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THE DETERMINANTS AND EFFECTIVENESS OF INDUSTRIAL POLICY IN CHINA: A STUDY BASED ON FIVE-YEAR PLANS

by

**Yiyun Wu
Zhejiang University, China**

**Xiwei Zhu
Zhejiang University, China**

and

**Nicolaas Groenewold
Business School
University of Western Australia**

DISCUSSION PAPER 16.21

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Yiyun Wu

(Zhejiang University, China)

Xiwei Zhu

(Zhejiang University, China)

Nicolaas Groenewold

(The University of Western Australia, Australia)

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Abstract: Industrial policy is ubiquitous in both developing and developed countries. In China, government intervention in favor of specific industries is believed to play an important role in economic development. The targeting of strategic industries for preferential treatment has been a central part of both national and provincial Five-Year Plans (FYPs). While arguments for and against industrial policy are well-known, empirical evidence regarding both the formulation and effects of such policy are scant. Our paper contributes to the literature by examining industrial policy in China over the period of four FYPs (the 9th to the 12th, running over the period 1996 to 2015). In particular, based on China's national and provincial FYPs, this paper investigates the determinants and effectiveness of industrial policy at the four-digit manufacturing sector level. This paper finds that the central government's preferences act as a key determinant of the provincial governments' FYPs. High productivity does not improve an industry's chance of selection by the provincial governments. We also show that preferential policy has a significant positive effect on industry output growth while the FYP is in effect but that there is no evidence of a beneficial effect beyond the end of the particular FYP.

Keywords: Industrial Policy; Five-Year Plan; Industrial Development; Productivity

1. Introduction

Industrial policy (IP) is widespread in both developing and developed economies. Although economists have held different opinions about the role of IP, policy-makers of many developing countries believe that the developing world is full of market failures and it is natural for their governments to seek to escape the poverty trap through forceful industrial interventions. Thus industrial policy, which comprises a variety of actions designed to correct market failure and foster the reallocation of productive factors from low to high productivity activities, is widely observed during the process of structural change (Pack, 2000, Pack and Saggi, 2006; Rodrik, 2004, 2009). This is also true for China where it has been an important part of Five Year Plans. Although China has implemented market-based economic reforms and transitioned from a Soviet-style planned economy since 1978, the far-reaching national programs officially titled “*Five Year Plan for National Social and Economic Development*” (henceforth FYP) still provide targets and programs for the country’s next five years of development and are believed to continue to have a substantial impact on the national economic landscape.

Besides the national FYP (NFYP), each provincial government in China also issues its own five-year program for regional development. In general, the provincial FYP (PFYP) imitates social and economic targets of the NFYP plus other development targets determined by local economic conditions. Special treatment (e.g. tax credits, subsidies, and favorable loan rates) by government at all levels is then assigned to strategic sectors identified by the national and provincial FYPs. For example, in the 12th NFYP (2011-2015), there were three main priorities viz., sustainable growth, industry upgrading and promotion of domestic consumption. These three priorities were copied by most PFYPs and induced provincial governments to reallocate productive resources to manufacturing sectors such as energy, machinery, automotive, IT, infrastructure, and biotechnology, which had already been selected as pillar industries in the 12th NFYP. In this way, the NFYP is implemented by the actions of provincial governments by which they not only show their loyalty but also obtain extra development resources from the central government by following the NFYP. Therefore the FYP is one of the most significant indicators of whether and how regional governments take part in resource reallocation in an attempt to influence the economic performance of industries in the short and long term. An analysis of this relationship between NFYPs and PFYPs which is the first main concern of this paper.

A central part of IP in many economies (including China) is to pick particular industries for preferential treatment. This policy begs the question: does it work; that is, do the selected industries benefit from the policy and, more broadly, does such policy benefit the economy as a whole? In general, many economists are skeptical of the efficacy of IP. They suspect governments are not very good at “picking winners” and that the real aim of IP is to benefit friends, electors in marginal electorates, lobby groups and so on. Nevertheless, there are some good arguments based on the presence of market failure to support the use of IP; these are comprehensively reviewed by Rodrik (2004) and Pack and Saggi (2006).

One argument for IP is based on the presence of market imperfections. Dethier et al. (2011), for example, pointed out that firms in emerging markets are exposed to more severe constraints due to financial market frictions than those in the developed countries, and financial constraints tend to be one of the primary obstacles for firms to invest in developing countries. Policies such as subsidies for innovation are capable of providing low-cost capital to relax firms' financial constraints in developing countries.

A second rationale for IP is the infant industry argument, which was first formulated by Hamilton (1791) and List (1856). The justification for infant-industry protection is the presence of dynamic learning effects that are external to the firm. The Mill-Bastable Test has been formulated to justify this kind of protection policy (Mill, 1848; Bastable, 1921), the thrust of which is as follows: (i) Protection must be temporary and the infant industry should mature to the point where it becomes viable without protection. (ii) The cumulative net benefits provided by the protected industry should exceed the cumulative costs of protection. Krueger and Tuncer (1982), using Turkish data for 1963-1976, is the first study to look for a correlation between infant-industry protection and productivity growth; they concluded that the empirical evidence did not provide support for the infant-industry argument. However, Harrison (1994), using the same data set, showed that more protected sectors did in fact exhibit higher productivity growth. Bardhan (1971), Redding (1999) and Melitz (2005) explored the conditions on the learning process under which the benefits of protection justify the initial costs. Melitz (2005) also studied the optimal way in which protection should be granted and Rodrik (2006) documented that much of China's export surge occurred simultaneously with the imposition of high tariffs during the period 1985-2004.

The third argument for IP is based on the idea that some industries exhibit Marshallian externalities and/or inter-industry externalities, which are local externalities due to the existence of transportation costs. These externalities can arise through labor pooling and input-output linkages which, together with transportation costs, ensure that the pecuniary externalities remain local and increase with the size of the industry (Marshall, 1920; Porter, 1990; Krugman, 1991; Fujita et al., 1999). Well-known cases of Marshallian externalities are Silicon Valley, Route 128 and Italian clusters, and the Manufacturing Belt in US, all of which have been emphasized in the literature on the New Economic Geography (NEG) as examples of inter-industry externalities. Due to the increasing returns to scale and transportation costs, the economy usually exhibits multiple equilibria in the NEG models, which makes it reasonable for the government to use IP to achieve an equilibrium which has a higher social welfare.

Finally, several recent studies focus on the argument of industrial policy for industrial upgrading. Hausmann, Hwang and Rodrik (2007) argued that the varied economic performance of different countries is partly explained by the goods that they produce. Harrison and Rodríguez-Clare (2010) emphasized that there are "special industries", and that countries can increase welfare by reallocating resources to those industries. Other things being equal (including physical and human capital stocks), countries that specialize in "strategic industries", which

provide more opportunities for learning by doing, will trigger technological and industrial upgrading. Within the framework of the new structural economics, Lin (2012) argued for a proactive role for the government in nurturing development by actively supporting industries that contribute to growth during industrial development and upgrading.

Our paper is related to the large body of empirical work on the effect of policy changes on industrial and regional development, including specific applications to China. Governments of many emerging-market countries, such as China, are more likely to play a proactive role in directing financial resources than governments in developed countries. In the allocation of capital they tend to favor state-owned firms and firms that have strong ties to the state (Song et al., 2011). Economic zones are an important vehicle of IP in China and have recently been the subject of several papers (Wei, 1993; Cheng and Kwan, 2000; Wang, 2013; Alder, 2016) studying their impact on economic development. While these papers focus on the effectiveness and heterogeneity of IP across places, ours is more interested in the effectiveness and heterogeneity of IP across industries.

Our contribution to the literature is twofold. First we investigate the determinants of an industry's being selected in a PFYP, focusing particularly on the influence of the national government's selections in its NFYP but also analysing the importance of industry- and province-specific characteristics. Second, we present an empirical analysis of the impact on industry output of its selection in the FYP to assess the benefits of IP in China. More specifically, we first estimate the predicted selection probability of an industry using a probit model. Then we use difference-in-differences (DID) analysis to evaluate whether IP actually accelerates the growth of the selected industries during the period covered by the FYP. Finally, we test whether the effect of IP persists beyond the period covered by the FYP. Using Chinese data disaggregated to the four-digit industrial level, we find that the central government's preferences act as a key determinant of industry selection by the provincial governments in drafting their FYs, while, surprisingly, industry productivity is not an important determinant of selection. Meanwhile, preferential policy does promote output of the selected industries during the period covered by the FYP but there is no evidence to support a persistent, long-lasting effect for industrial development beyond the end of the FYP.

The rest of the paper is organized as follows. Section 2 presents a brief introduction to China's FYs at national and provincial levels. Section 3 discusses data sources and data processing methods used in the paper, defines key IP variables for empirical analysis in the following two sections, and summarizes the main features of the 9th to the 12th NFYPs and PFYPs. Section 4 presents the determinants of provincial industrial policy based on probit models. Section 5 further discusses the impact of policy intervention on output in the short and long term. Section 6 concludes.

2. Background: China's Five-Year Plans

Since its establishment in 1949, the People's Republic of China has released thirteen national Five Year Plans (see Table 1 for the year of issue and the coverage period of each NFYP since 1949), providing a series of programs containing detailed economic development guidelines for all its regions. As shown in Table 1, the First Plan (1953-1957) was formally approved by the National Congress of the Communist Party of China in March 1955 and then officially adopted and issued by the National People's Congress in July of the same year. The key tasks highlighted in the First Plan were to concentrate efforts on the construction of 694 large and medium-sized industrial projects. Soon after the issue of the First NFYP the central government urged the officials of provincial governments to draft their own five-year plans in the light of the First NFYP and these were adopted one after another later in 1955. After China started market-oriented economic reforms in 1978, there were gradual changes in the formulation and contents of NFYPs. First, the central government launched NFYPs more regularly for every successive five years. In particular, since the 9th FYP, the *Proposal* for the next NFYP is formally approved after the fifth plenary session of the National Congress of the Communist Party of China held routinely in the last November before a new five-year period begins. Then, the *Outline* for the new FYP is officially approved by the National People's Congress in March of the following year after hearing opinions from all sides. The second change since 1978 is that, although setting quantitative targets of development (e.g. the growth rates of GDP and income, the rate of urbanization and the extent of industrial upgrading) are preserved as in earlier plans, principles and instructions have gradually taken the place of particular construction projects in the NFYP. However, more detailed targets of growth, projects and preferential guarantee conditions derived in accordance with the targets and instructions of the NFYP are still to be found in special FYPs for particular industries.¹ The third innovation since 1978 is that PFYPs and special PFYPs for particular industry are approved and issued by the provincial governments soon after the announcement of the corresponding NFYP.

(Insert Table 1 around here)

Take the 12th NFYP (covering 2011 to 2015) as an example of a typical compiling process of a FYP.² The formulation of the 12th NFYP consisted of several steps, including: (a) preliminary investigation (from 2008-2010); (b) formation of basic ideas and the drafting of the *Proposal* (in the autumn of 2010); (c) approving the *Proposal* (in November, 2010); (d) preparing and discussing the *Outline* by the National Planning Committee of Experts (NPC) (in the winter of 2010); (e) asking for internal and external suggestions (from 2010 to 2011); (f) approving the *Outline* by the NPC (in March, 2011); and then (g) publishing and implementing the plan (during

¹ Examples of special FYPs for particular industries in the 12th five-year round include the *Industrial Upgrading Plan (2011-2015)*, the *12th FYP for New Material Industry* and the *12th FYP for Sophisticated Equipment Manufacturing Industry*. See the website of the Central People's Government of the People's Republic of China for more details at http://www.gov.cn/zwgk/2012-05/10/content_2104148.htm.

² See Hu (2011) for a more detailed record of the compiling process of the 12th NFYP.

2011-2015). Since 1996, the formulation of the NFYP has become a public process with broad participation, with the goals of the each NFYP being widely known before the plan is formally approved. The formulation of the PFYP follows a similar procedure, except that planners would already know the main features of the corresponding NFYP.

NFYPs and PFYPs are definitely not a matter of mere formality. First, they provide an essential basis for drawing up more detailed industry-specific five-year plans, including investment schedules by the provincial government and projects by local leading enterprises. Second, they chart the course of regional policy for the next five years and therefore have a significant impact on the province and the regions which interact with that province. Finally, the requirement by the central government for a quantitative interim assessment of the implementation of FYPs at various administrative levels since 2000 forces PFYPs to be executable.³ In short, the FYP is one of the most significant indicators of the relationship between the central and local governments and how regional governments take part in the reallocation of resources among industries and influence the economic performance in the short run and in the long run

3. Data and stylized facts

Data used in this paper include industrial policies extracted from the latest four NFYPs and PFYPs (from the 9th to 12th, covering the period 1996 to 2015), as well as industry data for 31 Chinese provinces, autonomous regions and municipalities (hereafter abbreviated as provinces) obtained from CSMAR's *China Industrial Statistics Database*⁴. A provincial panel data set for 419 four-digit manufacturing industries for the period 1999 to 2010 was constructed to investigate the questions of interest.

Based on NFYPs and PFYPs, we divide industries into two categories for each FYP period: preferred industries and non-preferred industries. An industry is identified as preferred for a certain FYP if in this FYP it is described as an “advancing industry”, a “pillar industry”, a “promising industry”, a “priority industry”, a “breakthrough industry”, or it is planned “to enlarge and strengthen”, “to prioritize”, “to develop”, “to accelerate”, “to expand” or “to cultivate” this industry in the future when setting the goals for development for the next five years. The remaining industries are collectively termed “non-preferred industries” and they are either not mentioned in a FYP, or their prospects are designated as “to be rationally developed”, “to be

³ An interim assessment of the 10th NFYP (2001-2005) was first carried out by China's National Development and Reform Commission (NDRC) in 2003, and such an assessment was soon followed by several east-coast provinces. Since then, the *Law of the People's Republic of China on the Supervision of Standing Committees of People's Congresses at Various Levels* was enacted in 2006, under which FYPs at various administrative levels are acquired by law for the first time to undergo an interim assessment and were made subject to supervision. An investigation conducted by NDRC on the interim assessment of the 11th PFYPs also demonstrated that the PFYPs have a substantial impact on local development.

⁴ The China Industrial Statistics Database is a sub-database of CSMAR (China Stock Market Trading Database) developed by GTA Education Technology Limited, which includes aggregated data for 39 two-digit industries and 714 four-digit industries. The industrial data in this database is based on firms that are “state-owned and above-scale non-state-owned manufacturing enterprises”, where “above-scale” requires the main business income (that is, sales) of an enterprise to be no less than 5 million RMB (revised to 20 million RMB in 2011). More information about this database is available from the Users' Guide for China Industrial Statistics Database (version 2015) by CSMAR.

relatively controlled”, “to be optimized and adjusted”, “to be transformed”, “to be reduced in scale”, “to be gradually eliminated”, “to be limited”, “to be orderly transferred” and so on.

Once an industry is selected as preferred in a PFYP, it will receive favorable support from the provincial government in the next five years, including, but not limited to, priority in construction-land usage, tax exemption, financial support from special fiscal funds of the provincial government, expedited clearance of imported equipment and parts, deduction of research expenditures before tax, double amortization of the cost of intangible assets, priority in purchasing raw materials and electricity, free employee training programs offered by the provincial government and so on.⁵ A policy dummy variable is introduced with a value of one for preferred industries and zero otherwise.

Next, it is necessary to match the policy dummy to four-digit industry level data from CSMAR. This is challenging since industries mentioned in FYPs and in CSMAR do not always correspond. We use the following rules to solve this problem. First, if a preferred manufacturing industry is mentioned in a FYP by a four-digit industry name or by representative products of a four-digit industry, then this four-digit industry is identified as a preferred industry. Second, if the preferred industry is mentioned by the name of a two-digit or three-digit industry, then each four-digit industry belonging to this two-digit or three-digit industry is identified as a preferred industry. Thirdly, if the preferred industry is mentioned by the collective name of a certain type of industry, we refer to the specific guide on industrial classification and codes for statistics and match it to the corresponding four-digit industry.⁶

A further complication is that the National Bureau of Statistics of China (NBSC) changed its system of industry classification in 2002.⁷ To make the industry codes in the whole sample period (1999–2010) consistent, we converted the four-digit industry codes in the 1999–2003 data to new ones according to the correspondence table⁸ or by assigning a new code to a group of old codes

⁵ Take, for example, the new- and high-tech industry which has been emphasized since the 9th NFYPs. Firms identified as new- and high-tech firms are entitled to exemption from income tax for the first two years, a 10% reduction for the 3rd year, and weighted reduction of R&D expenditure pre-tax according to State Administration of Taxation. In Zhejiang province, which also prefers the new- and high-tech industry, cash grants of between 30 to 300 thousand RMB as well as various subsidies are offered to new- and high-tech firms in addition to the tax relief. More information about subsidies for the new- and high-tech industry in Zhejiang province can be found at <http://www.96871.com.cn>.

⁶ In a typical FYP, the manufacturing industries are mentioned either by representative products of a given four-digit industry, by name of the four-digit or two-digit industrial sectors (such as chemical industry), or by general name of certain type of industries (such as high-tech industry and new-material industry). We allocate each policy-preferred industry in the FYPs to the four-digit level by referring to various industrial classification standards established by the National Bureau of Statistics of China (NBSC) and supplementary guides for industrial classification provided by provincial bureaux of statistics, including the Code of Industrial Classification for National Economic Activities (GB/T4754-2002), the Product Classification for Statistics (NBSC, 2010), the Classification of Strategic Emerging Industry (NBSC, 2012), the Product Classification of New Materials, the Classification of High-tech (Manufacturing) Industry (NBSC, 2013), the Classification of High-tech Industry for Statistics (NBSC [2002] No. 33), the Interim Provisions for Classification of IT Industry for Statistics, the Classification of Environment Protection and Industrial classification for ocean industries and their related activities (GB/T 20794-2006). For more details of Industrial classification, see the website of the NBSC at <http://www.stats.gov.cn/tjsj/tjbz/>.

⁷ A new set of codes (GB/T 4754-2002) was adopted to replace the old one (GB/T 4754-1994) that had been used from 1995 to 2002.

⁸ In the case of a new four-digit code corresponding to an old four-digit code or several new four-digit codes corresponding to an old four-digit code.

based on product information⁹, as did Lu & Tao (2009). Given data limitations, all two-digit manufacturing industries except the Waste resources & materials recovering industry are included so that finally there are 419 four-digit manufacturing sectors in our analysis.

In the first part of our analysis, we not only examine the effect on industry selection in a PFYP of selection in the NFYP but also consider a number of industry characteristics as additional determinants, including an industry's total factor productivity (TFP). To do so, we use data from the *Annual Survey of Industrial Firms* (AFSI) for the years 2000 and 2005 from the NBSC to calculate firm- and industry-level TFP. The AFSI data are cleaned and processed as suggested by Nie et al. (2012); firm-level TFP is computed using the semiparametric method suggested by Olley and Pakes (1996). Based on firm-level TFP, provincial industry-level TFP is calculated as an output-weighted average of firm-level TFP.

Nominal variables are adjusted using price indexes taken from *China Urban Life and Price Yearbook* (NBSC, various years).¹⁰

In the rest of this section we provide some statistical material, both as background information to underpin later analysis and as an informal approach to some of the issues we deal with more formally later in the paper. We begin with a comparison of the number of industries listed as preferred in PFYPs and NFYPs for the latest four FYs; these are presented in Table 2. For provincial FYs, on average there are 91 out of 419 (or 21.71%) four-digit manufacturing industries that were selected for special development policy by at least one province. Interestingly, the mean number of preferred industries per PFYP is smaller than in the corresponding NFYPs. One possible reason is that the central government sets the course for the country as a whole and, therefore, has more general goals of industrial development. Also, some provinces might not have particular industries or have them but they are too small to be worth selecting.

(Insert Table 2 around here)

The above aggregate picture does not show the overlap between the provinces in their selection of industries. We consider this in Table 3 which lists the 30 most frequently selected industries (sorted by popularity in the 12th PFYP). The numbers in the last four columns are the number of provinces which chose that industry in the relevant PFYP. Grouping industries by their two-digit aggregates, it is clear that industry 27 (Pharmaceutical manufacturing), 37 (Auto manufacturing) and 26 (Chemical raw materials & chemical products manufacturing) are the most attractive two-digit industries for provincial planners. From Table 3, it can also be seen that, in the 12th PFYPs, of the most popular 30 industries, 22 to 30 of the 31 provinces simultaneously chose

⁹ In the case of several old four-digit codes corresponding to a new four-digit code.

¹⁰ The PPI and the GDP deflator are from *China Urban Life and Price Yearbook*. Since price indices for three two-digit industries are absent before year 2003, viz., the Agricultural products and byproducts processing industry, the Printing industry, and the Ordinary machinery manufacturing industry, this paper uses price indices for the Food manufacturing industry, the Paper and paper products industry, and the Special purposes equipment manufacturing industry of corresponding years to replace the missing deflator for the above industries before 2003.

these industries as their preferred ones, showing highly similar interests and judgements of planners in different provinces. There is also considerable uniformity in the ranking of selected industries across PYFPs; in Table 4 we report the relevant Spearman's rank correlation coefficients. They show considerable correlation across plans and, moreover, that the magnitude of the correlation coefficient between adjacent plans increases over time, implying that the popular industries are actually favored by more provinces in the next round. In other words, the selection of preferred industries between provinces is becoming more and more similar.¹¹

(Insert Table 3 around here)

(Insert Table 4 around here)

While there is a high level of consistency across provinces in the choice of the top 30, there is still a considerable diversity in the number of industries chosen per province. This is illustrated in Table 5 which lists the maximum, minimum and mean value of preferred industries selected by provincial governments in the 9th to the 12th PFYPs. It is clear that the number of favored industries varies considerably across provinces; the province which selected the maximum number of favored industries chose almost eight times the number of industries chosen by the province which selected the minimum number. If we consider the location of the provinces, it seems that provinces in the east coast chose more than those in the central region which, in turn, chose more than western provinces. This may be attributable to the more diversified industrial base of the coastal and central provinces and/or the greater concentration in the coast and the center of the type of industry typically chosen in the NFYP.

(Insert Table 5 around here)

We now look at the main features of the preferred and non-preferred industries at the time when the next FYP was being drafted, i.e., in the years 2000, 2005 and 2010, or one year before approval of the 10th, 11th, and 12th PFYPs respectively. Figures 1 to 6 illustrate the average characteristics of the two groups of industries and it is clear that the preferred industries are indeed quite different from the non-preferred ones.

We begin, in Figure 1, by comparing average firm size in the preferred and non-preferred industries, where firm size is measured by the average number of employees per firm in the two types of industry. It is clear from Figure 1 that preferred industries on average have firms which are about 40% larger than those in the non-preferred industries. This finding is consistent across

¹¹ The ranking of preferred industry is generally highly consistent through time except for industries within the two-digit Chemical raw materials & chemical products manufacturing industry (with two-digit code 26). The fluctuation in the number of provinces which selected these industries in the 11th PFYPs is noticeable and could be associated with a sudden reduction of 25% in numbers of preferred industries in this two-digit industry in the 11th NFYP, compared to the other NFYPs. The selection of PFYP are highly correlated with that of the NFYP; we provide evidence for this relationship between NFYPs and PFYPs in Table 6 and in section 4.

the three years considered with the largest differences being in 2005.

We turn, in the remaining figures to measures of industry size. In Figure 2 we picture industry size as measured by the average number of employees per industry for preferred and non-preferred industries. The data show that policy-preferred industries have more employees. In 2000, the mean number of employees in the preferred industries was more than 2 times larger than that of non-preferred industries; the ratio increased to approximately 2.5 by 2010.

Besides number of employees, Figures 3 to 5 indicate that, on average, preferred industries produce more gross output, more value-added and also have much larger net value of fixed assets.¹² In 2000, the magnitude of gross output, value-added and fixed assets of preferred industries were 2.9, 3.1, and 2.2 times larger than that of the non-preferred industries. And it is clear that the differences between preferred and non-preferred industry groups remain stable through time.

(Insert Figure 1. to Figure 6. around here)

A surprising contrast is the productivity difference between the two types of industry. Figure 6 shows the average industry level of TFP for preferred, non-preferred and total industries; as indicated earlier, industry TFP was calculated from the weighted average of firm-level TFP with firm's gross output as weights. It is puzzling that the mean value of preferred industries' TFP in Figure 6 is slightly lower than that of the non-preferred ones. Two possible explanations suggest themselves. One is that the government does not really care about the benefits of preferential treatment in terms of overall economic growth but wants to benefit relevant interest groups which are concentrated in large industries – they are more important (say, large industries dominated by state-owned enterprises which happened to have lower TFP).¹³ The other possibility is that the provinces intentionally pick (some) low TFP industries because they see potential for TFP growth in them. Further, more formal, exploration of the relationship between selection and productivity growth will be left to a later section.

Finally in this section, we turn to a preliminary examination of the relationship between NFYPs and PFYPs. Table 6 presents evidence that a provincial government is more likely to select an industry for policy-preference if it has already been chosen for preference by the national government. Among all the four-digit manufacturing industries, industries preferred by the central planners on average attracted more provinces than those not preferred by the central government. Thus in the 9th FYP cycle an industry already chosen by the national government was chosen by 11.5 provinces on average while one that had not been selected by the national government was

¹² Note that data for 2010 are not included in Figure 5 since data for value-added for 2010 are absent from the CSMAR database.

¹³ Among numerous papers which analyze TFP for Chinese firms, one of the common findings is that State-Owned Enterprises perform more poorly than Domestic-Private Enterprises. From 1992-2007, TFP in the private sector is believed to have been about 80 percent higher, on average, than in the state sector (Curtis, 2016). Moreover, TFP growth in industrial SOEs by the mid-1990s may even have turned negative (Laurenceson and Chai, 2000; Jefferson, Rawski, Wang and Zheng, 2000). See also Storesletten and Zilibotti (2014).

chosen by only 6.8 provinces on average. This selection pattern was more pronounced with each successive FYP. The last column of Table 6 reports a t-statistic for a test of significant difference between the number of industries chosen in the 9th and 12th plans and shows that the number of provinces following the national government's choice significantly increased while the number choosing industries not chosen by the central government fell significantly; the overall number selected did not change significantly over the period. Thus, provincial planners focus more and more on the industries preferred by the central government.

(Insert Table 6 around here)

In summary, the above stylized facts imply that provincial planners are inclined to accelerate the development of industries which, on average, have larger firms, more employees, more fixed assets, greater output, higher value-added, and those favored by the central government. However, industry TFP does not appear to be an important determinant of selection by provincial planners; if anything, planners choose industries with lower average TFP. We go on in section 4 to assess more formally the impact of these factors on the choices made by provincial planners.

4. Provincial governments' choice of industrial policy

In this section we report the first part of our empirical analysis in which we address the question of how industry policy is formulated in China. In particular, we examine the response of provinces in their choice of preferred industries to the selection of preferred industries by the central government before examining the importance of a number of industry characteristics for the selection process. Recalling the discussion in section 2 that PFYPs are drafted when the corresponding NFYP is already publicly known, a positive impact of industrial selection in NFYP on PFYPs is expected.

As discussed in Section 3, an industry may enjoy various benefits from selection: subsidies from government which may be financial, such as tax rebates and R&D subsidies, or policy-based, such as land preferential policies (see Hua et al., 2016; Lee et al., 2014). These Government subsidies are usually intended to achieve a number of social and political objectives including promoting export competitiveness, production efficiency, employment, and social welfare (Lee et al., 2014). Our earlier informal analysis also showed that policy-preferred industries are quite different from non-preferred industries. We now move to more formal analysis of the choice by provincial governments of their favorite industries and we do so by estimating the predicted probability of an industry's being selected using a probit model of the form:

$$PPOLICY_{irn}^* = Prob(PP_{irn} = 1|Z) = Z'\beta + u \quad (1)$$

where i indexes industry, r indexes province, and n indexes period. The dependent variable, $PPOLICY_{irn}^*$, is the probability of industry i being chosen by province r as a preferred one; it is dependent on Z , a series of social and economic characteristics of industry i and province r .

PP_{irn} is a binary variable, identifying industry i as selected or not (1, 0 respectively) by province r in its n^{th} PFYP. In section 3, when discussing Figures 1 to 5 we showed that the preferred industries have several characteristics, viz., more employees, more output, more value-added, and a higher probability of having been favored by the central government. In practice, these characteristics may be meaningful, because supporting large industries and maintaining a high employment level can be important for subsequent economic growth and local stability. As for the relationship between the NFYP and PFYPs, it may be argued that following the central government's decision about preferred industries not only shows the provincial planner's loyalty, but also gains extra resources from the central government for the purpose of local development. In addition, both loyalty and better economic performance are likely to benefit the provincial official's political career in a so called "promotion tournament" (Zhou, 2005). Therefore, we use an empirical model with explanatory variables which include the central government's preferences regarding favored industries, the number of industry employees, industry gross output and industry taxes and fees paid in province r . More specifically, the probit model is specified as follows:

$$Prob(PP_{irn} = 1|Z) = \beta_0 + \sum_{j=1}^3 \beta_j \cdot I(CTYPE_{in}^{j+1} = j + 1) + \beta_4 TAXFEE_{irn} + \beta_5 EMP_{irn} + \beta_6 OP SHARE_{irn} + \sum_{k=7}^K Ctrls_{irn}^k \beta_k + u_i \quad (2)$$

where $CTYPE_{in}$ is a categorical variable that captures whether industry i has been chosen by the central government in the previous two NFYPs. To be specific, $CTYPE_{in}$ equals to 1, 2, 3, and 4 respectively if industry i was never preferred in the latest two NFYPs, only preferred in the last-but-one NFYP, only preferred in the last NFYP and preferred in both NFYPs since the n^{th} NFYP (see Table 7 for details).

(Insert Table 7 about here)

Then $I(CTYPE_{in}^{j+1} = j + 1)$, $j \in (1, 2, 3)$, is an indicator operator which generates dummy variables for three of the four cases above. Furthermore, we choose the number of industry employees (EMP_{irn}), industry total tax and fee payment ($TAXFEE_{irn}$), industry output share ($OP SHARE_{irn}$) and industry productivity (TFP) as core explanatory variables. EMP_{irn} is defined as the total number of employees belonging to industry i in province r one year before the n^{th} PFYP is drafted, $TAXFEE_{irn}$ includes total tax and extra charges on sales of products plus income tax of that industry in the year before the n^{th} PFYP, and $OP SHARE_{irn}$ is gross output value of industry i in province r divided by total gross output of province r . All of these independent variables refer to the year before the n^{th} PFYP drafts are released. Finally, $Ctrls_{irn}^k$ represents a set of dummy variables including period dummies, industry dummies and province dummies, with β_k the corresponding regression coefficients.

The baseline estimation results are listed in Table 8. In the first column of Table 8, we include only policy variables and a set of dummy variables. The sign and magnitude of estimated

coefficients of the $CTYPE_{in}$ variables indicate that the central government's NFYPs have a profound effect on provincial policy design. The coefficients are all positive and significant, meaning that no matter whether an industry was selected once or twice in the most recent two NFYPs, there is a significant increase in its predicted selection probability by the provincial governments. In addition, the relative magnitudes of the $CTYPE_{in}$ coefficients also seem plausible: the probability of selection by a provincial government is higher if the industry was selected by the central government in the most recent NFYP than in the one before and, furthermore, the selection probability is higher still if the industry was selected in both the most recent NFYPs.

These results are completely unaffected by the addition of other influential variables: the number of employees, taxes & fees and the industry's output share. Neither the significance nor the relative magnitude of the estimated policy effects changes when variables are added and, indeed, the magnitudes of the coefficients themselves hardly changes, indicating that the impact of the NFYP is quite robust. At the same time, the sign of the coefficients of other control variables are also significantly positive and consistent with our expectations: industries having a larger number of employees, paying higher taxes and fees, or contributing more to provincial output tend to have a higher predicted probability of being selected by the provincial government.

(Insert Table 8 around here)

(Insert Table 9 around here)

In Table 9, we report the predicted probability of $CTYPE_{in}$ for industry i , when holding all other variables in column 5 of Table 8 at their means. Other things being equal, if an industry is never selected in the latest two NFYPs, the predicted probability of its selection by PFYP is 9.85%. If an industry is preferred in the last-but-one or in the latest NFYP, the predicted probabilities raise to 16.24% and 21.08% respectively. Although being selected in the most recent NFYP has a larger impact on the predicted probability of selection than being selected in the last-but-one, a t-test shows the difference is not statistically significant, i.e., the coefficient of $CTYPE_{in}^3$ is not significantly larger than that of $CTYPE_{in}^2$. However, when an industry is selected in both the latest two NFYPs, the predicted probability increases dramatically to 51.61%, which is significantly larger than all the former ones. Therefore it can be concluded that an industry's probability of selection by the provincial planner increases monotonically with the number of times an industry is selected by the central planner and if the policy enjoyed by an industry changes from not favored in the latest two NFYPs to selected in both NFYPs, the probability of its being selected as a policy-preferential industry by the provincial planner rises significantly by 41.76 percentage points. Table 9 also reports the estimated marginal effects of the main other independent variables. If the number of total employees, taxes and fees or output share of an industry go up by an infinitesimal amount, the probability of its being selected as a preferred industry by the provincial planner rises significantly by 0.25%, 1.54% and 4.00% respectively.

To investigate the relation between NFYP and PFYP more thoroughly, we consider whether the region in which the province is located has a systematic effect on the selection probability. We distinguish between two regions: inland and coast and add interaction terms between region and the $CTYPE_{in}$ variables to the baseline specification in which *inland* equals 0 for the eastern coastal provinces.¹⁴ It is well known that the inland provinces generally lag in their development compared to the coastal provinces. The results are reported in Table 10.

(Insert Table 10 around here)

Table 10 shows that the sign of the interaction term is consistently positive no matter which other variables are included in the equation, suggesting that the inland provinces are inclined to follow the central government's selection more closely than the coastal provinces are. More particularly, the magnitude of the $CTYPE_{in}$ coefficient for the inland provinces is much larger when an industry is preferred in the latest NFYP. Since the inland provinces are more dependent on resources obtained from the central government, it is not surprising that they have a greater enthusiasm for following the industrial selection by the central government. This confirms the finding of Wu and Zhu (2015) that inland provinces are likely to adapt their industrial plans much more readily to that of the central government than coastal provinces are.

Finally we consider whether an industry's productivity influences positively its predicted probability of selection by a regional government. A high TFP level in the recent past may generate optimistic expectations that an industry will grow rapidly in the future and is therefore worth selecting for preferential treatment. Therefore, in this part we focus on whether the level of an industry's TFP is another determining factor in the choice by provincial planners. In particular, are they inclined to select industries with a high level productivity growth (as a predictor of more high productivity growth in the future)? Following De Loecker (2007), we estimate firm-level TFP using the framework of Olley and Pakes (1996), where the export decision is introduced as dummy variable.¹⁵ For industry i in province r , TFP_{im} is calculated as the weighted average of firm-level TFP one year before the n^{th} FYP is approved (using firm-level output as weights). We first use TFP_{im} as a regressor in the probit selection equations. The results are reported in Table 11.¹⁶ Next, we use dummy variables to pick out the top 10% and top 20% of industries according to their TFP. Recall from Table 1 that, on average, PFYPs select about 20% of industries. In light of this, two dummy variables, H-TFP90 and H-TFP80, are introduced to identify high-TFP industry groups. To construct these two dummies, we first sort industries according to TFP_{im} in each province, and set H-TFP90 equal to 1 for industries with their TFP levels ranking in the top 0.10 quantile in that province and 0 for the others. Similarly, H-TFP80 is set equal to 1 for

¹⁴ The eastern coastal provinces include Beijing, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, and Guangdong province.

¹⁵ Due to value added of year 2010 is absent in ASIF, analysis of TFP focus only on year 2000 and 2005.

¹⁶ We also use simple average of firm level TFP as a proxy, and the results remain.

industries with their TFP levels ranking in the top 0.20 quantile in that province and 0 for others. The results of the use of these dummy variables in the probit equations are reported in Table 12.

(Insert Table 11 around here)

(Insert Table 12 around here)

To our surprise, the coefficient of TFP_{im} in column (1) of Table 11 is significantly negative, meaning higher productivity doesn't imply a higher chance of selection by the provincial government. When we further control for other variables in columns (2) to (5), this result remains unaffected – the coefficient is consistently negative and significant although the absolute magnitude falls somewhat suggesting possible negative collinearity with industry size – the larger the industry the lower the TFP. The results in Table 12 are consistent with those in Table 11 – the coefficient of the dummy variables is invariably negative although only *H-TFP80* is significant. Whether we look at the top 20% or at the top 10% of the most efficient industries, a higher TFP level does not improve these industries' chance of selection, whether we control for taxes and fees or output share or not. We can conclude that provincial planners selected industries without considering whether the chosen industries are among the most efficient industries in that province. As is well known, TFP is an important source of long-run growth so that a natural question is why planners don't choose to promote the most productive industries? One possible reason is that the PFYP usually sets a short-run growth target, which can be achieved with less risk by taking advantage of the traditional large industries, even though the productivity of these industries may be inferior to that of some emerging industries. This may be rationalized on the basis that an industry with high a TFP level but limited current scale cannot contribute greatly to the growth of provincial gross output or fiscal revenues in the short run. In addition, traditional industries might also be supported because of their contribution to maintaining local employment or having better relations with the provincial government.

All in all, we can conclude from the above analysis that the central government's preferences clearly act as a key determinant of provincial governments' selection of preferred industries, while industry output scale, taxes and fee paid, and employment also play significant roles. However high productivity doesn't improve an industry's chance of selection by the provincial government, which raises suspicions about the impact of policy on industrial performance. In section 5 we will test the effect of industry selection in PFYPs on industrial outcomes in the short run and in the long run.

5. The effect of industrial policy on output

We now turn to the second question of interest in this paper: do the selected industries develop faster because of the policy? And if the answer is "yes", then how long is the effect maintained? To address these issues we proceed as follows. First, we will use the

difference-in-differences (DID) method to measure the average treatment effect on the preferred industries. Second, to accommodate possible endogeneity in policy selection, we will also use a two-stage least squares method to estimate the effects on industrial outcomes (e.g., output growth, fixed assets, and employment) of being selected in a PFYP. However, the impact of policy during the currency of the PFYP captures only the short-term effect of policy and it is interesting to see whether any beneficial policy effect persists beyond the term of the FYP even after preferential support from the government ceases. Therefore in the third part of section 5 the propensity score matching (PSM) method is combined with DID to analyze whether any beneficial effect lasts beyond the current period of the relevant PFYP.¹⁷

5.1 Difference-in-differences analysis: basic specification

As mentioned before, China's industrial classification underwent a major revision in the late 1990s, making data before and after 1998 incompatible. We therefore have available repeated cross-section data sets for 2000, 2005 and 2010 which we can use for pre- and post-treatment data for the 10th PFYPS (2001-2005) and the 11th PFYPs (2006-2010). In keeping with the standard DID method, we take the preferred industries in the 10th or 11th PFYPs as the treatment group and those not exposed to provincial preferential policy as the control group. In the standard two-period DID specification where the same units within a group are observed in each time period, the average gain in the control group is subtracted from the average gain in the treatment group. This removes biases in second-period comparisons between the two groups that could be the result of permanent differences between them, as well as biases possibly resulting from comparisons over time in the treatment group that could be the result of trends. When focusing on the policy effect of industry selection in the 10th and 11th PFYPs, we have three periods for each sample and the specification of the multi-stage DID regression equation is as follows.

$$\ln Y_{irgn} = \alpha + \sum_{j=1}^3 \gamma_j \cdot 1(n = 8 + j) + \sum_{\tau=1}^I \theta_j \cdot 1(g = \tau) + \delta PP_{irn}^{10\&11} + \sum C_{irgn} \varphi + \varepsilon_{irn} \quad (3)$$

where i indexes the industry, r indexes the province, n indexes the period, and g indexes the group. $\ln Y_{irgn}$ is the logarithm of industry i 's output in province r in the last year of the n^{th} PFYP ($n=9, 10, 11$). The two indicator functions, $1(n = 8 + j)$ and $1(g = \tau)$, are equal to 1 if $n = 8 + j$ and $g = \tau$ respectively and 0 otherwise. $PP_{irn}^{10\&11}$ is a binary policy variable similar to PP_{irn} in Section 4 except that it focusses only on the 10th and 11th PFYPs. Finally, variables C_{irgn} are other covariates including industry dummies and province dummies. The entire sample is divided into three groups, *viz.*, the control group which includes industries neither preferred in the 10th nor in the 11th PFYPs, treatment group I (denoted Treat I) which includes industries selected twice and treatment group II (denoted Treat II) which includes those only selected once ever since the 10th PFYPs. Thus, we can alleviate other uncontrolled influences and test robustness of the results through the use of proper treatment groups.

¹⁷ In addition, we also use a two-stage panel model to assess the robustness of our estimates of the impact of industrial policies in the 10th (2001-2005) and 11th (2006-2010) PFYPs. The overall conclusions are similar.

(Insert Table 13 around here)

The results using the standard fixed-effects estimator for the multi-period model are reported in Table 13. As show in column (1), the coefficient of $PFYP_{irn}^{10\&11}$ is significantly positive, meaning preferential policy has a stimulating effect on industry output. This result remains consistent even if we drop from the sample those observations for which output ranks in the top 5% or bottom 5% in each province to reduce possible bias caused by outliers; these are reported in columns (2) and (3). However, the estimated coefficient of policy could still be biased because industries in Treat I had enjoyed preferential policy in two successive five-year periods and the impact of policy might be diminishing or increasing at the margin. For that reason, we re-run the fixed-effects model excluding samples in the Treat I group and report the result in column (4). The result remains: the estimated coefficient of provincial policy is significant and positive as formerly. Additionally, we also consider possible uncontrolled bias that might result from a carry-over effect of policy from the 9th PFYP (1996-2000) on industrial output in 2005 and 2010. To avoid the possible influence of the 9th PFYP we further drop all the observations for industries which have been selected in the 9th PFYP. At the same time, to better control group effects we split Treat II into two parts according to the timing of policy as well: treatment groups II-I (denoted Treat II-I) and II-II (denoted Treat II-II) are introduced for industries selected only in the 10th or 11th PFYPs, respectively. The results are shown in column (5) of Table 13. Although we take into consideration possible influences from the 9th PFYP and extra group effects due to program timing, the estimated coefficient of preferential policy remains significantly positive and the magnitude changes little from the previous specification, which confirms that industrial policy is effective during the period to which the PFYP applies.

Despite the strong and robust results reported in Table 13, data limitations due to the change in industrial classification in 1998, makes it impossible to enter unit-specific variables which might also influence industry development into the equation; variables such as those which capture the inter-firm competition effect and Marshallian externality. Moreover, we have not been able to test the parallel-trend assumption which underlies the DID method. Finally, it is possible that there is bias due to the endogeneity of policy selection, i.e., policy selection might be related to industrial outcome at the baseline. We will deal with all these problems in section 5.2 but to do so we will focus only on the effects of policy in the 11th PFYP for which a more comprehensive data set at the four-digit industry level is available.

5.2 Difference-in-differences analysis: robustness test

In this section, we deal with problems that might cause biased estimates of the policy effect and, in so doing, test the robustness of the results in Section 5.1. In particular, we analyze the following four additional cases. First, we employ the baseline DID specification set out in Equation (3) to estimate the impact of the 11th PFYP (2006-2010) with extra unit-specific covariates as controls. Second, given the possible failure of the parallel-trend assumption which

underlies the standard DID model, the change of industrial output is used instead of output as the dependent variable, which relieves the need for paralleled trends between the control group and the treatment group. Third, since preferential policies are implemented by successive five-year plans, some industries could be selected twice in adjacent plans. If policy has a persistent impact into the next round, the estimated coefficient could be biased. For that reason, we re-run regressions based on samples which omit industries affected in this way. Finally, as pointed out in Section 3, ex-ante, average firm employment, industry fixed assets, industry gross output, and industry value-added for the preferred industries consistently exceed those of the non-preferred industries, so that it is possible that policy selection might be related to outcomes at the baseline. To control for this possible source of endogeneity, we also implement a two-stage least squares as well as an instrumental-variables approach to further test the robustness of the previous results.

For simplicity, we rewrite Equation (3) in form of the standard two-period DID model as follows:

$$\ln Y_{ir}^{TD} = \delta_1 + \delta_2 PP + \delta_3 TD + \delta_4 PP * TD + \sum_{j=5}^J Ctrl_{ir}^k \delta_j + u_{ir} \quad (4)$$

where i indexes the industry, r indexes the province, n indexes the period, and g indexes the group. $\ln Y_{ir}^{TD}$ is the logarithm of industry i 's output in province r before and at the last year of the 11th PFYP (i.e., 2005 if $TD = 0$ and 2010 if $TD = 1$). PP is a binary provincial policy variable which equals one if the industry is preferred in the 11th PFYP and zero if not. TD is a time dummy that equals zero for 2005 (before the 11th PFYP) and one for 2010 (after the 11th PFYP). $Ctrl_{ir}^k$ are other control variables including the lagged number of firms, $FIRM$, and its square, $FIRMsq$, which are used to control inter-firm Marshallian externality and competition effects, following Belleflamme et al. (2000), Crozet et al. (2004), and Head (1995). In addition, the controls also include a set of dummy variables to control location- and industry-specific influences. In this form of the model, we are interested in estimating the coefficient of the interaction term, δ_4 , or the average treatment effect on the treated industries.

(Insert Table 14 near here)

The estimated coefficients for regression equation (4) are reported in the first three columns of Table 14. They show a consistent, significant positive association between policy and gross output and, also, the coefficients of the interaction term in columns (1) to (3) remain stable when control variables are added, confirming the results in section 5.1. In addition, the signs of the estimated coefficients of externality and competition effects are consistent with the predictions of the theoretical model in Belleflamme et al. (2000) and Crozet et al. (2004), i.e., the Marshallian externality effect shows a positive association with industrial development while the competition effect, on the contrary, reduces growth. Finally, the estimated coefficients of the dummy variable for location show that output growth is faster in the coastal provinces than in the inland provinces. In the light of our conclusions in section 4, this looks reasonable since we found there that the

inland provinces have a higher likelihood of mimicking the central government's choice which might result in sacrificing their own comparative advantage.

One of the most common problems with DID estimates is the failure of the parallel-trend assumption (Angrist and Krueger, 1999). Since we are focusing on the 11th FYP, we have two periods before the treatment (2000 and 2005) and one period after the treatment (2010). So we can use the conditional parallel-trend assumption and the corresponding regression model proposed by Mora and Reggio (2012), which is available for applications with more than one pre-treatment period and assumes that the average change in output for the treated industries had they been untreated is equal to the observable average change in output for the comparable controls. Obviously, the conditional parallel-trend assumption will hold if the unconditional parallel-trend assumption holds, but not vice versa. This involves using the difference of industrial output so that the traditional parallel-trend assumption is relaxed to obtain the following model.

$$\ln\Delta Y_{ir}^{TD} = \delta_1 + \delta_2 PP + \delta_3 TD + \delta_4 PP * TD + \sum_{j=5}^J Ctrl_{ir}^k \delta_j + u_{ir} \quad (5)$$

where for industry i in province r , $\ln\Delta Y_{ir}^{TD}$ is the logarithm of the output difference five years before and after implemented of the 11th PFYP (i.e. 2001 to 2005 and 2006 to 2010) and notation for other variables is the same as in equation (4). Again, we are interested in estimating δ_4 , the coefficient of the interaction term. The estimation results are listed in columns (4)-(6) of Table 14 from which it can be seen that the signs of the interaction term of policy and period are still consistently significantly positive, no matter whether additional control variables are used or not. Note that the estimated coefficient of the interaction term in column (4)-(6) is slightly larger than those in column (1)-(3). One possible explanation for this is the non-efficiency-oriented process of picking preferred industries discussed in Section 4, causing a downward bias in the estimate of the effect of policy. More specifically, since some inefficient industries with lower growth potential are singled out by the provincial government because of its willingness to copy the central government's choice or its aim to support friends, the coefficients of the interaction term increase in regression models based on the conditional parallel-trend assumption. However, it is noteworthy that, as shown in Table 14, this underestimation does not change the result that policy has a significant and positive impact on industrial output during its current period.

Another source of potential bias is due to the possible persistent impact of policy in the sense that being selected in one plan has effects beyond the end of the plan. In that case it would bias the estimator due to some industries having been selected in a previous plan but the effect being attributed to the current plan. To address this possibility we use an approach employed previously and run the regression models in equations (4) and (5) with samples which are restricted to those industries not picked in the 10th PFYPs; the results are reported in columns (1)-(4) of Table 15. The parameter of core interest is still the coefficient of the interaction term. It can be seen in the first two columns of Table 15, for which the logarithm of industry i 's output is used as the dependent variable in Equation (4), the estimated coefficients of the interaction term are positive and significant and similar in magnitude to those in Table 14. Moreover, the results are little

changed even if we take the logarithm of output difference as the dependent variable as specified in Equation (5), estimates for which are reported in the third and fourth columns, further confirming the robustness and plausibility of the estimation results.

Finally, we found in section 3 that informal evidence suggests that average firm scale, fixed assets, gross output, and value-added of the provincial preferred industries are considerably larger than those of the non-preferred industries, suggesting that policy selection might be related to outcomes at the baseline. For this reason, the estimated coefficient of interest might suffer from an endogeneity problem since if industries with lower (higher) growth potential are chosen intentionally, it would lead to the underestimation (overestimation) of the policy impact. To assess this possibility we employ a two-stage least squares approach together with instrumental-variables (IV). To employ this method we need to find a valid instrument. Recall from the analysis in Section 4 that the central government's preferences have a strong influence on provincial governments' policy selection. Further, if the central government's preferences were influenced by industry characteristics they would relate to the performance of industry i in the country as a whole, but not to the performance of industry i in any particular province which may influence that province's selection. Thus the central government's policy selection could be employed as an instrumental variable here. The instrument is constructed as shown in Table 16. To take advantage of as much information as possible, we divide policy intensity into eight different types based on the 9th-11th NFYPs, using definitions very similar to those of $CTYPE_{in}$ in Table 7. More specifically, according to policy status in the 9th to 11th NFYP, a value 1 to 8 is assigned to the variable $Ctype2$ for each industry i as explained in Table 16. The higher the value of $Ctype2$, the more important industry i is in the view of the central government. Since local governments have a strong incentive to follow the central government's policy, $Ctype2$ correlates highly with local governments' policy selection, as we found in the analysis reported in section 4. We then estimated the following equation on cross-section data for the 11th PFYP.

$$\ln\Delta Y_{irn} = \delta_1 + \delta_2 I(PP = 1) + \ln\Delta Y_{ir(n-1)} + \sum_{m=3}^M Ctrls_{ir}^m \delta_m + u_{irn} \quad (6)$$

where the notation in equation (6) is the same as that in Equation (5), the lagged dependent variable has been added to the control variables as suggested by Wooldridge (2006) to relieve the problem of omitted variables and the instrument explained above has been used for the policy-selection variable. As usual, the estimate of the policy parameter δ_2 is the coefficient of core interest and the estimated results of Equation (6) are reported in the last two columns of Table 15. In concordance with our expectation, the coefficient of PFYP is consistently significant and positive with a magnitude similar to previous estimates, once again supporting the hypothesis that provincial industry policy stimulates the industry's output level during the period of the plan. Tests for the validity of IV, including the first-stage robust F-statistic, Shea's partial R^2 , and Wooldridge's (1995) robust score test (a test of endogeneity), are also reported in Table 15 and all of them exceed the relevant critical value, thus ensuring the validity of IV. We also used GMM in the event that there is heteroscedasticity. The results are not reported but the estimation results

are consistent with those in Table 15.

(Insert Table 16 near here)

We can summarize the results reported in sections 5.1 and 5.2 by pointing to the remarkable robustness of the estimates (sign, significance and magnitude) of the crucial parameter measuring the effects of provincial policy selection on an industry's output in the period during which the relevant PFYP is current. This adds to the findings of Song and Wang (2013) where the industry policies in PFYPs is found to have a significant effect on productivity of the provincial pillar industries. While in our paper, we test the effectiveness of industry policy in PFYPs on output for all the preferred industries besides the pillar ones. Chen et al. (2016) shows evidence that export-promoting policies expanded export of targeted industries in export processing zones, which is a more specific example consistent with the results in ours. It seems that preferential policy programs could indeed have a positive impact on development of the affected industry.

Our findings however, leave open the question of whether industrial policy has a persistent effect on preferred industries beyond the currency of the PFYP in which the industry was selected. We turn to this question in section 5.3.

5.3 Policy effects in the short and long terms

So far we have analyzed the contemporaneous effect on industry output of being selected as a provincial preferred industry but we are also interested in whether the beneficial effect found in the previous section persists over time. For that reason, we choose industries that were selected as preferred in the 10th PFYP but not in the 11th PFYP as the treatment group, and industries not selected in either the 10th PFYP or the 11th PFYPs as the control group. Using this sub-sample, we first test whether policy interventions increased output of the treatment group during the period of the 10th PFYP (2001-2005) and then evaluate whether there was any carry-over effect in the subsequent five years after the preferential policy was cancelled, i.e., we re-evaluate the performance of the treated group at end of the 11th PFYP period. Since local government doesn't select/discard preferred industries randomly, preferential policy could be cancelled because of poor performance in particular industry. As discussed in section 4, if the difference between the treatment group and the control group at the baseline correlates with policy selection, it will lead to a biased estimator. Therefore, we employ the propensity-score matching (PSM) method proposed by Rosenbaum and Robin (1983) to screen industries in the control group to evaluate the net influence of policy intervention (the average treatment effect of the treated, hereafter ATT). With the control group singled out by the PSM method, DID analysis can be used to eliminate the influence of unobservable variables. It is found in this section that, although policy increases output of a preferred industry during the current period of the plan in which it is selected, the expansionary effect disappears once the preferential policy is cancelled, implying that temporary invention by the government does not contribute to growth in the long run.

Consider the method in more detail. PSM uses a set of observed characteristics X to predict the probability of an industry's being chosen in the 10th PFYPs. The control group is then constructed from the non-policy-selected industries to match the characteristics of the industries selected in the 10th PFYPs. With a known score $p(X)$ and the control group singled out by the PSM method, the ATT of output after implementation of the 10th PFYPs is

$$ATT = E[Y_r^1 - Y_r^0 | PP_{ir} = 1] = E\{E[Y_r^1 - Y_{ir}^0 | PP_{ir} = 1, p(X_{ir})]\} = E\{E[Y_{ir}^1 | PP_{ir} = 1, p(X_{ir})] - E[Y_{ir}^0 | PP_{ir} = 1, p(X_{ir})] | PP_{ir} = 1\}, \quad (7)$$

where i indexes the industry and r indexes the province. When evaluating the contemporaneous effect of the 10th PFYP, Y_{ir}^1 is the output level of industry i in province r in 2005 (after treatment) and Y_{ir}^0 the output level in 2000 (before treatment). When evaluating the carry-over effect of the 10th PFYP, Y_{ir}^1 is the output level of industry i in province r in 2010 (after treatment) and Y_{ir}^0 the output level in 2005 (before treatment). Since Y_{ir}^0 is unobservable, we construct a counterfactual to estimate ATT. To do this, industries which have not been favored during the 10th or the 11th FYPs are matched with those in the treatment group, and are picked to replace the counterfactual mean for those being treated. Since only variables that influence simultaneously the treatment status and the outcome variable should be included (Smith and Todd, 2005), the characteristic variables in X_{ir} for industry i in region r used here are selected based on a balance test and those finally included an industry dummy variable, a regional dummy variable, and a set of pre-treatment variables like output share, tax, TFP, number of employees, number of firms and its higher order forms, an industry dummy variable, and a regional dummy variable.¹⁸ The possibility of an industry in region r being favored in the 10th FYP is estimated with a logit model:

$$p(X_{ir}) = Pr\{PP_{i,s=0,r} = 1 | X_{ir}\} = \frac{\exp(h(X_{ir}))}{1 + \exp(h(X_{ir}))} \quad (8)$$

where $h(\cdot)$ is a polynomial function of the characteristic variable X .

(Insert Figure 7. around here)

Before considering the PSM-DID results, we look at some informal graphical evidence in Figure 7 which shows the mean output of the treatment and control groups from 2000 to 2010 (left-hand axis) as well as the ratio of treatment to control group output (right-hand axis). The steadily raising red and green dashed lines depict the trend of gross output of the treatment group and that of the control group respectively, showing that the average scale of both groups grew continuously since 2001, the first year of the 10th PFYPs. However the output ratio of the two groups (the blue line) has an inverted U-shape, reaching its peak value in 2006, the first year after

¹⁸ Since sample size in this section is sharply reduced, we use dummy variables for the traditional division of China into four economic regions instead of a province dummy variable to ensure quality of matching. The eastern region includes Beijing, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi and Hainan; the central region includes Inner Mongolia, Shanxi, Henan, Anhui, Jiangxi, Hubei and Hunan; the western region includes Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang; and the northeast region includes Liaoning, Heilongjiang, and Jilin.

the 10th PFYP. Thus, the treatment group had a higher average growth rate than the control group during 2001-2005, when the former enjoyed favorable policy from the 10th PFYPs but after the end of the plan the average growth rate of the treatment group was no longer faster than that of the control group. Figure 7 gives a straightforward picture suggesting that the industrial policy does not have a carryover effect. However, these are the unconditional effects likely to be biased because the choice of the treatment might depend on or affect growth. So we now move to the results of formal empirical analysis which accounts and corrects for the potential bias.

(Insert Table 17 around here)

(Insert Table 18 around here)

Table 17 and Table 18 show the estimation results for the standard two-period DID model as specified in Equation (4), with and without sample screening through the PSM method. The key parameter of interest is still the coefficient of the interaction term between policy and time. Estimates in column (1) of Table 17 are the result of a standard DID model without sample screening. It can be seen that the estimate of the interaction term is significant and positive, indicating a beneficial influence of policy on industrial output during the 10th five-year period. This is consistent with what we found in sections 5.1 and 5.2. We then use the PSM method to screen samples and make sure the treatment group and the control group are similar at the baseline. According to Abadie and Imbens (2006) and Baser (2006), there are several effective matching techniques, the main ones being nearest-neighbor matching, radius matching, and kernel matching. The estimates in column (2) are based on the matched samples using neighbor matching, where the balancing is good for all covariates since the standardized bias is less than 5% and/or the t-ratio is not significant for any covariates after matching.¹⁹ The estimated coefficient of the interaction term remains significant and positive but the magnitude is larger than that of the previous result. Recalling our previous discussion, this seems reasonable since the provincial planner chooses his favorite industries according to the choice of the central planner and as a result will reallocate resources to some industries which do not necessarily have local comparative advantage. Therefore, the coefficient of the interaction term without sample screening will be underestimated because of selection bias at the baseline. Moreover, if we take the logarithm of industrial output as the dependent variable, the conclusion of an effective policy intervention remains. This is shown in column (1) of Table 18. In brief, testing the effectiveness of the 10th PFYP during its plan-period confirms our previous conclusion that policy stimulates the output of preferred industries.

Having established the effectiveness of policy within the plan's period of operation using the

¹⁹ The estimates in column (2) of Table 17 remain stable if other matching techniques, such as kernel matching or radius matching with caliper, are used.²⁰ Note: $\forall i \in [1, 419]$ and $r \in [1, 31]$, the value of the non-preferred group is the simple average of all non-preferred industries, the value of the preferred group is the simple average of all preferred industries, and the value of the total group is the simple average of all industries.

PSM-DID approach, we now turn to test the existence of a carry-over effect, i.e., whether there is a persistent influence of preferential policy in the post-plan period. In column (3) of Table 17 we show the DID estimates for the post-plan period of the interaction term without using PSM to match samples. The relevant coefficient is positive and significant, indicating the existence of a carry-over effect. However, if we employ the PSM method to screen samples, the coefficient of the interaction term shown in column (4) is no longer significant and is much smaller than the unmatched estimate. Judging by the dashed green and red lines in Figure 7, the estimate of the simple DID method is biased due to the violation of the parallel-trend assumption. If the logarithm of industrial output or output change is used as the dependent variable in the PSM-DID model as reported in columns (2)-(4) of Table 18, the coefficient of the interaction term is no longer significant and positive, irrespective of which matching technique is employed.

All in all, our results show that, unfortunately, on average the policy-promoted growth observed during the currency of the relevant PFYP does not persist into the five-year period beyond the end of the plan and so, policy does not have a long-lasting effect on industrial development in China, unlike that found by Noland (1993) for Japan. Noland (1993) indicates that industrial policies in Japan have had an impact on the trade pattern and have been forward-looking in their policy interventions which have had persistent, long-lasting effects in Japan. Our contrasting results for China are perhaps not surprising when referring to the TFP of the treatment group and control group as illustrated in Figure 6. Since the preferred industries were neither those with higher TFP level, nor those which had experienced a more rapid rate of TFP growth than that of the control group during the period of the 10th PFYPs, it is natural, perhaps, to see that the growth rate of the treatment group decreases in the period after the 10th PFYP.

To summarize the discussion in this sub-section, we have deepened our understanding of the policy impact in the short and long terms and found that intervention by the government does increase industry growth contemporaneously but that in the long term the development path cannot easily be turned around. This suggests caution in the design of policy by provincial planners.

5.4 Policy impact on industrial inputs

In the above three sub-sections, it has been confirmed that industrial policy embodied in the FYP has a positive impact on contemporaneous output. Since industrial output could be viewed as the ultimate outcome of policy intervention, the question arises as to whether industrial inputs, such as labor and capital, are affected by the policy so as to finally result in increased output? In this part we briefly examine the impact of policy embodied in the 10th and 11th PFYPs using the regression specification defined in Equation (3) with various alternative dependent variables. More specifically, we will test the effect of the 10th and 11th PFYPs on industrial employment (measured by the logarithm of employee, $\ln L$), the stock of capital (measured by the logarithm of the real value of fixed assets, $\ln K$), and the emergence of entrepreneurs (measured by the logarithm of the number of firms, $\ln \text{Firm}$). To keep the analysis simple, we use the same

sub-sample as in the estimation of column (5) in Table 13, which drops all the industries preferred in both the 10th and 11th PFYPs as well as industries preferred in the 9th FYP.

(Insert Tables 19 near here)

(Insert Tables 20 near here)

The coefficient of the policy variable is again the key parameter of interest; the results are reported in Table 19 and Table 20. From the first three columns in Table 19, it can be seen that policy has a significant positive relationship with industrial employment and capital investment, but does not show a statistically significant relationship with the emergence of entrepreneurs. Further, the average firm size of preferred industries has increased significantly as a result of preferential policy, whether measured by employees per firm (column (5) of Table 19) or by capital per firm (column (4) of Table 19). Moreover, capital deepening (measured by the logarithm of capital per employee, $\ln(K/L)$) can be seen to be associated with preferred industries for which capital per worker is increasing about 10% more than for the non-preferred industries.

If we take the regional location of the province into consideration when evaluating the policy impact on industrial inputs which we do in Table 20, we find several differences between coastal and inland provinces. For coastal provinces, policy did not have a significant association with employment increases and capital deepening, although capital investment has been significantly increased in the preferred industries (columns (1), (3) and (5) of Table 20), while among the inland provinces, preferential policy was observed to have an obviously positive association with employment, capital investment and capital deepening (columns (2), (4) and (6) of Table 20). The reason for the differences in policy impact on industrial inputs between coastal and inland provinces could lie in the differences in natural endowments and industry structure between them. In the case of natural endowments, the inland provinces have more energy and resource industries, which are capital intensive by nature. That is probably why we observe capital deepening in the preferred industries in the economically lagging inland provinces compared to the more developed coastal provinces in China.

In summary, the results presented above show that industrial policy stimulates industry output mainly through increasing inputs like labor and capital rather than entrepreneurs, which result in larger average firm size but a relatively stable number of firms. Industrial policy has a positive association with capital deepening in the inland provinces, which might be associated with differences in industrial structure between coastal and inland provinces rather than different stages of industrial upgrading.

5.5 Further Robustness Checks

We have remarked several times above at the robustness of our results. Nevertheless, to further check the robustness of the results, we carried out the following extra analysis.

(1) We re-ran all the regressions in Sections 4 and 5 without the top and bottom 5% of

observations as measured by industry gross output, to assess whether the reported estimates suffer from extreme values.

(2) The simple average of firm-level TFP was used instead of the weighted average to compute industry-level TFP for inclusion in the regressions in Table 11 and Table 12.

(3) The GMM method was used to account for possible heteroscedasticity for regressions (5) and (6) in Table 15.

(4) For the PSM analysis, we also use radius matching with caliper to select matched samples.

In all cases the results are substantially unchanged.

6. Conclusions

In China, the Five-Year Plan is one of the most significant sources of information to assess whether and, if so, how regional governments take part in resource reallocation in an attempt to influence the economic performance of particular industries in both the short term and the long term. Based on the latest four rounds of FYPs and industry data at four-digit manufacturing sector level, this paper has investigated the determinants and effectiveness of industrial policies promulgated in successive provincial FYPs.

As to the determinants of choice embedded in the PFYPs, we found that the central government's preferences are a key determinant of the provincial governments' choice of favored industries when drafting their FYPs. We found this conclusion remarkably robust -- no matter which other variables are used as controls, the impact of the central government's FYP on the possibility of selection by provincial governments dominates variables which measure industry economic conditions at the beginning of the plan period. Moreover, the tendency for local governments to follow the central government's preference to select industries strengthens over successive FYPs. Contrary to expectations, industry productivity is not a significant determinant in selection of preferred industries, which means that the more efficient industries do not have a larger chance of selection. We rationalized this by arguing that provincial governments are willing to copy the central government's preference at the cost of deviating from their own comparative advantage, and/or aiming to support friends who happened to have lower productivity.

On the matter of the effectiveness of industry selection, we found that local industrial policy does increase industry output through employment expansion and/or capital deepening during the period for which the FYP is current. However, there is no statistical evidence that there is a persistent, long-lasting impact on industrial development after the preferential policy ceases.

The findings of this paper shed light on the formation and effect of industrial policy. Though the situation in China serves as the main motivation for the present paper, our analysis is general enough to be referred to other countries characterized by extensive governmental intervention in the allocation of resources at the industry level.

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Table 1. Period covered and year of issue of China's thirteen National Five-Year Plans

Plan number	Period covered	Month of approval	Plan number	Period covered	Month of issue
1 st Plan	1953–1957	1955.7	8 th Plan	1991–1995	1991.4
2 nd Plan	1958–1962	1958.8	9 th Plan	1996–2000	1996.3
3 rd Plan	1966–1970	Not formally issued	10 th Plan	2001–2005	2001.3
4 th Plan	1971–1975	1970, revised in 1973	11 th Plan	2006–2010	2006.3
5 th Plan	1976–1980	1977.12	12 th Plan	2011–2015	2011.3
6 th Plan	1981–1985	1982.12	13 th Plan	2016–2020	2016.3
7 th Plan	1986–1990	1986.3			

Table 2. Number of policy-preferred 4-digit industries in the 9th to 12th FYPs

Preferred industries	PFYPs					NFYPs				
	9 th	10 th	11 th	12 th	Mean	9 th	10 th	11 th	12 th	Mean
Number	2913	3208	2472	2685	2820	115	180	140	178	153
% of total industries	22.43	24.70	19.03	20.67	21.71	27.44	42.96	33.41	42.48	36.52

Note; the number of industries in the PFYP columns are summed across all provinces

Table 3. Top 30 policy-preferred 4-digit manufacturing industries in the 9th to 12th PFYPs

Industry code	Industry name	PFYP			
		9 th	10 th	11 th	12 th
2760	Biological, biochemical products manufacturing	28	31	29	30
2710	Chemical pharmaceutical raw material manufacturing	30	31	29	28
2720	Chemical pharmaceutical manufacturing	30	31	29	28
3721	Automobile manufacturing	27	18	24	27
2730	Chinese herbs slices and decoction processing	27	31	30	26
2750	Veterinary drug manufacturing	25	31	29	26
2770	Hygiene materials and medical supplies manufacturing	25	31	29	26
2665	Photographic chemicals manufacturing	25	20	29	26
1352	Meat products and by-products processing	11	20	20	26
4061	PCB and electronic components manufacturing	27	28	29	25
3725	Auto parts and accessories manufacturing	28	18	26	25
1494	Food and feed additives manufacturing	26	28	22	25
2631	Chemical pesticide manufacturing	24	25	18	25
2671	Soap and synthetic detergent manufacturing	25	26	17	25
1320	Feed processing	24	26	17	25
2619	Other chemical manufacturing	24	26	17	25
2672	Cosmetics manufacturing	25	25	17	25
2641	Paint manufacturing	24	25	17	25
2645	Sealing packing and similar products manufacturing	24	25	17	25
2644	Dye manufacturing	23	25	17	25
2661	Chemical reagent and catalysts manufacturing	24	22	17	25
2662	Special chemical products manufacturing	23	22	17	25
3220	Steel making	22	10	23	24
2511	Crude oil processing and petroleum products	18	16	22	24
2674	Flavor and fragrance manufacturing	24	19	18	24
2642	Ink and similar products manufacturing	23	25	17	24
2643	Pigment manufacturing	23	25	17	24
2679	Other daily chemical products manufacturing	22	21	17	24
1440	Liquid milk and dairy products manufacturing	10	20	20	22
1810	Textile and garment manufacturing	18	20	18	22

Note: (1) numbers in the last four columns represent the number of provinces which selected that particular industry in that particular PFYP; (2) industries are sorted according to times selected in the 12th PFYPs; (3) industry 2619 is a combination of Other basic chemical raw materials manufacturing (2619), Other specialized chemical products manufacturing (2669) and Manufacture of special chemicals for environmental pollution treatment (2666); (4) industry 4061 is a combination of Printed circuit board manufacturing (4061) and Electronic components manufacturing (4062); (5) The ranking of preferred industry is generally highly consistent through time except for industries within the two-digit Chemical raw materials & chemical products manufacturing industry (with two-digit code 26). The fluctuation in the number of provinces which selected these industries in the 11th PFYPs is noticeable and could be associated with a sudden reduction of 25% in numbers of preferred industries in this two-digit industry in the 11th NFYP, compared to the other NFYPs. The selection of PFYP are highly correlated with that of the NFYP; we provide evidence for this relationship between NFYPs and PFYPs in Table 6 and in section 4.

Table 4. Spearman rank correlation coefficient for industry rankings in Table 3

	9 th PFYP	10 th PFYP	11 th PFYP	12 th PFYP
9 th PFYP	1			
10 th PFYP	0.7455	1		
11 th PFYP	0.7084	0.7937	1	
12 th PFYP	0.7242	0.6912	0.8308	1

Table 5. Number of policy-preferred industries in the 9th to 12th PFYPs

Policy-preferred industries	9 th	10 th	11 th	12 th	Average
Maximum	182	201	138	155	169
Minimum	19	16	28	20	21
Mean: nationwide	94	103	80	91	92
Mean: coastal region	105	134	88	108	109
Mean: central region	106	105	90	75	94
Mean: western region	70	66	61	68	66

Note: the coastal region consists of Liaoning, Beijing, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi and Hainan; the central region consists of Heilongjiang, Jilin, Inner Mongolia, Shanxi, Henan, Anhui, Jiangxi, Hubei and Hunan; the western region consists of Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.

Table 6. Number of provinces selecting industries compared to the 9th to 12th NFYPs

	9 th	10 th	11 th	12 th	9 th v. 12 th (t-statistic)
For industries preferred in NFYPs	11.5	12.3	13	16.5	4.05***
For industries not preferred in NFYPs	4.9	4.1	2.3	3.9	-2.45***
For all the manufacturing industries	6.8	7.6	5.8	6.2	-1.18

Table 7 Construction of $CTYPE_{in}$ based on the two preceding NFYPs

Industry i	Status in the (n-1) th NFYP(2000-2005)	Status in the n th NFYP(2006-2010)
$CTYPE_{in}=1$ if	Non-preferred	Non-preferred
$CTYPE_{in}=2$ if	Preferred	Non-preferred
$CTYPE_{in}=3$ if	Non-preferred	Preferred
$CTYPE_{in}=4$ if	Preferred	Preferred

Table 8. Determinants of industry selection in PFYPs

	(1)	(2)	(3)	(4)	(5)
<i>CTYPE_{in}</i> : =2	0.315** (0.151)	0.313** (0.151)	0.311** (0.151)	0.306** (0.152)	0.305** (0.151)
=3	0.491*** (0.072)	0.487*** (0.072)	0.484*** (0.072)	0.488*** (0.072)	0.486*** (0.072)
=4	1.352*** (0.092)	1.339*** (0.092)	1.336*** (0.092)	1.332*** (0.093)	1.330*** (0.093)
<i>EMP</i>		0.023*** (0.007)	0.018*** (0.006)	0.011** (0.005)	0.009* (0.005)
<i>TAXFEE</i>			0.215*** (0.065)		0.140*** (0.050)
<i>OPSHARE</i>				0.062*** (0.019)	0.054*** (0.019)
<i>Perd_dummy</i>	YES	YES	YES	YES	YES
<i>Prov_dummy</i>	YES	YES	YES	YES	YES
<i>Ind_dummy</i>	YES	YES	YES	YES	YES
_cons	-0.592*** (0.152)	-0.592*** (0.152)	-0.591*** (0.153)	-0.625*** (0.154)	-0.620*** (0.154)
<i>N</i>	22113	22113	22113	22113	22113
LR chi2	3420.30 (0.000)	3529.64 (0.000)	3450.24 (0.000)	3522.45 (0.000)	3534.63 (0.000)
Pseudo R2	0.2653	0.2667	0.2682	0.2698	0.2703

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (3) cluster-robust standard errors (cluster at 4-digit industry level) are used.

Table 9 Predicted probabilities and marginal effects of the main variables in Table 8

	Margin	Std. Err.	Z	P>z	95% Conf. Interval	
Predicted probabilities:						
<i>CTYPE_{in}</i> =1	0.0985	0.0102	9.63	0.000	0.0785	0.1186
=2	0.1624	0.0340	4.78	0.000	0.0958	0.2290
=3	0.2108	0.0127	16.55	0.000	0.1858	0.2358
=4	0.5161	0.0246	20.97	0.000	0.4678	0.5644
Marginal effect:						
<i>CTYPE_{in}</i> =2	0.0639	0.0357	1.79	0.073	-0.0060	0.1337
=3	0.1122	0.0161	7.00	0.000	0.0808	0.1437
=4	0.4176	0.0283	14.77	0.000	0.3622	0.4730
EMP	0.0025	0.0014	1.76	0.079	-0.0003	0.0053
OPSHARE	0.0154	0.0054	2.83	0.005	0.0047	0.0261
TAXFEE	0.0400	0.0145	2.77	0.006	0.0117	0.0683

Table 10. The role of regions in the determinants of industry selection in PFYPs

Dependent. Variable: PP_{irn}	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit
$CTYPE_{in} = 2$	0.508*** (0.176)	0.510*** (0.175)	0.510*** (0.175)	0.508*** (0.174)	0.508*** (0.174)
$= 3$	0.550*** (0.067)	0.541*** (0.067)	0.539*** (0.068)	0.541*** (0.067)	0.540*** (0.068)
$= 4$	1.404*** (0.092)	1.383*** (0.093)	1.380*** (0.093)	1.378*** (0.093)	1.377*** (0.093)
$inland \times CTYPE_{in} = 1$	0.455*** (0.116)	0.453*** (0.115)	0.458*** (0.115)	0.432*** (0.115)	0.438*** (0.115)
$= 2$	0.0892 (0.196)	0.0784 (0.196)	0.0795 (0.195)	0.0473 (0.195)	0.0520 (0.195)
$= 3$	0.350*** (0.109)	0.356*** (0.108)	0.359*** (0.109)	0.336*** (0.108)	0.341*** (0.108)
$= 4$	0.361*** (0.112)	0.373*** (0.112)	0.378*** (0.112)	0.347*** (0.111)	0.353*** (0.111)
EMP		0.0226*** (0.007)	0.0174*** (0.006)	0.0103** (0.005)	0.00862* (0.005)
$TAXFEE$			0.217*** (0.065)		0.141*** (0.050)
$OPSHARE$				0.0618*** (0.019)	0.0541*** (0.019)
$Perd_dummy$	YES	YES	YES	YES	YES
$Prov_dummy$	YES	YES	YES	YES	YES
Ind_dummy	YES	YES	YES	YES	YES
$_cons$	-0.637*** (0.153)	-0.633*** (0.153)	-0.632*** (0.154)	-0.668*** (0.155)	-0.663*** (0.155)
N	22113	22113	22113	22113	22113
LR chi2	3746.28 (0.000)	3856.54 (0.000)	3720.10 (0.000)	3813.83 (0.000)	3833.39 (0.000)
Pseudo R2	0.2657	0.2670	0.2685	0.2701	0.2706

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (3) cluster-robust standard errors (cluster at 4-digit industry level) are used.

Table 11. Industry selection and TFP in the 10th and 11th PFYPs

Dependent. Variable: PP_{irn}	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit
$CTYPE_{in} = 2$	0.351 [*] (0.184)	0.345 [*] (0.183)	0.344 [*] (0.182)	0.339 [*] (0.181)	0.339 [*] (0.181)
$= 3$	0.558 ^{***} (0.088)	0.555 ^{***} (0.089)	0.553 ^{***} (0.089)	0.553 ^{***} (0.089)	0.552 ^{***} (0.089)
$= 4$	1.343 ^{***} (0.109)	1.331 ^{***} (0.110)	1.330 ^{***} (0.110)	1.323 ^{***} (0.111)	1.323 ^{***} (0.111)
TFP	-0.063 ^{***} (0.020)	-0.056 ^{***} (0.020)	-0.057 ^{***} (0.020)	-0.048 ^{**} (0.019)	-0.049 ^{**} (0.019)
EMP		0.020 ^{***} (0.00651)	0.014 ^{**} (0.00620)	0.007 (0.006)	0.005 (0.006)
$TAXFEE$			0.331 ^{**} (0.138)		0.185 [*] (0.113)
$OPSHARE$				0.056 ^{***} (0.017)	0.050 ^{***} (0.016)
$Perd_dummy$	YES	YES	YES	YES	YES
Ind_dummy	YES	YES	YES	YES	YES
$Prov_dummy$	YES	YES	YES	YES	YES
$_cons$	-0.396 ^{**} (0.180)	-0.403 ^{**} (0.180)	-0.402 ^{**} (0.180)	-0.431 ^{**} (0.181)	-0.428 ^{**} (0.181)
N	11191	11191	11191	11191	11191
LR chi2	2962.21 (0.000)	3183.69 (0.000)	3096.24 (0.000)	3257.97 (0.000)	3235.03 (0.0000)
Pseudo R2	0.3095	0.3103	0.3115	0.3134	0.3137

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) ^{*} $p < 0.10$, ^{**} $p < 0.05$, ^{***} $p < 0.01$. (3) cluster-robust standard errors (cluster at 4-digit industry level) are used. (3) TFP data are not available after 2008, so that the 12th PFYP is excluded from the sample used in Table 11.

Table 12. Industry selection and TFP in the 10th and 11th PFYPs, contd.

Dependent. Variable: PP_{irn}	(6) Probit	(7) Probit	(8) Probit	(9) Probit	(10) Probit
$CTYPE_{in} = 2$	0.314 [*] (0.188)	0.312 [*] (0.188)	0.309 [*] (0.187)	0.304 [*] (0.184)	0.303 [*] (0.184)
$= 3$	0.488 ^{***} (0.089)	0.489 ^{***} (0.089)	0.486 ^{***} (0.089)	0.486 ^{***} (0.089)	0.486 ^{***} (0.089)
$= 4$	1.296 ^{***} (0.110)	1.298 ^{***} (0.110)	1.291 ^{***} (0.110)	1.278 ^{***} (0.111)	1.275 ^{***} (0.112)
$H-TFP_{80}$	-0.089 ^{**} (0.045)				
$H-TFP_{90}$		-0.062 (0.054)	-0.064 (0.054)	-0.049 (0.054)	-0.047 (0.054)
$TAXFEE$			0.465 ^{***} (0.170)	0.248 [*] (0.128)	0.227 [*] (0.125)
$OPSHARE$				0.057 ^{***} (0.0180)	0.054 ^{***} (0.0177)
EMP					0.007 (0.00638)
$Perd_dummy$	YES	YES	YES	YES	YES
Ind_dummy	YES	YES	YES	YES	YES
$Prov_dummy$	YES	YES	YES	YES	YES
$_cons$	-0.375 ^{**} (0.178)	-0.381 ^{**} (0.179)	-0.380 ^{**} (0.179)	-0.401 ^{**} (0.181)	-0.398 ^{**} (0.181)
N	12340	12340	12340	12340	12340
LR chi2	2831.64 (0.000)	2835.49 (0.000)	2842.75 (0.000)	2987.71 (0.000)	3016.30 (0.0000)
Pseudo R2	0.3060	0.3057	0.3078	0.3106	0.3107

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) ^{*} $p < 0.10$, ^{**} $p < 0.05$, ^{***} $p < 0.01$. (3) cluster-robust standard errors (cluster at 4-digit industry level) are used. (3) TFP data are not available after 2008, so that the 12th PFYP is excluded from the sample used in Table 12.

Table 13. The output effects of industry selection in the 10th and 11th PFYPs

	(1) DID lnY	(2) DID lnY	(3) DID lnY	(4) DID lnY	(5) DID lnY
$PP_{irn}^{10\&11}$	0.110*** (0.0376)	0.0795** (0.0340)	0.0953** (0.0383)	0.134*** (0.0373)	0.145*** (0.0438)
Period: 2005	0.794*** (0.0283)	0.796*** (0.0262)	0.792*** (0.0266)	0.811*** (0.0286)	0.828*** (0.0317)
Period: 2010	1.239*** (0.0464)	1.204*** (0.0429)	1.288*** (0.0410)	1.243*** (0.0476)	1.263*** (0.0496)
Treat I	0.316*** (0.0750)	0.224*** (0.0624)	0.274*** (0.0688)		
Treat II	0.709*** (0.138)	0.383*** (0.0984)	0.660*** (0.131)	0.282*** (0.0739)	
Treat II-I					0.0639 (0.0832)
Treat II-II					0.274** (0.110)
<i>Ind_dymmy</i>	YES	YES	YES	YES	YES
<i>Prov_dummy</i>	YES	YES	YES	YES	YES
_cons	-1.628*** (0.345)	-1.804*** (0.298)	-1.422*** (0.308)	-1.616*** (0.385)	-1.698*** (0.413)
<i>N</i>	22113	20959	21052	18764	14608
adj. R^2	0.340	0.342	0.380	0.341	0.346
F-stat	84.81 (0.0000)	95.61 (0.0000)	88.79 (0.0000)	81.80 (0.0000)	60.57 (0.0000)

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (3) cluster-robust standard errors (cluster at 4-digit industry level) are used.

Table 14. The output effects of industry selection in the 11th PFYP

	(1)DID lnY	(2)DID lnY	(3)DID lnY	(4)DID lnΔY	(5)DID lnΔY	(6)DID lnΔY
<i>PP * TD</i>	0.175*** (0.0515)	0.172*** (0.0474)	0.172*** (0.0474)	0.200*** (0.0637)	0.192*** (0.0630)	0.192*** (0.0630)
<i>PP</i>	0.488*** (0.106)	0.330*** (0.0822)	0.330*** (0.0822)	0.414*** (0.111)	0.271*** (0.0915)	0.271*** (0.0915)
<i>TD</i>	0.401*** (0.0387)	0.382*** (0.0363)	0.382*** (0.0363)	0.409*** (0.0422)	0.397*** (0.0403)	0.397*** (0.0403)
<i>FIRM</i>		0.0189*** (0.00144)	0.0189*** (0.00144)		0.0169*** (0.00128)	0.0169*** (0.00128)
<i>FIRMsq</i>		-0.0941*** (0.0158)	-0.0941*** (0.0158)		-0.0830*** (0.0138)	-0.0830*** (0.0138)
<i>D_inland</i>			-0.653*** (0.129)			-0.395*** (0.131)
<i>Ind_dummy</i>	YES	YES	YES	YES	YES	YES
<i>Prov_dummy</i>	YES	YES	YES	YES	YES	YES
<i>_cons</i>	-0.800** (0.362)	-1.246*** (0.232)	-1.246*** (0.232)	-1.344*** (0.338)	-1.764*** (0.227)	-1.764*** (0.227)
<i>N</i>	16117	14764	14764	14662	13309	13309
<i>adj. R²</i>	0.306	0.463	0.463	0.281	0.413	0.413
<i>F-stat</i>	62.12 (0.0000)	52.96 (0.0000)	52.96 (0.0000)	49.42 (0.0000)	58.81 (0.0000)	58.81 (0.0000)

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; (3) r cluster-robust standard errors (cluster at 4-digit industry level) are used.

Table 15. The output effects of industry selection in the 11th PFYP: Controlling for multi-period selection

	(1) DID lnY	(2) DID lnY	(3) DID lnΔY	(4) DID lnΔY	(5) 2SLS lnY	(6) 2SLS lnY
<i>PP * TD</i>	0.202*** (0.069)	0.213*** (0.067)	0.243*** (0.083)	0.245*** (0.085)		
<i>PP</i>	0.347*** (0.110)	0.223*** (0.0831)	0.282** (0.114)	0.172* (0.095)	0.222*** (0.081)	0.243*** (0.080)
<i>TD</i>	0.428*** (0.0418)	0.423*** (0.0388)	0.442*** (0.045)	0.444*** (0.043)		
<i>FIRM</i>		0.020*** (0.001)		0.0175*** (0.001)		0.0031*** (0.0002)
<i>FIRMsq</i>		-0.095*** (0.015)		-0.084*** (0.012)		-0.015*** (0.002)
<i>lnY_{n-1}</i>					0.856*** (0.008)	0.793*** (0.010)
<i>Ind_dummy</i>	YES	YES	YES	YES	YES	YES
<i>Prov_dummy</i>	YES	YES	YES	YES	YES	YES
<i>_cons</i>	-0.755* (0.440)	-1.302*** (0.270)	-1.364*** (0.412)	-1.877*** (0.274)	0.268*** (0.070)	0.122* (0.071)
<i>N</i>	11319	10246	10368	9295	6510	6510
<i>adj. R²</i>	0.308	0.458	0.285	0.411	0.787	0.793
<i>F-stat</i>	46.70 (0.0000)	48.61 (0.0000)	38.34 (0.0000)	56.44 (0.0000)		
<i>Wald chi2</i>					22896 (0.0000)	22896 (0.0000)
<i>IV variables</i>	NA	NA	NA	NA	Ctype2 _i	Ctype2 _i
<i>1st stage robust F statistics</i>					686.064 (0.0000)	681.581 (0.0000)
<i>1st stage Shea's adj. Partial R-sq.</i>					0.1115	0.1108
<i>DHW (test of endogeneity)</i>					4.23982 (0.0395)	5.05886 (0.0245)

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; (3) cluster-robust standard errors (cluster at 4-digit industry level) are used.

Table 16. Definition of Ctype2 based on the 9th to 11th PFYPs and NFYPs

Industry i	Status in the 9 th NFYP	Status in the 10th NFYP	Status in the 11th NFYP
Ctype2 _i =1 if	Non-preferred	Non-preferred	Non-preferred
Ctype2 _i =2 if	Preferred	Non-preferred	Non-preferred
Ctype2 _i =3 if	Non-preferred	Preferred	Non-preferred
Ctype2 _i =4 if	Preferred	Preferred	Non-preferred
Ctype2 _i =5 if	Non-preferred	Non-preferred	Preferred
Ctype2 _i =6 if	Preferred	Non-preferred	Preferred
Ctype2 _i =7 if	Non-Preferred	Preferred	Preferred
Ctype2 _i =8 if	Preferred	Preferred	Preferred

Table 17. PSM-DID estimates of the short-term and long-term output effects of industry selection

	(1) DID	(2) PSM-DID (Neighbor)	(3) DID	(4) PSM-DID (Neighbor)
	Y	Y	Y	Y
	Short-term (2000-2005)		Long-term (2006-2010)	
<i>PP * TD</i>	0.734** (0.282)	1.491** (0.660)	1.556** (0.647)	1.061 (0.728)
<i>PP</i>	0.263 (0.217)	0.212 (0.253)	0.652 (0.402)	0.611 (0.494)
<i>TD</i>	0.416*** (0.101)	1.882*** (0.343)	1.493*** (0.203)	2.997*** (0.454)
Region dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
_cons	1.587*** (0.355)	1.230** (0.535)	2.922*** (0.620)	3.364*** (1.002)
<i>N</i>	14384	3134	21034	5682
adj. R^2	0.040	0.040	0.042	0.036
F-stat	12.93 (0.0000)	17.85 (0.0000)	25.69 (0.0000)	14.14 (0.0000)

Note: (1) * for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$; (2) the propensity score is estimated with the user-written program *psmatch2* (Leuven and Sianesi, 2003) in stata13. (3) the balance testing is conducted with the command *pstest*. (4) due to sample screening, the industry dummy in Table 17 and Table 18 is set according to the industrial category on page 259 of Zhang (2014).

Table 18. RPSM-DID estimates of the short-term and long-term output effects of industry selection: Alternative matching assumptions

	(1) PSM-DID (Neighbor) lnY	(2) PSM-DID (Neighbor) lnY	(3) PSM-DID (Kernel) lnΔY	(4) PSM-DID (Neighbor) lnΔY
	Valid Period (2000-2005)	Ex post (2006-2010)		
<i>PP * TD</i>	0.0675* (0.037)	-0.0108 (0.065)	-0.0940 (0.0860)	0.0347 (0.0950)
<i>PP</i>	0.0844 (0.137)	-0.0475 (0.116)	0.0996 (0.112)	-0.0516 (0.131)
<i>TD</i>	0.804*** (0.047)	0.519*** (0.072)	0.612*** (0.0730)	0.487*** (0.0940)
Region dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
_cons	-0.753*** (0.232)	0.103 (0.199)	-0.508** (0.192)	-0.415** (0.192)
<i>N</i>	3134	4977	9924	4439
adj. R^2	0.174	0.108	0.097	0.086
F-stat	121.93 (0.0000)	37.63 (0.0000)	31.12 (0.0000)	38.38 (0.0000)

Note: (1) * for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$; (2) the propensity score is estimated with user-written program *psmatch2* (Leuven and Sianesi, 2003) in stata13. (3) the balance testing is conducted with the command *pstest*. (4) due to sample screening, the industry dummy in Table 17 and Table 18 is set according to the industrial category on page 259 of Zhang (2014).

Table 19. The channels of industrial policy in the 10th and 11th PFYPs

	(1) lnL	(2) lnK	(3) lnFirm	(4) lnK/Firm	(5) lnL/Firm	(6) lnK/L
PP _{im}	0.129*** (0.0402)	0.229*** (0.0490)	0.0228 (0.0237)	0.102*** (0.0331)	0.0415* (0.0213)	0.104*** (0.0259)
Period: 2005	0.00247 (0.0289)	0.179*** (0.0346)	0.229*** (0.0252)	-0.0365 (0.0253)	-0.220*** (0.0192)	0.177*** (0.0170)
Period: 2010	-0.287*** (0.0458)	0.223*** (0.0544)	0.566*** (0.0317)	0.244*** (0.0289)	-0.344*** (0.0223)	0.507*** (0.0217)
Treat II-I	0.0699 (0.0748)	0.0385 (0.0863)	0.0504 (0.0620)	-0.000786 (0.0455)	0.0302 (0.0341)	-0.0372 (0.0290)
Treat II-II	0.289*** (0.0952)	0.316*** (0.117)	0.0994 (0.0786)	0.185*** (0.0665)	0.183*** (0.0483)	0.0263 (0.0377)
<i>Ind_dummy</i>	YES	YES	YES	YES	YES	YES
<i>Prov_dummy</i>	YES	YES	YES	YES	YES	YES
_cons	7.196*** (0.320)	11.51*** (0.410)	2.589*** (0.325)	8.988*** (0.124)	4.638*** (0.102)	4.319*** (0.117)
<i>N</i>	14608	14595	13018	13017	13018	14595
adj. <i>R</i> ²	0.267	0.244	0.318	0.176	0.155	0.234
F-stat	53.75 (0.0000)	35.25 (0.0000)	23.96 (0.0000)	16.45 (0.0000)	23.33 (0.0000)	31.59 (0.0000)

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; (3) cluster-robust standard errors (cluster at 4-digit industry level) are used.

Table 20. The channels of industrial policy in the 10th and 11th PFYPs: Regional differences

	(1)coastal lnL	(2)inland lnL	(3) coastal lnK	(4) inland lnK	(5) coastal lnK/L	(6)inland lnK/L
PP _{im}	0.0764 (0.0464)	0.204*** (0.0613)	0.118** (0.0581)	0.322*** (0.0730)	0.0412 (0.0337)	0.126*** (0.0368)
Period: 2005	0.144*** (0.0379)	-0.124*** (0.0344)	0.274*** (0.0451)	0.0989* (0.0412)	0.130*** (0.0199)	0.224*** (0.0225)
Period: 2010	0.00470 (0.0542)	-0.479*** (0.0531)	0.350*** (0.0646)	0.148** (0.0622)	0.344*** (0.0238)	0.622*** (0.0263)
Treat II-I	0.0656 (0.0949)	0.0461 (0.0872)	0.0171 (0.111)	0.0509 (0.102)	-0.0485 (0.0388)	-0.00779 (0.0381)
Treat II-II	0.301** (0.149)	0.231** (0.108)	0.321* (0.173)	0.262** (0.132)	0.0211 (0.0609)	0.0281 (0.0438)
<i>Ind_dummy</i>	YES	YES	YES	YES	YES	YES
<i>Prov_dummy</i>	YES	YES	YES	YES	YES	YES
_cons	6.766*** (0.294)	7.504*** (0.376)	11.21*** (0.369)	11.51*** (0.472)	4.449*** (0.132)	4.007*** (0.129)
<i>N</i>	6207	8401	6206	8389	6206	8389
adj. <i>R</i> ²	0.273	0.228	0.239	0.212	0.255	0.237
F-stat	34.77 (0.0000)	32.51 (0.0000)	23.64 (0.0000)	19.59 (0.0000)	31.82 (0.0000)	34.57 (0.0000)

Note: (1) for variables, standard errors in parentheses and for statistics, p value in parentheses; (2) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; (3) cluster-robust standard errors (cluster at 4-digit industry level) are used.

Figure 1. Firm scale and policy selection in the 10th - 12th PFYPs²⁰

Figure 2. Number of employees per industry and policy selection in the 10th - 12th PFYPs

²⁰ Note: $\forall i \in [1, 419]$ and $r \in [1, 31]$, the value of the non-preferred group is the simple average of all non-preferred industries, the value of the preferred group is the simple average of all preferred industries, and the value of the total group is the simple average of all industries.

Figure 3. Gross output and policy selection in the 10th - 12th PFYPs

Figure 4. Average fixed-assets and policy selection in the 10th - 12th PFYPs

Figure 5. Value added and policy selection in the 10th - 11th PFYPs²¹

Figure 6. Industry TFP and policy selection in the 10th - 11th PFYPs²²

²¹ Value-added by industry and province is not available for 2010.

²² Firm level FTP for 2010 is not available.

Figure 7. Trends of Gross Output

Appendix:

Summary of main regression variables

Variable	Explanation	Mean	S.E.
<i>EMP</i>	number of employees in industry <i>i</i> , province <i>r</i> , 10000 persons	0.631	2.784
<i>OPSHARE</i>	output of industry <i>i</i> , province <i>r</i> divided by total output of province <i>r</i> , %	0.239	1.111
<i>TAXFEE</i>	total tax and extra charges on sales of products plus income tax of industry <i>i</i> , province <i>r</i> , billion yuan	0.051	0.411
<i>PFYP</i>	binary variable, identifying whether industry <i>i</i> is in or out (1 for in and 0 for out) of province <i>r</i> 's preferred-industry list in the <i>n</i> th PFYP	0.190	0.393
<i>LnΔY</i>	logarithm of output differences over five years	-0.346	2.165
<i>LnY</i>	logarithm of output	-0.652	2.097
<i>FIRM</i>	number of firms	42.59	131.8
<i>FIRMsq</i>	square of <i>FIRM</i> /100	1.199	26.86
<i>CTYPE_{in}</i>	categorical variable, see Table 7	---	---
<i>Ctype2_i</i>	categorical variable, see Table 16	---	---
<i>Perd_dummy</i>	period dummy variables	---	---
<i>Prov_dummy</i>	province dummy variables	---	---
<i>Ind_dummy</i>	industry dummy variables	---	---
<i>Region dummy</i>	region dummy variables	---	---
<i>TFP</i>	total factor productivity for industry; data for 2010 is missing	---	---
<i>H-TFP90_{irn}</i>	binary variable which equals 1 for industry <i>i</i> in province <i>r</i> if its TFP ranks in the top 0.10 quantile of that province and 0 for the others; data for 2010 is missing	---	---
<i>H-TFP80_{irn}</i>	binary variable which equals 1 for industry <i>i</i> in province <i>r</i> if its TFP ranks in the top 0.20 quantile of that province and 0 for the others; data for 2010 is missing	---	---

Editor, UWA Economics Discussion Papers:
 Sam Hak Kan Tang
 University of Western Australia
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 Crawley WA 6009
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Email: ecoadmin@biz.uwa.edu.au

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