

PLC Working Paper

w068

2010.10



北京大学-林肯研究院 城市发展与土地政策研究中心

PEKING UNIVERSITY - LINCOLN INSTITUTE

Center for Urban Development and Land Policy

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PLC WORKING PAPER SERIES NO.068

http://www.plc.pku.edu.cn/en_publications.aspx

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China's Urban Infrastructure: Expenditure Patterns and Revenue Sources

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July, 2010

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Abstract

With a rapidly increasing need for urban infrastructure in China, a greater understanding of the issues of revenue and expenditure has become more vital. This paper focuses on the following three issues. First, it clarifies the trend and regional pattern of infrastructure expenditure. Second, this paper illustrates the current situation of urban infrastructure revenue. Third, it will discuss the interaction between revenue and expenditure structures. As the importance of the “semi-governmental” revenue— i.e. land transfer fee and market financing—has increased, investments on roads and bridges, mass transit and landscaping have been prioritized. Regional disparity of infrastructure expenditure has also decreased with the revenue changes while UDIC-leading and private sector involvement play a more essential role in funding and financing roads, bridges and landscaping.

China's Urban Infrastructure: Expenditure Patterns and Revenue Sources

1. Introduction

With China's rapid economic and urbanization growth, high quality urban infrastructure has become increasingly important. Much literature has shown the positive relationship between economic growth and urban infrastructure. Cities in particular are investing more in infrastructure and tend to experience higher rates of economic growth (Wu 2008). The core rationale that emerges from the theoretical literature is that urban infrastructure raises the marginal product of other capital used in production (Fedderkea et al. 2006).

1.1. Clarification of Some Concepts

Infrastructure provides "basic services to industry and household" (Martini and Lee 1996), "key inputs to the economy" (Threadgold 1996), and "a crucial input to economic activity and growth" (Department of Foreign Affairs Canberra 1998). Generally, the activities of infrastructure investment include: Energy (power generation and supply), transport (toll roads, light rail systems, bridges and tunnels), water (sewerage, waste water treatment and water supply), telecommunications (telephones), and social infrastructure (hospitals, prisons, courts, museums, schools and government accommodation) (Grimsey and Lewis 2000). The narrow definition, according to the Ministry of Housing and Urban-Rural Development of China (the authority for administrating urban infrastructure finance) includes public utilities (water supply and drainage, residential gas and heating supply, and public transportation), municipal works (roads, bridges, tunnels, dock, and sewerage), parks, sanitation and waste management, and flood control. Power, telecommunications and other transportation sectors (seaports, airports and railways) are not included as a part of urban maintenance and construction in China (Wu 1999).

In this paper, urban infrastructure refers to urban maintenance and construction, which are administered by the local Bureau of Urban Infrastructure Construction. Any related funds are only spent on local projects, including local roads, utilities, transit, etc. More specifically, (1) railroads and military projects are not included in urban infrastructure revenue and expenditure. (2) Investments on inter-municipal projects, for example, inter-city highways, are not included. (3) Expenditure on major projects is excluded. These projects are always listed in the general fiscal expenditures rather than urban construction funds (Wang and Zhang 2009). Especially, funds for national-level major projects are not included. For example, the Three Gorges Project is not listed in the urban maintenance and construction revenue. (5) This revenue includes a portion of the funds for rural construction. In central budgetary allocation, New Rural Construction (xin nongcun jianshe) funds are included (Wang and Zhang 2009). Also, Urban Maintenance and Construction Tax charges 5% in counties and towns (xian, xiang) and 1% for lower administrative units on the combined value of Value-Added Tax, product tax, and business tax, which also includes part of the funds coming from rural sectors.

There are always two dimensions in infrastructure research in the public finance field: urban infrastructure expenditure and revenue. The former refers to infrastructure provision in certain jurisdictions, while the latter deals with the issue of from where the money comes.

Concerning the first dimension, this paper concentrates on “expenditure” in monetary units rather than infrastructure size. The data originates from urban maintenance and construction expenditure 2001-2005, which has been spent on daily maintenance of low, medium, and high maintenance projects for urban public facilities, public real estate and labor costs for state enterprises. Urban public facilities include roads and bridges, water and sewerage pipes, levees, landscaping, and environmental sanitation. In addition, public real estate is supervised by municipal housing administration sectors.

Urban maintenance and construction expenditure can be categorized in two ways: by purpose and by industry. If categorized by purpose, it includes investment in fixed assets, maintenance costs, payment of domestic and international loans, tax and fees, and other expenditures. Investment on fixed assets consists of one of the following: renovating, transforming, relocating and building urban public facilities. Payment for domestic and international loans includes payment to government, domestic and international financial institutions, and foreign governments. Tax and fees are generated by production, operation, and fixed assets investment. Alternatively, if categorized by industry, urban maintenance and construction expenditure includes water supply, gas supply, heating, transit, roads and bridges, sewerage, flood control, landscaping, environmental sanitation and other expenditures.

For the second dimension of infrastructure development, this paper will discuss urban infrastructure revenue, which is urban maintenance and construction revenue. It is used for expenditure on fixed assets investment, maintenance, payment for domestic and international loans, tax and fees, and other expenditures. Urban maintenance and construction revenue includes central and local budgetary allocation (zhongyang he difang caizheng bokuan), Urban Maintenance and Construction Tax (chengshi weihe jianshe shui), Public Utility Surcharge (gongyong shiye fujia fei), water resource fee (shui ziyuan fei), Infrastructure connection fee (shizheng gongyong sheshi zengrong peitao fei), user charges (shizheng gongyong sheshi youchang shiyong fei), land transfer fees (tudi churang zhuanrang jin), assets exchange revenue (zichan zhihuan shouru), domestic loans, foreign capital, bonds, stock financing, and self-raised funds (qishiye danwei zichou zijin).

In this paper, infrastructure revenue includes fiscal revenue and market financing. “Fiscal revenue” in this paper is more general, with includes not only budgetary funds, but also extra budget, and land transfer fee. Therefore, fiscal revenue includes budgetary allocation, local earmarked taxes, fees and user charges, and land transfer fee. Market financing includes domestic loans, security market financing, self-raised funds, and foreign capital.

1.2. Research Questions

This paper will concentrate on clarifying the trends and patterns of urban infrastructure expenditure and revenue. On the revenue side, this paper discusses national trends of each revenue item as well as municipalities and east, central and west regional patterns. This will illustrate sources of urban infrastructure revenue. Furthermore, this paper will evaluate the trends and patterns based on five theoretical dimensions. Finally, the discussion of the funding and financing mechanisms is extended to the perspectives of government and market, which provide

a broader view of the urban infrastructure investment issue. On the expenditure side, this paper primarily concentrates on the main trends and regional disparities of infrastructure expenditure.

However, the separate discussions of urban infrastructure revenue and expenditure might be misleading in that it neglects the interaction between these two. In fact, one of the most important reasons for under-development in some infrastructure industries is considered to be under-funding. Thus, in order to make policy suggestions for under-developed industries, researchers need to clarify the relationship between revenue and expenditure structures. Which item of revenue is more directly related to a certain category of infrastructure expenditure? This is another research question this paper is trying to answer in order to help better under-developed investment items in certain areas.

Beside a systematic description of the trends and patterns of infrastructure expenditure and revenue, this paper tends to relate the two areas by showing how expenditure structure is affected by revenues. First, this paper will concentrate on the empirical results concerning the relationship between expenditure and revenue. Second, the question of how the priorities of expenditure and main sources of revenue are related is raised. Third, we will discuss the relationship between the regional disparities of expenditure and revenue.

1.3. How This Report is Organized

There are 8 sections in total in this paper. The first section talks about some background information, including definition of important concepts and research questions. The second section is about the history of infrastructure expenditure and revenue in China, while the third section discusses previous research in this area. Sections 4 and 5 focus on the current situation of infrastructure expenditure and revenue. Section 6 concentrates on the interactions between these two sides. Section 7 will further discuss this issue from theoretical dimensions and the perspectives of government and market.

2. The History of Urban Infrastructure Development

The history of urban infrastructure development is marked by a series of twists and turns, from negligence to targeted expansion to a general loosening of control. There was originally very little investment by the central government in urban infrastructure, relegated as peripheral to industrial growth. With economic growth and development, investments in urban infrastructure grew in importance as a supplement to the improvement of the quality of life. In more recent years, much of the increase in urban infrastructure revenue, aided and directed by central authority, has been provided by a more autonomous expansion as support from the central government became less critical.

2.1. Before 1978

Before the economic reform in 1979, China's infrastructure investment was typically characterized as centrally planned. The entire fiscal system was characterized by the centralized revenue collection and fiscal transfers. All taxes and profits were collected by local governments,

remitted to the central government and then transferred back to the provinces and municipalities according to their needs as determined and approved by Beijing (Wu 1999). For urban infrastructure, the central government, and the Ministry of Construction in particular, had the authority to set investment goals, devise development strategies, review long-term plans, approve projects with foreign investment and limit the scope of operation of certain infrastructure facilities. Large infrastructure projects, such as the Beijing, Shanghai and Guangzhou subway systems, needed to be incorporated into provincial plans or plans of the central government. All infrastructure projects of national importance were reviewed by the Ministry of Construction, while those of regional importance were reviewed and approved by provincial Departments of Construction. Projects exceeding 200 million yuan were required to be approved by the State Planning Commission, and those involving foreign capital were approved by both the State Planning Commission and the State Council at the central level. But neither the central nor the provincial governments were required to fund such projects partially or fully. Most other urban infrastructure projects were approved by municipal authorities (Wu 1999).

Under this central-local fiscal relationship, urban infrastructure construction was not sufficiently supported and developed. Between the 1950s through the 1970s, investment in urban construction totaled 12 billion RMB, about 1.43% of nation's total fixed investment and 0.23% of GDP, which was far lower than other countries (Chan 1998). The first reason was that during that period of time, urban infrastructure was not the priority of the central government. Consumption and infrastructure investment were deemed as "non-productive", compared to industrial investment. Therefore, for many years, the retention rates for municipal authorities was set very low by the central government and capital expenditure funding either in the form of grants or credit was largely unavailable to the service sector and directed mainly to the production sectors (World Bank 1997b; Wu 1999). The second reason was that the revenue sources of urban infrastructure from local governments were very limited. The major source of revenue for urban construction, the Urban Maintenance and Construction Funds ("UMCF"), depended heavily on central budgetary allocations and a number of changing levies and fees determined by the central government (such as the Public Utility Surcharge ("PUS") established in 1963).

2.2. 1978 to 1994

The central-local government relationship began to change after 1978, when fiscal decentralization was introduced and local government began to retain higher rates of revenue and allocated funds more freely (Wu 1999). In this new system, participating provinces and municipalities were allowed a share of the revenue and they retained all income collected in excess of the share. In exchange for being given a bigger proportion of revenue, they also were required to accept responsibility for most items of expenditure (Wu 1999).

Additionally, during this period, the central government began to recognize the importance of urban infrastructure construction and tried to support faster urban development by a utilizing an improved funding system. The National Conference on Urban Planning in 1980 reiterated the national policy of developing urban settlements and signified the central government's intent to continue to "control the growth of large cities, rationally develop medium cities and actively promote the development of small cities." Also, starting from the 1980s, China began to build

the legislative-administrative framework for urban construction. The Law of Urban Planning served as a major milestone in formalizing city planning legislation in China, which was approved by National People's Congress in 1989. Later, in 1991, the first national urban land-use classification and planning standards were issued. Consequently, the sources of urban infrastructure revenue were broadened. Until 1979, an urban construction levy of 5 percent of industrial and commercial profits of domestic enterprises was introduced to 57 cities and later expanded to 150 cities in 1984 (Chan 1998). Following the conversion of enterprise profits to taxes (*ligaishui* reform), the levy was replaced by the Urban Maintenance and Construction Tax (UMCT) in 1985 (Chan 1998). The UMCT was the only earmarked tax in the fiscal system and became an important tool for infrastructure funding.

Additionally in the 1980s, some local governments tried user charges on urban infrastructure. "Infrastructure connection" fees on new construction and new in-migrants (the so-called *zengrong fei*, or fees for expanding capacity) were also allowed by the State Council in some cities in 1984. Another important source of urban infrastructure revenue--land-use fees--began to arise in 1981, which was first applied in Shenzhen on projects funded by foreign sources. In 1988 the transfer of land-use rights was legalized and written into the revised Chinese Constitution. By the end of 1993, about 44,000 land sales had been transacted and 79,000 hectares of land had changed hands, which became a significant source of public revenue.

2.3. After 1994

Various taxes such as the UMCT and a Public Utility Surcharge (PUS) were instrumental in the controlled expansion of urban infrastructure revenue. However, approaches such as the earmarked local taxes declined in importance in the 1990s. After the fiscal reform of 1994, fiscal decentralization was further increased. Taxes were reassigned between the central and local governments, with a shift from a negotiated system of general revenue sharing to a mix of tax assignments and tax sharing (Wong and Bird 2004). For the first time, local governments were assigned some taxes with significant revenue-generation capacity as local taxes. Related to urban construction, an urban land use tax, a real estate tax, and an urban maintenance and construction tax are now among the local taxes (Wu 2008). In 1994, the urban land use tax was renamed "land use tax" and changed into a local tax to stimulate local tax efforts (Chan 1998).

3. Previous Research

Most of the previous research concentrates on the urban infrastructure revenue. On the revenue side, there are four streams concerning current literatures. The first is the history of urban infrastructure finance. The second is about the quantity and quality of urban infrastructure provision. The third is the positive relationship between urban infrastructure and economic growth. The fourth is about major trends and patterns of urban infrastructure funding and financing mechanisms.

The first topic that current literature concentrates on is the history of urban infrastructure finance. In the process of fiscal decentralization, local government has gained more autonomy in urban infrastructure finance and resources of funds have been diversified (Wu 1999; Wu 2008; Chan 1998). Furthermore, the importance of government as a provider of urban infrastructure funds

has decreased, while marketization, including funds from land leasing and borrowing, plays a more and more essential role (Wang and Zhang 2009).

The second topic of some literature is the quantity and quality of urban infrastructure provision. Traditional infrastructures grew slower after the economic reform of 1978; while the high-tech infrastructures developed more rapidly after 1978 than before, the reason of which includes low government infrastructure spending, decreased incentives of investment of state enterprise, and diminished power of government in mobilizing rural resources (Lin 2001). In addition, the problems of unmet demand, deficiencies in cost recovery and inadequate maintenance are revealed. As examples of unmet demand, wastewater treatment and sewage were not sufficient in late 1990s while a recycling program has not yet been initiated. Also, the user charges are too low to fund the proper maintenance. For instance, low water price led to excessive demand; however, because of the low price, sewerage and wastewater management contributed to insufficient revenue for the infrastructure sector (World Bank 1995; Wu 1999). Another problem of urban infrastructure provision is increasing provincial disparity (Lin 2001). Cities in the eastern region uniformly enjoy higher levels of services in all sectors, while in inland provinces, public transportation, roads, streets, water supply, waste treatment are in poor condition (Wu 2008).

The third topic is about urban infrastructure—economic growth relationship. The direct negative effect of insufficient infrastructure provision is the obstruction of economic growth. Munnell (1990) studied the impact of stock of public capital on economic growth in US and indicated that those states that had invested in infrastructure tend to have greater output, more private investment, and higher employment growth. A similar conclusion is drawn in the study of Spanish regions (Cutanda and Paricio 1994). The theoretical basis for this positive infrastructure-economic growth relationship is infrastructural investment would increase the marginal product of other production factors (Fedderkea et al. 2006). As evidence from China, Wu (2008) found out that cities investing more in infrastructure tend to experience higher rates of economic growth. Furthermore, infrastructure investment also has positive impact on labor productivity. Fu and Vijverberg (2004) finds that public infrastructure is a significant determinant of variations in labor productivity across provinces; but the contribution of public capital to labor productivity growth over time is likely non-existing or even negative (Fu and Vijverbery 2004).

Another issue on which much current literature concentrates is the categorization of urban infrastructure revenue. The most common categorization is employed according to the nature of the revenue. Urban infrastructure revenue includes central and local budgetary allocation, local earmarked taxes, fees and user charges, borrowing, and self-raised funds (Wu 1999; Wu 2008). Most commonly, a land-transfer fee is listed under “fees and user charges” because it is viewed as a significant source of local governmental revenue. However, some literature has made adjustments as they list the land-transfer fee in a separate category (Wang and Zhang 2009). Another categorization emphasizes more on the entity that provides urban infrastructure revenue. However, this categorization generally seems misleading and ambiguous. For example, projects sorted as direct budget, debt financing, and marketization were supported by urban development and investment companies (Su 2006). However, the entities that provide the funds are not clear under this classification. Within “debt financing”, the entity for those projects which are supported by the funds borrowed from nationally issued bonds is actually the central government

because the repayment of these borrowings is always waived in the process of political negotiation.” (Su 2006) Also, borrowing from commercial banks, bonds and foreign capital should be separated.

Some literature concentrates on urban infrastructure expenditure. Indicated by Lin (2001), the overall infrastructure construction is under-provided. the growth of several major infrastructures slowed down after the economic reform started in 1978, including many conventional infrastructures, i.e. roads, railways, and petroleum and gas pipelines. Many Chinese experts and policy officials believe that urban infrastructure investment lags behind the rate appropriate to the country’s growth in urbanization, industrialization, and income level (Su 2006). Moreover, provincial disparity has also widened. Lin (2001) indicates the unevenness in transportation, construction of highways, and telecommunication (which is not included in the concept of “infrastructure” in this paper) by using the length of transportation routes per square kilometers and per 100,000 persons, the growth rate of highways, and the number of subscribers per 10,000 persons¹. Also, the increasing disparity is also discovered under the indicator of water, gas coverage rate, public transportation vehicle, per capita road area, and wastewater treatment rate (Wu 2008).

The first limitation of current literature is that they concentrate on the “results” rather than the “expenditure in money units” in urban infrastructure. Therefore, the priorities of investment in each area are not identified. Also, some of the results are not comparable. For example, length of transportation routes might be incomparable because of different road conditions. In this paper, when analyzing infrastructure expenditure, we use per capita expenditure rather than “results”. Second, although the disparity problems have been analyzed in current literature, solutions are not clearly stated. In order to solve these problems, the relationship between each of the expenditure items and revenue sources should be clarified, which is part of the work of this paper.

4. Current Situation of China's Infrastructure Expenditure

This section mainly concentrates on the trends and regional patterns of each item of the urban infrastructure expenditure, using the data from *Zhongguo chengshi jianshe tongji nianjian, year 2001 to 2005*. In the data cleaning process, there are several steps worth mentioning. First, in order to remove the influence of inflation, the paper adjusts the urban infrastructure expenditure by the price index of fixed assets (constant 2001 RMB). Second, in the regional pattern analysis, while grouping all the provinces into eastern, central, western and municipality, Xizang and Beijing have been excluded from the west and municipality respectively because of the missing data problem.

The items of Expenditure from Urban Maintenance and Construction Fund include water supply, gas supply, central heating, transit, roads and bridges, sewerage, flood control, landscaping, environmental sanitation and other expenditures. In the analysis of this section, however, the paper makes the following adjustments. First, the expenditure on central heating is excluded in the analysis. Because this item depends largely on the location of the province (the expenditure is

¹ The indicator used is the number of subscribers per 10,000 persons of paging, mobile telephone, email service, internet service, urban telephone, rural telephone, and public telephone.

high in the north and low or zero in the south), it is very likely that the regional (municipality, eastern, central, and western) patterns of the expenditure depends on how many northern provinces each region includes. Second, because water supply, sewerage and gas supply have similar trends and regional patterns as well as similar natures in demand and supply, this paper combines them into one item "utilities". Third, environmental sanitation and flood control are very small relative to other expenditure items; therefore, they are integrated into one category "environmental facilities". Thus, the categorization we use includes utilities, transit, roads and bridges (the total of transit, and roads and bridges is also called surface transportation), environmental facilities, landscaping, and other expenditures.

In the following section, we will describe the trends and regional patterns of each expenditure item. Per capita total expenditure increased from 189 yuan in year 2001 to 376 yuan in 2005, with an annual growth rate of 25%. We can also see the rapid growth from figure 2.

4.1. *Utilities*

Utilities include water supply, sewerage, and gas supply. Urban water supply refers to water services that complied with state standards and codes to institutions and urban residents through water supply facilities, including water supply by public suppliers and by suppliers with self-built facilities (Ministry of Housing and Urban-Rural Development of PRC 2001). Urban gas is a general term describing energy such as man-made coal gas, natural gas and LPG, which is provided for urban production and domestic use according to the *Code on Design of Urban Gas in Towns and Cities*.

From year 2001 to 2005, per capita utilities expenditure increased from 34 yuan to 50 yuan, with an average annual growth rate of 12%, which is much lower than the growth rate of total expenditure. Therefore, utility as a traditional infrastructure investment grows significantly slower than other infrastructure items. In 2005, utilities accounted for approximately 13% of total infrastructure expenditure. Its importance also kept decreasing, mainly due to the water supply and sewerage, which grew with an annual rate of only 11%.

Municipality has the highest per capita expenditure on utility, which is 245 yuan in 2005 while the central areas have the lowest with 32 yuan. Also, municipalities spent the lowest proportion in utilities. The western areas have the highest annual growth rate, which is 19%. Central areas have both the lowest per capita utility expenditure and almost the lowest growth rate. This is consistent with the fact that the central area is the most underdeveloped with the lowest per capita expenditure and average annual growth rate in almost all items except the per capita expenditure on transit, which is higher than the western area, and growth rates on utility and landscaping, which are higher than municipalities. However, because the per capita expenditure in municipality is much higher, they are not comparable.

4.2. *Transit*

Transit is a general term describing various economical urban public transportation means, including bus, trolley bus and transit system (subway, light rail, tram, cableway and cable car), taxi, ferry etc (Ministry of Housing and Urban-Rural Development of PRC 2001).

Transit is one of the sources of growth in total infrastructure expenditure. From year 2001 to 2005, per capita transit expenditure grew from 11 yuan to 25 yuan, with an annual growth rate of 29%, slightly higher than total. Transit accounts for about 7% in total urban infrastructure expenditure and is even lower than landscaping. Therefore, the expenditure on transit is not consistent with its importance in urban infrastructure.

The most important regional characteristic in transit is the high expenditure in municipality (per capita expenditure on transit in municipality in 2005 is 574 yuan while the expenditures of this item in eastern areas are 28 yuan, and are as low as 7 yuan/person in central and western areas). However, the growth rate in eastern areas is much higher than municipality; eastern areas grew with an average annual growth rate of 58% while municipality is 28%. But because Beijing has been excluded from municipality, which has large subsidies on the public transit system, the size and growth rate of transit of municipality are likely to be underestimated.

4.3. Roads and Bridges

Roads and bridges are the most important item in infrastructure expenditure. It accounts for close to half of total expenditure (46%). Furthermore, this item grew the fastest in all urban infrastructure items. It had an average annual growth rate of 42%, much higher than the average of 25%. The growth rate is indicative of its rising importance.

Per capita expenditure on roads and bridges is much higher in municipalities than regions but the growth rate is also the highest among the four regions. The central area has the lowest per capita expenditure and growth rate. However, in all areas, roads and bridges grows faster almost than any other items in urban infrastructure expenditure.

4.4. Environmental Facilities

Environmental sanitation and flood control are both relatively small items in infrastructure expenditure. Therefore, they were combined for analysis in this paper. For clarification, urban environmental sanitation includes road cleaning and maintenance, domestic garbage services, and transferred and treated soil (Ministry of Housing and Urban-Rural Development of PRC 2001).

“Environmental facilities” is a relatively small item in urban infrastructure expenditure. It has a proportion of about 5%, with an annual growth rate of 19%. Per capita expenditure on this item is the lowest in central areas and highest in municipality. Western areas have the highest growth rate while central has the lowest. In addition, the proportion of environmental sanitation and flood control in total expenditure in western areas is also the highest.

4.5. Landscaping

Landscaping is another source of the increase of urban infrastructure expenditure. Its average annual growth rate 31% is higher than average. Another importance of landscaping is that it might be a way that local government uses to appreciate land value and promote revenue-raising

capacity. It is one of the hypotheses this paper is going to test. In addition, landscaping accounts for 8% in total expenditure, which is higher than both transit and environmental facilities.

Regionally, municipality has the highest per capita expenditure on landscaping while central area has the lowest. Also, for this item, the disparity between municipality and the second highest expenditure--eastern area is the lowest. This can be explained by the function of land value appreciation of landscaping in eastern areas.

5. Current Situation of China's Urban Infrastructure Revenue

This section tries to systematically describe the trends and patterns of each item of urban maintenance and construction revenues under a clearly defined categorization. As such, this section is interested in the following questions: which categorization should be used? Under this categorization, how should we clearly define each item? Given the range of each item, what is the difference between the role each of them plays in 1980s, 1990s and after 2000? What is the trend after 2000?

In order to answer these questions, this paper is going to use the data from *Zhongguo chengshi jianshe tongji nianjian, 2000-2008* to update the information already used, while the data before 1999 comes from Wu (2008). First, the national trends and patterns is described by analyzing per capita level of each item in fiscal revenue and market financing. In order to remove the influence of inflation, the paper adjusts the urban maintenance and construction revenue each year² using price index of fixed assets (constant 2000 RMB). Besides the national trends, it also clarifies regional patterns by analyzing per capita revenue and the proportion of each item in total revenue in municipality, east, central and west (year 2005). Because of the missing data problem in Xizang and Beijing, they are excluded from the west and municipality.

The total amount of urban maintenance and construction revenue has increased dramatically in the past two decades. It increased 1300% from 1990 to 2005 (constant 2000 RMB). Per capita revenue increased from 33 yuan in 1990 to 376 yuan in year 2005; also, urban maintenance and construction revenue as a percentage of GDP increased from 1.8% in 1999 to 2.9% in 2005. This section will first describe the trend and pattern of each item in fiscal revenue and market financing. Fiscal revenue includes central and local budgetary allocation, local earmarked taxes (“two-item fee”), fees and user charges (water resource fee, infrastructure connection fee, and user charges), and land transfer fee. Market financing includes domestic loan, other bonds, self-raised funds, foreign capital and stocks, in which domestic loans and other bonds are considered debt financing and self-raised funds, foreign capital and stocks are equity financing. Central and local budgetary allocation come from general funds, while local earmarked taxes include Urban Maintenance and Construction Tax and Public Utility Surcharge, which is the only earmarked fiscal revenue for urban construction.

² Because the price index of fixed assets for 1990 is not accessible, we use the price index of 1991 instead for calculating the adjusted urban maintenance and construction revenue of 1990. Assume the price index of 1999 equals 100.

The average annual growth rate of fiscal revenue from 1990 to 2005 is 12.8%, while market financing grew at 17.1%. Thus, the proportion of market financing in total revenue has been increasing in the past two decades, from 18% in 1990 to 51% in 2005, while fiscal revenue accounts for 44%. Regionally, the proportion of fiscal revenue is highest in the east, which is approximately 50% (the main reason for this is that land transfer fee in the east is much higher than other regions); municipality has the highest proportion of market financing (64%). However, both per capita and proportion of fiscal revenue and market financing in municipality are much higher other regions.

5.1. Urban Infrastructure Funding Mechanism — Fiscal Revenue

5.1.1. Central and Local Budgetary Allocation

Central budgetary allocation refers to the earmarked grants from the central government for urban maintenance and construction, which takes the form of fiscal transfer and special funds, namely irrigation works funds (*Shuili jianshe jijin*), road funds (*Gonglu jijin*), and rural construction funds (*Xin nongcun jianshe*); while local budgetary allocation always targets on big projects and major programs (*Zhongda xiangmu*), which takes the form of special grants (Wang and Zhang 2009).

The amount of central budgetary allocation is very limited compared to other resources. In 2007, it was 3 billion RMB (constant 2000 RMB), while the local budgetary allocation was 128.6 billion. Central budgetary allocation had increased from 1990 to 2000; per capita level increased 5 folds. However, it started to decrease from 2000. Per capita central budgetary allocation in 2007 was only 32% of 2001. By comparison, local budgetary allocation had dramatically increased 1990-2007 with an average annual growth rate of 17.3%, which is higher than fiscal revenue (15.3%). Therefore, local budgetary allocation is one source of the growth in fiscal revenue.

Regionally, per capita budgetary allocation in municipality is much higher than other regions; the east and west are lower; the central is the lowest. However, the west has the highest proportion in total urban infrastructure revenue (20%), which indicates that the west has the highest reliance on budgetary allocation. In addition, the central is lowest in both per capita and proportion.

5.1.2. Local Earmarked Taxes—Two-item Funds

The two-item funds play an important role in urban infrastructure revenue. Urban Maintenance and Construction Tax (UMCT) is collected by the local government as a surcharge on the combined value of Value-Added Tax, product tax, and business tax—7 percent in cities, 5 percent in towns and 1 percent elsewhere. A Public Utility Surcharge is a surcharge fee which is collected by local governments for such goods and services, including industry and domestic uses, as electricity, water, natural gas supplies, public transportation, and local telephone service (Ministry of Housing and Urban-Rural Development of PRC 2001).

The UMCT was launched at 1985, since when it has become a main source for urban infrastructure finance (The State Council 1985). Before implementing the UMCT, an urban

construction levy of 5 percent of the industrial and commercial profits of domestic enterprises was introduced in 57 cities in 1979 and applied to total of 150 cities in 1984. Then, following the conversion of enterprise profits to taxes (*ligaishui* reform), the levy was replaced by the Urban Maintenance and Construction Tax in 1985 (Chan 1998).

Although the earmarked local taxes played an essential role before 1990 (it accounted for 42% of total urban maintenance and construction funds in 1990), the importance has been decreasing since. Per capita local earmarked taxes increased from 13.8 in 1990 to 45.0 in 2007 with an average annual growth rate of 5.4%, which is much smaller than fiscal revenue (15.3%) and market financing (17.1%). Therefore, the proportion of local earmarked taxes in total revenue had been decreasing.

Regionally (year 2005), municipality has the highest per capita local earmarked taxes, while the west has the lowest. In addition, the central has the highest reliance (13%, year 2005).

The two-item funds also have some problems. The rate is set by the central government and is low relatively to the needs of many cities. The former is collected as a surcharge on three taxes levied on the output of industrial and commercial enterprises and incomes of enterprises in transportation, hotel, catering, and other service sectors. Therefore, it fluctuates with output levels of these enterprises and does not apply to public institutions (or *shiye danwei*), which is not desirable as a revenue source for infrastructure (Wu 2008).

5.1.3. Fees and User Charges

Fees and user charges include water resource fee, infrastructure connection fee, and user charges. In our data, before 2001, infrastructure connection fee and land transfer fee are included in other sources rather than fees and user charges, which explains the large gap of the amount of fees and user charges between years before 2001 and after. Also, it gives the reason for the dramatic decrease of other sources after 2001. For the same reason, the percentage of each item in fees and user charges are not listed before 2001.

The water resource fee refers to the fees that are charged to enterprises and public institutions (*shiye danwei*) for exploiting underground water resources in a programming zone of the city (*chengshi guihua qu*) (Ministry of Housing and Urban-Rural Development of PRC 2001). The infrastructure connection fee (*shizheng gongyong sheshi zengrong peitao fei*) refers to the fees charged to enterprises, institutions or individuals who engage in construction projects (including construction and expansion of land use) in the programming zone of the city. The charges are levied according to the building area (*jianzhu mianji*) or amount of the investment, which would be used for urban infrastructure including roads, water, sewerage, gases, heating, public transportation, sanitation and parks (Ministry of Housing and Urban-Rural Development of PRC 2001). This fee (the so-called *zengrong fei*) was launched by the State Council in some cities in 1984 and became popular in almost all cities by the early 1990s. By the early 1990s, the infrastructure connection fee was charged to permanent migrants and new developments by local governments (Chan 1998). In many places, this was combined with the sale of hukou, or urban residency rights. For instance, Anhui had sold 500 hukou since it started selling them in 1993, and most of the 1.5 million RMB raised was to be used to finance urban construction (Chan

1998). By early 1994, 3 million urban resident household registration books had been sold throughout the country, generating revenue of 25 billion RMB (Chan 1998).

User charges include tolls on roads and bridges, wastewater treatment fees, garbage treatment fees, and sewerage fees. During the 1980s, local governments of some cities began to implement user charges for promoting urban infrastructure revenues. For instance, wastewater treatment charges began to be collected in more than 30 cities in 1984 (Chan 1998). In the mid-1980s, Guangzhou and Foshan started requiring toll payment for vehicular use of their bridges (Chan 1998).

The average annual growth rate of fees and user charges is 21.7%, which is higher than fiscal revenue and market financing. User charges increased the fastest. However, compared to other items, the amount of user charges were very small. Per capita user charges were 19 yuan in 2007 while total fiscal revenue was 293 yuan. The east has the highest reliance on fees and user charges; however, it was only 7% in total revenue in 2005 (user charges: 3%). The low proportion of user charges became an obstacle for appropriate resource allocation; therefore, local government should concentrate on further developing it. Also, these fees and user charges have some problems: some municipal authorities have included a multitude of infrastructure services in the fee collection and often have asked for exorbitant amounts of money (Wu 1999; Wu 2008). This is shown in the case of some 28 different fees imposed on various aspects of real estate development in Shanghai (Bird 2004).

5.1.4. Land Transfer Fee

Land transfer fee is the most significant source of urban infrastructure revenue, which began to provide funds for urban infrastructure in 1980s. In this paper, land transfer fee infers to revenues from leasing land use rights and charging land use fees. From the 1980s, the Chinese government began to realize the inefficiency in land use and gradually developed an urban land market by charging for the use of land. Land-use fees were first used in 1981 in Shenzhen on projects funded by foreign sources. In 1987 the sale of land-use rights first appeared in Shenzhen and later in Shanghai, Tianjin, Guangzhou, Xiamen and Fuzhou (Chan 1998). Then, two laws (The State Council 1988; The State Council 1990) were launched in 1988 and 1990, respectively, which provided the legal foundation for land leasing as an infrastructure revenue tool by Chinese municipalities. By 1992, sale of land use rights had extended to individuals, foreign joint ventures, and domestic companies and also cover many cities (Chan 1998). By 1994, land-use right had been sold in all provincial units except Tibet (Chan 1998).

After introducing land leasing, it has gradually become one of the most important revenue items for urban infrastructure for local government. Originally, the central government's share of land-leasing revenues was set at 60 percent. The split subsequently was modified to 40:60 for central and local government, respectively, then to 32:68 and 5:95. By 1994, all land-leasing revenues were assigned to municipal governments (Peterson 2006; Chan 1997). Land leasing was an important step towards fiscal decentralization because after the initiation, local governments have found a revenue resource which is totally under their control.

As table 4 has shown, the data of land transfer fee starts from 2001. That is because this item is included in other sources before 2001. First, land transfer fee is the engine for the growth of fiscal revenue. It has an annual average growth rate of 54.3%, which is much higher than the one of fiscal revenue. Second, land transfer fee fluctuated a lot in the past ten year. It increased dramatically starting from 2001; then experienced the bottom point at 2005 and increased again after that. Regionally, the east has the highest reliance on land transfer fee, the proportion of which is 16%, the central 10%, the west and municipality even lower. Further, per capita land transfer fee in the east is higher than in municipality — the only item that the east has a higher per capita level than municipality.

5.2. Urban Infrastructure Financing Mechanism — Market Financing

5.2.1. Domestic Loans

Domestic loans include nationally issued bonds and bank loans. From 1998, the Ministry of Finance began to increase nationally issued bonds and grant loans to provincial governments from that for the purpose of local economic and social development. The local governments are responsible for repaying capital with interests. Borrowing from national bonds could have been used on environmental and other social projects unable to generate sufficient economic return; however, they were always invested in other economic development projects that were preferred by the local governments. The repayment of these loans is always waived in the process of political negotiation with central government (Su 2006).

The most important aspect of domestic loans is bank loans, which account for over 80% of domestic loans. Because local governments are not allowed to borrow money directly from commercial banks, Urban Development and Investment Companies are established to justify this way of financing urban infrastructure. However, because the maturity period of commercial bank loans does not exceed 5-8 years during which the infrastructure investment projects cannot recover cost, local governments choose to roll over the loans rather than repay them. After the implementation of higher credit standards for commercial banks, local governments' political control over commercial banks has weakened and it becomes harder to gain loans from these banks (Su 2006).

Domestic loans are the source of growth in market financing as: they account for a majority of market financing (50-60%) and the average annual growth rate from 1990-2005 is 24.0% while the growth rate of market financing is 17.1%. Regionally, the west has the highest proportion of domestic loans in total infrastructure revenue (2005). Municipality has the highest per capita domestic loan. Obviously, majority nationally issued bonds flowed into municipality; municipality has a per capita value at 171.1 yuan, while 1.9 for the west.

5.2.2. Self-raised Funds

Self-raised funds refer to those that come from the accumulated capital of enterprises and public institutions for the purposes of expanded reproduction (Ministry of Housing and Urban-Rural Development of PRC 2001). Self-raised funds are not specifically authorized as a fee or fund (Wu 2008; Wong and Bird 2004). However, enterprising sectors are forced to take the fiscal

burdens to finance public services (Wu 2008). For example, in Dongguan, Guangdong province, the local government created an energy and communications company to raise money from state, collective and private sources for the construction of roads and power plant. This company also is responsible for paying interest and repaying for the capital by collecting user fees and tolls (Wu 2008; Harral 1992). Another example of privately funded infrastructure is the small-scale secondary pipe networks for purified drinking water established in some cities in mid-1990s (Wu 2008; Boland 2007).

The average annual growth rate of self-raised fund is 14.3%, which is low than the 17.1% of market financing. Estimated by Wang and Zhang (2009), in self-raised funds, about 2/3 of them come from the direct investment of private enterprises. Municipality has the highest reliance on self-raised fund, the proportion of which is about 28% in 2005.

5.2.3. Foreign Capital

Foreign capital includes FDI, foreign loans, and other foreign investments. After the economic reform and the implementation of opening policy in 1978, China has attracted investments from foreign companies. In order to encourage these investments, the central government offers a series of incentives to prospective investors, including tax advantages, customs duty exemptions, a wider variety of permitted activities, and relative operational autonomy (Wu 1999). Foreign investment usually takes the form of public-private partnerships, in which Chinese government provides the land and foreign companies provide the funds needed (Bird 2004; Bellier and Zhou 2003). Foreign capital has a relatively low proportion in total infrastructure revenue, about 1-2%. The average annual growth rate 15.3% is also lower than 17.1% for market financing.

6. Exploring the Relationship between Infrastructure Expenditure and Revenue

This section will concentrate on explaining the relationship between urban infrastructure expenditure and revenue. First, it talks about the empirical results of the relationship between revenue and expenditure structure. Second, this section clarifies the priorities of expenditure and how it is related to main sources of revenue. Third, this section discusses the regional disparity of both expenditure and revenue.

6.1. The Relationship between Revenue and Expenditure Structure

6.1.1. Methodology and Data

In this section, we are going to use regression and elasticity analysis to test the relationship between the expenditure on each item and revenue structure. The following hypotheses are going to be tested:

- Budgetary allocation has positive impact on the expenditure on utilities;
- Fees and user charges have positive impact on the expenditure on utilities and roads and bridges because they include fees for the use of utility and roads and bridges;

- Land transfer fee has a positive impact on the expenditure on roads and bridges, and landscaping because these two are the expenditures that will dramatically increase the value of the land.
- Domestic loans and self-raised funds have a positive impact on the expenditure on roads and bridges, and transit.

In the regression analysis, we use provincial revenue and expenditure data from year 2001 to 2005 (Beijing and Xizang have been excluded). It uses OLS estimation with year dummies. The dependent variable is the log form of per capita expenditure on utilities, transit, roads and bridges, environmental facilities, and landscaping. The independent variables include log form of per capita central budgetary allocation, local budgetary allocation, local earmarked taxes, fees and user charges, land transfer fee, domestic loans, self-raised fund, and foreign capital. Also, national, non-municipality, eastern, central and western areas have been estimated separately in order to observe the different pattern in different regions. The reason why non-municipality has been estimated instead of municipality is that the number of observations for municipality is very low. Therefore, the relationship in municipality can be observed indirectly from the regression for non-municipality.

6.1.2. Results

In the national estimation, an obvious time trend has not been observed. Central and local budgetary allocation has a significant positive impact on utility. At the national level, when central budgetary allocation increases 1%, expenditure on utility will increase 0.08%, the impact of which is much lower than local budgetary allocation (with a coefficient of 15.6%). Also, when fees and user charges increase 1%, expenditure on utility will increase approximately 16.9%, which has the second highest impact on utility in all revenue items (lower than self-raised fund). This is consistent with our hypothesis because water resource fee and water treatment fee in fees and user charges will be used on utility. Self-raised fund has the highest impact on utility. Therefore, the expenditure on utility generally comes from budgetary allocation, fees and user charges, self-raised fund.

In the regional estimation, different patterns of the revenue sources of utilities have been revealed. The impact of central budgetary allocation on utility in municipality is smaller than the national because the coefficient of central budgetary allocation is bigger in non-municipality estimation. However, the effect of local budgetary allocation is higher. This indicates that although central allocation is much higher than other regions, it is not used on utilities. For other regions, budgetary allocation does not have an impact. Considering fees and user charges, this item is the main revenue source for the central area. The impact in other areas is very low or insignificant. The self-raised fund has larger impact in municipality, eastern and western areas than the national, among which it has the biggest impact in eastern area. Self-raised funds will not significantly increase expenditure on utilities in central area. Although the impact of foreign capital in the national estimation is very small, it is much bigger in the western region. Therefore, the revenue sources in the municipality, eastern, central and western areas are mainly self-raised funds, fees, user charges, and self-raised fund and foreign capital, respectively. Nationally, the main sources of revenue for transit are fees and user charges, self-raised funds, and foreign capital. Fees and user charges have the highest impact. Under our estimation, when

fees and user charges increase 1%, expenditures on transit will increase 0.54%. This is because a main part of fees and user charges is tolls on roads and bridges (tolls on roads and bridges have been used mainly on transit instead of the investment on roads and bridges: the impact of fees and user charges on expenditure on roads and bridges is not significant). Also, self-raised fund and foreign capital have significant positive impact (0.34% and 0.28%, respectively).

Regionally, after excluding municipality, the effect of fees and user charges increases from 0.541 to 0.546. Therefore, relative to other regions, municipality relies less on fees and user charges. The effects of self-raised fund and foreign capital have decreased, indicating that the impacts of them in municipality are higher than other regions. We can get the same conclusion from the regression for eastern, central and western regions. In both eastern and central areas, the impacts of fees and user charges are much higher than national. Self-raised fund and foreign capital do not have significant effects. In the western area, none of these revenue items are very significant (local earmarked taxes and fees and user charges are significant at 10% level). In sum, the impacts of fees and user charges mainly happen in eastern and central areas while self-raised fund and foreign capital increase the expenditure on transit in municipality significantly. In general, expenditure on roads and bridges has an obvious time trend. Expenditures in 2004 and 2005 have significantly increased. The main revenue sources for roads and bridges were land transfer fees and domestic loans. The elasticity of domestic loans was 0.596, while land transfer fees had the elasticity of 0.059.

Excluding municipality, self-raised fund is also an important revenue source of investment on roads and bridges. According to the result of non-municipalities, the importance of land transfer fees and domestic loans were lower than other regions. In the eastern area, local budgetary allocation and domestic loans played an essential role. In central and western areas, the expenditure on roads and bridges mainly relied on domestic loans and self-raised fund. Plus, the impact of land transfer fees was also significantly positive in central area.

In the national estimation, local budgetary allocation, domestic loans, and self-raised fund have significantly positive impact on the expenditure on environmental sanitation and flood control. The impacts of these three items are very close: when one of them increases 1%, expenditure will increase 0.22-0.27%.

Regionally, relative to national average, municipality relies more on local budgetary allocation and domestic loans and less on self-raised fund. In the eastern area, a 1% increase in land transfer fee will raise per capita expenditure on environmental sanitation and flood control by 0.334%. The western area also relies on local budgetary allocation too.

Nationally, the main sources for the expenditure on landscaping are local budgetary allocation, land transfer fees, and self-raised fund; among these sources, local budgetary allocation and self-raised fund have larger impact. Because investment in landscaping is one of the important ways to increase land value, it is predictable that the expenditure on landscaping is related to land transfer fee.

Regionally, municipality and western areas have similar funding and financing mechanisms for landscaping; in both areas, local budgetary allocation has played the major role in funding

landscaping. In eastern and central areas, however, the positive impacts of self-raised fund and land transfer fee are very significant. In addition, local earmarked taxes and foreign capital also exert positive influence on expenditure on landscaping in eastern area. Fees and user charges is significant for central area.

6.2. Priorities of Infrastructure Expenditure and Main Sources of Revenue

Concerning the growth rate of all industries, roads and bridges, transit, and landscaping are the priorities of local governments. The per capita expenditure on roads and bridges increased from 64 to 171 yuan/person from 2001 to 2005 with an average annual growth rate of 29%, while the total expenditure grew 19% every year on average. Also, this expenditure item accounts for close to half of total expenditure (46%). Therefore, investment on roads and bridges has become the first priority of local government in urban infrastructure construction. The initiation of municipal bonds in China has supported the development of the construction of roads and bridges.

Transit and landscaping are deemed as other two priorities of urban infrastructure expenditure. Their growth rates are also higher than average, although the importance of them in total expenditure is much lower than roads and bridges. Per capita expenditure on transit and landscaping grew from 11 to 25, and 14 to 30 yuan/person, respectively, from 2001 to 2005, with average annual growth rate of 24% and 23%. All these investments serve the purpose of increasing the land value, on which local governments heavily rely to increase local revenue raising capacity. Also, based on the relationship between revenue and expenditure structure shown in the next section, they are more likely to be related to land transfer fee.

By comparison, the development of utilities and environmental facilities has been proven to be much lower than other industries. From year 2001 to 2005, the annual growth rate of utilities is 11%, which is close to 50% lower than the one of total expenditure. Considering the importance of utility in the urban development (the proportion of utility in total expenditure is 13%) and the tension caused by water supply shortage in some western and central cities, the growth rate is undoubtedly low. However, the following issues need to be considered before drawing a conclusion. First, electricity provision is not included in our data, which is a significant component of utility. Second, the investment of national-level utility projects is not included in the data; therefore, the growth rate of spending on utility is very likely to be under-estimated. Environmental sanitation and flood control developed very slowly as well (17% annually), which also accounts for the lowest proportion in urban infrastructure expenditure (5%).

According to section 6.1, infrastructure expenditures are closely related to revenue structure. Therefore, the revenue structure should have the estimating ability for the priorities described above. Specifically, expenditures with high priority tend to be significantly correlated with revenue items that grew faster than average. Therefore, this following will first describe the trends and patterns of revenue sources; then, interprets the relationship between spending priority and revenue structure.

On one hand, local budgetary allocation (average annual growth rate: 22%) and land transfer fees (50%) contributed to the high growth rate of fiscal revenue, while in market financing, domestic loans (20%) and self-raised funds (21%) increased faster than total. On the other hand, local

earmarked taxes, which used to be the major source of infrastructure revenue, fees and user charges, and foreign capital grew slower than average. Particularly, Land transfer fees increased the fastest, from 13.1 (year 2001) to 41.2 (2005) Yuan/person. The items that grew faster than total accounted for the majority³ of total revenue; therefore, they were also the most significant.

From the relationship between expenditure and revenue structure as well the trends of revenue sources, table 13 shows that fast-developing infrastructure industries tend to be correlated with revenue items whose growth rate is higher than average. In table 13, the column “actual growth rate” shows the growth rate of all infrastructure expenditure industries; the higher it is the higher priority that item has. “Revenue sources” are the revenue items that significantly⁴ correlated with each expenditure item. For example, in the regression equation with expenditure on roads and bridges as dependent variable, domestic loans and land transfer fee have significant impact. The “coefficient” is for each one of the revenue sources. “Estimated growth rate” is the estimation of the growth rate of each infrastructure industry based on the coefficients and the growth rate of the significant revenue sources. For instance, the estimated growth rate of roads and bridges is $0.596 * 20\% + 0.059 * 50\% = 15\%$.

The growth rate of revenue items has a strong estimating ability for the priorities in infrastructure expenditure. According to the “estimated growth rate” results in table 13, roads and bridges, transit, and landscaping are the priorities, based on the growth rate of the revenue items that they are significantly related to. This is consistent with the actual growth rate of expenditures.

6.3. Regional Disparity of Infrastructure Expenditure and Revenue

When we talk about regional disparity, we mainly care about three questions: first, how big is the size of the disparity; second, the trend of the disparity; third, the patterns of every region. This section uses coefficient of variation (C.V.)⁵ to measure the size of the disparity. Therefore, the disparities of different industries are comparable although the per capita expenditures and revenue vary among them.

The first important pattern of the disparity of expenditure is that except for transit, the regional disparities of other industries are very close, which is in the range of 1 to 2, while C.V. of transit has been as high as 4.41. The second important pattern is that the disparities of most industries are decreasing except the increase in 2002. The C.V. of per capita total expenditure decreased from 2.05 to 1.15 from year 2001 to 2005. The C.V. of transit decreased from 4.41 (year 2002) to 2.93 (2005).

Third, all the provinces have been categorized into four regions according the economic condition: eastern, central, western, and municipality. Municipality has the highest per capita expenditure on every item, especially on transit, while central area is the lowest only except gas supply and environmental sanitation. In addition, one interesting pattern in municipality is also

³ The sum of local budgetary allocation, land transfer fee, domestic loans account for 67% of total revenue.

⁴ 5% level.

⁵ C.V.: Coefficient of Variation=Standard deviation/Mean.

that transit is the top priority of all expenditure items: municipality spends 24% of total revenue on transit, while the proportion are only 5%, 3%, and 3% in east, central and west. In comparison, expenditure on roads and bridges has been prioritized by central and western areas. Also, the proportion of expenditure on landscaping is higher than other areas, which is related to increasing land value.

As table 14 and 15 have shown, provincial disparities of infrastructure expenditure and revenue are intimately correlated with each other. From year 2001 to 2003, disparity of expenditure is slightly higher than revenue; starting from 2004, they remain at around the same level. Further, infrastructure revenue has the same trend as expenditure—they were both decreasing for the most part. One reasonable explanation is that as the low-revenue provinces widened the urban infrastructure revenue sources, they had more to invest in infrastructure construction.

The provincial disparity of market financing is higher than fiscal revenue. Especially before 2003, the C.V. of domestic loans, and self-raised fund and foreign capital are higher than other revenue sources. Further, market financing and land transfer fee are the ones whose disparity decreased the fastest. Local earmarked taxes, budgetary allocation, which are considered as the traditional revenue sources of infrastructure, have low C.V. level; they also have slightly changed. Thus, from 2001 to 2005, the extension of urban infrastructure revenue sources, from budgetary allocation and earmarked taxes to land transfer fee, from fiscal revenue to market financing, has alleviate the regional disparity of infrastructure revenue.

Also, the amount of infrastructure revenue that municipality, eastern, central and western areas got is consistent with expenditure gaps described. Regionally, per capita budgetary allocation in municipality is much higher than other regions; the east and west are lower; the central is the lowest. However, the west has the highest proportion in total infrastructure revenue (20%), which indicates the highest reliance in the west on budgetary allocation. In addition, the central is lowest in both per capita and proportion. Also, municipality has the highest per capita local earmarked taxes, while the west has the lowest. In addition, the central has the highest reliance (13%, year 2005). The east has the highest reliance on land transfer fee, the proportion of which is 16%, the central 10%, the west and municipality even lower. Further, per capita land transfer fee in the east is higher than in municipality — the only item that the east has a higher per capita level than municipality. The western area has the highest proportion of domestic loans in total infrastructure revenue (2005). Municipality has the highest per capita domestic loan. Obviously, majority nationally issued bonds flowed into municipality; municipality has a per capita value at 171.1 yuan, while 1.9 for the west. In addition, municipality has the highest reliance on self-raised fund, the proportion of which is about 28% in 2005.

7. Further Discussions of Infrastructure Development

7.1. *Theoretical Framework and Discussion*

In the research area of urban infrastructure investment, there are five theoretical issues that are essential to efficient intergovernmental relationship, funding and financing mechanisms, and resource allocation. The first issue is who should provide urban infrastructure, government or market. The second one is about the rationales for central or local government's provision of

urban infrastructure. The third one is about the choices among general revenue, special funds, and fees when it comes to urban infrastructure funding. The fourth one concentrates on the pros and cons of pay-as-you-go and pay-as-you-use, respectively. Last but not least, the fifth one is about the desirable pricing level of user charges.

The first question is about the role of government and market in infrastructure provision. There are two theoretical reasons for the government's provision of urban infrastructure. First, the production of some urban utilities exhibits increasing returns to scale, which is also deemed as natural monopoly. Under this circumstance, it is impossible to have a single price equal to marginal cost (which is required for efficiency) and have the producer earn a profit (Fisher 2007). The property of natural monopoly would give the company who provides the goods and services the market power to charge higher price and provide low quantity than the efficient level. Therefore, the government can resolve this difficulty either by becoming the producer or by regulating monopoly production (Fisher 2007). Second, some urban infrastructures are public goods, which bear the property of being non-rival and non-exclusive. Public goods are non-rival, meaning that one additional person can consume the good without reducing any other consumer's benefit; after the good or service is produced, the marginal cost of an additional consumer is zero. Public goods often are also said to be non-excludable, meaning that it is not possible (at least at reasonable cost) to exclude consumers who do not pay the price from consuming the goods or services (Fisher 2007). For non-rival goods, the price should be set at zero because the marginal social cost of adding another consumer is zero, which obviously does not provide revenue to cover any fixed costs (Fisher 2007). Therefore, these goods could not be efficiently provided by private firms (Fisher 2007). Also, private firms also are unable to collect revenue to cover costs for nonexclusive goods and services because it is not feasible to charge a price for the consumption (Fisher 2007). Therefore, projects like water supply and drainage, residential gas and heating supply, and public transportation, which exhibit property of natural monopoly, should be provided or at least price-regulated by government. Non-rival or non-exclusive goods and services as basic level roads, sanitation and waste management, and flood control would also be more efficiently provided by government than private sectors. Besides these projects, other profitable ones could be efficiently provided by private sectors, the involvement of which would help alleviate the financial burden of government, decrease administrative cost and transaction cost in the political negotiation process, and also introduce competition to create higher-quality project.

The second question is which government is more efficient for offering urban infrastructure, central or local. Wallace Oates's Correspondence Principle could help answer this question: each public good is provided in the smallest (that is, lowest level) government consistent with no externality (Fisher 2007). There are two dimensions in this principle: the first one is variance in demand while the second one is spatial externality. The greater the variations in what individual consumers want from government and the more consumers with similar wants are grouped together, the stronger is the case for decentralized provision (Fisher 2007). However, spatial externality is another factor that supports more centralized government. It occurs when the spatial distribution of the costs and benefits of government services is not confined to the jurisdiction boundaries of the providing government, the problem of which would be solved by internalizing the externalities—that is, bigger government jurisdictions (Fisher 2007). Therefore, it would be desirable to provide public goods and services by the smallest government consistent

with no externality. In urban infrastructure provision, this principle fits very well. First, those projects that are almost only beneficial to residents in the municipality like urban utilities (for example, water supply and drainage) and municipal works (roads, bridges etc.) should be financed and provided by local government (municipal jurisdiction). Second, upper-level governments are considered better to initiate projects that have externality problems in municipal level. For example, provincial rather than municipal government should provide provincial-level roads and flood control project to avoid municipal externality. Also, when it comes to projects that could benefit several provinces, central government provision is considered more efficient, as Three Gorge Project and national-level roads.

The third issue focuses on the best choice among general revenue, special funds, and fees. The criterion of this choice is the user-pay-and-benefit principle (or benefit-received principle), which examines the extent to which users pay in proportion to their amount of use and to the costs they impose on the system. Apparently, this criterion is based on the recognition of consumers and the extent of difficulty to collect user charges. On one hand, urban infrastructure for which consumers could not be recognized or charged is only possible supported by general revenue. For instance, the nonexclusive projects mentioned above, as basic level roads, sanitation and waste management, and flood control could not be supported by user charges because “users” are incredibly costly to identify or all residents and nonresidents are potential beneficiaries, however, who are always reluctant to uncover their demand. On the other hand, to the projects for which user charges could be collected (the cost of doing that is reasonable), user charges are more attractive: the greater is the share of marginal benefits that accrues to direct users, the greater the percentage of the benefits of a service or facility that go to direct users, the more easily users can be identified and excluded (at reasonable cost) from consuming the service unless the charge is paid, and the more price elastic is demand (Fisher 2007). Two other potential advantages of user charges are that they are one way to have nonresidents pay for benefits they enjoy, and the perception of fairness from users paying may result in more public acceptance of state and local government provision of certain services (Fisher 2007). Also, user fees could help better allocating scarce resource among competing demands (when congestion costs are imposed to current users from additional consumer) and providing a measure of the demand for new capital investment (Fisher 2007). However, there are also cons for user charges. Objection is raised on the grounds that they are a disadvantage for consumers with lower incomes and that the administration costs (to the government) and compliance costs (to the consumers) of collecting the charge may offset any expected efficiency gains (Fisher 2007).

The fourth issue concentrates on the pros and cons for pay-as-you-go and pay-as-you-use, or budgetary funding and debt financing. Pay-as-you-go means building up a reserve of funds from taxes over several years, while pay-as-you-use refers to borrowing the funds to be repaid with interest from taxes in future years (Fisher 2007). The first rationale supporting pay-as-you-use is the key economic characteristic of capital goods, which is that a relatively large initial expenditure is required to purchase facilities that then generate benefits over a number of years (Fisher 2007). That is the case in a lot of projects of urban infrastructure. The initial investment of public utilities (water supply and drainage, ect.) and capital spending in municipal works (roads and bridges etc.) are always debt-financed, while budgetary funding is always applied to urban infrastructure maintenance and basic level roads construction. The second rationale is the consideration of intergenerational equity. As a matter of fact, pay-as-you-go tends to put the tax

burden on contemporary generation for benefiting future ones, who are the final beneficiaries of the current capital spending. In comparison, by borrowing the cash for the facility now but effectively paying for the facility with future taxes, those who receive the services from the facility will be paying for them (Fisher 2007). However, there are also some cons of pay-as-you-use. It is criticized sometimes as creating an incentive for overcapitalization by sub-national governments if the individual voters who approve projects do not perceive their future costs (Fisher 2007). Such an incentive may be larger in jurisdictions where a greater fraction of the voters are temporary residents (Fisher 2007).

The fifth issue is about the desirable pricing level of user charges, which is an important signal to both consumers and investors. Too low user charges will lead to excessive consumption and insufficient investment and vice versa. Thus, the pricing level of user charges is essential for efficient resource allocation. The same as other goods and services, setting the price at marginal cost is always Pareto efficient. However, more complexity is caused by the problem of public goods and natural monopoly when setting price level for using urban infrastructures. When government regulates prices for public goods (especially as producer), not only private but also social marginal cost/benefits should be considered. For natural monopoly industries, in which the production exhibits increasing returns to scale, it is impossible to have a single price equal to marginal cost and have the producer earn a profit. Government has to subsidize the production, especially for the initial investment (Fisher 2007). In addition, setting user charges at marginal cost level, which means charging higher to consumers far away from existing services and hence costly to serve and lower to those who are closer, would encourage more efficient land use because if average costs are charged, urban sprawl would be encouraged by subsidizing people in outlying areas (Bird 2005). Therefore, although more complexity arises, marginal-cost pricing mechanism is still a direct and effective way to efficiency.

Based on the theoretical criteria, the question of interest is “*Are these trends theoretically reasonable*”? To answer this question, we will evaluate current infrastructure revenue trends in all five theoretical dimensions.

- It is very obvious that the current trend exhibits the characteristic that market is gradually substituting government provision. Theoretically, only pure public goods, which are nonrival and nonexclusive, as basic level roads, sanitation, urban infrastructure maintenance, and flood control should be provided by government. Apparently, local governments are involved much more than the projects mentioned above. Especially in some areas, UDIC acts like a political institution attached to local governments rather than a real market approach to provide revenue for infrastructure. In this sense, the current trend is theoretically reasonable and correct.
- The role of local government is much more important than central government in infrastructure provision, which is consistent with the *Correspondence Principle*. The main reason why almost all projects are supported by local jurisdiction (which is reflected by our data) is that those which have significant spatial externalities at municipal and provincial levels are not included in Urban Maintenance and Construction revenue. For example, spending on Three Gorge Project and national-level roads, which should be and are provided by central government, are separately listed or financed by

other resources. Therefore, the importance of central government is underestimated by our data.

- The proportion of budgetary allocation > local earmarked taxes > fees and user charges. Also, the proportion of fees and user charges is very low. Therefore, fees and user charges are not sufficiently used as a source of infrastructure revenue. Especially in the central and west, fees and user charges should be further developed considering inadequate revenue sources. Also, the trend of fees and user charges is not consistent with its effect on more efficient resource allocation. Furthermore, the growth rate of user charges is higher than the other two. Therefore, the trend in the future is that user charges are going to have a larger proportion in total fees and user charges.
- The basic trend for pay-as-you-go and pay-as-you-use is apparently the decrease in the proportion of the former one and increase in the latter one. That means debt-financing is becoming more and more significant. From this perspective, the trend is theoretically feasible. However, there is more complexity in the funding and financing mechanisms in China. Nowadays, another funding source is almost as important as debts—land transfer fee, which is considered unstable and non-lasting. From the perspective of generational equity, the high price of real estate and land which is encouraged by local governments is the cost current generation are paying for future ones. Also, frequent ups and downs of land leasing revenue are deemed as a factor that causes dramatic economic fluctuation. Therefore, how to substitute land leasing revenue by debt financing is still a big concern.
- It is really hard to say whether the level of user charges now DOES or DOES NOT equal to the marginal cost. However, some phenomenon we observed might point out some problems. The shortage of electricity happened during electricity-using summit might be better solved by adjusting the level of user charges—electricity fees rather than black-out in certain areas. Also, Beijing fails to follow the marginal cost principle when it decided to subsidize the public transport system. In addition, setting the user charges at marginal cost level relies on the fact that the producer is facing a monopolistic competitive market, which would drive the price down (or quantity up) close to the efficient level, or the price is regulated by the government. However, although UDIC-leading mode is deemed as a marketized approach, the mere fact that UDIC is attached to or even only an agent of the government makes it inevitable that UDIC has become a monopoly, who has no incentive to provide public goods and services at marginal cost level.

7.2. Urban Infrastructure Funding and Financing Mechanisms: from the Perspective of Government and Market

Section 5 illustrates the sources of urban infrastructure revenue from the angle of revenue resources. However, there is another angle of considering this issue, which might make it clearer—the operating agent. According to the agent who operates and manages the funding and financing process, the modes of urban infrastructure funding could be categorized as government-leading, UDIC-leading, and private involvement mode.

The government-leading mode refers to the one in which the government are in charge of collecting, managing, and expending urban infrastructure funds. These funds include central and local budgetary allocation, two-item funds, fees and user charges; land transfer fee is not included because it is considered UDIC-leading mode. In these funds, one part of them is granted

to Bureau of Housing and Construction as annual construction funds for daily maintenance and management, and normal road construction. The main sources of this part are two-item funds. Another part targets on major municipal projects, which are managed by Bureau of Housing and Construction, while costs are split by related enterprises and public institutions. In fact, normally, these funds come from general budget of government instead of being listed in urban construction expenditures (Wang and Zhang 2009).

Urban Development and Investment Company (UDIC) was established in most cities at the end of the 1990s or even later when central government required that responsibility for asset and liability management should be taken away from municipal governments and placed in the hands of specialized local enterprises (Su 2006). In addition, UDIC has to collect funds for the projects from the society, take the risk independently and recover the costs individually (Wang and Zhang 2009). In urban infrastructure provision, the UDIC mode has become more and more important. The main revenue resources are domestic loans (which include nationally issued bonds and bank loans) and land transfer fee. UDIC acts on behalf of the government to borrow funds from banks and other sources, issue bonds when allowed, enter into joint ventures with private companies for infrastructure development, sell local infrastructure assets, etc. Usually, the bank loans are guaranteed by local fiscal revenue, land revenue, or other fees and user charges. The loans are repaid by local fiscal revenue or operating revenue of the projects. The problem of bank loans as a way of financing urban infrastructure is that they are always constrained by credit policies implemented by central government (Wang and Zhang 2009; 21 Century Economic Report 2006). Also, urban infrastructure projects always need a relatively longer period to recover costs, which make local governments choose to roll over debts instead of repaying them. Consequently, the excessive debt ratio of local governments has become a public concern.

Another main revenue resource for UDIC is land revenue. As a matter of fact, not all the lands could provide funds for urban infrastructure construction. Vast majority of land revenue come from the lands of commercial and living purpose because the cost of industrial land is close to or even higher than the price of the land, which makes industrial land leasing ceases being beneficial. The main way of local governments operating land is land expropriating -- infrastructure construction—waiting for appreciation—land leasing—gaining the benefits. After leasing the land, part of revenue would be transferred to UDIC as funds for urban infrastructure construction (Wang and Zhang 2009).

In the private sector involvement mode, the most common ways of private sector involvement in China are BOT (Build—operate--transfer) and BT (build--transfer). The BOT mode has the following advantages: first, local government does not bear the risk during the franchising period. Second, the revenue-raising problem of urban infrastructure construction is easily solved for the local government. Third, BOT would help introduce advanced technology and managing technique, which are essential for economic and social development (Wang 2009). The main areas of private sector investment include profitable major project of public utilities (Water Company, Wastewater Treatment Factory, and Electricity Company), key bridges and tunnels, major road and other transportation projects (Wang and Zhang 2009). In the private sector involvement mode, the revenue of urban construction mostly comes from foreign capital, private capitals, and bank loans. According to our categorization in the revenue structure section, funds

for private sector involvement mode mainly come from three categories: domestic loans, foreign capital, and self-raised funds. Estimated by Wang and Zhang (2009), about 1/3 of foreign capital is foreign direct investment, and 2/3 of self-raised funds are direct investment of private enterprises.

8. Conclusion

As the importance of the nontraditional sources of revenue—land transfer fees and market financing has increased, expenditures on roads and bridges, transit and landscaping have been prioritized; furthermore, regional disparity of infrastructure expenditure has decreased. Therefore, broadening nontraditional revenue sources has exerted positive influence on the infrastructure construction in western and central areas, which are considered under-developed.

Although this paper illustrates the trends and patterns of urban infrastructure revenue and expenditure as well as the interaction between the two, this paper still has the following limitations. The first limitation of this paper is the lack of data analysis while clarifying urban infrastructure funding and financing mechanisms from the government and market perspective. That is because the data of domestic loans, loans for private sectors are not separated from those provided to local government or UDIC. For this reason, we failed to illustrate the trends and pattern of the three different modes. Second, because of the missing data problem for Beijing and Xizang, they are excluded from municipality and the west. However, they are considered representative in each region; therefore, some information is omitted due to the above reason mentioned. Third, because of the limitation of data, the estimation for municipality, east, central and west might be inaccurate because of the small sample size. Therefore, future research should concentrate on better data quality. Also, the same estimation can be implemented on city level data to test the same hypotheses.

Table 1: National Infrastructure Expenditure Items, 2001-2005 (10 Thousand RMB)

	2001	2002	2003	2004	2005
Utilities	4,196,314	4,684,207	6,069,604	6,113,976	6,288,676
Water supply & sewage	3,544,109	3,998,803	5,087,063	4,969,964	5,186,183
Gas supply	652,205	685,404	982,541	1,144,012	1,102,493
Surface transportation	9,394,057	12,103,125	18,272,544	20,592,903	24,752,401
Transit	1,438,983	2,262,197	2,003,841	2,224,980	3,157,259
Roads and bridges	7,955,074	9,840,928	16,268,703	18,367,923	21,595,142
Environmental facilities	1,381,951	1,959,497	2,521,121	2,262,785	2,456,629
Environmental sanitation	908,676	1,135,458	1,459,702	1,381,997	1,626,063
Flood control	473,275	824,039	1,061,419	880,788	830,566
Landscaping	1,709,735	2,497,717	3,249,348	3,346,329	3,845,763
Other expenditures	6,259,341	6,612,433	8,003,024	8,324,051	8,545,427
<i>Total</i>	<i>23,644,940</i>	<i>28,971,891</i>	<i>39,409,787</i>	<i>42,062,819</i>	<i>47,559,844</i>

Table 2: National Infrastructure Expenditure Items, Per Capita, 2001-2005 (Yuan/Person)

	2001	2002	2003	2004	2005
Utilities	34	37	48	48	50
Water supply & sewage	28	32	40	39	41
Gas supply	5	5	8	9	9
Surface transportation	75	96	144	161	196
Transit	11	18	16	17	25
Roads and bridges	64	78	128	144	171
Environmental facilities	11	16	20	18	19
Environmental sanitation	7	9	12	11	13
Flood control	4	7	8	7	7
Landscaping	14	20	26	26	30
Other expenditures	50	53	63	65	68
<i>Total</i>	<i>189</i>	<i>230</i>	<i>311</i>	<i>330</i>	<i>376</i>

Table 3: Infrastructure Expenditure Items, Per Capita and Proportion of Total Expenditure, 2005 (Yuan/Person and %)

	Municipality		East		Central		West	
	Per Capita	%*	Per Capita	%	Per Capita	%	Per Capita	%
Utilities	245	10%	75	13%	32	15%	38	13%
Water supply & sewerage	195	8%	63	11%	25	12%	32	11%
Gas supply	50	2%	12	2%	7	3%	6	2%
Surface transportation	1417	59%	267	48%	114	52%	170	58%
Transit	574	24%	28	5%	7	3%	7	3%
Roads and bridges	843	35%	239	43%	107	49%	163	55%
Environmental facilities	64	2%	29	5%	12	5%	19	7%
Environmental sanitation	52	2%	21	4%	9	4%	8	3%
Flood control	12	0%	8	1%	3	1%	11	4%
Landscaping	90	4%	56	10%	15	7%	21	7%
Other expenditures	575	24%	105	19%	34	15%	42	14%
Total	2,424	100%	552	100%	220	100%	299	100%

* The proportion of each item in total expenditure.

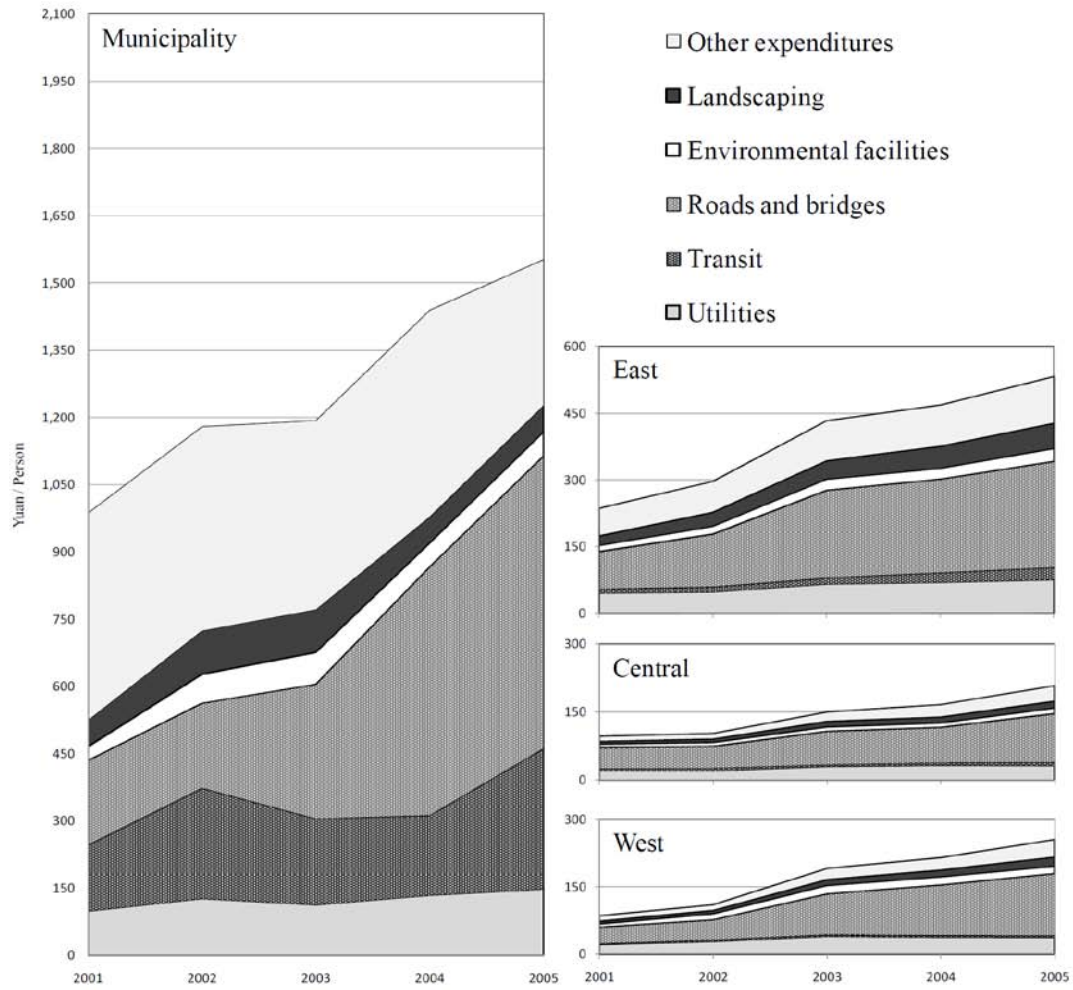


Figure 1: Regional Trends and Patterns of Urban Infrastructure Expenditure, 2001-2005

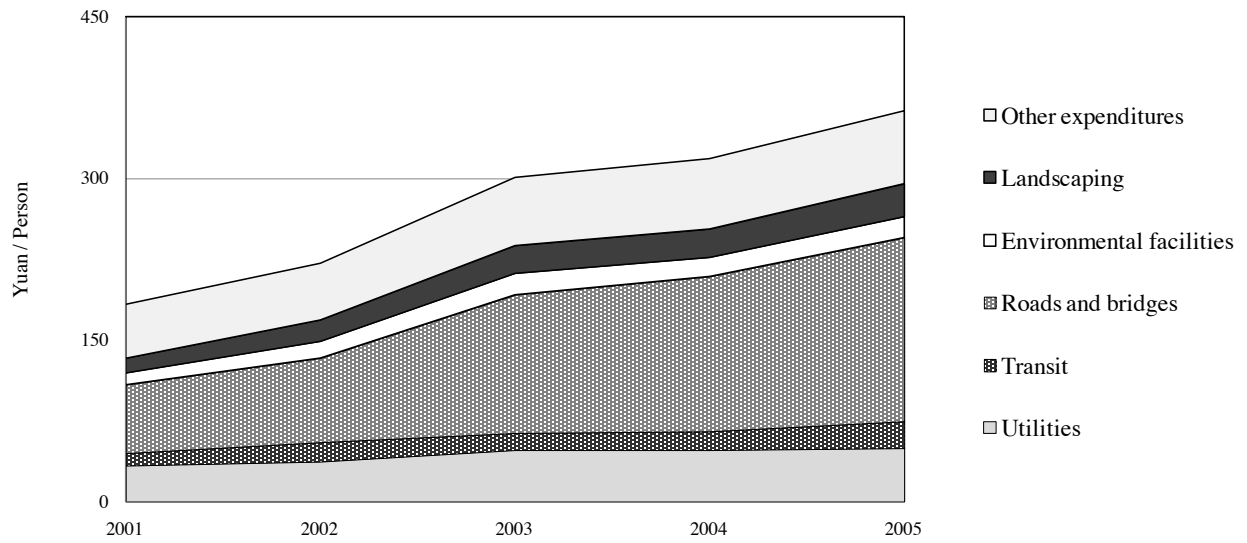


Figure 2: National Trends and Patterns of Urban Infrastructure Expenditure, 2001-2005

Table 4: Urban Maintenance and Construction Revenues, 1990-2007 (Billion RMB)

	1990	1993	1996	1999	2000	2001	2002	2003	2004	2005	2006	2007
Fiscal Revenues	22.0	27.6	32.3	57.3	62.5	105.0	129.8	171.3	237.1	215.2	278.3	387.2
Budgetary allocation	5.6	10.7	9.9	28.0	32.3	41.2	46.6	59.3	66.2	77.8	101.1	131.6
Central budgetary allocation	2.0	3.4	1.1	10.6	11.5	8.9	7.5	7.5	4.8	5.6	5.1	3.0
Local budgetary allocation	3.6	7.4	8.8	17.3	20.8	32.3	39.0	51.8	61.3	72.2	96.0	128.6
Local earmarked taxes	15.9	16.3	21.8	28.6	29.1	31.9	36.4	41.6	46.6	55.0	57.5	60.2
Maintenance and Construction Tax	11.8	12.2	16.1	22.2	23.7	27.0	31.4	36.2	41.1	50.0	50.6	53.1
Public Utility Surcharge	4.1	4.1	5.7	6.4	5.4	4.9	5.0	5.4	5.4	5.0	6.8	7.1
Fees and user charges	0.5	0.6	0.6	0.8	1.0	15.3	18.7	21.1	23.0	28.4	38.6	50.5
Water resource fee	0.5	0.6	0.6	0.8	1.0	1.1	1.2	1.6	1.9	2.3	2.2	2.4
Infrastructure connection fee	**	**	**	**	**	7.2	8.6	9.2	9.8	13.0	18.8	23.1
User charges ^b	**	**	**	**	**	7.0	8.9	10.3	11.3	13.2	17.6	25.1
Land transfer fee ^c	**	**	**	**	**	16.7	28.1	49.3	101.3	53.9	81.2	144.9
Market Financing	6.7	13.0	27.7	66.8	83.3	121.1	153.6	212.6	223.3	248.9	**	**
Domestic loans	1.6	5.5	9.8	37.8	41.5	73.9	86.9	129.5	133.2	151.5	**	**
Nationally issued bonds	**	**	**	**	**	12.7	6.6	3.6	3.2	13.9	**	**
Bank loans	**	**	**	**	**	61.2	80.3	126.0	130.0	137.6	**	**
Other bonds	**	**	**	**	**	0.7	0.3	1.5	0.1	3.1	**	**
Self-raised funds	4.7	5.7	12.2	24.0	33.3	40.8	59.7	74.9	82.9	85.8	**	**
Foreign capital	0.5	1.7	5.7	5.0	8.5	5.6	6.1	6.6	6.8	8.4	**	**
Stocks	**	**	**	**	**	0.1	0.7	0.0	0.3	0.1	**	**
Other sources^a	9.4	31.6	26.6	40.4	53.2	25.5	30.3	32.1	24.0	27.7	38.0	22.3
Total	38.1	72.2	86.6	164.5	198.9	251.7	313.7	415.9	484.4	491.8	316.4	409.5

Data sources: Wu (2008); China's Urban Construction Yearbook (2000-2008).

Note: ** for missing data.

All the data above has been adjusted by fixed assets index, 2000 constant price.

a. Other sources include infrastructure connection fee and land transfer fee before 2001. After 2001, other sources primarily include fees for temporary occupation of roads, roads destroying fee, and compensation fee for cutting down trees.

b. User charges include primarily toll on roads and bridges, water treatment fee, and garbage treatment fee.

c. Only data of year 2006 and 2007 is available for assets exchange revenue; therefore, it is combined with land transfer fee.

Table 5: Urban Maintenance and Construction Revenues, Per Capita, 1990-2007 (Yuan/Person)

	1990	1993	1996	1999	2000	2001	2002	2003	2004	2005	2006	2007
Fiscal Revenues	19.2	23.3	26.4	45.5	49.4	82.3	101.1	132.5	182.4	164.6	211.7	293.0
Budgetary allocation	4.9	9.1	8.1	22.2	25.5	32.3	36.3	45.9	50.9	59.5	76.9	99.6
Central budgetary allocation	1.7	2.8	0.9	8.4	9.1	7.0	5.9	5.8	3.7	4.3	3.9	2.3
Local budgetary allocation	3.1	6.2	7.2	13.8	16.4	25.3	30.4	40.1	47.2	55.2	73.1	97.3
Local earmarked taxes	13.9	13.7	17.8	22.7	23.0	25.0	28.3	32.2	35.8	42.1	43.7	45.5
Maintenance and Construction Tax	10.3	10.3	13.2	17.6	18.7	21.1	24.5	28.0	31.6	38.2	38.5	40.2
Public Utility Surcharge	3.6	3.5	4.6	5.1	4.3	3.8	3.9	4.2	4.2	3.8	5.2	5.4
Fees and user charges	0.4	0.5	0.5	0.6	0.8	12.0	14.6	16.3	17.7	21.7	29.3	38.3
Water resource fee	0.4	0.5	0.5	0.6	0.8	0.9	1.0	1.2	1.5	1.7	1.7	1.8
Infrastructure connection fee	**	**	**	**	**	5.6	6.7	7.1	7.6	9.9	14.3	17.5
User charges ^b	**	**	**	**	**	5.5	6.9	8.0	8.7	10.1	13.4	19.0
Land transfer fee ^c	**	**	**	**	**	13.1	21.9	38.1	77.9	41.2	61.8	109.7
Market Financing	5.9	10.9	22.6	53.1	65.8	94.9	119.6	164.5	171.8	190.3	**	**
Domestic loans	1.4	4.7	8.0	30.1	32.8	57.9	67.6	100.2	102.4	115.8	**	**
Nationally issued bonds	**	**	**	**	**	9.9	5.1	2.8	2.4	10.6	**	**
Bank loans	**	**	**	**	**	47.9	62.5	97.5	100.0	105.2	**	**
Other bonds	**	**	**	**	**	0.5	0.2	1.2	0.0	2.4	**	**
Self-raised funds	4.1	4.8	10.0	19.1	26.3	32.0	46.5	57.9	63.8	65.6	**	**
Foreign capital	0.4	1.4	4.7	4.0	6.7	4.4	4.7	5.1	5.3	6.4	**	**
Stocks	**	**	**	**	**	0.1	0.5	0.0	0.2	0.1	**	**
Other sources^a	8.3	26.7	21.8	32.1	42.0	20.0	23.6	24.8	18.5	21.2	28.9	16.9
Total	33.4	60.9	70.8	130.7	157.1	197.2	244.2	321.9	372.6	376.1	240.7	310.0

Data sources: Wu (2008); China's Urban Construction Yearbook (2000-2008).

Note: ** for missing data.

All the data above has been adjusted by fixed assets index, 2000 constant price.

a. Other sources include infrastructure connection fee and land transfer fee before 2001. After 2001, other sources primarily include fees for temporary occupation of roads, roads destroying fee, and compensation fee for cutting down trees.

b. User charges include primarily toll on roads and bridges, water treatment fee, and garbage treatment fee.

c. Only data of year 2006 and 2007 is available for assets exchange revenue; therefore, it is combined with land transfer fee.

Table 6: Urban Maintenance and Construction Revenue, Municipality, East, Central, and West, 2005

	Municipality			East			Central			West		
	Per Capita	% ^c	GR ^d	Per Capita	%	GR	Per Capita	%	GR	Per Capita	%	GR
Fiscal Revenue	547.9	34%	25%	291.6	50%	22%	82.7	39%	1%	96.4	37%	6%
Budgetary allocation	235.4	15%	48%	99.6	17%	24%	21.9	10%	-18%	52.7	20%	18%
Central budgetary allocation	30.9	2%	128%	2.5	0%	35%	2.5	1%	-13%	7.0	3%	-7%
Local budgetary allocation	204.5	13%	40%	97.1	17%	24%	19.4	9%	-19%	45.7	17%	24%
Local earmarked taxes	174.8	11%	44%	60.0	10%	31%	28.5	13%	9%	22.3	8%	5%
Maintenance and Construction Tax	173.3	11%	46%	52.6	9%	31%	25.2	12%	9%	20.3	8%	7%
Public Utility Surcharge	1.5	0%	-46%	7.4	1%	31%	3.3	2%	9%	2.0	1%	-10%
Fees and user charges	54.7	3%	-13%	39.4	7%	31%	11.8	6%	24%	11.0	4%	48%
Water resource fee	0.2	0%	398%	1.6	0%	4%	0.9	0%	84%	0.3	0%	-30%
Infrastructure connection fee	34.0	2%	12%	17.7	3%	29%	5.0	2%	38%	6.5	2%	89%
User charges ^b	20.5	1%	-37%	20.2	3%	37%	6.0	3%	10%	4.3	2%	18%
Land transfer fee	82.9	5%	-11%	92.6	16%	12%	20.5	10%	3%	10.4	4%	-42%
Market Financing	1029.4	64%	0%	255.9	44%	13%	113.5	53%	27%	154.5	58%	21%
Domestic loans	482.5	30%	-12%	164.9	28%	26%	68.4	32%	32%	106.5	40%	11%
Nationally issued bonds	171.7	11%	3903%	9.1	2%	200%	1.9	1%	-22%	2.0	1%	-15%
Bank loans	310.8	19%	-43%	155.8	27%	22%	66.6	31%	35%	104.5	40%	12%
Other bonds	59.4	4%		0.1	0.00%		0.1	0.05%		0.0	0%	
Self-raised funds	456.9	28%	1%	82.3	14%	-9%	39.4	18%	25%	43.8	17%	47%
Foreign capital	30.6	2%	-5%	8.6	1%	76%	5.3	2%	-14%	4.1	2%	76%
Stocks	0.0	0%		0.0	0%		0.2	0.09%		0.1	0.04%	
Other sources^a	37.3	2%	-37%	35.5	6%	28%	18.4	9%	26%	13.3	5%	15%
Total	1614.6	100%	6%	583.0	100%	18%	214.6	100%	15%	264.2	100%	15%

Data source: China's Urban Construction Yearbook, (2006).

a. Other sources primarily include fees for temporary occupation of roads, roads destroying fee, compensation fee for cutting down trees.

b. User charges include primarily toll on roads and bridges, water treatment fee, and garbage treatment fee.

c. The proportion of each item in total revenue.

d. Growth rate.

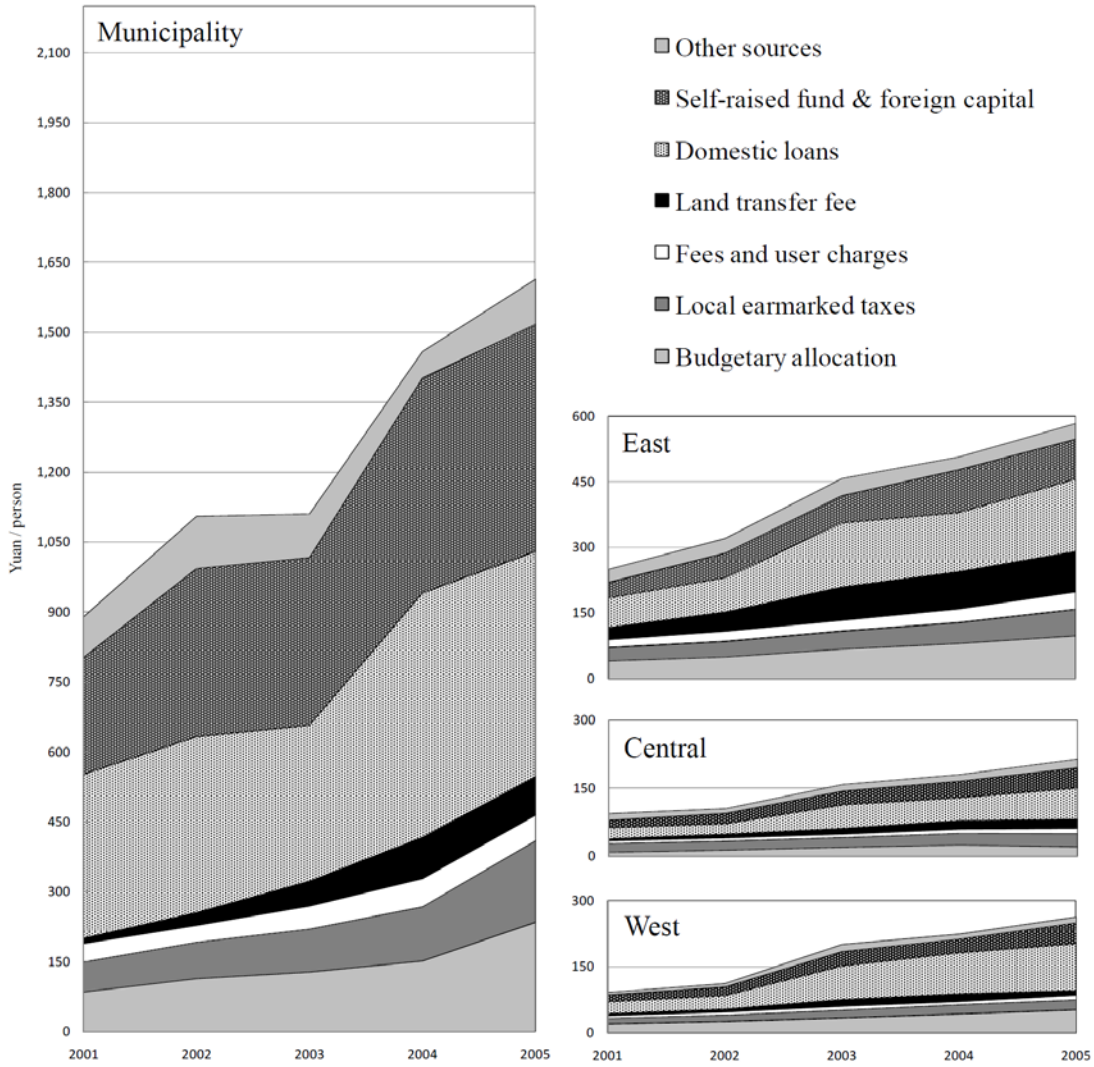


Figure 3: Regional Trends and Patterns of Urban Maintenance and Construction Revenues, 2001-2005

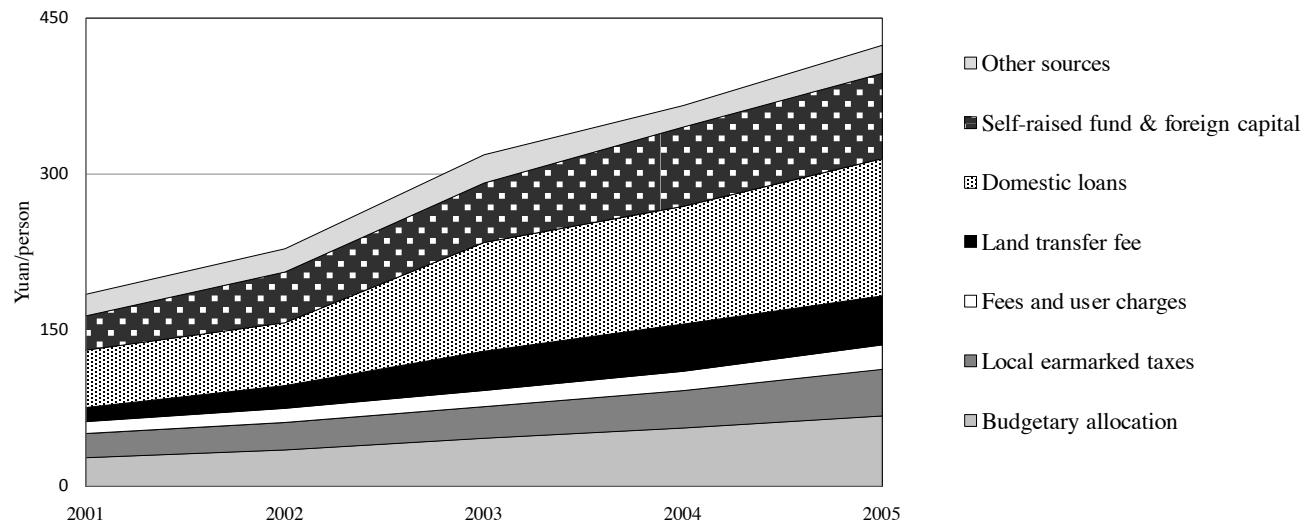


Figure 4: National Trends and Patterns of Urban Maintenance and Construction Revenues, 2001-2005

Table 7: The Impact of Different Revenue Items on Utility Expenditure
Dependent Variable: log(Per Capita Utility Expenditure)

	National	Non-municipality	East	Central	West
Year 2002	- 0.006	0.007	- 0.163	- 0.165	0.010
Year 2003	- 0.011	0.009	- 0.062	0.019	- 0.077
Year 2004	- 0.075	- 0.052	- 0.243	- 0.162	- 0.171
Year 2005	- 0.199*	- 0.187	- 0.308	- 0.113	- 0.262
Central budgetary allocation	0.088***	0.119***	- 0.072	0.154	0.148
Local budgetary allocation	0.156***	0.112**	- 0.042	0.198	- 0.143
Local earmarked taxes	0.084	0.098	0.095	- 0.027	0.139
Fees and user charges	0.169***	0.219***	0.202*	0.519***	0.031
Land transfer fee	- 0.035	0.005	0.224*	- 0.134	0.162*
Domestic loans	0.086	0.097*	- 0.061	- 0.136	0.252*
Self-raised fund	0.238***	0.201***	0.286***	0.263*	0.257**
Foreign capital	0.076**	0.116***	0.096	0.084	0.149***
Constant	1.227***	1.089***	1.624*	1.573*	1.018
Observations	128	114	38	38	38
R-squared	0.817	0.787	0.791	0.723	0.867

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: The Impact of Different Revenue Items on Transit Expenditure
Dependent Variable: log(Per Capita Transit Expenditure)

	National	Non-municipality	East	Central	West
Year 2002	0.197	0.460*	0.016	0.407	0.874**
Year 2003	- 0.154	0.091	0.473	- 0.221	0.602
Year 2004	- 0.142	0.157	0.591	- 0.241	0.859
Year 2005	- 0.218	- 0.027	0.400	- 0.277	0.525
Central budgetary allocation	- 0.010	- 0.064	- 0.047	0.285	0.217
Local budgetary allocation	- 0.254*	- 0.048	- 0.294	- 0.103	0.275
Local earmarked taxes	0.159	0.047	0.709	- 0.735	- 0.598*
Fees and user charges	0.541***	0.546***	1.009***	0.891**	0.356*
Land transfer fee	0.087	- 0.085	0.111	- 0.171	0.022
Domestic loans	0.234	0.120	- 0.458	0.398	- 0.216
Self-raised fund	0.337***	0.270**	- 0.221	0.317	0.216
Foreign capital	0.279***	0.183**	0.090	0.173	0.103
Constant	- 1.751***	- 1.095*	- 0.168	- 0.187	0.299
Observations	128	114	38	38	38
R-squared	0.639	0.528	0.484	0.545	0.699

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: The Impact of Different Revenue Items on Roads and Bridges Expenditure
Dependent Variable: log(Per Capita Roads and Bridges Expenditure)

	National	Non-municipality	East	Central	West
Year 2002	0.080	0.050	0.145	- 0.181	0.151
Year 2003	0.024	- 0.001	0.117	- 0.439	- 0.013
Year 2004	0.199**	0.084	0.131	- 0.357	0.031
Year 2005	0.208**	0.085	0.050	- 0.381	0.078
Central budgetary allocation	0.013	- 0.016	- 0.062	0.049	0.026
Local budgetary allocation	0.082*	0.047	0.238***	0.028	0.094
Local earmarked taxes	- 0.038	- 0.031	0.223	- 0.153	0.039
Fees and user charges	0.044	0.001	- 0.030	- 0.021	0.067
Land transfer fee	0.059**	0.090**	- 0.103	0.228***	0.020
Domestic loans	0.596***	0.601***	0.770***	0.599***	0.694***
Self-raised fund	0.076*	0.146***	0.019	0.246**	0.148**
Foreign capital	- 0.002	0.022	- 0.009	0.102	- 0.062*
Constant	1.257***	1.156***	0.020	1.300*	0.401
Observations	128	114	38	38	38
R-squared	0.892	0.890	0.971	0.815	0.950

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: The Impact of Different Revenue Items on Environmental Facility Expenditure
Dependent Variable: log(Per Capita Environmental Facility Expenditure)

	National	Non-municipality	East	Central	West
Year 2002	0.079	0.021	- 0.140	0.183	0.375
Year 2003	- 0.072	- 0.148	0.034	0.066	0.555
Year 2004	- 0.214	- 0.273	- 0.356	0.121	0.834*
Year 2005	- 0.254	- 0.256	- 0.342	0.378	0.683
Central budgetary allocation	0.018	0.001	- 0.235**	0.202*	0.033
Local budgetary allocation	0.267***	0.263***	0.042	0.080	0.478**
Local earmarked taxes	- 0.057	- 0.111	0.323	0.465	- 0.898***
Fees and user charges	0.141*	0.088	0.116	- 0.199	0.089
Land transfer fee	0.025	0.083	0.334**	- 0.214**	0.284*
Domestic loans	0.252***	0.217**	- 0.031	0.268*	- 0.435*
Self-raised fund	0.217***	0.255***	0.052	0.052	0.337*
Foreign capital	- 0.024	- 0.040	0.080	0.098	- 0.129
Constant	- 0.211	0.023	0.208	- 0.144	2.972**
Observations	127	114	38	38	38
R-squared	0.721	0.629	0.799	0.674	0.769

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11: The Impact of Different Revenue Items on Landscaping Expenditure
Dependent Variable: log(Per Capita Landscaping Expenditure)

	National	Non-municipality	East	Central	West
Year 2002	- 0.013	- 0.045	- 0.050	- 0.261	- 0.091
Year 2003	0.004	- 0.019	- 0.113	- 0.029	0.022
Year 2004	- 0.169	- 0.190	- 0.466**	- 0.300	- 0.013
Year 2005	- 0.171	- 0.160	- 0.553***	- 0.264	0.011
Central budgetary allocation	0.004	- 0.016	- 0.025	- 0.091	0.037
Local budgetary allocation	0.326***	0.270***	- 0.133	0.171	0.474***
Local earmarked taxes	0.075	0.162*	0.665**	- 0.473*	0.160
Fees and user charges	0.102*	0.047	0.053	0.389**	0.133
Land transfer fee	0.074**	0.137***	0.216**	0.178**	0.089
Domestic loans	0.101*	0.105	0.092	- 0.107	0.170
Self-raised fund	0.302***	0.326***	0.624***	0.645***	0.039
Foreign capital	0.045	0.069*	0.168***	- 0.015	0.101
Constant	- 0.447**	- 0.667**	- 2.313***	0.741	- 0.954
Observations	128	114	38	38	38
R-squared	0.872	0.858	0.938	0.781	0.870

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12: Elasticity Between Revenue and Expenditure Items, 2001-2005

	Utilities					Transit				
	National	Municipality	East	Central	West	National	Municipality	East	Central	West
Central Allocaion	0.101	-0.187	0.094	0.244**	0.345**	-0.176	-0.717	-0.224	0.313	0.105
Local budgetary allocation	0.474**	0.552**	0.454**	0.311**	0.305**	0.625**	1.065	0.418**	0.105	0.275**
Local earmarked taxes	0.859**	0.768**	0.923**	0.738**	0.721**	1.349**	2.271**	1.038**	0.697**	0.366
Fees and user charges	0.602**	0.294	0.497**	0.543**	0.630**	1.060**	2.294**	0.895**	0.611**	0.616**
Land transfer fee	0.267**	0.035	0.351**	0.078	0.442**	0.504**	0.779**	0.274	-0.024	0.295**
Domestic loans	0.564**	0.531**	0.348**	0.307**	0.666**	0.776**	1.331**	0.335**	0.603**	0.480**
Self-raised funds	0.509**	0.388**	0.460**	0.460**	0.471**	0.758**	0.941**	0.281	0.684**	0.431**
Foreign capital	0.376**	0.282	0.186**	0.230**	0.326**	0.669**	1.416**	0.310	0.287**	0.279**
	Roads and bridges					Landscaping				
	National	Municipality	East	Central	West	National	Municipality	East	Central	West
Central Allocaion	0.042	-0.189	-0.027	0.194	0.274**	0.004	-0.232	0.329**	-0.015	0.289**
Local budgetary allocation	0.536**	0.559**	0.670**	0.218	0.356**	0.727**	0.821**	0.731**	0.413**	0.577**
Local earmarked taxes	0.875**	0.720**	1.468**	0.343	0.487**	1.137**	1.184**	1.525**	0.474**	0.887**
Fees and user charges	0.610**	0.564**	0.686**	0.271	0.413**	0.761**	0.735**	0.662**	0.421**	0.580**
Land transfer fee	0.355**	0.085	0.551**	0.218**	0.480**	0.447**	0.138	0.585**	0.257**	0.525**
Domestic loans	0.752**	0.706**	0.656**	0.644**	0.848**	0.739**	0.783**	0.542**	0.376**	0.806**
Self-raised funds	0.527**	0.267**	0.572**	0.504**	0.484**	0.687**	0.566**	0.828**	0.592**	0.538**
Foreign capital	0.331**	0.359**	0.058	0.253**	0.137	0.457**	0.544**	0.250	0.166**	0.325**

Table 13: Priorities of Expenditure, from the Perspective of Urban Maintenance and Construction Revenues

	Actual Growth Rate	Revenue Sources	Coefficient	The Growth Rate of Revenue Items	Estimated Growth Rate*
Roads and bridges	29%	Domestic loans	0.596	20%	15%
		Land transfer fee	0.059	50%	
Transit	24%	Fees and user charges	0.541	16%	19%
		Self-raised fund	0.337	21%	
		Foreign capital	0.279	10%	
Landscaping	23%	Local budgetary allocation	0.326	22%	17%
		Self-raised fund	0.302	21%	
		Land transfer fee	0.074	50%	
Environmental facility	17%	Local budgetary allocation	0.267	22%	13%
		Self-raised fund	0.217	21%	
		Domestic loans	0.252	10%	
Utilities	11%	Local budgetary allocation	0.156	22%	11%
		Fees and user charges	0.169	16%	
		Self-raised fund	0.238	21%	
		Central budgetary allocation	0.088	-9%	
		Foreign capital	0.076	10%	

*Estimated Growth Rate = $coefficient_1 \times growth\ rate\ of\ revenue_1 + \dots + coefficient_K \times growth\ rate\ of\ revenue_K$
 K is the number of significant revenue sources.

Table 14: Coefficient of Variation of Urban Infrastructure Expenditure, 2001-2005

Year	Total	Utilities	Transit	Roads and Bridges	Environmental Facilities	Landscaping
2001	2.05	1.07	4.04	1.15	1.13	1.72
2002	2.05	1.21	4.41	1.01	1.75	2.09
2003	1.32	0.88	4.22	1.11	1.34	1.43
2004	1.31	0.81	3.39	1.14	0.98	0.99
2005	1.15	0.93	2.93	1.00	0.86	0.92

Table 15: Coefficient of Variation of Urban Infrastructure Revenues, 2001-2005

Year	Total	Budgetary Allocation	Local Earmarked Taxes	Fees and User Charges	Land Transfer Fee	Domestic Loans	Self-raised Fund & Foreign Capital
2001	1.86	1.21	1.04	1.48	1.63	2.54	2.62
2002	1.92	1.13	1.06	1.35	1.95	2.49	2.73
2003	1.21	1.04	1.03	1.16	1.77	1.32	2.53
2004	1.26	0.92	1.06	1.00	1.34	1.47	2.33
2005	1.13	1.08	1.03	0.83	1.32	1.23	2.16

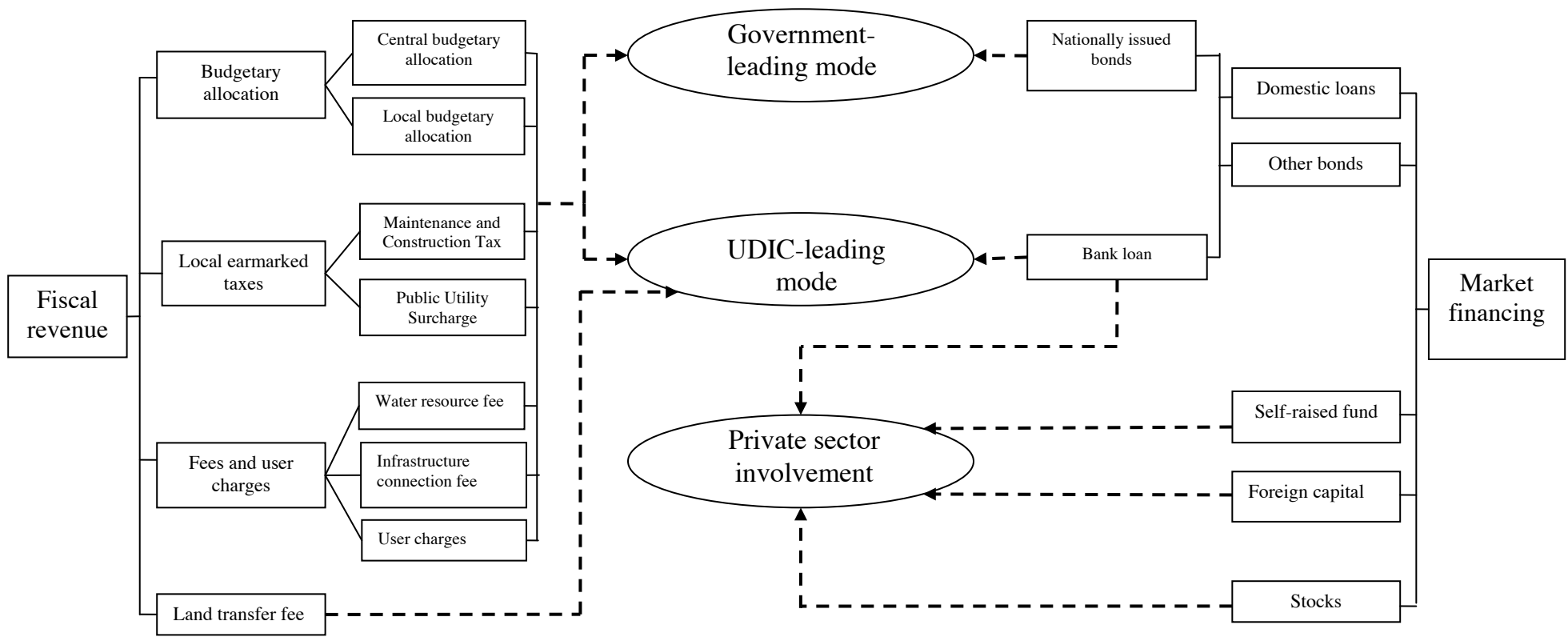


Figure 5: Urban Infrastructure Funding Mechanism

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