

The effects of China's VAT enlargement reform on the income redistribution of urban households

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Using the 2007 input-output data and 2012 household survey data, this paper estimated the overall VAT and business tax burden of urban households in China on basis of the statutory tax rates, and then studied the redistribution effects of China's recent VAT enlargement reform. We found that this reform improved the redistribution effects of VAT and business tax mainly through lowering the average tax burden and reducing the inequality within the bottom-income group, but the inequality among different income groups was not reduced considerably. Based on a simulation analysis, we finally suggested the reduction of applicable rates on necessities to improve the redistribution effects of VAT more effectively.

Keywords: VAT enlargement, redistribution effects, general entropy index, input-output model

1. Introduction

China launched the pilot VAT enlargement reform in Shanghai with the new rules taking effect on Jan 1, 2012 in transportation and some selected modern service industries and then quickly expanded to other regions and industries. It is planned that the switch from the current dual GST (Goods and Service Tax) system, which levies VAT and business tax concurrently on sale of goods or provision of services, to a single GST system with only VAT levied will be finished by the end of 2015.

At present, most entities conducting various business operations in China should pay GST for their sale or business revenue. In general, sale of goods is subject to VAT and provision of services is subject to business tax before the VAT enlargement reform. Therefore, the two taxes are both widely based and contribute considerably to China's overall tax revenue.¹ With the implementation of VAT enlargement reform, VAT has been levied in the pilot industries which are formerly subject to business tax. Since under China's VAT regime the final VAT payable is partly determined by the special invoice of the VAT already paid on purchased inputs, the fact that services or goods are liable to VAT or not will influence the tax burden of both their sellers and buyers. As such, the VAT enlargement reform will cause changes in the VAT and/or business tax

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¹ In 2013, the revenue from domestic VAT and business tax accounted for 26% and 16% of China's overall tax revenue respectively, which was ranked No.1 and No.3 among all taxes levied. Source: http://yss.mof.gov.cn/2013qgcjzs/201407/t20140711_1111970.html

(also referred to as “two taxes”) burden¹ of nearly every industry in the economy and undoubtedly further influences, which need thorough academic research.

This paper will mainly study the effects of the VAT enlargement reform on the income redistribution of China’s urban households.

In theory, the GST is regarded as indirect tax levied on consumption. As for high-income households, the share of consumption expenditure in the overall income is relatively low, the GST burden of high-income households is typically lower than the low-income households, the redistribution effects of GST tend to be regressive. Based on this consideration, in order to improve the overall redistribution effects of China’s taxation system, the ratio of indirect tax revenue to direct revenue should be lowered. Actually, the VAT enlargement reform is part of China’s structural tax-cut package, namely, the tax burden of the pilot industries and other related industries should be lowered or at least remain the same. Therefore, we may expect the redistribution effects of the two taxes to be improved by this reform.

However, it is easier to achieve the above conclusions under an ideal regime where various goods and services are subject to a single GST and only one applicable rate. But in China, different goods or services are subject to different GSTs (VAT or business tax) at different rates, and additional exemption or reduced rates are applied to selected necessities, so we cannot simply ascertain the regressivity of VAT and business tax as a whole. With the VAT enlargement reform, though more services are subject to VAT, several important industries including construction, real estate, banking and insurance, etc. are still liable to business tax, two additional reduced rates (11% and 6%) are introduced, and the changes in tax burden varies drastically across industries. Therefore, the exact influence of the VAT enlargement reform on China’s household income redistribution can only be determined through empirical study.

Concerning the burden or redistribution effects of indirect taxes, there has been much study in the literature. The methods adopted by the authors include micro simulation and general equilibrium analysis. Based on industry and household data, the micro simulation method is more suitable for figuring out the effects of the industry-related policy adjustments. In conducting research using this method, a key point is the estimation of the VAT and/or business tax included in the prices of the goods or services purchased by the households. Some studies directly take the statutory rates of VAT or business tax as the tax burden rates of the specific expenditure items of the households (Liu & Nie, 2004, 2009), others determine the tax burden of the household expenditure items through measuring the tax burden of various industries on the basis of input-output data and then matching the industries in the input-output table with the household expenditure items. Considering the fact that China levies VAT or business tax on different goods or services, and the applicable rates and credit rules varies across different taxable items even within the VAT regime, the method based on input-output data can achieve more accurate results.

¹This paper mainly considers the total tax burden of VAT and business tax or the sum of VAT burden and business tax burden.

However, in measuring the tax burden of each industry, earlier studies considered only the tax burden at the last stage in supplying the relevant goods and services, and ignored the taxes included in the prices of the inputs and shifted finally to the households (Tamaoka, 1994; Nie & Liu, 2009, 2010). More recent studies made important progress by including the input taxes in overall tax burden (Scutella, 1999; Nie & Yue, 2013). But since these analyses are based on the data of collected tax revenue and lead to results reflecting the combined effects of tax system and tax administration, their method is still problematic for evaluating the effects of tax reform.

In this paper, using the 135-industry input-output table in 2007 published by the National Statistics Bureau of China, we try to estimate the burden of VAT and business tax for each industry according to statutory tax rates with full consideration of input taxes. Then, on the basis of the results and 2012 Urban Household Survey data, we measure the VAT and business tax burden of sample urban households before and after the VAT enlargement reform and derive the redistribution effects of this tax reform. With regard to the measure of redistribution effects of taxation, apart from adopting the traditional methods such as comparing the before-tax and after-tax burden and income shares of household groups of different income level, comparing the before-tax and after-tax gini coefficients, we also introduce the general entropy index with various sensitive parameters so as to disclose the structural influences of the VAT enlargement reform on household income redistribution. Since the whole estimation has been built on statutory tax rates, we finally simulate the redistribution effects of some typical VAT regimes, which may be helpful for the decision-making concerning future VAT reform.

Similar to the findings of other authors, our analysis also indicates the regressive effects of VAT and business tax as a whole. In addition to this, we find the VAT enlargement reform has improved the redistribution effects of the two taxes through lowering the average tax burden and narrowing the income gap “within” the low-income household group. Since this reform has not brought considerable tax-cut to the expenditure items which are particularly essential for the low-income households, the income gap “between” the household groups with different income levels are nearly unaffected. As such, the overall improvement of the redistribution effects is rather mild. Further simulation indicates the redistribution effects of VAT can be more effectively improved through lowering the tax burden on necessities.

The rest of this paper is arranged as follows: section 2 introduces the methodology and data, section 3 presents the results of our estimation for the redistribution effects of the VAT enlargement reform, section 4 conducts simulation analysis for the redistribution effects of some typical VAT regimes and section 5 concludes.

2. Methodology and data

2.1. *Measuring the VAT and business tax burden of the households*

Households are the final consumers of various goods and services. Due to the complicated

interaction of the industries in the economy, the output of every industry can be purchased by the households or become the intermediate input for producing the goods or services purchased by the households. Based on the assumption of forward tax shifting as frequently used in the literature, the taxes paid by the business operators of various industries finally shall be included in the prices of the goods or services purchased by the households. Therefore, in order to measure the VAT and business tax borne by the households, we need to estimate the effective rate of VAT and business tax as a whole for each industry. Here, by effective tax rate, we mean the ratio of VAT and business tax included in the price of the output of an industry to the price of the output of that industry.

According to the structure of the input-output table, we have

$$p_j = \sum_{i=1}^n a_{ij} \cdot p_i + v_j, j=1, 2, \dots, n \quad (1)$$

Where p_j denotes the price of the output of the j th industry, p_i denotes the price of the output of the i th industry, a_{ij} is direct consumption coefficient reflecting the consumed inputs from the i th industry per unit of the output of the j th industry. Therefore, $\sum_{i=1}^n a_{ij} \cdot p_i$ represents the part of the output of the j th industry which is equivalent to the value of the intermediate inputs. In addition, v_j represents the value-added per unit of the output of the j th industry. Since the output of each industry is equal to the sum of value-added and the value of intermediate inputs, net production taxes (or the sum of VAT, business tax, consumption tax and other indirect taxes) is just a component of the value-added, and the inputs for each industry is just from the outputs of other industries, the value of the intermediate inputs of each industry shall include VAT and/or business tax as well. Therefore, the overall VAT and business tax included in the price of output of each industry shall be the sum of the two taxes directly paid by the sellers of the goods or services of that industry and the two taxes included in the prices of inputs of that industry. Let t_j denote direct effective tax rate, or the ratio of directly paid VAT and business tax to price of output of the j th industry, τ_j denote indirect effective tax rate, or the ratio of VAT and business tax included in the inputs to price of output of the j th industry, and T_j denote total effective tax rate which is the sum of direct effective tax rate and indirect effective tax rate, we can derive the three effective tax rates as follows.

On the basis of the VAT and business tax rules before and after the VAT enlargement tax reform, we can firstly get the direct effective tax rate for each industry. Let to_j denote the rate applied to the output of the j th industry, for the industries subject to business tax, we have

$$t_j = to_j \quad (2)$$

Where to_j is just the statutory rate; for the industries subject to VAT, in general, we have

$$t_j = to_j - \sum_{i=1}^n a_{ij} \cdot t_i - \sum_{i=1}^n k_{ij} \cdot t_i \quad (3)$$

Where a_{ij} is direct consumption coefficient, k_{ij} reflects the equipment investment from the j th industry per unit of the output of the j th industry. Since the tax base of VAT is tax-exclusive price, to_j is changed to “statutory rate/(1+ statutory rate)”;¹ ti_j denotes the credit rate for the inputs from the i th industry, which is “ statutory rate/(1+ statutory rate)” for inputs from industries subject to VAT, 13% for primary agricultural products produced by farmers, 7% for inputs from transportation industry before the reform and 0% for inputs from other industries subject to business tax. t_j is changed to 0 if $t_j < 0$ or the output is subject to VAT but enjoys exemption, and is changed to 3% for software industry before the reform and leasing industry (in case of tangible movable property leasing) after the reform.¹

Secondly, on the basis of the direct effective tax rates and direct consumption coefficients of inputs, we can derive the amount of VAT and business tax included in the prices of inputs directly consumed by each industry per unit of output of that industry. Since these inputs are produced in turn by consuming the inputs from various industries, according to similar logic, we can further derive the amount of the two taxes included in the prices of inputs indirectly consumed. Let A denote the matrix of direct consumption coefficients, then the matrix of the first indirect consumption coefficients is $A \times A$, the matrix of the second indirect consumption coefficients is $A \times A^2$, the matrix of the k th indirect consumption coefficients is $A \times A^k$. Assume $t = (t_1, t_2, \dots, t_n)^1$, which is the matrix of direct effective tax rates, and assume $\tau = (\tau_1, \tau_2, \dots, \tau_n)^1$, which is the matrix of indirect effective tax rates, then we have²

$$\tau = A' \cdot t + (A \times A)' \cdot t + (A \times A^2)' \cdot t + \dots + (A \times A^k)' \cdot t \quad (4)$$

Also assume $T = (T_1, T_2, \dots, T_n)^1$, which is the matrix of total effective tax rates, then according to its definition, we have

$$T = t + \tau = (I + A + A \times A + A \times A^2 \dots + A \times A^k)' \cdot t \quad (5)$$

For $k \rightarrow \infty$, we can get the limit of T as

$$T = ((I - A)^{-1})' \cdot t \quad (6)$$

On the basis of the results above, by matching the input-output industries with the expenditure items of the households, we can get the effective tax rates of the items purchased by the households and then calculate the burden of VAT and business tax according to the actual expenditure of households.

¹ The statutory rate for software industry before reform and tangible movable property leasing after reform is changed to 3% because the part of VAT that makes the actual burden exceed 3% can be refunded upon collection.

² See Appendix 1 for the derivation of equation (4).

2.2. Measuring the effects of VAT enlargement reform on income redistribution of households

We will evaluate the income redistribution effects of VAT and business tax by comparing the values of some inequality measures for household income before and after the levying of these two taxes. Here the household income means the annual per capita income of the sample households and the inequality measures include Gini coefficient and generalized entropy indexes.

The indicator of redistribution effects of taxation based on Gini coefficient is also called MT index, as it was initially put forward by Musgrave and Thin, two American scholars and could be expressed by the following formula:

$$MT = G_x - G_y \quad (7)$$

where G_x is Gini coefficient for before-tax income, G_y is Gini coefficient for after-tax income, and higher MT index means stronger redistribution effects. By decomposing the MT index, we can further analyze the horizontal equity effects and vertical equity effects of taxation and the influences of progressivity and average tax burden on the redistribution effects.

According to Kakwani (1984),

$$MT = (C_y - G_y) - \frac{tk}{1-t} \quad (8)$$

Where C_y is the concentration index for after-tax income ranked by before-tax income. Since G_y , the coefficient of after-tax income, is equivalent to the concentration index for after-tax income ranked by after-tax income, $(C_y - G_y)$ reflects the impact of re-ranking of the household income due to taxation and is referred to as the horizontal equity effect.

The second term in the equation (8) measures the vertical equity effects, where t is the average tax burden and K is the progressivity index put forward by Kakwani, which can be calculated by using the following formula:

$$K = C_t - G_x \quad (9)$$

Where C_t is the concentration index for tax payable ranked by before-tax income. Since G_x , the coefficient of before-tax income, is equivalent to the concentration index for before-tax income ranked by before-tax income, $(C_t - G_x)$ reflects the relative inequality of tax payable in comparison to the before-tax income.

Although Gini coefficient is frequently used as an inequality index that measures the income gap, it is not perfect. Suppos there is a pair of income distributions, x and y , x is more equitable than y only when x exceeds y in every point of the Lorenz Curve. Inequality indexes that are sensitive to the bottom, middle and top of the distribution curve should be considered together, rather than just the Gini coefficients of x and y .

The generalized entropy index put forward by Cowell (2011) is an inequality measure which contains a sensitivity parameter θ . When θ is given different values, the generalized entropy index is sensitive to the bottom, middle and top of the distribution curve respectively. So in this paper, we will try to refer to the idea of *MT* index to make further calculation of the income redistribution effects of taxation on the basis of the generalized entropy index.

RE, the income redistribution effect based on the generalized entropy index, can be calculated as:

$$RE = GE_{\theta}^x - GE_{\theta}^y \quad (10)$$

where GE_{θ}^x is the generalized entropy index for before-tax income and GE_{θ}^y is that for after-tax income. Larger value of *RE* indicates stronger redistribution effects of taxation, which is similar to *MT* index. Four important values, -1, 0, 1 and 2 of θ are applied in the calculation in this paper. If the value of *RE* is larger when θ equals 2, it indicates that the taxation is more effective in narrowing the income gap within the high-income group; on the contrary, if the value of *RE* is larger when θ equals -1, the taxation is more effective in narrowing the income gap within the low-income group.

By decomposing the generalized entropy index, we can easily decompose the redistribution effects into the between-group effects and within-group effects and obtain more structural information.

2.3. The data

The input-output data is from the 135-industry input-output table in 2007 published by the National Statistics Bureau of China. This table provides the most detailed input-output information with regard to industries. But according to the rules of VAT and business tax, there are still some cases where the products of a specific industry may be subject to different tax treatment. For instance, in the industry of “liquid milk and dairy products manufacturing”, the applicable VAT rate for “liquid milk” shall be 13% and for “dairy products” shall be 17%; and in the industry of agriculture, the self-produced products by the farmers shall be exempt from the output VAT and deducted at the rate of 10% if purchased by other VAT payers, while other agricultural products shall be taxed and deducted both at the rate of 13%, etc. In order to make our estimation more accurate, we breakdown some of the industries in the current input-output table so as to achieve a new 149-industry input-output table (See Appendix 2 for detailed information).

The household income and expenditure data is from the 2012 Urban Household Survey Data provided by the National Statistics Bureau. The sample includes 11271 households from China’s Liaoning, Sichuan, Guangdong provinces and Shanghai Municipality. The household consumption in the data is divided into 8 categories such as “food”, “clothing”, “residence”, “household facilities and articles”, “health”, “traffic and communications”, “education, culture and recreation”, and “other goods and services”. Each category is further broken

down into several sub-items. We try to match the input-output industry with the consumption items according to Urban Household Survey Manual and Category of Products for Statistics published by the National Statistics Bureau. However, since a specific consumption item in the Urban Household Survey Data may involve products from more than one industry, we have to breakdown some of the consumption items and allocate the consumption amounts among the related industries according to the nature of the goods or services involved (See Appendix 3 for detailed information).

Besides, in order to estimate the direct effective rate for each industry liable to VAT, we need the information about the equipment investment from other industries per unit of output of that industry, namely the k_{ij} in equation (3). Our data source for the equipment investment of each industry is the 2008 Fixed Assets Investment Yearbook (again adjusted according to the allocation rates in Appendix 2). We assume the equipment investment of the industry of “agriculture, forestry, husbandry and fishing” is from the industry of “agriculture, forestry, husbandry and fishingspecial equipment manufacturing” (the deducted rate is 13%), and the equipment investment of other industries is from the industry of other special equipment manufacturing (the deducted rate is 17%).

3. Estimation results

3.1. The direct effective tax rates and total effective tax rates

We divide all the 149 industries into three categories, namely, the industry which is subject to VAT both before and after the VAT enlargement reform (VAT industry), the industry which is subject to business tax both before and after the VAT enlargement reform (BT industry) and the industry which is subject to business tax before the reform and VAT after the reform (Trial industry). Figure 1 illustrates the direct effective tax rates and total effective tax rates calculated according to the statutory rates of VAT and business tax before and after the reform respectively, where the industries are ranked according to the statutory rates before the reform.

Obviously, there exists a gap between the direct effective tax rates and total effective tax rates so that the amount of the two taxes included in the inputs constitutes an important component of the overall burden of the two taxes included in the prices of various goods or services. The VAT enlargement reform has brought tax-cut to all three categories of industries, especially in terms of the total effective tax rates. As for the difference among the industries, the tax burden of the “trial industry” changes more significantly and the tax burden of the “VAT industry” drops slightly more than the “BT industry”. As for the differences within each category, the extents of tax-cut both within “BT industry” and within “VAT industry” are similar. But the extents of tax-cut within “Trial industry” vary dramatically, as the direct effective tax rates of some modern service industries dropped to 0 and those of post and some transportation industries are even higher after the tax reform.

In general, since the burden of VAT and business tax is lowered in most industries due to

the tax reform, the tax burden borne by the consumers of various goods and services shall be lower as well. Therefore, it is likely that the VAT enlargement reform can help to improve the redistribution effects of the two taxes. However, the tax-cut in most industries is only marginal, which may bring some doubts on this possible positive effect. Meanwhile, the variance in the total effective tax rates among industries is widened by the reform, which may make the burden of VAT and business tax depend more on the structure of consumption of the households. As such, the exact impact of the VAT enlargement reform on the income redistribution effects of the two taxes is rather unclear and should be determined by further serious analysis.

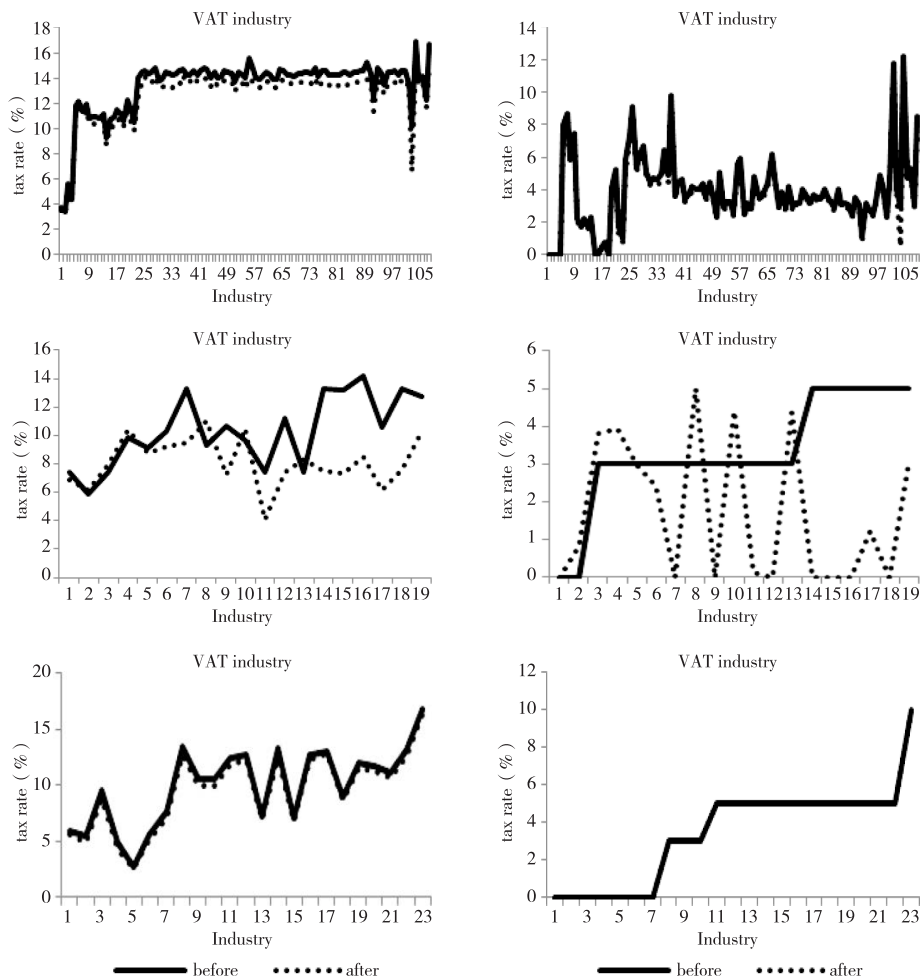


Figure 1. Total and direct effective tax rates of three categories of industries before and after the VAT enlargement reform

3.2. The effective tax rates of the household consumption on various goods and services

Table 1 reports the effective tax rates of major household consumption items before and

after the VAT enlargement reform. For each major consumption item, we adopt the weighted average of the effective tax rates of its sub-items. Actually, the effective tax rates for all the major consumption items have dropped after the reform with the tax reduction rate for “transportation and communications” highest and the tax reduction rate for “food” lowest. In terms of the absolute value of effective tax rate after reform, the lowest burden is for the “education, culture and entertainment services” and the highest burden is for the “household equipment and devices”.

However, with regard to the consumption structure of the sample households, “food” and “residence” constitute more important consumption items for low-income households, while “household facilities and articles”, “traffic and communications” and “education, culture and recreation” constitute more important consumption items for high-income households (See Figure1). This means the direction of tax-cut caused by the VAT enlargement reform is not fully consistent to the improvement of the redistribution effects of the two taxes.

Table1

The effective tax rate of major consumption items before and after the reform (%)

Item	Effective tax rate		% of decline in tax rate
	Before reform	After reform	
Food	11.5	11.0	4.4
Clothing	14.6	13.9	5.3
Housing	11.6	11.0	4.8
Household facilities and articles	14.3	13.4	6.4
Health	12.9	11.9	7.7
Traffic and communications	11.0	10.1	8.1
Education, culture and recreation	10.6	10.0	5.6
Other goods and services	13.6	12.7	6.0

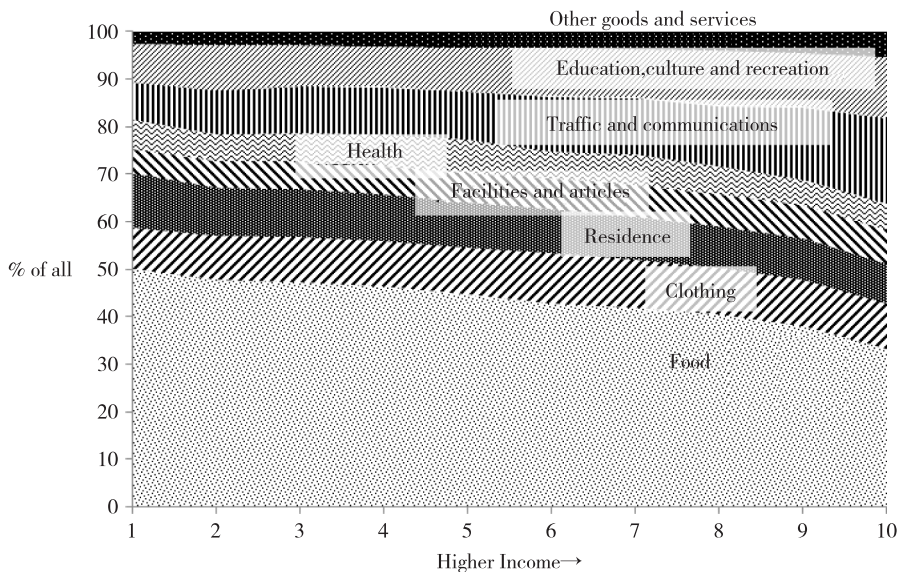


Figure 2. The consumption structure of 10 groups of households

3.3. The redistribution effects of VAT and business tax and the influence of the reform

Table 2 reports the calculated redistribution effects of VAT and business tax before and after the reform. In general, the redistribution effects of the two taxes are regressive both before and after the reform. But the reform has improved the redistribution effects of the two taxes by lowering the regressivity.

Table 2

Redistribution effects of VAT and business tax before and after the reform

Equity Measure	Before the reform			After the reform			% of decline in RE
	Before Tax Income	Before Tax Income	RE	Before Tax Income	Before Tax Income	RE	
GE ₂	0.2605	0.2666	-0.0061	0.2605	0.2660	-0.0056	8.2%
GE ₁	0.1951	0.1991	-0.0040	0.1951	0.1987	-0.0036	10.0%
GE ₀	0.1904	0.1943	-0.0039	0.1904	0.1939	-0.0035	10.3%
GE ₋₁	0.2535	0.2507	0.0028	0.2535	0.2492	0.0044	57.1%
Gini	0.3331	0.3367	-0.0035	0.3331	0.3364	-0.0032	8.6%

However, when measuring on the basis of different inequality measures, we achieve quite different results for the impact of the reform on the redistribution effects of the two taxes. In particular, if we choose the generalized entropy index with θ equal to -1 as the inequality measure, the redistribution effects of the two taxes become progressive both before and after the reform and the improvement of redistribution effects caused by the reform seems rather considerable. Therefore, we will try to make further analysis by decomposing the results in Table 2.

We firstly decompose the results achieved on the basis of Gini coefficient. As indicated in Table 3, in terms of both horizontal equity and vertical equity, the income gap of the sample households is widened by the “two taxes” but narrowed by the VAT enlargement reform. As for the vertical equity, since the percentage of reduction of the average tax rate is more than that of the regressivity, we can derive that the reform improved the redistribution effects of the two taxes mainly through lowering the overall tax burden instead of lowering the tax burden of the low-income households.

Table 3

Decomposition of the MT index for VAT and business tax before and after the reform

Tax regime (1)	MT index (2)	Horizontal equity (3)	Vertical equity (4)	Progressivity (5)	Average tax rate (6)
Before reform	-0.00352	-0.00133	-0.00220	-0.02562	0.08571
After reform	-0.00318	-0.00117	-0.00201	-0.02506	0.08029
% of change	9.7%	12.0%	8.6%	2.2%	6.3%

Note: (2)=(3)+(4), (4)=(5)×(6)

Secondly, we decompose the results achieved on the basis of generalized entropy index. Table 4 presents the decomposing of the before-tax income inequality of sample households and the redistribution effects of the two taxes on the basis of GE2 and GE-1 with G1 to G5 standing for five groups with household income from low to high. With regard to within-group effects, when measured on the basis of GE2, the redistribution effects of the two taxes are regressive for all the 5 groups and the reform just slightly reduces the regressivity; but when measured on basis of GE-1, the redistribution effects become progressive for two low-income groups (G1 and G3) and the reform significantly increases the progressivity. With regard to between-group effects, the redistribution effects of the two taxes are regressive on the basis of both GE2 and GE-1 and the reform slightly reduces the regressivity. As smaller value of θ gives more weight to low-income groups, the overall redistribution effects of the two taxes are progressive when measured by GE-1 and the reform significantly increases the progressivity.

Therefore, the above inconsistency in the estimation of the redistribution effects of the two taxes is just due to the different sensitivity of different inequality measures to the structural features of income distribution. We can summarize the results in Table 4 as follows: (1) The “two taxes” has narrowed the income gap within the low-income groups but has not helped to narrow the income gap within the high-income groups and between the high-income and low-income groups; (2) The VAT enlargement reform further narrowed the income gap within the low-income groups but has not helped much in narrowing the income gap between household groups of different income levels.

Table 4

Breakdown of the redistribution effects before and after the reform (based on GE2 and GE-1)

Group	GE2					GE-1				
	Inequality before tax			RE		Inequality before tax			RE	
	GE_0^x	Weight	Contribution(%)	Before reform	After reform	GE_0^x	Weight	Contribution(%)	Before reform	After reform
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
G1	0.0394	0.1407	0.0043	-0.0021	-0.0019	0.1078	2.6663	0.227	0.0149	0.0159
G2	0.0043	0.3779	0.0013	-0.0013	-0.0011	0.0044	1.6268	0.0056	-0.0020	-0.0017
G3	0.0036	0.6878	0.0019	-0.0015	-0.0014	0.0036	1.2057	0.0034	0.0008	0.0029
G4	0.0049	1.2730	0.0048	-0.0013	-0.0012	0.0049	0.8863	0.0034	-0.0017	-0.0015
G5	0.1044	4.2148	0.3377	-0.0035	-0.0031	0.0566	0.4871	0.0217	-0.0047	-0.0039
Between	0.1694	.	0.6501	-0.0020	-0.0019	0.1873	.	0.7389	-0.0034	-0.0032
Total	0.2605	.	1	-0.0061	-0.0056	0.2535	.	1	0.0028	0.0044

Note: (4)=(2)×(3)×100%, (9)=(7)×(8)×100%, where (3) and (8) represent the weights assigned to each group. Assume the average income of the i th group is $\bar{y}_i$, the overall average income is $\bar{y}$, the ratio of the population of the i th group to the overall population is m_i , the weight is W_i , then $w_i = m_i (\bar{y}_i / \bar{y})^\theta$.

We also show the average burden of the “two taxes” of household groups of different income levels before and after the reform in Table 5. It is clear that the reform has lowered the tax burden of the household groups of all income levels, and the lower-income groups got more tax reduction. But apart from the household group with the lowest income level, most household groups got similar tax reduction. This is consistent to the above structural features of the impact of the reform on the redistribution effects of the two taxes.

Table 5

The average tax burden of 10 groups of households before and after the reform

Group	Before	After	Tax cut	Group	Before	Before	Tax cut
1	9.86	10.44	-0.58	6	7.52	7.96	-0.44
2	8.02	8.48	-0.47	7	7.32	7.75	-0.43
3	7.95	8.42	-0.47	8	7.26	7.69	-0.42
4	7.79	8.25	-0.46	9	7.49	7.92	-0.44
5	7.69	8.14	-0.46	10	7.11	7.53	-0.41

Note: Tax burden = VAT and business tax burden / Household income.

4. Simulation of the redistribution effects of different VAT regimes

So far, our analysis indicates the positive impact of VAT and business tax on narrowing the income gap within low-income groups. But since this positive impact is quite limited, in general, the redistribution effects of VAT and business tax are still regressive when measured on the basis of Gini coefficient and several other inequality measures. Meanwhile, the VAT enlargement reform has improved the redistribution effects of the two taxes, but the improvement is quite limited as well.

According to China's 12th five-year plan, the VAT enlargement reform will continue and finally subject all the goods and services to VAT, but the rules for several industries which currently are still liable to business tax are still under discussion and the overall VAT system need to be streamlined after the reform. Therefore, we will try to estimate the desirable VAT statutory rates for the industries subject to business tax at present (or future pilot industries) and further simulate the redistribution effects of several alternative VAT regimes so as to provide references for the future VAT adjustments.

For the purpose of tax neutrality, the statutory VAT rates should be as few as possible. So the VAT rates applicable to the future pilot industries should be selected just from 17%, 13%, 11% and 6% which are the current VAT statutory rates for general taxpayers. Since the VAT enlargement reform requires “stable tax-cut” for the pilot industries, we just calculate the direct effective tax rates for the future pilot industries on the basis of each of the 4 possible statutory VAT rates, and for each industry, we choose the rate which leads to the lowest positive tax-cut as

the desirable statutory rate (See Table 6). Apart from the traditional tax-exempt industries such as education, health, our desirable statutory rates for the industries such as banking, securities and real estate are 6%, for other industries are 11%, 13% or even 17%, and can get tax reduction rate of as high as 20% for most industries.

Based on the above desirable statutory VAT rates for the future pilot industries, we give the measure of the redistribution effects of the new VAT regime. Meanwhile, we also examine four alternative regimes which are likely to improve the redistribution effects of VAT, namely: (1) VAT with overall rate reduction. Under this regime, the statutory rates of all items (excluding those exempt under former VAT and business tax rules) are reduced to 13% or 11%. (2) VAT with selected rate reduction. Under this regime, the necessities (or the items currently subject to VAT at the rate of 13% and accounting for more proportion in the consumption of low-income households) are taxed at lower statutory rate of 6% or exempt.

Table 6
The desirable statutory VAT rates for future trial industries(%)

Industry	VAT rate	Direct effective tax rate		Tax-cut rate	Industry	VAT rate	Direct effective tax rate		Tax-cut rate
		Before reform	After reform				Before reform	After reform	
Entertainment	17	10	7.5	25.2	Other services	13	5	3.5	30.7
Leasing(other than movable property)	13	5	3.2	35.9	Culture and Arts (non-exempt item)	11	3	2.5	16.4
Hoteling	13	5	4.1	17.8	Sports	11	3	1.6	45.2
Catering	13	5	3.6	28.1	Construction	13	3	1.2	59.5
Insurance	11	5	3.0	40.8	Education	0	0	0.0	-
Tourism	13	5	3.9	22.0	Health	0	0	0.0	-
Real estate	6	5	3.5	30.0	Social security	0	0	0.0	-
Environmental management	13	5	3.1	37.4	Social welfare	0	0	0.0	-
Public facilities management	13	5	2.8	44.7	Agricultural Services	0	0	0.0	-
Banking, securities and other financial activities	6	5	3.8	23.6	Public management and social organizations	0	0	0.0	-
Water conservancy management	11	5	4.7	5.3	Culture and Arts (exempt)	0	0	0.0	-
Household services	11	5	4.1	17.8					

As indicated in Table 7, given the stable tax-cut for the future pilot industries, finally the VAT enlargement reform will only slightly improve the redistribution effects of the two taxes. As for future VAT adjustments, in comparison to overall tax reduction, granting greater tax relief to necessity items will improve the redistribution effects of VAT more effectively.

Table 7

Simulated redistribution effects of typical GST regimes

RE	Regime	Current VAT/BT	VAT after enlargement	VAT with overall rate reduction		VAT with selected rate reduction	
				13%	11%	6%	exemption
	GE ₂	-0.0056	-0.0054	-0.0037	-0.0032	-0.0029	-0.0024
	GE ₁	-0.0036	-0.0035	-0.0024	-0.0022	-0.0019	-0.0015
RE	GE ₀	-0.0035	-0.0033	-0.0023	-0.0020	-0.0017	-0.0013
	GE ₋₁	0.0044	0.0043	0.0075	0.0081	0.0083	0.0088
	Gini	-0.0032	-0.0030	-0.0022	-0.0020	-0.0017	-0.0014

5. Conclusions

On the basis of the input-output table and urban household survey data, this paper studied the impact of China's recent VAT enlargement reform on the redistribution effects of VAT and business tax as a whole.

We derive the method to measure the full burden of VAT and business tax included in the prices of goods and services purchased by households on the basis of the statutory rates of the two taxes. It is found that the reform only slightly lowered the tax burden of purchasing the goods and services from most industries, and has not brought more tax-cut for such items as "food", which are more important in the consumption structure of low-income households. This reflects the fact that narrowing income gap is not main and direct purpose of the reform.

But the reform still influences the income distribution of the urban households. The analysis based on most inequality measures indicates the reform has improved the redistribution effects of VAT and business tax. In contrast, according to several authors, though having taken the narrowing of income gap as the main target, China's adjustments of Individual Income Tax system in 2011 just weakened the redistribution effects of that tax. So the positive effects of VAT enlargement reform on income redistribution are worth of due attention.

According to further decomposing analysis, instead of lowering the tax burden of low-income households, the VAT enlargement reform has actually improved the redistribution effects of the "two taxes" through reducing the tax burden of all the households. Moreover, the reform has narrowed the income gap within the low-income groups, but failed to narrow the income gap between groups of different income levels. This means there is still considerable space for strengthening the income redistribution through future adjustments of the VAT system.

In order to find the VAT regime that has stronger redistribution effects, we estimate the desirable statutory VAT rates for future pilot industries, and partly based on which simulate the redistribution effects of various VAT regime. The results suggest the regime granting greater tax relief to necessity items will improve the redistribution effects of VAT more effectively.

Appendix 1

The indirect effective tax rate of a specific industry is the VAT and business tax included in the prices of inputs directly and indirectly consumed per unit of output of that industry.

We first consider the VAT and business tax included in the prices of inputs directly consumed. Assume there are n industries in the economy, then according to the definition of direct consumption coefficient, we have

$$A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} \quad (11)$$

where a_{ij} represents the quantity of inputs from the i th industry per unit of output of the j th industry. And according to the definition of the matrix of direct effective tax rates, we have

$$t = \begin{pmatrix} t_1 \\ t_2 \\ \vdots \\ t_n \end{pmatrix} \quad (12)$$

where t_i represents the direct effective tax rate of the i th industry. Therefore, the VAT and business tax included in the prices of inputs directly consumed by the j th industry is

$$t0_j = a_{1j} \cdot t_1 + a_{2j} \cdot t_2 + \dots + a_{nj} \cdot t_n \quad (13)$$

Assume the matrix of effective tax rates for direct consumption is $t0 = (t0_1, t0_2, \dots, t0_n)'$, then

$$t0 = A' \cdot t \quad (14)$$

Secondly, we consider the VAT and business tax included in the prices of inputs indirectly consumed. With regard to the inputs from various industries directly consumed by the j th industry, each unit is produced by consuming the inputs from other industries as well, and the prices of the inputs shall still include VAT and business tax. Based on the direct consumption coefficient matrix, we can derive the inputs from the i th industry indirectly consumed by the j th industry for the first time as $a_{1j} \cdot a_{i1} + a_{2j} \cdot a_{i2} + \dots + a_{nj} \cdot a_{in}$, so the included two taxes shall be

$$t1_j = (a_{1j} \cdot a_{11} + a_{2j} \cdot a_{12} + \dots + a_{nj} \cdot a_{1n}) \cdot t_1 + (a_{1j} \cdot a_{21} + a_{2j} \cdot a_{22} + \dots + a_{nj} \cdot a_{2n}) \cdot t_2 + \dots + (a_{1j} \cdot a_{n1} + a_{2j} \cdot a_{n2} + \dots + a_{nj} \cdot a_{nn}) \cdot t_n \quad (15)$$

Let $t1$ denote the matrix of effective tax rates for the first indirect consumption, and $t1=(t1_1, t1_2, \dots, t1_n)'$, then from equation (15) we can get

$$t1=(A \times A)' \cdot t \quad (16)$$

Similarly, let tk denote the matrix of effective tax rates for the k th indirect consumption, we have

$$tk=(A \times A^k)' \cdot t \quad (17)$$

Therefore, we get

$$\tau=A' \cdot t+(A \times A)' \cdot t+(A \times A^2)' \cdot t+ \dots +(A \times A^k)' \cdot t \quad (18)$$

Appendix 2

Industries in the input-output table and their statutory tax rates

Tax Rule		Industry	New code	Original code	Allocation rate ¹	Tax rate	
						Before reform	After reform
VAT industry	exempt	Farming, forestry, animal husbandry and fishery (by farmers)	136-139	001-004	0.20	0	0
	Low Rate	Farming, forestry, animal husbandry and fishing (non-farmers)	001-004	001-004	0.80	0.13	0.13
		Grain grinding	011	011	1.00	0.13	0.13
		Forage processing	012	012	1.00	0.13	0.13
		Vegetable oil refining	013	013	1.00	0.13	0.13
		Food processing (Rare)	015-017	015-017	0.50	0.13	0.13
		Liquid milk and Dairy Products manufacturing (Liquid Milk)	143	019	0.50	0.13	0.13
		Fertilizer manufacturing	040	040	1.00	0.13	0.13
		Pesticide manufacturing	041	041	1.00	0.13	0.13
		Manufacturing of special purpose machinery for agriculture, forestry, animal husbandry and fishery	071	071	1.00	0.13	0.13
		Production and supply of electric power and heat power (Heat power)	144	092	0.20	0.13	0.13
		Production and distribution of gas	093	093	0.20	0.13	0.13
		Production and distribution of water	094	094	0.20	0.13	0.13
		Broadcasting, movies, televisions and audiovisual activities (Audiovisual activities)	148	131	0.20	0.13	0.13

Tax Rule		Industry	New code	Original code	Allocation rate ¹	Tax rate	
						Before reform	After reform
VAT industry	Stand- ard rate	Journalism and publishing	130	130	0.90	0.13	0.13
		Sugar manufacturing	014	014	1.00	0.17	0.17
		Food processing (cooked)	140-142	015-017	0.50	0.17	0.17
		Liquid milk and dairy products manufacturing (dairy products)	019	019	0.50	0.17	0.17
		Mining	006-010	006-010	1	0.17	0.17
		Manufacturing of other products	018, 020-039, 042-070, 072-091	018, 020-039, 042-070, 072-091	1.00	0.17	0.17
		Computer services (repair)	146	146	0.20	0.17	0.17
		Production and supply of electric power and heat power (Electric power)	092	092	0.80	0.17	0.17
		Wholesale and retail trades	108	108	1.00	0.17	0.17
		Software industry	107	107	1.00	0.173	0.06
Trial industry		Transportation	096-101	096-101	1.00	0.03*2	0.11
		Loading, unloading, portage and other transport services	102	102	1.00	0.03*	0.06
		Storage	103	103	1.00	0.05*	0.06
		Post	104	104	1.00	0.03*	0.11
		Telecom and other information transmission services (high-level services)	105	105	0.50	0.03*	0.06
		Telecom and other information transmission services (basic services)	145	105	0.50	0.03*	0.11
		Computer services (other than repair)	106	106	0.80	0.05*	0.06
		Leasing	114	114	1.00	0.05*	0.17
Trial industry		Business services	115	115	1.00	0.05*	0.06
		Research and Experimental Development	117	117	1.00	0*	0.06
		Professional technical services	118	118	1.00	0.05*	0.06
		Science and technology exchanges and promotion	119	119	1.00	0*	0.06
		Geological Prospecting	120	120	1.00	0.05*	0.06
		Broadcasting, movies, televisions and audiovisual activities (Broadcasting, movies and televisions)	131	131	0.80	0.03*	0.06

Tax Rule	Industry	New code	Original code	Allocation rate ¹	Tax rate	
					Before reform	After reform
BT-Indus_try	Services in support of agriculture	005	005	1.00	0.05*	0.05*
	Construction	095	095	1.00	0.03*	0.03*
	Hoteling	109	109	1.00	0.05*	0.05*
	Catering	110	110	1.00	0.05*	0.05*
	Banking, securities and other financial activities	111	111	1.00	0.05*	0.05*
	Insurance	112	112	1.00	0.05*	0.05*
	Real estate	113	113	1.00	0.05*	0.05*
	Leasing	114	114	0.50	0.05*	0.05*
	Tourism	116	116	1.00	0.05*	0.05*
	Water conservancy management	121	121	1.00	0.05*	0.05*
	Environment management	122	122	1.00	0.05*	0.05*
	Public facilities management	123	123	1.00	0.05*	0.05*
	Household services	124	124	1.00	0.05*	0.05*
	Other services	125	125	1.00	0.05*	0.05*
	Education	126	126	1.00	0*	0*
	Health	127	127	1.00	0*	0*
	Social security	128	128	1.00	0*	0*
	Social welfare	129	129	1.00	0*	0*
	Sports activities	133	133	1.00	0.03*	0.03*
	Entertainment	134	134	1.00	0.14*	0.10*
	Public management and social organization	135	135	1.00	0*	0*
	Cultural and art activities (non-exempt items)	149	132	0.80	0.03*	0.03*
	Cultural and art activities (exempt items)	132	132	0.20	0*	0*

Note: 1. Allocation rate=input (output) of new code/input (output) of original code. 2.The mark “*” represents rate of business tax. 3.The rate for software industry before reform and tangible movable property leasing after reform is 3% because the part of VAT that makes the actual burden exceed 3% can be refunded upon collection. 4. The applicable rate for entertainment industries ranges from 5% to 20%, so we adopt the middle level of 10%.

Appendix 3

Matching of the consumption items with industries

No.	Consumption item		Industry	Code	Allocation rate ¹
1	Rice	Grain grinding		011	1
2	Flour	Grain grinding		011	1
3	Other grain and products	Grain grinding		011	0.5
4	Other grain and products	Fast food manufacturing		018	0.5

No.	Consumption item	Industry	Code	Allocation rate1
5	Starch and patatos	Agriculture	001	0.45
6	Starch and patatos	Other foods processing	017	0.45
7	Starch and patatos	Grain grinding	011	0.1
8	Dry beans and bean products	Other foods processing	017	0.5
9	Dry beans and bean products	Agriculture	001	0.5
10	Edible vegetable oil	Vegetable oil refining	013	1
11	Edible animal oil	Other foods processing	017	1
12	Meat	Slaughtering and meat processing	015	1
13	Poultry	Animal husbandry	003	0.5
14	Poultry	Slaughtering and meat processing	015	0.5
15	Egg	Animal husbandry	003	1
16	Egg products	Other foods processing	017	1
17	Aquatic products	Fishery	004	0.5
18	Aquatic products	Aquatic product processing	016	0.5
19	Fresh vegetables	Agriculture	001	1
20	Dried vegetables	Agriculture	001	1
21	Vegetable products	Other foods processing	017	1
22	Flavorings	Flavoring and ferment product manufacturing	020	1
23	Sugar	Sugar manufacturing	014	1
24	Tobacco	Tobacco manufacturing	024	1
25	Wine	Alcohol and wine manufacturing	022	1
26	Drinks	Soft drinks and purified tea processing	023	1
27	Fresh fruit	Agriculture	001	1
28	Fresh melon	Agriculture	001	1
29	Other fruits and melons and products	Agriculture	001	0.5
30	Other fruits/melons and products	Other foods processing	017	0.5
31	Cakes	Other foods manufacturing	021	1
32	Fresh milk	Liquid mild and dairy products manufacturing	019	1
33	Milk powder	Liquid mild and dairy products manufacturing	019	1
34	Yoghurt	Liquid mild and dairy products manufacturing	019	1
35	Other diary products	Liquid mild and dairy products manufacturing	019	1
36	Other food	Other foods manufacturing	021	1
37	Food processing fees	Household services	124	1
38	Dining out	Catering	110	1
39	Clothes	Leather, fur, feather(down) and its products manufacturing	031	0.5
40	Clothes	Textile wearing apparel, footwear and caps manufacturing	030	0.5
41	Clothing materials	Textile products manufacturing	028	0.25
42	Clothing materials	Spinning and weaving of hemp and tiffany	027	0.25

No.	Consumption item	Industry	Code	Allocation rate1
43	Clothing materials	Spinning and weaving, dyeing and finishing of wool	026	0.25
44	Clothing materials	Spinning and weaving, printing and dyeing of cotton and chemical fiber	025	0.25
45	Shoes	Plastic manufacturing	049	0.2
46	Shoes	Rubber manufacturing	048	0.2
47	Shoes	Leather, fur, feather(down) and its products manufacturing	031	0.4
48	Shoes	Textile wearing apparel, footwear and caps manufacturing	030	0.2
49	Other Clothing articles	Plastic manufacturing	049	0.2
50	Other Clothing articles	Knitted fabric and its products manufacturing	029	0.2
51	Other Clothing articles	Textile products manufacturing	028	0.2
52	Other Clothing articles	Textile wearing apparel, footwear and caps manufacturing	030	0.2
53	Other Clothing articles	Leather, fur, feather(down) and its products manufacturing	031	0.2
54	Clothes processing fees	Other services	125	0.5
55	Clothes processing fees	Household services	124	0.5
56	Furniture	Furniture manufacturing	033	1
57	Household facilities	Household electric and non-electric appliances manufacturing	080	1
58	soft furnishings	Other electric machinery and equipment manufacturing	081	0.25
59	soft furnishings	Textile products manufacturing	028	0.25
60	soft furnishings	Artwork manufacturing and other manufacturing	090	0.5
61	Bedding articles	Textile products manufacturing	028	1
62	Household groceries	Metal products manufacturing	063	0.2
63	Household groceries	Glass and its products manufacturing	053	0.1
64	Household groceries	Paper and paper products manufacturing	034	0.1
65	Household groceries	Manufacturing of chemical products for daily use	045	0.1
66	Household groceries	Pottery and Porcelain manufacturing	054	0.1
67	Household groceries	Rubber manufacturing	048	0.1
68	Household groceries	Plastic manufacturing	049	0.1
69	Household groceries	Artwork manufacturing and other manufacturing	090	0.2
70	Furniture materials	Furniture manufacturing	033	1
71	Household services	Household services	124	1
72	Processing the repair services	Other services	125	1
73	Medical appliances	Household electric and non-electric appliances manufacturing	080	1
74	Healthcare appliances	Household electric and non-electric appliances manufacturing	080	1
75	Medicine	Medicine manufacturing	046	1
76	Nourishing health products	Other foods manufacturing	021	1
77	Medical fees	Health	127	1

No.	Consumption item	Industry	Code	Allocation rate1
78	Other medical and healthcare expenses	Sports activities	133	0.5
79	Other medical and healthcare expenses	Artwork manufacturing and other manufacturing	090	0.5
80	Motorcycles	Other transportation equipment manufacturing	076	1
81	Scooters	Other transportation equipment manufacturing	076	1
82	Cars	Automobiles manufacturing	074	1
83	Other vehicles	Other transportation equipment manufacturing	076	1
84	Vehicle Fuel	Processing of petroleum and nuclear fuel	037	1
85	Vehicle parts	Other transportation equipment manufacturing	076	1
86	Other vehicle expenses	Other transportation equipment manufacturing	076	1
87	Vehicle repair fees	Other services	125	1
88	Taxes and fees for car use	Public management and social organizations	135	1
89	Taxes and fees for use of other vehicles	Public management and social organizations	135	1
90	Plane	Air Transportation	100	1
91	Railway	Railway transportation	096	1
92	Long-distance bus	Road Transportation	097	1
93	In-town public traffic	Urban public traffic	098	1
94	Taxi	Urban public traffic	098	1
95	Other traffic fees	Water transportation	099	1
96	Communication appliances	Manufacture of communication equipment	082	1
97	Telecom fees	Telecom and other information transmission services	105	1
98	Post fees	Post	104	1
99	Other communication fees	Telecom and other information transmission services	105	1
100	Color TVs	Manufacture of household audiovisual apparatus	086	1
101	Computers	Computer manufacturing	084	1
102	Audio systems	Manufacture of household audiovisual apparatus	086	1
103	Video cameras	Manufacture of household audiovisual apparatus	086	1
104	Cameras	Manufacture of machinery for cultural activity and office work	089	1
105	Pianos	Manufacture of articles for culture, education and sports activities	036	1
106	Other high-end instruments	Manufacture of articles for culture, education and sports activities	036	1
107	Fitness appliances	Manufacture of articles for culture, education and sports activities	036	1
108	Electronic dictionaries	Other electronic equipment manufacturing	087	1
109	Video-audio products and software	Broadcasting, movies, televisions and audiovisual activities	131	0.4
110	Video-audio products and software	Software	107	0.3
111	Video-audio products and software	Journalism and publishing	130	0.3
112	Sports articles	Manufacture of articles for culture, education and sports activities	036	1

No.	Consumption item	Industry	Code	Allocation rate ¹
113	Books, newspaper and magazines	Journalism and publishing	130	1
114	Paper and stationery	Manufacture of articles for culture, education and sports activities	036	1
115	Other cultural and recreation articles	Other electronic equipment manufacturing	087	0.9
116	Other cultural and recreation articles	Manufacture of articles for culture, education and sports activities	036	0.1
117	Visiting and travelling	Tourism	116	1
118	Fitness activities	Sports activities	133	1
119	Group travelling	Tourism	116	1
120	Other cultural and recreation activities	Broadcasting, movies, televisions and audiovisual activities	131	0.25
121	Other cultural and recreation activities	Cultural and art activities	132	0.25
122	Other cultural and recreation activities	Entertainment	134	0.5
123	Cultural and recreation appliances repair	Computer services	106	0.5
124	Cultural and recreation appliances repair	Other services	125	0.5
125	Textbooks and reference books	Journalism and publishing	130	1
126	Education software	Software	107	0.5
127	Education software	Journalism and publishing	130	0.5
128	Other textbooks	Journalism and publishing	130	1
129	Education fees	Education	126	1
130	House rents	Real estate	113	1
131	House decoration expenses	Construction	095	1
132	Construction materials for repairing	Glass and its products manufacturing	053	0.2
133	Construction materials for repairing	Processing of timbers and manufacture of wood, bamboo, rattan, palm and straw products	032	0.2
134	Construction materials for repairing	Metal products manufacturing	063	0.2
135	Construction materials for repairing	Cement and plaster products manufacturing	051	0.2
136	Construction materials for repairing	Brick, stone and other building materials manufacturing	052	0.2
137	Other residence expenses	Real estate	113	1
138	Water	Production and distribution of water	094	1
139	Electricity	Production and supply of electric power and heat power	092	1
140	Coal	Artwork manufacturing and other manufacturing	090	0.5

No.	Consumption item	Industry	Code	Allocation rate ¹
141	Coal	Mining and washing of coal	006	0.5
142	Filled liquefied petroleum gas	Processing of petroleum and nuclear fuel	037	1
143	Pipeline liquefied petroleum gas	Production and distribution of gas	093	1
144	Pipeline coal gas	Production and distribution of gas	093	1
145	Pipeline natural gas	Production and distribution of gas	093	1
146	Other fuel	Alcohol and wine manufacturing	022	0.2
147	Other fuel	Processing of petroleum and nuclear fuel	037	0.8
148	Heating	Production and supply of electric power and heat power	092	1
149	Other relevant expenses	Production and distribution of gas	093	0.25
150	Other relevant expenses	Processing of petroleum and nuclear fuel	037	0.25
151	Other relevant expenses	Production and supply of electric power and heat power	092	0.25
152	Other relevant expenses	Production and distribution of water	094	0.25
153	Residence services	Real estate	113	1
154	Gold, silver and jewelleryes	Artwork manufacturing and other manufacturing	090	1
155	Watches	Manufacture of measuring instruments	088	1
156	Haircut and beauty appliances	Household electric and non-electric appliances manufacturing	080	1
157	Cosmetics	Manufacturing of chemical products for daily use	045	1
158	Other goods	Artwork manufacturing and other manufacturing	090	1
159	Hotel expenses	Hoteling	109	1
160	Haircut and bathing expenses	Household services	124	1
161	Beauty expenses	Household services	124	1
162	Other services	Household services	124	1

Note: 1. Allocation rate represent the portion of the consumption amount allocated to the specific industry. 2 For the industries whose input(output) is broken down due to different applicable rates of the products(see Appendix 2), the consumption amount is also broken down where necessary.

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