

Preliminary draft, only for discussion

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## Politico-economics of Over-investment in Regional China---An Experimental Study based on Provincial Panel Data

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### Introduction

China's extraordinarily rapid and long economic growth has ended around 2010, but its historic record of high economic performance posed a big question for development as well as transition economists. The high growth rate, no doubt, was realized by a high rate of investment, but how and why was China able to maintain such an extraordinary high investment rate during so long a period? As for this question, the common understanding among China specialists is that the high rate of China's macro investment was a result of over-investment at the regional level. As Figure 1 demonstrates, a majority of Chinese investment has increasingly been implemented as local projects. In addition, regional investment ratio is tightly associated with aggregate investment rate at least until 2010, implying that one of the major sources of high growth rate is a huge amount of regional investment.

Such a high rate of regional investment is recognized as generally being driven by strong political factors, rather than by purely economic forces alone. Although the Chinese economy has certainly been marketized to a great extent since the policy of reforms and opening up started in 1978, its regional investment behavior has long been colored more or less by a sort of political features. Given these features, the Chinese regional economy is often characterized by over-investment, which has been blamed for excessiveness as well as inefficiency. The local political leadership, for instance, tries to bring in as much investment as possible from the central government, or to attract private capital to the utmost from the domestic as well as foreign capital market, through a variety of political means, such as special connections with top leaders and/or personal relations with the business circle. Local leaders, whether at provincial or city and county levels, are strongly inclined to engage themselves in raising growth rate of their own region, in order to emulate their rivals (*panbi*, in Chinese terminology), furthermore in an attempt to get promoted to the higher ranks in their political ladder within the existing Communist Party regime.

Thus it may be natural to assume that China's regional investment basically consists of two parts, i.e. basically economically determined one and more or less politically motivated one. The composition of such investment structure probably differs depending on region and period, but we believe that it can capture some important nature inherent in China's central-local relationships, which must be a key issue to characterize the Chinese political as well as economic system. Is that composition closely related with the political strength of local leaders in the region? Is it just representing some political wish of the regional leaders? Or, is it noting but reflecting the development level of the region and/or economic trend of the period?

A number of authors have tackled this problem, i.e. regional over-investment in China, which has eventually led to a high and long-run economic growth, although often blamed for being a major cause of over-capacity in industrial production. They have also pointed out the politico-economic nature of such an excess-supply of investment funds. Surprising enough, however, no one has ever pursued a dynamic mechanism between these two parts of investment, much less decomposed the whole regional investment structure. Moreover, there is almost no study focusing on macro-investment functions of the Chinese regional economy. We then tried to formulate alternative macro-economic functions of regional investment in China based on provincial panel data for the period from 2001 to 2014, and decomposed the investment into the above two parts in order to approach a mechanism of heated excess investment at the regional level.

This paper is organized as follows. In section 1, we make a brief literature review on the studies of regional over-investment as well as over-capacity in China. In section 2, we present several working hypotheses to be testified in this paper. In section 3, we arrange an analytical framework to investigate the Chinese regional over-investment. We first estimate investment functions based on provincial panel data. Then, an experimental methodology to decompose the regional investment into two parts, i.e. basically economic elements and rather non-economic or political elements are presented. Section 4 is devoted to explaining the data and their sources used for our analysis. In section 5, the statistical results are provided to check the validity of our hypotheses. Final section 6 concludes the discussion in addition to some reservations to our analysis and its results.

## 1. Literature Review

An issue of over-investment in China, particularly in industrial production, has long been a serious matter annoying the political leadership since as early as the 1980's, because it has created distorted distribution of industrial capital as well as

over-capacity of industrial output, which in turn led to excessive exports in the international market, often generating a source of trade conflicts between China and the other world. A typical example is steel industry. China's annual steel production is only 31.8 million tons in 1978, far behind Japan. It increased to 89.5 million tons approaching the Japanese level in 1993, then jumped to more than 200 million tons after its entry into the WTO, even surpassing Japan, the world major steel producer. Many regions and companies, whether state-owned or private, expanded their production capacity of steel. The government has issued directives to control steel production and investment but in vain. The total amount of steel production has not declined, finally to reach 779 million tons in 2013, exceeding greatly the total amount of domestic demand. Naturally, a great volume of China's steel was exported to the world market, which resulted in a sharp decline of international steel price.

Over-investment, which generally results in over-capacity, is not confined to manufacturing industries. Chinese regional governments have had a strong tendency to excessively invest in their own regions, particularly in infrastructural facilities, such as roads, airports, development zones, etc. They appear to be "hungry for investment"<sup>1</sup>. As a result, numerous duplicated, and useless or inefficient local capital construction projects have been implemented. Finances of their investment are provided by a various kind of banking loans plus land revenues. Accordingly, many regional governments are sinking into a serious situation with huge debts.

What factors have actually produced such circumstances of regional over-investment and what mechanism has been working behind this phenomenon? Numerous papers and articles have taken up this issue, which appear mostly in Chinese journals, in particular. They may be classified into the following several types.

- 1) One is a type of works dealing with microscopic financial aspects of over-investment focusing on investing enterprises. Wang (2009), for example, collected financial data of firms listed in the Shanghai stock market, finding that the more excessive free cash they have in hand, the more likely they are to invest excessively. Luo et al. (2012) distinguished private firms from all listed companies, concluding that bank loans are closely related with their over-investment behavior but such a relationship can only be found for state enterprises. Therefore, state ownership may matter in this issue.
- 2) There are works on the effects of state and political interventions on firms'

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<sup>1</sup> Former socialist firms were said to be in "investment hunger", but their motives were different from those of regional governments in China today. They were forced to invest in the existing capital stock, which was allocated only in a "planned way" from the state organ, in order to achieve or over-achieve their production plan.

over-investment while using microscopic data. An example is Tang et al.(2010), who discovered that over-investment by local SOEs are strongly associated with regional economic growth, concluding based on the data of listed companies for 2000-2006 that the less marketized and developed a region is, the more serious its over-investment is. Certainly, an inter-regional comparison indicates the existence of strong relationship between SOE ratio and zombie (chronically deficit) firms' ratio (e.g. Chanye Zhuanxing Shengji Ketizu 2017).

Zhou and Luo (2011), on the other hand, investigated a relationship between financial decentralization and regional over-investment on the basis of listed companies' data for 2001-2007, with a result that the less fiscally decentralized and the less economically developed a region is, the more likely it is to invest in its own region. Therefore, institutions as well as political elements can be said to be working against the background of this issue.

- 3) There are also researches on this issue from macroeconomic perspectives. Some authors focused on market forces or business cycles. Lin (2007) and Lin et al. (2010) pointed out that the issue of over-capacity in Chinese industry is brought about by “wave phenomena” in which enterprises are involved during the general process of business upswings. They are in a harsh competition in the market, often emulating with each other, and when a product is discovered to be very profitable, many of them begin to leap at this product simultaneously<sup>2</sup>. Xu and Zhou (2015) emphasized a point that even though there is no intervention by state industrial policies, a number of enterprises rushes into the market as long as its size is thought to be large enough from their point of view. This type of studies is in the major part emphasizing an economic aspect of the over-investment issue. Thus this issue can be approached as an economic movement of investment itself.
- 4) A number of studies put emphasis on political or non-economic rather than a purely economic aspect of this issue. In this sense, a politico-economic analysis of regional over-investment in China is required. To the best of our knowledge, this kind of studies is initiated by Huang (1999), who insisted that China's regional investment was determined by certain political elements, such as in-office years of regional political leaders like provincial party secretaries and administrative heads, the

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<sup>2</sup> According to Lin, enterprises in developing countries are likely to have common understanding about the possible growing industries in the next generation, so that they leap at some particular industries simultaneously like “waves” to result in over-investment, therefore over-capacity as well as excessive production in the industries concerned. This kind of their behaviors, in our view, could be described as a sort of their emulations with their competitors.

degree of their integration with the central bureau, their personal relationships with the top leadership, and so on. He tested his hypothesis by running several types of regression models, concluding that political factors strongly affect investment decisions in regional China<sup>3</sup>.

Huang's idea has triggered a wide range of academic interests in this issue to the effect that many researches and studies regarding the politico-economic nature of regional investment have been carried out particularly in Chinese journals, for example as to how the emulation consciousness of local leaders and their promotion system influence investment and fiscal expenditures in their regions. By the same token, various statistical models have been applied to the analysis.

The most common understanding is that one of the major reasons for excessive regional investment is "growth competition" among local leaders, who are not motivated by maximizing local revenues as Huang assumed but in growth rate of their regions. The reason for their inter-regional growth competition is that they involved in a promotion contest among these political leaders (e.g. Zhou 2004, Li and Zhou 2004, Jiang et al. 2015)<sup>4</sup>. They know that the simplest way for them to enhance the promotion chance is to achieve high performance, particularly growth rate, consequently to raise the investment rate while they are in office during the administrative terms. They are deeply engaged in a severe emulation mechanism which accelerates interregional competition for investment growth (e.g. Li and Luo 2015, Yu 2016). Therefore, an increase in fiscal deficits is closely related with heated competition with surrounding districts (Li and Luo 2015). This sort of interregional emulation moves can be often escalated into heated tax competition to invite FDIs. Local leaders are inclined to give more favorable advantages to foreign investors, e.g. tax cuts or exemption, reduction of land rental fees, etc. than their counterparts to attract as much foreign capital as possible (Liu et al. 2014). This style of studies strongly emphasizes the political nature of regional investment in China.

Xu and Zhou (2015) argued, on the other hand, that the market competition is actually mixed up with political emulation among regional governments in China, so that we cannot assert that the regional over-investment is necessarily caused by

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<sup>3</sup> But his analysis seemingly depends on a wrong hypothesis, i.e. that local governments tend to avoid central investment because of its low profitability and externality as they are assumed to maximize local revenues.

<sup>4</sup> They can be said to be in "mixed competition" in the sense that they compete not only for their own region, but also for their personal interests (Li 2004). Chen and Chen (2014) pointed out that a motive of both high political performance of local leaders and increased fiscal revenues in their own region provides them with a strong stimulus for regional growth.

various political interventions by local governments alone.

5) There are also studies on regional over-investment from a perspective of fiscal system characterizing China. Chen=Chen (2014), for example, investigated this issue in terms of “soft budget constraint” involved in the Chinese regional fiscal system. Based on “budget constraint indicator” they concluded that this institutional weakness was one of the major sources producing regional over-investment in China. Fang=Zhang (2009), too, pointed out the occurrence of over-investment by local governments during the boom period against the background of soft budget constraint as well as fiscal decentralization since 1994. It may be, then, natural to admit that certain political as well as institutional elements are deeply involved in the over-investment in regional China.

## 2. Hypotheses and Definitions

A relatively popular view is that Chinese local leaders or governments have two objectives, i.e. to maximize the welfare of their region’s whole people and to maximize their own welfare (e.g. He(2006))<sup>5</sup>. Thus it may be natural to assume that from their points of view, excessive investment in regional China is basically a product of the two inter-related forces, i.e. basically economic interests plus rather political or non-economic motives, although it is still unknown which factor is relatively more effective and stronger. The economic interests in investment decisions include improvement of local people’s welfare and/or alleviation of poverty at the regional level, arrangement of infrastructure necessary for existing industrial facilities, build-up of appropriate sized development zones to invite new industrial capital, and so on. Political or non-economic motives, on the other hand, include achieving higher growth rate simply for the leaders’ own future promotion, establishing duplicated development zones just for the sake of emulating with their rival regions, constructing luxurious city government buildings to demonstrate their vanity, and so on.

However, these two motives, accordingly the results derived from these motives, too, of local political leaders in China, are often so tightly inter-connected that there can be no clear-cut way to distinguish them. Construction of such development zones, for example, as undoubtedly oversized for regions with poor fiscal capacity have even an effect on providing relevant facilities for inviting outside capital, which could stimulate regional growth both in output and employment for the region concerned. Therefore, there could be no definite method to decompose the effects of these two kinds of different

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<sup>5</sup> He assumes that their objective is to maximize the weighted average of these two objectives.

motives in any investment decisions. No one could estimate how much an investment project made by a region is affected by certain political motives, even though it is obviously and substantially motivated by a politically ambitious person for his or her own private interests. There would be no leader who asserts frankly that his or her plan of regional investment is for the sake of attaining his or her own political goal in the future promotion race.

The simplest and surest way of estimating the volume of investment related to non-economic motives is to deduct an “economically rational” portion from the total volume of actual regional investment. Let us assume here that a portion of investment which can be explained by an investment function without any political variables should be “economically rational”. Let us call, on the other hand, the volume of “economically irrational” portion of investment thus calculated as regional over-investment (hereafter ROI for convenience). Let us further assume that the proportion of ROI in the total investment (hereafter called “politico-economic ratio” PER of such over-investment), can reflect, more or less, the relative importance of the two motives as well as their resulting effects, although those components cannot truly measure the actual value of what they represent.

It seems convenient here to define two concepts: absolute over-investment and relative over-investment. Let us call the volume of investment in a region as absolute over-investment: if its ROI is positive and moreover it exceeds some fixed standard of investment determined by a long-run nation-wide level. On the other hand, let us call the volume of investment in a region as relative over-investment: even if its ROI is negative but it exceeds that level.

What is required, then, is specification of investment functions that should be employed, and how it should be estimated. The investment function and estimation method that we actually employed in this paper will be discussed in the next section. Given the investment function, the above standard of investment will be defined.

If the above argument can be recognized as substantially reasonable, and if the two components inherent in the regional investment can be distinguished successfully, then we may be able to approach the mechanism of over-investment in regional China by testing several hypotheses. Referring to the above literature review, we can arrange the following hypotheses, i.e.

H1: The proportion of such non-economic motives vis-à-vis economic ones for regional investment (PER) must not be same across regions. It is supposed to be associated with their development level. Probably it may tend to be higher in the poorer regions, because they need more investment to catch up their counterparts in the richer regions

as early as possible. Political leaders in the poorer regions must have a stronger political motive to develop their whole regions vis-à-vis the richer ones.

H2: The institutional quality, e.g. softness of regional budget constraint, may also affect ROI, consequently PER. Regions with the higher institutional quality, other things being equal, may tend to invest more for non-economic reasons, because they are more inclined to rely on political power in making investment decisions.

H3: ROI may have some relationship with the regions' openness, too. The more economically open they are toward the outside world, the more they can tend to be free from political measures in absorbing regional investment, because they can rely on well-functioning markets rather than on political forces in their economic activities.

H4: ROI may also have a sort of associations with the regional privatization level. It may be reasonable to assume that the more private economy develops in a region, the less political means it needs, because the private sector can be relatively free in investment decisions than the public counterpart.

### 3. Methodology and Analytical Framework

Our methodology consists of two steps. First we estimate China's regional invest functions, taking popular views of existing related literature into account. Then, we try to decompose the actual investment of each region into a part explained by those investment functions and the other part unexplained by such functions in order to derive ROI and PER.

#### 1) Estimation of macro-investment functions

There are several types of investment functions generally for the sake of investigating investment behaviors in the developed market economies. Probably the most well-known type one is that of the accelerator principle, at least as far as macro-investment function is concerned. According to this principle, investment  $I_t$  is determined by output growth during the previous year,  $Y_{t-1}-Y_{t-2}$ , but when we regard it as regional level function, initial conditions, such as the initial level of capital stock  $K_0$  and the initial level of output  $Y_0$ , too, should be included in the model. Since our focus is on the macro-investment growth at regional level, it may be convenient to set the following investment function as a baseline one for the analysis of the Chinese regional economy.

$$I_{it} - I_{it-1} = f(Y_{it} - Y_{it-1}, K_{i0}, Y_{i0}) \quad \text{-----} \quad (1),$$

where  $i$  denotes region, and all variables are measured in real and per capita terms.

Equation (1) can be specified in the following linear way.

$$I_{it} - I_{it-1} = a + b(Y_{it} - Y_{it-1}) + c K_{i0} + dY_{i0} + u_{it} \quad \text{-----} \quad (2),$$

where  $u$  denotes an error term.

The above investment function (1) could be modified to describe accelerator principle directly as follows,

$$I_{it} = f(Y_{it-1} - Y_{it-2}, K_{i0}, Y_{i0}) \quad \text{-----} \quad (1-1)$$

Corresponding to the equation (2), we can get the following specific function,

$$I_{it} = a + b(Y_{it-1} - Y_{it-2}) + c K_{i0} + dY_{i0} + u_{it} \quad \text{-----} \quad (3)$$

where  $b$  is just equivalent to the accelerator in question.

It goes without saying that equations (2) and (3) can be transformed into those of national level by dropping  $i$ . Aggregated  $I_i$  and  $Y_i$  must be, in theory, equal to  $I$  and  $Y$ , respectively, but in reality are not necessarily equal to the national figures of investment and output in China. It is often said that the growth rate of aggregated regional GDP outperforms that of the national level. This may reflect the reality of China's over-estimation of both investment and output statistics at the regional level<sup>6</sup>.

Those baseline models can be extended to become more real ones by adding certain control variables, referring to the main arguments in the literature review above, for, e.g. a) economic openness to the outside world, e.g. the rate of dependence on external trade and capital, b) fiscal conditions, e.g. the rate of surplus or deficit in the fiscal expenditure, c) institutional quality, e.g. the degree of government quality level, marketization level, etc. d) regional development policies, e.g. "Great Development of Western Regions" program which was launched in the late 1990's, etc. e) privatization in the sense of development of private economies, which may be able to capture, for instance, the extent of state interventions in investment decisions.

When three control variables, for example, openness, institutional quality and development of private economies as economic variables in the broad sense are added to such baseline models as stated above<sup>7</sup>, equation (2) can be extended in the following way,

$$I_{it} - I_{it-1} = a + b(Y_{it} - Y_{it-1}) + c K_{i0} + dY_{i0} + e \text{Open} + f \text{Inst} + g \text{Priv} + u_{it} \quad \text{-----} \quad (2-1)$$

where "Open" denotes openness of a regional economy, while "Inst" indicates its institutionalization level and "Priv" represents its degree of privatization of regional economies.

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<sup>6</sup> Overestimation of investment and output at the regional level, no doubt, can be aggregated into overestimated investment and output at the national level.

<sup>7</sup> One may doubt if a variable  $Inst$  is "economic" in nature, but we treat it as an economic variable for the time being as our interests lie in economic institutions, including the government, and their quality.

Likewise, equation (3) can be extended as in the following way,

$$I_{it} = a + b(Y_{it-1} - Y_{it-2}) + c K_{it0} + dY_{it0} + e \text{ Open} + f \text{ Inst} + g \text{ Priv} + u_{it} \quad \text{-----} \quad (3-1)$$

Needless to say, it is quite possible to include year and/or region dummies to those equations, which may reflect the effects of regional development policies launched by the central government.

These investment functions can provide us with an effective standard to measure the long-run nation-wide trend of regional investment, when estimated by regressions with pooled panel data. They can be used as a yardstick to interpret actual investment level in each region as absolutely or relatively excessive.

## 2) Decomposition of regional investment

The second step is to decompose China's regional investment into two parts in order to obtain PERs; one which can be explained by the above investment functions and the other which is the deduction of the first part from the total volume of investment. Investment functions (2) and (3) are composed by several economic variables. Our fundamental assumption is, the part explained by those functions are assumed to be an "economically rational" portion of total investment at the regional level<sup>8</sup>, while the residual is defined as an "economically irrational" portion, which should be explained in the most part by non-economic factors like political pressures from the local leaders or their ambition for their own political motives, etc. More specifically, we adopted the following way to obtain ROIs and PERs. We first estimated each coefficient of equations (2) and (3), (2-1) and (3-1) by utilizing pooled data of Chinese provinces for the period of 2001 through 2014, then calculate hypothetical values of investment for each region (province) by applying the estimated coefficients to these equations with their actual values of related explanatory variables. ROI can be interpreted, then, as a difference between the actual value and this hypothetical value of investment. PER is defined as a ratio of the ROI to the actual value of investment. ROIs thus obtained are assumed to be **reflecting** the extent of over-investment for the regions<sup>9</sup>.

Such ROIs and PERs as derived in this way can be, needless to say, negative for some provinces and in some years. But this situation does not necessarily mean that

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<sup>8</sup> No doubt, this assertion may be open and/or must be subject to criticism, since even the economic variables in the above equations like Y and I must naturally be inflated by certain political elements by local leaders in China. However, there is no suitable way in our hand at present to clarify explicitly the real political elements included within these "economic variables".

<sup>9</sup> The ROI thus calculated cannot necessarily measure the actual amount of regional over-investment led by non-economic motives, but it seems to be convincing to assume that it could at least be proportional to such an amount.

over-investment was avoided in these regions and those years. The provinces lying above the trend line could be interpreted as being **reflecting** circumstances of “relative over-investment” as noted above. In other words, the provinces with positive ROIs and PERs, moreover lying above the trend line should be called “absolutely over-invested”.

#### 4. Data

The data related to the baseline models for 30 provinces in China, including autonomous regions and special cities except for Tibet, are basically derived from the official statistics, such as various issues of *Zhongguo Tongji Nianjian* (China Statistical Yearbook, hereafter CSY) and *Xinzhongguo 60nian Tongji Ziliaohuibian* (China Compendium of Statistics, hereafter CCS). The data of capital stock  $K_{i0}$  are derived from an estimate made by Huang and Gong (2010).

Investment (I) data that we use in our analysis are from “total investment in fixed assets” in CSY and CCS, whether by domestic or foreign funds, or whether by public or private funds, or whether in industrial production or in infrastructural construction<sup>10</sup>. Output (Y) used here is indicated by “gross regional product”, defined explicitly in the CSY.

Control variables are defined and calculated in the following way. Regional openness (Open), is defined as a ratio of each region’s external trade to its output. The level of privatization (Priv) is defined as a ratio of the number of non-SOE firms to the total in industry, both of which appear in the CSY and the CCS. The index of institutional quality or institutionalization (Inst) is from Nakagane and Mitsunami (2016), who calculated those indexes in their own way. Since institutions are extremely wide in range and difficult to define in a clear-cut way, we prepared four alternative cases of indexes<sup>11</sup>.

As we noted above, all variables are measured in real terms. Output is deflated by the regional GDP deflator. Investment is deflated by the “price index for investment in fixed assets” by region which appears in the CSY and the CCS.

Descriptive statistics of the variables in our models are summarized in Table 1.

#### 5. Results and Implications

The estimated results of the baseline models are summarized as in Tables 2 and 3 below. The initial levels of output and capital stock are fixed for 1978, the year when

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<sup>10</sup> Therefore, it does not include inventory investment. But when it comes to over-investment in China, inventory cannot be an important issue.

<sup>11</sup> See Nakagane and Mitsunami (2016) for more details.

China's reform and opening-up policy started. We employed the pooled OLS method to estimate those models, and the period covered for analysis is 14 years from 2001 to 2014<sup>12</sup>. Panel A records the results based on equation (2), while Panel B shows the results derived from equation (3). The coefficient on  $Y_{it}-Y_{it-1}$  in equation (2) is 2.97, that is to say, one percent of economic growth can produce generally and over years nearly three percent of investment growth at regional level. The accelerator reduced from equation (3) is 22.56, which implies that one per cent increase of output growth during the previous year generates as high as 22 per cent of regional investment.

The initial condition affects such investment and its growth differently between capital stock and output level. The coefficient on initial capital stock is significantly positive, which indicates that the more developed a region is in capital construction; the more rapidly its regional investment in subsequent years grows. On the other hand, the coefficient on initial outputs is significantly negative, which implies that the less developed a region is in terms of output, the more rapidly its regional investment expands in subsequent years. In contrast to the initial condition of output, however, the more developed a region is in terms of capital stock, the more rapidly it is likely to invest in its own region, while the more developed it is in terms of income level, the less rapidly it tends to make regional investment. These results appear to make sense economically, since the less developed regions in the sense of initial income level may tend to require the more investment to boost the economic growth, while the more developed regions may have the greater advantage in absorbing new capital, given their relatively favorable initial level of capital, e.g. infrastructural facilities as well as human resources.

The statistical results based on extended investment functions (2-1) and (3-1) are also recorded in Panel B of Tables 2 and 3. The estimated results are slightly different depending on which case of institutionalization index is adopted, but undeniably they are essentially same as to confirm the results of Panel A, particularly as far as the signs and significance levels of main explanatory variables are concerned.

What deserves to be pointed out is that the results are basically not different between Table 2 and 3. Thus we may be allowed to insist that an accelerator-principle type of investment functions could be applied to the Chinese regional economy. At the same time, we may now be able to use these functions as ones which can depict "basically

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<sup>12</sup> We estimated the equations (2-1) and (3-1) with year dummies, too. The results are skipped for the sake of saving space, but they seem to suggest that there exist some "turning-points" of ROIs during the period in consideration, which will be discussed below in the text. Year dummies are included when we discuss the determinants of ROIs below.

economic” parts of regional investment in China.

Let us, then, calculate ROIs and PERs in such a way as described in section 3 above. PERs calculated from the results of such decomposition can be contrasted with four control variables, i.e. economic development, openness, privatization and institutionalization for each model (equation) and each period. Dozens of such figures can be drawn, but we would like here to focus on only several important figures in order to grasp some major tendencies regarding the regional over-investment. Figures 2 and 3 present relationships between PERs and economic development. What do these figures indicate us, bearing the above four hypotheses in mind, and what implications can we draw from them?

a) PERs based on equation (2).

Figure 2 illustrates the following three facts very clearly. Let us assume the trend line as a demarcation of the long-run nation-wide standard of regional investment. Then we can draw some implications from this Figure

First, while many provinces were in the state of relative over-investment, there were few regions with absolute over-investment in 2001, but the number of such regions has increased dramatically by 2014. This fact seems to imply that something like emulation mechanism began or was generated during this period in search of new investment projects.

Second, PERs certainly have a tendency to link closely with development level, but this tendency has changed greatly as time elapsed. In 2001, this ratio tended to be higher in the richer regions mostly in coastal area (correlation: 0.6480), while in 2014 it tended to be higher in the poorer regions mostly in inland area (correlation: -0.4133). It suggests that there exists a sort of “turning-points” which must have transformed such a politico-economic relationship that determines regional investment motives during the process of economic development. Thus, structural and/or policy changes must have taken place during this period as to regional investment in China. Our explanation is that at first the richer regions like Shanghai had a relatively strong political power to invite capital, whether domestic or foreign, but the poorer regions in the inland area began increasingly to display their political capacity as inter-regional gaps have been widened.

Third, there was no clear tendency as to a relationship between ROIs and development level of inland regions in 2001, while they seem to have followed the general trend after the turning-point.

These findings demonstrate that our hypothesis H(1) is relevant, but only partially. At the same time, they imply that China’s regional investment has tended to be more

normalized than before, in that it is “irrational” in the strictly economic sense but “rational” from a point of view of national welfare, as more resources began to be invested in the poorer regions.

As far as relationships between the other explanatory variables and ROEs are concerned, let us take a look at only general tendencies without showing concrete figures.

2) When we look at an impact made by institutionalization on PERs, we can find out a fact that there was a strong positive relationship between PERs and institutionalization in 2001 (correlation: 0.6432), but in 2009 such a tendency disappeared, though only with a negative and insignificant relationship between these two variables (correlation: -0.3243). Thus our hypothesis H(2), too, is partially and weakly relevant.

3) As for a relationship between PERs and economic openness, we can find the same tendency as in the relationship between PERs and economic development. This may just reflect a close association between openness and development. Therefore, our hypothesis H(3) is also partially relevant as is H(1).

4) Regarding a relationship between PERs and privatization, hypothesis H(4) seems to be relevant since as time elapses we can find a negative relationship between these two variables, though rather weak (correlation: -0.2078) .

b) PERs based on equation (3).

Are the above conclusions as derived from equation (2) still valid even for the PERs based on equation (3)? This could be a kind of robustness checks on our estimation model (2).

Figure 3 obviously indicates that almost the same tendency can be found regarding the relationship between economic development and PERs as has been discovered for equation (2). Although there were few regions with absolute over-investment in 2002, such regions increased in 2014, lying over the long-run nation-wide trend line. The correlation between these two variables changes from 0.4940 for 2002 to -0.7037 for 2014. The only significant difference between these two models is that the “turning-point” for equation (3) appears much earlier than that for equation (2).

2) As far as a relationship between PERs and institutionalization is considered, the “turning-point” for equation (3) is displayed much more clearly than the case for equation (2).

3) When it comes to PERs vis-à-vis openness, we can find a similar situation to the case of equation (2) even in the case of equation (3).

4) As for a relationship between PERs and privatization, they are in negative correlation even in the case of equation (3) just as equation (2).

On the whole, no substantial difference can be found between model (2) and model (3) as to PER's behaviors of Chinese regional investment in relation to the above four important variables. Therefore, we may be allowed to insist that the conclusions derived from the two baseline investment functions are almost same, thus our hypotheses are nearly testified, taking it into account that some relationships between PERs and certain explanatory variables can have turning-points during the period under consideration. Moreover, more and more regions seem to tend to face "absolute over-investment" as time elapsed. This seems to suggest that China's regional over-investment issue is inclined to become more serious at the later stage of development.

c) PERs based on equations (2-1) and (3-1).

If the more actual investment functions like equations (2-1) and (3-1) were employed, are the above conclusions still valid? The results, details of which we avoid here to show for convenience, indicate that some of those conclusions cannot be supported on the basis of such investment functions. A typical example is an issue of PERs compared with economic development. In the case of equations (2-1) and (3-1), the relationship is negative at first, but changes later into positive after the "turning-point", in contrary to the baseline model cases. This tendency implies that regional overinvestment by certain non-economic forces may take place more in the poorer regions at first.

We have so far investigated one-to-one relationships between PERs and the four control variables separately. But how are the PERs, therefore ROIs determined when we include these variables together, then? In order to answer this question, we tried to specify simple OLS models to estimate the determination of ROIs by these variables. This is a very tentative analysis, just in an attempt to get implications as to possible relationships between the over-investment and those variables. ROIs are calculated only on the basis of equation (2). We included several interaction terms and year dummies for the sake of approaching the "turning-points" regarding ROIs. The major results from this sort of analysis are recorded in Table 4

From this table, we can infer the following facts: (a) institutionalization (Inst) seems to have played a significant role in affecting ROIs (see cases 3 and 4). It increases ROIs directly, but decreases them indirectly through privatization effects. We should remember, however, that a concept of institutions (therefore institutionalization) is very broad in meanings and scope, different from the other economic variables used in our model. It could have acted as a kind of non-economic variables. Something related to political institutional factors, e.g. the "soft budget constraint" within the regional fiscal

system may dominate over regional investment in China as a potential mechanism controlling ROIs. (b) Economic development level has a positive impact on ROIs (see cases 1 and 3), but has a negative impact on them when an interaction term  $Y_0 * Priv$  is included in the estimation. This implies that the development of private economies has positively influenced regional over-investment in the poorer regions. (c) Economic openness (Open) has certain fixed power to reduce overinvestment (see cases 1 and 3), but it is uncertain whether it affects such investment through the other variables, except for a case of  $Y_0$  (see case 2).

However, we must still be deliberate in interpreting the mechanism of ROI determination which must be entangled in a complicated way with institutions, openness, ownership, development level, and other factors. Implications that we got above do only indicate possible channels connecting the regional over-investment with those variables.

As Table 4 indicates, we inserted year dummies to the model of determining ROIs. The results tell us obviously that year dummies 2005 and 2009 are significant in every case of variable combinations, particularly the year dummy 2009 is highly significant (one percent significance level<sup>13</sup>). The historical background behind this fact is quite evident, since the central government decided to inject “booster shots” amounting to four trillion yuan to the national economy in order to deal with the worldwide financial crisis in 2008. No doubt, a huge volume of excessive regional investment was implemented to satisfy strong requests by the central government.

## 6. Concluding Remarks with Reservations

Let us conclude the major findings from the above analysis. We specified investment functions of accelerator principle type and applied them to the Chinese provincial panel data to identify the “economically reasonable” volume of regional investment. On the basis of these functions, we then decomposed the actual volume of regional investment at provincial level into two parts, one which can be explained by the functions and assumed to be “economically rational” and the other which cannot be explained by those investment functions and assumed to be “non-economically or politically determined”. Next, based on such results of decomposition analysis, we analyzed the characteristics of each province and overall changes in regional investment over time to search for

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<sup>13</sup> When case 4 in Table 4 is taken for example, the t-value of the coefficient on year dummy 2009 is as high as 6.94, while that on year dummy 2005 is only 1.74, i.e. at 10% significance level.

possible mechanism determining regional over-investment in China. Our tentative conclusions from this analysis can be summarized as follows.

First, China's regional over-investment is closely related to development level. Given the level of institutional quality, economic openness, and privatization, the over-investment first occurred in relatively rich regions in coastal area mostly in the form of relative over-investment, and then moved to the poorer regions in inland area, at the same time in the form of absolute over-investment. In other words, the regional over-investment situation seems to become more serious as the economies develop further.

Second, institutional level seems to be affecting regional over-investment in China, particularly at the relatively early stage of development. Our analysis of ROIs indicates that institutions matter for regional over-investment in China both directly and indirectly through other factors. One possibility is that something related to political institutional factors, e.g. the "soft budget constraint" within the regional fiscal system may have dominated over regional investment in China as a potential mechanism controlling ROIs.

Third, economic openness and development of private economies also have an impact on regional over-investment in China, but this impact may change in character according to the period under consideration.

Last but not the least, this fact leads us to an implication that there seems to be a sort of turning-points as to relationships between over-investment and its determinants such as development level, institutionalization, and other economic variables. What determines such turning-points in reality remains to be seen, however. Probably, some institutional factors or policy-related forces might be a key to determine those turning-points. After 2009, in particular, when an extraordinary drive of investment was geared by the government in order to treat the world-wide financial shock, China's regional over-investment seems have entered a new stage, while regional debts and deficits dramatically increased.

However, we must admit that the above analysis and the derived conclusions are subject to several reservations, namely--

1) Due to the unavailability of required data, our analysis is limited to a relatively short period and provincial level. If we could have extended it to cover the much longer-run period, hopefully since the beginning of the 1980's until the middle of the 2010's, we would have been able to trace more vividly the historical changes in central-local relationships, in search of the mechanism which produces the over-investment, and thus over-capacity in regional China. If we could have extended our research down to the much lower

jurisdictional level, e.g. county, we would have been able to capture the more real features of such over-investment phenomena. Then, we would have been able to describe more clearly some interesting specific aspects of China's economic system, above all interplay of the state and the market. This paper is just an introduction to, or more correctly an experimental trial for, this goal of studies.

2) We just tried in this paper to decompose the structure of regional investment in China into two parts, i.e. basically economic and rather political, without touching upon the factors which bring about different investment behaviors in each region. Is a factor that determines the "political component" included in regional investment actually the promotion campaign among local political leaders as Zhou and others have stressed as noted above? The more in-depth analysis of regional investment "sources" remains to be seen for future studies.

3) More importantly, our methodology to decompose the actual regional investment into those two parts is certainly what is theoretically open to question, as we mentioned in the footnote (8). Naturally one may ask, "Can such coefficients on economic variables as derived from the data including political elements reflect "purely economic components"? Logically speaking, this question is quite reasonable, but as the Oaxaca=Blinder decomposition analysis, too, which has been widely used by many authors particularly in decomposing the structure of wages of employees and workers<sup>14</sup>, and an idea of which we borrow a bit here, is also subject to the same line of question and criticism.

4) We have discussed the relationship between total investment and total output in regions. The situation may be depending on industry. China's over-investment and over-capacity are phenomena characteristic of manufacturing industries, in particular. Industry-specific studies may be required when we talk about the over-capacity issue in China.

5) The relationship between investment and growth is a subject that must be pursued in relation to the analysis in this paper. We implied here that development of private enterprises must have some impacts on regional investment behavior. How private investment affects private sector's growth, and how it affects public sector's growth, vice versa, are totally out of the scope of our knowledge in hand. The structure and

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<sup>14</sup> It is usually used to decompose the total actual wage of a group of people into "rational" portion, which could be explained by ordinary explanatory variables like their educational level, age, occupation and status, and the "irrational" one which cannot be explained by these variables. Such an irrational one includes, for example, that which could be caused by differences in e.g. gender, races, and religion, etc. The basis of this decomposition analysis is coefficients of such explanatory variables which are derived from the estimation model utilizing actual sample data.

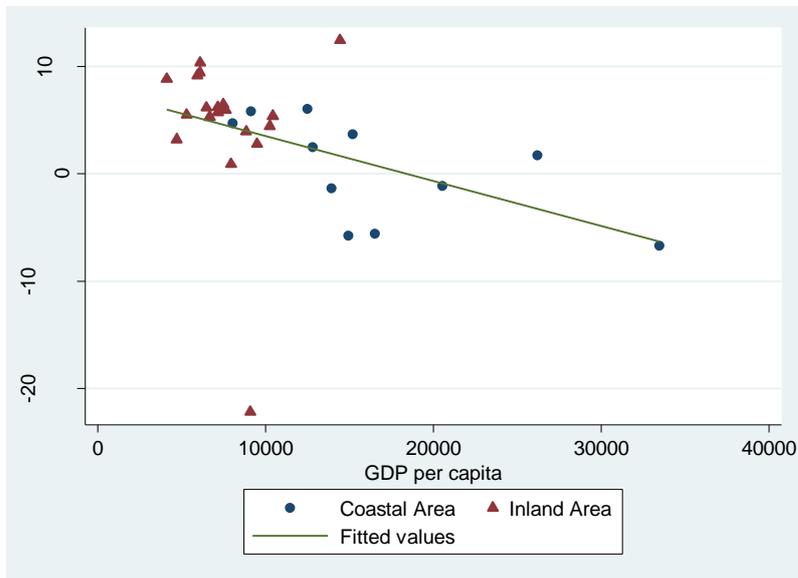
mechanism of regional over-investment in China is so complicated that the study requires the more in-depth as well as extensive analysis, particularly surrounding a nexus both in production and in investment between the private and public sector. Such a dynamic inter-relationship as between growth and investment will be a topic to be dealt with in our next research project.

### Acknowledgements

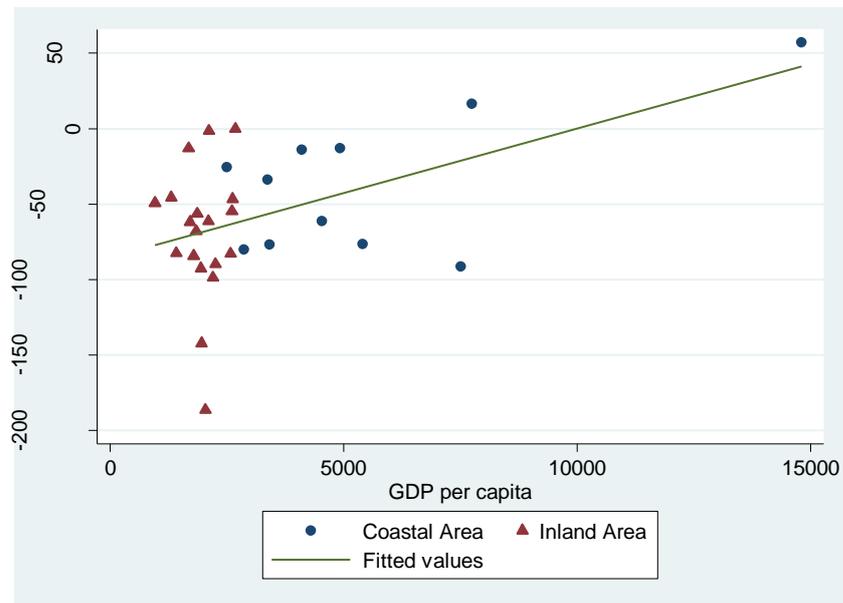
We appreciate Professor Jingbin Wang at Osaka Sangyo University for his kindness of providing us with a compact review of Chinese articles on the issue of over-capacity of industrial production in China.



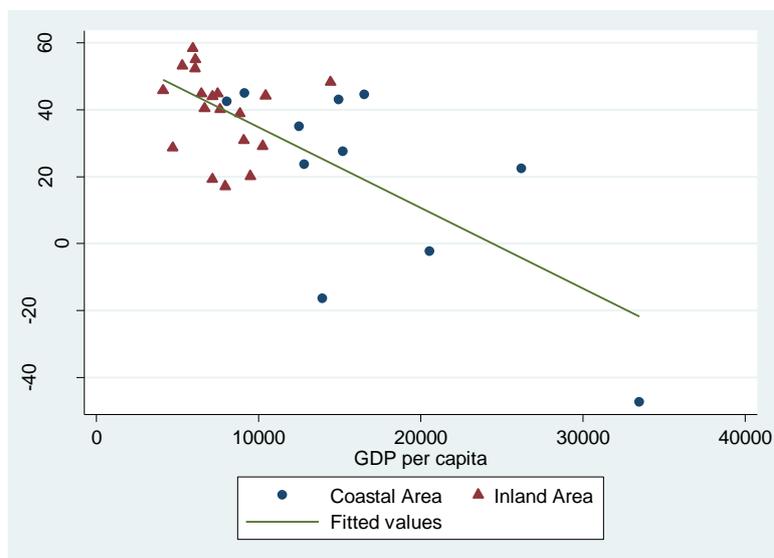
**Figure 2-b** PERs and Economic Development in 2014 (equation 2)



**Figure 3-a** PERs and Economic Development in 2002 (equation 3)



**Figure 3-b** PERs and Economic Development in 2014 (equation 3)



**Table 1** Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$I_t - I_{t-1}$	420	1734.50	1577.93	-3135.66	9137.23
$Y_t - Y_{t-1}$	420	585.47	385.15	62.43	2163.40
$K_{1978}$	420	846.43	540.05	318.27	2388.61
$Y_{1978}$	420	459.89	444.75	173.54	2483.98
$I_t$	390	12912.67	9190.37	1638.42	52535.06
$Y_{t-1} - Y_{t-2}$	390	572.21	380.44	62.43	2163.40
Open	180	35.13	41.15	5.65	167.74
Inst	180	5.12	2.74	1.34	15.98
Priv	180	83.90	11.44	46.71	98.79

**Table 2 Regional Investment Functions (baseline models)**

Dependent Variable: $I_t - I_{t-1}$										
	Panel A:Equation(2)		Panel B:Equation(2-1)							
			Case1		Case2		Case3		Case4	
	Coef.	t value	Coef.	t value	Coef.	t value	Coef.	t value	Coef.	t value
$Y_t - Y_{t-1}$	2.97***	8.85	3.42***	6.52	3.42***	6.86	3.42***	6.56	3.42***	6.95
$K_{1978}$	0.75***	3.31	0.54**	2.58	0.47**	2.43	0.53**	2.57	0.46**	2.45
$Y_{1978}$	-2.43***	-10.81	-1.41***	-2.95	-1.20***	-3.13	-1.37***	-2.95	-1.18***	-3.06
Open			-16.71***	-4.00	-12.89***	-4.51	-15.92***	-4.08	-12.54***	-4.39
Inst			65.74	0.71	-59.82	-0.62	85.58	0.54	-108.94	-0.80
Priv			12.82**	2.28	18.51***	3.05	13.91**	2.60	19.10***	3.21
Cons	480.38***	3.51	1041.88***	-3.22	-1074.69***	-2.93	-1285.88**	-2.38	-881.93*	-1.89
Number of obs	420		180							
R-squared	0.37		0.47		0.47		0.47		0.47	

**Table 3 Regional Investment Functions (extended models)**

Dependent Variable: $I_t$										
	Panel A:Equation(3)		Panel B:Equation(3-1)							
			Case1		Case2		Case3		Case4	
	Coef.	t value	Coef.	t value	Coef.	t value	Coef.	t value	Coef.	t value
$Y_{t-1} - Y_{t-2}$	22.56***	10.56	11.76***	5.61	13.55***	6.61	11.72***	5.46	13.48***	6.45
$K_{1978}$	4.12**	2.47	3.69***	4.78	3.13***	3.00	3.67***	4.75	3.19***	3.00
$Y_{1978}$	-9.63***	-5.03	-4.05***	-2.85	-2.40	-1.39	-4.18***	-3.17	-2.60	-1.59
Open			-72.38***	-4.76	-46.09***	-3.24	-71.55***	-5.07	-48.67***	-3.25
Inst			1286.64***	3.18	855.01	1.29	2394.81***	3.40	1405.49	1.37
Priv			20.83	0.83	51.28*	1.78	20.66	0.81	47.05	1.55
Cons	944.72	1.01	-4026.43**	-2.45	-5996.37***	-2.61	-10071.05***	-3.94	-8428.90**	-2.39
Number of obs	390		180							
R-squared	0.66		0.80		0.74		0.80		0.74	

**Table 4 Relationships between ROI and Explanatory Variables**

Dependent Variable Explanatory variables	ROI			
	case 1	case 2	case 3	case 4
Y <sub>0</sub>	1.17 <sup>***</sup>	-4.48	1.25 <sup>***</sup>	-10.13 <sup>**</sup>
	(5.17)	(-1.32)	(3.32)	(-2.12)
Open	-8.23 <sup>**</sup>	-3.86	-69.11 <sup>*</sup>	-5.68
	(-2.45)	(-0.65)	(-1.86)	(-0.14)
Inst	-81.71	-64.86	917.98 <sup>***</sup>	1170.56 <sup>***</sup>
	(-1.15)	(-0.62)	(2.68)	(2.93)
Priv	14.05 <sup>**</sup>	-16.58	36.51 <sup>***</sup>	9.42
	(2.08)	(-0.90)	(2.91)	(0.52)
Y <sub>0</sub> × Open		-0.01 <sup>*</sup>		-0.01
		(-1.95)		(-1.27)
Y <sub>0</sub> × Inst		-0.07		-0.16
		(-0.98)		(-1.46)
Y <sub>0</sub> × Priv		0.09 <sup>*</sup>		0.16 <sup>**</sup>
		(1.83)		(2.36)
Open × Inst			-0.76	0.96
			(-0.66)	(0.73)
Open × Priv			0.75	-0.05
			(1.55)	(-0.09)
Inst × Priv			-10.83 <sup>***</sup>	-13.39 <sup>***</sup>
			(-2.84)	(-3.20)
Cons	-1531.05 <sup>***</sup>	407.82	-3739.62 <sup>***</sup>	-1859.18
	(-3.03)	(0.33)	(-3.92)	(-1.36)
Year Dummies	Yes	Yes	Yes	Yes
R-squared	0.52	0.56	0.55	0.60
Number of obs	180			

Notes) ROIs are calculated on the basis equation (2). Inst is derived from case 1 in Nakagane and Mitsunami (2016).

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