AN INVESTIGATION ON THE EFFECTIVENESS

OF THE 4 TRILLION STIMULUS PACKAGE

IN 2008 TO 2010 OF CHINA

BY

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We hereby recommend that the Project by Miss. Lam Sze Wing entitled "an

investigation on the effectiveness of the 4 trillion stimulus package in 2008 to 2010 of

china" be accepted in partial fulfillment of the requirements for the Bachelor of Social

Sciences (Honours) Degree in China Studies in Economics.

_____   _____

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Student's signature

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Abstract

Many economies faced a deep recession after the 2008 global financial crisis. China

also suffered from a fall of GDP growth rate in 2008. To response to the crisis, the

Chinese government had introduced an RMB 4 trillion stimulus package to motivate the

market. This dissertation is to investigate the effectiveness of the 4 trillion stimulus

package in 2008 to 2010 of china. To measure the effectiveness, the study use time

series regressions and cross-sectional regressions to estimate the GDP contribution of

the policy by observing the fiscal multiplier. Moreover, it lists out some arguments

suggested by economists for the policy to figure out the possible drawbacks brought by

it.

Content

I.   Introduction

This dissertation is to investigate the effectiveness of the 4 trillion proactive fiscal

policy in 2008 to 2010 of China that implement to alleviate the negative impacts

brought by the 2008 financial crisis. It aims to find out the relationship between

government's expenditure and the GDP of China in 2009 to 2010 and to ascertain any

by-effects that might be created by the policy.

The list of the dissertation is organized as the follows:

The next section is to explain the background of the global financial crisis and the

China's stimulus package. It would also mention the reason for doing this study. The

third section is to have a literature review on the studies related to the fiscal multiplier

in China. There is a review on the IS-LM model as well. Section 4 lists out the methods

to find out the fiscal multiplier in this dissertation. The data sources used would be

mentioned in the next section. The empirical results and analysis are shown in section 6

and section 7 respectively. Section 8 discusses some arguments about the package

suggested by economists. We would highlight some negative impacts that might be

brought by the policy. The last section would be a conclusion of this dissertation.

II. Background

A. The economy of China in the 2008 financial crisis

The 2008 financial crisis broke out in the September 2008 Lehman Brothers

collapsed. (The Economist, 2013). Although the financial crisis occurred in the

United States, it spread to the global soon. It overflowed from the financial sector

to the real economy (Schmidt, 2009). The risk premium

on interbank borrowing increases rapidly to 5%. Furthermore, the risk premium on

corporate bonds grew up to over 6%. It created panic in the financial

markets(McKibbin & Stoeckel, 2010). The decline in credibility made borrowing

and lending became difficult. Companies were unable to pay suppliers or workers

by borrowing, causing a disaster in the real economy(The Economist, 2013) Also,

there was a fall in demand, especially for the investment goods

and manufacturing durables.

Most of the major developed economies were suffered from a deep recession in the

financial crisis. Global trade was seriously affected. According to the statistics

released by the World Trade Organization(2010), there was a decline of 4.5% in the

growth in the volume of world merchandise export in 2008. It has further dropped

to -12% in 2009. The world GDP has been also decreased during the recession. It

has fell from 3.5% in 2007 to -2.5% in 2009. Also, it caused a dramatic rise in the

unemployment rate. Most of the governments have responded the crisis by

easing of monetary and fiscal policy. Domestic subsidies and broader protection

were imposed by many governments in order to have a protection on the local

industries(McKibbin & Stoeckel, 2010).

China is having a relatively closed financial system than developing countries,

therefore, its financial system had not been affected seriously. However, the

recession in the United States and Europe had influenced the export of China as

well as China's economy as the demand decreased.

Figure 1   GDP growth (quarter on quarter), nominal GDP)(Source: Wong,2011)
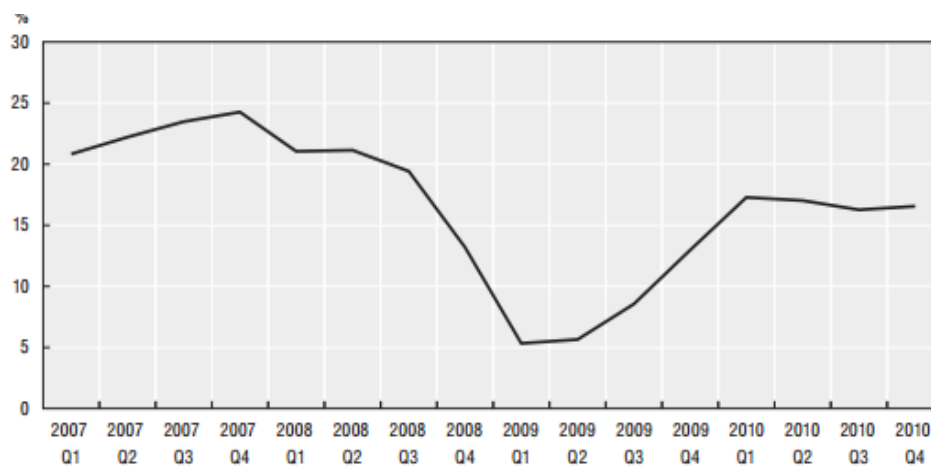
Source: National Bureau of Statistics of China.

Figure 1 shows the nominal quarterly GDP growth rate from 2007 to 2010. It

illustrates that there was a sharp drop in the GDP growth in China from the quarter

3 of 2008, which matched with the period of the outbreak of 2008 financial crisis.

The GDP growth rate has decreased from about 20% to about 5% in the quarter 1

of 2009. This can be an evidence that the 2008 financial crisis had negative effects

on China's economy. The trend of decreasing in the GDP growth rate was then

stopped in the quarter 2 in 2009 and started to raise again in the quarter 3 of 2009

and stayed steadily in 2010. A "V-shape GDP growth was shown.

One of the reasons of having a decrease in the GDP growth rate may be the

decrease in net export. China is recognized as a country that has a large trading

surplus. Starting from the market reform policy in 1978, China has a rapid growth

in the economy based on the domestic market, especially the increased in domestic

consumption and government expenditure. However, since 2001, which was the

year that China has become one of the members of the World Trade Organization,

exports have started to play a more important role in the growth of economics (Zhu

& Kotz, 2010).

Figure 2 Export of goods and services in China (percentage of GDP)

The graph above is the export of goods and services in the percentage of GDP in China from 1991 to 2014. The data source of the graph is from the World Bank. It is noticeable that export is being more and more important to the GDP since 2001. The percentage share of export of export to the China's GDP was maximum in 2006, which export occupied for more than 35% in the China's GDP. Nonetheless, there was a dramatic reduction in the percentage of export to GDP of China in 2008 and 2009. The percentage of export to GDP of China decreased from around 35% in 2007 to 23.73% in 2009.

Figure 3 Growth in export (quarter on quarter) (Source: Wong,2011)
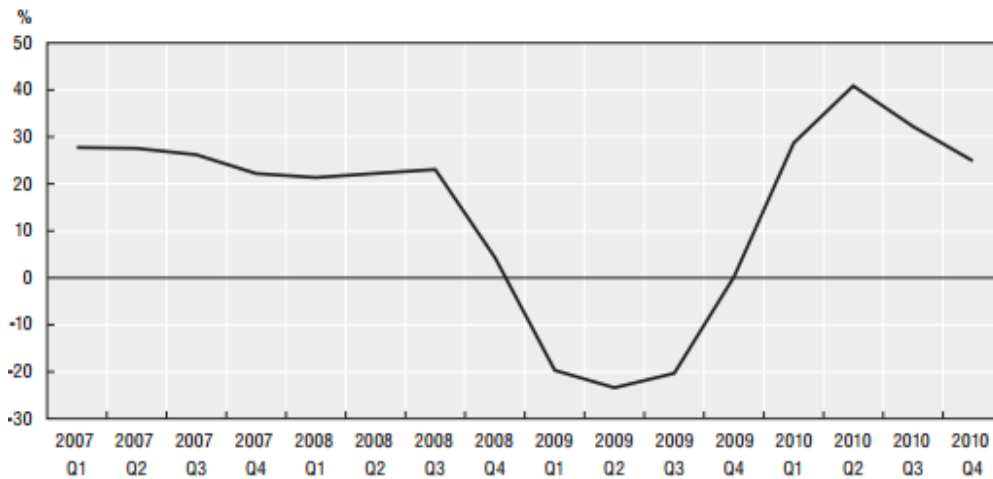
Also, 2008 was the first time that China's export growth rate had increased less

than 20% since 2004. Starting from November 2008, China even faced a negative

growth rate of exportation. In 2009, the export growth rate of China was decreased

to -10.56%, reflecting the demand of foreign countries had dropped seriously

(International Monetary Fund, 2016). In 2008, China's GDP growth rate has

decreased to below 10%, which was the lowest since 2002 (International monetary

fund, 2016). Figure 2 shows the growth in export from 2007 to 2010 quarterly. We

can see that there was a dramatic decrease in the exports growth rate of China after

the 2008 financial crisis. The statistic shows that the growth in exports sudden fell

from more than 20% to lower than -20% in the trough in the second quarter of

2009. It is clear that there is a high dependence on the export in the Chinese GDP

after China has become a member the World Trade Organization. However, as

there was a decrease in foreign demand of goods due to the financial crisis, the

export was seriously affected.

Although there was a decrease in a number of exports, the GDP growth rate was still positive. Therefore, there should be other factors, for example, an increase in consumption, investment or a decrease in the import to cover the decrease in export.

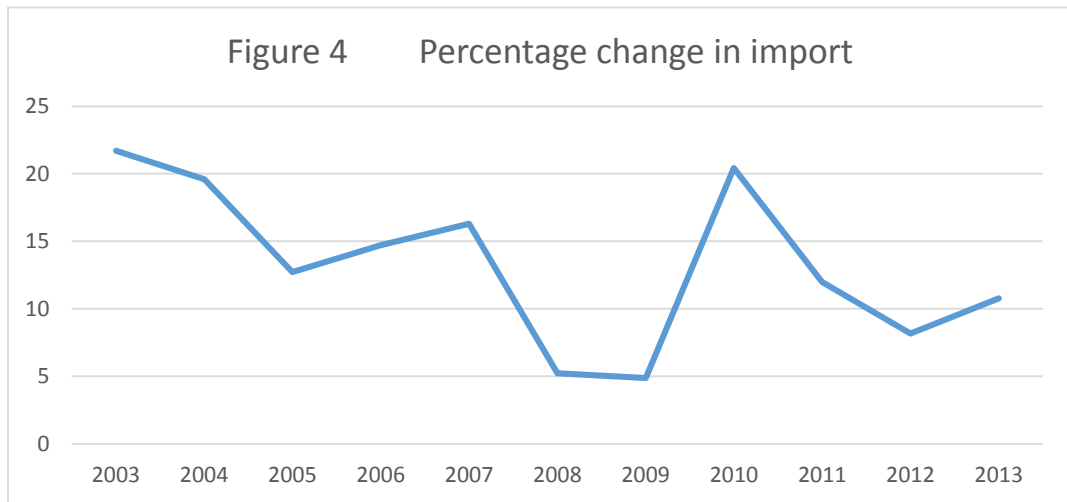Figure 4 — Percentage change in import

Figure 4 shows the percentage change in import from 2003 to 2013. According to the graph, we can figure out that apart from export, there was also a huge decrease in import during the financial crisis. These would lead to a smaller effect in the decrease in net export, which is counted in the GDP.

Figure 5　　Goverenment Expenditure

Figure 6　　Government expenditure in percentage of GDP
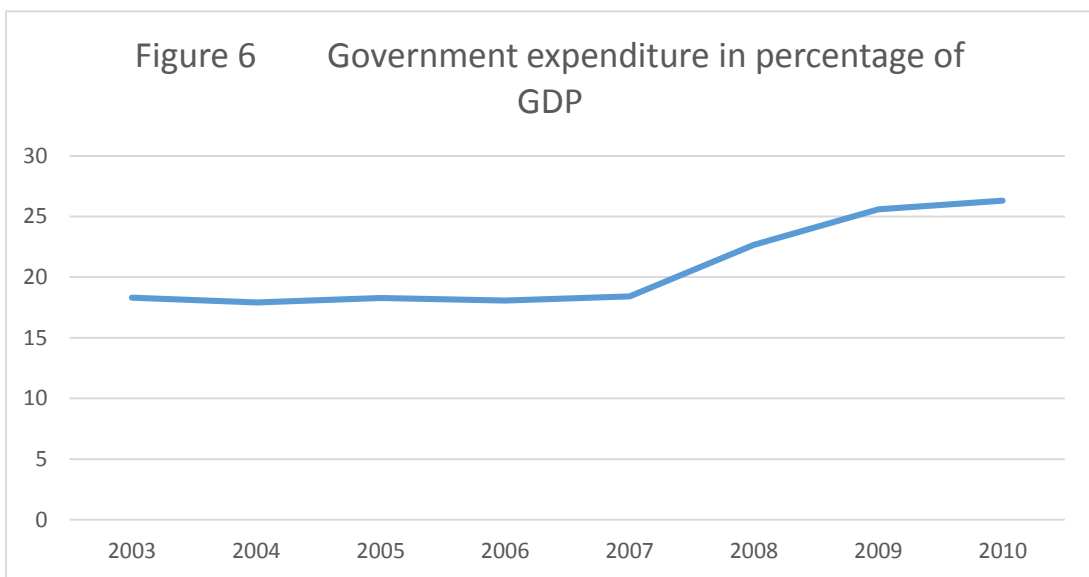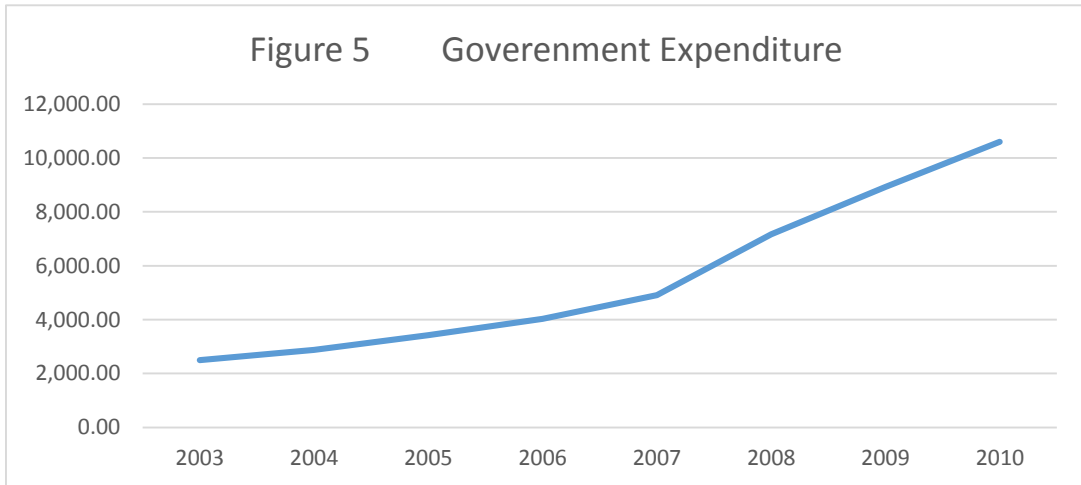
Figures 5 and 6 show the government expenditure and the government expenditure

in percentage of GDP from 2003 to 2010 in China respectively. From the graphs, it

is noticeable that China's government expenditure had a fast grew since 2008 and

has been more significant to the GDP. The government expenditure has doubled in

2010 when compared with the expenditure in 2007. Also, the percentage share of

GDP contributed by the government expenditure has increased from generally 18%

in 2007 to more than 25% in 2010. It may due to the implementation of the Chinese

economic stimulus plan in late 2008, which will be further discussed in this report.

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Figure 7   Investment in perncentage of GDP

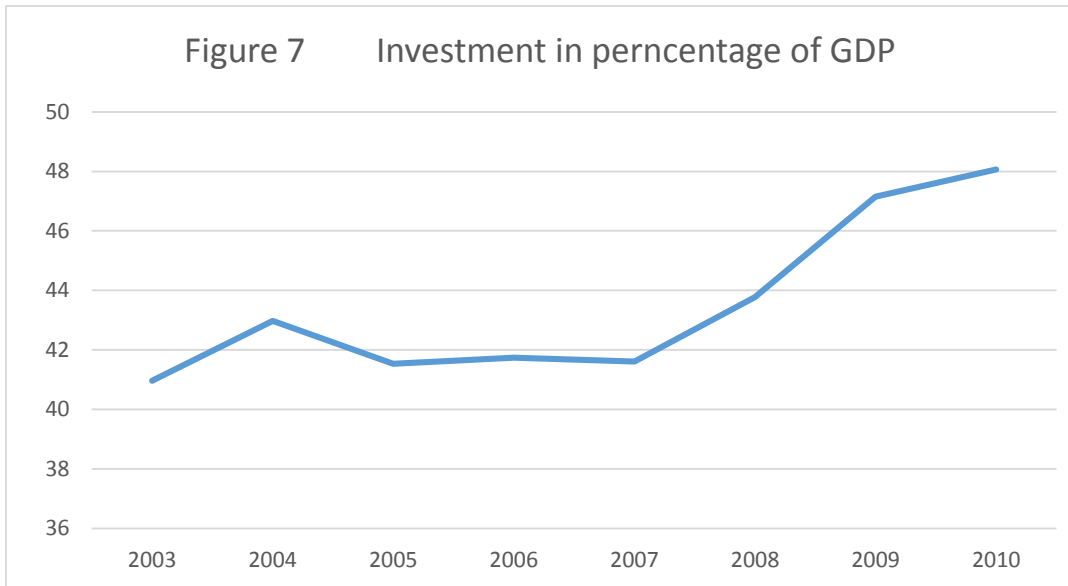Figure 7 demonstrates the investment in the percentage of GDP in China from 2003

to 2010. We can notice that apart from the government expenditure, the investment

also has a larger percentage share of GDP in 2008. This may due to the direction of

the Chinese economic stimulus plan. In the plan, the government only provides a

certain percentage of funds and its items are related to infrastructure and

construction.

Figure 8 Source of growth (percent of GDP) (Source: Wong,2011)
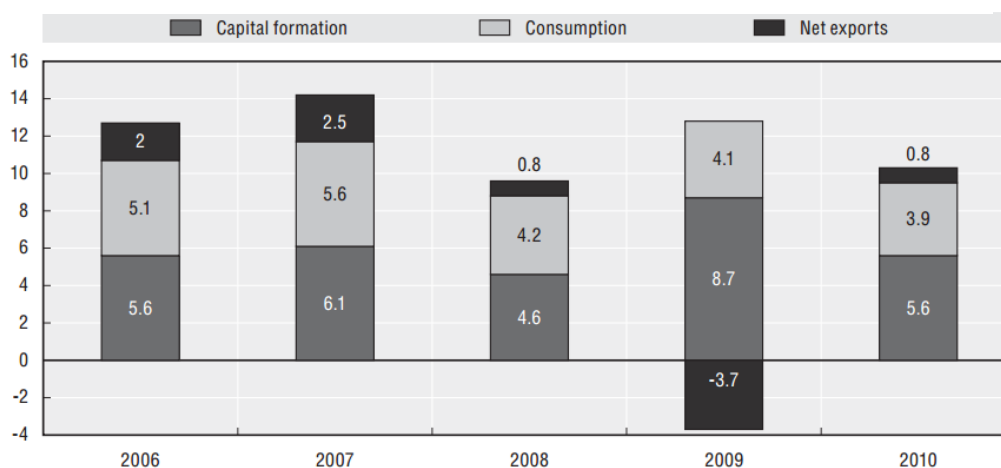
Sources: *China Statistical Yearbook* 2010; *DragonWeek* (March 2011).

Figure 8 shows how the GDP growth rates of China from 2006 to 2010 constituted

are. By observing from the graph, we can find out that net export is less significant

in the GDP growth rate of China in 2008 to 2010. What is more, capital formation is

having the largest percentage share of the GDP growth rate, especially in 2009, the

growth of capital formation is near to the net GDP growth.

B. The response of Chines government

Because of the challenges from the global financial crisis, in the State Council of

People's republic of China executive meeting on 5th November, 2008, the Premier

of the State Council at that time, Wen Jiabao had announced several new policies to

further expand domestic demand and assure stable rapid growth, which is named as

Chinese economic stimulus plan. The plan includes expansionary monetary and

fiscal policy with 10 measures in order to boost the economics. As stated by Wen

Jiabao, the 10 measures focus on the areas such as low-income housing, rural

infrastructure, water, electricity, transportation, the environment, technological

innovation and rebuilding from several disasters in Sichuan. The policies also

include a reform in value-added taxes in order to encourage enterprises to have

investments that can benefit the economy in the long run. Besides, the government

has abolished the credit ceilings of commercial banks for lending to the related

projects. It is estimated that 4 trillion yuan would be spent (XinHua Net, 2008) for

supporting the stimulus plan. The project would be started since the announcement

of the end of 2010 to lowering the negative impacts brought by the financial crisis

(國務院, 2008) .

The RMB 4 trillion was constituted by RMB 1.18 trillion in central government

funding and the remaining funds were constituted by local government and bank

lending, which accounted for 31% and 40% of the total investment respectively (新

華網, 2009). In order to help the localities come up with the funding, the central

government has approved three measures, which included issuing treasury bonds

valued as 200 billion and specifically designated for local government use during

2009; authorizing the local government to enjoy an extra-long-term and favorable

interest rate bank loans to provide paid-in capital for investment projects which

may reduce the required capital ratio; and having a permission on issuing corporate

debt under the sponsorship of local governments(Naughton, 2009).

The 1.18 trillion funds provided by the central government from 2008 Q4 to 2010

was planned to allocate as the following(中華人民共和國財政部經濟建設司編,

2010):

Table 1

Year	Central government funds	Percentage share
2008 Q4	RMB 10.4 million	8.81%
2009	RMB 50.38 million	42.63%
2010	RMB 57.22 million	48.49%

From table 1, we can observe the central government planned to invest less than

10% of the total funds in the last quarter of 2008 while it would like to allocate

more than 40% of the total funds in 2009 and 2010.

The usage of the 4 trillion is proposed to be as the following(國務院, 2009):

Table 2

Investment Items	Proposed capital investment	Percentage share of the economic stimulus plan
Low cost housing	RMB 4 hundred million	10%
Rural livelihood and infrastructure	RMB 3.7 hundred million	9.25%
Infrastructure	RMB 15 hundred million	37.5%
Health and education	RMB 1.5 hundred million	3.75%
Ecological and Environment Projects	RMB 2.1 hundred million	5.25%
"indigenous innovation" projects	RMB 3.700 hundred million	9.25 %
Sichuan earthquake reconstruction	RMB 10 hundred million	25%

From the table above, it is clearly shown the project mainly focused on

infrastructure and Sichuan earthquake reconstruction, which accounted for more

than half of the investment of the project. Low-cost housing, rural livelihood, and

infrastructure, "indigenous innovation" projects are made up of about 10% each in the project while health and education, ecological and environment projects weighted least.

C. Why do we study China?

After the global financial crisis in 2008, many countries has launched fiscal policies to boost the countries' economies. In the following, I would like to state three reasons that why I would choose the case of China to study.

1. The economic status of China

After the introduction of the open door policy, the share of China's GDP in the world economy increased from 1.7% in 1978 to 9.5% in 2010 at market exchange rates. This shows that China is having an increasing weight in the world economy. It has a large contribution to the global economic growth. Since the 1970s, there is an approximately double increasing in the trading value of China in every 4 to 5 years. The speed of increasing value of trade has even gone faster after the economic reforms in 1992. In 2010, China has surpassed Germany to become the largest exporter in the world with 10% share of the world exports. Meanwhile, China's has also become the third largest importer in

the world. This rapid growth has given China a strong status in the world

economics as it is the world's leading exporter and one of the largest importers

(Li, Willett & Zhang, 2012).

2. The economic characteristic of China

Also, unlike many of others developed countries, China is having a socialism

with Chinese characteristics, which is the official ideology of the Communist

Party of China. The Chinese government is aiming to establish a socialist market

economy(中國共產黨新聞網, 2007). The state-owned enterprises have an

important role in China's economy. They can follow the direction of the

government and have strong capital supply from the central government. The

state-owned banks also are willing to lend money to the state-owned enterprises.

Therefore, although the Central government only contributed 29% of the total

investment, there are still many investments from the market. In the stimulus

plan, most of the projects were taken by the state-owned enterprises(騰訊新聞,

2009).

3. The scale of the stimulus fiscal policies after the financial crisis in China

The project involved an immense amount of capital investment. Even in the

countries suffered more seriously in the financial crisis, the amount invested in

the fiscal policy is not as big as China. IMF Managing Director Dominique

Strauss-Kahn commended the policy is a "good news" and it would help the

global economy ride out the financial crisis after the announcement of the

policy(latimes, 2008). According to the IMF, the initial stimulus packages from

2008 to 2010 were as large as 5% GDP in the United States and China(Horton &

Ivanova,2009).

China was also recognized as the quickest country to recover after the economic

crisis. China was the first major economy to recover from the financial crisis.

China's GDP growth rate has rebounded to a double-digit pre-crisis level in late

2009. Even the United States and Europe governments have taken a quicker

reaction to the crisis earlier than China, yet, they could not be totally recovered

in late 2011(Wen & Wu, 2014). Owing to the recession in most of the countries

during the financial crisis, China's economic growth contributed for nearly half

of global GDP growth at that period(WEO & IMF, 2010).

In this paper, I would like to investigate the effectiveness of the 4 trillion proactive

fiscal policy in 2008 to 2010 of China that implement to alleviate the negative impacts

brought by the 2008 financial crisis. I would use a time-series regression and a cross-sectional regression by using the provincial level data to figure out the fiscal multiplier of the government expenditure so as to indicate how the economic stimulus plan affects the GDP in China. Also, I would list out the arguments suggested by some of the economics so as to point out the possible by-effects of the policy.

III. Literature review

A. Studies of literature

There are several studies about fiscal multipliers in China. He, Zhang, Zhang(2009) used the IO-table to analyze the fiscal stimulus of RMB2 trillion yuan in 2009 could lead to a growth in the GDP by nearly RMB1.7 trillion, which suggested the fiscal multiplier is roughly 0.84. Hemming, Mahfou, and Schimmelpfenning(2002) estimated that the fiscal multiplier is likely to be very small but positive. Some of the literature derive a single fiscal multiplier in a Keynesian framework by assuming or predicting the trend in the marginal propensities, which include consumption, investment, and imports. Peng and Zheng(2008) found that the fiscal multiplier of China should be between 1 to 1.5 while Liu and Tsang(2009) observed the fiscal multiplier fall within a range of 2.53 to 5.36.

Cova, Pisani and Rebucci(2010) evaluated the impact of fiscal stimulus policies

activated in China quantitatively in a macroeconomic prospective by simulating a

dynamic general equilibrium multi-country model of the world economy, figured

out that the fiscal stimulus China's GDP has boosted the China's GDP by 2.6% and

0.6% in 2009 and 2010 respectively.

Wang and Wen(2013) observed that China has a government expenditure multiplier

approximately bigger than 3 both in aggregate time series data as well as in the

panel data at the provincial level. They provide a theoretical model with market

failures and Monte Carlo analysis to rationalize their empirical findings and use the

model as a laboratory to gauge whether structural VARs can yield consistent

estimates of the theoretical multiplier in short samples.

B. IS-LM Model

The IS-LM model shows the general equilibrium in the goods and financial markets.

It explains how the goods and financial markets together to examine the joint

determination of output and the interest rate in the short run. The interest rate affects

output through investment and output affects the interest rate through money

demand. The following discussion of the IS-LM model follows largely from Young

and Zilberfarb(2000).

As our project focuses on the effect of the fiscal policy announced by Wen Jiabao in November 2008, we mainly focus on the goods market, which is the movement on the IS(investment-saving) curve. Keynesian Cross model suggested the basic intuition about the determination of output and the role of fiscal policy. The spending approach stated that output(Y) is comprised of consumption(C), investment(I), government expenditure(G) and net export(X-M). At equilibrium, the supply of goods should be equal to the demand of good(Z). As a result, when there are Y units of goods supplied in the market, there should be same amount units of good demanded in the market at equilibrium. Therefore, we can have an equation

$$Z = Y = C + I + G + (X - M).$$

There are two factors having influences on the investment, which are the Y and the interest rate(i). When Y increases, it is suggested that the economic is in a good shape and it is expected to have a higher demand for goods in the future, leading to an increase in investment. When i increases, there is a higher cost of borrowing, and investment is being less attractive. Therefore, I=I(Y,i). In addition, consumption is affected by the disposable income, the income and tax payable of a household will affect their spending, as a result, C=C(Y-T)

And the equation can be rewritten as follows:

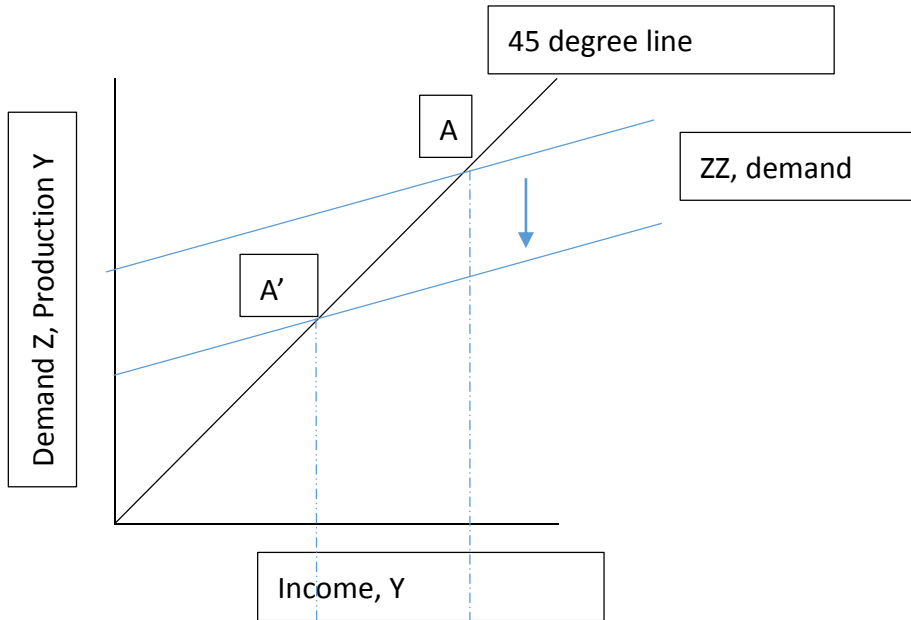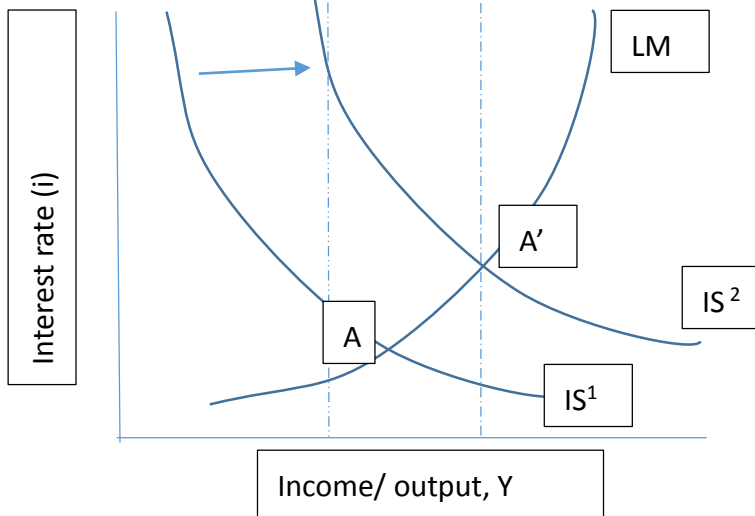$$Z = C(Y - T) + I(Y, i) + G + (X - M)$$

Figure 9.1

Figure 9.2

Figure 9.1 shown that if the output change because of the decrease in investment due to the increase in interest rate, the ZZ curve will shift downward. The equilibrium of the good market will shift from A to A' in figure 9.2. As a higher interest rate would lead to a smaller output, the IS curve is downward sloping. For change in factors that

increase(or decrease) the demand for goods by a given interest rate, for example, an

increase(or decrease) in government expenditure, the IS curve will shift to the right(or

left).

The LM(liquidity preference–money supply) curve shows the equilibrium in the

financial market, which is real money supply equal to real money demand. This would

be depended on the real income(Y) and the real interest rate(i), and the equation can be

shown as the below:

$$M/P = YL(i)$$

As an increase in income change would lead people to increase the money demand at

any given interest rate, since the money supply is given, the interest rate must go up

until the demand for money is equal to the unchanged money supply.
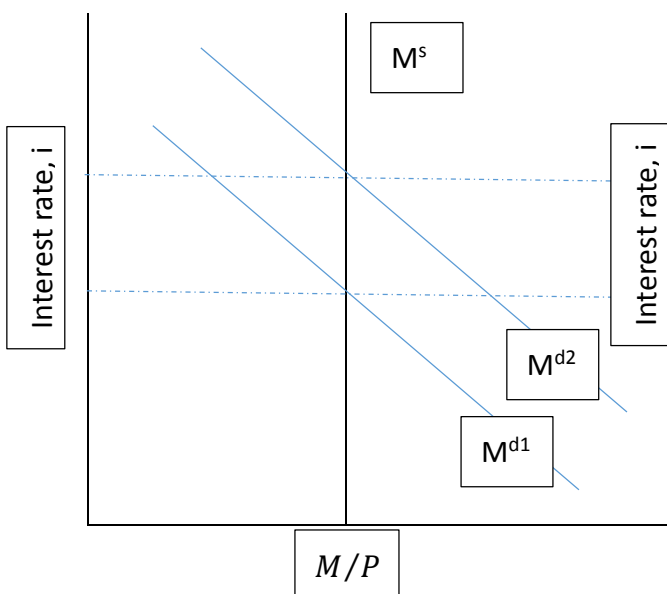
figure 10.1   figure 10.2
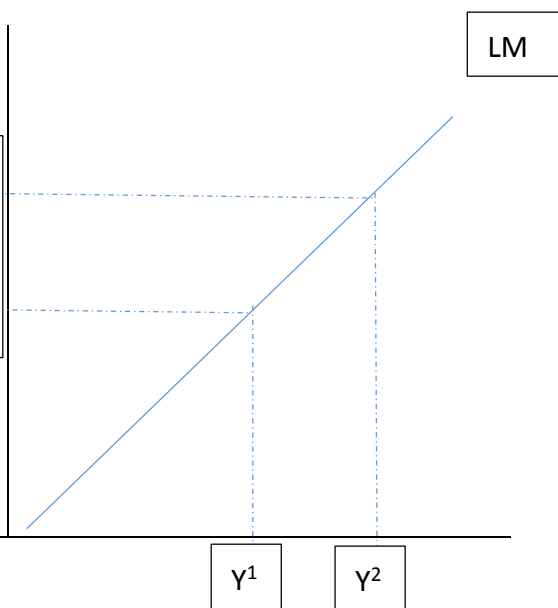
The relation between the interest rate and output can be then represented by an upward-

sloping LM curve. Change in money demand(figure 10.1) will lead to a movement

along the LM curve(figure 10.2).

Figure 11
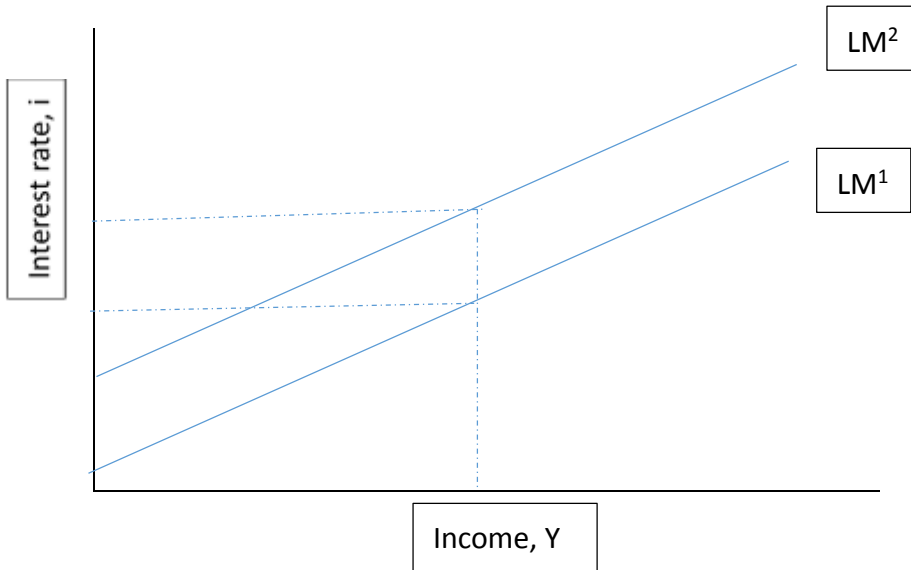
The shift of LM curve will be caused by the change in real money supply. Figure 11

shows there is an increase in real money supply, therefore, LM^1 moves upward to LM^2.

And when we put the IS and LM curve together, we will have figure 12:

Figure 12
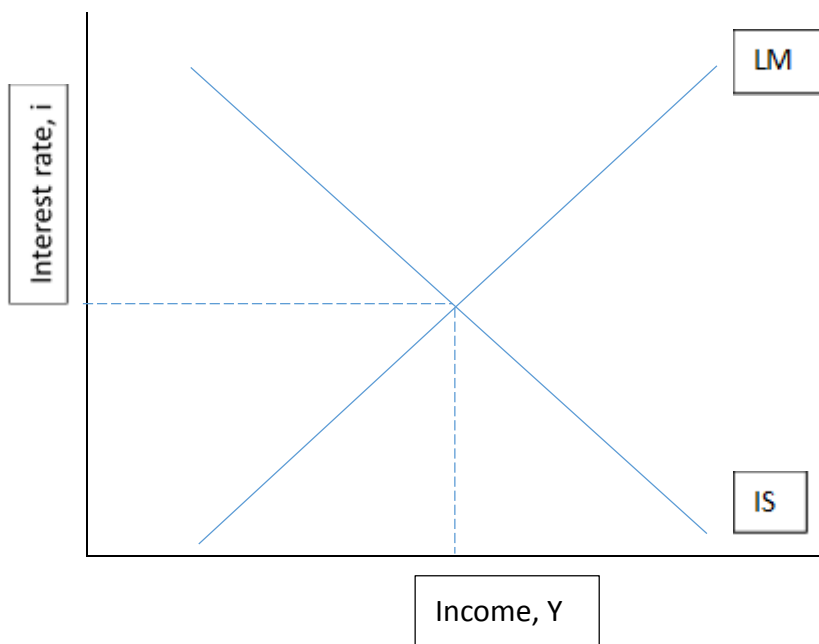
The interception point of IS and LM curves in figure 12 is the "general equilibrium" in

both markets.

Figure 13 shows how an implementation of expansionary fiscal policy affects the IS-

LM model.

Figure 13
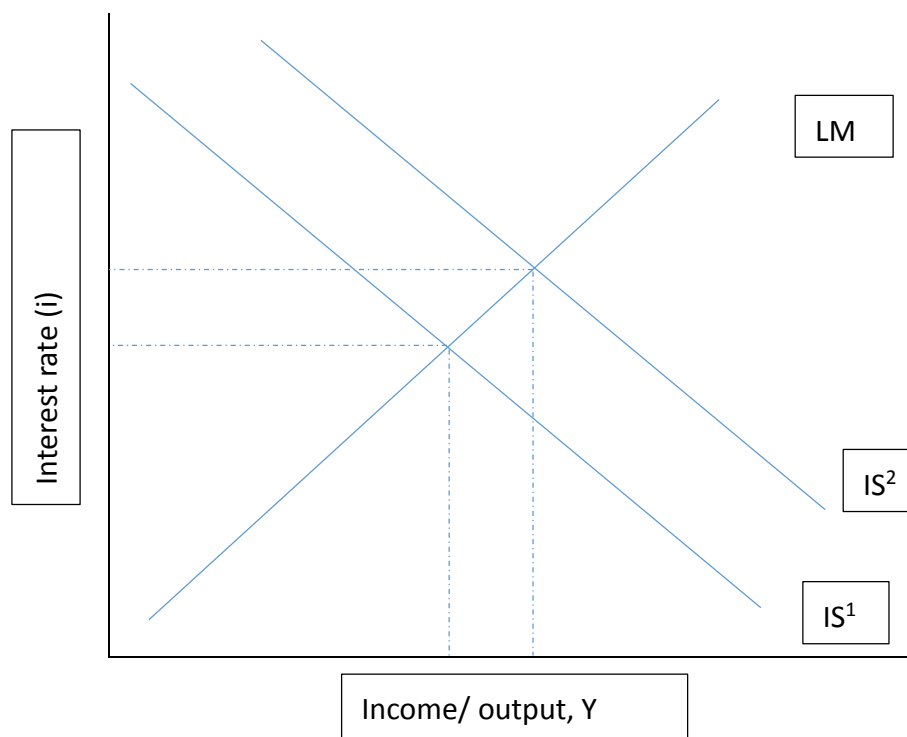
The economic stimulus plan is a kind of expansionary fiscal policy, therefore, IS curve

will shift to the right from IS^1 to IS^2, while LM curve will remain unchanged. Both

output and interest rate will increase. However, the increase in interest rate may lead to

a decrease in private investment. Therefore, fiscal multipliers are likely to be small and

may even be negative when there is crowding out when government expenditure

substitutes for private investment.

IV. Methodology

The report uses regression to find out how government expenditure(G) affects GDP(Y).

There will be two sets of regression. The first set is a time series regression and the

second set is a cross-sectional regression by using provincial level data.

A. Time series regression

This regression is to show how the change in government expenditure in every

quarter would affect the change of the level of GDP. The reason of using quarterly

data is to have a better a bigger size of observations. The regression equation id the

following:

$$\Delta Y_t = \beta_1 + \beta_2 \Delta G_t + \varepsilon \tag{1}$$

Equation (1) shows how an increase in government expenditure would affect the

change of the GDP. For a variable $X_t, \Delta X_t = X_t - X_{t-1}$. And ε is an independent

and identically distributed and is normally distributed error.

Apart from this, since fiscal policy introduced by the Chinese government might

also affect investment through several channels. First, there might be some

construction works assigned to state-owned enterprises; second, the expenditure

fiscal approach might enhance the confidence of foreign investors; and third, by

what has mentioned in the IS-LM model, when government expenditure increases,

the interest rate would increase as well since the aggregate demand raised. There

might be a decrease in investment(I) of private sector due to the increase in lending

interest rate(L). For the reason above, we run the following regressions as well:

$$\Delta I_t = \beta_1 + \beta_2 \Delta G_t + \varepsilon \tag{1a}$$

$$\Delta L_t = \beta_1 + \beta_2 \Delta G_t + \varepsilon \tag{1b}$$

Equation (1a) shows how a change in government expenditure would affect the

total investment. Equation (1b) shows how a change in government expenditure

would affect the lending interest rate.

However, the causality may go in another direction. The government is likely to

implement an expansionary fiscal policy when the economy is facing a downturn

and the policy is used to stimulus the economics. Therefore, it may have a

probability that government expenditure is negatively related to the GDP, but this

reverse causality is not what we want to investigate in this study. Therefore, we

could add a the change in world GDP(WGDP) as a control variable in the functions

to include the world economics climates as a factor which would have influences to

the GDP. Then, we would have regression functions:

$$\Delta Y_t = \beta_1 + \beta_2 \Delta G_t + \beta_3 \Delta WGDP_t + \varepsilon \qquad (2)$$

$$\Delta I = \beta_1 + \beta_2 \Delta G_t + \beta_3 \Delta WGDP_t + \varepsilon \qquad (2a)$$

$$\Delta L_t = \beta_1 + \beta_2 \Delta G_t + \beta_3 \Delta WGDP_t + \varepsilon \qquad (2b)$$

We might also add other factors, such as net export(NX), which might have a large

impact on the China's GDP growth and at the same time related to government

spending. For this reason, we add net export as an additional control variable.

$$\Delta Y = \beta_1 + \beta_2 \Delta G_t + \beta_3 \Delta WGDP_t + \beta_4 \Delta NX_t + \varepsilon \qquad (3)$$

$$\Delta I = \beta_1 + \beta_2 \Delta G_t + \beta_3 \Delta WGDP_t + \beta_4 \Delta NX_t + \varepsilon \qquad (3a)$$

$$\Delta L_t = \beta_1 + \beta_2 \Delta G_t + \beta_3 \Delta WGDP_t + \beta_4 \Delta NX_t + \varepsilon \qquad (3b)$$

Regression coefficients are estimated by ordinary least squares(OLS).

B. Cross-sectional regression by using provincial level data

This regression studies the relationship between provincial government

expenditures and provincial level GDP. The reason of using the cross-sectional

regression by using provincial level data is because we cannot completely solve the

problem of reverse causality in the time series regressions, and we want to reduce

the effect of it. By using the cross-sectional provincial data, within the same period

of time, when the economics is facing a recession, it is very likely that almost all

provincial level GDP would be affected badly, so the problem brought by the

reverse causality will be smaller.

There are some macroeconomic literature suggested that we can eliminate the

reverse causality by imposing identifying restrictions, for example, that

government spending does not react to current economic conditions at the quarterly

frequency, or relying on natural experiments to establish exogeneity, for example, a

war initiated by another country that causes increased government spending not

motivated by current economic conditions in the home country(Fuchs-Schundeln

& Hassan, 2015). Since it is too difficult to have the natural experience, we would

not try this in the report.

The function of the cross-sectional regression using provincial level data would be

the follow:

$$\Delta Y_i = \beta_1 + \beta_2 \Delta G_i + \varepsilon \qquad (4)$$

Since the study is to investigate the effectiveness of the 4-trillion stimulus package,

we will select two time points around the time of fiscal expansionary policy and

compute the changes in government expenditure and the change in GDP in

provincial level.

Because net export would also influence GDP, we might also add the net export of

each province as a control factor that would affect the GDP in the function:

$$\Delta Y_i = \beta_1 + \beta_2 \Delta G_i + \beta_3 \Delta NX_i + \varepsilon \qquad (5)$$

Regression coefficients are estimated by ordinary least squares(OLS).

V. Data Sources

For the time series regressions, we use the quarterly data used founded in Federal

Reserve Bank Center of Atlanta. The organization has the statistics of China's GDP,

government expenditure, net export and fixed assets investment by quarterly from 1992

Q1 to 2014Q4. The data is updated annually. The reason of using data started from 1992

Q1 is that some of the data required in the regression are only available from 1992.

Since data set provided by the organization is nominal statistics, to be more accurate, we

compute the real data, such as real government expenditure and real GDP by using the

GDP deflator. The GDP deflator would be found in the Federal Reserve Bank Center of

Atlanta as well. The calculation of the real data is as the following:

$$\text{Real data} = \text{Norminal data} \div \text{GDP deflator} \qquad (6)$$

The real data could eliminate the change in the price level and only reflect the change in output level. The data of the WGDP is found in OECD(Organization for Economic Co-operation and Development) Statistics. The data of the WGDP is proxy by the GDP of OECD-total as quarterly WGDP is not available. The bank lending rate of China would be observed from the People Bank of China website. Because the lending rate adjusts overtimes, the report would use the latest lending rate of each quarter to run the regressions. There are different kinds of lending rate according to the lending period from the People Bank of China website, and in this study, we choose the lending rate within 6 months to 1 year to observe. For the time series regression, there are 91 observations in total.

For the cross-sectional regression by using provincial level data, we used the data found in the China Statistical Yearbooks. There are the annual provincial GDP, provincial government expenditure, provincial import and export in yearbooks. As the data provided by the China Statistical Yearbooks is in terms of current dollars, we would calculate the real data by using equation (6). As we use annual data in the regressions this time, we use the yearly GDP deflator of China provided by the World Bank. The regional import and export are shown in terms of US dollars, therefore, we would times

the average exchange rates of Renminbi for US dollars in years before doing the

regressions. The exchange rates are found in the China Statistical Yearbook 2015.

We have two specifications in the cross-sectional regression by using provincial level

data. In the first specification, we use a change of annual GDP in provincial level and

the change in annual government expenditure in provincial level from 2007 to 2011,

which is the before and after the implementation of the stimulus package.

In the second specification, we use a change of annual GDP in provincial level and the

change in annual government expenditure in provincial level from 2008 to 2009, which

is in the period that the policy started to implement. For the cross-sectional regression

by using provincial level data, there are 31 observations in total.

VI. Empirical result

With the regression set in the section of the methodology using the data sources in the

previous section to process the following empirical results. The results would be

corrected to 2 decimal places. If the results are smaller than zero, they would be

corrected to 2 significant figures. The p-values of the coefficients would be shown in the

parentheses.

A. Time series regression

Table 3

	(1)	(2)	(3)
Observations	91	91	91
R-squared	0.04	0.10	0.10
Intercept	102.19	81.24	79.49
Change in government expenditure	0.50 (0.05)	0.49 (0.05)	0.54 (0.04)
Change in world GDP	-----	6.2 (0.02)	6.4 (0.02)
Change in net export	-----	-----	-0.11 (0.35)

Table 3 shows the empirical results of regression (1), (2) and (3). This three

regressions aim to figure out how a change in the government expenditure

would affect the level of GDP in China. There are totally 91 observations. For

regression (1), the r-squared is 0.04. For regression (2) and (3), the r-squared is

0.11. R-squared measures the proportion of the total variation in the dependence

variables that is explained by the model (Gordon, 2015). The range of the R-

squared is between 0 and 1. The bigger the number of the R-squared is, the more

variations could be explained by the model. From the table, all the three

regressions show that the change in government expenditure has significant

impacts on the change in GDP as the p-values of the coefficients of the

government expenditure are smaller than 0.05. The coefficients to change in

government expenditure are closed in the three regressions, meaning that the

results are stable. The results show that increasing $1 in the government

expenditure would have an increase in about $0.49-$0.54 in the level of GDP.

Apart from the change in government, the regression results also illustrate that

the change in world GDP would have a significant influence on the China's

output level but the change in net export is not significant in this regression.

Table 4

	(1a)	(2a)	(3a)
Observation	91	91	91
R-squared	0.026	0.030	0.058
Intercept	83.64	94.22	88.27
Change in	0.77	0.77	0.96

government expenditure	(0.13)	(0.12)	(0.06)
Change in world GDP	-----	-3.1 (0.57)	-1.7 (0.75)
Change in net export	-----	-----	-0.37 (0.11)

Table 4 shows the empirical results of regression (1a), (2a) and (3a). There are totally 91 observations. The R-squared of the three regressions is 0.026, 0.30 and 0.58 respectively. These three regressions aim to figure out how a change in government expenditure would affect the change in investment. It is obvious that all the three regressions show that the change in government expenditure is not significant to the change in investment as the p-values of the three coefficients of change in government expenditure are larger than 0.05. The coefficient of change in government expenditure which is closest to significant is the one in regression (3a). The p-value of it is 0.06. Its coefficient is 0.96, which means an increase in $1 of government expenditure would increase $0.96 of investment in China. According to the results, change in world GDP and change in net export is not significant to the investment in China either.

Table 5

	(1b)	(2b)	(3b)
Observation	91	91	91
R-squared	0.00049	0.10	0.11
Intercept	-0.028	-0.23	-0.24
Change in government expenditure	-0.00038 (0.84)	-0.00045 (0.80)	-0.000086 (0.96)
Change in world GDP	-----	0.0060 (0.002)	0.0062 (0.0017)
Change in net export	-----	-----	-0.00072 (0.38)

Table 5 shows the empirical results of the regression (1b), (2b) and (3b). There are totally 91 observations. The R-square of the three regressions is 0.00049, 0.10 and 0.11 respectively. These three regressions aim to figure out how a change in government expenditure would affect the change in lending rate within 6 months to 1 years in China. From the above result, we can see that the

change in government expenditure is insignificantly related to the change of

lending rate. The p-value of the coefficient of change in government

expenditure in the three regressions is between 0.80 and 0.96, which are much

higher than the significant standard, p-value smaller than 0.05. Change in net

export is not a significant issue affecting the lending rate as well. However, the

result shows that the change in world GDP is significant to the change in

lending rate. The p-value of the change in world GDP in the regression (2b)

and (3b) are 0.002 and 0.0017 respectively, which is smaller than 0.05.

B. Cross-sectional regression by using provincial level data

Table 6

	2007-2011		2008-2009	
	(4)	(5)	(4)	(5)
Observations	31	31	31	31
R-squared	0.73	0.74	0.57	0.58
Intercept	346.59	-63.13	-520.92	-474.26
Change in government expenditure	4.10 (8.25E-10)	4.38 (1.75E-09)	4.60 (1.03E-06)	4.34 (6.16E-06)

Change in net export	-----	-28.43	-----	-0.14
		(0.19)		(0.36)

Table 6 shows the empirical results of the regression (4) and (5) in two

difference time specifications, which are 2007-2011 and 2008-2009. These

regressions aim to figure out how a change in the provincial government

expenditure would affect the change in the GDP in provincial levels. There are

totally 31 observations. The R-squared of the four regressions is 0.73, 0.74, 0.57

and 0.58 respectively. The results indicate that the change in provincial

government expenditure has a significant impact on the change in the GDP in

provincial levels, which the p-values of the coefficients of the change in

government expenditure in the 4 regressions are far smaller than 0.05. The range

of the coefficient of the change in government expenditure is between 4.10 and

4.60. The results show that fiscal multiplier of the provincial level government is

between 4.10 and 4.60. From the results of equation (5), we can observe that the

change in net export is not significant to the change in the GDP at provincial

levels.

VII. Empirical analysis

A. The contribution of the 4 trillion stimulus fiscal package to the GDP

From the report, we can observe that the fiscal multipliers of the government

expenditure of China in the time series regressions and the cross-sectional

regressions by using provincial level data are different. For the time series

regressions, the fiscal multiplier is between 0.49 and 0.54, while the results from

the cross-sectional regression by using provincial level data is between 4.10 and

4.60. The results are reasonable as they are close to the observations of the studies

in the section of literature reviews. We use 0.54 as the fiscal multiplier of the time

series regressions and4.38 as the fiscal multiplier of the cross-sectional regression

by using provincial level data because of the more control variables they contain

and the more significance they are in the regression results. We use the percentage

share of the central government funds distributed in the three years which has

mentioned in table 1 in the background to proxy the effect of the 4 trillion stimulus

package to the GDP.

Table 7

Years	Percentage share of the 4 trillion	Fiscal multiplier	GDP generated by the fiscal	GDP of the year	Percentage share of the GDP

42

			policy		generated by the fiscal policy to the total GDP
2008	8.81%		190 billion	31, 675 billion	0.60%
2009	42.63%	0.54	920 billion	34, 563billion	2.66%
2010	48.49%		1047 billion	40, 890 billion	2.56%
Total	100%		2157 billion	107,128 billion	2.01%

Table 7 demonstrates how the 4 trillion stimulus fiscal policies contributed to the

GDP by using the results of the time series regression. We can observe that the policy

has contributed to the GDP by about 2.01%, which generated about 2157 billion of

the GDP.

Table 8

Years	Percentage share of the 4 trillion	Fiscal multiplier	GDP generated by the fiscal policy	GDP of the year	Percentage share of the GDP generated

					by the fiscal policy to the total GDP
2008	8.81%		1544 billion	31, 675 billion	4.87%
2009	42.63%	4.38	7468 billion	34, 563 billion	21.61%
2010	48.49%		8495 billion	40, 890 billion	20.73%
Total	100%		17,507 billion	107,128 billion	16.34%

Table 8 demonstrates how the 4 trillion stimulus fiscal policies contributed to the

GDP by using the results of the cross-sectional regression by using provincial level

data. We can observe that the GDP generated by the fiscal policy and percentage

share of the GDP generated by the fiscal policy to the total GDP in this time is

much bigger than the one by using the time series regressions. It is because the

fiscal multiplier is nearly 10 times bigger than the multiplier in the time series

regressions. By using the cross-sectional regression by using provincial level data,

we can advert that about 16.34% of the GDP from 2008 to 2010 is made up by the

policy.

One of the reasons that the fiscal multiplier in the time series is relatively lower

may due to the reserve causality that we have mentioned in the methodology

section. The expansionary fiscal policies are more likely to be introduced during the

recession so the results of the regressions may be underestimated.

Another reason is that there may be capital transfers across provincial levels. For

example, after the Sichuan earthquake, government investment in Sichuan would

increase. Meanwhile, firms from other provinces may also have some investment in

Sichuan for the reconstructions. The capital transfers would lead to an increase in

the provincial level output, causing an overestimation in results of the cross-

sectional regressions by using provincial data.

On the other hand, the cross-sectional regression by using provincial data may be

overestimated. As we only concluded one to three control variables in the

regressions, there might be other factors that related to the change in GDP that we

have not considered in this study. In fact, besides the expansionary fiscal policy, the

Chinese government has also introduced an expansionary monetary policy during

the 2008 global financial crisis. We would have a brief discussion on it in part C of

this section.

B. Change in other factors related to the change in GDP

By observing table 5, we can notice that the change in world GDP has a significant

positive relationship with the GDP in China. The world GDP interprets the global

economics. If the world GDP grows fast, the demand for goods and services in the

world may increase. Since China is the world's largest exporter, the GDP may

increase due to an increase in net export. However, when we take a look at table 3

and table 6, it is surprised that the change in net export is an insignificant factor to

the change in China's GDP in the two sets of regressions.

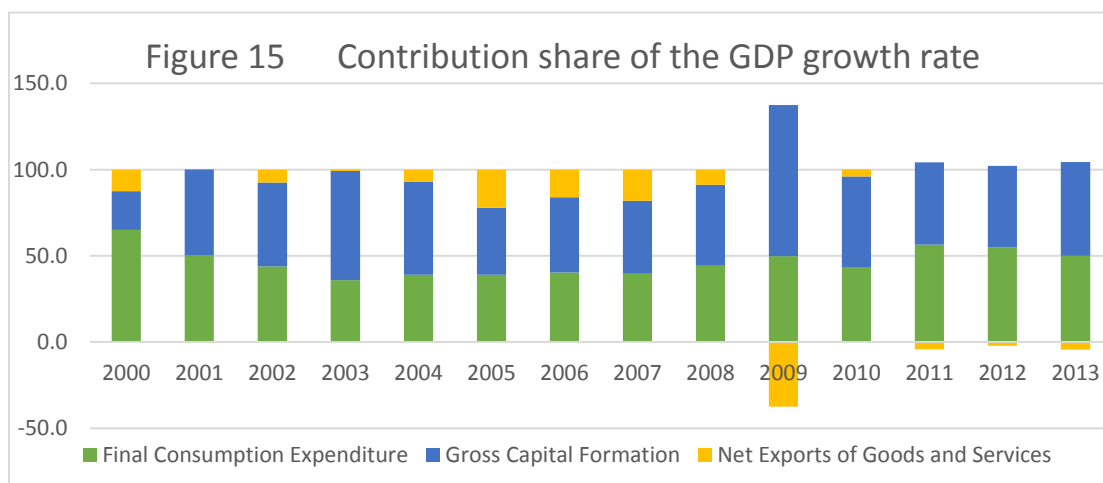Figure 15   Contribution share of the GDP growth rate

Figure 15 shows the contribution share of the GDP growth rate in China. The source

of the data is from the China Statistic Yearbook 2014. Although there is a large share

of GDP contributed by the net export, which has been mentioned in the section of

background, we can observe from the above graph that net export is relatively less

important than the consumption expenditure and the gross capital formation in the

contribution of the GDP growth. In fact, the contribution share of the GDP growth

rate by the net export has even become smaller and smaller after 2005. This might

be the reason that the change in net export is recognized as insignificant in the two

sets of regressions.

So, what other factors lead the change in world GDP significantly related to China's

GDP? In fact, the world GDP indicates the world economics. Moreover, as China

has become the world's second largest economy, its GDP growth would also have an

influence of the world's GDP. It may be a reverse causality that we cannot eliminate

in the regressions. According to Credit Suisse, China represents 32% of all global

GDP growth and about 30% of global capital expenditures (Edwards, 2015). The

significant relationship between the change in China's GDP and the change in the

world GDP might due to the contribution of China's GDP to the world GDP.

In addition, the impacts of the world economics to China's economics may not only

reflect on trading but also investment and employment. According to the World

Bank(2010a), inbound foreign direct investment(FDI) has played an important role

in China's economic development. They compose for the majority of exports and

imports in China. As they owned the advanced techniques that have a higher

productivity, they provide for 30% of Chinese industrial output and generate 22% of

industrial profits by employing only 10% of workers. When the optimistic view in

the global economics, the firms would have more capital to invest in China. This

would affect China's GDP.

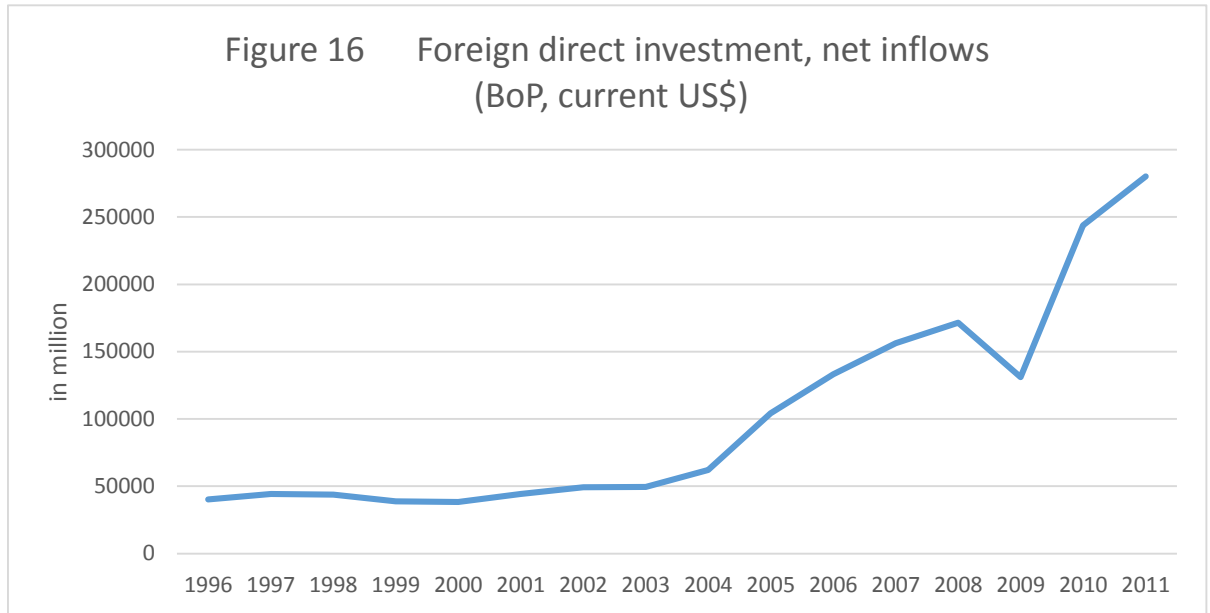Figure 16   Foreign direct investment, net inflows (BoP, current US$)

Figure 16 shows the net inflow of FDI in China. The data is found in the World

Bank Database. We can observe that in the beginning of the financial crisis, the FDI

in China has also been affected and having a recovery to the precrisis level in 2010.

C. Change in the investment and the interest rate related to the change in

   government expenditure

Before we process the regression, we have some mentioned some of the possible

ways that the fiscal policies might affect the investment, which may also affect the

GDP. Nevertheless, according to table 4, an increase in the government expenditure

is not significant to the change in investment.

We have also run a regression to test whether the change in the government

expenditure would affect the interest rate and lead to a crowding out effect. The results shown in table 5 suggest that the increase in government expenditure is insignificantly negatively related to the change in the interest rate, which is not matched with the IS-LM model.

This might due to the expansionary fiscal policy. According to Liqing Zhang(2009),In November 2008, China has converted to an expansionary monetary policy from a contractionary monetary policy that has executed for 5 years. The expansionary monetary policy includes having a reduction in the interest rates to a historically low level, cutting down the minimum reserve requirement ratios for banks, and eliminate the control on the lending quota by commercial banks. As the interest rate is intervened by the government through monetary policies, it could offset the effect brought by increasing government expenditure.

Figure 17   M2 in China
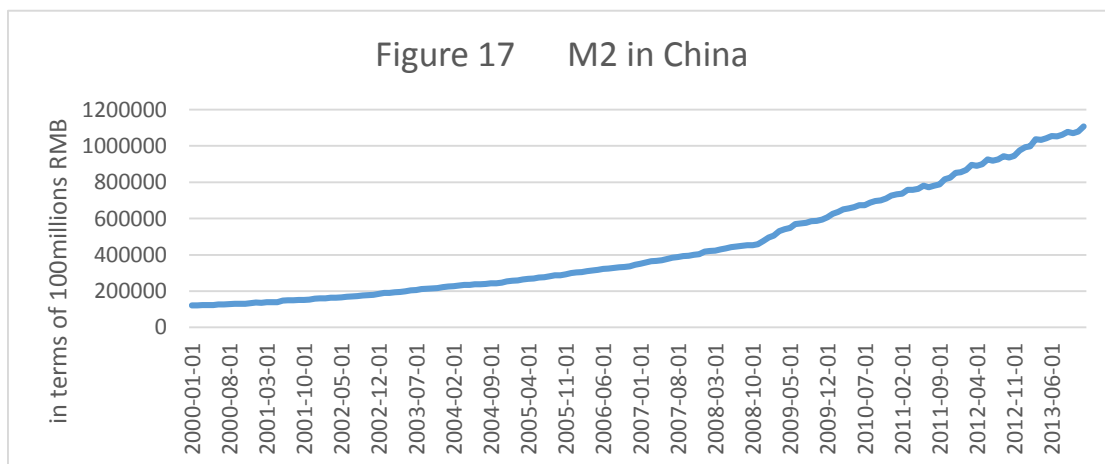
Another reason may be the increase in money supply, which is shown in Figure 17.

The data is provided by the World Bank Database. We can observe that the M2 in

China started to increase quicker from about November 2008, which is also when

the expansionary fiscal policy has to be announced. In accordance with the IS-LM

model, an increase in money supply would lead to a decrease in the interest rate,

this may also neutralize the effect of increasing interest rate after raising the

government expenditure.

VIII. Arguments of the stimulus fiscal policy

Some economists consider the fiscal policy as successful and essential to China's

economic development.

Fan-gang pointed out that the 4 trillion stimulus fiscal policies would have a

multiplier effect, leading China to have a stable economic growth (晴朗, 2013).

Also, the former Chief Economist and Senior Vice President of the World Bank Lin

Yifu stated that the advantages of the stimulus fiscal policy introduced by the

Chinese government in 2008 outweigh the disadvantages in an interview[1]. He

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[1] The interview was done in 2012 by 楊中旭,a reporter of 《財經》.

explained that the China still needed an investment-dominate economic structure

instead of a consumption-dominate economic structure to catch up with other

developed countries. Since there are rooms to improve in China's infrastructure,

more investment can enhance China's productivities and thus benefits its economy

in the long-run, while encouraging consumptions only have influences in the growth

of China's economy in a specific period. He believed that China would have a

potential of annually 8% increase in the GDP in average in the future 20 years.

He mentioned that the jobs creations are the largest contribution of the 4 trillion

investments. In fact, according to Zhang BenBo, an Chinese government official,

the 4 trillion investment has created about 48million job opportunities in the

construction of cheap buildings, infrastructures, and reconstruction in SiChuan.

Apart from this, other parts of the stimulus program also created job opportunities

and about 50 million employees were benefited(中國就業網, 2010).

Figure 18   Unemployment rate
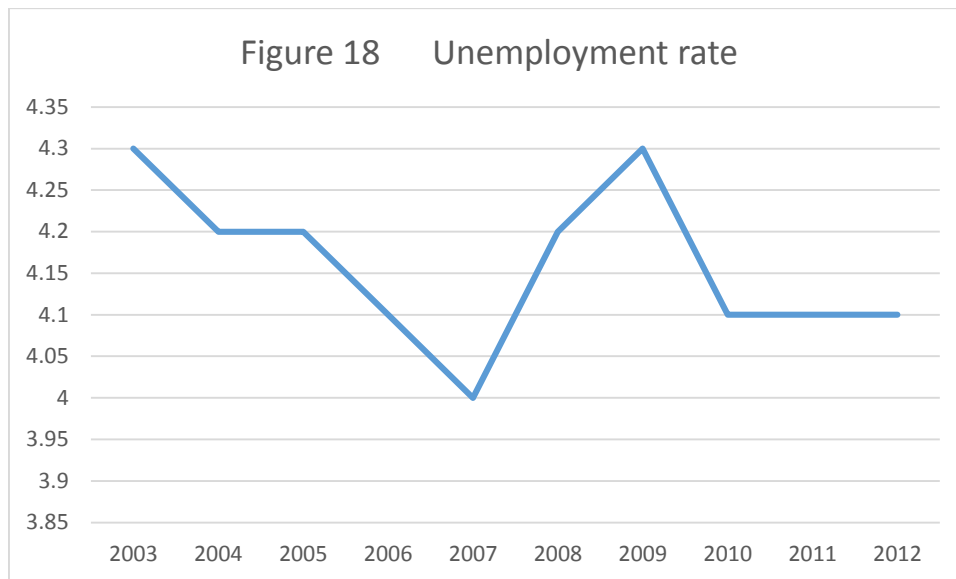
Year	Rate

Figure 18 shows the unemployment rate in China from 2005 to 2012. The lowest

unemployment rate shown in the graph is 4% in 2007. It then raised to 4.2% in 2008

and peak at 4.3% in 2009. We can observe that there was still an increase in

unemployment rate in China during the global financial crisis. However, the increase

was not very large.

Meanwhile, some economists argue that the economic stimulus plan actually creates

many by-effects. Zhang Weiying, the professor of Beijing University, pointed out that

China was employing the Keynesian model to boost the economics and maintaining

the GDP growth rate through enlarging government expenditure in recent years(信

報, 2014). However, this led to a misdirection to the enterprises since the government

has intervened the market, and the enterprises would then make wrong decisions.

Firms can be survived even with a poor management. The problems they create

would be more serious than the problems they solved, which may become disasters

of the economy.

The Professor of Economics and Finance at China Europe International Business

School Xu Xiaonian also explained that using expansionary fiscal policies was not a

sustainable way for the economics growth in a seminar(龍睿, 陳思宇 & 王琦,

2015). If the government keeps on investing capital into the market, there will be a

diminishing marginal return, causing the effect decrease. This is consistent with Wu

Jinglian's argument. He mentioned the market had an obvious outcome quickly after

in the large investment in 2009. However, in recent years, the returns for the increase

in government investment could not affect the GDP growth rate much (騰訊財經,

2015).

Moreover, Wu pointed out that most of the loans and projects created in the 4 trillion

investment were assigned to the state-owned enterprises. The stated-owned

enterprises received the money but did not know how to deal with it, so many of

them have set up property firms and invested in the property market, which created

many ghosts cities in China. He Jian, an economist in China, has figured out that

keep on investing in the property market and infrastructure would create the problem

of excess capacity(新浪財經, 2014). In fact, the average capacity utilization of

production in China before 2008-2009 was 80%. After the implementation of fiscal

policy, the capacity utilization of production in China has further decreased to 60%,

which was lower than 78.9% in the United States(華爾街見聞, 2012). One of the

examples is facing the problem of excess capacity in China is the steel industry. It is

reported the steel market has been collapsed in 2012. Wu XiChun , the consultor of

China Iron and Steel Industry Association, believed the difficulties faced by the steel

markets are mainly due to the overproduction caused by the stimulus project(人民網,

2012).

Another by-effect brought by the 2008 fiscal policy is the increase in the loans due to

the encouragement of investment.

Figure 19   Increase in Bank Lending has
supported the Infrastructure Stimulus
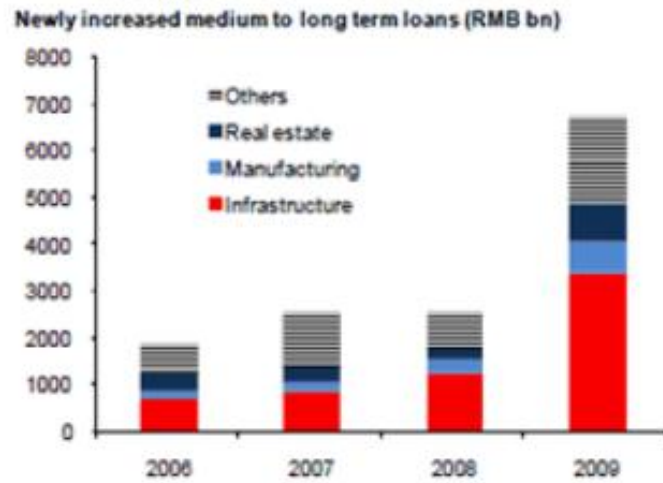
Source: PBOC, World Bank staff estimates.

Figure 19 shows the newly increase medium to long-term bank loans in terms of

billion dollars which supported the infrastructure stimulus. The data is found from a

report of the World Bank(2010b). We can observe that bank lending was close to

quadruple in 2009 after the introduction of the stimulus package. The major increase

is the lending for infrastructure, which constitutes half of the total new bank lending.

In the report of McKinsey Global Institute(2015), the change-in-debt ratio from 2007

to 2014 is 83%, which is the highest among the developing countries, and ranked as

the fifth highest leverage level country in the world. China's total debt has risen by

nearly four times to $28.2 trillion from 2007 to the second quarter of 2014. More

than half of the new debts were constituted by the corporate.

Furthermore, the increase in the local government loan in China is also a

considerable problem. The stimulus measures had motivated local governments to

have investments the infrastructure project in order to generate economics growth

and create employment. A rapid expansion of the local government financing

platforms[2](LGFP) has existed in China in 2009 and 2010. By mid–2009, more than

3,800 LGFPs had set up by different levels of governments. According to the

National Audit Office of the People's Republic of China in June 2011, there is an

RMB10.7 trillion of the stock of local government debt at the end of 2010, which is

equal to 27 percent of GDP for the year, while there was approximately RMB 4.7

trillion LGFP debts in which. The amount of the LGFP debt is equivalent to two

thirds of the sum of total local government revenue and transfers from the central

government(Lu & Sun, 2013).

Lang Xianping, the Emeritus Professor of the Business School of the Chinese

University of Hong Kong, pointed out the local government debt is a serious problem

in China. He explained that there would be RMB 4 trillion debt being matured by the

end of 2012, but the local government only capable to paid for one-fourth of the

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[2] Local government financing platforms (LGFPs) are the platforms that provides channels for local governments raising money in order to promote infrastructure development in China. The role of LGFPs is to provide financial supports to local governments to invest in infrastructure. The investment and bond issuing by this platforms would not show on the balance sheets of the local governments.

matured debts(朗咸平, 2013). In additions, as reported by IMF, the ability of local governments to repay the loans depend on the property markets. 80% of the cities would like to sell lands for settling the debts but not through the returns of the investment(World Bank, 2010b).

The stimulus package announced in 2008 maybe is not the only factor in causing the problems mentioned by the above economists, but it is likely to be one of the origins.

IX. Conclusion

To conclude, we have used the time series regressions and the cross-sectional regressions by using provincial level data in this study in order to figure out the effectiveness of the 4 trillion stimulus packages in 2008 Q4 to 2010 in China by finding out the fiscal multiplier. We observed that China has a fiscal multiplier in between 0.54 and 4.38. The 4 trillion fiscal policies launched for responding the challenges brought by the global financial crisis has generated for about 2157 billion yuan to 17,507 billion yuan output, which accounted for about 2.01% to 16.34% of China's GDP from 2008 to 2010. One of the reasons that China could have a speedy recovery in the financial crisis may be the economy stimulation created by the policies.

In the dissertation, we have also pointed out some arguments of the economists to this policies. It shows that the expansionary fiscal policies may have an effect of maintaining economic growth and creating job opportunities. However, the stimulation might not be sustainable or even created some side-effect to the economy. Some economists have mentioned that using an expansionary fiscal policy might lead to an inefficient economic market. Moreover, because of China's special economic characteristics, such as the insufficient banking systems and the unfair competitions between the state-owned enterprises and the private banks, most of the capital and loans were allocated to the state-owned enterprises, causing the market being even more inefficient. Overproduction and serious debts problems were seriously founded. The GDP growth rate recovered to the pre-crisis level in 2010 but started to slow down again in 2011.

In short, an expansionary fiscal policy might have an outstanding effect in a short term, but the effect may not be long lasting. In addition, there might be some side-effects, which we have to aware of when imposing an expansionary fiscal policy.

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