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**The Changing Patterns of Investment in the PRC  
Economy**

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# The Changing Patterns of Investment in the PRC Economy

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The investment-intensive growth model of the People's Republic of China (PRC) is often viewed as state-driven and ultimately unsustainable. But largely unnoticed, a shift has taken place. This paper examines the changes in investment patterns since 2003 and the potential impact of industrial policies on these patterns. The point of view is macroeconomic, based on economy-wide data with various breakdown. Significant shifts in investment patterns across sectors and ownership forms have occurred over time, supporting a new growth model with a reduced role of the state, and these shifts appear driven more by market factors than by government policies.

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- E6 Macroeconomic Policy, Macroeconomic Aspects of Public Finance, and General Outlook
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## I. Introduction

The high investment rate of the People's Republic of China (PRC) has attracted much attention. But the investment rate—measured as the ratio of gross fixed capital formation to gross domestic product—has already declined from its peak of 46% in 2010–2013 to 43% in 2015, and both the levels and the inverse U-shaped trend of the PRC investment rate over time are comparable to those of other countries at similar stages of economic development. The changes in patterns of investment, and the factors that drive these changes, are of great interest for the PRC's future economic growth yet have so far escaped attention.

In the PRC, investment played a historic role as the cornerstone of the centrally planned economy. In a post-civil war economy, planners allocated investment with a view to establishing the foundations for a rapidly growing economy. The State Planning Commission planned (or authorized) all investment projects. Investment was undertaken by the state and financed out of the state budget. Depending on political prerogative, planners preferably channeled investment into heavy industry, light industry, or the Third Front Construction.<sup>1</sup>

In the reform period, investment planning morphed into an investment approval procedure. By liberalizing prices, the “investment hunger” of the socialist system (Kornai, 1979) that was previously kept in check through fixed prices and physical planning—and led to shortages—now triggered price increases. Investment approval procedures then became an active tool of macroeconomic policy. For example, central investment policies played a crucial role in the 1988/89 contractionary macroeconomic policies when planners, in order to reign in double-digit inflation, ordered investment projects to be stopped and denied approval for new projects.<sup>2</sup> The approval requirement was dismantled only gradually, with a major relaxation of approval procedures in 2004, though continuing for some types of projects.

In the face of the current annual economic growth targets, investment also matters as a component of aggregate demand. Consumption's contribution to annual real GDP growth is relatively stable, with on average 5.5 percentage points in the years from 1979 through 2015 (NBS database). The contribution of net exports fluctuates tremendously, with a long-run average of 0.2 percentage points per year. The average annual contribution of gross capital formation (gross fixed capital formation plus the typically very small item inventory

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<sup>1</sup> On the Third Front Construction, see, for example, Naughton (1988). It denotes the creation of an industrial base in the PRC's heartland between 1964 and 1971 as a defensive measure against a foreign aggressor (that was expected to breach the first front, the PRC's shoreline or land border, and then to be stopped in the second front, the area between the shoreline / land border and the new industrial heartland).

<sup>2</sup> For details on the 1988/89 contractionary macroeconomic policy period see Holz (1999).

investment) is 4.1 percentage points, with some variation over time. Of the aggregate expenditure components, gross capital formation responds quickest and most reliably to central government policies and since the early 2000s has been as important as consumption for generating annual economic growth.

Gross capital formation played a particularly important role in the aftermath of the 2008 U.S. financial crisis, in 2009 and 2010. But by 2016, based on the official first release of data (CEIC database), consumption contributed 4.3 percentage points to GDP growth, gross capital formation 2.8% and net exports  $-0.5\%$ . I.e., gross capital formation's contribution to GDP growth, relative to consumption's contribution, has now fallen below its long-run level.

Given that annual investment fluctuates more than consumption, stable annual economic growth is conditioned on a continuously growing stream of investment. The PRC government's growth prerogative then translates into maintaining a high growth rate of investment. The central government influences investment directly through public investment in infrastructure, and through government industrial policies favoring particular types of projects. The government also influences investment indirectly through regulatory mechanisms as well as interest rate and tax policies.

But the government's push for investment at times of otherwise low GDP growth rates—such as in the aftermath of the 2008 U.S. financial crisis, or to stop the growth slowdown in 2015/16—has been criticized as leading to “overinvestment.” Overinvestment is taken to cause inefficient resource allocation, excess capacity, high levels of debt, and poor asset quality. For example, BAI Chong-en et al. (2016) suspect that local governments' access to financial resources translates into investment that potentially worsens the overall efficiency of capital allocation. Others have expressed concern about an increasing role of the state in investment, with a supposedly receding share of the private sector in 2016.

This leads to a conundrum: on the one hand, the central government would like to see a stable and relatively high investment rate for the sake of economic growth. On the other hand, it would prefer not to have to deal with the negative consequences of overinvestment or mis-investment. One solution is to encourage private investment, leaving any consequences of overinvestment or mis-investment for the private sector to sort out.

The shift in the government's management of investment originally occurred in the mid-2000s. In 2004, the investment approval procedures were relaxed, loosening the grip of planners on the volume of investment. But the government not only wants stable and reasonably high investment growth, it also would like investment to flow in sectors of its preference. Since the early 2000s, the central government has issued a plethora of industrial

policy measures in an attempt to direct investment (and productive activities). Investment's role as macroeconomic policy tool, thus, has been reduced, but investment continues to serve a role in strategic economic planning.

This paper examines the changes in investment patterns since 2003, and explores the impact of the changes in decision-making and in industrial policies on investment. The point of view is macroeconomic, based on economy-wide data with various breakdowns. In the presence of a multitude of policies, each listing a great number of desirables, a singular hypothesis to be tested quantitatively cannot be the objective of this paper. Rather, a first objective of this paper is to show the changes in investment patterns that have happened and are continuing to be underway. The second objective is to relate the observed changes in investment patterns to industrial policies and to draw conclusions on the impact of the central government, through its policies, on investment outcomes in the PRC.

This big picture is still missing from the literature. Business-oriented news items and articles may report the latest monthly changes in real estate investment. The academic literature tends to focus on foreign investment in PRC (such as its effects on exports), on financing constraints in the PRC, and on investment efficiency (typically as part of production function estimations). Slightly closer to the topic here, one recent article finds that certain categories of listed firms restrict investment in the face of economic policy uncertainty (WANG et al., 2014), while another finds no impact of real estate collateral value on firm investment (WU et al., 2015).

The next section extracts specific industrial policies from the various industrial policy measures issued since the mid-2000s and from the latest Five-Year Plans. This is followed by a brief discussion of the data. The analysis proceeds in three steps: (i) separate analysis by sector, ownership, and subordination of investment; (ii) multivariate analysis of sector times ownership, and of the relationship between investment and profitability; and (iii) the most recent developments based on the available (incomplete) data for 2016.

## **II. Industrial Policy**

Explicit industrial policy as an instrument of economic reform first emerged in the PRC's Seventh Five-Year Plan (1986–1990), but early policies appeared to have little effect.<sup>3</sup> This changed in the 2000s.

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<sup>3</sup> For an overview of the development of industrial policy in the PRC see Heilmann and Shih (2013), and Lo and Wu (2014).

## A. 2004–2011

Industrial policy in the form of cross-sector programs, sector-specific programs, and investment guidelines began to blossom starting in the mid-2000s. As documented by Heilmann and Shih (2013), the themes include adjustment of the industrial structure (2005), acceleration of service sector development (2007), industrial technology (2009), acceleration of strategic emerging industries' development (2010), and industrial restructuring and upgrading (2011–15); targeted industries are the automobile industry (2004), machine-building industry (2006), nine traditional sectors for revitalization (2009),<sup>4</sup> information technology industry (2009), logistics industry (2009), culture industry (2009), nine traditional industries & seven strategic emerging industries (2010/2011), and 21 ministerial sector-specific Five-Year Plans. These were accompanied by priority investment catalogues for high-tech industries (2004, 2007, 2011) and foreign investors (2005, 2007), guidelines for restructuring of selected industries (2005, 2011), a list of import technologies and products (2007, 2009, 2011), and guidelines for overseas investment (2008).

The conclusion from this rich list is that industrial policy in the PRC is not narrowly targeting selected sectors. Instead, the state issued a plethora of guidelines and regulations, each with potentially far-reaching consequences for investment behavior. For example, the 2005 guidance catalogue for adjustment of the industrial structure lists approximately 500 “encouraged” types of (implicit: investment) projects (or “items”), such as “Construction of a National Agricultural Products Base” or “Development of Inter-Regional Power Grid Engineering Technology,” 200 “restricted” types of projects, and 400 types of projects to be “eliminated” (NDRC, 2005). The catalogue was revised in 2011.<sup>5</sup> A number of implementation instructions accompanied and followed the catalogues, with later individual instructions also reclassifying specific projects in the catalogues.

A wide range of further government policies affect investment, from sector-specific discrimination via promotional strategies to restructuring efforts, demand creation, regulation of investment, and import/export policies. A key step in reforming the investment system was a State Council regulation issued in 2004. This regulation specified the adoption of a new investment approval system, with non-state investment, in principle, no longer subject to

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<sup>4</sup> These include, with concrete plans for 2009–2011, the automobile industry, biology and medicine industry, equipment manufacturing, and new energy (see <http://www.china-briefing.com/news/2009/11/24/revitalization-programs-set-for-five-industries.html>, accessed 10 February, 2017).

<sup>5</sup> See Traurig (2011) for details on the differences between the 2005 and 2011 catalogues. Items not covered by the catalogue are permitted.

government approval. An appendix to the regulation provides a lengthy list of restricted types of investment projects by sector that continue to require government authorization, while direct government investment is to be limited to sectors where the market cannot achieve an “effective allocation of resources.”

## **B. Strategic Emerging Industries (2010)**

In 2010 the State Council identified seven “strategic emerging industries” which were to be supported in the following years, with a target share in GDP for 2015 of 8%, and for 2020 of 15%. The seven industries are:

- energy saving and environmental protection technologies,
- next generation information technology,
- biotechnology,
- high-end equipment manufacturing,
- new energy,
- new materials, and
- new energy vehicles.<sup>6</sup>

The document elaborates on each of these industries, and then, on several pages, lists ways of supporting their development. Non-state (*minjian*) investment is explicitly encouraged.

These industries, except for high-end equipment manufacturing, are difficult to identify in the sector classification system because they reflect subsets of, or particular aspects within, individual sectors. For example, the sector classification system does not distinguish between “old” and “new” within any one sector. Statistics published by the National Bureau of Statistics (NBS) can also not tell if the 2015 target share in GDP of 8% was reached.

## **C. Twelfth Five-Year Plan (2011-2015)**

One of the 60 sections of the Twelfth Five-Year Plan (2011–2015) covers the strategic emerging industries, without, however, going into any further depth than the 2010 State Council document does.<sup>7</sup> Some of the subsequent sections cover aspects of the seven strategic emerging industries, though the term “strategic emerging industries” is not used.

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<sup>6</sup> For an English language summary of the State Council document see The US-China Business Council, 2013.

<sup>7</sup> See section 10 of the Twelfth Five-Year Plan, available at [http://www.gov.cn/2011lh/content\\_1825838.htm](http://www.gov.cn/2011lh/content_1825838.htm), accessed 9 February 2017.



Another section of the plan covers nine traditional industries (with in parentheses a selection of what appear the most important items):

- equipment manufacturing (a switch to numerical controls, information technology, and green technology; service-orientation; development of strategic emerging industries),
- shipping industry (including liquefied gas carriers, ocean fishing vessels, luxury tourist boats),
- automotive industry (including new products, new forms of production, breakthroughs in battery technology and motors),
- iron and steel (with a focus on steel for high-speed railways, high-grade silicon steel, magnetic silicon steel, and high-strength steel for machine-building),
- non-ferrous metals (especially for aerospace and information technology industries),
- building materials (with a focus on photovoltaic glass, ultra-thin substrate glass, special glass fiber, and special ceramics and other new materials),
- petrochemical industry (construction of a large-scale integrated refinery base; coal electrification; carbon dioxide utilization; petroleum to reach the level IV standard),
- light industry (new batteries, new plastics for agriculture, energy-saving light sources, intelligent home appliances, self-reliance in equipment for key sectors), and
- textiles (high-tech fibers, next-generation industrial fiber applications and use, self-reliance in high-end textile machinery, recycling of textile waste products).

While the list comprises clearly defined sectors, the details suggest that it is not the sector itself that is favored, but specific aspects within the sector, or specific sub-sectors. Implicit is the understanding that some aspects of (or sub-sectors within) a sector that are not addressed in the policy are not favored. Overall, investment in a particular sector then can rise or fall.

A key topic of the Twelfth Five-Year Plan is “structural change,” comprising, among others, a breakthrough for the strategic emerging industries and an increase in the share of the tertiary sector in GDP by four percentage points.<sup>8</sup> For investment, the plan, in adjusting and “optimizing” the investment structure, emphasizes the important role of investment for domestic demand. It promotes maintaining a “rational” increase in investment, changing the

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<sup>8</sup> Structural change, in the Twelfth Five-Year Plan, further encompasses an increase in household consumption, consolidation of the agricultural foundation, “optimization” (*youhua*) of the industrial structure, an increase in the urbanization rate by 4 percentage points, and a strengthening of the coordination between urban and rural development.

investment system, clearly defining the scope for government investment, standardizing the investment behavior of SOEs, encouraging an increase in non-state investment, effectively curbing “blind” expansion and duplication of investment, accelerating the beneficial interactions between consumption and investment, and creating final demand by organically combining increases in investment, employment, and people’s livelihood. The plan does not single out individual industries for specific treatment. The primary concern appears to be investment’s contribution to GDP growth, and a restructuring of ownership patterns.

#### **D. Supply-side Structural Reform (2015)**

The “supply-side structural reform” agenda was first introduced at the 11<sup>th</sup> meeting of the Finance and Economics Leading Small Group of the Chinese Communist Party Central Committee on 10 November 2015. Articles by an “authoritative personage” in *Renmin ribao* (People’s Daily) on 4 January 2016 and on 9 May 2016 widely promoted the supply-side structural reform agenda. This agenda comprises five elements: eliminating excess capacity, reducing stocks (mostly in real estate in second- and third-tier cities), de-leveraging across the economy, lowering costs (including costs due to taxes, regulations, and social security contributions), and a broad catch-all “strengthening weak points.”<sup>9</sup>

Eliminating excess capacity, reducing stocks, and deleveraging all have an immediate impact on investment. While the agenda identifies general obstacles to economic growth on the supply side, the issue of excess capacity affects certain sectors more than others, in particular steel and coal.<sup>10</sup>

The government’s intention to reduce excess capacity not so much represents draconian orders to close down industrial plants as a nod to firms to merge and become more efficient, and an encouragement of local officials to implement environmental and other regulations and thereby eliminate the least desirable production capacities. Quite likely, much of the reduction in excess capacity is simply the logical, market-based outcome of falling profitability and increasing losses as prices of coal and steel have plummeted. Overall, investment in these sectors could still continue (rather than fall to zero) in order to implement technological upgrading.

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<sup>9</sup> For details, see Naughton (2016a,c).

<sup>10</sup> Some details on capacity reduction are provided in Appendix 1.

## **E. Thirteenth Five-Year Plan (2016–2020)**

The Thirteenth Five-Year Plan (2016-2020), like previous plans, does not contain a section specifically on investment. The section on industry in the plan is entitled “Promote the optimization and upgrading of the industrial structure” and in three paragraphs lists comprehensive and industry-specific desirables.<sup>11</sup> Separate sections promote the development of the service industry, regional balancing, and energy saving and environmental protection.

The industry section elaborates, in more detail, on six sub-sectors (here listed with some summary statements and selected specific explanations):

- acceleration of the development of high-tech industries (manufacturing related to digital information; bio-medicine, bio-agriculture, bio-energy, bio-manufacturing; aerospace industry; new materials industry);
- revitalization of equipment manufacturing (technical standard of equipment; innovation capability of the automobile industry; independent design and construction capability of the shipbuilding industry);
- optimal development of the energy industry (strengthening coal resource exploration, reorganizing coal enterprises, and closing certain coal enterprises; developing large and efficient thermal power stations, developing hydropower and nuclear power, strengthening the power grid; developing oil and natural gas exploration and production; developing renewable energy);
- adjustment of the raw materials industry (resolving excess capacity in the metallurgical industry; adjustment of the chemical industry with a focus on quality improvement, less environmental pollution, and independent developmental capacity; improving building materials while saving energy and protecting the environment);
- an increase in the level of light industry (build own, high-quality textile brands; develop new light industry products; promote energy and raw material reduction; use information, biotechnology, environmental protection and other new technologies to transform light industry); and

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<sup>11</sup> The section starts out with a summary in form of “Continue along the road of New Industry; adhere to the leading role of the market with enterprises as the mainstay; put the ability for independent innovation at the center; continue to give full play to the competitive advantages of labor-intensive industries; adjust and optimize the product structure, the organizational structure and the sector distribution of industry, raise the technology level in every respect and the overall competitiveness; and accelerate the transition of industry from ‘big’ to ‘strong.’” (Section 3 of the Thirteenth Five-Year Plan, at <http://ghs.ndrc.gov.cn/zttp/ghjd/quanwen/>, accessed 18 November 2016.)

- promotion of information technology (use information technology to promote industrialization and use industrialization to promote information technology; use information technology in manufacturing; develop a national information database; speed up development of the broadband access network and the mobile communications network and create a triple-network of telecommunications, radio and television, and broadband; strengthen information security).

The coverage of the plan is far-reaching, covering virtually every aspect of industry (and similarly for the non-industry sections). Except for some industries within the raw materials sectors, where capacity reduction is an important factor, the plan it is not so much about promoting particular sectors over other sectors than about various forms of improvements/upgrading within each sector. The implications for investment, apart from the sectors targeted for capacity reduction, are ambiguous. Investment may well continue equally across all sectors but targeting the forms of improvement/upgrading outlined in the plan.

## **F. “Made in China 2025”**

For industry, the Thirteenth Five-Year Plan is supplemented by “Made in China 2025,” the PRC version of Germany’s 2012 “Industry 4.0” (fourth industrial revolution), passed by the State Council on 8 May 2015.<sup>12</sup> Breakthroughs are to occur in ten priority industries: information technology, numerical control tools and robotics, aerospace equipment, ocean engineering equipment and high-tech ships, railway equipment, energy saving and new energy vehicles, power equipment, new materials, medicines and medical devices, and agricultural machinery.<sup>13</sup>

A State Council (English language) webpage promotes “Made in China 2025” events, decisions, and achievements (<http://english.gov.cn/2016special/madeinchina2025/>), a central leading group has been set up, and supporting documents are gradually being released. Implementation of “Made in China 2025” follows traditional PRC reform patterns with pilot cities (Ningbo being the first one), annual targets and tasks, and assignment of responsibility for implementation to specific individuals or parties.

The impact of “Made in China 2025” on specific sectors is ambiguous. Beyond

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<sup>12</sup> The four revolutions are: water- and steam-powered mechanical manufacturing, mass production based on electric power, automation of manufacturing based on information technology, and cyber-physical systems (smart factories with embedded information technology systems).

<sup>13</sup> For additional details on “Made in China 2025,” see Appendix 1

identifying ten priority industries, “Made in China 2025” does not favor certain sectors over others, and even in the case of the priority industries, investment need not increase for the industry in total, but could shift between projects within a sector. An overall objective of becoming the leading manufacturing nation of the world in little more than thirty years suggests broad growth in manufacturing with adjustments to how manufacturing is conducted within each sector, rather than drastic redirection of investment flows between sectors.

It is also unclear to what extent policy statements such as “Made in China 2025” can shape actual outcomes. Breakthroughs can be desired, but not forced to occur; they may be *more likely* to occur if the government takes supporting measures, but at least the policy document “Made in China 2025” does not go as far.

## **G. Sector Focus of Investment**

The various industrial policies represent a combination of broad exhortations and specific objectives. But even when specific objectives are given, including on types of projects, these make no reference to the official sector (or: industry) classification system. In many instances, objectives cut across sectors or shift the balance of different projects within a sector. In other instances, it is possible to venture a guess as to which sector in the official sector classification system may be affected.

Table 1 represents an attempt to map policies into the sector classification system. For the various pre-2015 policies (following the sections above), a year date is given in the table; for the specific other five sets of policies, “x” denotes that this particular sector is covered (positively) by the policy and “(-)” that the policy constrains development in that sector. The policy abbreviations are listed below the table.

The identification of specific sectors to match industries listed in policies is exceedingly difficult, and often impossible. For example, the sector classification system includes a fourth-digit sector “biotechnology extension services” within the first-digit service sector “science” as the only identifiable potential counterpart to a policy promoting biotechnology. And while there is a second-digit service sector “ecological protection and environmental management,” none of its sub-sectors is an immediate counterpart for a policy targeting “environmental protection technology.” There are also no sector counterparts for policies on “new energy,” “new materials,” or “new energy vehicles” (none of the automobile manufacturing sub-sectors refers to new energy vehicles, or electric vehicles). An increase in the level of light industry (Thirteenth Five-Year Plan) cannot just be reduced to the textile

and apparel industry, but that is the only sector in the official sector classification system that can be matched with the description in the plan.<sup>14</sup> Keeping these caveats in mind, Table 1 shows a certain repetition of the same themes over time with an emphasis on new technologies across all sectors.

### III. Data

Detailed investment data for the PRC are available for a measure labeled “Fixed Asset Investment” (FAI, *guding zichan touzi*). FAI is the sum of all fixed asset spending of firms. FAI data were first compiled in the early years of the PRC as a key performance indicator for central planners concerned with establishing the foundations for rapid economic growth, and as a monitoring mechanisms for government budgets (with all investment expenditures allocated through the budget).

In contrast to the national income accounts measure of gross fixed capital formation, FAI does not net out sales of old fixed assets and does not distinguish between produced and non-produced fixed assets.<sup>15</sup> While gross fixed capital formation is the more desirable measure, only one annual aggregate, economy-wide data point is available, without sector or ownership breakdown. In contrast, the NBS publishes a multitude of annual (as well as monthly) FAI data; these data are used in the following.

The national FAI data are derived as summed provincial data, and the FAI values of Liaoning province were acknowledged in 2016 to have been exaggerated. At least the time trend of FAI data, thus, needs to be viewed with caution. Much of this paper works with proportions: the shares of different sectors or different ownership forms in economy-wide FAI. As long as any form of data inaccuracy affects each sector (or ownership form) equally, the analysis is valid. Similarly, while FAI is not an ideal proxy for gross fixed capital formation, as long as sales of existing assets and land account for the same proportions across sectors (or ownership forms), any findings based on FAI data extend to the more meaningful measure of gross fixed capital formation.

FAI data are compiled by the NBS’s Department of Investment and Construction Statistics and published in the investment section of the *Statistical Yearbook* series. More details are provided in a separate *Investment Statistical Yearbook* series published for 1950–

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<sup>14</sup> Aerospace equipment, one of the ten priority industries of “Made in China 2025,” can be matched directly with the third-digit sector “aviation and aerospace equipment manufacturing,” with a further, four fourth-digit sectors. But in the investment statistics, checked for 2012-2015 values, this third-digit sector is missing.

<sup>15</sup> For details on the relationship between gross fixed capital formation and FAI, and questions about the quality of FAI data, see Holz (2017).

1995 (one issue) and then as annual issues in 1997 through 1999 and again starting 2003 (with the exception of 2014). The NBS database includes data on FAI (for the years since 1980 or 1981, depending on the series), as does the CEIC database. The latter two include monthly FAI data, which are also available in the NBS magazine *China Monthly Statistics*.

Through 2002, PRC statistics on investment in fixed assets were primarily ownership-focused, with ample detail on state-owned units (SOUs) and urban collective-owned units (COUs), and over time increasing coverage of other ownership forms. In 2003, the arrangement of investment statistics shifted to an urban-rural distinction. In 2003, urban investment accounted for 82% of total investment, and in 2010 for 87%.<sup>16</sup> In 2011, the urban-rural distinction further evolved into a distinction between “investment, except by rural households” (for which detailed data are available) and “investment by rural households,” accounting for 97% and 3% of total investment, respectively.

Figure 1 illustrates the 2011 transition. Up through 2010, total investment comprises urban investment and rural investment. Rural investment comes with a breakdown into rural households and rural non-households, with the latter capturing everything rural that is not a rural farm household. (The terminology in official sources varies over time, with alternative terms being rural farm-household vs. rural non-farm-household.) Since 2011, only the rural household category is retained as a separate category. Rural non-households, previously accounting for three-quarters of rural investment, are now merged with the previously “urban” category into the newly formed category “investment, except by rural households.”

The distinction between “urban” investment and “investment, except by rural households” matters in that detailed sector investment data are only available for the urban FAI coverage in 2003–2010, and for “investment, except by rural households” since 2011. I.e., use of the detailed sector investment data imply a statistical break in 2011. Both series can also be found reported together in NBS data sources (for example, *Statistical Yearbook 2015*, p. 307) or in the CEIC database under the label “urban,” which ignore the 2010–2011 statistical break altogether.

A second statistical break in 2011 is a change in the size criterion applied for investment to be included in “investment, except by rural households.” The minimum investment size is CNY5 million, ten times higher than the size criterion previously (through 2010) applied to “urban investment,” of CNY500,000. The two statistical breaks together imply that the officially published, retrospectively revised 2010 FAI value is 9.51% smaller than the earlier

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<sup>16</sup> See *Investment Statistical Yearbook 2004*, pp. 3, 73, 415; *2011*, pp. 13, 55, 415.

published 2010 FAI value (as the sum of urban and rural investment, with the CNY500,000 criterion applied to the urban category).<sup>17</sup>

A third statistical break occurs in the sector classification system, in 2012. The 2003–2011 sector FAI data follow the “national [sector] standard” (GB, *guobiao*) of 2002 (in the following abbreviated “GB2002”), the sector data since 2012 follow GB2011. Confusingly, the NBS does not apply the sector classification system consistently. Thus, while investment data since 2012 are compiled according to GB2011, the NBS at times reports these data fitted into GB2002, leading to missing data where a sector match is not possible (and to differences between the aggregate value and the summed sector value).

The 2012 change in sector classification scheme adds to the data complications, which, in total, then are:

- The coverage of the detailed sector data changed in 2011, from urban investment to “investment, except by rural households.”
- The size criterion for inclusion changed in 2011 (and in some sources is applied retrospectively to 2010 aggregate data).
- The sector classification scheme changed in 2012.

This suggests analysing the FAI data in two separate, consistent time periods: 2003–2009/2010, and from 2012 onwards.

At the first- and second-digit sector level, GB2002 and GB2011 are similar. The first-digit sector classification—comprising 19 sectors (plus an “international” sector with typically zero investment)—is largely unchanged; only one second-digit sector moves between first-digit sectors.<sup>18</sup> Within individual first-digit sectors, one dozen of the approximately one hundred second-digit sectors are re-arranged, typically with minor effects

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<sup>17</sup> In some data sources, the change in size criterion already occurs in 2010 (it is implemented retrospectively), but then typically applies only to an aggregate value (and the disaggregate data then do not add up to the retrospectively revised 2010 aggregate value). The absolute value of rural household investment in 2010 is unchanged across the 2010/2011 statistical break, i.e., the retrospectively revised 2010 FAI value solely incorporates changes to “investment, except by rural households.” For more details on statistical breaks and coverage changes over time, see Holz (2017).

<sup>18</sup> The first-digit sector “Health, Social Security and Social Welfare” in GB2002 loses the second-digit sector “social security” to the first-digit sector “Public Management, Social Security and Social Organizations” in GB2011 (with corresponding changes in the first-digit sector labelling). Moves of third- or fourth-digit sectors from one first-digit sector to another first-digit sector cannot be ruled out. The NBS in its time series ignores the reclassification: the *Statistical Yearbook 2012*, pp. 164ff. reports economy-wide first-digit sector investment data for 2003–2011 following GB2002, while the *Statistical Yearbook 2013*, pp. 159ff., reports economy-wide first-digit sector investment data for 2003–2012 following GB2011; the values through 2011 in the two affected sectors were not revised in the more recent *Statistical Yearbook 2013* edition, which follows GB2011.



on the affected second-digit sector values.<sup>19</sup>

Investment data come with details up to the fourth-digit sector level (with close to one thousand sectors), including various characteristics of investment within a fourth-digit sector. (Appendix 2 elaborates on the availability of investment and other data used in the following sections.) The first-digit sector level with 19 sectors is typically too coarse for detailed analysis. The second-digit sector level with approximately one hundred sectors is often good enough. At the fourth-digit sector level, findings become harder to present beyond summarizing key relationships or, on the other hand, drilling down to specific sectors. A limited matching with industry profitability is possible at the fourth-digit sector level.

All data are in nominal terms. Neither nominal nor real investment would seem to be a preferred measure to assess changing patterns of investment. These are simply measured differently depending on whether one uses nominal or real data. With an investment in fixed asset price index available only for the aggregate of all sectors, the measurement proceeds in nominal terms.

The aggregate investment in fixed assets price index has remained nearly unchanged since 2012, with, at most, upper single-digit price increases in 2003–2011. This suggests price stability across sectors and types of investment expenditures—or otherwise reflects a rather unlikely consistent evening out of different price changes across sectors and types of investment expenditures in every single year. As investment across sectors constitutes expenditures on rather similar items (structures, some equipment), it is likely that investment in different sectors is subject to similar price changes.<sup>20</sup>

#### **IV. Univariate Analysis**

To account for the change in size criterion in 2011 (or in 2010, in some sources, for aggregate data), for the change in coverage in 2011, and for the change in the sector classification system in 2012, the data are analyzed separately for the two periods 2003–2009/2010 and 2011/2012–2014/2015. Key variables of interest are investment by sector, by ownership, and

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<sup>19</sup> For details on the transition, see Holz (2017).

<sup>20</sup> The investment in fixed assets price index in 2003–2015 (previous year = 100) was 102.2, 105.6, 101.6, 101.5, 103.9, 108.9, 97.6, 103.6, 106.6, 101.1, 100.3, 100.5, 98.2 (NBS database). A breakdown of the investment in fixed assets price index by structures, equipment, and “others” is available; price increases tend to be higher for structures than for “others,” and higher for “others” than for equipment. Sector analysis is not affected as long as each sector’s investment expenditures are somewhat equally distributed across these three types of investment (which is likely as no sector will rely on structures only, without equipment and various other investment expenditures incurred in the purchase and installation of structures and equipment).

by central-local subordination.

## **A. Sector Distribution of Investment**

The first two sections below provide a broad overview of investment patterns, while the following two sections delve deeper into the most detailed sector data, available for urban investment through 2010 and “investment, except by rural households” since 2011 (and then focuses primarily on the second period, the years since 2012). To avoid cumbersome phrasing, the term “urban” investment is frequently used to denote both urban investment through 2010 and “investment, except by rural households,” since 2011.

### **1. Primary, Secondary, and Tertiary Sectors**

Between 2003 and 2015, the shares of the primary, secondary, and tertiary sectors in FAI did not exhibit continuous trends (Figure 2). The share of the secondary sector—industry (mining, manufacturing, and utilities) and construction—rose from 38% in 2003 to 45% in 2008. Then it started a long-term decline, ending the period, after the statistical breaks, slightly higher (at 40%) in 2015 than it started out in 2003. The primary and tertiary sectors exhibit the reverse pattern, with declining shares through 2007/2008, and then increasing shares; this also holds for the tertiary sector if one excludes real estate.

The tertiary sector has always accounted for the bulk of investment (59% in 2003, 56% in 2015). Following the 2010 and 2011 statistical breaks, real estate accounted for almost one-half of tertiary sector investment, before its share declined gradually, to 43% of tertiary sector investment and 24% of FAI in 2015, while the share of all other tertiary sectors in investment increased, to 32% of FAI in 2015. The share of real estate investment in FAI is rather stable over time, except for a slight decrease in 2009 and then the gradual decrease since 2013. The share of tertiary sector investment except real estate investment experienced a sudden increase in 2009 and then gradual increases starting 2013.

The increase in the tertiary sector share in investment in 2009 is not due to a sudden decrease in the share of other sectors. FAI grew at 30% in 2009, the highest rate in the period 2004–2015, but tertiary sector investment grew even faster than the FAI average, suggesting that following the U.S. financial crisis there was a push for investment across the board, but in particular in the tertiary sector, which also includes infrastructure investment.

Official NBS infrastructure investment data are available only since May 2014, and only on a cumulative monthly basis. An annual “urban” infrastructure investment measure is

constructed following NBS practice (see Appendix 3). The NBS measure of infrastructure comprises transportation (rail, road, water, air, pipeline), information technology, and public facilities (“water conservancy, environment, and public facilities,” the latter accounting for more than 80% of investment in this sector). It does not include other tertiary sectors such as health, science, or education, or the secondary sector sub-sector “utilities.” The annual “urban” infrastructure investment measure shows a decline in infrastructure investment between 2003 and 2012, with a one-time uptick in 2009 and then a gradual increase starting 2013. The 2015 share of 18% is well below the 2003 share of 24% (albeit with the two statistical breaks in between), though higher than the all-time low of 16% in 2012. The trend in the share of infrastructure investment thus is no different than that of the tertiary sector.

## **2. First-digit Sectors**

In 2010, investment in the PRC was heavily concentrated in one-third of the 19 first-digit sectors: six sectors together account for more than four-fifths of economy-wide investment (bars in Figure 3). Manufacturing alone accounted for 35% of total investment, followed by real estate with 26%. The next four sectors were transport, storage and post (9%), public facilities (8%), utilities (5%), and mining (4%).

Economy-wide (nominal) investment grew 4.5 fold between 2003 and 2010, with some variation across those sectors that receive only a small amount of investment (line in Figure 3). The growth rate of investment in information technology (information transmission, computer services and software) as well as the share of investment in this sector in 2010 are rather low, suggesting that some investment in information technology might not be captured by the sector “information technology”—or that, indeed, the share of information technology in investment, as well as its growth rate, are low.

By 2015, the picture is virtually unchanged (Figure 4). Manufacturing and real estate still account for 32% and 24% of economy-wide investment, with no major change from 2010, and transport and public facilities have traded places with now 9% and 10% investment shares (vs., in 2010, 12% and 10%). Information technology still accounts for only 1% of economy-wide investment. Three sectors have seen relatively large changes in their small percentages between 2010 and 2015: the share of trade increased from 2% to 3% while that of science tripled from 0.5% to 1.5%, and the share of mining halved from 4% to 2%.

In this second period of 2012–2015, investment in mining was stagnant and thereby had the slowest investment growth rate of all first-digit sectors. Investment in information

technology, business services, health, trade, and science grew fastest. These patterns conform with the 2009 push towards the tertiary sector, and the more detailed sector preferences specified in the Thirteenth Five-Year Plan—at a time before the plan had been passed.

### 3. Second-digit Sectors

The analysis proceeds for the two periods 2003–2008 and 2008–2010 with urban investment following GB2002, and for 2012–2015 with “investment, except by rural households” following GB2011. Table 2 reports each sector’s share in total investment in 2008, 2010, 2012, and 2015 (with first-digit sectors in bold) and the growth rates of investment 2008 vs. 2003, 2010 vs. 2008, and 2015 vs. 2012, expressed as multiples of the earlier year values.

Economy-wide urban investment in 2008 was 3.2 times the 2003 value. All sectors that experienced significantly faster growth than the economy-wide average growth, with a multiple of 5 or more, are marked in red in the table (and appear slightly pale in a black-and-white version).<sup>21</sup> In the period 2003–2008, growth was particularly fast in mining and manufacturing sectors. Animal husbandry and fishery also grew fast, as did a selection of tertiary sector second-digit sectors, such as railway transport, storage, hotels and catering, securities activities, leasing, “other services,” and social welfare.

In the period 2008–2010, very few mining and manufacturing sectors grew faster than the economy-wide average (of 1.6, with 2.0 as cut-off point to be marked as a “fast” growth sector). Instead, many more tertiary sector second-digit sectors now grew faster. Comparing the list of pre-2010 industrial policies (Table 1) to the 2010 vs. 2008 sector investment growth rates (Table 2) shows a relatively good match, including the sectors “manufacture of electrical machinery and equipment” (machine building policy 2006), “loading, unloading and other transport services” (logistics, 2009), “computer services” (information technology, 2009), “services of science and technology exchanges and promotion” (information technology, 2009), and “cultural and art activities” (culture, 2009). Other relatively fast-growing sectors such as leasing and business services, services to households and other services, and some of the financial services would also seem to fit the general policy framework. The observed concentration of fast-growing sectors in the tertiary sector matches

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<sup>21</sup> The data cover 93 second-digit sectors. In addition, two first-digit sectors do not come with a second-digit sector breakdown and are included in analysis of second-digit sectors. Investment data on a 20<sup>th</sup> first-digit sector “international organizations” are almost never available and this sector is therefore ignored.

the overall policy push towards the tertiary sector.<sup>22</sup>

In the period 2012–2015, none of the mining and manufacturing sectors makes it into the group of fast-growing sectors (two-fold increase compared to the economy-wide average of a 1.5-fold increase), except the manufacturing sector “articles for culture, education, arts and crafts, sport and entertainment activities.” Mining and heavy industry, across the board, fell back. Farming and animal husbandry grew fast, as did various tertiary sector second-digit sectors such as internet and related services, software and information technology, capital market services, other financial services, leasing, science and technology popularization and application services, social services, and radio / television / film. These sectors are all relatively small in terms of investment received.

While the data show some congruence with the 2010 industrial policy on strategic emerging industries, there is quite a discrepancy to the objectives of the Twelfth Five-Year Plan. Among the destined strategic emerging industries, investment data on equipment manufacturing and automobile manufacturing, at the second-digit level, do not bear out the 2010 policy; environmental management, information technology, and science do. The Twelfth Five-Year Plan additionally includes a focus on nine traditional industries: for these sectors, the investment data show no particularly fast growth. Towards the end of the Twelfth Five-Year Plan period excess capacity in some industries had already become apparent and may have weighed down investment, and the plan stresses technological upgrading rather than expansion.

The coefficient of variation decreases from the first to the second and third period from 0.76 to 0.32 and 0.34. This means that since 2008 there is less variation in investment growth across second-digit sectors than before. This suggests increasingly broad-based, economy-wide investment growth rather than any form of specialization.

Overall, the second-digit sector data reveal a clear shift in investment over time away from mining and manufacturing to some agriculture and otherwise tertiary sector activities. The shifts broadly conform with industrial policies, though there is no perfect match and industrial policies that focus on technological upgrading may not necessarily yield above-average investment growth and thereby be visible in the data. Real estate is not a particularly

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<sup>22</sup> Between 2010 and 2012, ignoring the statistical breaks, the manufacturing sector’s share in investment rose from 30.6% to 34.1%—the increase could be due to the new inclusion of rural non-farm-household investment in these investment statistics by 2012— and then fell back (for the now consistently defined coverage) to 32.7% in 2015. Only one manufacturing sector experienced a noticeable increase in its share in total investment between 2010 and 2012, and that is “special purpose machinery” (a sector also favored by machine building industry and high-end equipment manufacturing policies).

fast-growing sector. Its share of total investment in 2015 stood at 23%, almost unchanged, or slightly down, from earlier years. I.e., investment in the real estate sector continues, but does not exceed the average growth rate of investment (nor does it fall back, as the 2015 supply-side structural reform program would have suggested).

#### **4. Fourth-digit Sectors**

Detailed sector investment data covering 1181 sectors (first- through fourth-digit sectors) are available for *urban* investment in 2003–2010 (GB2002), and for “investment, except by rural households” with 1409 sectors for 2012 and 2015 (GB2011). A first step is to identify the 30 fastest-growing third and fourth-digit sectors (with third-digit sectors included if they do not come with fourth-digit sectors).

In 2003–2010, the fastest-growing sectors are found across the economy (Appendix 4). A relatively small number is in manufacturing—manufacturing accounts for only 8 of the 30 fastest-growing sectors but comprises half of all sectors (though only 31% of investment)—and a relatively large number in retail trade. The list comprises a range of diverse sectors, from magnesium dressing to notary services. The 30 fastest-growing sectors together account for only 1.7% of total urban investment in 2010, where one would expect three percent (30 out of approximately 1,000 third- and fourth-digit sectors). I.e., the fastest-growing sectors tend to be relatively small sectors to begin with, and to grow fast from a small base. This suggests that fast-growing investment in a particular sector primarily serves to develop previously underdeveloped sectors.

In 2012–2014, the fastest-growing sectors are again found across the economy, but the balance has shifted: none of the mining sectors makes it into the group of 30 fastest-growing sectors (vs. six in the previous period), and fewer manufacturing sectors do (Appendix 5). More third- and fourth-digit sectors now are from financial intermediation, leasing and business services, and culture, sports and entertainment. “Water conservancy, environment, and public facilities” newly enters with three sub-sectors. The 30 fastest-growing sectors in 2012 together account for only 0.34% of “investment, except by rural households,” where one would expect approximately 2.5% to 3% (30 out of approximately 1,300 third- and fourth-digit sectors). I.e., the fastest-growing sectors in 2012–2014 are even smaller than the fastest-growing sectors in 2003–2010, being one-tenth the average sector size, again suggesting a catch-up process or the completion of an industrial structure more than any kind of specialization.

This process continues in 2015, with the 30 fastest-growing third- and fourth-digit sectors in 2014–15 accounting for only 0.089% of total investment in 2014, i.e., one-thirtieth of what one would expect (Appendix 6). The earlier discernible shifts continue: five agricultural sectors are included, the five included manufacturing sectors are all niche light industry sectors, and the tertiary sector continues to account for the bulk of fastest-growing sectors, with a particular strong showing of trade and of leasing and business services; information technology is represented by two sectors, as is science, while “water conservancy, environment, and public facilities” has disappeared.

The 2012–2014 and 2014–15 data suggest a broad-based shift in investment growth to the tertiary sector. While manufacturing sectors make up more than half of all fourth-digit sectors, they account for only 20% or less of the 30 fastest-growing sectors. Given the time period, much of this shift would appear to *predate* government industrial policy (the Twelfth Five-Year Plan, 2011–2015, still promoted various traditional manufacturing sectors). Similarly, government de-emphasis of coal, steel, and, more generally, mining, only surfaced in policies starting 2015. The move to a high-tech, next generation textile industry as propagated in the Twelfth Five-Year Plan either does not yield investment growth, or has not happened (beyond the hemp-dyeing industry in the most recent year). Medicines manufacturing, glass fiber products, and the automobile and motor industry don’t appear among the fastest growing sectors. Railway equipment and shipbuilding make it into the 2012–14 list of fast-growing sectors, well ahead in time of corresponding industrial policies. A very few light industrial sectors—promoted by the Twelfth Five-Year Plan—appear in the list in 2014–15, as do public facilities (2012–14), and information technology and science (2014–15).<sup>23</sup> But perhaps two-thirds of the sectors that appear on the lists of the 30 fastest-growing sectors are not captured by earlier industrial policies. Environment, a favorite of industrial policy, does not make it into the list of fastest-growing 30 sectors in 2015 (though most of its third- and fourth-digit sectors experience above-average investment growth).

Browsing through the individual 1409 first- through fourth-digit sectors with their 2015 investment growth rate confirms and refines the above observations. The year 2015 saw a boom in farm investment, especially in cash crops, sectors that do not appear in policies beyond the upgrading of agriculture. Mining and most heavy industry manufacturing sectors

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<sup>23</sup> The Twelfth Five-Year Plan also promotes breakthroughs in battery technology. Between 2012 and 2014, economy-wide investment grew by 37%, while investment in the third-digit battery sector declined by 13%. Between 2014 and 2015, investment in the third-digit battery sector increased at the same rate as economy-wide investment, 10%. (Investment in the fourth-digit sector “nickel-hydrogen battery manufacturing” grew 31%.)

fare badly. Manufacturing sectors in which investment grows faster than average tend to be concentrated in consumer goods (textiles, apparel, furniture, printing, cultural goods, automobiles, and computers).<sup>24</sup> Above-average growth in investment also occurs in the construction sector, in leasing and business services, household services, and in the health sector. Investment in the manufacture of medicines (the subject of policies in the later Thirteenth Five-Year Plan, 2016–2020) fares slightly better than average. Investment in power generation, road transport, air transport, and storage grows above-average (all sectors mentioned in later policies). High investment growth rates in information technology sectors, in “water conservancy, environment, and public facilities,” and in science match policies of the Twelfth Five-Year Plan.

Overall, in the 2010s, there is a clear shift of investment out of mining and heavy industry into agriculture, light industry, and most tertiary sectors. The approximate match that is possible between industrial policies with individual sectors suggests no overwhelming direct impact of industrial policies on investment growth across identified sectors; investment grows fast in some policy-favored sectors, but not so in others.<sup>25</sup> If anything, changes in investment patterns tend to precede industrial policies. The 2010 industrial policy theme of moving towards strategic emerging industries, to the extent that it can be mapped into the sector classification system, is little apparent in the investment data through 2015.

## **B. Ownership Distribution of Investment**

### **1. Fixed asset investment**

Figure 5 shows the percentage shares of different ownership forms in economy-wide FAI from 2006, the earliest year for which the data are available in the source, to 2015. The share of investment by a narrowly defined category of state-owned units (SOUs) rises slightly in 2009 (the year after the U.S. financial crisis) before continuing its gradual downward trend from 30% in 2006 to 25% in 2015, albeit with a slight uptick in 2015. To capture all state-controlled units, the following needs to be added to SOUs: an unknown state fraction of the approximately 25% share of limited liability units, an unknown state fraction of the

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<sup>24</sup> Some of this investment could be driven by export demand for the products of these sectors.

<sup>25</sup> For example, biotechnology is promoted in both the Twelfth and the Thirteenth Five-Year Plan, but the sector classification system contains no “biotechnology” sector. Investment in the tertiary sector fourth-digit sector “biotechnology extension services” grows at above-average rates in both 2012–14 and 2014–15.



approximately 5% of FAI by shareholding units,<sup>26</sup> and a very small category of state-state and state-other joint units. For such a comprehensive state category, labeled “state-owned and state-controlled units” (SOSCUs), values are available for the FAI subset of “investment, except by rural households” (where rural households, by definition, cannot be SOSCUs). The percentage of SOSCU investment in FAI in 2015 is 32% (vs. the SOU 25% share).

The third-largest ownership category in 2006 (after SOUs and limited liability companies) is private units with 18%, rising to become the largest ownership category at 30% in 2015. Presumably some of the limited liability and shareholding companies should also be considered private, and the actual private share thus is higher. Investment by “Hong Kong, Macau, and Taipei,China” (HKMT) and by foreign (non-HKMT) units falls from an initial 4% and 6% continuously to 2% each at the end of the period, and the self-employed exhibit a similar pattern with a decline from 5% to 2%. The share of an initially small category of domestic “others”—given the exhaustive ownership breakdown presumably capturing investment by units whose ownership form is indeterminable—rises from 2% to 5%.

## 2. “Urban” investment

In the case of urban investment, accounting for approximately 85% of FAI in the 2000s, and of “investment, except by rural households,” accounting for approximately 97% of FAI since 2011, a different ownership breakdown is available, including the SOSCU category but with an aggregation only of other ownership categories (Figure 6).

A first distinction is between domestic investment vs. HKMT and foreign-funded investment. Domestic investment accounted for 89% of investment in 2003, and then continuously increased to 96% in 2015 (not shown in Figure 6). The investment shares of “Hong Kong, Macau, and Taipei,China” units (HKMTUs) and of foreign-funded units (FFUs) correspondingly decreased, from 5% and 6% in 2003 to 2% each in 2015 (and since 2012 their investment values also stagnate in absolute terms).

A breakdown of domestic investment is available starting 2008. In this ownership classification system, joint units, cooperative units, limited liability units, and shareholding units have been dissolved into SOSCUs, COUs, or private units (or a residual), and the self-employed have presumably been added to the private units. The bulk of domestic investment then occurs in SOSCUs and in private units, with investment in private units on a steady

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<sup>26</sup> The declining share of shareholding units over time is unexpected. Perhaps their share in investment is correlated with new listings on the stock market, of which there have been few in recent years.

upward trend and exceeding SOSCU investment starting 2010. By 2015, private units accounted for more than half of investment (51%).<sup>27</sup> SOSCUs, after a phase of decline, accounted for 32%, COUs for 4%, and an undefined implicit residual—increasing over time—for 8%.<sup>28</sup>

Since 2008, thus, a shift in investment shares has happened away from SOSCU, COU and foreign investment, and towards investment by private units. The transition from a 3 percentage point lead of SOSCUs over private units to an 18 percentage point lead of private units over SOSCUs has been particularly dramatic, though some of the shift could possibly be attributed to the statistical breaks.

### C. Central vs. Local Investment

“Central” investment denotes investment by units, enterprises, administrative facilities, and administrative units subordinate to the Chinese Communist Party Central Committee, the National People’s Congress, and the State Council with its ministries, commissions, offices, and companies.<sup>29</sup> All other investment is “local:” all projects, enterprises, administrative facilities, and administrative units that are directly led and administered by provincial, municipal, and county governments with their relevant departments; “local” further includes “other” investment that is not subordinate to any of the above government tiers (and also covers foreign investment).<sup>30</sup>

The central share in FAI declined from 13.3% in 2003 to 4.7% in 2015 (NBS database). I.e., the center now accounts for less than one-twentieth of FAI. The biggest share of FAI, 95.3%, is “local.”

A more detailed breakdown of local investment is available for “investment, except by rural households.” Economy-wide, in 2015, the various tiers accounted for the following

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<sup>27</sup> The share of private units in FAI (rather than “investment, except by rural households”) is likely even higher, since investment by rural households should by definition be private.

<sup>28</sup> The SOSCU share drops significantly between 2009 and 2011, the period of statistical breaks. It is unclear, how much of this drop is due to (i) a higher minimum size requirement for inclusion in these investment statistics (probably affecting private units, with likely smaller investment, more negatively than SOSCUs), (ii) the switch in the coverage of these investment statistics from urban investment to “investment, except by rural households” (newly including likely private investment by non-farm-household rural enterprises and rural administrative facilities and institutions, favouring the private unit share), and (iii) the relative growth of investment by private units vis-à-vis investment by SOSCUs in the absence of statistical breaks.

<sup>29</sup> For the definition see the NBS database [http://www.stats.gov.cn/tjsj/zbjs/201310/t20131029\\_449538.html](http://www.stats.gov.cn/tjsj/zbjs/201310/t20131029_449538.html), accessed 31 January 2017. It also gives examples of such units, such as the NBS local survey teams (directly subordinate to the NBS), the Industrial and Commercial Bank of China, China Telecom, and PetroChina.

<sup>30</sup> The source does not mention Party organs or people’s congresses in its definition of “local,” but presumably these are included.

shares of investment: center 5%, province 4%, municipality 8%, county 17%, and “others” 65% (Figure 7). I.e., two-thirds of all investment is undertaken by a unit that is not subordinate to any government tier.

Central investment has a relatively high share in mining, utilities, and transport; provincial investment particularly in transport; municipal investment also in transport and then across all tertiary sectors; and county investment in construction, transport, “water conservancy, environment, and public facilities,” education, health, and public management. I.e., investment subordinate to governments tends to be focused on public goods sectors where one would expect a relatively high share of government involvement, ranging from transport to education, health, and public management. The center’s 21% share in mining may largely be a historical remnant, with land a key state resource, while the center’s 21% share in utilities may reflect projects such as the nationwide electricity grid and gas supply.

“Other” investment is the dominant form of investment in more than half of all first-digit sectors (Figure 7), in particular in manufacturing (where it accounts for 87% of investment) and real estate (69%), which are also the largest sectors by investment volume (56% of FAI). “Other” investment also accounts for approximately three-quarters of investment in agriculture, trade, leasing, science, and household services. The share of “other” investment is lowest in transport (29%), education (34%), and public management (34%).

The allocation of investment across sectors varies among the different types of units (Figure 8). Central units concentrate their investment in utilities (21%) and transport (31%). Provincial units also concentrate their investment in transport (34%), and then in real estate (24%). Municipal and county units concentrate their investment in “water conservancy, environment, and public facilities” and real estate, with further percentages in the teens in transport and manufacturing. Two-thirds of “other” investment is in manufacturing (43%) and real estate (24%). Again, investment by units subordinate to governments appears to target sectors where one would expect some government involvement; provincial, municipal, and county tier units dabbling in real estate likely serves as a means of improving local government finances.

Across sectors, central investment is highly correlated with provincial investment (Pearson correlation coefficient of 0.93), and correlated to continuously decreasing degree with municipal, county, and then “other” investment (other: 0.27). The same pattern holds for the correlation between provincial investment and municipal/county/“other” investment, and finally municipal investment (vs. county, “other”). This gradation in correlation also suggests the existence of certain central state (and then provincial, and municipal) investment

prerogatives, which weaken the further one moves down the state hierarchy and finally to units not subordinate to state organs.

Overall, the extremely low share of central investment in FAI of 4.7% suggests that the central government's direct impact on investment, via units subordinate to the central government, is small. Implementing central policies via provinces, and then municipalities and counties, faces three problems: (i), the transmission may not be flawless (lower-level governments may have no interest in implementing central policies); (ii) the province's share in investment is limited, too (4.3% of "urban" investment in 2015); and (iii), although the investment shares of municipality and county are slightly higher (8.5% and 17.3%), these tiers are furthest removed from the center (least likely to respond to unfavorable central policies), and, furthermore, among all four tiers of the state, have a stronger presence in tertiary sectors such as education, health, and public management that are less likely the subject of industrial policies. Finally, independent of government tier, units subordinate to a government typically do not operate by discretionary government orders, but operate quite independently. I.e., central government industrial policies are unlikely to be implemented via direct central government investment decision.

## **V. Multivariate Analysis**

Given constraints of data availability, the detailed analysis in the following is based on urban investment prior to 2011, and then mostly "investment, except by rural households" since 2012 (or "urban" investment in short, to cover both periods).

### **A. Sector times Ownership**

Relatively comprehensive ownership data at the second-digit sector level are available for the years 2008–2015 for "urban" investment, covering domestic investment with the three sub-categories of SOSCUs, COUs, and private units (with data on the sub-categories available starting 2008), and then "Hong Kong, Macau, and Taipei,China" units (HKMTUs) and foreign-funded units (FFUs). The domestic investment category also includes an implicit residual, on which no information is provided. It could comprise individual-owned units and/or shareholding units, or reflect an inability of the NBS to properly classify some units.

Examining annual investment patterns between ownership and first- and second-digit sectors (using Pearson correlation coefficients, Appendix 7 and Appendix 8), the following three conclusions emerge:

- No particular ownership form allocates an over-proportional share of its annual investment to fast-growing sectors.
- In 2008–2010 (only), fast-growing first-digit sectors tend to be characterized by an over-proportional share of investment by COUs and, to a lesser degree, private units, and by an under-proportional share of HKMTUs and FFUs.<sup>31</sup> At the second-digit sector level, the results are weaker, and disappear in 2010.
- If investment in any one sector in one of the two periods 2008–2010 or 2012–2015 grows fast, investment by all individual ownership forms in that sector in that period also grows fast (particularly strongly so for SOSCUs at the first-digit sector level), except for FFUs, which exhibit only a weak correlation at the first-digit sector level and none at the second-digit sector level, and except for HKMTUs in 2012–2015 with only a weak correlation at both first- and second-digit sector level.

In the medium run, over several years, this suggests a certain degree of domestic herd behavior in that all ownership forms increase their investment in the same sectors of fast-growing investment.

The fact that clear ownership patterns across sectors are hard to find suggests a closer look at individual sectors, which in the following is done for the years 2012 and 2015. Figure 9 illustrates the relative size of investment in the 19 individual first-digit sectors, and within each sector by ownership, for 2015. The earlier noted concentration of investment in a very few sectors—manufacturing, real estate, transport, and “water conservancy, environment, and public facilities”—is immediately apparent, but also the extent of private investment in manufacturing and in real estate, and the concentration of HKMTU and FFU investment in manufacturing and real estate. There are no drastic changes between 2012 and 2015 and the 2012 figure is omitted.

Figure 10 presents the same data, for 2015, in form of ownership percentages within each sector, providing a clearer picture of the ownership distribution of investment in sectors with relatively low investment. (The 2012 patterns are similar and the 2012 figure has been

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<sup>31</sup> Perhaps investment by HKMTUs and FFUs is not over-represented in the fastest-growing sectors because the fastest-growing sectors tend to be tertiary sectors, where foreign access is likely more limited. But while that is true for FFUs, it is not true for HKMTUs. In the three years 2008–2010, 56-57% of domestic investment went to the tertiary sector, compared to 52-54% of HKMTU investment (and 33-35% of FFU investment).

omitted.) Private investment is dominant across half of all sectors, and increasingly so over time.<sup>32</sup> It is particularly strong in manufacturing, trade, hotels and catering, real estate, leasing, science, and household services.

In manufacturing, SOSCUs in 2015 accounted for only 7% of investment, while private units accounted for 78%. Investment by SOSCUs, as a share of a sector's investment, however, is still strong in utilities, construction, transport, information technology, finance, public facilities, education, health, culture, and public management.<sup>33</sup> Investment by COUs is spread across all sectors, in slightly diminishing form over time, and accounting for 4% of economy-wide investment in 2015. Small shares of investment by FFUs are present across two-thirds of all sectors—though not (or only minimally) in the sectors construction, transportation, public facilities, household services, education, health care, and public management—while investment by HKMTUs is slightly more dispersed (and with a relatively lower proportion in manufacturing).

The analysis can be continued in similar fashion at the second-digit sector level, quickly leading to an overload of sectors and charts. A pattern that emerges for second-digit sectors is that private units play a dominant role except in traditional state monopoly sectors, of which some second-digit sectors can be found in almost every first-digit sector. For example, in the first-digit sector mining, SOSCUs account for more than 90% of investment in the (second-digit sector) extraction of petroleum and natural gas. In the first-digit sector manufacturing, SOSCUs account for 80% of the manufacture of tobacco. In the first-digit sector information technology, SOSCUs account for 80% of telecommunication, radio and television and satellite transmission services. In the first-digit sector “water conservancy, environment, and public facilities,” SOSCUs account for 60%–85% of investment across all second-digit sectors. If state monopoly sectors (whether natural monopolies or state policy monopolies) were omitted from the analysis, the private sector's share of (the remaining) investment would be yet higher.

The more dis-aggregated data show FFU investment to be highly concentrated in a very few sectors. But even in highest-concentration FFU sectors, such as automobile

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<sup>32</sup> Economy-wide, private investment accounted for 48.5% of investment in 2012 and for 50.6% in 2015. In 17 out of the 19 first-digit sectors, private investment's share in sector investment increased between 2012 and 2015 (it fell by 1% in real estate, and by 7% in public management), and it increased in 76 out of 93 second-digit sectors (where none of the decreases are of significant size).

<sup>33</sup> SOSCUs account for 24% of investment in agriculture in 2015, reflecting large investment shares (based on second- to fourth-digit sector data) of the state in staples, sugar, tobacco, forestry, and agricultural services (including irrigation, and fire prevention in forests).

manufacturing, computer manufacturing, or “other financial activities,” FFUs do not account for more than 15% of investment.

## **B. Investment and Profitability**

If investment patterns change in the direction favored by economic policy sometimes *before* specific economic policies have actually been issued, one wonders to what extent factors other than economic policy affect investment. A prime competing explanatory variable is profitability. Perhaps investment in the PRC simply follows market forces. Economic policy, ex-post, then, puts its imprimatur on market-driven developments.

Investment data and profitability data can be matched, with some caveats, for industry. What is available for industry is (limited) balance sheet and profit and loss account data for the above-norm industrial enterprises, a set of enterprises that accounts for approximately ninety percent of industrial value-added and half of industrial employment.<sup>34</sup> If one assumes that the profitability of the above-norm industrial enterprises in a particular sector is representative of the profitability of all industrial enterprises in that particular sector, and that investment in industrial sectors is exclusively conducted by industrial enterprises, then the two datasets can be combined, using data at the fourth-digit sector level. Profitability is defined as return on equity (total profit divided by equity), or, alternatively, return on assets.

As of early 2017, fourth-digit sector level industry data are available for 2012 through 2014. Fourth-digit sector level investment data are available for 2003 through 2015 except for 2013. The analysis examines to what extent investment growth between 2012 and 2014 can be explained by profitability.

A number of control variables are included: sales growth, price changes, ownership structure, and investment per employee. Sales growth and price changes represent market demand, with changes in market demand potentially triggering changes in investment. Price changes for an enterprise’s products could not only signal changes in market demand, but also changes in input prices, but input price data by sector are not available. Different ownership forms may exhibit different investment behavior; the available ownership data in the fourth-digit sector level industry data are for ownership shares in paid-in equity in the specific fourth-digit sector. All variables discussed so far are measured in percent. In

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<sup>34</sup> Above-norm industrial enterprises are industrial enterprises with annual revenues from principal business above (since 2011) CNY20 million.

addition, a measure of investment per employee (CNY per employee) is included to control for capital intensity of a sector.

Sales growth data are for 2013 vs. 2012. With investment growth measured for the period 2012–2014 (in the absence of fourth-digit sector level 2013 investment data), a preferred sales growth measure might cover the period 2012 vs. 2011, but 2011 industry fourth-digit sector level data are not available. Price changes are also for 2013 vs. 2012; the second-digit sector price data according to the sector classification system GB2011 start in 2012. For consistency, the ownership data then are for 2013, too. Data on investment per employee can only be constructed for 2014 as the 2012 industry data do not report employment values (and no 2013 investment values are available).

Table 3 reports the OLS regression results. The first regression of investment growth on return on equity (RoE) for the 194 third-digit sectors with data shows that profitability matters. The return on assets (RoA) in the second regression is even more significant. Given the absence of a clear criterion for choosing one measure of profitability over another and the in some sectors vast divergence between equity and “paid-in equity” (raising questions about the precise meaning of return on equity), the subsequent regressions focus on RoA. The third and fourth regression repeat the second regression for all fourth-digit sectors, and then for all fourth-digit sectors (490 observations) plus those third-digit sectors for which no fourth-digit sector data are available (567 observations). Profitability, invariably, significantly explains investment growth.

Continuing with the 4<sup>th</sup>-digit sector plus relevant 3<sup>rd</sup>-digit sector data (maximum 567 observations), adding sales growth, in the fifth regression, shows that sales growth is an important explanatory factor for investment growth. Market demand thus has an impact on investment growth. Price changes have no significant impact (sixth regression); perhaps price changes are too ambiguous a measure since they potentially also capture input price changes.

Ownership shares do not seem to matter (regressions seven and eight). Relative to state ownership, individual ownership (but not private ownership)—presumably referring to sole proprietorships, a very small ownership category by investment volume—may have a positive influence on investment growth, as does HKMT ownership (but not foreign ownership). Relative to all non-state ownership forms, state ownership may have a slightly negative impact on investment growth (significant at the 10.0% significance level). These influences are very weak.

Dropping the ownership variables and adding investment per employee (ninth regression) suggests that investment per employee has a highly significant impact on investment growth.



I.e., the higher the capital-intensity in a sector, the higher investment growth, which in turn suggests that investment in the PRC in 2012–2014 favors a greater bifurcation of investment concentration towards sectors with higher capital-intensity. Focusing solely on third-digit sectors (tenth regression), these results only become stronger.

The explanatory power of the regressions (as measured by the  $R^2$ ) is low throughout. Variation in the explanatory variables typically explains between one and three percent of the variation in investment growth. Only when the analysis is limited to the third-digit sectors, in the tenth regression, does the explanatory power rise to 21%. The fact that the fit increases drastically when the number of observations is reduced to the third-digit sectors suggests that sector-specific characteristics have large explanatory power. This could be due to various factors from product cycles to barriers to market entry and government policies.

The findings lead to the following conclusions: profitability, market demand, and capital intensity exert a positive influence on investment growth in 2012–2014, while ownership hardly matters. For both profitability and market demand, a one-percentage point increase in profitability or in sales results in one-half to one-percentage point faster investment growth. In terms of standard deviations (across fourth-digit sectors plus those third-digit sectors which do not have fourth-digit sector data), a one standard deviation increase in RoA, sales growth, or investment per employee yields increases in investment growth (using the coefficients of the ninth regression) of 6.0, 8.0, and 7.6 percentage points. This compares to an average investment growth rate in 2012–2014 of 43.9%.

## **VI. Cumulative Monthly Investment Data, 2016**

As of early 2017, annual data for 2016 are not yet available. The NBS database provides cumulative monthly investment data for first-digit sectors and for a typically incomplete set of second-digit sectors within some but not all first-digit sectors. It also provides cumulative monthly investment data by ownership form. To extend the analysis beyond the available (and more complete) annual data that reach through 2014 and 2015, this section examines cumulative monthly December data for 2015 and 2016.<sup>35</sup> The data, while not further labeled

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<sup>35</sup> Shorter-term analysis would appear inappropriate as already the quarterly year-on-year growth rates are very variable. For example, investment in repair services for metal products, machinery and equipment repair grew 41% year-on-year in the fourth quarter of 2016, but fell 11% in the full year 2016.

in the source, likely cover “investment, except by rural households.”<sup>36</sup>

## A. By Sector

Figure 11 shows the first digit-sector distribution of cumulative monthly December 2015 investment, i.e., of annual 2015 investment as captured by the cumulative monthly data. Unchanged from 2012, manufacturing and real estate still account for more than half of all investment, followed by environment and transport. Added into the chart are the year-on-year first-digit sector growth rates of cumulative monthly December investment (i.e., investment in January through December 2016 compared to investment in January through December 2015). Growth rates are highest in tertiary sectors, at 31% for leasing and between 15% and 25% for information technology, science, public facilities, education, health and culture. This compares to a growth rate of economy-wide investment of 8%. The growth rate of investment in mining is –20%, in finance –4%, and in and construction –7%. Investment growth in manufacturing is 4%. In agriculture, it is 19%.

In manufacturing, a broad range of light industry sectors, and also medicines, experiences on the order of ten percentage points investment growth, while investment in heavy industry stagnates (Figure 12). Investment growth is fastest for “computers, communication and other electronic equipment” (16%) and “electrical machinery and apparatus” (13%). In the first-digit transport sector (no chart provided), investment rises by 21% in air transport; in the first-digit sector “water conservancy, environment, and public facilities,” investment in environment grows by 40%.

The 2016 investment patterns offer a mixed picture regarding the implementation of the various industrial policies (Table 1): investment in mining fell (but that includes a 32% fall in investment in oil and natural gas extraction, a sector favored by the Thirteenth Five-Year Plan); investment in light industries, including medicines, rose; investment in heavy industry stagnated; investment in the sector electrical machinery and apparatus in 2016 rose 13% but investment in general purpose machinery and in special purpose machinery fell 2% and 3%; investment in the automobile industry (where policy promotes the development of electric vehicles) only rose 4%; investment in the manufacture of computers, communication, and other electronic equipment rose 16%, and in the information technology service sector 15%;

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<sup>36</sup> The cumulative December values of 2013, 2014, and 2015 fall short of the corresponding FAI values by 2.2%, 2.0%, and 1.9%, and they exceed the corresponding values of “investment, except by rural households” in 2013 and 2014 by 0.2% and 0.1%, while they are equal in 2015.

investment in agriculture grew 19%; investment in air transport services rose 21% but investment in rail services stagnated while investment in the “manufacture of railway, ship, aerospace and other transport equipment” fell 9% and investment in water transport services fell 8%; investment in the production and supply of electricity grew 12%, but investment in the production and supply of gas decreased 8%; investment in science grew 17%. Overall, many of the sectors favored by industrial policies experienced solid investment growth, but several did not. This suggests that other factors, such as demand factors, likely play an important role.

Four sectors experienced high investment growth in 2016 without representing sectors or products targeted by industrial policy: leasing (31%), education (21%), health (21%), and culture (16%). While growth in investment in leasing and culture may reflect market developments, investment growth in education and health likely derives from other government priorities that do not fit into policies such as “Made in China 2025.”

## **B. By Ownership**

An ownership breakdown is available following the methodology used in the FAI statistics (the source refers to “enterprises” rather than “units”), with an SOSCU data point provided separately. SOSCUs accounted for 32% of investment in 2015 and experienced a 19% investment growth rate in 2016 (Figure 13). The ownership category with the fastest-growing investment is the category of limited liability companies at 36%; its sub-category solely state-owned limited liability companies exhibits a 155% growth rate. The officially labeled private enterprises accounted for 31% of investment in 2015 and their investment grew 12% in 2016. Investment by “Hong Kong, Macau, and Taipei, China” enterprises and foreign-funded enterprises grew 19% and 12%.

The pattern of investment growth across ownership forms in 2016 suggests somewhat of a reversal of the earlier 2012–2015 pattern in that investment growth in state-owned and state-controlled enterprises (SOSCEs) exceeds that in (an incomplete measure of) private enterprises, although investment by private enterprises still grew faster than the economy-wide average. These findings warrant further examination.

Table 4 provides detailed data on ownership shares in annual investment in comparison to ownership shares in cumulative monthly December values. Cumulative monthly December investment of the years 2011–2015 is equal to 97%–98% of annual FAI values; in the years 2006–2010, the percentages are 85%–87%, reflecting the likely “urban” coverage of the

cumulative monthly data. Since 2011, the individual ownership shares in the two sets of data match reasonably well, except for sole proprietorships, which in 2015 accounted for 2.2% of FAI but for only 0.4% of cumulative monthly December investment; the rationale for the difference is probably the fact that FAI also captures rural households, which may contain a good number of sole proprietorships.

As of early 2017, for 2016 only cumulative monthly December values are available, not annual values. The share of SOUs in investment falls significantly from 25.3% to 21.8% in 2016, while the share of private units in investment increases from 31.1% in 2015 to 31.5% in 2016. However, the SOSCU share rises significantly from 32.4% to 35.7%, and a measure included in the monthly statistics (starting 2012) but not in the annual statistics through 2015, labeled “non-state” investment (*minjian*), falls from 64.2% of investment to 61.2% in 2016.

Examining the data reveals that “non-state” investment simply refers to domestic investment less SOSCU investment, in deviation from the (erroneous) “private” ownership interpretation often found in the media and indicated by the Chinese term. The NBS likely adopted the term “non-state” from government policies such as the Twelfth Five-Year Plan (section II.C, above), to distinguish between the state and everything else.

The fall in the non-state share in investment matches a halving of the investment share of COUs (–1.3 percentage points), a 0.9 percentage point reduction in the shareholding share, and a 1.7 percentage point reduction in the residual share “others,” with as counterpart a more than doubling of the investment share of solely state-owned limited liability companies (part of the SOSCUs) from 2.4% to 5.6%. The size of these changes stretch credulity, as does the decrease in the SOU share from 25.3% to 21.8% even while the share of the larger SOSCU ownership category, of which the SOUs are a subset, rises from 32.4% to 35.7% (are some SOUs reclassified as companies?). This suggests either definitional changes to the individual ownership categories in 2016, or a major data correction. As a consequence, the changes in the shares of the SOSCU and non-state categories in 2016 should not be further interpreted.

In sum, the often reported retreat of the private sector from investment in 2016 can by definition not be deduced from the non-state data, and the opposite finding holds for investment by “private units.”<sup>37</sup> A comparison of SOSCU and non-state data of 2016 vs.

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<sup>37</sup> The *perceived* reduction in the share of private investment has Lardy and Huang (2016) venturing that the receding share of the private sector is due to a reclassification starting 2016 of some stock companies as state vs. privately controlled, following the PRC government’s intervention in the stock market in the summer of 2016 (which may have tipped the balance of the dominant or controlling ownership form towards the state in some companies). Kuijs (2016) suggests that as part of the restructuring of local government financing vehicles, some of their investments were reclassified from “private” to “state controlled;” he also considers the possibility that the data for private FAI growth experienced a correction but overall FAI growth did not.

2015 is likely not permissible due to what appear definitional changes in these series in 2016, compared to previous years.

## **VII. Conclusions**

The PRC's high investment rate is often viewed as a sign of imbalances. But a shift in the sector composition of investment is well underway. Recent years have seen a decline in investment in mining, stagnating investment in heavy industry, and growing investment in light industry, agriculture, and most of the tertiary sector (which attracts more than half of investment, a share that is increasing). Investment growth is fastest in some of the, by investment volume, smallest sectors, suggesting a gradual deepening of the economic structure rather than a process of specialization

Private investment has come to account for just over half of all investment. Only in a few, small sectors do state units still play a dominant role, perhaps not astonishingly in utilities, transport, public facilities, education, health, and public management. To the extent that this investment occurs in state-owned enterprises which compete with private enterprises for public sector projects, such investment is already open to private units. The dominant role of state units in investment in information technology, finance, and culture suggests some scope for further liberalization.

In some sectors with a high state share in investment, this outcome may reflect a lack of interest by private units, perhaps given the extent of regulation or certain levels of uncertainty, including policy uncertainty. For example, private initiative in the health sector may be officially encouraged, but private investment in hospitals can be held back by doctors being reluctant to move from state to private hospitals. Thus, ownership and regulation, policy environment, and institutional framework cannot be viewed separately, and a full understanding of the reasons behind a certain share of the state in investment in a particular sector requires sector-specific studies.

Emphasis on ownership form may also be misguided if the public sector or state-owned enterprises, once all externalities are considered, operates as efficiently as non-state units. The regression analysis suggests that, at least in industry, investment growth is driven by factors other than ownership.

Recent alarmist reporting on a relative decline of private investment and an increase in state investment in 2016 is false. The share of properly defined private investment in total

investment continued to increase in 2016, while the state share exhibits a statistical break, the reasons for which are not known (in all likelihood, reclassifications).

Across specifically manufacturing second-digit sectors, state-owned and state-controlled units by 2015 accounted for only 7% of investment, while private units accounted for 78%. The share of state-owned and state-controlled investment is high only in natural and state policy monopoly sectors. Foreign-funded investment is high only in a very few sectors (automobile manufacturing, computer manufacturing, “other financial activities”) and never exceeds 15% of investment in any one sector. This suggests that the PRC today, unlike in the past, has a very strong core of domestic investment that does not depend on state-led investment projects or on foreigners. I.e., what is driving economic growth in the PRC economy today is not the state, nor foreigners, but a solid manufacturing base that likely, given the ownership structure, resembles a market economy. That, together with the deepening of the economic structure suggest a transition away from any state-driven heavy industry biased growth model.

The PRC government plays a historic role in directing investment dating back to the early 1950s. Today, units subordinate to the central and local governments account for only 5% and 30% of investment, while all “other” investment is undertaken by units not subordinate to any government tier. I.e., the implementation of central government industrial policies in the area of investment faces increasing challenges: the share of centrally controlled investment is very small and locally controlled investment may not follow central government orders. Much of investment can probably only be influenced through regulation and incentives. Central government industrial policies appear to follow sector investment trends more than shaping them.

The high degree of sector-specific characteristics in determining investment growth of individual sectors implies significant sector idiosyncrasies. Detailed sector-specific studies may shed more light on what is driving investment in individual sectors. In the meantime, it would appear to be a promising finding that profitability and market demand play the crucial roles in driving sector investment growth that they do. The observed investment outcome is an amalgam of market forces, sector-specific characteristics, and industrial policies, likely in this order of importance.

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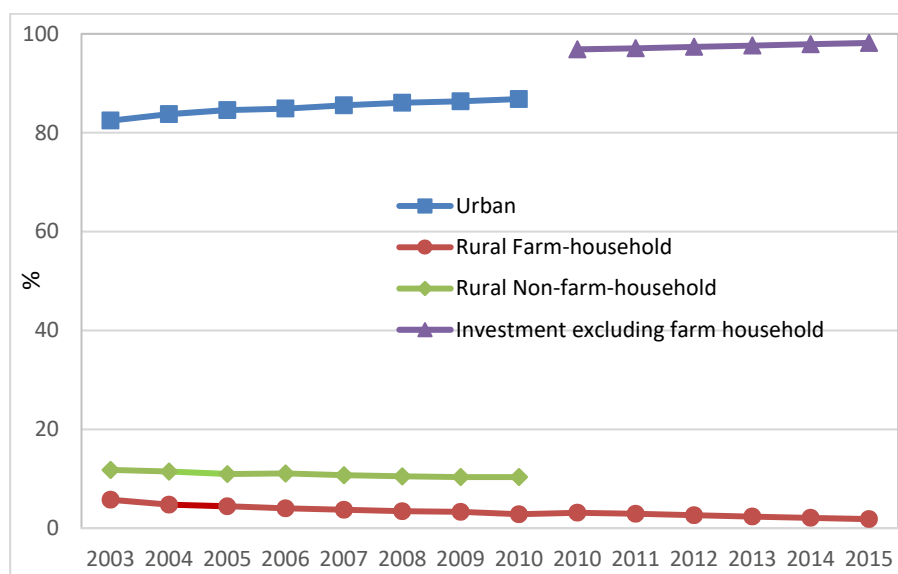
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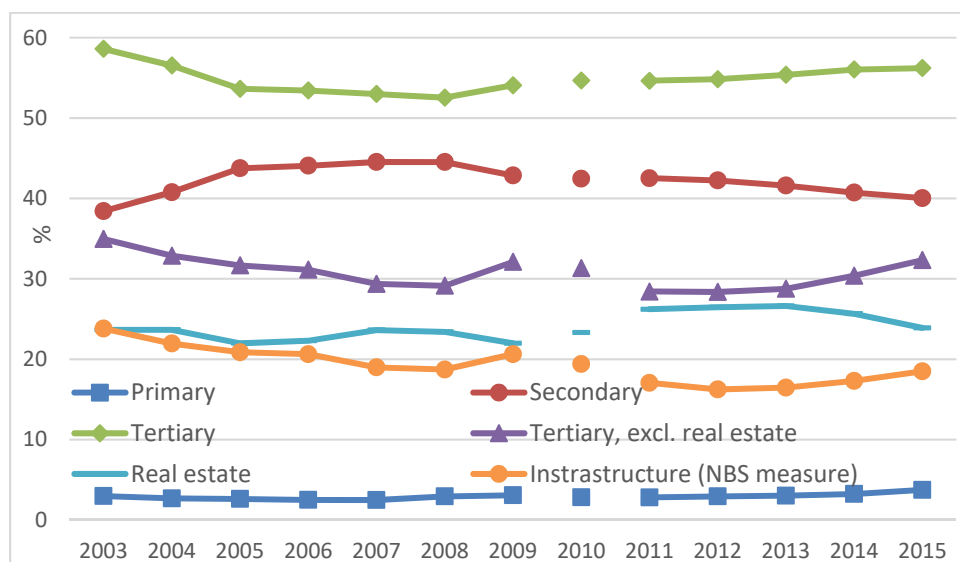
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**Figure 1: Composition of Fixed Asset Investment (shares in %)**



Sources: *Statistical Yearbook 2011*, p. 144; *Statistical Yearbook 2016*, Table 10-2.

**Figure 2: Sector Investment Shares 2003–2015 (%)**



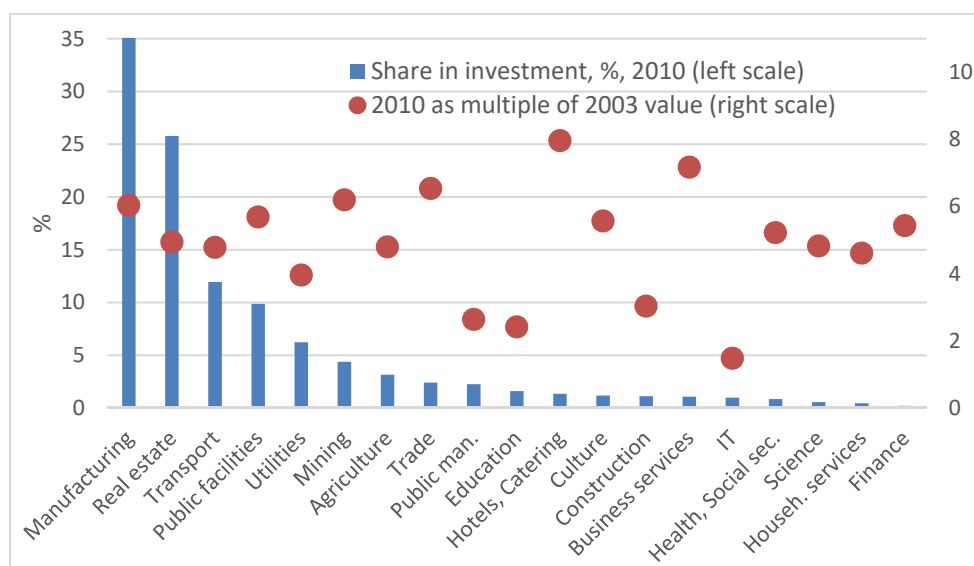
Notes:

The size criterion for urban investment increased from CNY500,000 to CNY5 million in 2010, the coverage of investment subject to the size criterion changed in 2011 from urban to “investment, except by rural households,” and the sector classification system changed in 2012 (which should not affect any of the shares).

The share of infrastructure in investment is based on data on urban investment (and “investment, except by rural households”), following NBS practice. Infrastructure investment is the sum of investment in most sub-sectors of transportation (rail, road, water, air, pipeline), information technology, and public facilities’ sub-sectors.

Source: NBS database (economy-wide values).

**Figure 3: Sector Investment Shares and Growth Rates, 2003–2010**

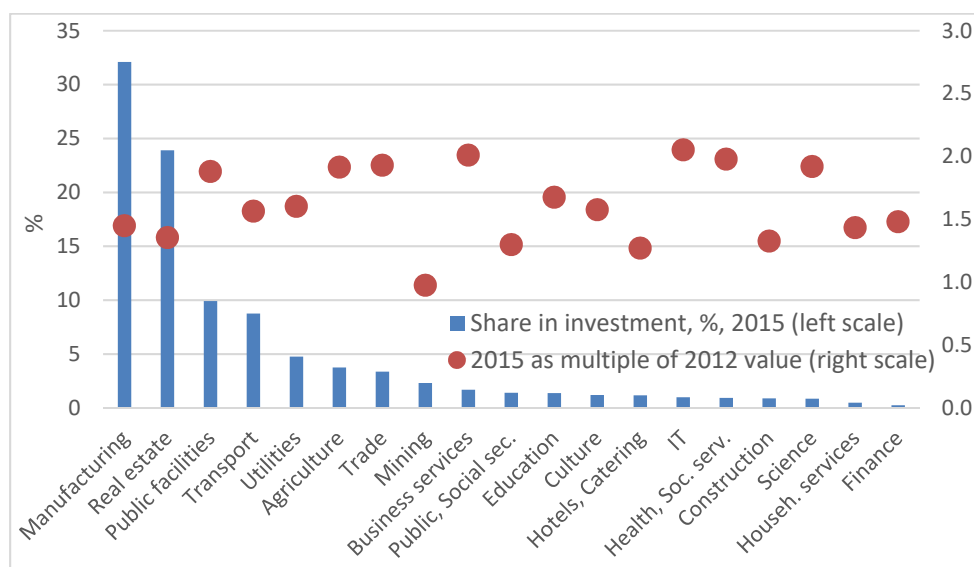


IT: information technology.

Note: Except for real estate investment and rural (collective- and individual-owned) investment, the minimum size of investment projects to be included in the statistics is CNY500,000. The sector classification system, to judge by the sector labels, is GB2002.

Source: NBS database.

**Figure 4: Sector Investment Shares and Growth Rates, 2012–2015**



IT: information technology.

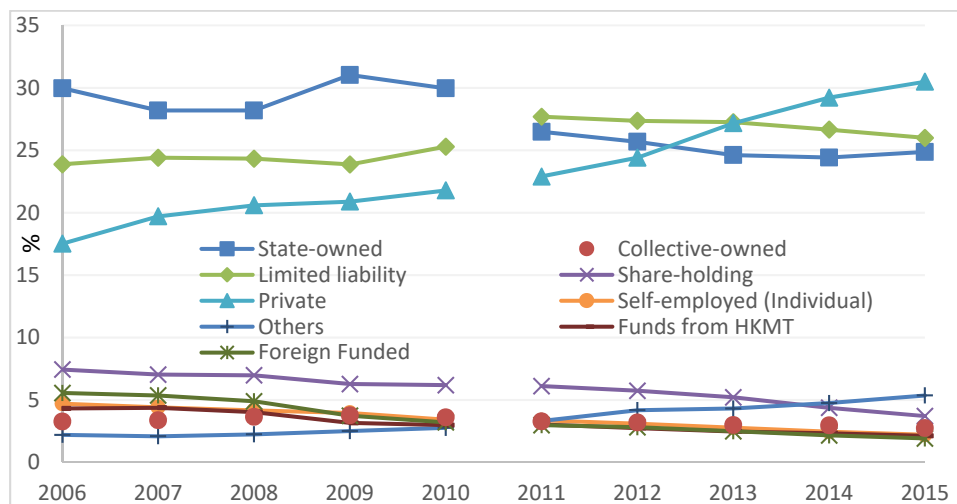
Notes:

Except for real estate investment and rural individual-owned investment, the minimum size of investment projects to be included in the statistics is CNY5 million.

The sector classification system, to judge by the sector labels, is GB2011. (The source includes data starting 2003 which are identical to the NBS database data available for 2003–2014 with sector labels for the NBS database data that reveal the use of GB2002; i.e., the source used here, *Statistical Yearbook 2016*, probably mis-labels the sectors of its 2003–2011 data, while the NBS database probably mis-labels the sectors of its 2012–2014 data.)

Source: *Statistical Yearbook 2016*, Table 10-6.

**Figure 5: Investment Shares by Ownership, FAI (%)**



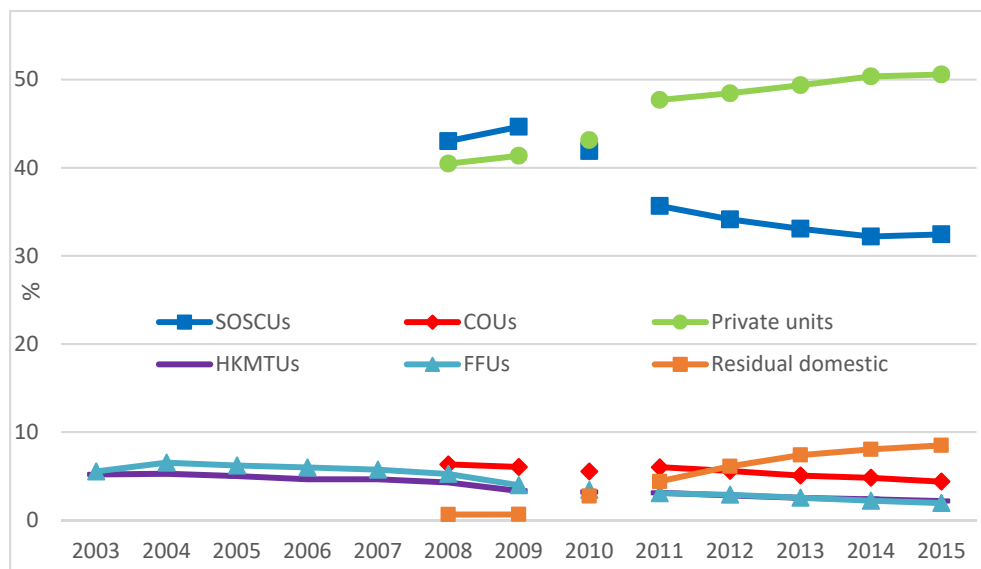
Notes:

In 2011, the size criterion for inclusion (of non-rural-household, non-real-estate investment) in the investment statistics increases from CNY500,000 to CNY5 million (and previously the size criterion did also not apply to rural collective-owned investment).

Two very small ownership categories are omitted from the chart because they never exceed 1% of the total: cooperative units and joint units.

Sources: NBS database (with annual data for 2006–2014); 2015: *Statistical Yearbook 2016*, Table 10-3.

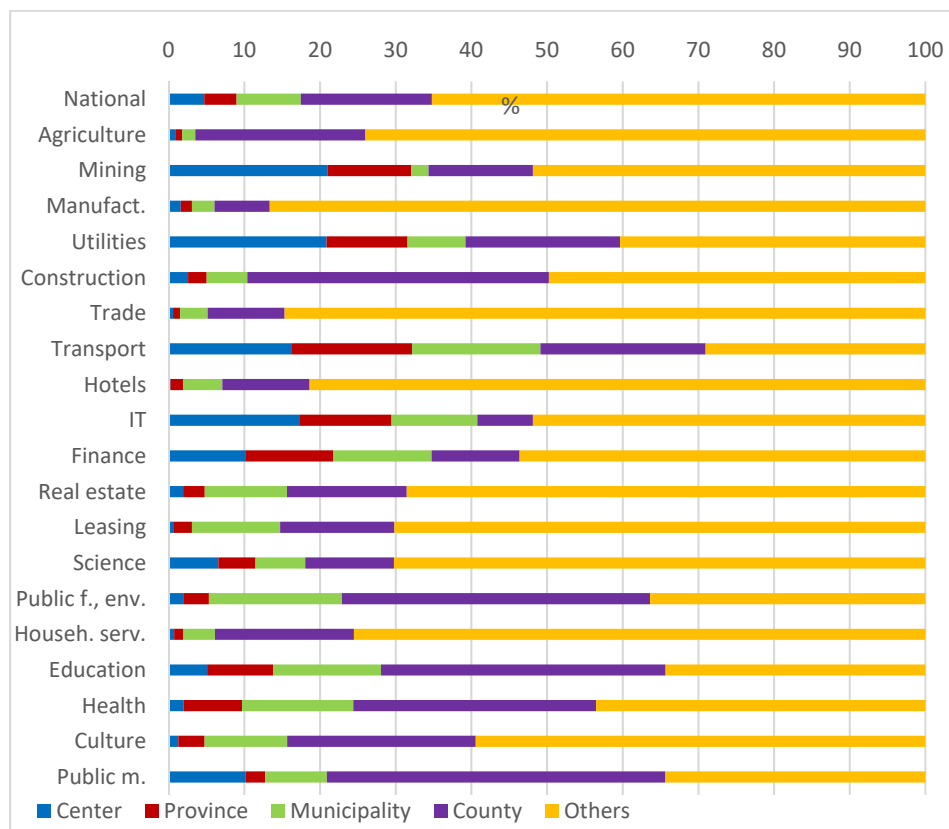
**Figure 6: Investment Shares by Ownership, “Urban Investment” (%)**



Note: In 2010, the size criterion for inclusion in urban investment increased from CNY500,000 to CNY5 million (the NBS retrospectively revised the 2010 data), and in 2011 the coverage switched from urban investment to “investment, except by rural households.”

Source: NBS database.

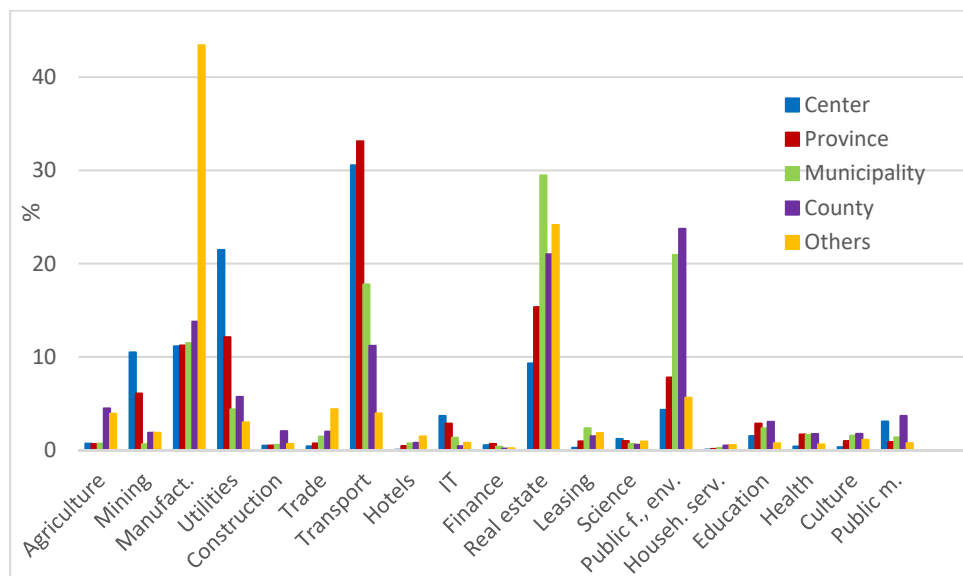
**Figure 7: Central vs. Local Shares in “Urban” Investment, 2015 (%)**



IT: information technology.

Source: *Investment Statistical Yearbook 2016*.

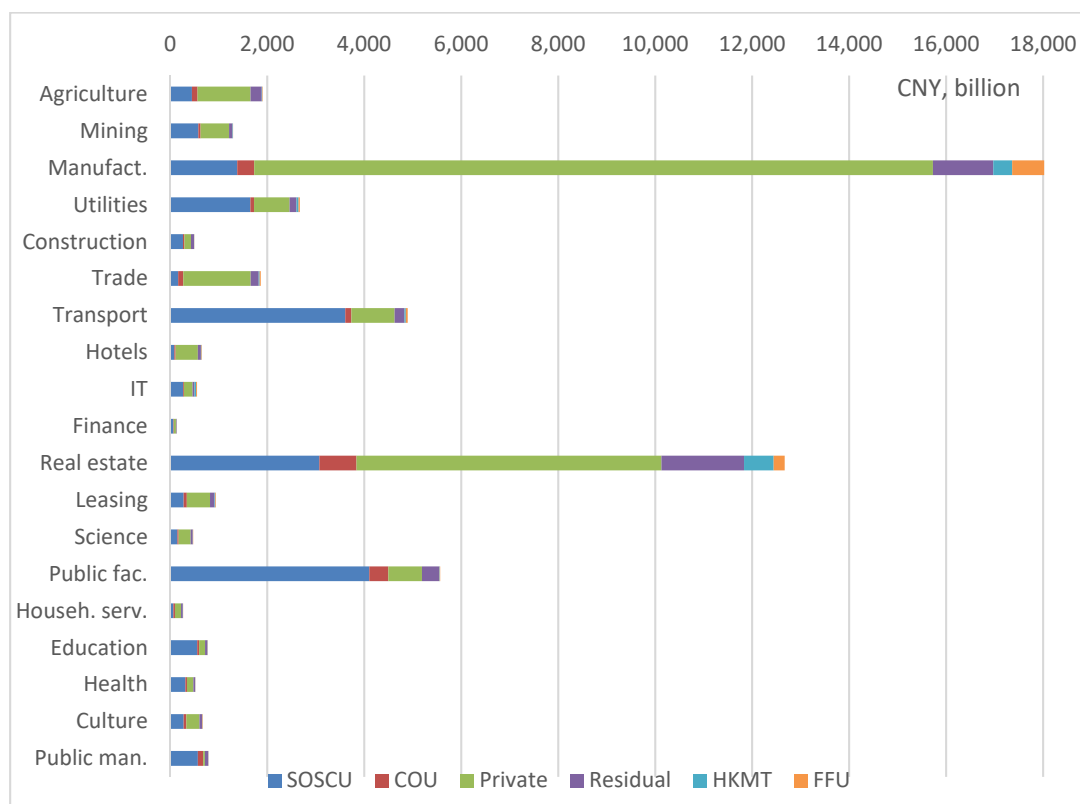
**Figure 8: Distribution of “Urban” Investment across Sectors by Investing Tier, 2015 (tier percentage share in sector investment)**



IT: information technology.

Source: *Investment Statistical Yearbook 2016*.

**Figure 9: Investment (Except by Rural Households) by Sector and Ownership, 2015  
(CNY, billion)**



IT: information technology.

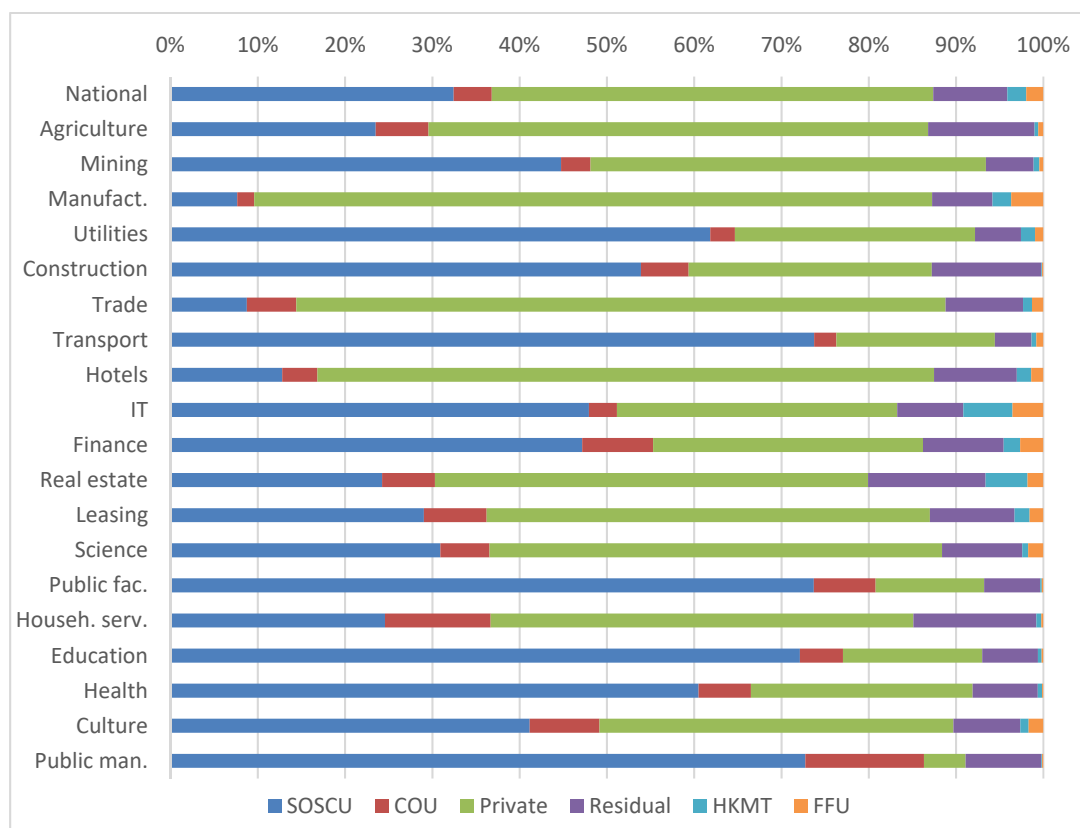
Notes:

“Residual” is the implicit residual obtained as domestic investment less investment by SOSCUs, COUs, and private units.

The unabbreviated sector labels are: Agriculture, Forestry, Animal Husbandry and Fishery; Mining; Manufacturing; Production and Supply of Electricity, Heat, Gas and Water; Construction; Wholesale and Retail Trade; Transport, Storage and Post; Hotels and Catering Services; Information Transmission, Software and Information Technology; Financial Intermediation; Real Estate; Leasing and Business Services; Scientific Research and Technical Services; Management of Water Conservancy, Environment and Public Facilities; Service to Households, Repair and Other Services; Education; Health and Social Service; Culture, Sports and Entertainment; Public Management, Social Security and Social Organizations.

Source: NBS database.

**Figure 10: Investment (Except by Rural Households) by Sector and Ownership, 2015 (%)**



IT: information technology.

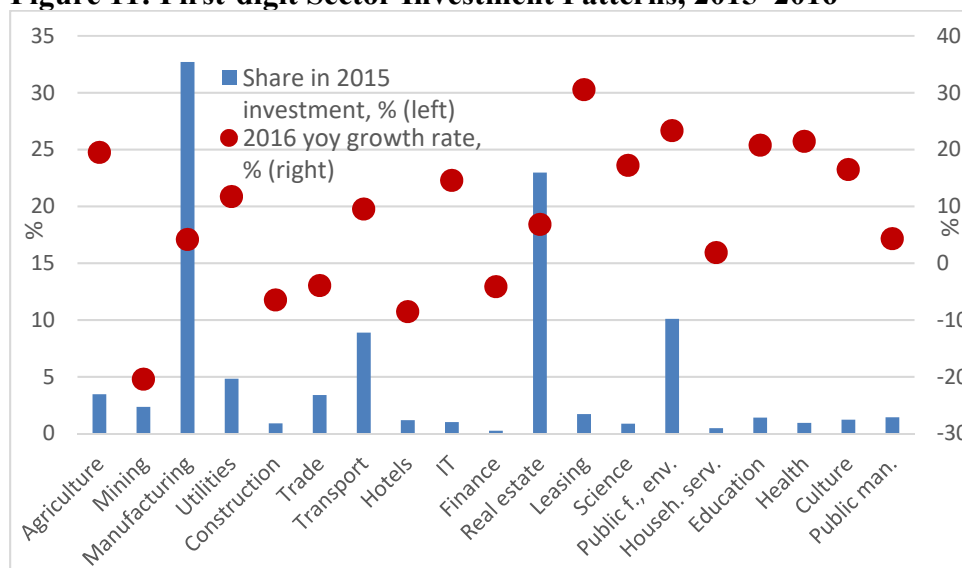
Notes:

“Residual” is the implicit residual obtained as domestic investment less investment by SOSCUs, COUs, and private units.

For unabbreviated sector labels see previous figure.

Source: NBS database.

**Figure 11: First-digit Sector Investment Patterns, 2015–2016**

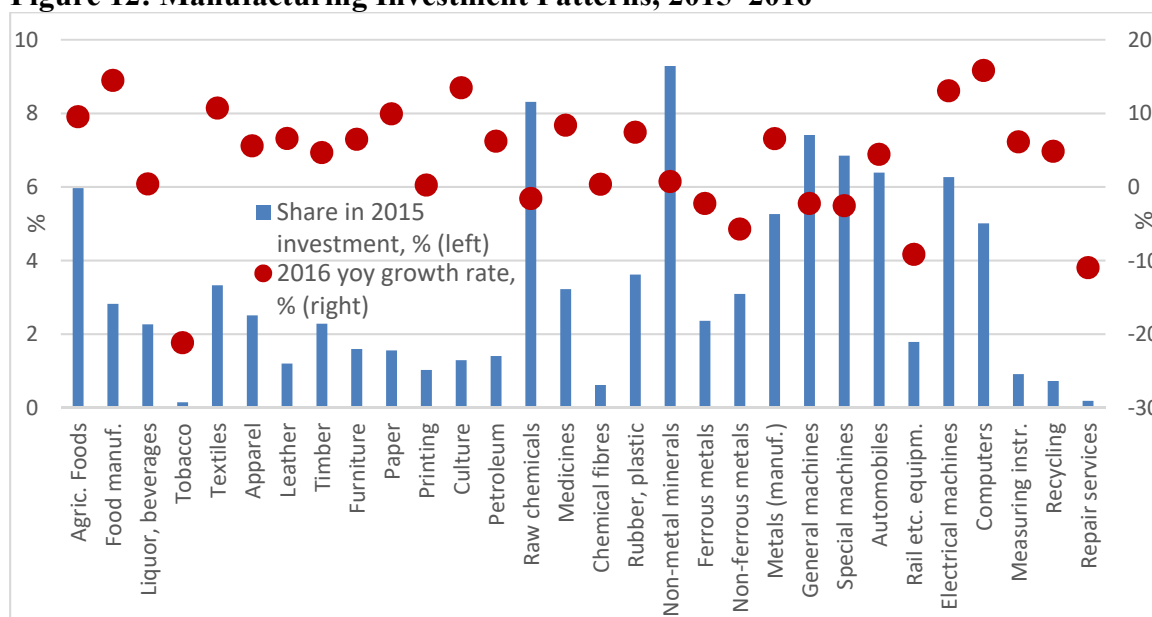


IT: information technology.

Note: 2016 data are cumulative monthly December values.

Source: NBS database.

**Figure 12: Manufacturing Investment Patterns, 2015–2016**



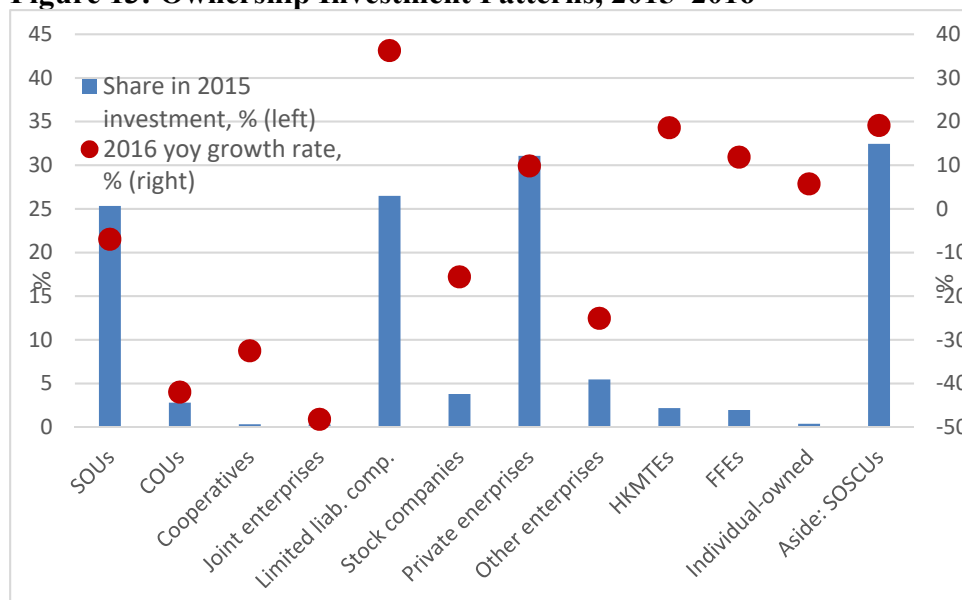
Notes:

2016 data are cumulative monthly December values.

The first-digit sector manufacturing also contains an implicit residual accounting for 1% of 2015 investment.

Source: NBS database.

**Figure 13: Ownership Investment Patterns, 2015–2016**



Note: 2016 data are cumulative monthly December values.

Source: NBS database.



**Table 1: Industrial Policy Summary**

Sector classification system (GB2011) Digit Name	Policy	A	B	C	D	E	F
<b>Primary sector</b>							
2	Fisheries			x			
<b>Secondary sector</b>							
2	Mining and washing of coal	Coal; Energy development			(-)	(-)	
3	Oil and natural gas exploration	Energy development				x	
2	Mining and processing of ferrous metal ores	Steel; Raw material industry adjust.			(-)	(-)	
2	Textile manufacturing	Textiles (high-tech, next generation)		x			
2	Textile and apparel	Light industry				x	
3	Refined petroleum products manuf.	Petrochemical industry			x		
2	Chemical Raw Materials and Products	Raw material industry adjustment				(-)	
2	Medicine manufacturing	Medicine; Medicine. medical devices	2009				x
3, 4	Glass fiber and ceramic products manufacturing (3); with sub-sectors (4)	Building materials (focus on glass, ceramics)			x		
2, 3	Smelting and pressing of ferrous metals	Iron and steel; Steel; Raw material adj.			x	(-)	(-)
2, 3, 4	Smelting and pressing of non-ferrous metals	Non-ferrous metals			x		
2, 3, 4	General purpose machinery (2); Special purpose machinery (2); Electrical machinery and apparatus (2); each with numerous sub-sectors (3, 4)	Machine building; High-end equipment manuf.; Equipment manuf. (twice); Numerical control tools & robotics	2006	x	x		x x
4	Agricultural and sideline food processing equipment manufacturing	Agricultural machinery					x
3	Special equipment manufacturing: Agriculture, forestry, animal husbandry, fishing special machinery manufacturing	Agricultural machinery					x
4	Special instrument manufacturing: Agriculture, etc. special instrument manufacturing	Agricultural machinery					x
4	Other motor-driven equipment manufacturing	Motor breakthrough				x	
3, 4	Motor manufacturing	Motor breakthrough				x	
3	Automobile manufacturing	Automobiles	2004, 2009		x		
3	Automobile manufacturing	New energy vehicles (twice); Energy saving and new energy vehicles		x	x		x
3	Railway transportation equipment manuf.	Railway equipment					x
2	Rail, shipbuilding, aerospace and other transportation equipment manufacturing— with missing aerospace sub-sector	High-tech industries				x	
3	Railway transportation equipment manuf.	Railway equipment					x
3	Shipbuilding and related equipment manuf.	Ocean engineering equipment					x
4	Electric light source manufacturing	Light industry			x		
3	Household electric appliance manufacturing	Light industry			x		
3, 4	Battery manufacturing (3); sub-sectors Lithium-Ion, Nickel-Hydrogen, and “Other” (4)	Battery technology			x		
4	Thermal / hydroelectric / nuclear power gener.	Energy development					x
3	Electricity production	Power equipment					x
3	Electricity supply	Energy development				x	
2	Gas production and supply	Energy development					x
<b>Tertiary sector</b>							
1, 2	Transportation (1); sub-sectors include loading/unloading and warehousing (2)	Logistics	2009				
4	Ocean freight and passenger transportation	Logistics				x	
2	Environmental management	Environmental protection technologies			x	x	
1	Information technology (services)	Information techn.; Next-generation inf. techn. (twice); High-tech industry	2009	x	x		x x
2	Air transport services	High-tech industries; Aerospace equip.					x x
2	Water transport (services)	Ocean engineering equipment					x
1	Real estate	Real estate				(-)	
1	Science	Same as information techn. (services)	2009	x	x		x x
4	Biotechnology extension services	Biotechnology (twice); Light industry			x	x	x
1	Culture, sports, and entertainment	Culture	2009				

Notes: The order of sectors follows the official sector classification system GB2011. Numbers in parentheses after sector labels denote the digit-level of the sector. Policies of two separate periods in one field are separated by a semi-colon.

A: pre-2010 industrial policies. B: Strategic emerging industries (2010). C: Twelfth Five-Year Plan (2011–15). D: Supply-side structural reform program (2015). E: Thirteenth Five-Year Plan (2016–20). F: “Made in China 2025” (2015).

Source: see discussion of industrial policies in text.

**Table 2: Second-Digit Sector Investment Growth**

	2008 /	2008 %	2010 /	2010 %		2012 %	2015 /	2015 %
<b>National Total</b>	<b>3.2</b>	<b>100</b>	<b>1.6</b>	<b>100</b>	<b>National Total</b>	<b>100</b>	<b>1.5</b>	<b>100</b>
<b>Agriculture, Forestry, Animal Husbandry and Fishery</b>	<b>4.2</b>	<b>1.5</b>	<b>1.7</b>	<b>1.6</b>	<b>Agriculture, Forestry, Animal Husbandry and Fishery</b>	<b>2.4</b>	<b>2.2</b>	<b>3.5</b>
Farming	3.3	0.3	2.1	0.4	Farming	0.9	2.5	1.4
Forestry	2.6	0.3	1.9	0.3	Forestry	0.3	1.9	0.4
Animal Husbandry	6.9	0.4	1.6	0.4	Animal Husbandry	0.6	2.2	0.9
Fishery	5.0	0.1	2.0	0.1	Fishery	0.1	1.7	0.2
Services in Support of Agriculture	4.9	0.4	1.6	0.4	Service in Support of Agriculture	0.5	1.9	0.6
<b>Mining</b>	<b>4.4</b>	<b>4.6</b>	<b>1.4</b>	<b>4.0</b>	<b>Mining</b>	<b>3.6</b>	<b>1.0</b>	<b>2.4</b>
Mining and Washing of Coal	5.5	1.6	1.6	1.6	Mining and Washing of Coal	1.5	0.7	0.7
Extraction of Petroleum and Natural Gas	2.8	1.8	1.1	1.2	Extraction of Petroleum and Natural Gas	0.8	1.1	0.6
Mining and Processing of Ferrous Metal Ores	13.6	0.5	1.6	0.4	Mining and Processing of Ferrous Metal Ores	0.4	0.9	0.2
Mining and Processing of Non-Ferrous Metal Ores	9.2	0.4	1.6	0.4	Mining and Processing of Non-Ferrous Metal Ores	0.4	1.1	0.3
Mining and Processing of Nonmetal Ores	9.2	0.3	2.3	0.4	Mining and Processing of Non-metal Ores	0.4	1.3	0.4
Mining of Other Ores	6.8	0.0	3.6	0.0	Support Activities for Mining	0.1	1.4	0.1
<b>Manufacturing</b>	<b>4.3</b>	<b>31.2</b>	<b>1.6</b>	<b>30.6</b>	<b>Manufacturing</b>	<b>34.1</b>	<b>1.4</b>	<b>32.7</b>
Processing of Food from Agricultural Products	5.1	1.4	1.8	1.5	Processing of Food from Agricultural Products	1.9	1.6	2.0
Manufacture of Foods	3.9	0.8	1.7	0.8	Manufacture of Foods	0.8	1.7	0.9
Manufacture of Beverages	4.1	0.6	1.5	0.6	Manufacture of Liquor, Beverages and Refined Tea	0.7	1.6	0.7
Manufacture of Tobacco	1.7	0.1	1.4	0.1	Manufacture of Tobacco	0.1	1.1	0.0
Manufacture of Textile	2.5	1.0	1.8	1.1	Manufacture of Textile	1.1	1.5	1.1
Manufacture of Textile Wearing Apparel, Footwear and Caps	4.5	0.6	1.8	0.7	Manufacture of Textile, Wearing Apparel and Accessories	0.7	1.8	0.8
Manufacture of Leather, Fur, Feather and Related Prod.	4.5	0.3	1.6	0.3	Manufacture of Leather, Fur, Feather and Related Products and Footwear	0.4	1.6	0.4
Processing of Timber, Manuf. of Wood, Bamboo, Rattan, Palm and Straw Products	6.9	0.5	1.7	0.6	Processing of Timber, Manuf. of Wood, Bamboo, Rattan, Palm and Straw Products	0.7	1.7	0.7
Manufacture of Furniture	6.9	0.3	1.8	0.4	Manufacture of Furniture	0.4	1.9	0.5
Manufacture of Paper and Paper Products	3.3	0.7	1.4	0.6	Manufacture of Paper and Paper Products	0.6	1.3	0.5
Printing, Reproduction of Recording Media	3.6	0.3	1.6	0.3	Printing and Reproduction of Recording Media	0.3	1.8	0.3
Manufacture of Articles For Culture, Education and Sport Activities	4.5	0.1	1.7	0.1	Manufacture of Articles for Culture, Education, Arts and Crafts, Sport, Entertainment Activities	0.3	2.0	0.4
Processing of Petroleum, Coking, Processing of Nuclear Fuel	5.7	1.2	1.1	0.8	Processing of Petroleum, Coking and Processing of Nuclear Fuel	0.7	1.0	0.5
Manufacture of Raw Chemical Materials and Products	4.3	3.2	1.5	2.9	Manufacture of Raw Chemical Materials and Chemical Products	3.1	1.3	2.7
Manufacture of Medicines	2.1	0.7	1.7	0.7	Manufacture of Medicines	1.0	1.6	1.1
Manufacture of Chemical Fibers	2.4	0.2	1.7	0.2	Manufacture of Chemical Fibers	0.2	1.3	0.2
Manufacture of Rubber	3.5	0.3	1.7	0.4	Manufacture of Rubber and Plastics Products	1.2	1.5	1.2
Manufacture of Plastics	4.2	0.7	1.8	0.8	Manufacture of Non-metallic Mineral Products	3.3	1.4	3.0
Manufacture of Non-metallic Mineral Products	5.3	2.8	1.9	3.3	Smelting and Pressing of Ferrous Metals	1.4	0.8	0.8
Smelting and Pressing of Ferrous Metals	2.3	2.2	1.0	1.4	Smelting and Pressing of Non-ferrous Metals	1.2	1.2	1.0
Smelting and Pressing of Non-ferrous Metals	4.1	1.3	1.5	1.2	Manufacture of Metal Products	1.6	1.6	1.7
Manufacture of Metal Products	7.8	1.5	1.9	1.7	Manufacture of General Purpose Machinery	2.3	1.6	2.4
Manufacture of General Purpose Machinery	8.9	2.2	1.8	2.4				

Manufacture of Special Purpose Machinery	6.7	1.5	1.9	1.7	Manufacture of Special Purpose Machinery	2.3	1.5	2.2
Manufacture of Transport Equipment	5.3	2.5	1.7	2.7	Manufacture of Automobiles	2.2	1.4	2.1
Manufacture of Electrical Machinery and Equipment	7.4	1.6	2.3	2.2	Manufacture of Railway, Ship, Aerospace and Other Transport Equipment	0.6	1.4	0.6
Manufacture of Communication Equipment, Computers and Other Electronic Equipment	3.2	1.7	1.6	1.6	Manufacture of Electrical Machinery and Apparatus	2.3	1.4	2.1
Manufacture of Measurement Instruments and Machinery for Cultural Activity and Office Work	4.2	0.3	1.8	0.3	Manufacture of Computers, Communication and Other Electronic Equipment	1.6	1.5	1.6
Manufacture of Artwork and Other Manufacturing	3.3	0.5	1.8	0.5	Manufacture of Measurement Instruments and Machinery	0.4	1.3	0.3
Recycling and Disposal of Waste	22.5	0.1	2.6	0.1	Other Manufacture	0.4	1.5	0.4
<b>Production and Supply of Electricity, Gas and Water</b>	<b>2.8</b>	<b>7.1</b>	<b>1.4</b>	<b>6.0</b>	Utilization of Waste Resources	0.2	1.8	0.2
Production and Supply of Electric Power and Heat Power	2.7	6.1	1.3	4.7	Repair Service of Metal Products, Machinery and Equipment	0.1	1.1	0.1
Production and Supply of Gas	2.8	0.3	2.3	0.4	<b>Production and Supply of Electricity, Heat, Gas and Water</b>	<b>4.6</b>	<b>1.6</b>	<b>4.8</b>
Production and Supply of Water	3.0	0.7	1.7	0.7	Production and Supply of Electric Power and Heat Power	3.5	1.6	3.7
<b>Construction</b>	<b>2.3</b>	<b>0.8</b>	<b>1.9</b>	<b>0.9</b>	Production and Supply of Gas	0.4	1.5	0.4
Construction of Buildings and Civil Engineering	2.1	0.7	1.8	0.8	Production and Supply of Water	0.6	1.9	0.7
Building Installation	2.7	0.0	1.6	0.0	<b>Construction</b>	<b>1.0</b>	<b>1.3</b>	<b>0.9</b>
Building Decoration	3.4	0.0	1.8	0.0	Construction of Buildings	0.4	1.1	0.3
Other Construction	5.3	0.1	2.4	0.1	Civil Engineering	0.5	1.4	0.5
<b>Transport, Storage and Post</b>	<b>2.8</b>	<b>10.6</b>	<b>1.8</b>	<b>11.4</b>	Building Installation	0.0	1.8	0.0
Railway Transport	5.8	2.7	1.8	3.1	Building Decoration and Other Construction	0.1	1.8	0.1
Road Transport	2.1	5.0	1.7	5.0	<b>Wholesale and Retail Trades</b>	2.7	1.9	3.4
Urban Public Transport	2.9	0.9	1.6	0.8	Wholesale Trade	1.2	2.2	1.7
Water Transport	3.3	0.8	1.6	0.8	Retail Trade	1.5	1.7	1.7
Air Transport	2.7	0.4	1.4	0.3	<b>Transport, Storage and Post</b>	8.5	1.6	8.9
Transport Via Pipelines	1.0	0.1	0.7	0.0	Railway Transport	1.7	1.3	1.4
Loading, Unloading and Other Transport Services	2.5	0.1	2.9	0.1	Road Transport	4.8	1.6	5.2
Storage	7.6	0.6	2.1	0.7	Water Transport	0.6	1.2	0.4
Post	0.7	0.0	1.7	0.0	Air Transport	0.3	1.6	0.3
<b>Information Transmission, Computer Services and Software</b>	<b>1.3</b>	<b>1.4</b>	<b>1.1</b>	<b>1.0</b>	Transport Via Pipelines	0.1	1.5	0.1
Telecommunications and Other Information Transmission Services	1.2	1.3	1.0	0.8	Loading, Unloading and Forwarding Agency	0.2	1.8	0.2
Computer Services	4.9	0.0	2.4	0.1	Storage	0.9	2.1	1.2
Software	4.5	0.1	1.8	0.1	Post	0.0	3.5	0.0
<b>Wholesale and Retail Trades</b>	<b>4.0</b>	<b>2.1</b>	<b>1.6</b>	<b>2.1</b>	<b>Hotels and Catering Services</b>	1.4	1.3	1.2
Wholesale Trade	4.8	1.0	1.5	1.0	Hotels	1.0	1.3	0.8
Retail Trade	3.5	1.1	1.7	1.2	Catering Services	0.4	1.3	0.3
<b>Hotels and Catering Services</b>	<b>5.4</b>	<b>1.2</b>	<b>1.7</b>	<b>1.2</b>	<b>Information Transmission, Software and Information Technology</b>	0.7	2.0	1.0
Hotels	5.3	0.8	1.8	0.9	Telecommunication, Radio and Television and Satellite Transmission Service	0.4	1.5	0.4
Catering Services	5.5	0.4	1.6	0.4	Internet and Related Service	0.1	3.4	0.1
<b>Financial Intermediation</b>	<b>2.9</b>	<b>0.2</b>	<b>1.9</b>	<b>0.2</b>	Software and Information Technology	0.2	2.7	0.4
Bank	2.5	0.1	1.7	0.1	<b>Financial Intermediation</b>	<b>0.3</b>	<b>1.5</b>	<b>0.2</b>
Security Activities	19.3	0.0	1.7	0.0	Monetary and Financial Service	0.2	1.2	0.1
Insurance	1.9	0.0	2.9	0.0	Capital Market Service	0.0	2.5	0.1
Other Financial Activities	5.2	0.0	3.7	0.0	Insurance	0.0	1.1	0.0
<b>Real Estate</b>	<b>3.2</b>	<b>24.1</b>	<b>1.6</b>	<b>23.6</b>	Other Financial Activities	0.0	2.2	0.0
<b>Leasing and Business Services</b>	<b>4.1</b>	<b>0.8</b>	<b>2.0</b>	<b>1.0</b>	<b>Real Estate</b>	<b>25.4</b>	<b>1.4</b>	<b>23.0</b>
Leasing	16.6	0.0	3.4	0.1	<b>Leasing and Business Services</b>	<b>1.3</b>	<b>2.0</b>	<b>1.7</b>
Business Services	3.9	0.8	1.9	1.0	Leasing	0.1	4.3	0.2
<b>Scientific Research, Technical Service and Geologic Prospecting</b>	<b>2.5</b>	<b>0.5</b>	<b>1.8</b>	<b>0.5</b>	Business Services	1.2	1.9	1.5
Research and Experimental Development	2.1	0.2	1.6	0.2	<b>Scientific Research and Technical Services</b>	<b>0.7</b>	<b>1.9</b>	<b>0.9</b>

Professional Technical Services	2.5	0.1	1.8	0.2	Research and Experimental Development	0.2	1.6	0.3
Services of Science and Technology Exchanges and Promotion	4.0	0.1	2.1	0.1	Professional Technical Services	0.3	1.9	0.3
Geologic Prospecting	3.3	0.1	1.7	0.1	Science and Technology Popularization and Application Services	0.2	2.4	0.3
<b>Management of Water Conserv., Environment and Public Facilities</b>	<b>2.9</b>	<b>8.3</b>	<b>1.8</b>	<b>9.2</b>	<b>Management of Water Conservancy, Environment and Public Facilities</b>	<b>8.1</b>	<b>1.9</b>	<b>10.1</b>
Management of Water Conservancy	2.0	1.0	2.1	1.2	Management of Water Conservancy	1.2	1.7	1.3
Environmental Management	2.8	0.5	2.1	0.6	Ecological Protection and Environmental Management	0.3	2.1	0.4
Management of Public Facilities	3.1	6.8	1.7	7.0	Management of Public Facilities	6.6	1.9	8.4
<b>Services to Households and Other Services</b>	<b>4.8</b>	<b>0.2</b>	<b>2.4</b>	<b>0.3</b>	<b>Service to Households, Repair and Other Services</b>	<b>0.5</b>	<b>1.6</b>	<b>0.5</b>
Services to Households	3.9	0.1	1.8	0.1	Service to Households	0.2	1.7	0.3
Other Services	8.0	0.1	3.6	0.2	Repair of Motor Vehicle, Electronics and Household Products	0.1	1.8	0.1
<b>Education</b>	<b>1.6</b>	<b>1.6</b>	<b>1.6</b>	<b>1.5</b>	Other Services	0.1	1.1	0.1
<b>Health, Social Security and Social Welfare</b>	<b>3.0</b>	<b>0.7</b>	<b>1.8</b>	<b>0.8</b>	<b>Education</b>	<b>1.3</b>	<b>1.7</b>	<b>1.4</b>
Health	2.8	0.6	1.7	0.6	<b>Health and Social Service</b>	<b>0.7</b>	<b>2.0</b>	<b>0.9</b>
Social Security	3.2	0.0	4.4	0.0	Health	0.6	1.8	0.7
Social Welfare	5.9	0.1	1.7	0.1	Social Services	0.1	2.9	0.2
<b>Culture, Sports and Entertainment</b>	<b>3.0</b>	<b>1.0</b>	<b>1.8</b>	<b>1.1</b>	<b>Culture, Sports and Entertainment</b>	<b>1.2</b>	<b>1.6</b>	<b>1.2</b>
Journalism and Publishing Activities	2.8	0.0	0.8	0.0	Journalism and Publishing Activities	0.0	1.9	0.0
Broadcasting, Movies, Television and Audiovisual Activities	1.9	0.1	1.6	0.1	Radio, Television, Motion Picture and Videotape Program Production Services	0.1	2.0	0.1
Cultural and Art Activities	3.7	0.3	2.0	0.4	Cultural and Art Activities	0.5	1.6	0.6
Sports Activities	2.5	0.2	1.9	0.2	Sports Activities	0.2	1.2	0.2
Entertainment	3.4	0.3	1.9	0.4	Entertainment	0.3	1.7	0.4
<b>Public Management and Social Organization</b>	<b>1.8</b>	<b>2.2</b>	<b>1.5</b>	<b>2.0</b>	<b>Public Management, Social Security and Social Organization</b>	<b>1.7</b>	<b>1.3</b>	<b>1.4</b>
Organs of Communist Party of China	0.9	0.0	1.2	0.0	Organs of Communist Party of China	0.0	0.8	0.0
Government Agencies	1.5	1.6	1.6	1.6	Government Agencies	1.2	1.2	0.9
People's Political Consultative Conference and Democratic Parties	1.2	0.0	0.9	0.0	People's Political Consultative Conference and Democratic Parties	0.0	0.9	0.0
Non-Governmental Organizations, Social Organizations and Religion Organizations	2.9	0.1	1.9	0.1	Social Security	0.1	1.3	0.1
Grass Roots Self-governing Organizations International Organizations	5.5	0.5	1.1	0.3	Non-Governmental Organizations, Social Organizations and Membership Organizations	0.2	1.1	0.1
					Grass Roots Self-Governing Organizations	0.0		0.0
Coefficient of variation	0.76		0.32				0.34	

Note: Red color: column 2008/2003: if value is equal to or larger than 5.0; 2010/2008 and 2015/2012: if value is equal to or larger than 2.0.

Source: NBS database.

**Table 3: Explaining Investment Growth 2012–2014**

	Dependent variable: growth rate of investment 2012–2014 in %									
	3 <sup>rd</sup> -digit sectors		4 <sup>th</sup> -digit sectors	4 <sup>th</sup> -digit sectors, plus 3 <sup>rd</sup> -digit sectors if a 3 <sup>rd</sup> -digit sector has no 4 <sup>th</sup> -digit sectors			3 <sup>rd</sup> -digit sectors		3 <sup>rd</sup> -digit sectors	
	I	II	III	IV	V	VI	VI	VIII	IX	X
RoE 2013	**0.62 (0.27)									
RoA 2013		***1.54 (0.54)	*1.25 (0.65)	**1.27 (0.58)	*1.06 (0.58)	0.83 (0.60)	0.41 (0.67)	0.67 (0.63)	*1.14 (0.58)	**1.00 (0.49)
Sales growth 2013					***0.53 (0.18)	***0.53 (0.18)	***0.51 (0.18)	***0.52 (0.18)	***0.49 (0.18)	***0.90 (0.18)
Price index 2013						2.53 (1.64)				
<i>Ownership shares 2013:</i>										
State								*-0.42 (0.25)		
Collective								-0.34 (1.11)		
Private								0.03 (0.35)		
Individual								*0.55 (0.30)		
HKMT								*0.68 (0.40)		
Foreign								0.11 (0.34)		
Residual								0.29 (1.76)		
Investment per employee 2014									***5.6*10 <sup>-6</sup> (2.1*10 <sup>-6</sup> )	***8.4*10 <sup>-6</sup> (1.6*10 <sup>-6</sup> )
Constant	***22.9 (6.19)	***20.7 (5.83)	***32.0 (7.85)	***30.6 (6.92)	***24.8 (7.27)	***29.7 (7.94)	6.25 (23.48)	***32.7 (8.70)	***21.9 (7.33)	*10.11 (5.64)
Obs.	194	194	490	567	564	564	564	564	563	193
R <sup>2</sup>	0.027	0.041	0.007	0.008	0.022	0.026	0.036	0.027	0.034	0.206

RoE: return on equity.

RoA: return on assets.

Notes:

Sales growth refers to main business income (*zhuying yewu shouru*).

Price index: the second-digit sector level ex-factory price index.

Ownership shares are in paid-in equity, the list of ownership shares is exhaustive, and “residual” denotes an implicit residual.

Except for investment per employee (which is in CNY), all other explanatory variables are expressed in %.

Investment data cover “investment, except by rural households.”

Industry data cover the above-norm industrial enterprises.

Figures in parentheses are standard errors. Significance levels: \* 10%, \*\* 5%, \*\*\* 1%.

All variables are expressed in percent except investment per employee (CNY per employee).

Sources: *Investment Statistical Yearbook 2012*, *Investment Statistical Yearbook 2014*, *Industrial Statistical Yearbook 2012*, *Industrial Statistical Yearbook 2013*.

**Table 4: Ownership Shares, Annual and Cumulative Monthly Values**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<b>Share in annual FAI (%)</b>													
Domestic			90.1	90.3	91.1	93.1	93.8	94.0	94.4	95.0	95.5	96.0	
SOU			30.0	28.2	28.2	31.0	30.0	26.5	25.7	24.6	24.4	24.9	
COU			3.3	3.4	3.6	3.8	3.6	3.3	3.2	3.0	3.0	2.7	
Cooperative units			0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.3	
Joint units			0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
LLCs			23.9	24.4	24.3	23.9	25.3	27.7	27.4	27.2	26.7	26.0	
Shareholding units			7.4	7.0	7.0	6.3	6.2	6.1	5.7	5.2	4.4	3.7	
Private units			17.5	19.7	20.6	20.9	21.8	22.9	24.4	27.2	29.2	30.5	
Sole proprietorships			4.7	4.4	4.2	4.0	3.4	3.4	3.1	2.8	2.5	2.2	
Others			2.2	2.1	2.2	2.5	2.8	3.3	4.2	4.3	4.7	5.4	
HKMTUs			4.3	4.4	4.0	3.2	3.0	3.0	2.7	2.5	2.3	2.1	
FFUs			5.6	5.4	4.9	3.7	3.2	3.0	2.8	2.5	2.2	1.9	
<b>Share in cumulative monthly December investment (%)</b>													
Domestic	86.9	87.8	88.9	89.1	89.9	92.2	92.9	93.3	93.8	94.5	95.0	95.5	95.3
SOU	39.1	36.1	34.3	31.6	31.3	34.0	32.4	27.3	26.2	25.9	25.0	25.3	21.8
COU	2.1	2.2	2.3	2.5	2.9	3.0	2.8	3.4	3.3	3.1	3.0	2.8	1.5
Cooperative units	1.0	0.9	0.7	0.7	0.7	0.5	0.6	0.5	0.5	0.5	0.4	0.3	0.2
Joint units	0.8	0.7	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1
LLCs	23.5	25.3	25.8	26.4	26.1	25.8	27.1	28.3	27.8	26.9	26.9	26.5	33.4
# solely state-owned	2.8	2.8	2.9	2.8	2.6	2.9	2.8	2.3	2.2	2.0	2.3	2.4	5.6
# others	20.8	22.4	23.0	23.6	23.5	22.9	24.3	26.0	25.6	24.9	24.7	24.1	27.7
Shareholding units	9.3	9.0	8.3	7.8	7.9	6.9	6.7	6.3	5.9	5.2	4.4	3.8	2.9
Private units	9.9	12.4	14.8	17.8	18.6	19.3	20.7	23.8	25.5	27.8	30.0	31.1	31.5
Sole proprietorships	1.2	1.1	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4
Others	1.2	1.4	2.1	1.9	2.0	2.4	2.5	3.4	4.3	4.7	4.9	5.5	3.8
HKMTUs	5.3	4.9	4.6	4.6	4.3	3.3	3.2	3.1	2.8	2.5	2.4	2.2	2.4
FFUs	6.6	6.2	6.0	5.8	5.2	4.0	3.4	3.1	2.9	2.5	2.2	1.9	2.0
<b>Percentage share in FAI or cumulative monthly December investment (%)</b>													
SOSCU: annual					37.0	38.6	36.7	34.6	33.2	32.3	31.5	31.8	
SOSCU: cumulative monthly					43.3	44.6	42.3	35.6	33.9	33.0	32.2	32.4	35.7
Non-state units: annual, constructed					54.1	54.6	57.1	59.4	61.2	62.7	64.0	64.1	
Non-state units: cumulative monthly									61.4	62.9	64.1	64.2	61.2
Non-state units: cum. monthly, constr.			40.5	44.5	46.6	47.6	50.6	57.7	59.9	61.5	62.8	63.1	59.5

LLC: limited liability companies.

Notes:

Cooperative units are collective-owned units in formal “cooperative” organizational form.

Cumulative monthly data are the cumulative December values. Cumulative monthly December investment of the years

2011–2015 is equal to 97%–98% of annual FAI values; in the years 2006–2010, the percentages are 85%–87%. This suggests that the coverage of the cumulative monthly data is “urban” investment.

Constructed non-state values are obtained as value of domestic investment less value of SOSCU investment.

Source: NBS database.

## Appendix 1: Further Policy Details

### A. Policies for Capacity Reduction

The State Council on 4 February 2016, issued “suggestions” on how to reduce excess steel production. Following “the elimination of backward steel production capacity in recent years,” starting 2016 crude steel production capacity is to be reduced by 100–150 million tons over a period of five years (SC, 4 February 2016); this compares to output of 804 million tons in 2015.<sup>38</sup> The guideline stresses the importance of environmental, efficiency, quality and technology criteria in eliminating excess capacity, and favors mergers and restructuring over bankruptcies. Localities are to organize the reduction in excess capacity, with a supporting role for the center. The role of the market and the importance of legal procedures is stressed. The overall objective is one of sector upgrading.

Further measures to eliminate capacity are currently only planned for coal. Xu Zhaoshi, head of the National Development and Reform Commission, on 27 June 2016 announced a reduction in coal production capacity for 2016 of 280 million tons (and a reduction in steel production capacity of 45 million tons) with corresponding layoffs of 700,000 (and 180,000) workers.<sup>39</sup> By 2020, the reduction in coal production capacity is to have reached 500 million tons, with an additional reduction in coal production (though not necessarily capacity) of 500 million tons; this compares to output of raw coal (*yuanmei*) of 3.7 billion tons in 2015. Xu Zhaoshi also reiterates the State Council’s 100–150 million ton target for reduction in steel production capacity. The intention is to achieve near-half of the reduction in production capacity in 2016. These measures match the development of coal and steel output over time, which both declined in 2015. But by 2016 steel production was flat, while a further decline in coal output in the first half of 2016 was followed by coal shortages in the second half of 2016.<sup>40</sup>

The case of coal illustrates that what is to be regarded as excess capacity is hard to determine. In fact, examining the (limited) available annual data in the *Statistical Yearbook* series and in the CEIC China Premium database on production capacity (of above-norm industrial enterprises) vs. actual output (of all industry) of crude oil, coal, coke, cement, crude steel, and rolled steel from 2005 to 2015, no major drop in capacity utilization is apparent, in part due to incomplete data, except perhaps for crude steel. Crude steel experiences a drop from capacity utilization of around 85% in the second half of the 2000s to approximately 73% in the first half of the 2010s. Coal capacity data are missing for the years since 2009. Capacity utilization in cement appears steady at around 70%. Excess capacity in the PRC, furthermore, may not necessarily imply a need for capacity reduction in the PRC. For example, in the case of aluminum, a non-ferrous metal, Michael Komesaroff (2015) finds that “China’s aluminum smelters are operating with the world’s

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<sup>38</sup> According to an official State Council website ([http://english.gov.cn/policies/policy\\_watch/2016/08/05/content\\_281475409540166.htm](http://english.gov.cn/policies/policy_watch/2016/08/05/content_281475409540166.htm), accessed 14 December 2016), more than 90 million tons of crude steel production capacity have already been cut “in recent years.”

<sup>39</sup> The head of the PRC’s Ministry of Human Resources and Social Security had previously (in February 2016) suggested a total of 1.3 million layoffs in the coal industry and 0.5 million in the steel industry (presumably by 2020). The (central) government budget will provide CNY100 billion to help along the reduction in capacity, mostly to be spent on the new placement of staff and workers. This follows layoffs in recent years on the order of 1–2 million workers in the coal and steel industry following firm decisions to close or restructure, largely in the absence of government pressures. (Gatley and YAO write on 18 January 2016 that the coal and steel sectors have shed about 1.4 million workers since 2014.)

<sup>40</sup> See YAO (16 November 2016) for an overview through late 2016.

most efficient technology.” Thus, even though in 2014 the PRC’s aluminum smelters were operating at just 68% of capacity, the shake-out hoped for by foreign firms, operating with less efficient technology, did not happen. I.e., reducing excess capacity is not a supreme PRC objective when the existing capacity operates at the technological frontier and cyclical downswings can be expected to eventually have run their course. Overinvestment in the PRC, then, is only a temporary phenomenon; the shake-out may well happen elsewhere.

## **B. “Made in China 2025”**

The State Council document of 8 May 2015 also lists nine strategic tasks followed by eight supporting measures. The nine strategic tasks focus on improving manufacturing innovation capacity with the integration of information technology and industrialization, the development of high-quality brands, and green manufacturing. The eight supporting measures range from reforming the institutional mechanism and a fair competitive market environment to financial and fiscal support policies, and personnel training.

In detail, the nine strategic tasks are:

- (1) Increase the national manufacturing innovation capacity,
- (2) promote the deep integration of information technology and industrialization,
- (3) strengthen the industrial base capacity,
- (4) strengthen the development of quality brands,
- (5) fully implement green manufacturing,
- (6) promote breakthrough developments in key areas (with a list of ten priority industries),
- (7) promote the structural adjustment of the manufacturing industry,
- (8) actively develop service-oriented manufacturing and producer services, and
- (9) raise the level of manufacturing internationalization.

The eight supporting measures are:

- (1) Deepen the reform of the institutional mechanisms,
- (2) create a fair competitive market environment,
- (3) improve financial support policies,
- (4) increase fiscal and taxation policy support,
- (5) establish a healthy multi-level personnel training system,
- (6) perfect micro, small and medium-sized enterprise policies,
- (7) further open up manufacturing to the outside world, and
- (8) create a healthy organizational implementation mechanism.

“Made in China 2025” is to be achieved in three stages. By 2020, the first step of the first stage, the PRC is to have completed basic industrialization, with consolidation of the PRC as a big manufacturing nation including much increased use of information technology in manufacturing. By 2025, the second step of the first stage, the quality of manufacturing is to have much increased with significant improvements in innovation capacity and labor productivity. By 2035, the PRC’s manufacturing sector is to have advanced into the middle field of the world’s manufacturing nations. By 2049, 100 years after the founding of the PRC, the PRC’s manufacturing sector is to be in the forefront of the world’s manufacturing nations. The document also provides a dozen specific targets; for example, internal R&D expenses of above-norm manufacturing industry are to reach 1.68% of main business revenue by 2025 (after 0.88% in 2013, 0.95% in 2015, and 1.26% in 2020).

Using the formula “1+X” (where 1 refers to “Made in China 2025”), 11 supporting implementation plans are expected, of which five have been formulated: the manufacturing innovation center project, the project to build a more solid foundation for industrial



development, the green manufacturing project, the smart manufacturing project and the high-end equipment innovation project.<sup>41</sup>

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<sup>41</sup> See <http://economists-pick-research.hktdc.com/business-news/article/Business-Alert-China/China-Releases-Implementation-Guidelines-for-Five-Made-in-China-2025-Projects/bacn/en/1/1X2ZLGG8/1X0A768A.htm>, accessed 14 December 2016. According to this source, the other six supporting documents include development planning guidelines for manufacturing talents, information industry, new materials industry and pharmaceutical industry and action guides for developing service-oriented manufacturing and promoting the upgrading of quality and brands in equipment manufacturing.

## Appendix 2: Data Availability

### 1. Investment

The *Statistical Yearbook* series provides second-digit sector investment values for urban areas for the years 2004–2010, and for “investment, except by rural households” for the years since 2011; a change in size criterion for inclusion in investment of CNY50,000 to CNY500,000 concurs with the change in coverage. The sector classification system changed from GB2002 to GB2011 a year later, in 2012. Data are available on: total investment, investment by composition and by type of construction (on which more below), sources of funding, ownership, central vs. local investment, and cumulative investment by project.

The NBS database provides similar second-digit sector data for the years since 2003 under the label “investment, except by rural households” and within the GB2002 classification system (i.e., ignores the change in coverage, size criterion, and classification system). The available breakdowns of sector investment are the same as in the *Statistical Yearbook* series.<sup>42</sup>

The *Investment Statistical Yearbook* series provides similar second-digit sector data as the *Statistical Yearbook* series does, for the years since 2003 but not for 2013 (with no *Investment Statistical Yearbook 2014* having been published). The break between “urban investment” and “investment, except by rural households” occurs in 2011, as does the change in size criterion. The switch from GB2002 to GB2011 occurs one year later, with the 2012 data. The *Investment Statistical Yearbook* series also includes fourth-digit sector investment data for all years since 2003 (except for 2013), including a large number of further breakdowns.

These breakdowns are the following:

- By composition: construction and installation (*jianzhu anzhuang gongcheng*), purchase of equipment (*shebei gongqiju gouzhi*), and other expenses (*qita feiyong*).
- By type: new construction (*xinjian*, accounting for approximately two-thirds of the total), expansion (*kuojian*), reconstruction and technical transformation (*gaijian he jishu gaizao*), and four residual categories (with data sometimes not provided), together accounting for approximately five percent of the total: singular construction of living facilities (*danchun jianzao shenghuo sheshi*), relocation (*qianjian*), resumed construction (*huijian*), singular purchase (*danchun gouzhi*).
- By source of funds: state budgetary funds (*guojia yusuannei zijin*), domestic loans (*guonei daikuan*), bonds (*zhaiquan*), foreign funds (*liyong waizi*) with sub-category foreign direct investment (*waishang zhijie touzi*), self-raised funds (*zichou zijin*) with sub-category own funds of enterprises and administrative facilities (*qishiye danwei ziyou zijin*), and “other funds” (*qita zijin*).
- By ownership: state-owned and state-controlled investment (*guoyou ji guoyou konggu touzi*); domestic investment (*neizi touzi*, sometimes with a further breakdown), foreign investment (*waishang touzi*), and investment by Hong Kong, China, Macau, China, and Taipei, China businesses (*gang'aotai shang touzi*).
- By administrative level of the project: central (*zhongyang*) and local (*difang*), and the latter with an exhaustive four sub-categories: provincial (*shengshu*), municipal (*dishishu*), county (*xianshu*) and “others” (*qita*).

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<sup>42</sup> CEIC proceeds as the NBS database does, with annual second-digit sector investment data since 2003; the only breakdown available is by composition. CEIC also offers monthly second-digit sector investment data since 2004 (under a label “investment” that is not limited by such terms as “urban” or “investment, except by rural households);“ the NBS database also offers limited monthly data.

- Volume of ongoing construction: total/aggregate value of construction (*jianshe zong guimo*), cumulative completed investment since the beginning of construction (*zi kaishi jianshe leiji wancheng touzi*), total value of construction in progress (*zaijian zong guimo*), net value of construction in progress (*zaijian jing guimo*).

## 2. Profitability

In order to relate investment to profitability, profit and equity data are needed. Such data are available only for a subset of enterprises in industry (mining, manufacturing, utilities). The subset is the set of above-norm industrial enterprises, i.e., since 2011 industrial enterprises with annual sales revenue in excess of CNY20 million, from 2007 to 2010 industrial enterprises with annual sales revenue in excess of CNY5 million, and before 2007 (1998–2006) all SOEs plus all non-SOE industrial enterprises with annual sales revenue in excess of CNY5 million. Above-norm industrial enterprises typically account for 90 percent of industrial value-added, and profitability indicators of the above-norm industrial enterprises in a particular sector may thus be indicative of the (unknown) profitability of all industrial enterprises in that sector.<sup>43</sup>

These data are available in the *Industry Statistical Yearbook* series at the second-digit sector level for industry for 2003–2011 (except for 2004, with no yearbook published in 2005), and at the fourth-digit sector level for industry for 2012–2014 (and presumably continuing with upcoming editions of the yearbook).<sup>44</sup>

Industrial equity and profit data are further available by ownership category times sector: for 2003–2011 (except 2004), data are available by second-digit sector for, separately, SOSCEs, collective-owned enterprises (COEs), private enterprises, and “foreign-funded enterprises and Hong Kong, Macau, and Taipei, China enterprises”, and for 2012–2014 for the same ownership categories except COEs, by third-digit sector.

Second-digit industry equity and profit data are equally available on the NBS database for all years, including by second-digit sector times ownership category (SOSCEs, private enterprises, and “foreign-funded enterprises and Hong Kong, Macau, and Taipei, China enterprises”). The data are provided separately for 2003–2011 vs. the years since 2012, to account for the change in the sector classification system. CEIC carries the same data as the NBS database but as continuing time series, ignoring the change in sector classification. In contrast to the *Industry Statistical Yearbook* series, thus, the NBS and CEIC databases provide 2004 data but do not offer fourth-digit sector data when the yearbook does, for the years since 2012. The NBS and CEIC databases also do not provide sector COE data ever, whereas the yearbook series does for 2003–2011 (except 2004).

In addition, CEIC provides fourth-digit sector data on a monthly basis typically starting 2006, albeit with various breaks and omissions; the same series are not provided on a yearly basis. Data cover profit but not equity; total equity can be derived as difference of assets and liabilities, but no measure of “actually paid-in equity” (as provided in the above listed sources) can be derived. The NBS database provides the same monthly data, at the second digit sector level only, with the same limitation on the derivation of equity, with no January data and frequent other omissions, since 2003. (January and February values in the CEIC database appear identical throughout, suggesting that in the CEIC database half of the published NBS February value is attributed to January, and the other half to February.)

<sup>43</sup> For details on the coverage of the above-norm industrial enterprises, see Holz (2013).

<sup>44</sup> The *Statistical Yearbook 2005* does not offer sufficiently detailed industry data to provide the 2004 data missing due to the absence of a *Industry Statistical Yearbook 2005* volume.

### **Appendix 3: Establishing the NBS Definition of “Infrastructure”**

The NBS practice is deduced from the available NBS cumulative monthly investment data in the CEIC database, with these infrastructure data available for May–November 2014, all months of 2015, and all months of 2016, and cumulative monthly data on all tertiary sector first-digit sectors and some second-digit sectors, as available. Cumulative monthly data are turned into monthly data; January and February values each are obtained as half the cumulative February value (with the source providing identical January and February values).

In the CEIC database, the NBS infrastructure values are listed as an aside to the NBS tertiary sector investment values. These infrastructure monthly (non-cumulative) investment values are regressed on all available second-digit tertiary sector investment values and, where second-digit sector investment values are not available, first-digit tertiary sector investment values. Sectors with a significance level higher than 10% are eliminated one by one, then a very few sectors with negative coefficients are eliminated, followed by further elimination one by one of sectors with a significance level higher than 10%, or negative coefficients.

The resulting set of sectors typically has a coefficient of one (except pipeline transportation, with a coefficient of two), the significance levels are 0.1% (except for pipelines, 2%), and investment in these such identified sectors adds up across all months for which investment data are available to 99–100% of infrastructure investment. The same set of sectors obtains with or without constant, and with or without monthly dummy variables.

## Appendix 4: Thirty Fastest-Growing Third- or Fourth-digit Sectors, 2010 vs. 2003

<i>First digit sector (sometimes with second-digit sector)</i>	% of investment 2010 / 2003	Mul-tiple 2010 / 2003
Third- or fourth-digit sector		
<b><i>Agriculture, forestry, animal husb., fishery: Cereals and other crops</i></b> 谷物及其他作物的种植		
Tobacco cultivation 烟草的种植	0.009	126
Bamboo harvesting 竹材的采运	0.000	68
Inland fishery 内陆捕捞	0.001	156
<b><i>Mining: Non-ferrous metal industry</i></b> 有色金属矿采选业		
Antimony ore mining 锑矿采选	0.005	65
Aluminum mining and dressing 铝矿采选	0.020	81
Magnesium dressing 镁矿采选	0.005	67
Other commonly used non-ferrous metals 其他常用有色金属矿采选	0.033	87
Other precious metals mining and dressing 其他贵金属矿采选	0.011	3681
Radioactive metal ore mining 放射性金属矿采选	0.002	160
<b><i>Manufacturing: General equipment manufacturing</i></b> 通用设备制造业		
Guns and similar appliances 喷枪及类似器具制造	0.005	113
<b><i>Manufacturing: Special equipment manufacturing</i></b> 专用设备制造业		
Oil drilling equipment 石油钻采专用设备制造	0.113	66
Feed production equipment 饲料生产专用设备制造	0.008	61
Postal machinery and equipment 邮政专用机械及器材制造	0.000	90
Traffic safety and control equipment 交通安全及管制专用设备制造	0.007	69
<b><i>Manufacturing: Transportation equipment manufacturing</i></b> 交通运输设备制造业		
Aids to navigation equipment and other floating devices 航标器材及其他浮动装置的制造	0.008	253
<b><i>Manufacturing: Electrical machinery and equipment manufacturing</i></b> 电气机械及器材制造业 Generators and generator sets 发电机及发电机组制造	0.189	65
<b><i>Manufacturing: Waste resources and materials recycling and processing</i></b> 废弃资源和废旧材料回收加工业 Metal waste and scrap processing 金属废料和碎屑的加工处理	0.083	74
<b><i>Utilities: Electricity and heat, production and supply</i></b> 电力、热力的生产和供应业		
Other energy production 其他能源发电	1.015	66
<b><i>Transportation, storage and postal serv.</i></b> 交通运输、仓储和邮政业 Freight trains 货运火车站	0.006	68
<b><i>Trade – retail trade</i></b> 零售业		
Audiovisual products and electronic publications 音像制品及电子出版物零售	0.003	58
Photographic equipment 照相器材零售	0.001	588
Medical supplies and equipment 医疗用品及器材零售	0.006	57
Other electronic products 其他电子产品零售	0.005	80
Paint 涂料零售	0.002	138
<b><i>Financial intermediation</i></b> 金融业 Financial companies 财务公司	0.001	224
<b><i>Leasing and business services</i></b> 租赁和商务服务业		
Other machinery and equipment rental 其他机械与设备租赁	0.034	270
Notary services 公证服务	0.000	93
Other unlisted business services 其他未列明的商务服务	0.110	62
<b><i>Resident services and other services</i></b> 居民服务和其他服务业		
Office equipment maintenance 办公设备维修	0.002	209
<b><i>Cultural, sports and entertainment</i></b> 文化、体育和娱乐业 Audiovisual production 音像制作	0.018	71
<b><i>Sum shares</i></b>	<b>1.706</b>	

Notes:

Total number of first- through fourth-digit sectors: 1182.

For some second-digit sectors, only third-digit sector values are available, for others, also fourth-digit sector values.

Therefore, in the search for the fastest-growing sectors all levels of sector classification were retained.

About one dozen sectors saw no investment in 2003; these sectors are omitted from the search for the fastest-growing sectors.

Source: *Investment Statistical Yearbook*.

[SectoralInvestmentValues -> wksht: 2ndDigit03-11 or -> Top Growing]

## Appendix 5: Thirty Fastest-Growing Third- or Fourth-digit Sectors, 2014 vs. 2012

<i>First digit sector (sometimes with second-digit sector)</i>	% of investment 2012	Multiple 2014 / 2012
Third- or fourth-digit sector		
<b>Agriculture, forestry, animal husbandry and fishery 农、林、牧、渔业</b> Sheep raising 羊的饲养	0.039	4.8
<b>Agriculture, forestry, animal husbandry and fishery 农、林、牧、渔业</b> Corn cultivation 玉米种植	0.009	4.7
<b>Manufacturing: Rubber and plastic products 橡胶和塑料制品业</b>		
Waterproof construction materials 防水建筑材料制造	0.006	14.2
<b>Manufacturing: Rail, shipbuilding, aerospace and other transportation equipment 铁路、船舶、航空航天和其他运输设备制造业</b> Recreational boats, and sport boats 娱乐船和运动船制造	0.005	7.6
<b>Manufacturing: Smelting and pressing of ferrous metals 黑色金属冶炼和压延加工业</b>		
Silver smelting 银冶炼	0.007	5.0
<b>Manufacturing: Rail, shipbuilding, aerospace and other transportation equipment 铁路、船舶、航空航天和其他运输设备制造业</b> Narrow gauge locomotive and rolling stock 窄轨机车车辆制造	0.001	4.8
<b>Manufacturing: Chemical fibers 化学纤维制造业</b> Vinylon fiber manuf. 维纶纤维制造	0.003	4.0
<b>Manufacturing: Instruments 仪器仪表制造业</b> Agriculture, forestry, animal husbandry and fishery special instrument manufacturing 农林牧渔专用仪器仪表制造	0.001	4.0
<b>Wholesale and retail trade 批发和零售业</b>		
Internet retail 互联网零售	0.001	16.9
Newspaper, Wholesale 报刊批发	0.000	10.2
Auctions 拍卖	0.000	8.7
Photographic equipment retail 照相器材零售	0.000	5.1
<b>Transportation, Storage and Post 交通运输、仓储和邮政业</b> Railway freight transport 铁路货物运输	0.190	4.3
<b>Accommodation &amp; catering services 住宿和餐饮业</b> Other beverages & cold drinks 其他饮料及冷饮服务	0.001	4.7
<b>Financial intermediation 金融业</b>		
Other insurance activities 其他保险活动	0.000	8.2
Securities brokerage services 证券经纪交易服务	0.002	6.3
Capital investment services 资本投资服务	0.015	4.4
Futures market management services 期货市场管理服务	0.001	4.3
<b>Leasing and business services 租赁和商务服务业</b>		
Other security services 其他安全保护服务	0.000	7.4
Other machinery and equipment rental 其他机械与设备租赁	0.029	4.9
Labor dispatch service 劳务派遣服务	0.001	4.9
Car rental 汽车租赁	0.003	4.4
Other Human Resources Services 其他人力资源服务	0.002	4.4
Human resources services 人力资源服务	0.007	4.2
<b>Water conservancy, environment and public facilities management 水利、环境和公共设施管理业</b>		
Radioactive waste treatment 放射性废物治理	0.000	6.4
Wildlife Protection 野生动物保护	0.004	5.0
Protection of wild plants 野生植物保护	0.002	4.6
<b>Culture, sports and entertainment 文化、体育和娱乐业</b>		
Film and television program distribution 电影和影视节目发行	0.002	5.4
Film and television program production 电影和影视节目制作	0.015	4.7
<b>Public management: Mass organizations, social groups and other member org. 群众团体、社会团体和其他成员组织</b> Communist Youth League 共青团	0.000	12.4
<b>Sum shares</b>	<b>0.346</b>	

Notes:

Total number of first- through fourth-digit sectors: 1409.

For some second-digit sectors, only third-digit sector values are available, for others, also fourth-digit sector values.

Therefore, in the search for the fastest-growing sectors all levels of sector classification were retained.

About half a dozen sectors saw no investment in 2012; these sectors are omitted from the search for the fastest-growing sectors.

Source: *Investment Statistical Yearbook*.

## Appendix 6: Thirty Fastest-Growing Third- or Fourth-digit Sectors, 2015 vs. 2014

<i>First digit sector (sometimes with second-digit sector)</i>	% of investment 2014	Multiple 2015 / 2014
Third- or fourth-digit sector		
<b><i>Agriculture: Farming 农业</i></b>		
Sugar plantation 糖料种植	0.0025	3.4
Banana and other subtropical fruit cultivation 香蕉等亚热带水果种植	0.0061	2.6
Spice crop cultivation 香料作物种植	0.0028	2.5
<b><i>Agriculture: Animal husbandry 畜牧业</i></b> Camel breeding 骆驼饲养	0.0001	5.4
<b><i>Agriculture: Services 农、林、牧、渔服务业</i></b> Forest fire prevention services 森林防火服务	0.0013	2.6
<b><i>Manufacturing: Textiles 纺织业</i></b> Hemp dyeing 麻染整精加工	0.0012	3.9
<b><i>Manufacturing: Metal products 金属制品业</i></b> Enamel sanitary ware 搪瓷卫生洁具制造	0.0042	2.4
<b><i>Manufacturing: Special Purpose Machinery 专用设备制造业</i></b> Fishery machinery 渔业机械制造	0.0015	2.8
<b><i>Manufacturing: Measuring instruments 仪器仪表制造业</i></b> Agriculture, forestry, animal husbandry and fisheries special instrument manufacturing 农林牧渔专用仪器仪表制造	0.0017	2.8
<b><i>Manufacturing: Repair Service of Metal Products, Machinery and Equipment 金属制品、机械和设备修理业</i></b> Instrument repair 仪器仪表修理	0.0004	2.8
<b><i>Trade: Wholesale trade 批发业</i></b> Nutrition and health products wholesale 营养和保健品批发	0.0020	2.3
<b><i>Trade: Retail trade 零售业</i></b>		
Mail order and television, telephone retail 邮购及电视、电话零售	0.0003	3.8
Internet retail 互联网零售	0.0143	2.9
Audio-visual products and electronic publications retail 音像制品及电子出版物零售	0.0003	3.4
Stationery retail 文具用品零售	0.0010	2.5
<b><i>Information technology: Telecommunication, Radio and Television and Satellite Transmission Service 电信、广播电视和卫星传输服务</i></b> Other telecommunications services 其他电信服务	0.0216	2.3
<b><i>Information technology: Internet and related services 互联网和相关服务</i></b>		
Other Internet services 其他互联网服务	0.0123	2.7
<b><i>Finance: Monetary and financial services 货币金融服务</i></b> Financial leasing serv. 金融租赁服务	0.0037	2.7
<b><i>Finance: Capital market services 资本市场服务</i></b> Fund management services 基金管理服务	0.0005	2.3
<b><i>Finance: Insurance 保险业</i></b> Risk and loss assessment 风险和损失评估	0.0001	2.8
<b><i>Leasing and business services: Leasing 租赁业</i></b>		
Entertainment and sports equipment rental 娱乐及体育设备出租	0.0025	2.6
Other cultural and daily necessities 其他文化及日用品出租	0.0008	3.2
Cultural and daily necessities 文化及日用品出租	0.0033	2.8
<b><i>Leasing and business services: Business services 商务服务业</i></b>		
Notary services 公证服务	0.0000	56.3
Market surveys 市场调查	0.0003	4.1
Other legal services 其他法律服务	0.0005	3.9
<b><i>Science: Professional technical services 专业技术服务业</i></b>		
Ecological monitoring 生态监测	0.0015	2.5
Water, carbon dioxide and other mineral geological prospecting 水、二氧化碳等矿产地质勘查	0.0005	2.3
<b><i>Health and social services: Social services 社会工作</i></b> Mental rehabilitation serv. 精神康复服务	0.0016	2.8
<b><i>Culture: Journalism and publishing activities 新闻和出版业</i></b> Journal Publications 期刊出版	0.0004	2.4
<b><i>Sum</i></b>	<b>0.0890</b>	

Notes and sources: see previous table (with "2014" instead of "2012").

**Appendix 7: Pearson Correlation Coefficients between 2008-2010 Sector Investment Growth Rates and Ownership Characteristics (Urban Investment)**

	Domestic	SOSCUs	COUs	Private	HKMTUs	FFUs
<i>Share of a particular sector in this ownership category total</i>						
First-digit (19 sectors)						
2008	-0.21	-0.22	-0.24	-0.16	-0.21	-0.18
2009	-0.19	-0.17	-0.19	-0.15	-0.20	-0.18
2010	-0.18	-0.14	-0.17	-0.15	-0.18	-0.17
Second-digit (94 sectors)						
2008	-0.13	-0.19	-0.12	-0.07	-0.12	-0.12
2009	-0.13	-0.16	-0.11	-0.07	-0.10	-0.13
2010	-0.11	-0.14	-0.10	-0.07	-0.09	-0.12
<i>Share of this ownership category in economy-wide investment in a particular sector</i>						
First-digit (19 sectors)						
2008	0.52	-0.20	0.31	0.29	-0.53	-0.50
2009	0.51	-0.20	0.53	0.23	-0.50	-0.51
2010	0.50	-0.14	0.55	0.15	-0.45	-0.53
Second-digit (94 sectors)						
2008	0.17	-0.21	0.07	0.25	-0.25	-0.13
2009	0.15	-0.15	-0.01	0.19	-0.20	-0.11
2010	-0.03	-0.13	0.04	0.09	-0.12	-0.19
<i>Growth rate 2008-2010 of investment by this ownership category in a particular sector</i>						
First-digit	0.99	0.84	0.83	0.40	0.53	0.25
Second-digit	0.97	0.52	0.47	0.36	0.39	-0.06
<i>Share of this ownership category's investment that is in the tertiary sector in %</i>						
2008	56.1	63.0	60.0	45.6	52.2	34.9
2009	57.1	67.2	62.2	42.8	52.5	33.2
2010	56.9	68.9	63.1	43.3	53.8	34.4

Notes:

SOSCU, COU, and private units' data start in 2008 only.

Second-digit sectors include two first-digit sectors for which no second-digit sector data are available in the source: real estate, education.

SOSCU, COU, and private unit investment do not add up to domestic investment; the percentage shortfall in the aggregate to the domestic value is small at 0.70, 0.71, and 2.94% in 2008-2010, but can differ significantly in individual sectors, with the biggest difference in the first-digit sector information technology, where the three ownership categories exceed the domestic total by 22.49%.

For 60 observations (and very similarly for 120, and thus also for 95), a correlation coefficient of 0.40 is significant at the 10% significance level, a correlation coefficient of 0.73 at the 5% significance level, and a correlation coefficient of 0.985 at the 1% significance level.

Source: NBS database.



**Appendix 8: Pearson Correlation Coefficients between 2012–2015 Sector Growth Rates and Ownership Characteristics (Investment, except by Rural Households)**

	Domestic	SOSCUs	COUs	Private	HKMTUs	FFUs
<i>Share of a particular sector in this ownership category total</i>						
First-digit (19 sectors)						
2012	-0.24	-0.14	-0.22	-0.23	-0.26	-0.20
2013	-0.22	-0.12	-0.19	-0.22	-0.26	-0.20
2014	-0.20	-0.09	-0.16	-0.20	-0.25	-0.19
2015	-0.18	-0.05	-0.12	-0.18	-0.24	-0.19
Second-digit (95 sectors)						
2012	-0.09	0.07	-0.03	-0.08	0.01	0.16
2013	-0.08	0.03	0.00	-0.05	-0.03	0.17
2014	-0.12	-0.02	0.01	-0.01	-0.01	0.22
2015	-0.09	-0.04	-0.03	0.03	0.07	0.10
<i>Share of this ownership category in economy-wide investment in a particular sector</i>						
First-digit (19 sectors)						
2012	-0.09	-0.07	-0.06	-0.11	-0.08	-0.13
2013	-0.08	-0.05	-0.05	-0.10	-0.07	-0.11
2014	-0.07	-0.04	-0.03	-0.09	-0.07	-0.11
2015	-0.05	-0.03	-0.02	-0.07	-0.06	-0.09
Second-digit (95 sectors)						
2012	0.00	-0.07	0.02	0.01	0.11	-0.10
2013	-0.07	-0.11	0.02	0.04	0.18	-0.06
2014	-0.06	-0.14	0.12	0.04	0.16	-0.05
2015	-0.24	-0.15	0.06	0.07	0.32	0.12
<i>Growth rate 2012-2015 of investment by this ownership category in a particular sector</i>						
First-digit	1.00	0.77	0.76	0.84	0.27	0.09
Second-digit	0.99	0.60	0.53	0.79	0.19	0.25
<i>Share of this ownership category's investment that is in the tertiary sector in %</i>						
2012	54.9	71.3	68.1	40.1	56.0	32.8
2013	55.2	72.3	70.2	40.9	60.6	34.1
2014	55.8	74.3	72.7	41.1	63.8	35.6
2015	56.1	75.8	74.7	40.7	62.5	34.4

Notes:

Second-digit sectors include two first-digit sectors for which no second-digit sector data are available in the source: real estate, education.

SOSCU, COU, and private unit investment do not add up to domestic investment; the implicit residual accounts for 6.1, 7.4, 8.0 and 8.5% of investment in 2012-2015, and can differ significantly in individual sectors, with the biggest percentage in leasing in 2013 of 40.2%, and the biggest negative percentage in internet and related services in 2012 of -9.2% (both are second-digit sectors).

For 60 observations (and very similarly for 120, and thus also for 95), a correlation coefficient of 0.40 is significant at the 10% significance level, a correlation coefficient of 0.73 at the 5% significance level, and a correlation coefficient of 0.985 at the 1% significance level.

Source: NBS database.