China's Western Development Program and Firm Profitability

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Abstract

This paper provides a difference in differences analysis on whether the China's Western Development Program (WDP), a government regional economic program carried out in 2000, has a positive effect on the western firms' profitability. Controlling for the firm, regional and time effects, from 1999 to 2001, the program brought the western firms with a significant relative increase of 0.49%, 0.45% and 2.61% in profitability measured by return on sales (ROS), return on assets (ROA) and return on equity (ROE) respectively.

1. Introduction

The efficiency and profitability of firms are central indicators of the economy's performance as a whole. Firm's profitability is shown to be affected by macroeconomic conditions, industry characteristics, and firm characteristics (Joh, 2003). The key determinant of firm performance is the state of the business environment, defined broadly to include the key features of the legal, regulatory, financial and institutional systems (EBRD, 2013). Firms perform better under more favorable business environment, or investment climate, which is another similar concept referring to the policy, institutional and behavioral environment, both present and expected, that influences the returns, and risks, associated with investment (Stern, 2002).

Based on the above theories, the policies or government programs that help to create a better business environment should have positive effects on the firms' performance. In this paper, I look at whether the China's Western Development Program (WDP), a government program carried out in 2000 whose main purpose is to speed up the development of the western regions and close the regional gaps, has a positive effect on the western firms' profitability.

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The WDP, covering 12 provinces in western China, had a big number of policies regarding infrastructure, environmental protection, sectoral and economic adjustments, human capital and R&D, foreign investment and trade, and raising living standards in the western region. It has been shown that the program has a general positive effect on the western economy's growth (Wang and Wei, 2003; Liu and Qiu, 2006; Liu et al., 2009). However, there is little research on firm level performance.

In order to separate the overall national economic growth effect and the WDP's effect on the firms, I use a difference in differences model and the analogous regression, comparing the profitability increase of firms from 1999 to 2001 in the western region with those in the northeastern and central regions. I exclude firms in eastern region because the eastern region is much more developed in a different growth trend even in the absence of intervention, which may provide biased estimation under difference in differences method.

My data come from the Chinese Industrial Enterprises Database developed and maintained by National Bureau of Statistics of China (NBS). The dataset provides basic identification information and financial and income data for most the above-scale (ie. annual sales to be no less than 5 million RMB) Chinese industrial firms. I only use data from 1998 to 2003 to rule out the effects from two other regional development programs announced and carried out after 2003. My final sample contains 717,103 observations.

Results show that the program has a significant but small positive effect on the western region firms' profitability relative to the control group. Controlling for the firm, regional and time effects, WDP brought the western firms with a relative increase of 0.49%, 0.45% and 2.61% in profitability measured by return on sales (ROS), return on assets (ROA) and return on equity (ROE) respectively.

The remainder of the paper is as follows. Section 2 is the literature review on firm performance determination. Section 3 provides a general introduction of China's regional economy and the China's Western Development Program. Section 4 introduces the empirical methods and the data. Section 5 presents the results. Section 6 is the concluding remarks.

2. Literature review

There are two traditional major groups of research on the determinants of firm performance. Industrial organization economics provides a basic theoretical perspective on the role of market structure. Under the economic model, (1) characteristics of the industry in which the firm competes, such as the average industry profits (Schmalensee, 1985); (2) the firm's position relative to its competitors, such as relative market share (Buzzell and Gale, 1987); and (3) the quality of quantity of the firm's resources are the major determinants of firm profitability. External market factors are of major importance. On the other hand, organizational researchers, or strategic management researchers, believe the effects of structure, motivation, group dynamics, decision making, leadership, etc. are more important. One stream attempts to capture this multidimensional aspect of organizational phenomena in a concept of "organizational climate" (Steers and Lee, 1983; Litwin and Stringer, 1968). They believe that environmental factors such as sociological, political, economic and technological, organizational factors such as structure, systems, size, history, and people factors such as skills, personalities, age together form the organizational climate, which influence the individuals' behavior and directly determine the organization's performance. Hansen and Wernerfelt (1989) test the two theories empirically and find out that the two effects are roughly independent and that organizational model explain about twice as much variance in profit rates as economic model.

Recent literatures combine the above two streams into another framework. Firm's profitability is shown to be affected by macroeconomic conditions (regulation, level of competition), industry characteristics (R&D intensity, importance of fixed costs), and firm characteristics (ownership, financial structure, size, business strategy) (Joh, 2003). Business environment, defined broadly to include the key features of the legal, regulatory, financial and institutional systems, has received much attention. Governance (Kaufmann, 2002), regulatory constraints (Botero et al., 2004), strength of the legal system (Durnev and Kim, 2005) are used as country-level proxy indicators of business environments. Hallward-Driemeier et al. (2006) use a survey of 1500 Chinese firms to examine whether investment climate, which is the policy, institutional and behavioral environment, both present and expected, that influences the returns, and risks, associated with investment

(Stern, 2002). Their findings are that firm performance is positively correlated with light regulatory burdens, limited corruption, technological infrastructure and labor market flexibility; however, there are limited gains from improving banking access and physical infrastructure.

Firm level studies show that export orientation has positive effect on performance (Tybout, 2003), foreign ownership has a general positive effect, but the effect of domestic private ownership is less clear (Estrin et al., 2009). Using a heterogeneous group of very large firms doing business around the world, Dewenter and Malatesta (2001) show that government-owned firms are significantly less profitable than privately owned firms. Zhang et al. (2002) show that state-owned enterprises (SOEs) grew faster in productive efficiency during the SOEs reform in 1996-1998 in China, but their growth rate in profitability still lagged behind that of firms with other ownership structures.

Some researches start to look at whether indicators that have been found to be significant in explaining performance at a country level also have a significant effect on firm performance. Commander and Svejnar (2011) find that country fixed effects, reflecting time-invariant differences in the business environment as well as other factors such as country-wide tertiary school enrollment or expenditures on health care relative to GDP, matter more for firm performance than differences in the business environment across firms within countries. Tzelepis and Skuras (2004) examine the effect of capital subsidization, which has neutral or even negative effects on total factor productivity of recipient sectors and firms (Bergstrom, 2000), on four dimensions of the financial performance of firms, ie. efficiency, profitability, capital structure and growth. They find that capital subsidization is ineffective in improving the efficiency and profitability of recipient firms, while only affects growth.

China’s Western Development Program (WDP), which will be introduced in detail below, is a government program whose main purpose is to speed up the development of the western regions. A series of policies taken have created a more productive investment climate where governance and institutions support entrepreneurship and well-functioning markets in order to help generate growth and development, especially by enhancing the financial and legal systems, and building up infrastructure necessary for productive investment such as transportation and communication.

Researchers find a general positive effect of this program on the western economy's growth, especially in infrastructure and environmental protection (Wang and Wei, 2003). However, it does not close the regional income gap between western and eastern China (Wei and Sun, 2004). The favorable tax treatment has a positive while not long-lasting effect on growth (Liu and Qiu, 2006). Liu et al. (2009) find that the growth of the western China is facilitated mainly by the increasing infrastructure investment and capital stock, rather than its attractiveness to human capital or foreign direct investment. There is little improvement in industry structure, or total factor productivity (TFP).

While there are many researches that use growth rate of GDP as the dependent variable to evaluate the economic effect of WDP (Liu et al., 2009), few have looked at its effect on the performance of firms in the western China. In this paper, I perform a firm-level analysis to examine whether China's Western Development Program, which is designed to develop the western economy, has any effect on that region's firm profitability.

3. China Western Development Program

3.1 China's regional economy

China has a vast territory of 9.6 million km^2, stretching from the temperate to subtropical zones. Mountains and plateaus take up 60% of the territory, while only 12% are plains less than 500 m of elevation (CSY, 1998). As Bao et al. (2002) describe, China is a three-step staircase stepping from west to east, with Qinghai-Tibet Plateau of 4000 mu of elevation in the southwest, highlands and basins between 2000 to 1000 m in the central regions, and plains below 1000 m in the east. The eastern regions have better natural environment for farming, such as higher precipitation level and warmer climate, and better location for trade as they are closer to the coastline.

Historically, the Chinese civilization started in the Loess Plateau and the Yellow River Valley in 2000 BC, which are in the northwestern China, because of the high agricultural productivity. As the population grew, people gradually moved to the southeastern area and adapted to the climate there. After the Opium War in 1840, western powers forced China to open coastal ports, and as a result, the international trade started to prosper the eastern coast. From 1949 when the Communists took power, to the early 1970s, China

was an agricultural economy under the Mao's doctrine of self-reliance. The gap between the interior and coastal regions was not substantial at that time (Jian et al., 1996).

In 1978, the government started the Chinese economic reform (aka Reform and Opening-up Policy). The first stage of the reform, from 1978 to 1984, succeeded mainly in the agricultural sector. Starting in 1984, controls on private businesses and government intervention continued to decrease. The Chinese government focused its attention on the coastal area at the second stage from 1984 to mid 90s. Deng Xiaoping, the reform leader, created the first four special economic zones, namely Shenzhen, Zhuhai, Shantou, and Xiamen in 1980. And a further 12 coastal cities were opened up in 1984. In these special economic zones and cities, foreign investments are generally exempted from taxes and regulations; the firms participate more in international trades; products are primarily export-oriented; economic activities are primarily driven by market forces. Deng pointed out in 1988, "The coastal areas, which comprise a vast region with a population of 200 million, should accelerate their opening to the outside world, and we should help them develop rapidly first; afterwards they can promote the development of the interior".

Both the coastal development strategy and the fiscal reforms of 1994 (especially changes in tax rates and in revenue sharing between the center and provinces) widened the gap between the coastal and the interior regions (Fang and Chen, 2000). Coastal regions grew far more rapidly than the mountain areas of the hinterland. During 1978-1997, the GDP per capita in the coastal, central, and western regions grew at an average of 10%, 8.4%, and 7.4% respectively (Bao et al., 2002). Fig.1 shows the average growth rates of GDP in different regions from 1978 to 1997.

[Fig.1 Growth rates of GDP (1978-1997), mainland China]

In late 1999, after two decades of pursuing coastal development, Chinese leaders announced a change in China's regional development strategy to restart a more balanced national development. On June 19, 1999, Jiang Zemin, general secretary of the Party at that time, announced the western development program, whose aim is to accelerate the development of western areas. The program started in 2000. In 2002, the Northeast Area Revitalization Plan was announced to rejuvenate industrial bases in Northeast China, and the guidelines were released in 2003. In 2004, the government announced the Rise of Central China Plan, the main purpose of which is to make the central region a food

production, energy and raw material, modern manufacturing, high-tech industrial base and a transportation hub; its guidelines were released in 2006. Fig.2 shows the four economic regions. Table 1 lists the major development programs for the four regions.

[Fig.2 Four economic regions in China]

[Table 1 China economic regions and development programs]

3.2 China's Western Development Program

The program, intending to address economic, regional, ecological and security concerns in the western region (Lai, 2002), covers 6 provinces (Gansu, Guizhou, Qinghai, Shaanxi, Sichuan, and Yunnan), 5 autonomous regions (Guangxi, Inner Mongolia, Ningxia, Tibet, and Xinjiang), and 1 municipality (Chongqing). The leading group to develop the western region was formed on 16 January 2000. Zhu Rongji and Wen Jiabao, the premier and vice premier, were its director and vice director, and seventeen ministers, along with two ministerial-level party officials, became members of the group (Chen, 2000). Following the policy framework released by the State Council, relevant departments of central and local governments also issued some specific policies. The major policies focused on infrastructure, environmental protection, sectoral and economic adjustments, human capital and R&D, foreign investment and trade, and raising living standards in the western region (Lai, 2002).

Most of the investment has been dedicated to developing transportation, energy, communication, irrigation, and improving urban infrastructure in the interior regions. For example, eight national highways of 12,600 kilometers will be built to connect the country's major cities. In terms of railways system, the government started to build Qinghai-Tibet railway in 2001. To promote environmental protection, the government launched three key environmental projects to control such ecological disasters as floods, draughts and sandstorms. Sectors that rely on the west's comparative advantages in minerals and other resources, crops, fruits, and cattle, as well as tourism and related service industries are greatly encouraged. Funding and support for research facilities, technical training, and college education are provided. The Ministry of Personnel formulated "A Plan for Human Resource Development in the West" in 2000 to attract talents in science, technology and management, by offering high wages and good compensations.

The tax reduction and treatment policies have the most important direct effects on the firms in the western region (Lu and Deng, 2013). These policies include:

(1) Domestic and foreign investment enterprises (FIEs) in western China which belong to the encouraged category are liable for 15% income tax rate for 10 years (compared to the normal 33%)

(2) New domestic enterprises in the categories of transportation, power, water conservancy, postal service, radio and television in western China are exempted from the enterprise income tax for the first two years and get a 50% reduction in the third year from the year of operation (aka "two-year exemption and third-year half"). Foreign-funded enterprises can also benefit from the same policy if they have been operating for more than ten years.

(3) Tariff and import value added tax are exempted for imported equipment used in the encouraged projects in western China (except for commodities otherwise specified)

(4) Key infrastructure projects get special tax treatments from the government. For example, during the construction of Qinghai-Tibet Railway, almost all kinds of tax generated by the project were exempted.

In response to the interior regions' lack of foreign investment, FIEs get a set of preferential policies as well. The policies include:

(1) The selected foreign investment projects in the *A Catalogue of Advantaged Industries for Foreign Investment in the Central and Western Regions* can enjoy existing favorable tax treatment. After the treatment expires, they will be liable for three years to an income tax of 15%.

(2) The government offers FIE treatment to any reinvestment project in the central and western regions made by FIEs in which foreign funds account for at least 25% of the total investment.

(3) FIEs can extract minerals on their own or jointly with a Chinese partner in the western region; they will enjoy a reduction in or exemption from mineral compensation and usage fees.

(4) With certain restrictions on their stock shares, FIEs can construct branch railways as well as local railways, urban subways, bridges, tunnels, and harbors in the central and

western regions. They can also invest in projects to extract, store, process, and pipe oil and gas.

The above policies, together with others such as increased central government fiscal transfers to the western region, encouragement policies for domestic and foreign banks, financial institutions, and private capital to provide more financing and credit support for the western firms etc. all help to create a more productive investment climate and better business environment. In line with the literatures, a positive effect on the firms' performance is expected.

4. Methods and data

4.1 Methods and predictions

I use difference in differences method to test whether China's Western Development Program has effect on firms' profitability.

Let Y_{0irt} denote profitability of firm i, which belongs to region r, at time t in the baseline group, and Y_{1irt} in the treatment group.

$$E(Y_{0irt} \mid r,t) = \gamma_r + \lambda_t$$

where γ_r is the region effect and λ_t is the time effect.

Suppose the region effects and time effects are the same, the only difference between the expected value of the profitability of the two groups comes from the intervention. That is

$$E(Y_{1irt} \mid r,t) - E(Y_{0irt} \mid r,t) = \delta$$

where δ is the treatment effect.

Here the treatment or intervention is the China's Western Development Program. The treatment group contains those firms in the 12 provinces which belong to the western region. I take the firms from provinces that belong to the northeastern or central region as the control group. I did not include firms in eastern region because the eastern region is much more developed, in a different growth trend. Difference in differences model requires that untreated group provide estimate of baseline trend that would have existed in the absence of intervention, which cannot be true if firms in eastern regions were included as the baseline.

Since the WDP began in 2000, which means the intervention happens in 2000, I use the year before and the year after, ie. 1999 and 2001, as the before treatment and after treatment period. The program leading group was formed at the beginning of 2000, carrying a lot of policies in that year and firms have already responded to the incentives. However, I use data in 2001 instead of 2000 as the after treatment period because the effect on profitability might not be fully reflected in the year when the policies just came into effect. If a firm invested more in 2000 due to the more favorable financial support from government or less credit constraint from the bank, the investment might take some time to generate profit.

A more specific version of the model is:

$$\begin{aligned}&[E(Y_{irt} \mid r = Western, t = 2001) - E(Y_{irt} \mid r = Western, t = 1999)] \\ &-[E(Y_{irt} \mid r = Northeastern/Central, t = 2001) - E(Y_{irt} \mid r = Northeastern/Central, t = 1999)] \\ &= \delta \end{aligned} \quad (1)$$

If the development program increased firms' profitability, δ should be positive.

Alternatively, the treatment effect can be estimated under a regression framework.

$$Y_{irt} = \beta_0 + \beta_1 T_r + \beta_2 A_t + \delta T_r A_t + \alpha X_{irt} + \varepsilon_{irt} \quad (2)$$

where Y_{irt} is the firm's profitability; T_r is a dummy variable (=1 if the firm is in the western region, =0 if the firm is in the northeastern or central region); A_t is a dummy variable (=1 if in 2001, =0 if in 1999); $T_r A_t$ is the interaction term; X_{irt} contains the control variables; ε_{irt} is the error term.

The coefficient δ before the interaction term is the same as the treatment effect δ in the difference in differences model above. Again, if WDP has positive effect on firms' profitability, δ is expected to be significant and positive.

4.2 Dataset

The data I use come from Chinese Industrial Enterprises Database developed and maintained by National Bureau of Statistics of China (NBS). Its data mainly come from the annual or quarterly reports of the industrial firms that are state-owned or above-scale (ie. annual sales to be no less than 5 million RMB) non-state-owned. The database contains over 2 million observations from 1998 to 2007. Two types of information are provided: (1) basic identification information including identification number, enterprise

name, address, industry, ownership, affiliation, time founded, number of employees etc. (2) financial and income data including assets, liabilities, depreciation, capital, sales revenue, profits, etc.

For this paper, I only use data from 1998 to 2003, because two other regional development programs were announced and carried out after 2003, namely the Northeast Area Revitalization Plan and Rise of Central China Plan, which may also have effects on firms' performance.

To rule out outliers, I mainly follow the method of Cai and Liu (2009), Levinsohn and Petrin (2003) and Yu (2011) and delete the following kinds of observations:

(1) observations with missing information on critical variables, specifically total assets, the number of employees, gross value of industrial output, fixed assets, sales or profit, affiliation

(2) observations with operation scales smaller than the classification standard of "above scale" firms, specifically if the value of total sales is less than 5 million RMB or the number of employees is less than 10

(3) observations that have a negative value for one of the following:

1) total assets minus liquid assets

2) total assets minus fixed assets

3) accumulated depreciation minus current depreciation

4) equity

5) paid-up capital

(4) observations whose identification number is missing

(5) observations with invalid time founded, specifically, month later than 12 or earlier than 1, year later than 2003

(6) observations with extreme values, specifically, the values of key variables including ROS, ROA, ROE are either greater than the 99.5 percentile or less than the 0.5 percentile

As a result, my final sample contains 717,103 observations. Table 2 presents the frequency distribution of firms by year.

[Table 2 Frequency distribution of firms by year]

4.3 Variable definition

4.3.1 Profitability measures

Firm profitability is measure by conventional accounting ratios, return on sales (ROS), return on assets (ROA) and return on equity (ROE). Using the financial statement information provided by the dataset, I compute the three profitability measures for each firm by the following formulas:

ROS=Profit/Sales

ROA=Profit/Asset

ROE=Profit/Equity

Table 3 provides summary statistics for the profitability measurements.

[Table 3 Summary statistics for profitability measurements (1998-2003)]

4.3.2 Control variables

From the dataset, I construct the following variables of firm characteristics.

SIZE is measured by the natural log of employee numbers. I also include a SIZESQ terms which is the square of SIZE.

AGE is measured by the years of operation. The dataset reports the founded year of the firms. Subtracting the founded year from the respective report year, I get the age of the firms. AGESQ, which is the square of AGE, is also included in the regression.

The industry characteristics are controlled by the industry dummies. Every firm has an industry code that falls into one of the 40 two-digit industry codes assigned by NBS. The frequency distribution is reported in Table 4.

[Table 4 Frequency distribution of firms by two-digit industry codes (1998-2003)]

Firm ownership is defined by capital structure. Using the capital resource information in the dataset, I construct seven dummy variables to represent a firm's ownership status. Their definitions and frequencies are reported in Table 5.

[Table 5 Firm ownership (1998-2003)]

I construct five dummies to represent the firms' government affiliation status, which is reported in the dataset directly. Table 6 reports their categories and frequencies.

[Table 6 Firm affiliation (1998-2003)]

To control for the regional effects, I construct 31 dummies for province. The province and city code is reported in the dataset, from which I get the two-digit province code for each firm.

A dummy WEST is constructed to record whether the firm is located in western region or not. For the sake of difference in differences model, the firms with WEST equaling to 1 are the treatment group. The control group, which includes the firms in northeastern or central regions, has a WEST of 0. Similarly, I use a dummy variable A00 to indicate whether the observation firm comes from before or after 2000. Specifically, A00 equals to 1 for 2001, and 0 for 1999.

Finally, five year dummies are created to capture the time-varying effects, as well as to perform the difference in differences regression.

5. Empirical results

5.1 Difference in differences results

The time trends of the three measurements of firm profitability are shown in Fig.3 to Fig.5. The western firms had lower profitability than the firms in northeastern or central regions. Before 2000, the gaps between the ratios were getting bigger from 1998 to 1999. In 2000, the gaps started to become smaller, and the same trend was kept during the following four years. While the differences are noticeable, but not obvious from the graphs, the difference in differences results in Table 7 confirm that the WDP has increased the western firms' profitability relative to the northeastern or central firms'. Specifically, there was a relative increase of 0.58% in ROS, 0.65% in ROA and 3.28% in ROE from 1999 to 2001. The estimates are calculated based on equation (1).

[Fig 3. Mean ROS of firms (1998-2003)]

[Fig 4. Mean ROA of firms (1998-2003)]

[Fig 5. Mean ROE of firms (1998-2003)]

[Table 7 Firm profitability during the years before and the year after WDP]

5.2 Regression estimates

To account for changes in the composition of the sample before and after 2000, I use a series of regression analysis that include different sets of control variables for the firm characteristics. The regressions, estimating equation (2), are analogous to the difference

in differences model in the last section. Firms in western regions and northeastern or central regions are pooled. Table 8 presents the results.

Coefficient of the interaction between WEST and A00 is the treatment effect. For equations (1), (4) and (7), the regressions give the same results as the difference in differences model. When the firm characteristics are controlled, the estimation power of the model increases largely. Note that the number of observations is fewer when firm age is controlled, because some firms did not report their year founded to NBS.

Although WDP has only a small effect on firm profitability, an increase of 0.49%, 0.45% and 2.61% on ROS, ROA and ROE relative to the control group respectively, the positive effects are statistically significant. This shows that the effects as we see in Fig.3 to Fig.5 do exist.

The results indicate that WDP has a small positive effect on firm profitability.

[Table 8 OLS regression results for firm profitability]

5.3 Model falsification

The key requirement of the difference in differences model is that the time trends in the absence of the intervention are the same in both the control and the treatment groups. If the intervention is more likely to take place in a group with a different trend, the OLS regression will provide biased estimates. This raises the concern that the development program is carried out in a region where the trends of the firm profitability are different in the first place. I have already excluded the eastern region firms to minimize this possibility. In this section, I add "leads" to the model to show that the time trends of firm performance are similar before WDP took place in the western regions and the northeastern or central regions.

I use the following falsification model to test the validity of the difference in difference method:

$$Y_{irt} = \alpha_0 + \sum_r \delta_r T_r + \sum_{t=-q}^{-1} \phi_t W_t + \sum_{t=-q}^{-1} \varphi_t T_r W_t + \alpha X_{irt} + \varepsilon_{irt} \qquad (3)$$

where Y_{irt} is the firm's profitability; T_r is a dummy variable (=1 if the firm is in the western region, =0 if the firm is in the northeastern or central region), controlling for region effects; W_t is a dummy variable (=1if the observation is from year t), controlling

for year effects; $T_r W_t$ is the interaction term; X_{irt} contains the control variables; ε_{irt} is the error term. q is the number of leads.

As the dataset only contains data for 1998 and 1999 before WDP, and 2000 is already a year after intervention, I compare the time trends of 1998 relative to 1999. In another word, q=1, and the respective year dummy is Y_{98} (=1 if 1998, =0 if 1999). As before, T_r is replaced with the dummy variable WEST.

If the coefficient of the interaction term $T_r W_t$ is not statistically significant, there is no difference in the trends between the western firms and the control firms before WDP.

Table 9 reports the results. For the coefficient of WEST*Y_{98}, it is only statistically significant when ROA is the profitability measurement. And it gives a surprising positive sign as for the other two financial ratios this coefficient is negative and not significant. There must be something relative to the assets that is not captured in the model. But in general, there is no obvious trend difference in firm profitability between the two groups.

[Table 9 Leading effects of the western firms before WDP]

6. Concluding remarks

In this paper, I test whether the China's West Development Program has positive effect on firms' profitability. I use a difference in differences model and the analogous regression to compare firm performance in 1999 and 2001. Results show that the program has a significant but small positive effect on the western region firms' profitability relative to the control group. Controlling for the firm, regional and time effects, WDP brought the western firms with a relative increase of 0.49%, 0.45% and 2.61% in ROS, ROA and ROE.

As WDP focused more on a group of encouraged industries, further research can be done to compare the different contributions of industries to the relative increase in profitability. Another direction is to look at the long term effect of the program. A third one is to see whether the program changes the industry composition in the region, and whether the change makes better use of the natural, social or cultural comparative advantage of the western area.

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Figures

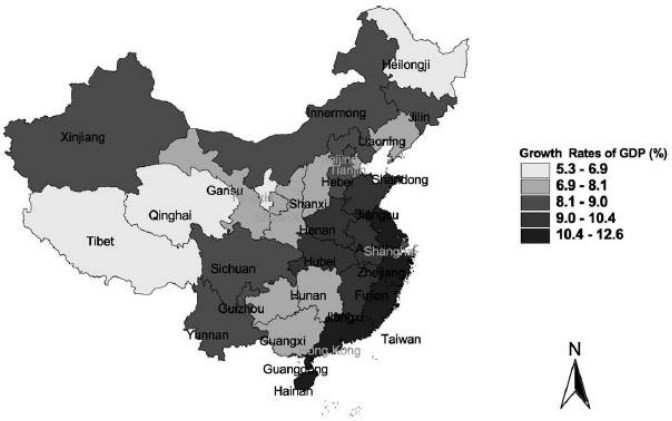

Fig.1 Growth rates of GDP (1978-1997), mainland China
Source: S. Bao et.al/China Economic Review (2002)

Fig.2 Four economic regions in China
Source: Wikipedia commons[1]

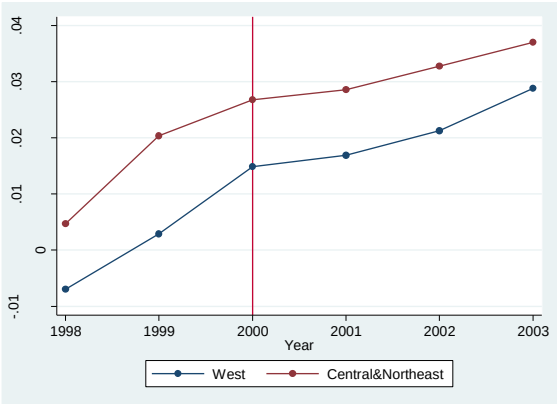

Fig.3 Mean ROS of firms (1998-2003)

[1] http://commons.wikimedia.org/wiki/File:Zhongguo_jingji_bankuai.svg

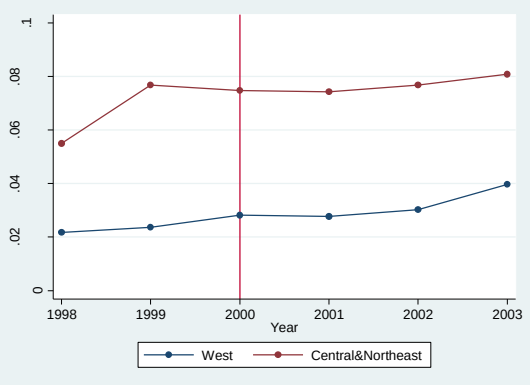

Fig.4 Mean ROA of firms (1998-2003)

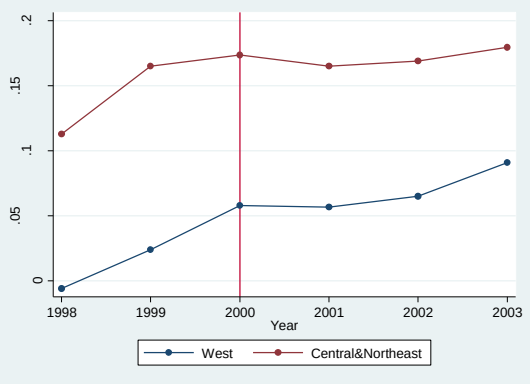

Fig.5 Mean ROE of firms (1998-2003)

Tables

Table 1 China economic regions and development programs

Region	Province/Autonomous region/ Municipality	Development program (starting year)
Eastern/ Coastal	Beijing, Tianjin, Shanghai, Hebei, Shandong, Jiangsu, Zhejiang, Fujian, Taiwan, Guangdong, Hong Kong, Macao, Hainan	Coastal Development (1984)
Western	Gansu, Guizhou, Qinghai, Shaanxi, Sichuan, Yunnan, Guangxi, Inner Mongolia, Ningxia, Tibet, Xinjiang, Chongqing	China's Western Development (2000)
Northeastern	Heilongjiang, Jilin, Liaoning	Northeast Area Revitalization Plan (2003)
Central	Shanxi, Henan, Anhui, Hubei, Hunan, Jiangxi	Rise of Central China Plan (2006)

Table 2 Frequency distribution of firms by year

Year	Frequency (%)
1998	99,130 (13.82%)
1999	103,622 (14.45%)
2000	108,966 (15.20%)
2001	120,150 (16.75%)
2002	132,563 (18.49%)
2003	152,672 (21.29%)
Total	717,103 (100%)

Table 3 Summary statistics for profitability measurements (1998-2003)

Variable	Region	Frequency (%)	Mean	Std. Dev.	Min.	Max.
ROS	Eastern	496,272 (69.21%)	.0335	.0802	-.7754	.4154
	Western	76,086 (10.61%)	.0144	.1033	-.7715	.4136
	Northeastern	33,961 (4.74%)	.0213	.1044	-.7651	.4150
	Central	110,784 (15.45%)	.0281	.0837	-.7754	.4144
	Total	717,103 (100%)	.0301	.0850	-.7754	.4154
ROA	Eastern	496,272 (69.21%)	.0706	.1237	-.2291	1.203
	Western	76,086 (10.61%)	.0293	.0844	-.2287	1.174
	Northeastern	33,961 (4.74%)	.0516	.1219	-.2288	1.200
	Central	110,784 (15.45%)	.0811	.1469	-.2316	1.190
	Total	717,103 (100%)	.0669	.1249	-.2316	1.203
ROE	Eastern	496,272 (69.21%)	.1722	.4008	-4.834	5.116
	Western	76,086 (10.61%)	.0517	.3559	-4.849	5.118
	Northeastern	33,961 (4.74%)	.1124	.4217	-4.855	4.857
	Central	110,784 (15.45%)	.1794	.4530	-4.717	5.100
	Total	717,103 (100%)	.1577	.4077	-4.855	5.118

Table 4 Frequency distribution of firms by two-digit industry codes (1998-2003)

Two-digit industry	Frequency (%)
[06] Coal Mining	10,294 (1.44%)
[07] Petroleum Extraction	289 (0.04%)
[08] Ferrous Mining	2,714 (0.38%)
[09] Nonferrous Mining	4,979 (0.69%)
[10] Nonmetal Mining	6,708 (0.94%)
[11] Other Mining	68 (0.01%)
[12] Timber and Bamboo Transportation	834 (0.12%)
[13] Food Processing	37,832 (5.28%)
[14] Food Production	15,997 (2.23%)
[15] Beverage	11,506 (1.60%)
[16] Tobacco	1,312 (0.18%)
[17] Textile	53,806 (7.50%)
[18] Garments	37,930 (5.29%)
[19] Leather	16,856 (2.35%)
[20] Timber	11,411 (1.59%)
[21] Furniture	7,234 (1.01%)
[22] Papermaking	22,157 (3.09%)
[23] Printing	11,797 (1.65%)
[24] Cultural and Educational	9,614 (1.34%)
[25] Petroleum Processing	4,823 (0.67%)
[26] Raw Chemical	51,693 (7.21%)
[27] Medical	14,042 (1.96%)
[28] Chemical Fibre	3,913 (0.55%)
[29] Rubber	8,309 (1.16%)
[30] Plastic	31,635 (4.41%)
[31] Nonmetal Mineral Products	59,864 (8.35%)
[32] Pressing of Ferrous	14,315 (2.00%)
[33] Pressing of Nonferrous	12,371 (1.73%)
[34] Metal Products	40,199 (5.61%)
[35] Ordinary Machinery	44,568 (6.22%)
[36] Special Equipment	25,795 (3.60%)
[37] Transport Equipment	29,381 (4.10%)
[39] Electric Machinery	9,166 (1.28%)
[40] Electric Equipment	36,434 (5.08%)
[41] Electronic and Telecom	19,556 (2.73%)
[42] Arts and Instruments	10,164 (1.42%)
[43] Recycle Manufacturing	14,698 (2.05%)
[44] Electric Power	17,074 (2.38%)
[45] Gas Production	1,247 (0.17%)
[46] Tap Water	4,518 (0.63%)
Total	717,103 (100%)

Table 5 Firm ownership (1998-2003)

Dummy variable	Ownership	Definition	Frequency (%)
D^{SOE}	State-owned enterprise	If state capital is equal to or more than 50% in total paid-up capital.	99,908(13.93%)
D^{CE}	Collective enterprise	If collective capital is equal to or more than 50% in total paid-up capital.	149,371(20.83%)
D^{LPE}	Legal person enterprise	If legal person capital is equal to or more than 50% in total paid-up capital.	137,000(19.10%)
D^{PE}	Private enterprise	If private capital is equal to or more than 50% in total paid-up capital.	211,760(29.53%)
D^{HKTW}	HKTW enterprise	If capital from Hong Kong and Taiwan is equal to or more than 50% in total paid-up capital.	59,390 (8.28%)
D^{FIE}	Foreign investment enterprise	If foreign capital is equal to or more than 50% in total paid-up capital.	49,480 (6.90%)
D^{OTH}	Other	If the firm does not fall into any category above.	10,194 (1.42%)
	Total		717,103 (100%)

Table 6 Firm affiliation (1998-2003)

Dummy variable	Affiliation	Frequency (%)
D^{ACG}	Affiliation to central government	14,403 (2.01%)
D^{APG}	Affiliation to provincial government	33,221 (4.63%)
D^{ARG}	Affiliation to regional government	74,965 (10.45%)
D^{AOG}	Affiliation to government at other levels	382,782 (53.38%)
D^{AOTH}	Other	211,732 (29.53%)
	Total	717,103 (100%)

Table 7 Firm profitability during the years before and the year after WDP

Dependent variable	Western		Northeastern & Central		Differences		Difference in differences
	1999	2001	1999	2001	[(2)-(1)]	[(4)-(3)]	[(5)-(6)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ROS	.0029	.0169	.0204	.0286	.0141	.0082	.0058
	(.0011)	(.0009)	(.0006)	(.0005)			
ROA	.0236	.0277	.0768	.0743	.0041	-.0025	.0065
	(.0001)	(.0007)	(.0010)	(.0009)			
ROE	.0238	.0567	.1651	.1652	.0328	.0001	.0328
	(.0037)	(.0029)	(.0033)	(.0027)			
Observations	11342	12654	23005	23631			

Notes: Standard errors are in parentheses.

Table 8 OLS regression results for firm profitability

Independent variable	Profitability measurement								
	ROS			ROA			ROE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WEST	-.0175	.0585	.0548	-.0532	.0206	.0174	-.1413	.0220	.0121
	(.0011)	(.0098)	(.0097)	(.0015)	(.0126)	(.0127)	(.0049)	(.0434)	(.0434)
A00	.0082	.0052	.0055	-.0025	-.0051	-.0047	.0001	-.0060	-.0046
	(.0009)	(.0009)	(.0009)	(.0012)	(.0011)	(.0011)	(.0040)	(.0039)	(.0039)
WEST*A00	.0058	.0049	.0049	.0065	.0047	.0045	.0328	.0272	.0261
	(.0015)	(.0015)	(.0015)	(.0021)	(.0019)	(.0019)	(.0068)	(.0065)	(.0065)
SIZE		-.0328	-.0319		-.0840	-.0835		-.1856	-.1836
		(.0018)	(.0019)		(.0024)	(.0024)		(.0081)	(.0083)
SIZESQ		.0023	.0024		.0059	.0061		.0128	.0132
		(.0002)	(.0002)		(.0002)	(.0002)		(.0007)	(.0007)
AGE			-.0004			-.0007			-.0011
			(.0001)			(.0001)			(.0004)
AGESQ			-.0000			.0000			-.0000
			(.0000)			(.0000)			(.0000)
D^{CE}		.0305	.0265		.0472	.0436		.1349	.1237
		(.0011)	(.0011)		(.0014)	(.0015)		(.0050)	(.0050)
D^{LPE}		.0321	.0256		.0368	.0302		.9670	.0790
		(.0011)	(.0012)		(.0015)	(.0015)		(.0051)	(.0053)
D^{PE}		.0326	.0266		.0441	.0380		.1217	.1051
		(.0012)	(.0012)		(.0016)	(.0016)		(.0053)	(.0055)
D^{HKTW}		.0302	.0212		.0249	.0155		.0427	.0178
		(.0028)	(.0028)		(.0037)	(.0037)		(.0125)	(.0127)
D^{FIE}		.0344	.0255		.0277	.0186		.0519	.0271
		(.0024)	(.0024)		(.0031)	(.0031)		(.0106)	(.0108)
D^{OTH}		.0415	.0369		.0427	.0385		.0947	.0826
		(.0026)	(.0026)		(.0033)	(.0033)		(.0114)	(.0115)
D^{APG}		.0055	.0046		.0032	.0022		.0135	.0109
		(.0024)	(.0024)		(.0031)	(.0032)		(.0107)	(.0108)
D^{ARG}		.0017	.0006		-.0104	-.0117		-.0260	-.0290
		(.0021)	(.0021)		(.0027)	(.0028)		(.0094)	(.0095)
D^{AOG}		.0229	.0220		.0119	.0091		.0559	.0482
		(.0021)	(.0021)		(.0027)	(.0027)		(.0093)	(.0094)
D^{AOTH}		.0170	.0120		-.0036	-.0089		.0114	-.0026
		(.0022)	(.0023)		(.0029)	(.0030)		(.0100)	(.0101)
Industry dummies	no	yes	yes	no	yes	yes	no	yes	yes
Province dummies	no	yes	yes	no	yes	yes	no	yes	yes
Observations	70632	70632	70070	70632	70632	70070	70632	70632	70070
R^2	0.008	0.092	0.098	0.032	0.183	0.186	0.019	0.108	0.110

Notes: 1) D^{CE} , D^{LPE} , D^{PE} , D^{HKTW}, D^{FIE}, D^{OTH} are firm ownership dummies; D^{SOE} is used as baseline. 2) D^{APG} , D^{ARG}, D^{AOG}, D^{AOTH} are affiliation dummies; D^{ACG} is used as baseline. 3) A constant is included in each equation. 4) Standard errors are in parentheses.

Table 9 Leading effects of the western firms before WDP

Independent variable	Profitability measurement		
	ROS	ROA	ROE
	(1)	(2)	(3)
WEST	-.0449	-.0271	-0.2000
	(.0065)	(.0076)	(.0301)
Y_{98}	-.0064	-.0042	-.0077
	(.0011)	(.0012)	(.0049)
WEST*Y_{98}	-.0011	.0054	-.0126
	(.0017)	(.0021)	(.0081)
SIZE	-.0416	-.1058	-.2718
	(.0022)	(.0026)	(.0101)
SIZESQ	.0030	.0077	.0193
	(.0002)	(.0002)	(.0009)
AGE	-.0006	-.0011	-.0024
	(.0001)	(.0001)	(.0005)
AGESQ	-.0000	.0000	.0000
	(0.0000)	(.0000)	(.0000)
Ownership dummies	yes	yes	yes
Affiliation dummies	yes	yes	yes
Industry dummies	yes	yes	yes
Province dummies	yes	yes	yes
Observations	62932	62932	62932
R^2	0.113	0.190	0.112