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Counting Urban Population in Chinese Censuses 1953-2000: Changing Definitions, Problems and Solutions

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ABSTRACT

The level of urbanization in many developing countries such as China has remained at less than 50% despite rapid urban population growth since the 1950s. Obtaining accurate information on urban population is essential for monitoring and studying the on-going urbanization process that is restructuring the societies of less urbanized countries. The difficulties in counting China's urban population have arisen from the accelerated urbanization in China under a model of dual track urbanization since the early 1980s. Institutional settings for urbanization have also been altered with the revision of criteria for city and town designation. These developments make it increasingly difficult to count urban population in China, causing frequent changes in the definition of urban population in five censuses from 1953 to 2000. Two approaches have been adopted to estimate urban population data series for inter-census periods. This paper proposes a third approach based on the concept of dual track urbanization, counting and estimating urban non-agricultural and agricultural populations separately. After thorough examination and comparison of the definition of urban population and data quality from five censuses, this paper obtains a set of more consistent urban population data after a series of adjustments. A new series of urban population data is estimated for 1982-2001. The results provide reliable urbanization data for further study on urban transition and development in China.

Keywords: Estimation techniques, urbanization, urban population, Census, China

INTRODUCTION

Urbanization, along with industrialization, tertiarization and ‘informationization’ (Castells, 1996), has transformed human society over the past two centuries. Currently, more than half of the world’s population lives in urban areas, and large numbers of advanced economies might be described as highly urbanized with more than 75% of their populations in urban areas. But urbanization has been an uneven process (Gugler, 1996). Despite rapid urban population growth since the 1950s, the level of urbanization in many developing countries such as China has remained at less than 50%. Urbanization remains a fundamental process in these less urbanized countries that is driving their socio-spatial transformation. In these countries on-going urbanization does not simply repeat the processes experienced in the past in developed countries (Cohen, 2004). There is therefore great value in the continued study of urbanization in less developed countries since it may lead to new theories about urbanization processes, novel insights into emerging spatial urban forms (Firman, 2004) and new understandings of the changing roles of the state, institutions and globalization in relation to urban growth. Indeed, some new theoretical and conceptual developments have already emerged such as an Asian model of urbanization (McGee, 1991), and the identification of rural urbanization or *in situ* urbanization (Ma and Fan, 1994; Zhu, 1999) and dual-track urbanization (Shen et al., 2002; Shen, 2005).

Obtaining accurate information on urban population is essential for studying the on-going urbanization process. However, the quality and accuracy of urban population data have suffered from administrative deficiencies and changing definitions for a long time, especially in developing countries (Gugler, 1996). The following quotation indicates how important the definition of urban population and the accurate bounding of urban areas are:

‘It would only take China, India or a few of the other most populous nations to change their definition of urban centres for there to be a significant increase or decrease in the proportion of the world’s population living in urban centres’ (HABITAT, 1996: 14).

This paper illustrates this point with particular reference to China, which in the year 2000 (NBS, 2001: 93) had an official urban population of 458.44 million (ie. a figure that is greater than the total population of any other country in the world except India). The thrust of the paper is however methodological, with the principle concern being to evaluate a range of methods for estimating urban population numbers. Counting urban population properly has always been a challenging issue in China. The method of counting urban population has changed regularly since the early 1950s with the definition of ‘urban population’ changing in each census. This in part has reflected the country’s evolving policies on urbanization. Whatever the reasons for the changes, the result has been to raise serious questions about the quality, reliability and comparability of urban population data in China.

At least three serious problems can be identified that make comparative measurement of the urban population of China difficult. First, a household registration (*hukou*) system was introduced across all of China from 1958 onwards. A person’s *hukou* stipulated his/her place of residence and status as either part of the agricultural or non-agricultural population. Having an agricultural *hukou* status did not mean, however, someone had an agricultural job. People living away from their *hukou* place of registration (such as agricultural *hukou* populations living

temporarily in cities) were excluded from the urban population count under the *de jure* system of enumeration. Between 1964 and 1981 the *de jure* approach enumerated only specific kinds of population, such as those with a local hukou of non-agricultural status, as being part of the urban population of China. Second, there was a switch from a *de jure* to a *de facto* system in the 1982 census. A *de facto* approach enumerates all people who are present in a particular place at the time of census. The principle of this approach was used to count population, including urban population, at the place of usual residence, disregarding their hukou status in the 1982 census. There are both pros and cons of *de jure* and *de facto* approaches depending on the particular context of population enumeration. Some countries such as the Philippines and Thailand also use the *de jure* approach for enumerating population, but most use a *de facto* system (Adams et al, 1999). Third, administrative areas such as cities and towns were used as basic units to count urban population before the 2000 census. Since the number of cities and towns has increased rapidly as the criteria for designating new cities and towns have been relaxed (especially since 1983), many agricultural peoples have been counted as urban simply due to administrative boundary changes during this period. The 2000 census attempted to overcome the problem by introducing smaller spatial units to count the urban population.

Given these problems, it is not surprising that scholars have proposed various approaches to adjust and estimate the changing size of the urban population in China over time. After critically reviewing these approaches, this paper proposes an approach based on the concept of 'dual track' urbanization (Shen et al., 2002). This paper argues that the spatial coverage of urban population used in the 1982 and 2000 censuses is comparable despite the administrative changes in city and town boundaries since 1983. But the urban population data between 1982 and 2000 have to be estimated. With the available census data for the urban populations in 1982 and 2000, a more reliable figure for the agricultural population can be estimated for these years. Such information is then used to estimate a new series of urban population data for China from 1982 to 2001. Before this estimation can be attempted, it is first necessary to construct more consistent census data for all recent Chinese censuses.

The paper is organized as follows. The next section reviews previous approaches to and existing problems in estimating urban population data. Then the different coverage of urban population in each census is compared and a set of more consistent urban population data for the five most recent censuses is obtained after making a series of adjustments. Finally, a new series of urban population data for China is estimated using an approach based on the concept of dual track urbanization. The case of Guangzhou city is used to illustrate the complexities of counting and estimating urban population at the city level.

EXISTING APPROACHES AND PROBLEMS

The size of China's urban population has long been an 'enigma' (Orleans and Burnham, 1984). Several scholars have attempted to clarify urban population data in China (Zhou, 1988; Shen, 1995; Zhou and Ma, 2003; Chan, 1994). Shen et al. (1999) pointed out the internal inconsistency of the urban population definition adopted in the 1990 census. An alternative way to define the urban population based on urban actual non-agricultural population was also proposed (Shen, 1994). Zhang and Zhao (1998) argued that a better alternative was to use a typology based on actual occupation and actual residential status.

As a new urban population definition was adopted in the 2000 census, official statistics about the level of urbanization released by the National Bureau of Statistics (NBS, 2000) for the period 1991-1999 were superseded by the census. Two approaches have been adopted to re-estimate the level of urbanization for the periods 1982-2000 and 1990-2000. The first is linear interpolation as used by NBS (2002). Accepting the level of urbanization from the 1990 census, 1995 1% sample survey and the 2000 census, the level of urbanization was interpolated for the periods 1990-1995 and 1995-2000. The result from this approach was not convincing as it assumes a constant increment within each of two five-year periods.

The second approach is to use the United Nations method and to make additional adjustments by applying annual ratios as done by Zhou and Ma (2003) and Chan and Hu (2003). The United Nations method assumes a constant difference in the growth rates of urban and rural populations and typically produces smooth trends similar to linear interpolation. Two previous studies used annual ratios to adjust the results from the United Nations method to capture yearly fluctuations. The ratios used by Zhou and Ma (2003) are based on official urban population data series. The ratios used by Chan and Hu (2003) are based on the non-agricultural population data from the Ministry of Public Security, assuming implicitly equal growth rates of the urban agricultural and non-agricultural populations. The third approach as employed in this paper also uses data on the urban non-agricultural population. But it is based on a different assumption. It is assumed that the growth rate of the urban agricultural population is proportional, rather than equal, to the growth rate of the urban non-agricultural population.

Three problems remain to be solved. First, the United Nations method assumes a constant difference in the growth rates of urban and rural populations. This assumption is not valid in the case of China. It is widely accepted that urbanization in China has accelerated since the 1980s while the growth rates of the total population and rural population have stabilized (Shen, 1995; Shen and Spence, 1996). The urban-rural difference in the population growth rate was not stable at all in the period 1982-2000. It is not perfect to estimate the level of urbanization using the United Nations method and then adjust the results using annual ratios to capture yearly fluctuations.

Second, previous studies focused exclusively on the percentage of the urban population in the total population without examining the data on urban population and total population that are the basis for calculating the level of urbanization. Indeed, the census data on the level of urbanization used in previous studies are not consistent. As revealed in this paper, the army population was included in the urban population for 1953 and 1964 but not for 1982, 1990 and 2000.

Third, population was under-enumerated to different extents in each census and the extent to which non-hukou residents who were living away from their place of hukou were counted at their place of residence instead of place of hukou was different in the 1982, 1990 and 2000 censuses. The data on the total and the urban population therefore needs to be adjusted accordingly to make them comparable between these censuses.

The first two problems are related to the methods of estimating the level of urbanization. The third problem indicates the need to adjust the census data before estimation is made for inter-census years.

This paper argues that the difficulties in counting China's urban population have arisen from the accelerated urbanization in China under a model of dual track urbanization since the early 1980s (Shen et al., 2002). The urban population definition used in the 1953 census included all people living in urban areas using a *de facto* approach. But the hukou system was introduced nationwide in 1958 when the government adopted a policy to control the size of the urban population (Central Committee of CCP and State Council, 1963). State-sponsored urbanization was formally instituted when only the non-agricultural population in urban areas was defined as urban population using a *de jure* approach. This definition was adopted in the 1964 census and was in use for 18 years until the 1982 census.

The economic reforms that began in 1978 dramatically affected the subsequent urbanization path in China (Pannell, 2002). The dual track model of urbanization that emerged (Shen et al., 2002) involved a new pattern of spontaneous urbanization developing in parallel with the reconfigured state-sponsored pattern. Essentially, state sponsorship of the non-agricultural population was reduced although the non-agricultural population still enjoyed substantial privileges. By 'spontaneous urbanization' I am referring to township and village enterprise-led 'rural urbanization' and the migration of 'temporary population' into urban areas (Zhu, 2003). Thus, while active urbanization took place in rural areas (Lo, 1989; Ma and Fan, 1994), from 1985 onwards rural migrants were allowed to move into cities and towns to set up business and to find work. These people constitute the non-hukou population and have restricted access to the labour market without any state benefits (Fan, 2002; Shen and Huang, 2003).

It has been argued elsewhere that rural people who were employed in town and village enterprises and who were living in small towns should be counted as urban population (Ma and Fan, 1994; Shen, 1995). The 1982 census took a dramatic step by reverting to the *de facto* approach of the 1953 census to include all usual residents in urban areas disregarding their hukou status. This change was correct in 1982 but became problematic after 1983.

Relaxed criteria for city and town designation were introduced after 1983, changing the institutional setting for urbanization (Ministry of Civil Affairs, 1986). This was coincident with the government adopting a pro-urbanization strategy that saw many townships (*xiang*) and counties (*xian*) being converted to towns (*zhen*) and cities (*shi*) (Shen, 2004). The number of towns jumped from 2968 in 1983 to 19555 in 2001 and the number of cities increased from 245 in 1982 to 662 in 2001 (Urban Socio-economic Survey Team of NBS, 1999; Shen, 2004). Such rapid administrative changes have created over-bounded urban areas that question the validity of using the *de facto* approach to counting urban population. Indeed, the share of non-agricultural population in the total population of cities and towns declined from 69.55% in 1982 to 32.87% in 1990. Thus further changes were made in the 1990 and 2000 censuses in search of a better definition of the urban population.

The urban population includes city and town non-agricultural populations in all censuses. According to the model of dual track urbanization, part of the agricultural population in cities and towns should also be counted as urban population. To estimate the urban population for the inter-census period 1982-2000, an alternative approach used in this paper is to count and estimate the urban non-agricultural and agricultural populations separately.

COMPARING THE COVERAGE OF URBAN POPULATION IN FIVE CENSUSES

This section compares the definition of urban population in five censuses, which is essential to assessing the comparability of urban population data. The definition of urban population in a census, i.e., the coverage of urban population, depends on both spatial and population coverage, i.e., the kinds of areas and the kinds of populations to be included in the enumeration of the urban population. Basic administrative area units are used in defining the spatial coverage of urban population and will be outlined first.

Administrative areal units in China exist at six levels. Figure 1 presents the area and population types as well as the coverage of the urban population in China in the 2000 census. Cities could be designated at provincial level, prefecture-level or county-level. A provincial level or prefecture-level city includes urban districts as the city proper (*shiqu*), counties and county-level cities. Urban population in counties and county-level cities under the administration of such cities are counted separately in all Chinese censuses. An urban district or county-level city consists of streets (*jiedao*), towns and townships. A county includes both towns and townships.

(Figure 1 about here)

A designated town consists of a town proper (*zhenqu*) and other rural settlements. A township is basically made up of rural settlements. Residents (*jumin*) and villagers (*cunmin*) committees are area-based civil organizations for urban and rural settlements respectively. Residents committees are organized within a street or a town while villagers committees are organized within a town or township. It is noted that the equivalent units for townships and villagers' committees were People's Commune and Production Brigades during the period from the late 1950s to the late 1970s. The terms "township" and "villagers' committee" also refer to such equivalent units throughout this paper.

There are different concepts of population in residents' or villagers' committees. Some are general population concepts not unique to China, while some are unique especially those involving hukou status. Considering general population concepts first (Figure 2a), the census population refers to all the people who are present at the set census date, including all visitors but excluding residents who are away temporarily. The usual resident population (hereafter referred to as the resident population) in a place refers to all people whose usual addresses are in that place. Census results report the usual resident population that is more stable than the census population. Visitors from foreign countries staying for less than six months are often excluded.

(Figure 2 about here)

As mentioned before, hukou refers to a person's household registration status. The hukou population is a concept unique to China. It refers to all the people who have registered their hukou in a place (Figure 2b). Most people are in their place of hukou at the time of the census (this is the hukou population present). But some of these people may have left their hukou place and gone to other places within or outside mainland China at the time of the census. In the case of China, theoretically, the census population includes several components including the hukou population that was present, the non-hukou population that has left their own hukou place, populations whose hukou is not determined, and finally migrants and visitors from outside mainland China. But the last component is ignored in the practice of Chinese censuses. The

resident population includes most population components in the census population, but the non-hukou population who has left their hukou place for less than one year (half year in 2000 census) and visitors from outside mainland China are excluded. It also includes hukou population that has been away for under one year and people who have cancelled their hukou and are working or studying abroad.

In Chinese censuses since 1982, the non-hukou population that has been away for less than one year (half year in the 2000 census) has been considered as part of the resident population in an urban area while hukou population absent for over one year is excluded. The cut-off time was reduced from one year in the 1982 and 1990 censuses to half a year in the 2000 census. There are resident hukou and non-hukou populations in both residents' and villagers' committees. They have the status of either agricultural or non-agricultural population according to their hukou.

The coverage of the urban population in the 2000 census is the most sophisticated of any to date (Figure 1). Using the same spatial and population framework as in Figure 1, it is possible to compare differences in the coverage of the urban population in each census since 1953 (Figure 3-5). Table 1 shows the differences in spatial coverage and population coverage of each census in more detail. The basic units for counting urban population at various administrative levels are contrasted between censuses. For example, a whole city was considered as a basic unit in the 1953, 1964 and 1982 censuses. But a city without being divided into urban districts was not a basic unit for counting urban population in the 1990 and 2000 censuses.

(Table 1 about here)

In the 2000 census, three different spatial resolutions were used for counting urban population. First, high-density and low-density urban districts were differentiated using a population density of 1500 persons per km² as a threshold. A high-density urban district was considered as a city proper and its whole population was counted as urban population. Low-density urban districts adopt the same procedure to count urban population as county-level cities.

Second, streets, towns and townships were the basic area units in counting the main part of the urban population in low-density urban districts and county-level cities (Table 1). All streets were considered as part of the city proper. A town or township where a prefecture administration, a city or an urban district government was located, i.e., the seat of a government, was also considered as part of a city proper. Furthermore, a town or township contiguous to the government seat of an urban district or a city without urban districts was also considered as part of a city proper. All population in such a city proper was counted as urban population. The introduction of the concept of "city proper" in the 2000 census was a measure to overcome the over-bounding problem of expanded administrative areas that occurred after 1983. Urban population in other towns was identified in the same way as counties.

Third, residents and villagers committees were the basic areal units for counting urban population in a designated town in a county in the 2000 census. A residents' or villagers' committee that was the seat of a town government and those contiguous to such seats were regarded as a town proper. The introduction of the concept of "town proper" in the 2000 census was another measure adopted to overcome the over-bounding problem of the expanded administrative areas that emerged after 1983. In addition, populations in special areas outside a city or a town, each with a usual resident population over 3000, were also counted as town

populations. Such special areas include mining areas, development zones, tourism zones, research institutes, universities and colleges.

In the 2000 census, the resident hukou population as well as the resident non-hukou population who had left their hukou place for over half a year, in the city proper and town proper as defined above, were counted as urban population. People with the hukou status of either agricultural or non-agricultural population were included. This is by far the most sophisticated and realistic counting of urban population in China that has taken place to date.

The coverage of urban population in previous censuses was different from the 2000 census (Table 1). Spatial coverage was at three spatial levels, cities/urban districts, streets/towns/townships/ special areas and residents/villagers' committees in towns. In all censuses before 2000, urban districts were not divided into low-density or high-density ones. A town was considered as a single unit rather than being divided into town proper and rural areas before the 1990 census. No township hosting a county-level city government, nor those contiguous to it, was identified as urban in the 1990 census although all townships in cities were considered urban before the 1990 census. No special areas were considered as urban. Thus the basic areal units used to count the urban population were urban districts and county-level cities and towns in counties up to the 1982 census, and urban districts, streets in county-level cities, residents' committees in towns in county-level cities and counties in the 1990 census. The coverage of urban population in 1953, 1964 and 1982 shared many similarities except for the different treatment of the agricultural and non-hukou population. The 1990 definition was midway between the 1982 and 2000 censuses.

In the 1953 census, all people in cities (excluding counties under their administration) and towns were counted as urban population using a *de facto* approach (Figure 3). Low-density and high-density districts as well as agricultural and non-agricultural populations were not differentiated in 1953. There was no hukou system so that migrants in urban areas were also counted in the urban population. As the boundaries of cities (excluding counties under their administration) and towns were close to the boundaries of the 'city proper', the share of population engaged in agriculture was small. No figure was available for 1953. But the share of agricultural population in the city and town populations was only 28.28% in 1961 suggesting that the urban population definition in 1953 was very realistic (DPSSTS, 2002).

(Figure 3 about here)

From the late 1950s, the Chinese government introduced the hukou system to control urban population strictly. In the 1964 census, the definition of urban population changed to include only the non-agricultural population in cities (excluding counties under their administration) and towns (Figure 4). Non-hukou population was excluded but was negligible as population mobility was tightly controlled. As the criteria of city and town designation in 1964 were stricter than 1953 (Shen, 2004), the urban population based on the *de facto* approach would be the urban population based on the 1964 census definition plus the agricultural population in cities and towns in 1964. It would be comparable to the definition of the 2000 census.

(Figure 4 about here)

The third census was conducted in 1982. There were two major improvements over the 1964 census. First, non-hukou population in cities and towns who had left their origin of hukou for over one year was counted as urban population (Shen et al., 2002). Second, agricultural population in urban areas was also counted as urban population similar to the 1953 census (Figure 3). In 1982, the criteria of city and town designation remained the same as in 1964. Thus the urban population data in 1982 were comparable to the urban population definition in the 2000 census except for the undercounting of the non-hukou population in urban areas who had left their origin of hukou for half to one year and the overcounting of hukou population in urban areas that had left for half to one year (Table 1).

Since 1983, many counties have been converted to county-level cities and townships to towns. These new cities and towns were over bounded and included too much of the 'real' agricultural population. The 1990 census adopted two definitions of urban population. The first definition was the same as in the 1982 census. In the second definition, cities with and without urban districts were treated differently (Figure 5). Both the agricultural and non-agricultural populations in urban districts were counted as urban population. This is in line with the 1953/1982 definitions. But only the populations in streets in cities without urban districts and in residents' committees in towns in such cities and in counties were counted as urban population. Thus the people, mostly agricultural population, in villagers' committees in towns of counties and cities without urban districts were excluded. This is roughly in-line with the 1964 definition. However, there was no consistency between the definitions of urban population in a county with those in a city (Shen et al., 1999). The urban population in towns was clearly undercounted.

(Figure 5 about here)

The definitions of and data on urban population in the 1990 and 2000 censuses do not match very well (Table 1). For example, in comparison with the 2000 census, the non-hukou population that had left their hukou for between six months and one year were excluded from the urban population in the 1990 census. Furthermore, people, mostly agricultural population, in villagers' committees that were the seats, or contiguous to the seats, of town administration within counties, and cities without urban districts, were excluded. So also were the people in special areas.

ADJUSTING AND ESTIMATING URBAN POPULATION DATA

This section reports on three interrelated tasks. First, to obtain comparable time series data, it was necessary to obtain the most reliable data for each census by identifying and removing errors in the data released by the census authority. Second, the census data were adjusted to account for census undercounting and changes in the definition of the urban population in various censuses. Third, an estimate was made to produce a new set of time series data for China for the urban population, 1982-2001, based on adjusted and comparable data for urban populations from the 1982 and 2000 censuses. The first two tasks had to be completed before task three could be conducted.

Obtaining the most reliable census data and adjusting for undercounting

Details of how inconsistencies in time-series data have been tackled by the author are included in Appendix 1. Two sets of reliable census data on the urban population, with and without the army, were obtained. The next step was to make adjustments for census undercounting and for the changing definitions over time. To achieve this, the total and the urban population were first adjusted for undercounting. They were 0.116%, 0.015%, 0.60% and 1.81% in 1953, 1982, 1990 and 2000 censuses respectively (DPS, 1991; PCO and DPS, 1985; 1993; PCO and DPSSTS, 2002). Mainly due to increasing mobility in the 1990s, the size of the undercounted population increased from 6.78 million in the 1990 census to 22.49 million in the year 2000 (Table 2). The army population was considered to be part of the urban population and was added. Also, the 1964 census definition of urban population excluded an agricultural population of 32.56 million in urban areas. This was also added to the urban population.

(Table 2 about here)

Another problem was that the non-hukou population who had left their place of hukou was counted differently in various censuses. Methods of adjustments are reported in Appendix 2 for data from the 1982 and 1990 censuses. The results are presented in table 2. The shares of urban population in table 2 were substantially different from the official figures in NBS (2001: 93), DPSSTS (2001: 31) and Zhou and Ma (2003: 170). They were 1% higher generally in the 1982, 1990 and 2000 censuses. For example, the level of urbanization would be 27.57% and 37.04% instead of the commonly used official figures of 26.23% and 36.09% based on the 1990 and 2000 censuses respectively (DPSSTS, 2001: 31). When expressed as absolute numbers, a difference of 1% of the Chinese population is very significant accounting for 12.68 million people.

Estimating a new annual series of urban population data

The third step undertaken by the author to achieve more accurate and useful urban data was to produce a new annual series of urban population estimates for 1982-2001. The urban population data from the 1990 census are not used as benchmarks as they are not comparable with the 2000 census data due to its peculiar definition. Many scholars have scrutinized the 1990 census data. Zhou and Ma (2003) recognized that the urban population statistics for cities and towns were not comparable. There are also different views on whether there was any undercounting in the level of urbanization from the 1990 census. For example, the estimated level of urbanization in 1990 according to Zhang and Zhao (1998) and Zhou and Ma (2003) was higher than the census figure by 0.8 and 2.15 percentage points respectively. On the other hand Chan and Hu (2003: 54) believed that the aggregated national level of urbanization from the 1990 census was acceptable based on Yu's finding from the 2000 census (Yu, 2001: 17).

According to Yu, the national levels of urbanization in 2000 based on the 1990 and 2000 census definitions were very close, 36.25% and 36.09% respectively. But there would be significant undercounting in several provinces such as Zhejiang if the 1990 census definition were used. The level of urbanization in Zhejiang in 2000 would be 36.13% using the 1990 census definition instead of 48.67% using the 2000 census definition. However, it is difficult to assess whether the undercounting and overcounting in the level of urbanization in the 1990 census would cancel each other out if the 2000 census definition were used. The alternative approach used in this

paper requires that the urban agricultural and non-agricultural populations be treated consistently in a way that is not the case in the 1990 census. An advantage of this approach is that it can also be used for provincial level estimates.

The paper now turns to estimating a set of urban population data for the inter-census years 1982-2001 using the 1982 and 2000 census data as benchmarks. The advantage of this is that the impact of the administrative changes of urban boundaries on the size of urban population can be minimized as the estimate relied only on the comparable spatial coverage of urban population used in the 1982 and 2000 censuses. The following steps were used to estimate the urban population series and the level of urbanization for the period 1982-2001.

First, the data on non-agricultural population was obtained from official sources (DPSSTS, 2002: 194). They are fairly reliable as registration of non-agricultural population is controlled by the hukou system (Zhang and Zhao, 1998). These year-end data were converted to mid-year data for the period 1982-2001 by taking the average of the non-agricultural population at the end of the previous and current year (Table 3). The annual growth rate of non-agricultural population for the period 1983-2001 can also be calculated.

(Table 3 about here)

Second, the agricultural population in urban areas was estimated. The agricultural population in urban areas in 1982 and 2000 can be obtained readily by subtracting the difference between the urban population and the urban non-agricultural population. But the agricultural population for 1983-1999 and 2001 has to be estimated.

As agricultural and non-agricultural populations are two parts of the urban population, it is reasonable to assume that agricultural population grows along with the non-agricultural population. Thus it is assumed that the urban agricultural population F_t grew at the rate of D_t in year t . It is further assumed that D_t was proportional to the growth rate C_t of urban non-agricultural population and the ratio is O . This means that:

$$D_t = OC_t \quad t = 1983, 1984, \dots, 2001 \quad (1)$$

$$F_t = F_{1982} \prod_{j=1983}^t (1 + OC_j) \quad t = 1983, 1984, \dots, 2001 \quad (2)$$

It is also found that:

$$F_{2000} = F_{1982} \prod_{j=1983}^{2000} (1 + OC_j) \quad (3)$$

As F_{2000} and F_{1982} and C_j are known in the above equations, it is found that O equals to 1.08455 through simulation in an Excel worksheet. It means that the growth rate of the urban agricultural population was 8.455% greater than that of urban non-agricultural population. Then the urban agricultural population in various years can be calculated using equation (2). The estimated urban population is the total of the urban non-agricultural and agricultural populations.

Third, the annual data on the total population was adjusted. NBS (2002: 93) provides annual data on the total population in the period 1982-2001 while the most reliable census data are only available for census years. The NBS data have to be adjusted to match the total population from the 1982 and 2000 censuses according to the following procedures.

The population growth rates were first calculated using the mid-year populations worked out from the year-end NBS data (Table 4). Then these growth rates are adjusted by a ratio so that the total population in 1982 and 2000 from NBS would match the adjusted total population from the censuses in table 2. The ratio that met the above condition is 1.0075. This means that the actual growth rates of the total population were 0.75% greater than those reported in NBS data. The total population consistent with the 1982 and 2000 censuses is then calculated using adjusted growth rates for the period 1982-2001.

(Table 4 about here)

Finally, the share of urban population can be calculated using the estimated total population and urban population for the period 1982-2001.

The estimated urban population in table 3 and the share of urban population in table 4 in 1982 and 2000 match the 1982 and 2000 census data adjusted by the author (Table 2). Comparing the adjusted figures of 314.44 million from the 1990 census in table 2 and the newly estimated urban population of 322.14 million represents a difference of 7.70 million. The estimated share of urban population was 28.36%, greater than author's adjusted figure of 27.57% and the official figure of 26.23%, both based on the 1990 census data.

The above estimation is made for the urban population of China as a whole. The case of Guangzhou city is used here to illustrate the complexities of counting and estimating urban population at the city level. This example shows how the expansion of the administrative area artificially inflated the size of the urban population and how the author's definition based on the city proper to some extent resolved this problem. Like many prefecture-level cities, Guangzhou city consists of urban districts and county-level cities. We only need to focus on the urban districts here. From 1982 to 2000, the urban administrative area of Guangzhou city increased by two urban districts, Panyu and Huadu. These were listed as counties in 1982. Table 5 shows the size of urban population based on 1982 and 2000 urban administrative areas based on the adjusted census data.

(Table 5 about here)

In 1982, there was an urban population of 3.192 million in the five urban districts of Guangzhou. Only 8.76% and 5.96% of the population of Panyu and Huaxian counties respectively were counted as urban in 1982. These urban people lived in three separate towns. By 1987, all townships in the two counties had been converted to towns due partly to the relaxation of the criteria used to define urban areas and due partly to 'real' urban development. By 2000, Panyu and Huadu (renamed from Huaxian) became two new urban districts within Guangzhou city. If the 1982 census definitions of urban population were used in 2000, then 100% of the population in all urban districts would be counted as "urban" population, reaching 8.679 million, including 2.386 million in the two new urban districts. As argued in the previous section, this 'urban population' would be an over-count and the 2000 census definition based on a more precisely defined city population solves the problem effectively. According to the 2000 census definition,

only 73.23% and 54.69% of the populations in Panyu and Huadu respectively should be counted as urban population. The urban population in the old urban districts was 6.071 million, increasing from 3.192 million in 1982. Most of this increase was due to migration especially of non-hukou migrants. The addition of two new urban districts, i.e., the expansion of the urban administrative area, increased the urban population by another 1.613 million.

As argued previously, the 1982 and 2000 censuses provided the most reliable counts of the urban population after adjusting for under-enumeration and the non-hukou population who had left their former hukou location for between half and one year. Two series of urban population figures for the period 1982-2000 were estimated for Guangzhou city based on the 1982 and 2000 urban administrative areas respectively, using the same approach as has been described for the national estimates. The estimation used the 1982 and 2000 census data in table 5 and non-agricultural population data from official sources (Guangzhou economic yearbook editorial committee, 1983: 586; Statistical Bureau of Guangzhou, 1999: 235; 1984-1989; 1990-2001). The result is shown in figure 6.

(Figure 6 about here)

There was significant urban population growth (90.17%), in old urban districts in the period 1982-2000 based on the fixed 1982 urban administrative area. But the most rapid urban growth took place in two former counties where the urban population increased by 18 times, from 0.085 million to 1.613 million over the same period. Thus on the basis of the 2000 urban administrative area, urban population in Guangzhou increased by 134.48%, growing from 3.28 million to 7.684 million. Figure 6 also presents the official statistics on usual urban population based on the hukou registration system for the 1982 urban administrative area. Such statistics did not take non-hukou migrants into account. The official figure was close to the census figure in 1982 as there were few non-hukou migrants. But the gap between the official and estimated urban population increased rapidly. The official figure undercounted the real urban population by 32.71% in 2000. It is clear therefore that the official statistics on urban population do not reflect the rapid urban population growth in many Chinese cities such as Guangzhou. There was an even more rapid growth in the urban population of former counties, reflecting the importance of rural urbanization (Ma and Fan, 1994). The analysis of this paper also shows that both the non-agricultural and agricultural populations contributed to urban expansion. In the case of Guangzhou city, based on the 1982 urban administrative area, the non-agricultural population and agricultural population increased by 1,079,000 and 1,800,000 respectively. The result provides further empirical evidence of dual-track urbanization in China (Shen et al., 2002).

CONCLUSION

Despite rapid urban population growth that has taken place since the 1950s, the overall level of urbanization in many developing countries such as China has remained at less than 50%. Urbanization remains a fundamental process in these less urbanized countries that is driving their socio-spatial transformation (Gugler, 1996). Obtaining accurate information on urban population is essential for monitoring and studying the on-going urbanization process.

Estimating China's urban population has been a serious concern for many years. This paper has argued that the difficulties in counting China's urban population have arisen mainly from accelerated urbanization under a model of dual track urbanization that has operated since the

early 1980s. The growth of both the non-agricultural and agricultural populations has contributed to Chinese urbanization in the reform period (Shen et al., 2002). A large quasi-urban population has emerged in China but it is not granted non-agricultural population status due to the rigid hukou system.

In the mean time, institutional settings for urbanization have been altered with the revision of criteria for city and town designation, which makes cities and towns invalid units to count urban population after 1983. Each census in China made a serious attempt to adopt a realistic definition of urban population. The move towards a *de facto* approach in the 2000 census with a sophisticated definition of urban population based on small administrative units below the city and town level is significant.

It is clear that the changes in the definition of urban population in Chinese censuses are not a result of *ad hoc* government policy, but represent attempts to count Chinese urban population appropriately at the time of each census. Most of these changes are necessary given the dramatic socio-economic changes between censuses, while changes in urbanization policies have also played a role (such as in the 1964 census).

One important objective of this paper has been to estimate a new series of urban population data for non-census years that is consistent with the 2000 census. After a thorough comparison of the definitions of urban population and data quality in various censuses, more consistent census data were obtained for all censuses.

There was no major problem using the urban population definition as laid down by the 1982 census. At that time, all new urban districts and county-level cities identified in the 2000 census, only had the status of counties. Each county only had a few towns and only the population in these towns was counted as urban. It is in this sense that the urban population data in the 1982 census are based on properly bounded urban administrative areas and are comparable to those of 2000 census. It is not feasible, however, to apply the 2000 census definitions of urban population to the non-census years between 1982 and 2001, since reliable population data and spatial information on small administrative units at town level and below are not available.

An alternative approach based on the concept of dual track urbanization was used to estimate an annual statistical record of the urban population for China for the period 1982-2001. It was argued that urban non-agricultural and agricultural populations should be counted and estimated separately using the two well-established hukou statuses that exist in China. A new urban data series was therefore obtained for 1982-2001 that is consistent with both the 1982 and 2000 censuses.

The case of Guangzhou city has been used to illustrate the complexities of counting and estimating urban population at the city level. This example shows how the expansion of the administrative area affected the size of urban population and how the new urban population definition based on the city and town proper solved the problem to some extent. Based on the 1982 urban administrative area, it was found that the gap between the official and estimated urban population had increased rapidly by 2000. It is clear that the hukou-based official statistics on urban population did not reflect the rapid urban population growth of many Chinese cities such as Guangzhou.

The results of this paper facilitate further study of the urbanization process in China. Many studies on urban transformations in China such as the dynamics of the Chinese urban system, the relationship between administrative position and city size, and the impact of globalization on Chinese cities rely heavily on accurate estimates of the population size of cities in calculating their development level and the investment intensity of domestic and foreign capital (Zhao et al., 2003). Previous studies have mostly used urban non-agricultural population to measure city-size, which is questionable given the increasing size of the temporary agricultural population living in Chinese cities. Having re-estimated the urban population, it may be necessary to re-visit many existing studies of urban China. It is expected that this would lead to a re-theorization on urbanization processes, the recognition of new spatial forms and a better understanding of the changing roles of the state, institutions and globalization in urban growth.

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APPENDIX 1: REMOVING INCONSISTENCIES IN URBAN POPULATION DATA FROM THE LAST FIVE CHINESE CENSUSES

Census data on urban population are affected by errors in data processing and the different ways that census undercounting and the army population are handled. Several problems are identified in the official 'census' data on urban population with and without army population (NBS 2001: 93; DPSSTS 2001: 31). To overcome these problems five steps were taken to remove inconsistencies. First, the census definition of 1982 instead of 1964 was applied to the 1964 census data to report the urban population in 1964. Second, the army population, if included in official census material, is counted in the urban population (NBS 2002: 93), but it has not been included consistently. For example, this resulted in an underestimate of the urban population at 18.30% of the total in 1964 instead of 18.79% according to the author's calculations. Third, the total population of the army given in the 1953 census (NBS 2001: 93) was incorrect. A population of 11.74 million overseas Chinese and students studying abroad was also included (DPS 1991: 27). This resulted in an underestimated share of urban population at 13% in 1953. Fourth, census undercounting was found in 1953, 1982, 1990 and 2000 censuses, while no report was released about the 1964 census. The NBS and DPSSTS data were not adjusted for undercounting except in the 2000 census. This caused another inconsistency. Fifth, census data were released at different stages in the 1982, 1990 and 2000 censuses. The official NBS and DPSSTS data mentioned above were based on the manually counted data that were less precise than the computer-tabulated data released a few years later. There were only slight differences between the two in the 1982 and 1990 censuses, but significant differences in the 2000 census. Computer-tabulated data were preferred and used by the author.

Two sets of data, with and without army, were calculated by the author using computer-tabulated data. These data were consistent if there was no change in census definition and no undercounting of the population in various censuses.

APPENDIX 2: ESTIMATING THE NON-HUKOU POPULATION WHO HAD LEFT THEIR PLACE OF HUKOU FOR BETWEEN HALF A YEAR AND ONE YEAR IN THE 1982 AND 1990 CENSUSES

Non-hukou population who had left their place of hukou was counted differently in various censuses. In 1953 there was no hukou system and all residents including migrants were counted in the 1953 census. The 1964 census excluded non-hukou population (negligible due to tight migration control) while the 1982 and 1990 censuses did not include the non-hukou population who had left their place of hukou for between half a year and one year. This had to be estimated to make the data close to that in the 2000 census. According to the detailed temporary population data of 1997 (Bureau of Hukou Administration, 1997), the ratio of the non-hukou population who had left their place of hukou for between half a year and one year to the non-hukou population who had left over one year was estimated as 0.7804. This ratio was used to estimate the non-hukou population who had left their place of hukou for between half a year to one year in the 1982 and 1990 censuses. It is assumed that this ratio was relatively stable although the size and spatial pattern of migration may have changed.

Another adjustment was needed here as part of the above non-hukou population, i.e. the non-hukou, non-agricultural population that moved between different urban areas and should have been counted as urban population in their urban place of origin in the 1982 and 1990 censuses. Such non-hukou population should be deducted to avoid double counting. In the 1982 census, the non-hukou, non-agricultural population was unknown and such double counting could not be removed. But this figure should be small as the total non-hukou population who had left between half a year and one year before was only 5.13 million in the 1982 census. In the 1990 census, the non-hukou, non-agricultural population who had left their place of hukou over one year before was 4.53 million. Using the above ratio of 0.7804, the non-hukou, non-agricultural population who left their place of hukou between half a year and one year before was estimated as 3.53 million. This population was deducted from the urban population in the 1990 census.

Table 1. Coverage of urban population in the last five censuses in China.

Census	1953	1964	1982	1990	2000
Spatial coverage					
<i>Cities/urban districts</i>					
Urban districts with population density over 1500 persons per km ²	Yes	Yes	Yes	Yes	Yes
Urban districts with population density less than 1500 persons per km ²	Yes	Yes	Yes	Yes	No
Cities without districts	Yes	Yes	Yes	No	No
<i>Streets/towns/townships/special areas</i>					
Streets in cities that are not wholly covered ¹	Yes	Yes	Yes	Yes	Yes
Towns in counties	Yes	Yes	Yes	No	No
Towns in cities that are not wholly covered	Yes	Yes	Yes	No	No
Town or township as or contiguous to the government seat of its urban district ²	Yes	Yes	Yes	Yes	Yes
Town or township as or contiguous to the government seat of a city without districts	Yes	Yes	Yes	No	Yes
Town or township as government seat of prefecture in a city not wholly covered	Yes	Yes	Yes	No	Yes
Special area with population over 3000 persons	No	No	No	No	Yes
<i>Residents/villagers committees in towns in counties and cities that are not wholly covered</i>					
Residents committees in towns	Yes	Yes	Yes	Yes	Yes
Villagers committees as or contiguous to the seat of its town government ³	Yes	Yes	Yes	No	Yes
Population coverage					
Including all agricultural population in villagers committee in cities that are wholly covered	Yes	No	Yes	Yes	Yes
Including all agricultural population in villagers committee in towns of counties and in cities that are not wholly covered	Yes	No	Yes	No	No
Excluding hukou population who has left their place of registration over one year	NA ⁴	No	Yes	Yes	Yes
Excluding hukou population who has left their place of registration for half to one year	NA	No	No	No	Yes
Including non-hukou population who has left their place of registration over one year	NA	No	Yes	Yes	Yes
Including non-hukou population who has left their place of registration for half to one year	NA	No	No	No	Yes

Sources: PCO and DPSSTS (2002: 1905-6); Population Census Office of Guangdong Province (2002: 3146-55); DPS (1991: 74-7); PCO and DPS (1985: 26).

Notes:

1 A city without being divided into urban districts was not a basic unit for counting urban population in 1990 and 2000 censuses. Thus such city was not wholly covered for counting urban population and lower level administrative units such as streets are used instead. Similarly, a city with low-density urban districts was also not wholly covered in the 2000 census.

2 A town or township was considered contiguous to the government seat of an urban district or a city without urban districts if the built-up area of the government seat extended to the seat of the town or township government, i.e., the residents or villagers committee hosting the government, or to over 50% of the seats of its villagers' committees, i.e, the villages hosting the offices of villagers' committees.

3 A villagers' committee was considered contiguous to the seat of town government if its built-up area extended to the seat of the villagers' committee.

4 NA: not applicable. There was no hukou system and no hukou population in 1953.

Table 2. Adjusted urban population data for the last five censuses in China.

Indicator	30 June 1953	30 June 1964	1 July 1982	1 July 1990	1 November 2000
Total population including army (million)					
Census data including army. Author's estimate.	582.60	694.58	1008.18	1133.71	1245.11
Under-enumerated population	0.68	na	0.15	6.78	22.49
Adjusted census data	583.28	694.58	1008.33	1140.49	1267.60
Urban population (million)					
Census data excluding army. Author's estimate.	74.46	94.55	206.31	296.15	458.77
Army	2.80	3.36	4.24	3.20	2.50
Agricultural population in urban area	Included	32.56	Included	Included	Included
Non-hukou non-agricultural population who left origin half to one year	na	na	na	-3.53	Included
Non-hukou population who left origin half to one year	na	na	5.13	16.86	Included
Non-hukou population who left origin over one year	na	na	Included	Included	Included
Under-enumerated population	0.09	na	0.03	1.78	8.30
Adjusted census data	77.35	130.46	215.71	314.44	469.57
Urban population share (%)					
Adjusted census data	13.26	18.78	21.39	27.57	37.04
Census data by author with army. Author's estimate.	13.26	14.10	20.88	26.40	37.05
Census data by author without army. Author's estimate.	12.84	13.68	20.55	26.20	36.92

Sources: Calculated by author using data in NBS(2001: 93); DPSSTS (2001: 31, 39 & 41; 2002: 2, 1883 & 1886); PCO and DPS (1985: 16, 26 & 553; 1993: 2-18); DPS (1988: 334-5; 1991: 26-7 & 45); History of the PLA <http://www.globalsecurity.org/military/world/china/pla-hist.htm> (accessed at 10 May 2003).

Table 3. Estimating urban population in China 1982-2001 (million).

Year	Urban non-agricultural population at year-end ¹	Urban non-agricultural population at mid-year	Growth rate of urban non-agricultural population at mid-year (%)	Growth rate of urban agricultural population at mid-year (%)	Adjusted urban population based on census ²	Estimated urban agricultural population	Estimated urban population
t	A	B(t)= [A(t-1)+A(t)]/2	C(t)= [B(t)/B(t-1)-1]*100	D=C*1.08455	E	F(t)=F(t-1) *[1+D(t)/100]	G=B+F
1981	143.20						
1982	147.15	145.18			215.71	70.54 ⁴	215.71 ⁵
1983	152.34	149.75	3.15	3.41		72.94	222.69
1984	166.89	159.62	6.59	7.15		78.16	237.77
1985	179.71	173.30	8.57	9.30		85.43	258.73
1986	185.15	182.43	5.27	5.71		90.31	272.74
1987	194.41	189.78	4.03	4.37		94.25	284.03
1988	204.06	199.24	4.98	5.40		99.34	298.58
1989	211.70	207.88	4.34	4.71		104.02	311.90
1990	217.33	214.52	3.19	3.46		107.62	322.14
1991	222.92	220.13	2.62	2.84		110.67	330.80
1992	234.12	228.52	3.81	4.14		115.25	343.77
1993	246.03	240.08	5.06	5.48		121.57	361.65
1994	259.40	252.72	5.27	5.71		128.51	381.23
1995	272.66	266.03	5.27	5.71		135.86	401.89
1996	279.38	276.02	3.76	4.07		141.39	417.41
1997	287.35	283.37	2.66	2.89		145.47	428.84
1998	293.20	290.28	2.44	2.64		149.32	439.59
1999	300.99	297.10	2.35	2.55		153.12	450.22
2000	311.21	309.51 ³	4.18	4.53	469.57	160.06	469.57
2001	321.71	316.46	2.25	2.44		163.96	480.42

Notes:

1 Column A from DPSSTS (2002: 194);

2 Column E from Table 2;

3 The formula for year 2000 is: B(t)=[2A(t-1)+10A(t)]/12, see text for explanations;

4 The formula for year 1982 is: F=E-B;

5 The formula for year 1982 is: G=E.

Table 4. Estimating total population and share of urban population in China 1982-2001.

Year	Total population at year-end ¹ (million)	Total population at mid-year (million)	Growth rate of total population (%)	Estimated total population (%)	Adjusted total population based on census ² (million)	Estimated total population (million)	Estimated share of urban population ³ (%)
t	A	B(t)= [A(t-1)+A(t)]/2	C(t)= [B(t)/B(t-1)-1]*100	D=C*1.0075	E	F(t)= F(t-1)*[1+D(t)/100]	G
1981	1000.72						
1982	1016.54	1008.63			1008.33	1008.33 ⁵	21.39
1983	1030.08	1023.31	1.46	1.47		1023.12	21.77
1984	1043.57	1036.83	1.32	1.33		1036.73	22.93
1985	1058.51	1051.04	1.37	1.38		1051.05	24.62
1986	1075.07	1066.79	1.50	1.51		1066.92	25.56
1987	1093.00	1084.04	1.62	1.63		1084.29	26.20
1988	1110.26	1101.63	1.62	1.64		1102.03	27.09
1989	1127.04	1118.65	1.54	1.56		1119.18	27.87
1990	1143.33	1135.19	1.48	1.49		1135.85	28.36
1991	1158.23	1150.78	1.37	1.38		1151.57	28.73
1992	1171.71	1164.97	1.23	1.24		1165.87	29.49
1993	1185.17	1178.44	1.16	1.16		1179.46	30.66
1994	1198.50	1191.84	1.14	1.15		1192.96	31.96
1995	1211.21	1204.86	1.09	1.10		1206.09	33.32
1996	1223.89	1217.55	1.05	1.06		1218.90	34.24
1997	1236.26	1230.08	1.03	1.04		1231.53	34.82
1998	1247.61	1241.94	0.96	0.97		1243.49	35.35
1999	1257.86	1252.74	0.87	0.88		1254.39	35.89
2000	1267.43	1265.84 ⁴	1.05	1.05	1267.60	1267.60	37.04
2001	1276.27	1271.85	0.48	0.48		1273.67	37.72

Notes:

1 Column A from NBS (2002: 93);

2 Column E from Table 2;

3 Column G is calculated by dividing column G in table 3 by column F in table 4;

4 The formula for year 2000 is: B(t)=[2A(t-1)+10A(t)]/12, see text for explanations;

5 This is not estimated.

Table 5. The impact of changing urban administrative boundary on the urban population Guangzhou city in 1982 and 2000 censuses.

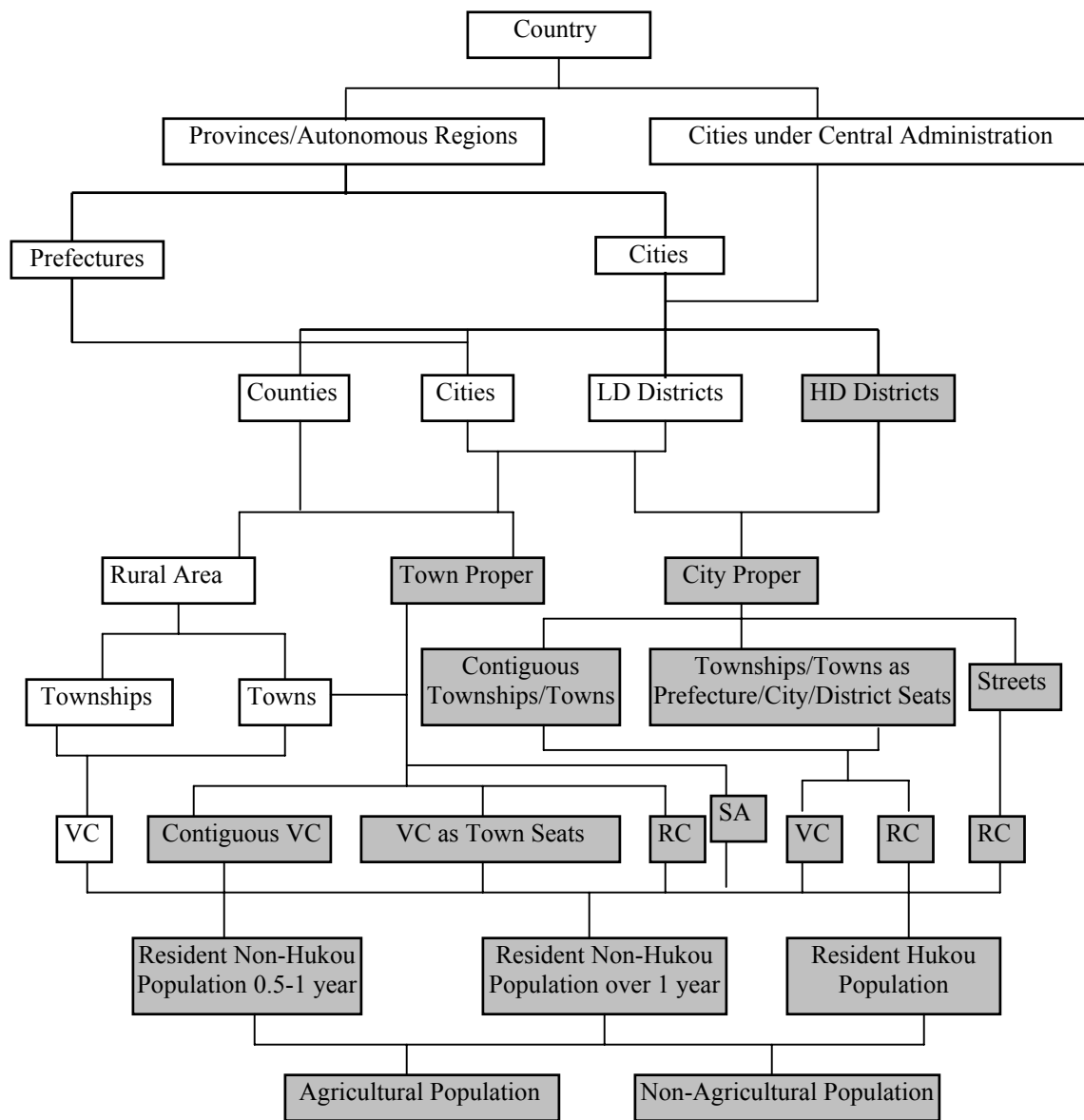
Urban districts		1982 based on urban districts and towns (1982 census definition)		2000 based on urban districts and towns (1982 census definition)		2000 based on city and town proper (2000 census definition)	
1982	2000	Urban population (thousand)	% of total population	"Urban" population (thousand)	% of total population	Urban population (thousand)	% of total population
Dongshan	Dongshan	433	100	566	100	566	100
Liwan	Liwan	550	100	483	100	483	100
Yuexiu	Yuexiu	499	100	348	100	348	100
Haizhu	Haizhu	492	100	1260	100	1260	100
Huangpu	Huangpu	134	100	396	100	396	100
Suburb ¹	Tianhe	1084	100	1129	100	1129	100
	Fangcun	na	na	330	100	330	100
	Baiyun	na	na	1780	100	1559	88
<i>1982 administrative area</i>	Sub-total	3192	100	6293	100	6071	96
(Panyu county)	Panyu ²	59	8.76	1660	100	1216	73
(Huaxian county)	Huadu ²	26	5.96	726	100	397	55
<i>2000 administrative area</i>	<i>Total</i>	3277	76.28	8679	100	7684	89

Sources: Adjustments are made by the author for including non-hukou population who left their hukou place for half to one year in 1982 and under-enumeration in 1982 and 2000 on the census data from Guangzhou yearbook editorial committee (1985: 70-79); Population Census Office of Guangdong Province (2002:10-18).

Notes:

1. Part of the suburb district formed Tianhe and Fangcun districts in 1985 and itself was renamed as Baiyun district in 1987.

2. Panyu county was designated as Panyu city in 1992 and urban district in 2000. Huaxian county was designated as Huadu city in 1993 and urban district in 2000.



Coverage of urban population:

LD districts: urban districts with population density less than 1500 persons per km².

HD districts: urban districts with population density over 1500 persons per km².

VC: villagers committees

RC: residents committees

SA: Special areas with population over 3000 persons

Figure 1. Categories of areas, population types, and the coverage of urban population in China in the 2000 census

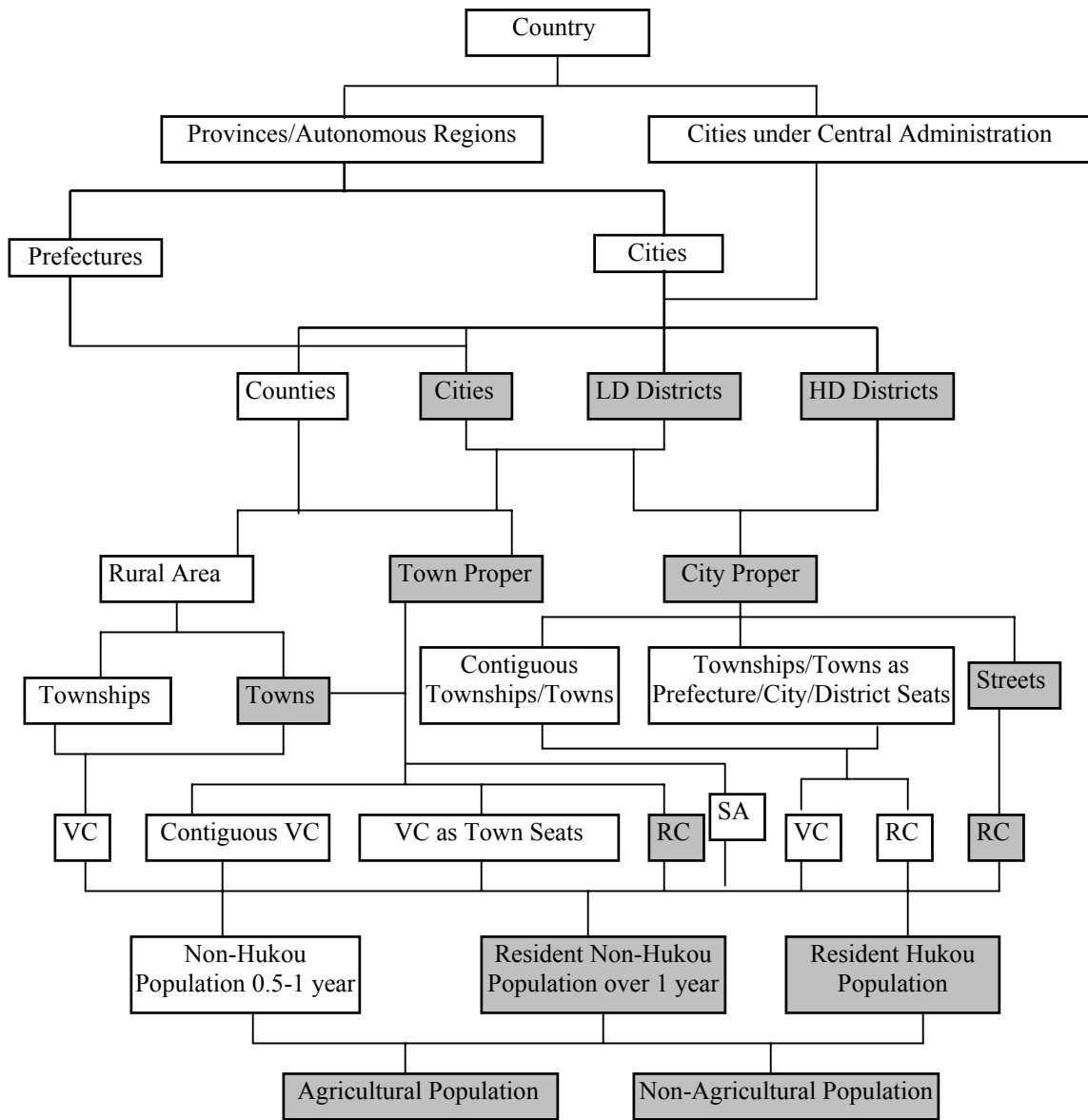
Census population		Usual residents present	Domestic visitors	Foreign visitors
Resident population	Usual residents absent	Usual residents present		

a. General relationship in all countries

Census population	Resident population	Hukou population
		Hukou population away over half or one year
	Hukou population away under half or one year	Hukou population away under half or one year
Hukou population present	Hukou population present	Hukou population present
Population whose hukou not determined	Population whose hukou not determined	
Non-hukou population left hukou place over half or one year	Non-hukou population left hukou place over half or one year	
Migrants from outside mainland China	Migrants from outside mainland China	
Visitors from outside mainland China		
Non-hukou population left hukou place under half or one year		
	Population working and studying abroad with hukou cancelled	

b. Unique relationships in China

Figure 2. Relationship between census population, resident population and hukou population



Coverage of urban population:

LD districts: urban districts with population density less than 1500 persons per km².

HD districts: urban districts with population density over 1500 persons per km².

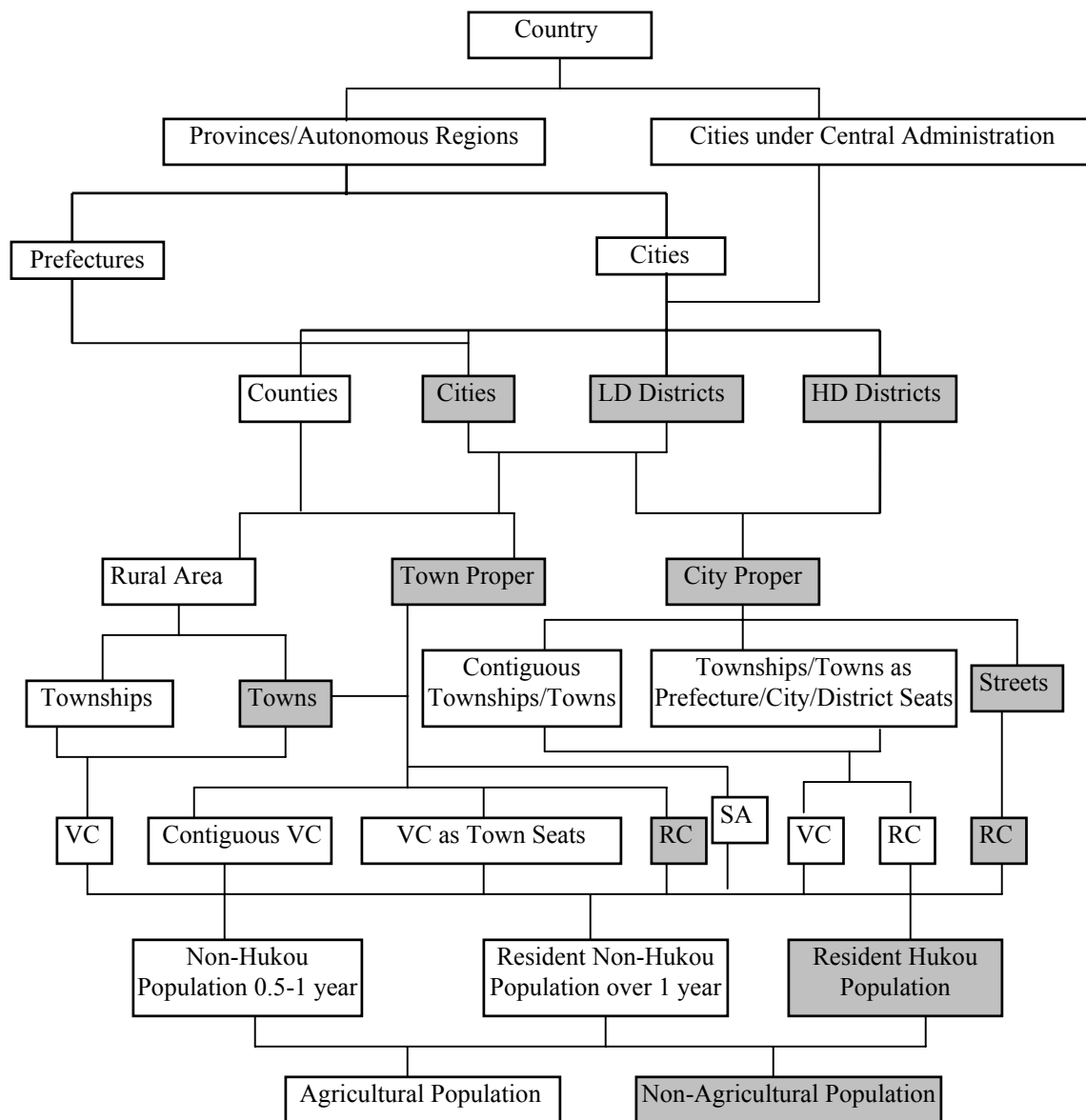
VC: villagers committees

RC: residents committees

SA: Special areas with population over 3000 persons

Figure 3. The coverage of urban population in China in the 1953/1982 censuses

Note: The 1953 census includes all migrants who arrived at the destination for less than half year or over half year. There was no distinction of hukou and non-hukou populations as well as of agricultural and non-agricultural populations.



Coverage of urban population:

LD districts: urban districts with population density less than 1500 persons per km².

HD districts: urban districts with population density over 1500 persons per km².

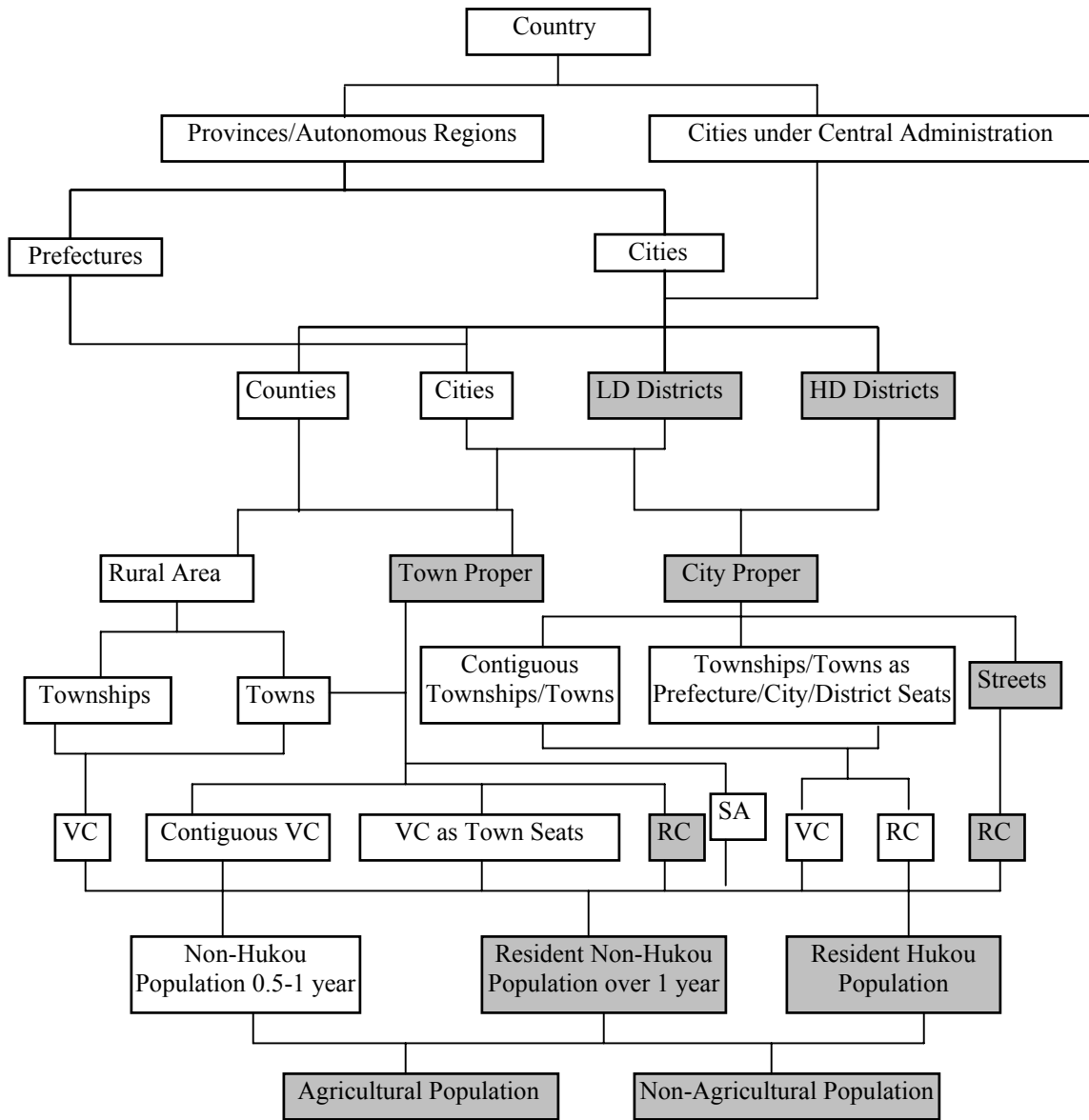
VC: villagers committees

RC: residents committees

SA: Special areas with population over 3000 persons

Figure 4. The coverage of urban population in China in the 1964 census

Note: only non-agricultural population in urban districts, cities and towns were counted as urban population in 1964 census



Coverage of urban population:

LD districts: urban districts with population density less than 1500 persons per km².

HD districts: urban districts with population density over 1500 persons per km².

VC: villagers committees

RC: residents committees

SA: Special areas with population over 3000 persons

Figure 5. The coverage of urban population in China in the 1990 census

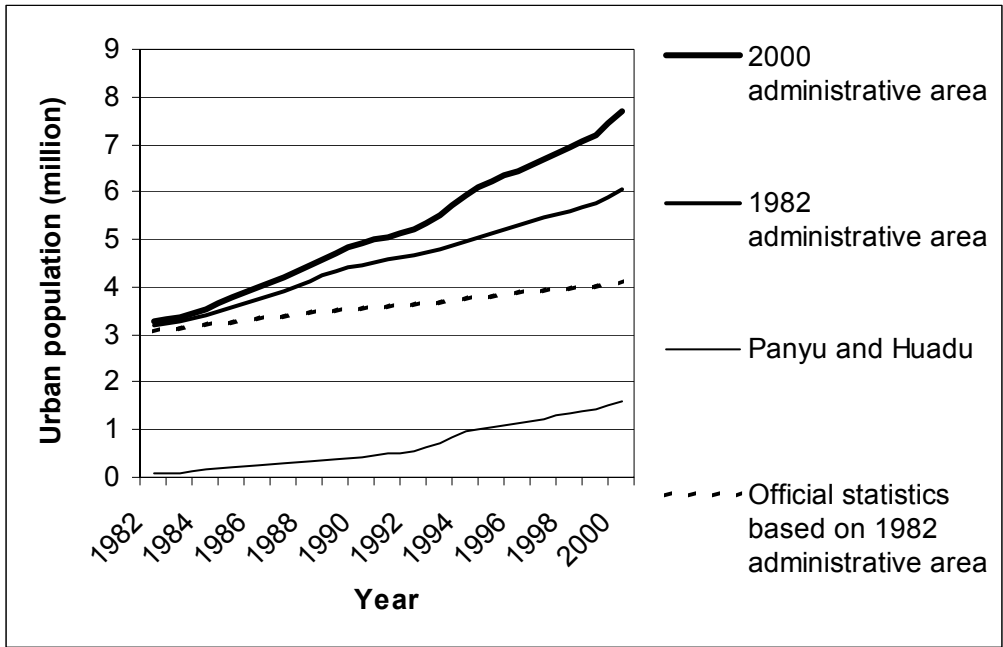


Figure 6. Estimated and registered urban population in Guangzhou city based on the 1982 urban administrative area and estimated urban population in Panyu and Huadu, and in Guangzhou city based on the 2000 urban administrative area for 1982-2000