A Model-Based Estimate of China's Effective Tax Rates

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Abstract

This paper develops a general equilibrium model to estimate China's effective tax rates on consumption, labor, and capital from 2001 to 2017. Unlike previous studies that apply top-down approaches based on simplified tax classifications, this paper adopts a bottom-up strategy that explicitly models China's complex tax system, incorporating 25 distinct tax instruments. By tracing tax incidence through the economy and reclassifying tax revenues according to their actual economic burden, the model provides internally consistent and theoretically grounded estimates of effective tax rates. The results reveal that China's tax burden follows a clear hierarchy—capital taxes are highest, followed by consumption taxes, and then labor taxes. The analysis also highlights significant shortcomings in earlier studies, including the exclusion of key tax categories (such as tariffs) and the arbitrary reallocation of production taxes. By correcting these misclassifications and aligning tax revenues with their appropriate economic bases, this study offers a more accurate and comprehensive picture of China's fiscal landscape and contributes to international tax burden comparisons.

Keywords: *effective tax rates; national account; tax burden*

1 Introduction

Effective tax rates measure the proportions of a country's consumption, labor income, and capital income that are subject to taxation. Because they capture the actual tax burden at the national level—rather than merely reflecting statutory rates—effective tax rates are widely used by researchers to compare household tax burdens across countries. Among the various methods for calculating effective tax rates, the approach proposed by Mendoza, Razin, and Tesar (1994) is the most popular, valued for its clarity and simplicity. However, applying this method to China is challenging. In contrast to the U.S. and other OECD countries, where direct taxes play a prominent role and the link between tax revenues and underlying tax bases is relatively straightforward, China's tax system is dominated by indirect taxes levied on goods and services. Because the burden of indirect taxes can be shifted between producers and consumers, it becomes difficult to accurately trace tax revenues back to specific tax bases. As a result, to estimate China's effective tax rates, economists must develop a method to allocate indirect taxes appropriately and categorize them according to their respective tax bases.

In this paper, I propose a general equilibrium framework that aligns China's nine composite tax categories with its 25 statutory levies (see Table 2). Rather than beginning with three assumed effective rates and allocating revenues "top-down" as in Mendoza et al.

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(1994), the model explicitly represents each tax instrument observed in China, traces tax payments through households and firms, and then groups revenues according to their ultimate economic incidence. By embedding the classification within the model structure, this approach offers a transparent procedure for mapping revenues to consumption, labor, and capital bases, and helps reduce inconsistencies in existing estimates of effective tax rates.

The results indicate that some earlier studies may misallocate certain revenue items, introducing bias into their rate calculations. For example, tariffs are often omitted or treated separately, whereas here they are incorporated as a form of consumption tax because of their impact on import prices. Likewise, net production taxes have sometimes been split between consumption and capital without a clear criterion. I show that applying a model-consistent grouping of these taxes leads to more nuanced estimates of the burden on each factor and highlights where misclassification in prior work may have distorted conclusions. Even if subsequent researchers disagree with some aspects of this taxonomy, they can build on this framework—refining the underlying model structure or re-estimating key parameters—to derive more precise measures of China's effective tax rates. Together, these contributions lay a foundation for future extensions and help set the stage for a more coherent literature on tax incidence measurement.

Related Literature

This paper contributes to the literature on the estimation of national effective tax rates. Mendoza, Razin, and Tesar (1994) first proposed a simple and intuitive method for calculating national effective tax rates and comparing tax burdens across countries. This approach was later refined by Carey and Tchilinguirian (2000), who revised the definitions of tax revenue components and tax bases. Most studies on China's effective tax rates have relied on these two methods. For example, B. Lyu and Zhigang Chen (2015) applied Carey and Tchilinguirian (2000)'s method to estimate China's effective tax rates; however, they did not provide a theoretical model to justify their classification of tax revenues. More recent contributions include Liang and H. Lyu (2022), who adopted China's flow of funds table as a data source but lacked a theoretical framework to guide the allocation of net production taxes between consumption and capital. In contrast, this paper builds on previous work by providing a theoretical foundation for the allocation of tax revenues, thereby improving the accuracy and consistency of effective tax rate estimates for China.

This paper is also related to the literature that examines China's tax structure and tax reforms. For example, Zhao Chen, He, et al. (2021) provides a comprehensive analysis of China's tax revenues and their composition. Cai and Harrison (2021) investigates the economic consequences of a pioneering provincial tax reform that reduced the value-added tax (VAT) on fixed asset investment. They find that the reform did not significantly increase fixed investment but instead led to greater capital intensity in production and a sharp decline in employment. In contrast, Liu and Mao (2019) shows that the subsequent national-level VAT reform increased both investment and productivity among affected

firms. Building on this line of research, Zhao Chen, Jiang, et al. (2023) developed a dynamic firm-investment model to further analyze the effects of the national VAT reform, illustrating its effectiveness in stimulating firm investment. This paper benefits from these prior studies by incorporating their insights into its analysis and modeling framework.

The remainder of the paper is organized as follows. Section 2 provides background information and presents descriptive statistics on China's tax system. Section 3 develops a theoretical model that incorporates all major taxes in China. Section 4 describes the data used for effective tax estimation. Section 5 introduces the methodology used to compute China's effective tax rates and presents the corresponding results. Section 6 compares the model-based effective tax rate estimates to the estimates reported by B. Lyu and Zhigang Chen (2015) and Liang and H. Lyu (2022). Section 7 concludes.

2 Background

This section provides an overview of the institutional background of China's tax system and examines the composition of its tax categories during the period 2001–2017. Compared to the United States and other OECD countries, China maintains a relatively low overall tax burden. Moreover, taxes on goods and services—particularly the value-added tax (VAT) and the now-repealed business tax—have consistently dominated China's tax revenue, accounting for over 60% of total revenue in 2011. This reliance on indirect taxation is unusually high relative to other middle- and high-income countries (Zhao Chen, He, et al. (2021)). Finally, between 2001 and 2017, China implemented several major tax reforms that altered tax rates, redefined tax bases, and in some cases introduced or eliminated entire tax categories.

2.1 Overview of China's Current Tax System

China operates a dual tax system consisting of national taxes and local taxes, each administered by separate tax authorities. National taxes are collected by the State Taxation Administration, which is directly supervised by the central government, while local taxes are collected by the Local Taxation Administration, under the oversight of local governments. Some taxes are shared between the central and local governments, with revenue-sharing ratios subject to occasional adjustments.

For example, following the 1994 tax-sharing reform, the VAT was designated as a national tax and has since been collected by the State Taxation Administration. However, VAT revenue on domestic goods and services was split between the central and local governments at a 75:25 ratio prior to 2016. In response to the Business Tax Reform, this ratio was revised to 50:50 in 2016.

In addition to revenue-sharing arrangements, tax rates themselves have evolved over time. Before 2008, foreign enterprises in China benefited from preferential corporate income tax (CIT) rates of either 15% or 24%, while domestic firms faced a higher rate of 33%.

In 2008, the CIT system was unified, setting a standard rate of 25% for both domestic and foreign enterprises.

2.2 Tax Categories During 2001–2017

Between 2001 and 2017, a total of 25 different taxes were administered by China's tax authorities. However, only 16 of these were levied consistently throughout the entire sample period. These include: the value-added tax (VAT), excise tax, business tax (BT), corporate income tax (CIT), personal income tax (PIT), tariffs, resource tax, city maintenance and construction tax, real estate tax, stamp tax, urban land use tax, land appreciation tax, vehicle and vessel tax, vehicle purchase tax, farmland occupation tax, and deed tax.

The remaining taxes were either introduced, suspended, or merged during the period. Prior to 2008, corporate income tax for domestic enterprises was labeled as CIT, while foreign enterprises were subject to a separate income tax for foreign-invested and foreign enterprises. These two taxes were unified in 2008, with all enterprises subject to a single CIT rate. The fixed asset investment orientation adjustment tax was officially suspended in 2012, though local tax authorities continued to collect it until 2016. The slaughter tax was suspended in 2006, while the banquet tax was officially repealed in 2008, having already generated zero revenue since 2006 due to minimal collections and its negative impact on the catering sector. The agriculture tax, agricultural specialty products tax, and animal husbandry tax were suspended in 2006 and were effectively replaced by the tobacco leaf tax.

A summary of each tax's name, tax base, and a brief description is provided in Table 5 in Appendix A. For simplicity and focus, this section discusses only the three taxes that have historically contributed the most to total tax revenue in China: the VAT, the CIT, and the business tax. These three taxes also went through significant reforms during the sample period, which altered their tax bases, rates, and in some cases, their very structure——changes that have important implications for measuring effective tax rates.

Among all tax categories in China, the value-added tax (VAT) has consistently generated the largest share of total tax revenue. In 2017, for instance, VAT alone accounted for approximately 44.98% of total tax collections (excluding social insurance contributions). Levied on the production and sale of goods and services, VAT initially had a broader base than typical consumption taxes. Prior to 2004, firms were not permitted to deduct fixed asset investments——such as equipment and tool purchases or expenditures on construction and installation projects——from their VAT liabilities. As a result, the VAT base effectively included both final consumption and fixed asset investment. This changed in 2004, when the Chinese government launched a pilot reform in northeastern China, allowing firms in selected industries to deduct equipment and tool purchases from their output VAT. The reform was expanded nationwide in 2009, enabling all firms to deduct input VAT on such purchases. This marked a fundamental shift in the VAT base——from a production-type to a consumption-type structure——bringing it more in line with international standards (Zhao Chen, Jiang, et al., 2023; Liu and Mao, 2019). This institutional change has impor-

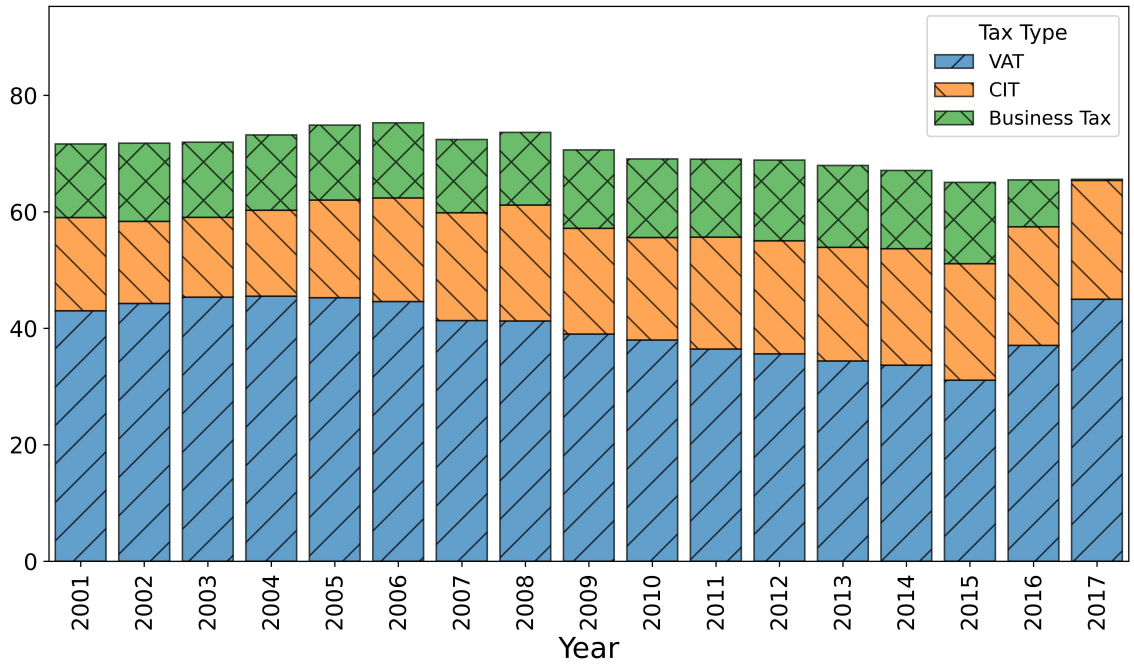

Figure 1: Tax Share (% of Total Tax Revenue)

Note: "Total tax revenue" in this figure does not include social insurance contribution, and should not be confused with Figure 2.

tant implications for measuring the effective tax rate on capital.

Corporate income tax (CIT) is the second-largest source of tax revenue in China. In 2017, CIT accounted for approximately 20.37% of total tax revenue (excluding social insurance contributions). It is levied on the production and operational income, as well as other forms of income, generated by enterprises and business units operating in China. Prior to 2008, domestic and foreign enterprises were subject to different CIT regimes: domestic firms paid what was officially termed the "corporate income tax," while foreign-invested and foreign enterprises were subject to a separate "income tax for foreign-invested and foreign enterprises," often at preferential rates of 15% or 24%. In 2008, these parallel systems were unified under a single corporate income tax law, setting a standard rate of 25% for all enterprises. Foreign firms that had previously benefited from the 15% preferential rate were granted a transitional period during which the CIT rate was gradually increased over four years, reaching the unified 25% rate by 2012 (Zhao Chen, Jiang, et al., 2023).

The third-largest source of tax revenue in China was the business tax. I use the past tense because the business tax was officially abolished in 2018. The phase-out began in 2011, when the Chinese government launched a pilot program aimed at replacing the business tax with the value-added tax (VAT). This reform was gradually expanded and fully implemented by 2017, after which all business tax revenue streams were incorporated into the VAT system. Despite its eventual elimination, the business tax was once a significant component of China's tax revenue. For example, in 2012, it accounted for approximately 13.87% of total tax revenue (excluding social insurance contributions). The tax was levied

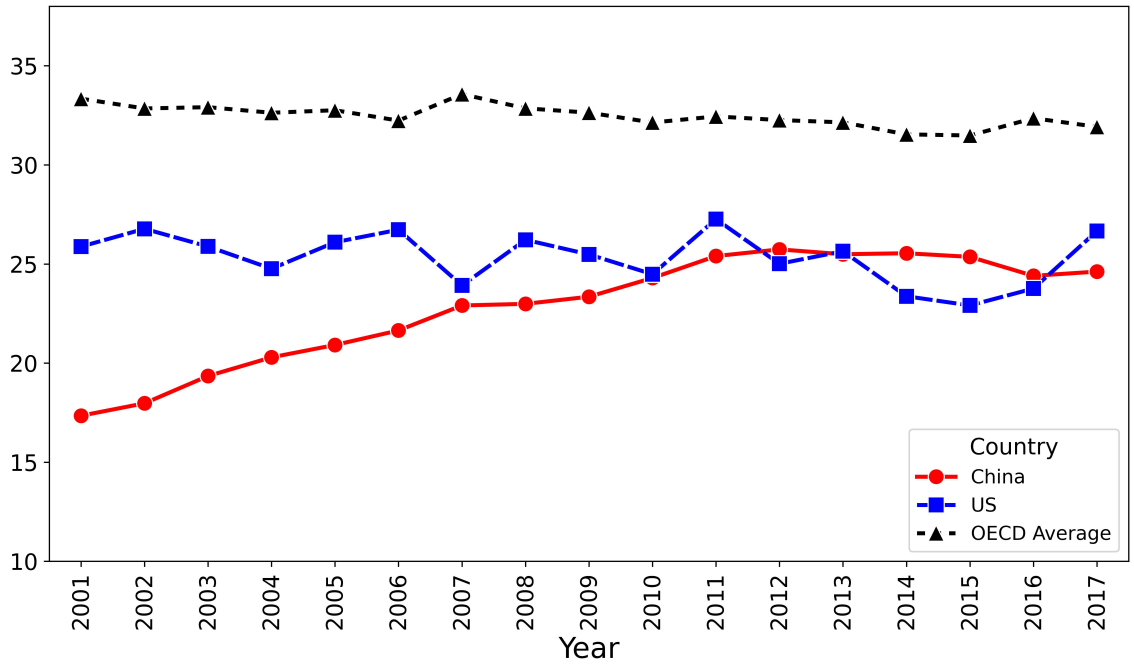

Figure 2: Tax Revenue (% GDP)

Note: This figure compares the tax to GDP ratios of China, the United States, and the OECD average from 2001 to 2017. China's gross tax revenue is defined as the sum of total tax revenue and social insurance contributions. Data on China's tax revenue, social insurance contributions, and GDP are sourced from the China Taxation Yearbook and the China Statistical Yearbook. Tax to GDP ratios for the United States and the OECD average are obtained from the OECD database.

on sales revenue generated from the provision of taxable services, the transfer of intangible assets, and the sale of real estate.

Figure 1 shows the evolution of the shares of VAT, CIT, and business tax in China's total tax revenue from 2001 to 2017. VAT consistently accounted for the largest portion, followed by CIT and business tax. Together, these three taxes contributed more than 60% of the country's total tax revenue over the period.

2.3 China's Overall Tax Burden and Tax Structure

China's overall tax burden differs markedly from that of developed countries. Figure 2 displays the overall tax revenues (including social insurance contributions) of China, the United States, and the Organization for Cooperation and Development (OECD) average as a share of GDP during the sample period from 2001 to 2017. During this time, China's average tax-to-GDP ratio was approximately 22.80%, slightly smaller than that of the United States (25.34%), and significantly smaller the OECD average (32.47%). This comparison suggests that during the sampled periods, China maintained a lighter overall tax burden relative to the size of its economy than most advanced economies.

The OECD classifies tax revenues into six broad categories: (i) taxes on income, profits, and capital gains of individuals and corporations; (ii) social security contributions (SSC); (iii) taxes on payroll and workforce; (iv) taxes on property; (v) taxes on goods and services;

and (vi) other taxes. Since China is not an OECD member, its tax revenues are not officially categorized under this framework, making direct comparisons of tax structures between China, the United States, and the OECD average challenging. To facilitate such a comparison, I use 2017 as the reference year and reclassify China's tax revenue statistics based on their tax bases and methods of collection, aligning them as closely as possible with the OECD taxonomy. The results are summarized in Table 1.

Table 1 reveals three notable features of China's tax structure. First, taxes on goods and services dominate, accounting for approximately 45.8% of total tax revenue in 2017. In contrast, this category represents only 16.1% in the United States and 33.2% in the OECD average. Second, taxes on income, profits, and capital gains play a smaller role in China than in the United States or the OECD average. These taxes constitute about 21.6% of China's tax revenue, compared to 44.8% in the United States and 33.6% in the OECD average. Finally, the property taxes by Chinese government is moderate: the taxes on property to GDP ratio is 7.9%, while this number is 15.8% in the United States and 5.7% in the OECD average.

Table 1: Tax Structures: United States, OECD Average, China (2017)

Tax category	United States	OECD Average	China	Tax basket
Taxes on income, profits and capital gains of individuals and corporations	44.8	33.6	21.6	CIT, PIT
Social security contributions (SSC)	23.2	25.7	22.5	Social insurance contribution
Taxes on payroll and workforce	0.0	1.3	0.0	-
Taxes on property	15.8	5.7	7.9	Property tax, Stamp tax, Land appreciation tax, Farmland occupation tax, Deed tax
Taxes on goods and services	16.1	33.2	45.8	VAT, Excise tax, Business tax, Tariff, Resource tax, Fixed asset investment orientation adjustment tax, Urban land use tax, Vehicle and vessel tax, Vehicle purchase tax, Tobacco tax
Other taxes	0.0	0.5	2.1	City maintenance and construction tax, Other taxes

In the next section, I present a model that incorporates all the tax categories during 2001-2017, which provides a theoretical foundation for the estimation of effective tax rates in China.

3 Model

In this section, I develop a model that incorporates all 25 taxes levied in China between 2001 and 2017. These taxes are grouped into nine categories and systematically integrated into the firm's profit function, the household's budget constraint, and the government's budget. I then compute the revenues for the effective consumption tax, effective labor tax, and effective capital tax by aggregating relevant components from the nine categories, based on their roles in the model. The tax base for each effective tax is derived directly from the economy's resource constraint. Effective tax rates are calculated as the ratio of total tax revenues to their respective tax bases.

This approach is conceptually similar to that of Mendoza, Razin, and Tesar (1994), in that effective tax rates are defined as the ratio of total tax revenues to total tax bases. However, it differs from Mendoza's framework by adopting a bottom-up methodology. Rather than beginning with three broad tax categories—consumption, labor, and capital—and filling them with empirical data in an ad hoc fashion, my model is constructed from the outset to align with nine disaggregated tax categories. This design ensures closer correspondence between the model and the actual structure of China's tax system, thereby improving the precision of effective tax rate calculations and enhancing the model's empirical relevance.

The remainder of this section is organized as follows. I first present the structure of the economy, where the government imposes nine types of taxes on firms and households. I then describe the composition of these nine tax categories, each encompassing at least one of the taxes levied in China during the study period.

Firm

There is a representative firm that produces domestic consumption goods with two inputs: capital K and labor L. The production function exhibits decreasing return to scale, as a result the firm makes positive profit. Each period, the firm maximizes its discounted flow of profits by making decisions on its investment I and employment L; the end-of-period profit is passed to a representative household—who owns the representative firm—as dividends. The firm's problem can be written in a recursive form:

$$V(K,D) = \max_{I,L} \pi(K,I,L) + \beta V(K',D')$$

$$\text{s.t.} \quad \pi(K,I,L) = (1-\tau_f)\Big[\big[1-(1+\tau_u)\tau_b\big]Y - wL\Big] - \Big[1+(1+\tau_u)\nu+\kappa\Big]I + \tau_f\hat{\delta}\Big[D+(1+\nu)I\Big]$$

$$Y = K^{\alpha}L^{\theta},\ \alpha+\theta<1$$

$$K' = (1-\delta)K + I$$

$$D' = (1-\hat{\delta})\Big[D+(1+\nu)I\Big]$$

where $\pi(K,I,L)$ is the firm's after tax, D the depreciation allowance of the firm, w the wage rate, $\hat{\delta}$ the accounting depreciation schedule of capital, δ the physical depreciation rate of capital, τ_f the CIT rate, τ_b the business tax rate, τ_u the city maintenance and construction

tax rate, ν the VAT rate. κ denotes a list of taxes: resource tax, fixed asset investment orientation adjustment tax, property tax, stamp tax, urban land use tax, land appreciation tax, vehicle and vessel tax, farmland occupation tax, and deed tax.

Note that when paying the CIT, the firm receives tax reductions based on a fraction of the sum of two components: (i) the depreciation allowance D carried over from the beginning of the period, and (ii) the VAT-inclusive cost of investment, expressed as $(1+\nu)I$, where ν is the VAT rate and I is the investment amount. Prior to the 2009 VAT reform, firms could not deduct VAT from equipment purchases, which is reflected in the use of $(1+\nu)I$ as the relevant investment cost. However, after the reform, firms were allowed to deduct VAT on equipment purchases, effectively reducing the investment cost considered for CIT reduction to I. This change introduces a trade-off: while the reform lowers the firm's upfront investment cost, it also reduces the base on which CIT reductions are calculated.

Two points require clarification: the role of the urban maintenance and construction tax, and the composition of the tax category κ. According to general regulations, the tax base for the urban maintenance and construction tax is the actual amount of VAT and excise tax paid. Therefore, when a firm pays VAT on its investment, it must also pay an additional amount of urban maintenance and construction tax. The category κ includes the fixed asset investment orientation adjustment tax, since fixed asset investment is inherently part of total investment. It also includes the resource tax, urban land use tax, vehicle and vessel tax, and farmland occupation tax, as these taxes are levied on fixed assets, mineral resources, salt, land, and means of transportation that serve as production inputs for final goods and services. Hence, they are treated as taxes on investment. Additionally, the property tax, stamp tax, land appreciation tax, and deed tax are considered part of κ, as they apply to the investment or transaction of properties, land, and financial assets more broadly.

Finally, Winberry (2021) and Zhao Chen, Jiang, et al. (2023) show that, the firm's value function can be rewritten, so that the aggregate capital stock K becomes the only state variable, and the impact of depreciation allowance D on firm profit is summarized by a discounted present value of depreciation deductions z:

$$v(K) = \tilde{\pi}(K, I, L) + \beta v(K')$$

$$\tilde{\pi}(K, I, L) = (1-\tau_f)\Big[\big[1-(1+\tau_u)\tau_b\big]Y - wL\Big] - \Big[1+(1+\tau_u)\nu+\kappa\Big]I + \tau_f z(1+\nu)I$$

where $z = \hat{\delta} + \beta(1-\hat{\delta})z$. For details of the derivation of $v(K)$ see Appendix B.

Household

The household consumes a basket of goods comprising ordinary domestic goods C_H, special domestic goods C_H^e, ordinary foreign goods C_F, and special foreign goods C_F^e. Special goods refer to consumption items subject to taxes other than VAT, such as the excise tax, slaughter tax, and similar levies. Ordinary domestic goods serve as the numeraire in the economy, with their price normalized to 1. The prices of the other goods are denoted by

P_H^e, P_F, and P_F^e, respectively. Special domestic goods are produced by a representative firm using a one-to-one production function with ordinary domestic goods as inputs. Both types of foreign goods—ordinary and special—are imported from abroad.

Each period, the household maximizes the sum of its discounted utilities by choosing its consumption bundle. Consumption expenditures are financed by after-tax labor income and capital income:

$$\max_{C_{H,t},C_{H_t}^e,C_{F,t},C_{F,t}^e} \sum_{t=0}^{\infty} \beta^t u(C_{H,t}, C_{H_t}^e, C_{F,t}, C_{F,t}^e)$$

$$\Big[1+(1+\tau_u)\nu\Big]C_H + \Big[1+(1+\tau_u)(\nu+\tau_e)\Big]P_H^e C_H^e + \Big[1+(1+\tau_u)\nu+\tau_m\Big]P_F C_F + \Big[1+(1+\tau_u)(\nu+\tau_e)+\tau_m\Big]P_F^e C_F^e = (1-\tau_h)wL + (1-\tau_k)\pi$$

where τ_u denotes the city maintenance and construction tax (CMCT) rate, ν the VAT rate, τ_m the tariff rate, and τ_k the personal income tax rate on capital income. τ_e represents taxes imposed on a specific group of consumption goods, including the excise tax, slaughter tax, banquet tax, and vehicle purchase tax. τ_h denotes the rate of taxes applied to a set of labor-income-related or agriculture-related taxes: the personal income tax on labor, agriculture tax, agricultural specialty tax, animal husbandry tax, and tobacco leaf tax. The agriculture tax, agricultural specialty tax, animal husbandry tax, and tobacco leaf tax are not classified as consumption taxes, as they are levied on agricultural outputs—such as crops and livestock—which serve as raw materials for the production of final consumption goods. Instead, these taxes are treated as taxes on labor income, reflecting the fact that agriculture and husbandry are labor-intensive sectors, and their outputs constitute a major component of practitioners' earned income.

Government

The government collects taxes from households and firms to finance its expenditures on G and G^e, where G denotes government consumption of ordinary domestic goods, and G^e represents consumption of special domestic goods. For simplicity, government borrowing is not considered in the analysis. The government's budget constraint is given by the following equation:

$$\begin{aligned}
&\Big[1+(1+\tau_u)\nu\Big]G + \Big[1+(1+\tau_u)(\nu+\tau_e)\Big]P_H^e G^e \\
&= (1+\tau_u)\Big[\nu C_H + (\nu+\tau_e)P_H^e C_H^e + \nu P_F C_F + (\nu+\tau_e)P_F^e C_F^e \nu G + (\nu+\tau_e)P_H^e G^e\Big] \\
&\quad + \tau_m(P_F C_F + P_F^e C_F^e) + \tau_h wL + \tau_k \pi + (1+\tau_u)\tau_b Y \\
&\quad + \tau_f\Big[\big[1-(1+\tau_u)\tau_b\big]Y - wL\Big] + (1+\tau_u)\nu I + \kappa I - \tau_f z(1+\nu)I
\end{aligned}$$

Table 2: Summary of Model Tax Categories

Tax category	Components
ν	VAT (excluding export VAT refund and VAT exemption)
τ_b	Business tax
τ_f	Corporate income tax
τ_e	Excise tax, slaughter tax, banquet tax, vehicle purchase tax
κ	Resource tax, fixed asset investment orientation adjustment tax, property tax, stamp tax, urban land use tax, land appreciation tax, vehicle and vessel tax, farmland occupation tax, deed tax
τ_h	Personal labor income tax, agriculture tax, agricultural specialty tax, animal husbandry tax, tobacco leaf tax
τ_k	Personal capital income tax
τ_m	Tariff
τ_u	City maintenance and construction tax

International Trade

The home economy exports ordinary domestic goods in exchange for ordinary foreign goods and special foreign goods from foreign countries. To simplify the analysis I assume that the home economy runs a balanced trade, so that I do not need to consider the accumulation of foreign assets or foreign debt. The balance of trade is described by the following equation:

$$C_H^\star = P_F^e C_F^e + P_F C_F$$

Summary

In equilibrium, prices P_H^e, P_F, P_F^e, and w clear the goods market and labor market. Both the representative firm and representative household make optimal decisions to maximize their profit or utility under the equilibrium prices. Summing up the firm's profit function, the household's budget constraint, the trade balance, and the government's budget, I obtain the resource constraint of the home economy:

$$Y = C_H^\star + C_H + P_H^e C_H^e + G + P_H^e G^e + I$$

That is, the representative firm's output is used for export, production of ordinary domestic goods and special domestic goods for final consumption, and investment.

Table 2 summarizes the components of each tax category in the model.

4 Data

4.1 Tax Revenue Statistics

Tax revenue statistics are obtained from the *China Taxation Yearbook* and the *China Statistical Yearbook*. The table titled *Breakdown of Revenue Collected by Tax Authorities Nationwide, by Tax Category and Administrative Level* in the *China Taxation Yearbook* provides detailed data for most taxes, but excludes the agriculture tax, agricultural specialty tax, animal husbandry tax, tobacco leaf tax, and tariff. Additionally, data on the farmland occupation tax and deed tax are unavailable for the years 2001–2011. To address these omissions, statistics on the agriculture tax, agricultural specialty tax, animal husbandry tax, tobacco leaf tax, and the deed and farmland occupation taxes (2001–2011) are sourced from the table *Main Items of National Government Revenue of the Central and Local Governments* in the Government Finance section of the *China Statistical Yearbook*. Tariff data are obtained from the table *Taxes*, also located in the Government Finance section of the *China Statistical Yearbook*.

An important advantage of the *China Taxation Yearbook* is that it reports disaggregated data on various categories of personal income tax (PIT), enabling a direct classification of most PIT revenues into labor and capital income taxes. For PIT categories that are mixed or ambiguous in nature, the corresponding tax revenues are reallocated based on the share of labor income in the household sector's gross primary income. Further details on the reallocation methodology are provided in the next section.

One important clarification is necessary. Since effective tax rates are intended to measure a country's actual aggregate tax burden, their computation must be based on actual tax revenue collected, rather than tax revenue payable. In China, the government provides export VAT refunds to ensure that exported goods are not subject to domestic VAT. Additionally, certain goods—such as specific agricultural products—may be exempt from VAT. Therefore, when calculating the effective tax rates, I rely on actual VAT revenue, which excludes amounts refunded through export VAT rebates and revenues forgone due to VAT exemptions.

4.2 National Account Statistics

To calculate effective tax rates, I require not only tax revenue data but also information necessary to estimate the corresponding tax bases. Data on compensation of employees and operating surplus are obtained from the *Income Approach Components of Gross Regional Product* table, found in the National Accounts section of the *China Statistical Yearbook*. This table reports the four components of income-approach GDP at the provincial level: Compensation of Employees, Net Taxes on Production, Depreciation of Fixed Assets, and Operating Surplus. National-level figures are constructed by aggregating the provincial data. However, the income-approach GDP statistics are missing for the years 2004, 2008, and 2013. To address this issue, I applied interpolation using data from the surrounding years.

In addition, I collected statistics on Final Consumption Expenditure and Gross Fixed Capital Formation from the *Gross Domestic Product by Expenditure Approach* table, also lo-

cated in the National Accounts section of the *China Statistical Yearbook*. Finally, data on Social Insurance Contributions and Household Gross Primary Income are sourced from the *Flow of Funds Accounts (Non-financial Transactions)*, published annually in the same section. Gross primary income refers to the residual income derived from the allocation of value added in the form of compensation of employees, consumption of fixed capital, production taxes, and property income.

The specific statistics are listed below:

$$
\begin{aligned}
W &= \text{Compensation of Employees} \\
OS &= \text{Operating Surplus} \\
FC &= \text{Final Consumption Expenditures} \\
GFCF &= \text{Gross Fixed Capital Formation} \\
GPI^{HH} &= \text{Resources of Households Gross Primary Income} \\
SIC &= \text{Resources of Total Social Insurance Contributions}
\end{aligned}
$$

4.3 Other Data

Starting in 2009, all firms in China were permitted to deduct expenditures on equipment and tools from their output VAT, representing a potentially significant shift in the VAT tax base. To account for this change, I utilized data from the table *Sources of Funds for Investment and Structure of Investment in Fixed Assets in the Whole Country*, found in the *Investment in Fixed Assets* section of the *China Statistical Yearbook*. This table breaks down total fixed asset investment into the following three categories:

$$
\begin{aligned}
FA_{CI} &= \text{Construction and Installation} \\
FA_{PEI} &= \text{Purchase of Equipment and Instruments} \\
FA_{O} &= \text{Others}
\end{aligned}
$$

Among these, expenditures classified under Purchase of Equipment and Instruments should be excluded from the VAT tax base starting in 2009.

It is important to note that *Total Fixed Asset Investment* differs from *Gross Fixed Capital Formation (GFCF)*. The former reflects the flow of funds used for fixed asset investment and is **not** used in GDP accounting, while the latter captures the actual gross formation of fixed capital and is an essential component of GDP accounting. *Total Fixed Asset Investment* is a concept specific to China's statistical system, whereas *Gross Fixed Capital Formation* follows the United Nations' System of National Accounts (SNA). In my analysis, I adopt specific methods to mitigate the impact of these differences.

5 Estimation of Effective Tax Rates

In this section, I present the estimation of China's effective tax rates on consumption, labor, and capital. Each effective tax rate is calculated as the ratio of the relevant tax revenue to

its corresponding aggregate tax base.

5.1 Effective Tax Rate on Consumption

According to the model previously presented, taxes levied on the final consumption of the representative household and the government include: shares of value-added tax (VAT), business tax (BT), and city maintenance and construction tax (CMCT) levied on final consumption, excise taxes on special consumption goods, and tariffs on imported consumption goods. Excise taxes on special consumption goods comprise the excise tax, slaughter tax, banquet tax, and vehicle purchase tax (VPT). The tax base for the effective consumption tax rate is total actual final consumption by households and the government. Accordingly, the effective tax rate on consumption, denoted as τ_c, is defined as:

$$\begin{aligned}\tau_c = & \frac{(1+\tau_m)\Big[\nu(C_H + P_F C_F + G) + (\nu+\tau_e)(P_H^e C_H^e + P_F^e C_F^e + P_H^e G^e)\Big] + \tilde{\theta}_m^C \tau_m \tau_b Y}{C_H + P_H^e C_H^e + P_F C_F + P_F^e C_F^e + G + P_H^e G^e} \\ & + \frac{\theta_b^C \tau_b Y}{C_H + P_H^e C_H^e + P_F C_F + P_F^e C_F^e + G + P_H^e G^e} \\ & + \frac{\tau_m (P_F C_F + P_F^e C_F^e)}{C_H + P_H^e C_H^e + P_F C_F + P_F^e C_F^e + G + P_H^e G^e} \\ \approx & \frac{\theta_\nu^C \text{VAT} + \theta_b^C \text{BT} + \theta_m^C \text{CMCT} + \text{Excise Tax} + \text{Slaughter Tax} + \text{Banquet Tax} + \text{VPT} + \text{Tariff}}{FC - \Big[\theta_\nu^C \text{VAT} + \theta_b^C \text{BT} + \theta_m^C \text{CMCT} + \text{Excise Tax} + \text{Slaughter Tax} + \text{Banquet Tax} + \text{VPT} + \text{Tariff}\Big]}\end{aligned} \tag{1}$$

In Equation (1), $\theta_\nu^C, \theta_b^C, \theta_m^C \in (0,1)$ denote the share of VAT, BT, and CMCT generated from actual final consumption. As previously discussed, in China, VAT is imposed on both final consumption and fixed asset investment, BT is levied on the gross business revenue of firms, whereas the tax base of CMCT comprises the sum of VAT, the excise tax, and the business tax paid. The formulas used to compute θ_ν^C, θ_b^C, and θ_m^C are as follows:

$$\theta_\nu^C = \begin{cases} \dfrac{FC}{FC + GFCF}, & \text{if } t < 2009 \\ \dfrac{FC}{FC + GFCF \cdot \left(1 - \dfrac{FA_{PEI}}{FA}\right)}, & \text{if } t \geq 2009 \end{cases} \tag{2}$$

$$\theta_b^C = \frac{FC}{FC + GFCF} \tag{3}$$

$$\theta_m^C = \frac{\theta_\nu^C \text{ VAT} + \theta_b^C \text{ BT} + \text{Excise Tax}}{\text{VAT} + \text{Excise Tax} + \text{Business Tax}} \tag{4}$$

Equation (2) shows how to calculate the portion of VAT attributable to final consumption. Before the 2009 VAT reform, this portion is determined by the ratio of actual fi-

nal consumption to the sum of actual final consumption and gross fixed capital formation—representing the relative weight of consumption in the total VAT base. After 2009, firms were allowed to deduct spending on equipment and instruments from their output VAT. Consequently, the part of gross fixed capital formation related to these purchases should be excluded from the VAT base associated with consumption. Although total fixed asset investment and gross fixed capital formation are compiled under different statistical standards and are not directly equivalent, fixed asset investment data can still approximate the share of equipment and instrument purchases within gross fixed capital formation. In Equation (2), fixed asset investment is used solely to estimate the portion of capital formation that should be excluded from the VAT base after 2009.

Similar to VAT, BT in China also requires reallocation. The tax base of BT consists of gross business revenue generated from the provision of taxable services, the transfer of intangible assets, and the sale of real estate. Although BT lacks an input tax credit mechanism and differs from VAT in design, it is still classified as an indirect tax, consistent with OECD tax categorization frameworks. Taxes of this nature—such as turnover taxes or gross receipts taxes—are typically grouped under taxes on goods and services and are assumed to be passed on to the final users through prices. Following this reasoning, BT is reallocated into taxes on consumption and investment according to the expenditure approach to GDP. In this context, the share of BT attributed to consumption, denoted as θ_b^C, is calculated as the ratio of actual final consumption to the sum of actual final consumption and gross fixed capital formation.

Finally, Equation (4) shows how to compute the share of CMCT levied on final consumption. The CMCT tax base comprises three components: VAT, excise tax, and BT. Accordingly, the portion of CMCT attributable to final consumption includes the CMCT levied on VAT and BT associated with consumption and the CMCT on excise tax. Equation (4) allocates the total CMCT based on the relative share of VAT on consumption and excise tax in the overall tax base.

5.2 Effective Tax Rate on Labor

The effective tax rate on labor is defined as the ratio of tax revenue collected from labor income to total labor income. Labor-related tax revenue includes the portion of personal income tax (PIT) attributable to labor income, as well as the agriculture tax, agricultural specialty tax, animal husbandry tax, tobacco leaf tax, and social insurance contributions (SIC). The *China Taxation Yearbook* provides disaggregated data on twelve categories of PIT in China, as listed in Table 3.

Among these, taxes on wages and salaries income, income from labor services, and income from author's remuneration are classified as labor income taxes. In contrast, taxes on income from royalties, interest, dividends and bonuses, property leasing, and property transfers are treated as capital income taxes. Two categories—income from production and business operations of self-employed individuals and households, and income from contracted or leased operations of enterprises and institutions—are considered mixed income

Table 3: Categories of China's Personal Income Tax (PIT)

Category	Type	Index
Wages and salaries income	Labor income	L_1
Income from production and business operations of self-employed individuals and households	Mixed	M_1
Income from contracted or leased operations of enterprises and institutions	Mixed	M_2
Income from labor services	Labor income	L_2
Income from author's remuneration	Labor income	L_3
Income from royalties	Capital income	C_1
Income from interest, dividends, and bonuses	Capital income	C_2
Income from property leasing	Capital income	C_3
Income from property transfers	Capital income	C_4
Occasional income	Vague	V_1
Other income	Vague	V_2
Income from tax arrears penalties and fines	Vague	V_3

sources, and are accordingly split between labor and capital components. The remaining categories, including taxes on occasional income, other income, and income from tax arrears penalties and fines, lack a clearly defined tax base and are therefore excluded from the classification.

To reallocate the income taxes whose sources are either mixed or vague, I follow the approach below. First, I compute the share of labor income among the gross primary income of the household sector θ_{PI}^L, which is defined as the ratio of compensation of employees to household gross primary income. Then, following Mendoza, Razin, and Tesar (1994), I assume that the average income tax rate on the mixed or vague resources income are the same, so that the tax revenue can be reallocated based on θ_{PI}^L:

$$\theta_{PI}^L = \frac{W}{GPI^{HH}} \tag{5}$$

$$\begin{aligned} \text{PIT}^L &= L_1 + L_2 + L_3 + \theta_{PI}^L(M_1 + M_2 + V_1 + V_2 + V_3) \\ \text{PIT}^K &= C_1 + C_2 + C_3 + C_4 + (1 - \theta_{PI}^L)(M_1 + M_2 + V_1 + V_2 + V_3) \end{aligned} \tag{6}$$

where PIT^L denotes the amount of PIT attributable to labor income, PIT^K the amount of PIT attributable to capital income.

I then calculate the effective labor tax rate, τ_l, defined as the ratio of total labor-related tax revenue to total labor income. For simplicity, the sum of the agriculture-related taxes

is denoted as "aggregate agriculture tax" (AAT). The formula for τ_l is as follows:

$$\tau_l = \frac{\tau_h w L}{wL} \approx \frac{\text{AAT} + \text{PIT}^L + \text{SIC}}{W + \text{AAT}} \tag{7}$$

Unlike Mendoza, Razin, and Tesar (1994), the denominator in Equation (7) excludes social insurance contributions (SIC). This is because, in China's Flow of Funds Accounts, *Compensation of Employees* already includes SIC, as it is defined as the sum of (i) wages and salaries and (ii) employers' social contributions. Consequently, SIC is not added separately to the labor tax base.

In addition, the labor tax base includes the aggregate agriculture tax (AAT), which is treated as a proxy for the portion of *Net Taxes on Production* that falls on labor. AAT is not part of *Compensation of Employees* and is therefore not otherwise captured in the labor tax base. To account for this, I add AAT to the labor tax base. This treatment diverges from Mendoza, Razin, and Tesar (1994), who omit net production taxes entirely from their calculation of labor and capital effective tax rates. My approach reflects the institutional features of China's tax system, in which production-related taxes can impose a meaningful burden on labor income even in the absence of direct wage taxation.

5.3 Effective Tax Rate on Capital

The computation of the effective capital tax rate, τ_k, follows the same methodology as for τ_c and τ_l. It is defined as the ratio of capital-related tax revenue to total capital income in the economy. Capital-related tax revenue includes corporate income tax (CIT), resource tax, fixed asset investment orientation adjustment tax, property tax, stamp tax, urban land use tax, land appreciation tax, vehicle and vessel tax, farmland occupation tax, deed tax, and the portions of value-added tax (VAT), business tax (BT), personal income tax (PIT), and city maintenance and construction tax (CMCT) that are levied on capital income. For convenience, I group the resource tax, fixed asset investment orientation adjustment tax, property tax, stamp tax, urban land use tax, land appreciation tax, vehicle and vessel tax, farmland occupation tax, and deed tax into a single category denoted as the *aggregate capital tax* (ACT). Formally, τ_k is expressed as:

$$\tau_k = \frac{\tau_f \left[(1-(1+\tau_u)\tau_b)\, Y - wL\right] + \kappa I + \tau_k \pi + (1+\tau_u)\nu I + (1-\tilde{\theta}_m^C)\tau_m \tau_b Y - \tau_f z(1+\nu) I}{Y - wL - \delta K}$$

$$\approx \frac{\text{CIT} + \text{ACT} + (1-\theta_\nu^C)\text{VAT} + (1-\theta_b^C)\text{BT} + \text{PIT}^K + (1-\theta_m^C)\text{CMCT}}{OS + \text{ACT} + (1-\theta_\nu^C)\text{VAT} + (1-\theta_b^C)\text{BT} + (1-\theta_m^C)\text{CMCT}} \tag{8}$$

My definition of the tax base for τ_k follows B. Lyu and Zhigang Chen (2015), which slightly departs from Mendoza, Razin, and Tesar (1994). Specifically, the capital tax base is defined as the operating surplus OS, but augmented by the aggregate capital tax (ACT) and the capital-income-related shares of VAT, BT, and CMCT. In contrast to production taxes, in-

Table 4: China's Effective Tax Rates (%), 2001-2017

Year	τ_c	τ_l	τ_k
2001	12.45	6.57	28.98
2002	12.67	7.73	27.49
2003	13.54	8.47	27.89
2004	14.98	9.11	24.90
2005	14.44	9.57	22.27
2006	15.00	9.98	22.87
2007	15.47	10.77	25.73
2008	15.64	10.75	29.23
2009	17.22	10.34	28.95
2010	18.85	10.84	27.78
2011	18.97	11.37	29.28
2012	18.52	11.26	30.66
2013	17.46	12.30	32.90
2014	17.63	11.89	32.06
2015	15.43	12.36	32.31
2016	14.76	12.66	30.52
2017	14.74	13.79	30.66

come taxes—such as the capital-related shares of PIT and CIT—are not included in the tax base, as they do not arise from the use of capital in production but rather from the distribution of income after value creation.

This adjusted capital tax base reflects a broader and more comprehensive concept of capital income than that employed by Mendoza, Razin, and Tesar (1994), who define the tax base narrowly as operating surplus and exclude net production taxes entirely. In contrast, the above approach incorporates a wider range of taxes that affect capital returns—particularly production-related and property-based levies that are not captured by corporate income tax alone. This adjustment is especially relevant in the Chinese context, where such taxes impose a significant fiscal burden on capital income. By including these components, the estimated effective capital tax rate offers a more accurate reflection of the actual tax pressure on capital in China's institutional environment.

5.4 Result

Table 4 presents the time series of effective tax rates, while Figure 3 illustrates the evolution of the effective tax rates on consumption (τ_c), labor (τ_l), and capital (τ_k) from 2001 to

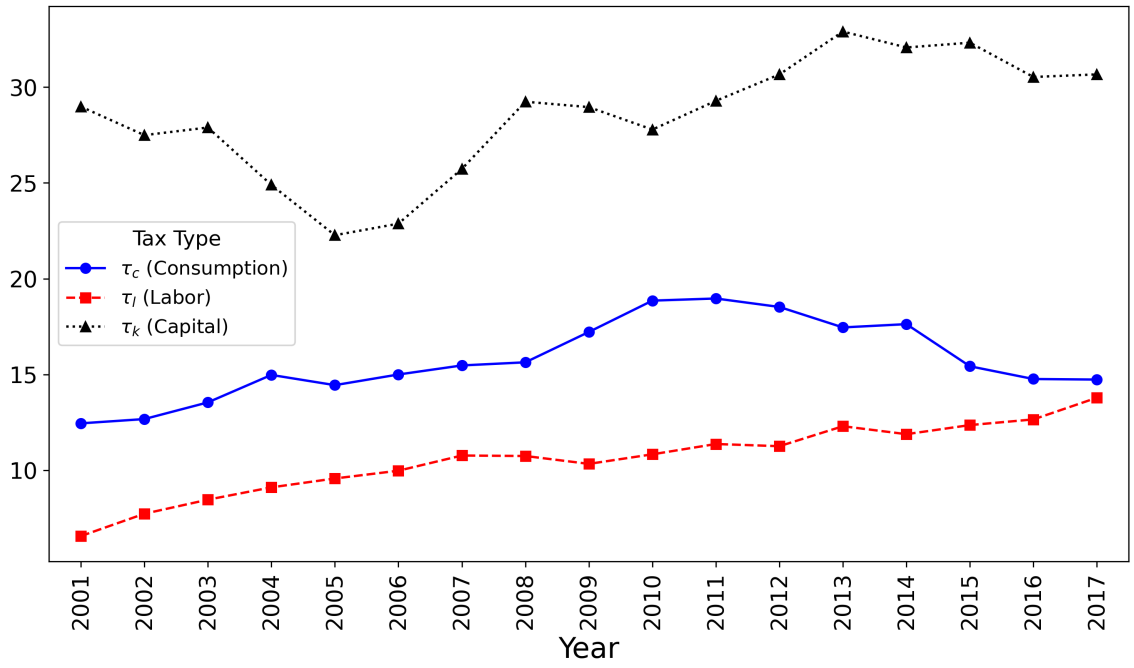

Figure 3: China's Effective Tax Rates (%), 2001-2017

2017. Over this period, the labor tax rate increased steadily, with τ_l rising from 6.67% in 2001 to 13.08% in 2017. In contrast, both τ_c and τ_k exhibited substantial fluctuations. The consumption tax rate (τ_c) rose from 12.45% to a peak of 18.97% in 2011, before declining gradually to 14.47% by 2017. The capital tax rate (τ_k) started at 28.98% in 2001, fell to 22.87% in 2005, then climbed to a peak of 32.90% in 2013, before decreasing to 30.66% by 2017.

Overall, the effective tax rates followed the pattern $\tau_l < \tau_c < \tau_k$ throughout the sample period, consistent with findings in the existing literature.

6 Comparison with Previous Literature

This section compares the estimated effective tax rates with those reported in previous studies. Specifically, I compare my results with B. Lyu and Zhigang Chen (2015) and Liang and H. Lyu (2022). The former closely follows the methodology of Mendoza, Razin, and Tesar (1994), while the latter represents the most recent study employing the flow of funds table to estimate effective tax rates.

6.1 Effective Consumption Tax Rate

Figure 4 shows that this paper's estimates of τ_c are consistently higher than those reported by B. Lyu and Zhigang Chen (2015) and Liang and H. Lyu (2022). This discrepancy primarily arises from differences in the treatment and composition of consumption tax revenues.

In B. Lyu and Zhigang Chen (2015), the total tax revenue on consumption includes the tobacco leaf tax but excludes both the vehicle purchase tax and tariffs. Notably, the to-

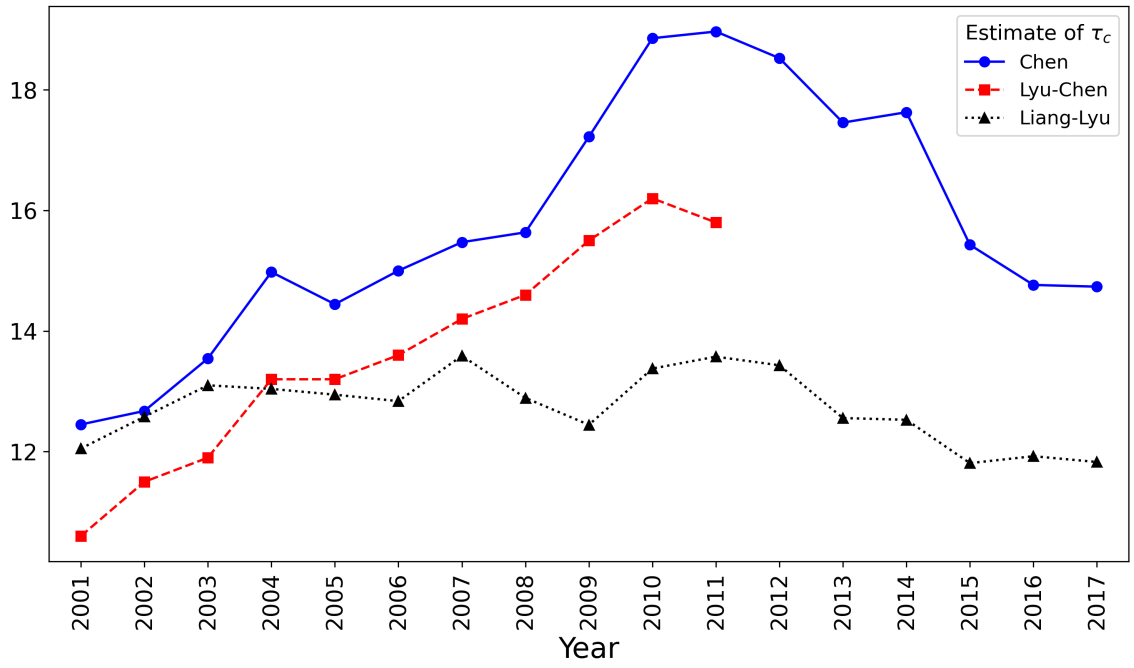

Figure 4: Estimates of effective consumption tax rates τ_c (%)

bacco leaf tax is levied on producers at the production stage, rather than on consumers, and therefore should not be classified as a consumption tax. By contrast, the vehicle purchase tax—imposed on individuals and entities purchasing designated vehicles within China—functions similarly to an excise tax and should be treated as a consumption tax. Likewise, tariffs, which are levied on the consumption of imported goods by households and enterprises, should also be included in the measurement of consumption tax revenue. According to my own calculations, the vehicle purchase tax and tariffs together accounted for approximately 10% to 14% of total consumption tax revenue during 2001–2017. Omitting these components can therefore lead to a significant underestimation of τ_c.

The estimates of τ_c in Liang and H. Lyu (2022) are both lower and less volatile than those reported in this paper and in B. Lyu and Zhigang Chen (2015). This discrepancy primarily stems from two methodological issues: (i) mis-specification of the consumption tax base, and (ii) improper reallocation of net production taxes.

First, when calculating τ_c, Liang and H. Lyu (2022) used actual final consumption as the tax base without deducting consumption tax revenues. However, under China's accounting standards—which align with the *System of National Accounts 2008 (SNA 2008)*—both final consumption expenditure and actual final consumption are recorded at purchasers' prices, meaning they include indirect taxes such as VAT. Failing to deduct the consumption tax revenues from the base leads to an underestimation of τ_c.

Second, Liang and H. Lyu (2022) estimated total consumption tax revenue by multiplying *Net Taxes on Production* by the ratio of actual final consumption to GDP, on the grounds that VAT dominates net production taxes. However, *Net Taxes on Production* also include other components such as the excise tax, vehicle purchase tax, and stamp tax. These taxes

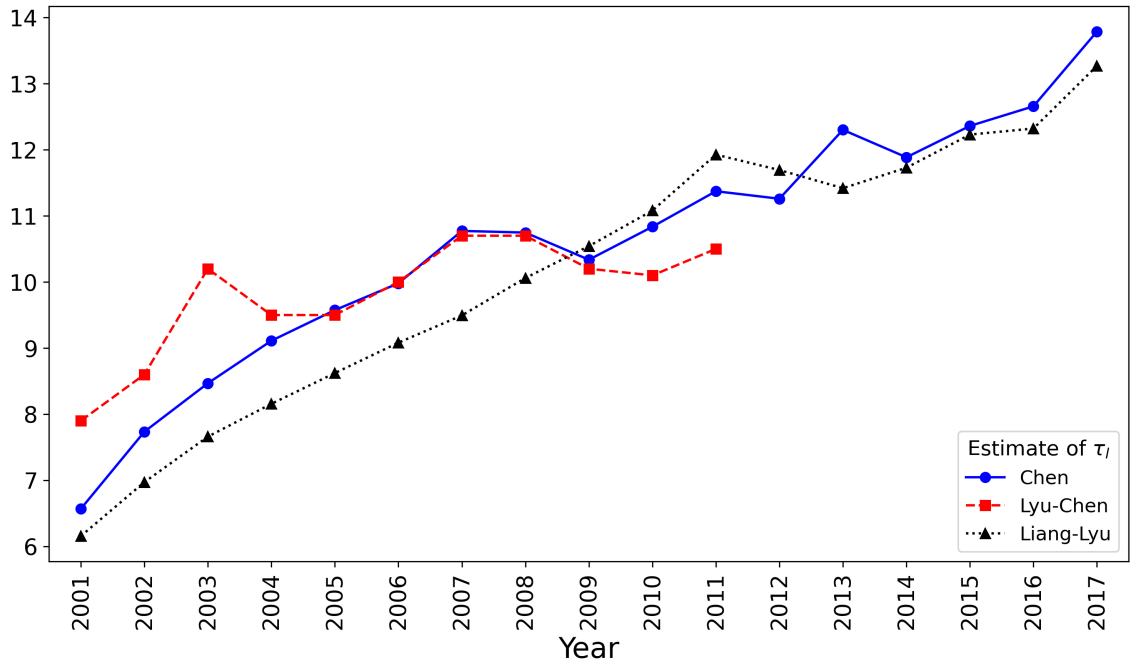

Figure 5: Estimates of effective labor tax rates τ_l (%)

are either directly levied on consumption or indirectly related to capital income, and thus cannot be cleanly allocated based on consumption shares.

Therefore, the methodology used in Liang and H. Lyu (2022) likely produces a downward-biased and overly smoothed estimate of τ_c, due to both an inflated tax base and incomplete coverage of tax revenues. Similarly, in B. Lyu and Zhigang Chen (2015), the exclusion of certain tax categories from total consumption tax revenues also contributes to an underestimation of τ_c. These findings highlight the importance of employing a theoretical framework that systematically incorporates all relevant tax components, thereby providing clarity on the structure and composition of consumption tax revenues.

6.2 Effective Labor Tax Rate

Figure 5 presents the time series of estimated effective labor tax rates (τ_l) from this paper, as well as from B. Lyu and Zhigang Chen (2015) and Liang and H. Lyu (2022).

The difference between my estimate and that of B. Lyu and Zhigang Chen (2015) is partly due to variations in the calculation of labor tax revenue. Specifically, in disaggregating the income of self-employed individuals and households, B. Lyu and Zhigang Chen (2015) adopt the method proposed by Carey and Tchilinguirian (2000), which estimates labor income based on the average wage and the number of self-employed workers, treating the residual as capital income. Additionally, they classify income from contracted or leased operations of enterprises and institutions entirely as capital income—an arguably problematic assumption, given that labor remains a crucial input in such activities. Another possible source of discrepancy is the revision of data: in 2018, the National Bureau of Statistics (NBS) systematically revised historical GDP figures to align with international

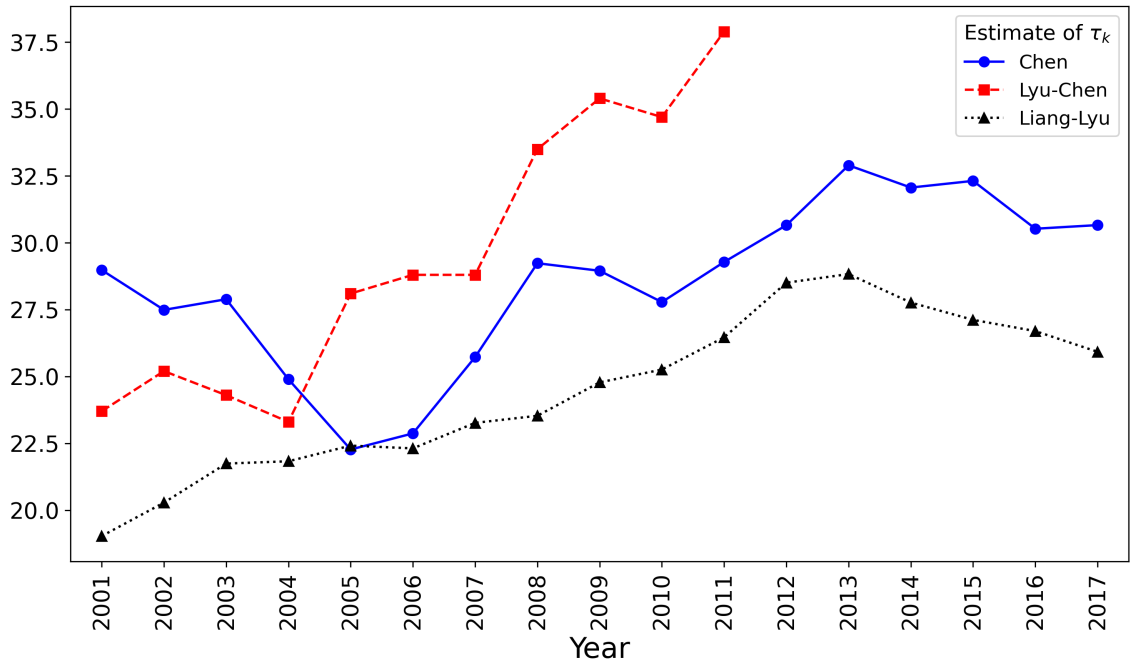

Figure 6: Estimates of effective capital tax rates τ_k (%)

standards. This revision may have significantly affected the reported values of compensation of employees, a key component of the labor tax base.

By contrast, Liang and H. Lyu (2022) do not use disaggregated personal income tax (PIT) data to compute τ_l. Instead, they follow the methodology introduced by Mendoza, Razin, and Tesar (1994): first estimating an average PIT rate on total household income, then reallocating tax revenue under the assumption that this average rate applies equally to labor and capital income. Their compensation of employees data are derived from the *Flow of Funds Accounts (Nonfinancial Transactions)*, which is not the same as the value reported in the *Income Approach Components of Gross Regional Product*. As a result, their estimates of effective labor tax rate differs from mine.

In summary, the comparison across different estimates of the effective labor tax rate underscores the importance of using disaggregated tax revenue data, especially for accurately constructing the total amount of labor-related tax revenue.

6.3 Effective Capital Tax Rate

Figure 6 displays the time series of the estimated effective capital tax rates τ_k. My estimate of τ_k is significantly smaller than B. Lyu and Zhigang Chen (2015) and Liang and H. Lyu (2022), due to the difference in tax revenue composition and calculation of tax bases.

In B. Lyu and Zhigang Chen (2015), the authors defined the capital tax base as the sum of operating surplus, plus the sum of total capital tax revenue excluding corporate income tax (CIT). This approach follows Mendoza, Razin, and Tesar (1994) and is more well-defined, as the production tax on capital is also included in the tax base. However, when calculating the capital-related tax revenue, the authors included vehicle purchase

tax, but excluded farmland occupation tax and deed tax. Vehicle purchase tax should be classified as a tax on consumption. Farmland occupation tax could be regarded as a tax on immovable properties, while the deed tax can be regarded as a tax on financial and capital transactions. Therefore, the difference in tax revenue composition has lead to the difference between my estimate of τ_k and theirs.

As for Liang and H. Lyu (2022), they adopt a different definition of both capital-related tax revenue and the capital tax base. In their study, capital-related tax revenue includes income taxes paid by corporations and households, as well as the share of net taxes on production attributed to capital income. However, their method for reallocating net taxes on production is not based on a disaggregated breakdown of tax categories. Instead, they assume that capital's share corresponds to the ratio of fixed asset investment to GDP. As previously argued, this method oversimplifies the issue, as many production taxes are levied exclusively on consumption or on specific capital inputs, and therefore cannot be proportionally allocated based on such a broad proxy.

Furthermore, Liang and H. Lyu (2022) define the capital tax base as the gross primary income of households and enterprises, minus the total compensation of employees. The problem with this approach is that gross primary income includes mixed income—particularly from self-employment—which contains both labor and capital components. Simply subtracting compensation of employees does not fully exclude labor income, leading to an overstatement of the capital tax base.

7 Conclusion

This paper provides a comprehensive and theoretically grounded estimate of China's effective tax rates on consumption, labor, and capital over the period 2001–2017. By constructing a general equilibrium model that fully incorporates the complexity of China's tax system, including 25 tax instruments and nine composite tax categories, the analysis offers significant improvements over previous estimation approaches.

One of the central contributions of this study is its bottom-up modeling strategy, which begins with the actual tax instruments used in China and maps them systematically to their corresponding economic tax bases. This approach resolves key ambiguities in the prior literature, particularly in the treatment of indirect taxes and the allocation of net production taxes between factors. The model also provides a transparent framework for classifying tax revenue components, thereby reducing the scope for ad hoc assumptions and improving cross-country comparability.

The results show that effective capital taxes are consistently higher than consumption and labor taxes, confirming a widely recognized pattern in the literature, but also revealing larger magnitudes than previously estimated once all relevant tax burdens are included. Importantly, the study identifies several sources of bias in earlier research, including the exclusion of tariffs and vehicle purchase taxes from consumption taxes, the improper reallocation of production taxes, and the over-simplification of mixed income in labor and

capital tax base definitions.

By addressing these gaps, this paper advances our understanding of China's fiscal policy structure and provides a valuable tool for future research on tax reform, incidence, and international tax burden comparison. The model and methodology developed here can also be adapted for similar analyses in other countries with complex or nonstandard tax systems.

References

Cai, Jing and Ann Harrison (2021). "Industrial policy in China: Some intended or unintended consequences?" In: *ILR Review* 74.1, pp. 163–198.

Carey, David and Harry Tchilinguirian (2000). *Average effective tax rates on capital, labour and consumption*. Vol. 258. OECD.

Chen, Zhao, Yuxuan He, et al. (2021). "The structure of business taxation in China." In: *Tax Policy and the Economy* 35.1, pp. 131–177.

Chen, Zhao, Xian Jiang, et al. (2023). "Tax policy and lumpy investment behaviour: evidence from China's VAT reform." In: *The Review of Economic Studies* 90.2, pp. 634–674.

Liang, Ji and Hui Lyu (2022). "Research and international comparison on the measurement of the effective labour tax ratio, effective capital tax ratio and effective tax ratio on consumption–based on the 2000-2018 flow of funds table." In: *Inquiry into Economic Issues*.

Liu, Yongzheng and Jie Mao (2019). "How do tax incentives affect investment and productivity? Firm-level evidence from China." In: *American Economic Journal: Economic Policy* 11.3, pp. 261–291.

Lyu, Bingyang and Zhigang Chen (2015). "The calculation of China's provincial average tax rate of capital, labor and consumption." In: *Finance & Trade Economics* 7, pp. 44–58.

Mendoza, Enrique G, Assaf Razin, and Linda L Tesar (1994). "Effective tax rates in macroeconomics: Cross-country estimates of tax rates on factor incomes and consumption." In: *Journal of Monetary Economics* 34.3, pp. 297–323.

Winberry, Thomas (2021). "Lumpy investment, business cycles, and stimulus policy." In: *American Economic Review* 111.1, pp. 364–396.

A China's tax categories (2001-2017)

Table 5: Tax categories in China (2001-2017)

Name	Tax base	Instructions
VAT	Production and sales of goods	Value-added tax (VAT) is a type of tax levied on entities and individuals for the value added in the process of selling goods, providing processing, repair, and maintenance services, as well as importing goods.
Excise tax	Tobacco, alcohol, precious jewelry, etc.	Excise tax is a type of tax levied on specific consumer goods and falls within the category of turnover taxes. On top of the general imposition of VAT on goods, certain consumer goods are subject to an additional excise tax. The purpose of this tax is to regulate product structures, guide consumption patterns, and ensure government revenue.
Business tax	Gross business receipts with no deductions of input tax credits	Business tax is a type of tax levied on entities and individuals within China for the revenue they earn from providing taxable services, transferring intangible assets, or selling real estate.
Corporate income tax (CIT)	Production and operational income of enterprises	Corporate income tax is a tax levied on the production and operational income, as well as other income, of domestic enterprises and business units in China. The tax is imposed on the income earned by taxpayers, including income from the sale of goods, provision of services, transfer of assets, dividends and bonuses, interest, rental income, royalties, donations received, and other forms of income.
Income tax for foreign-invested enterprises and foreign enterprises	Production and operational income of foreign enterprises	Income tax for foreign-invested enterprises and foreign enterprises is levied on the income from production, business operations, and other sources of foreign-invested enterprises established within China, as well as on the income from production, business operations, and other sources earned within China by foreign enterprises.
Personal income tax (PIT)	Personal income	Personal income tax is a type of income tax levied by the state on the income of its citizens, individuals residing within its territory, and foreign individuals earning income from within the country. In China, taxpayers include individuals who have a domicile in China or those who, without a domicile, have resided in China for at least one year, in which case they are subject to tax on both domestic and foreign income. Additionally, individuals without a domicile who do not reside in China or who reside for less than one year are subject to tax only on income earned within China.

Resource tax	Production of mine and salt	Resource tax is a tax levied on various taxable natural resources, aimed at regulating differential resource income and reflecting the principle of compensated use of state-owned resources. Entities and individuals engaged in the extraction of mineral products or the production of salt, as stipulated in the Interim Regulations of the People's Republic of China on Resource Tax, are considered taxpayers and are required to pay resource tax.
Fixed asset investment orientation adjustment tax	Fixed asset investment	The tax base for the Investment Orientation Adjustment Tax is the actual completed investment amount of fixed asset investment projects, with renovation and upgrading projects being based on the actual completed investment in construction projects. The fixed asset investments of Sino-foreign joint ventures, Sino-foreign cooperative enterprises, and wholly foreign-owned enterprises are not subject to these regulations.
City maintenance and construction tax	VAT and excise tax	Following the 1994 tax reform, taxpayers of the urban maintenance and construction tax were redefined as entities and individuals paying VAT, excise tax, and business tax, excluding foreign-invested enterprises, foreign enterprises, and importers. According to general regulations, the tax base for the urban maintenance and construction tax is the actual amount of VAT, excise tax, and business tax paid.
Property tax	Property value and rental income	Property tax is a type of tax levied on real estate, using the taxable residual value of the property or rental income as the tax base, and is imposed on property owners.
Stamp tax	Security transaction and other economic activities	Stamp tax is a tax levied on the execution of taxable documents in economic activities and on securities transactions. It is named after the practice of affixing a stamp duty ticket to taxable documents as proof of tax payment.
Urban land use tax	Value of urban land	Urban land use tax is a type of transactional tax levied on land within the designated taxation area. It is based on the actual area of land occupied and is imposed on entities and individuals holding land use rights at the prescribed tax rate.
Land appreciation tax	Sales of land and buildings	Land appreciation tax is a tax levied on the appreciation in value arising from the transfer of land-use rights and the sale of buildings. The land appreciation amount refers to the balance obtained by deducting the prescribed real estate development costs, expenses, and other expenditures from the revenue generated from the transfer of real estate.

Vehicle and vessel tax	Vehicles and vessels	The vehicle and vessel usage tax is a usage-based tax levied on vehicles operating on public roads and vessels navigating domestic rivers, lakes, or territorial waters. It is calculated based on the type of vehicle or vessel (such as motor vehicles, non-motor vehicles, passenger cars, cargo trucks, etc.), tonnage, and the prescribed tax rate.
Slaughter tax	Consumption of livestocks	The slaughter tax refers to a tax imposed by the state on slaughtering units and individuals when certain livestock, such as pigs, cattle, and sheep, are slaughtered. The slaughter tax was abolished in 2006.
Banquet tax	Catering activities	The banquet tax was a tax levied on units and individuals hosting banquets at restaurants, hotels, guesthouses, reception halls, and other food service establishments within China, based on the amount paid for the banquet. The banquet tax was abolished in 2008.
Vehicle purchase tax	Consumption of vehicles	The vehicle purchase tax is a tax levied on entities and individuals who purchase specified vehicles within China. It evolved from the former Vehicle Purchase Surcharge. Taxpayers include entities and individuals who acquire taxable vehicles for their own use through purchase, import, self-production, donation, awards, or other means. The tax applies to automobiles, motorcycles, trolleybuses, trailers, and agricultural transport vehicles.
Agriculture tax	Production of staple crops	The tax base for agriculture tax is agricultural income, which can be categorized into two types: agricultural income calculated based on average annual yield and agricultural income calculated based on product revenue. All entities and individuals engaged in agricultural production and earning agricultural income are taxpayers of the agriculture tax. As of January 1, 2006, China fully abolished the agriculture tax.
Agricultural Specialty Tax	Production of economic crops	The agricultural specialty tax is different from the agriculture tax. The agriculture tax refers to a tax levied on staple crops, such as wheat and corn. In contrast, the agricultural specialty tax is imposed on economic crops, such as apples, pears, and tobacco leaves. In 2006, China exempted agriculture tax and abolished all agricultural specialty taxes except for the tax on tobacco leaves.
Animal husbandry tax	Income generated from animal husbandry	China imposed a tax on entities and individuals engaged in animal husbandry in pastoral and semi-pastoral agricultural areas, based on their livestock income or the number of livestock they owned. The taxable livestock mainly included five types: horses, cattle (including hybrid cattle and yaks), camels, sheep, and goats. The livestock tax was primarily collected in real terms, with a few regions levying it in monetary form. The tax was abolished in 2006.

Tobacco leaf tax	Production of tobacco leaves	Entities that purchase tobacco leaves (including sun-cured and flue-cured tobacco leaves) within the territory of the People's Republic of China are taxpayers of the tobacco leaf tax and are required to pay the tax in accordance with the law. The tobacco leaf tax is levied based on the purchase amount of tobacco leaves acquired by the taxpayer.
Farmland occupation tax	Value of occupied farmland	The farmland occupation tax is a tax levied on entities and individuals who occupy farmland for housing construction or other non-agricultural purposes. The taxable scope includes farmland used for growing crops (including land previously used for crop cultivation), fish ponds, orchards, vegetable fields, and other agricultural land, such as artificially planted grasslands and reclaimed tidal flats used for crop cultivation or aquaculture.
Deed tax	Transferee of real estate	Deed tax is a property tax levied on the transferee of real estate when there is a change in ownership. The taxable scope includes the transfer, donation, and exchange of land use rights, as well as the sale, donation, and exchange of houses.
Tariff	Imported goods	A tariff refers to a tax levied by customs authorities, as authorized by the state, on goods and articles that enter or exit the customs territory. The tax base for tariffs is the corresponding dutiable value of imported goods.
Other taxes	-	-

B Derivation of the firm value function $v(K)$

For simplicity, I omit all taxes but VAT (ν) and the corporate income tax τ_f. Let $\hat{\pi}(K) = \max_L (1-\tau_f)(Y - wL)$, the firm's original value function is:

$$V(K,D) = \max_I \ \hat{\pi}(K) - (1+\nu)I + \tau_f \hat{\delta}\Big[D + (1+\nu)I\Big] + \beta V(K', D')$$

Consider the set of functions of the form $f(K,D) = g(K) + \tau z D$, where $z = \hat{\delta} + (1-\hat{\delta})z$, and the operator T defined by the right-hand-side of the original Bellman equation. One can prove that T maps the set of functions $f(K,D)$ to itself. To see, this, note that:

$$\begin{aligned}
Tf(K,D) &= \hat{\pi}(K) - (1+\nu)I + \tau_f \hat{\delta}\Big[D + (1+\nu)I\Big] + \beta\Big[g(K') + \tau_f z D'\Big] \\
&= \hat{\pi}(K) - \Big[1 + \nu - (1+\nu)\tau_f\hat{\delta}\Big] I + \tau_f \hat{\delta} D + \beta g(k') + \beta \tau_f z \underbrace{\Big[(1-\hat{\delta})[D + (1+\nu)I]\Big]}_{=D'} \\
&= \hat{\pi}(K) - \Big[1 + \nu - \tau_f(1+\nu)\underbrace{\Big(\hat{\delta} + \beta(1-\hat{\delta})z\Big)}_{=z}\Big] I + \tau_f \underbrace{\Big(\hat{\delta} + \beta(1-\hat{\delta})z\Big)}_{=z} D + \beta g(k') \\
&= \hat{\pi}(K) - \Big[1 + \nu - \tau(1+\nu)z\Big] I + \beta g(k') + \tau z D
\end{aligned}$$

The right-hand side is also a function of the form $h(k) + \tau z d$, that is, the operator T maps function $f(k,d) = g(k) + \tau z d$ to itself. Since the set of functions $f(k,d)$ is a closed set, there exists a unique fixed point and the fixed point lies in the set. By the definition of the value function, which is the fixed point, it follows that $V(k,d)$ is of the form:

$$V(K,D) = v(K) + \tau z D$$

Substitute the expression of $V(k,d)$ back to the original Bellman equation, we have:

$$v(k) = \max_{I,L} (1-\tau_f)\Big[Y - wL\Big] - (1+\nu)I + \tau_f z(1+\nu)I + \beta v(K')$$