0322)			
gdp2_share	0.00227	0.00211	–0.00373			
	(0.0316)	(0.0317)	(0.0315)			

trend	0.280***	0.282***	0.270***	0.264***	0.267***	0.252***
	(0.0892)	(0.0900)	(0.0898)	(0.0875)	(0.0885)	(0.0882)
constant	–478.6**	–483.4**	–459.3**	–442.0**	–449.3**	–419.6**
	(190.6)	(193.1)	(192.8)	(186.6)	(189.5)	(188.9)
Country Fixed Effect	YES	YES	YES	YES	YES	YES
Observation	342	342	342	342	342	342

Note: The numbers in parentheses are standard errors, where *, **, and *** indicate significance levels of 10%, 5%, and 1% respectively.

Sources: World Bank World Development Indicators; Food and Agriculture Organization of the United Nations.

The regression results in Table 4 may suffer from endogeneity for two reasons. First, other things being equal, countries with a higher level of population urbanization may need more food from other countries. Second, trade of cereals may be correlated with the residual term in the regression model. However, it is not easy to find instrument variables for non-cereals trade and for cereals imports and exports. So, next we try to find instruments only for net import of cereals and then test the causal effect of trade on population urbanization. The instrumental variables used in this paper are the interaction terms of two variables: the trade openness of neighboring countries and the total cereals yield of the top five cereals producers in the world (Brazil, Canada, France, Russia, and the United States). We use these two variables as instruments for the following reasons.

Firstly, it is straightforward that a country's trade openness can be directly affected by its neighbors due to their shared borders. A country is more likely to open if its neighbors have a high level of openness (Rajan and Zingales 2003; Baltagi, Demetriades, and Law 2009). In the following two-stage least squares estimations, trade openness of neighbors will be lagged by 10 years.

Secondly, total cereals yield of those top five grain producers and exporters may have an immediate effect on supply and prices in the global grain market. The cereals trade of Asian developing countries will be affected directly by the total cereals production in those five countries whose production is determined by climate, their agricultural endowments, technological progress of agriculture, etc. These factors are obviously unrelated to the socioeconomic variables in Asian developing countries.

Finally, we use the interaction term of these two variables as an instrumental variable because opening up is the precondition for the aggregate grain output of the five main producers to affect urbanization in the relevant countries in Asia. We expect this interaction variable to have a positive effect on its cereals trade in the first stage regression models.

Table 5: Effect of Cereals Trade on Population Urbanization (Two-Stage Least Squares Estimation)

	1	**2**	**3**	**4**	**5**
netimp_c	3.612***	3.826***	4.014***	4.012***	4.242***
	(1.355)	(1.443)	(1.484)	(1.484)	(1.303)
avgdp	1.852***	2.037***	2.678***	2.678***	2.513***
	(0.631)	(0.628)	(0.766)	(0.766)	(0.912)
totpop	4.015	3.655	5.146	5.155	
	(6.558)	(6.902)	(6.664)	(6.665)	
surface	–1.713	–0.495	–2.722		
	(13.33)	(14.09)	(13.77)		

gdp1	0.0149	0.00572				
	(0.0411)	(0.0420)				
gdp2	0.0268					
	(0.0354)					
trend	0.286**	0.289**	0.238*	0.237*	0.327***	
	(0.128)	(0.134)	(0.123)	(0.123)	(0.0499)	
Constant	–604.8**	–619.2**	–517.8*	–552.2***	–636.9***	
	(299.5)	(314.8)	(294.7)	(140.8)	(97.03)	
Country Fixed Effect	YES	YES	YES	YES	YES	
Stage-1 regression results						
Instrumental variable	0.00035***	0.00033***	0.00033***	0.00033***	0.00039***	
	(0.00012)	(0.00011)	(0.00011)	(0.00011)	(0.00011)	
Number of observation	516	516	550	550	550	

Note: The numbers in parentheses are standard errors, where *, **, and *** indicate significance levels of 10%, 5%, and 1% respectively.

Sources: World Bank World Development Indicators; Food and Agriculture Organization of the United Nations.

Regression results of the two-stage least squares estimations are reported in Table 5. It can be seen that the coefficient of the instrumental is significantly positive in the first stage regressions, which is consistent with theoretic predictions. From the second stage regressions we can find that "*netimpt_c*" is significantly positive in five models, which suggests that net import of cereals can improve the level of population urbanization in developing Asia. Consistent with the results from earlier studies, the coefficient of GDP per capita is significant and positive in five models. Other results are broadly in line with expectations.

3.3 Evidence from the Comparison between the People's Republic of China and India

Table 6 shows that from 1971 to 2010, total population in the PRC increased by more than 50% while that of India more than doubled. However, the share of urban population in India only increased 10 percentage points, while that of the PRC increased more than 30 percentage points. As will be demonstrated, international trade and grain surplus have played important roles in driving the different pace of urbanization in the PRC and India.

Table 6: Comparison of Population Urbanization between the People's Republic of China and India

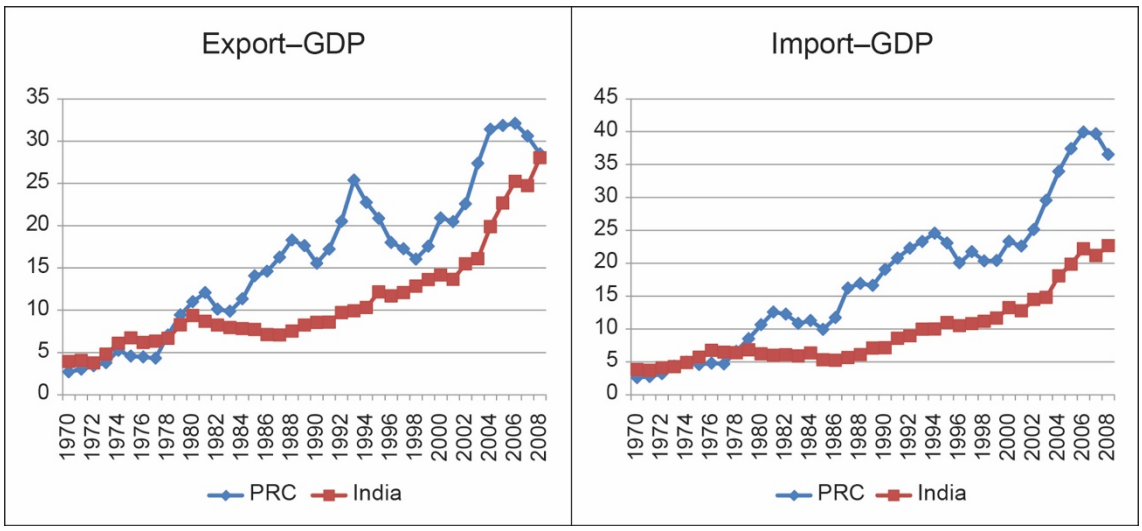
		1971	1981	1991	2001	2006	2007	2008	2009	2010
Total Population (100 million)	PRC	8.52	10.01	11.58	12.76	13.14	13.21	13.28	13.35	13.41
	India	5.51	6.89	8.52	10.33	11.20	11.37	11.53	11.69	11.86
Population Urbanization (%)	PRC	17.26	20.16	26.94	37.66	44.34	45.89	46.99	48.34	49.95
	India	20.10	23.34	25.72	27.9	28.98	29.26	29.54	29.80	30.10

PRC = People's Republic of China.

Data sources: China Statistical Yearbook 2012; World Bank World Development Indicators 2013.

Figure 6 depicts trade liberalization in the PRC and India from 1970 to 2008, measured by the ratios of export and import to GDP. Until the end of the 1970s, the two ratios were higher in India than in the PRC, which corroborates the higher urbanization rate in India. This situation was reversed right after the People's Republic of China adopted reform and opening-up policies at the end of the 1970s. Trade liberalization in the PRC has accelerated since then, along with urbanization.

Figure 6: Ratios of Export and Import to Gross Domestic Product in the People's Republic of China and India (1970–2008)



PRC = People's Republic of China, GDP = gross domestic product.

Source: World Bank World Development Indicators 2010.

Table 7 shows the total and average output of cereals in the PRC and India, which represent the availability of cereals from the domestic agriculture sector.

Table 7: Output of Cereals in the People's Republic of China and India

		1971	1981	1991	2001	2006	2007	2008	2009	2010
Total output (million tons)	PRC	207.86	272.81	395.66	396.48	450.99	456.32	478.47	481.56	496.37
	India	84.50	104.10	141.90	162.50	170.80	177.70	197.20	192.40	178.00
Per capita output (kilograms)	PRC	377.24	395.95	464.39	383.81	402.67	401.34	414.98	411.94	418.52
	India	153.36	151.09	166.55	157.31	152.50	156.29	171.03	164.59	150.08

PRC = People's Republic of China.

Note: Per capita output equals total output divided by total population.

Data sources: China Rural Statistical Yearbook 2013; and Economic Survey of India 2012–2013, http://indiabudget.nic.in/es2012-13/estat1.pdf.

Table 7 shows that from 1971 to 2010, the total and average output are much higher for the PRC than for India, indicating that peasants in the PRC provide more surplus cereals than Indian peasants do. Per capita cereals production in the PRC increased steadily, but this is not the case for India.

Turning to grain trade, Table 8 and Table 9 report net export of cereals in the PRC and India. Export of cereals outweighs import of cereals in India, but the contrary was true in the PRC, especially after 2008.

Table 8: Net Export of Cereals in India
(million tons)

	1971	1981	1991	2001	2006	2007	2008	2009	2010
India	–2.0	0.5	0.6	4.5	3.8	7.0	14.4	7.2	4.7

Data source: Economic Survey of India 2012–2013, http://indiabudget.nic.in/es2012-13/estat1.pdf.

Coupled with lower farming productivity, more export of cereals in India not only hindered urbanization, it also resulted in serious malnutrition (Gulati et al. 2012). For example, the 2016 global hunger index released by the International Food Policy Research Institute said that 38.7% of Indian children under 5 years are stunted due to lack of food,[1] and 42% of underweight children and 32% of stunted children in the developing world are in India.

Table 9: Net Export of Cereals in the People's Republic of China
(million tons)

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
10.73	5.32	0.86	0.54	–5.01	3.87	2.47	8.31	0.27	–1.83	–4.51	–4.29

Data source: China Statistical Yearbook 2013.

The above comparison once again illustrates that grain surplus as determined by farm productivity and international trade, especially trade of cereals and grain, exerts very crucial impacts on population urbanization in developing economies.

[1] *News Today*. 2016. 15% of India's population are undernourished. 12 October. http://newstodaynet.com/nation/15-indias-population-are-undernourished (accessed 15 November 2016).

4. POLICY IMPLICATIONS

Developing countries have seen a rapid rise in population urbanization and urban concentration after the 1960s. At the same time, they have actively participated the process of globalization. However, possible interlinks between population urbanization and openness in developing economies have been ignored in the present literature. Firstly, we argue that there is an equilibrium between grain surplus and population urbanization in developing economies and explain why cereals trade can affect population urbanization. Then, historical evidence, empirical tests, and case studies from the PRC and India are employed to test two theoretical hypotheses.

Notwithstanding urban diseases such as congestion, ghetto housing, and crime, the following policies are proposed to make urbanization more sustainable and inclusive.

First, given the interlinkages between trade and urban concentration, economies adopting an export-oriented strategy may see more concentration in harbor or border cities. While one of the goals of the United Nations Sustainable Development Goals is to "[by 2030] provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons." Thus, more public goods and services shall be provided to these cities, including more roads, schools, hospitals, and so on. Our research points out the direction of such investment providing public goods and services.

Second, as more poor megacities emerge, the challenges of poverty alleviation and weak governance may reduce the ability to address the negative externalities that come with density (Glaeser 2014). Thus, improving governance is urgent to cope with the externality of density. In addition to social protection and unemployment insurance, priority areas of intervention include efficient public policies to cope with crime, intelligent traffic management systems to cope with traffic congestion, public housing to shelter the poor or those in ghetto houses, and sanitation facilities.

Third, one of the goals of the SDGs is to "support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning." This paper shows that agricultural development can loosen the grain constraint and promote population urbanization. Consequently, investment in agriculture, including irrigation, soil improvement, and technology upgrades, can help promote population urbanization and economic growth. Technology assistance from developed countries on improving labor productivity or gross output of food in developing countries is also helpful to fulfill the goals of the SDGs.

Fourth and finally, for small developing countries, or countries having limited agricultural endowments, importing grains is a possible way to promote sound and orderly population urbanization and sustainable economic growth.

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