

Research on the Forecast and Development of China's Taxation based on ARMA Model

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Abstract

China's tax revenue has increased quickly in recent years, significantly higher than China's economic growth. This not only goes against performance of government functions and economic development, but also increases burden to enterprises and individuals. This paper carried out a deep analysis on the tax changes of China from 1995 to 2013 based on the collected data of China Statistical Yearbook for Regional Economic. Moreover, short-term tax changes in future forecasted by ARMA model and reasons of its quick growth were analyzed. The analysis discovered that China's taxation still will maintain quick growth in the short run. This indicates that China's tax growth will be accelerated, which will further increase burdens to enterprises and individuals. To slow down the tax growth and guarantee performance of government functions, it is suggested to: 1) strengthen tax supervision and strictly prohibit increasing tax items and rate blindly; 2) improve tax structure, reduce tax items and prevent double taxation; 3) implement transformation from production-type VAT to consumption-type VAT; 4) promote reform of taxation expenses and correct taxation disorder.

Keywords: ARMA model; taxation forecasting; economic regulation

1 Introduction

Taxation is the basis for a country to implement government functions and an important macroeconomic control mean. It is vital to the regional economic development. Taxation changes with economic development and policy changes. Government is committed to pursuit of taxation balance: getting adequate tax revenue for government functions but not increasing economic burdens to enterprises and individuals. This is the problem of taxation reasonability. According to the economic theory, tax growth is always related with economic growth rate. Taxation maintains certain growth rate. Recently, many Chinese enterprises and individuals declare that China is over-taxed. Based on data, this paper analyzed China's taxation and predicted tax development by using ARMA model. The analysis results were used to test synchronism between China's taxation and economic growth rate as well as reasonability of taxation.

2 Descriptive analysis of data

Since most China's fiscal revenue is contributed by taxation, tax changes in China can be reflected by fiscal revenue. China's tax revenue includes several categories which have different growth trends.

Figure 2 shows that China's taxation grows quicker than the economic growth rate. Generally, local taxation grows quicker than tax increase. Quick growth of national fiscal taxation, central financial revenue and local financial revenue is observed in Figure1. The lowest growth rate of national fiscal taxation was 10.14% in 2013, while the highest growth rate was 32.41% in 2007. The average growth rate of national fiscal taxation from 1995 to 2013

was 18.50%, significantly higher than China's economic growth rate. The lowest growth rate of central financial revenue was 7.12% in 2013, but the highest growth rate was 35.65% in 2007. The average growth rate of central financial revenue from 1995 to 2013 was 17.45%, lower than the growth rate of national fiscal taxation, but still far higher than China's economic growth rate. The lowest growth rate of local financial revenue was 9.12% in 2002, but the highest growth rate was 28.8% in 2011. The average growth rate of local financial revenue from 1995 to 2013 was 19.73%, higher than the growth rate of national fiscal taxation.

There's evident difference of growth rate among different categories of taxation. However, the average growth rates of all taxations are higher than economic growth rate, especially the corporate income tax. The lowest growth rate of VAT was 8.86% in 2012 and the highest growth rate was 24.62% in 2007. The average growth rate of VAT from 1995 to 2013 was 14.32%. The lowest growth rate of business tax was 6.98% in 1999 and the highest growth rate was 28.34% in 2007. The average growth rate of business tax from 1995 to 1999 was 5.93%. The lowest growth rate of consumption tax was 0.70% in 1999 and the highest growth rate was 85.39% in 2009. The average growth rate of consumption tax from 1995 to 2013 was 17.06%. The lowest growth rate of tariff was -16.21% in 2002 and the highest growth rate was 79.60% in 1999. The average growth rate of tariff from 1995 to 2013 was 14.50%. The lowest growth rate of corporate income tax was -12.33% in 1999 and the highest growth rate was 163.18% in 2001, followed by tariff and consumption tax.

Both conformity and inconformity are observed in term of the growth fluctuation of different taxations. The central financial revenue and local financial revenue fluctuated

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synchronously from 2006 to 2013, but they presented greatly different and even opposite variations from 1995 to 2005. For example, the central financial revenue still kept increasing in 2005, but the local financial revenue dropped suddenly. They still have small difference in fluctuation range even from 2006 to 2013. Different categories of taxation fluctuates varies even more disorderly, especially the tariff. From 1995 to 2013, there were three negative growths of tariff, namely, 2002, 2009 and 2013. In 2002, other taxations still kept increasing. Moreover, different taxations have significantly different growth rates. For instance, the growth rates of VAT, business tax, consumption tax, tariff and corporate income tax in 2005 were 12.74%, 29.18%, 11.10%, 7.02% and 23.99%, respectively. Among them, consumption tax and business tax vary the most similarly.

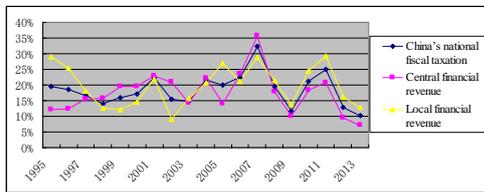


FIGURE1. Growth rate of China's national fiscal taxation, central financial revenue and local financial revenue (Note: Data comes from www.tjcn.org)

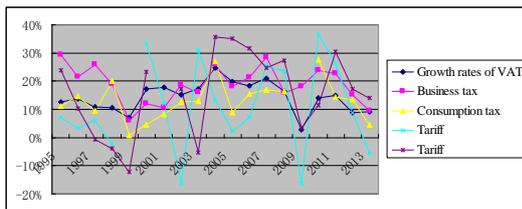


FIGURE 2. Growth rate of different taxations in China (Note: Data comes from www.tjcn.org)

3 Auto-regression forecasting analysis

3.1 CONTENT OF ARMA MODEL

Basic principle of ARMA model. Data sequence formed by predictive indexes against time is viewed as a random sequence. The dependence relationship in this group of random variables reflects the time continuity of original data. Such dependence relationship is influenced by both influencing factors and its own variation law. Suppose the influencing factors are $x_1, x_2 \dots x_p$. According to the regression analysis,

$$Y = \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p + Z$$

Where Y is the observed value of prediction objects and Z is error. Y_t is influenced by its own variation law:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + Z_t$$

The error item has dependence relationship in different stages:

$$Z_t = \epsilon_t + \alpha_1 \epsilon_{t-1} + \alpha_2 \epsilon_{t-2} + \dots + \alpha_p \epsilon_{t-p}$$

Therefore, the expression of ARMA model can be acquired:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + \epsilon_t + \alpha_1 \epsilon_{t-1} + \alpha_2 \epsilon_{t-2} + \dots + \alpha_p \epsilon_{t-p}$$

ARMA model can be divided into three kinds:

(1) Auto-regression model. If the time sequence satisfy $Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + Z_t$ and $Var \epsilon_t = \sigma_\epsilon^2 > 0, E(\epsilon_t) = 0$, it is called as the p-order auto-regression model. The steady condition of this auto-regression model is $\varphi(B) = 1 - \beta_1 B - \beta_2 B^2 - \dots - \beta_p B^p$ (root of $\varphi(B) = 0$ is larger than 1).

(2) Moving average model. If the time sequence satisfies $Y_t = \epsilon_t + \alpha_1 \epsilon_{t-1} + \alpha_2 \epsilon_{t-2} + \dots + \alpha_p \epsilon_{t-p}$, it is called as q-order moving average model.

(3) Autoregression moving averaging model (ARMA model). If the time sequence satisfies:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + \epsilon_t + \alpha_1 \epsilon_{t-1} + \alpha_2 \epsilon_{t-2} + \dots + \alpha_p \epsilon_{t-p}$$

It is called as (p,q)-order ARMA model, recorded as $\varphi(B) = \theta(B)$.

3.2 APPLICATION OF ARMA MODEL

In this paper, Y_t is taken as China's taxation sequence. To make specific tax forecasting, this paper firstly conducted an overall analysis which including estimation and forecast of China's national fiscal taxation, central financial revenue and local financial revenue. Secondly, different categories of taxation, including consumption, tax, business tax, corporate income tax and tariff, were predicted. Annual data published on www.tjcn.org from 1975 to 2013 were used. According to the need of ARMA model, the autocorrelation and partial correlation of time sequence data have to be analyzed to determine p and q. It is discovered that the correlation coefficient falls in the random interval when $p = 6$ and $q = 2$. At this moment, both partial correlation and autocorrelation of the time sequence have truncation, thus enabling to establish the AR(6)MA(2) model. ARMA model has no strict requirements on T-test and is mainly depend on determination coefficient, AIC and SC. The analysis results of determination coefficient, AIC and SC are listed in Table 1. After the AR(6)MA(2) model is established, autocorrelation and partial correlation of all residual sequences are tested, finding that all sequences tend to be steady. The determination coefficient in Table 1 reflects the good fitting effect (>0.99), indicating the success of AR (6) MA (2) model establishment.

TABLE 1 Correlation coefficients, AIC and SC for sequence analysis of ARMA model

Sequence	QGC	ZYC	DFC	ZZS	YYS	XFS	GS	QYS
Determination coefficient	0.999	0.998	0.998	0.995	0.995	0.962	0.991	0.994
AIC	16.510	16.444	16.121	15.978	14.872	15.669	11.642	15.479
SC	16.918	16.852	16.529	16.423	15.316	16.080	12.050	15.923

Firstly, data samples to 2014 are forecasted by using Eviews software. Due to the data imperfection, only VAT (Figure3), business tax (Figure.4) and consumption tax (Figure5) can be forecasted. Figure3 and Figure4 show that China's tax revenue keeps increasing continuously. In

Figure5, China's consumption tax presents a fluctuating increasing trend.

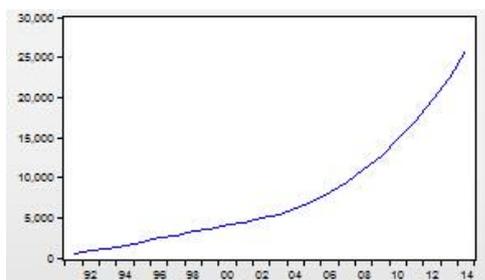


FIGURE 3 Forecast of VAT

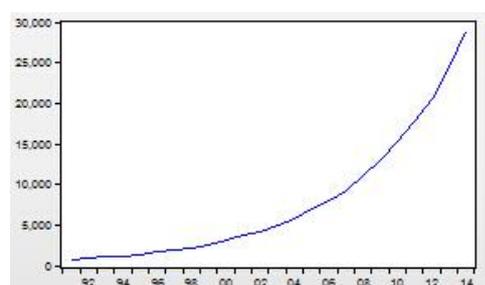


FIGURE 4 Forecast of business tax

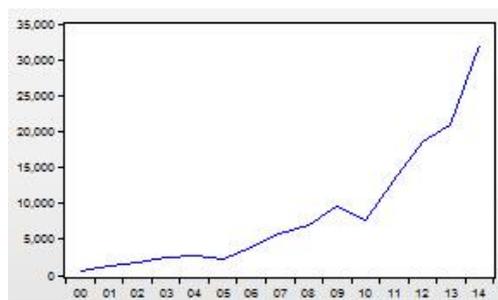


FIGURE 5 Forecast of consumption tax

3.3 RESULT ANALYSIS

It can be concluded from above analysis that China's taxation growth too quickly. Actually, it is reported by statistics that the elastic coefficient of taxation keeps higher than 1 for several successive years. This indicates that tax growth is quicker than economic growth all the time and the economic burden of taxpayers is increasing year by year. Over high burden of taxation will bring negative impact on economic development, because it will influence profit and competitiveness of enterprises. To be more specifically, China's quick growth of taxation is mainly caused by following reasons:

Firstly, tax reform fails to achieve long-term actual effect and the effective tax rate remains unchanged for a long time. China's tax reform progresses slowly. Forced by various local government policies, tax rate increases continuously rather than changing promptly according to need.

China's tax reform experiences four stages, but still failed to achieve actual effect. The first stage is the establishment of China's tax system in 1950. At that time, China adopted 14 central taxes and local taxes uniformly, including commodity tax, business tax, salt tax, tariff, income tax on salaries and remunerations, income tax on

interest, stamp tax, inheritance tax, transaction tax, butchery tax, property tax, land tax, tax on special consumption behaviors and vehicle and vessel license tax. Some tax items were added in 1953, but the tax rate still remained same. The second stage is the tax reform started in 1958. This tax reform mainly aims to: 1) simplify the tax system and implement industrial and commercial consolidated tax to replace original commodity tax, commodity circulation tax, business tax and stamp tax; 2) create industrial-commercial income tax, which separated the original income tax from the business tax to be an independent tax; 3) unify the agricultural taxation system around the whole China. The third stage is tax reform after the reform and opening-up. This tax reform is to adapt to the reform of economic system. During this stage, tax items become more complicated, covering more than 20 categories of taxations (e.g. bonus tax, feast tax as well as city maintenance and construction tax). The fourth stage is the latest tax reform in 1994. It was to solve the confusing taxation, but only achieved poor effect. Except for tax, there were abundant charge items, which were disguised tax items.

Secondly, tax items couldn't be distinguished from each other. Except for rated taxes, China has various charge items, such as highway cost, port charges, airport construction fee, public welfare fund from lottery, land-transferring fees (the heaviest charge on common people in recent one century), etc. Moreover, charge items of different departments with right of collection cost can be viewed as indirect taxation. Although each item charges a small amount, they contribute a huge amount together, which makes many enterprises and individuals overwhelmed.

Thirdly, tax items are very complicated, accompanied with double taxation. Since the implementation of tax cuts, the central government has withdrawn agriculture tax, unified corporate income tax for both domestic-funded and foreign-funded enterprises, reformed production-type VAT and amended individual income tax and resources tax. The pilot project of replacing business tax with VAT was promoted in a larger scale in 2014. Although such "structural tax cut" has achieved some effect, it is not so satisfying. Government tax revenue still grows quicker and quicker, while enterprises and individuals still have to pay a lot of tax items at a high rate. Double taxation is always the key point of China's tax reform. However, attentions are mainly paid to the pilot project of replacing business tax with VAT in recent years, neglecting the double taxation of other taxes.

Fourthly, tax revenue collection and supervision system is not so perfect and tax concept is incorrect. In China, local governments take tax planning as an economic index that has to be fulfilled completely. Tax collectors often will impose excessive taxations in order to accomplish the task. For example, to accomplish the taxation task, some local taxation bureaus neither check taxpayers who make negative tax declaration nor consider the practical operation of enterprise. They just give stamps on the tax return of enterprises and ask enterprises to pay desired taxes. In some places, small enterprises are asked to return certain proportion of operating income as income tax. As a result, income tax becomes a high turnover tax, which is a heavy burden of enterprises, especially small ones.

4 Suggestions

Based on above analysis, China's tax growth is too quickly, which will significantly influence enterprise and individual development and even regional economic development. Such quick tax growth is caused by the over high tax rate and double taxation. To guarantee the performance of government functions and lower tax rate to slow down China's tax growth, it is suggested to:

- (1) Enhance taxation supervision. Tax supervision system shall be established to curb and crack down illegal taxations and criminal behaviors, strengthen rigidity of taxation, and maintain the basic order of tax system. Correct goal of tax collection shall be set, instead of changing tax collection into the driver of government's economic benefit growth. To solving the overwhelming comparison of tax collection, abundant tax items and high tax rate of regions and government departments, China shall relieve macro-tax burden, determine taxation goal, adjust tax collection goal more vigorously based on current reform, and strictly prohibit to increasing tax standard in order to make up the financial deficit of local governments. Tax supervisory authorities shall monitor departments responsible for tax collection, repeal unreasonable tax items and approve new tax items strictly.
- (2) Perfect China's tax structure. China's and international economies change quickly. China's tax structure lags behind the economic changes and economic form changes significantly, especially after China entered into the WTO. In fact, resources tax, business tax and corporate income tax are not local taxation in the strict sense. They are more appropriate to be called as share tax with obvious subjection to local governments. All of these reflect China's unsatisfying tax structure. As a result, China shall accelerate tax structure improvement (especially local taxation) in considering of regional and China's economic development structure, economic growth rate, economic development strategy, tax system as well as current and future industrial structure. The numerous, scattered,

instable and inelastic tax items in local tax system deserve key attention of tax structure reform.

- (3) Promote the reform from production-type VAT to consumption-type VAT gradually. Production-type VAT must be converted into consumption-type VAT in order to perfect tax system. Based on the macro-economic environment that controlling growth of fixed investment scale and maintaining basically stable tax burden, the VAT reform in 1994 adopted production-type VAT that is rarely used in international. Restricted by such production-type VAT, enterprises were only allowed to deduct withholdings on VAT for raw materials, but not those for fixed assets. This brought double taxation on capitals, thus affecting enthusiasm of enterprise investment and restricting development of enterprises with high organic composition of capital and new high-tech technology industries. Consumption-type VAT is widely applied in the world. It allows enterprises to deduct VAT for fixed asset purchase, avoiding double taxation. Therefore, it encourages enterprises, especially those with high organic composition of capital, to increase fixed investments, drive industrial restructuring, facilitate technical process of enterprises and thereby stimulate economic growth.
- (4) Intensify reform of taxation expenses. China is facing with serious confusing taxations. A lot of charges are disguised in taxation. To increase tax revenue, local governments generally collects various charges. To address this problem, China shall intensify reform of taxation expenses. Charges pertaining to taxation nature and functions shall be enlisted into tax. Fees-for-tax reform shall be accelerated to ease abundant heavy economic burdens on enterprises. Expense items also shall be determined and stabilized to avoid them turning into disguised taxation. Since over high taxation goes against economic development, local taxation reform shall make prompt adjustment according to current economic development.

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