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**PRC Industrial Policies Postdate Rather than Lead Economic Activity**  
(Unabridged)

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Abstract:

Industrial policies are widely credited with upgrading the economic structure of the People's Republic of China (PRC) and advancing its economy towards and beyond the current technological frontier. Yet the data suggest that the PRC's economy-wide investment patterns—with investment embodying technological progress—are largely divorced from industrial policies, and, if anything, predate them. The significant shifts in investment across sectors and ownership forms that have taken place since the early 2000s are driven more by profitability considerations and private entrepreneurship than by government policies.

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## Introduction

The industrial policies pursued in the People’s Republic of China (PRC) have raised concerns in the West. The 2015 policy of “Made in China 2025,” in particular, is widely viewed as creating an economic powerhouse that is harmful to Western interests. Underlying such interpretations is the assumption that the PRC’s industrial policies have a decisive effect on resource allocation. The findings of this chapter suggest that this assumption is not valid.

The term “industrial policy” traditionally refers to government measures “which attempt to speed the process of resource allocation among or within industrial sectors with the aim of correcting market distortions” (Rutherford, 1992). Other aims include gaining an early comparative advantage or creating a “national champion.” A broader understanding of industrial policy will also include government measures that are not sector-specific, such as attempts to increase competitiveness or innovativeness across the economy.

Industrial policy is widely credited with having played a major role during East Asia’s phase of rapid economic growth (for example, Wade, 1988 and 1990; Amsden, 1994). The view that the government can “pick winners” has since given way to justifying government intervention with information and coordination externalities (for example, Rodrik, 2004); government coordination may be beneficial in the presence of market failures or market imperfections, as well as in the presence of learning effects or other positive externalities.<sup>1</sup>

Today’s industrial policy may have many dimensions, as Bai Gao in this volume shows, from resource mobilization to infrastructure provision, research subsidization, market protection and regulation. According to Li and Alon (2019), the traditional infant industry argument applies to intellectual property rights in the PRC: Strategic industries are protected from global competition while themselves enjoying open, global markets. For the case of the PRC biotech industry, Ballard (2019) reports on measures that include loose rules around the sharing of medical information, state funding, and centralized procurement processes that lower prices for generic drugs.

The results of individual industrial policies in the PRC are mixed. For the shipbuilding industry, Brawick, Kaloutsidi and Zahur (2019) find that while industrial policy was successful in terms of boosting domestic investment in the industry, domestic entry, and

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<sup>1</sup> Sometimes the term “industrial strategy” is used instead of “industrial policy” to denote a new “focus on creating positive incentives, correcting market failures, and addressing imbalances (whether social, geographical, or sectoral)” (Subacci, 2017). The government avoids picking winners and may not even have an explicit GDP or GDP growth target.

world market share, it also created large distortions, fragmentation, and underutilization.<sup>2</sup> For R&D inputs of large- and medium-sized firms, Eberle and Boeing (2019) find that subsidies crowd out private R&D investments (while overall R&D employment in firms increases). Subsidies lead to increased investment rates for physical capital but that includes increased investment in residential buildings; i.e., some subsidies are used for purposes other than R&D. Soo and Jing (2019) document the repeated, unsuccessful government attempts to establish a semiconductor industry going back to the 1990s and argue that the capability to reverse-engineer designs did not translate into the ability to innovate.<sup>3</sup> Holz (2011) shows that the PRC does not strategically make use of positive externalities through linkage effects in that the state does not channel state-owned enterprise activities into high-linkage sectors.

Implementation of industrial policy requires a capable administration. Prud'homme's (2016) analysis of provincial Strategic Emerging Industries programs suggests that administrative decentralization in the PRC may lead to sub-optimal implementation of industrial policies. While some provinces pursue their comparative advantages and specialize appropriately, other provinces do not and instead pursue new developments likely to fail.<sup>4</sup>

Industrial policies enter the PRC's five-year plans. The national five-year plan trickles down into provincial five-year plans, which in turn have a significant impact on the output growth of favored industries, albeit, as Wu et al. (2016/2019) show, only during the period of the five-year plan. Political compliance with central directives as well as the availability of additional resources seem to be the leading drivers of policy implementation.

How success of industrial policy is measured varies across the literature. One criterion tends to be output growth of the industry under consideration. Others, such as Aghion et al (2015), focus on productivity growth: In large and medium-sized industrial enterprises in the PRC in 1998-2007, industrial policies directed at competitive sectors or fostering competition within a sector increase total factor productivity growth in majority-private domestic firms, but this only holds for subsidies and tax holidays, not for subsidized loans or tariffs.<sup>5</sup> The most appropriate criterion for the evaluation of industrial policy, however, would probably be

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<sup>2</sup> Production and investment subsidies could be justified by market share considerations (which in turn may reflect a desire to become "number one"). Entry subsidies and the pro-cyclical policies turned out to be wasteful.

<sup>3</sup> A shortage of intellectual property in integrated circuits and in qualified staff proved to be a long-term handicap to establishing a successful domestic semiconductor industry. Artificial Intelligence chips could be a breakthrough for the PRC, building on long-standing research by existing technology firms in the PRC.

<sup>4</sup> These latter provinces may for political reasons implement what they perceive to be central priorities, or they may not be qualified to design and implement industrial policies to begin with.

<sup>5</sup> Spreading the benefits more widely and targeting younger firms is further beneficial to productivity growth. This points towards economy-wide policies as crucial for productivity growth.

a measure of *economy-wide* consequences of the policy, or a cost-benefit analysis for the particular application of government resources and government regulatory authority.

This chapter bypasses the question of how to evaluate outcomes. It also does not focus on the different facets of industrial policies or on the individual means by which the government interferes in the economy. Instead, it focuses on the one channel through which industrial policy is inevitably realized: changes in investment patterns. Since the PRC's industrial policies target specific sectors (or products), they affect investment patterns. Whether the objective of industrial policy is innovation (product or process innovation) or economies of scale or consolidation, or any other objective, implementation will involve reallocation of capital i.e., changes to investment patterns.

In the remainder of this chapter six sets of industrial policies enacted since 2004 are introduced, and their impact on the patterns of investment growth in industry is examined through regression analysis. Further analysis investigates sector, subordination, funding and ownership patterns of investment.<sup>6</sup>

## **Industrial Policy**

Establishing investment priorities has long played an important role in the economic development of the PRC. In the second half of the 1950s, investment in 156 industrial projects established with the help of the Soviet Union laid the foundation for the PRC's economy. In the Third Front Construction of the late 1960s and early 1970s, industrial investment was directed geographically according to military prerogatives. By the late 1980s, investment policy repeatedly assumed macroeconomic policy functions; for example, in the aftermath of the 2008 global financial crisis, an aggregate investment push—which distinguished little between different types of projects—helped maintain economic growth.<sup>7</sup>

A fundamental change in investment decision-making occurred in 2004. The State Council decreed that investment planning would morph into an investment approval procedure, transferring to the investing unit the investment initiative and extensive decision-

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<sup>6</sup> This chapter includes some (updated and expanded) earlier analysis of the author (Holz, 2019).

<sup>7</sup> An early example of the macroeconomic policy function of investment policies are the contractionary macroeconomic policies of 1988/89 (Holz, 1999). For the investment spurt after the global financial crisis, frequently viewed as “overinvestment” leading to excess capacity, high levels of debt, and poor asset quality, see Bai et al. (2016); the authors suspect that local governments' access to financial resources translated into investment that potentially worsened the overall efficiency of capital allocation.

making authority. Investment by non-state units became, in principle, no longer subject to government approval (SC, 2004).<sup>8</sup>

The government did not, however, fully surrender its influence over investment decisions. An appendix to the regulation listed restricted types of investment projects by sector that continued to require government authorization. Direct government investment was still to occur in sectors where the market could not achieve an “effective allocation of resources.” The government continued its practice of setting out its priorities in five-year plans. And it began to issue a number of industrial policy measures intended to channel investment and productive activities into government-favored endeavors. The following sub-sections briefly describe six sets of industrial policy measures issued since the early 2000s.<sup>9</sup>

### **A. Industrial Policies 2004–2009**

Three types of industrial policies evolved in the intermediate aftermath of the relaxation of investment controls in 2004:<sup>10</sup>

- (i) Broad policies addressing more than one sector: priority investment catalogues for high-tech industries (2004, 2007, 2011) and foreign investors (2005, 2007), adjustment of the industrial structure (2005 and 2011), a Science and Technology Development Plan 2006-2020,<sup>11</sup> acceleration of service sector development (2007), lists of technologies and products for import (2007, 2009, 2011), and industrial technology promotion (2009).
- (ii) Policies targeting individual industries: the automobile industry (2004), machine-building industry (2006), nine traditional sectors for revitalization (2009),<sup>12</sup> information technology industry (2009), logistics industry (2009), and culture (2009).

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<sup>8</sup> For a description of the investment procedures in effect through the mid-1990s, focusing on the gradual decentralization of investment approval authority within the planning bureaucracy (while the central government retained strong control during austerity periods), see Huang (1996a, b). On increasing encouragement of private investment in the 2000s, see Lardy (2014, pp. 91f.).

<sup>9</sup> Each set of industrial policies comprises numerous documents, from the initial document to follow-up instructions and corresponding documents issued by central ministries and provincial and municipal governments. Prud’homme’s (2016) finds more than 300 documents for the case of the 2010 Strategic Emerging Industry policy alone.

<sup>10</sup> Heilmann and Shih (2013) provide a list of industrial policies, here augmented, and categorized. For an overview of the development of industrial policy also see Lo and Wu (2014).

<sup>11</sup> Science and technology five-year plans have been issued parallel to the national five-year plans all along. This mid- to long-term Science and Technology Development Plan (2006-2020) carried particular weight.

<sup>12</sup> These sectors for revitalization 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), all of which were later integrated into the Twelfth Five-Year Plan, 2011-2015.

(iii) Sector-specific ministry five-year plans.

Many of these policies are not narrowly focused on one sector but expansive in their coverage. For example, the 2005 guidance catalogue for adjustment of the industrial structure lists approximately 500 “encouraged” types of investment projects such as “Construction of a National Agricultural Products Base” and “Development of Inter-Regional Power Grid Engineering Technology,” 200 “restricted” types of projects, and 400 types of projects to be “eliminated” (NDRC, 2 December 2015) The catalogue was revised in 2011 (NDRC, 27 March 2013).<sup>13</sup> A number of implementation instructions accompanied the catalogues, with later instructions reclassifying some projects.

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

In 2010, the State Council identified seven “strategic emerging industries” (*zhanluexing xinxing chanye*), with a target share in 2015 GDP of 8 percent, and in 2020 GDP of 15 percent (SC, 10 October 2010). The seven industries are:

- Energy-saving and environmental protection technologies;
- next generation information technology;
- biotechnology;
- high-end equipment manufacturing;
- new energy;
- new materials;
- new energy vehicles.<sup>14</sup>

The document elaborated on each of these industries and then proceeded to list ways to support their development. Non-state (*minjian*) investment was explicitly encouraged.

These industries cannot be readily identified in the sector classification system because each of them cuts across the PRC’s sector classification system as published by the National Bureau of Statistics (NBS). For example, the “new energy” industry touches more than one sector in the sector classification system, and the sector classification system does not distinguish between “old” and “new” within any one sector. (It is thus also not possible to ascertain if the 2015 GDP target share of 8 percent was met.)

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<sup>13</sup> See Traurig (2011) for details on the differences between the 2005 and 2011 catalogues. Projects not covered by the catalogue are permitted.

<sup>14</sup> For an English language summary of the State Council document see The US-China Business Council (2013).

The catalogue of strategic emerging industries was revised in 2013 and then again in 2016. In 2016, “digital innovation” was newly added as an eighth favored industry, and the eight industries were broken down into 174 “key directions” with 4000 products and services (NDRC, 25 January 2017).

### **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 detail than the 2010 State Council document does.<sup>15</sup> Another section of the plan covers nine traditional industries, with what seems a wish-list for development (here itemized in parentheses):

- 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 projects within a sector. A particular sector thus may

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<sup>15</sup> See section 10 of the Twelfth Five-Year Plan. Some of the subsequent sections cover aspects of the seven strategic emerging industries, though the term “strategic emerging industries” does not always appear.

comprise favored and non-favored projects, with an ambiguous overall effect on investment in this sector.

A key topic of the Twelfth Five-Year Plan was “structural change,” targeting a breakthrough for the strategic emerging industries and an increase in their share of the tertiary sector (i.e., services) in GDP by four percentage points.<sup>16</sup> The Plan also involved adjusting and “optimizing” the investment structure, emphasized the important role of investment for domestic demand, and encouraged non-state investment.<sup>17</sup>

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

The “supply-side structural reform” agenda was first introduced by the Finance and Economics Leading Small Group of the Party Central Committee in November 2015.<sup>18</sup> It comprises five elements, with the first three directly impacting on investment: eliminating excess capacity, especially in steel and coal production; reducing stocks, mostly in real estate in second- and third-tier cities; de-leveraging across the economy; lowering costs, including those due to taxes, regulations, and social security contributions; and a broad catch-all call for “strengthening weak points” (Naughton, 2016a,b).<sup>19</sup>

The agenda does not involve draconian closure orders but represents a nod to publicly owned firms to merge and become more efficient, and an encouragement of local officials to implement environmental and other regulations and to eliminate the least desirable production capacities. A call to reduce excess capacity may be a response to falling profitability and increasing losses at a time when prices for coal and steel were plummeting.

#### **E. “Made in China 2025” (2015)**

On 8 May 2015 the State Council issued a circular titled “Made in China 2025”—the PRC version of Germany’s 2012 “Industry 4.0”—which encouraged a fourth industrial revolution

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<sup>16</sup> Structural change further encompassed an increase in household consumption, consolidation of the agricultural foundation, “optimization” of the industrial structure, an increase in the urbanization rate by four percentage points, and a strengthening of the coordination between urban and rural development.

<sup>17</sup> The plan promoted maintaining a “rational” increase in investment, changing the 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.

<sup>18</sup> 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.

<sup>19</sup> Some details on capacity reduction are documented in an appendix available upon request.



towards smart factories.<sup>20</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>21</sup> These ten priority industries dovetail with the 2010 seven strategic emerging industries, slightly rephrased, and the original “high-end equipment manufacturing” now reflected in several more narrowly defined categories.<sup>22</sup> A central leading group was set up and supporting documents were released.<sup>23</sup> Implementation of “Made in China 2025” follows traditional PRC policy patterns with pilot cities (Ningbo being the first), annual targets and tasks, and assignment of responsibility for implementation.

The impact on investment in individual sectors of the economy is unclear. Beyond identifying ten priority industries, “Made in China 2025” does not favor certain sectors over others. Even in the case of the priority industries, investment need not increase for the sector in total, but could shift between projects within a sector. An overall objective to become 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 a drastic redirection of investment flows between sectors.

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

The industry section of the Thirteenth Five-Year Plan in three paragraphs lists comprehensive and industry-specific desirables.<sup>24</sup> The section elaborates in more detail on six sub-sectors and covers similar ground as the original seven strategic emerging industries (2010) and “Made in China 2025.”<sup>25</sup>

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<sup>20</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>21</sup> Additional details on “Made in China 2025” are documented in an appendix available upon request. Wang (2018) argues that China’s success in the technology industry so far has been in downstream consumer goods; “Made in China 2025” is an attempt to catch up in the upstream, component-supplying sectors such as semiconductors.

<sup>22</sup> Explicit reference is made to “strategic emerging industries” once, as part of an introductory passage on strengthening the manufacturing capacity of the PRC.

<sup>23</sup> For an English-language State Council webpage that promotes “Made in China 2025” events, decisions, and achievements, see <http://english.gov.cn/2016special/madeinchina2025/> (accessed 12 July 2018).

<sup>24</sup> The industry section is titled “Promote the Optimization and Upgrading of the Industrial Structure.” Separate sections promote the development of the service industry, regional balancing, and energy saving and environmental protection.

<sup>25</sup> The term “strategic emerging industries” does not appear in the plan. Kenderdine (2017) shows the policy consistency from “Strategic Emerging Industries” to “Made in China 2025” and the 13<sup>th</sup> Five-Year Plan.

- 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 (a high 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 (strengthen coal exploration, reorganize coal enterprises and close certain coal enterprises; develop large and efficient thermal power stations, hydropower and nuclear power; strengthen the power grid; promote oil and natural gas exploration and production; develop renewable energy);
- adjustment of the raw materials industry (resolve excess capacity in the metallurgical industry; adjust the chemical industry with a focus on quality improvement, less environmental pollution, and independent developmental capacity; improve building materials while saving energy and protecting the environment);
- an increase in the level of light industry (build Chinese-owned high-quality textile brands; develop new light industry products; promote energy and raw material reduction; use information technology, biotechnology, environmental protection, and other new technologies to transform light industry); and
- promotion of information technology (IT) (use IT to upgrade manufacturing, leading to yet further IT development; create a national information database; speed up development of broadband and mobile communications networks and create a triple-network of telecommunications, radio and television, and broadband; strengthen information security).

Beyond these specifically listed industries, the coverage of the plan is far-reaching, covering virtually every aspect of industry. Except for some raw materials industries singled out for a reduction in excess capacity, the plan is not so much about promoting particular sectors than about various forms of upgrading within each sector.

### **Matching Industrial Policies into the Sector Classification System**

The industrial policies represent a combination of broad exhortations and specific objectives that are difficult to match into the official sector classification system along which the official investment data, used here for analysis, are organized. Even when specific objectives are

given, including on types of projects, the objectives in many instances cut across sectors or shift the balance of different projects within a sector.

Table 1 presents an attempt to map the six sets of policies to the greatest extent possible into the sector classification system (“GB2011,” the 2011 sector classification standard (*guobiao*)). For the various pre-2010 policies, a year is given in the table. For the subsequent five sets of policies, “x” denotes that this particular sector is covered (positively) by the policy and “(-)” that the policy constrains development in this sector.

Some examples illustrate the difficulty of matching industrial policies with sectors. The sector classification system includes a fourth-digit sector “biotechnology extension services” within the first-digit service sector “science” as the only potential counterpart to a policy promoting biotechnology. 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 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 quality of light industry stipulated in the Thirteenth Five-Year Plan cannot be confined to just the textile and apparel industry, yet that is the only sector in the official sector classification system that can be matched with the description in the plan.<sup>26</sup>

For the case of the strategic emerging industries, the NBS in December 2012 issued a trial sector classification system explicitly in response to the State Council’s 10 October 2010 decision and to assist in the implementation of the Twelfth Five-Year Plan.<sup>27</sup> Strategic emerging industries are classified in the State Council’s seven categories, further broken down into 30 sub-categories and 100 sub-subcategories, at which level a correspondence is being established with 359 sectors in the NBS’s official sector classification system (GB2011).<sup>28</sup> The NBS itself emphasizes that the correspondence is not exact in that a particular aspect of the strategic emerging industries may be reflected in more than one sector

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<sup>26</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 2012-2017 values, this third-digit sector is missing.

<sup>27</sup> An updated version of the document adopting the new sector classification system GB2017 was issued in 2018. It still refers back to the State Council’s 2010 policy but now also refers to the *Thirteenth Five-Year Plan*.

<sup>28</sup> A further breakdown identifies more than 700 products or services. While the official NBS sector classification system reaches no further than the fourth-digit level—each fourth-digit level sector being accompanied by at times lengthy lists of products—NBS (December 2012), matching strategic emerging industries into the sector classification system, also includes four levels of product categories (with 4-digit, 6-digit, 8-digit- and 10-digit numbers) as sub-categories of fourth-digit sectors. The 2011 and 2017 sector classification systems (NBS, 2011, 30 June 2017) do not include product numbers.

of the official sector classification system (which its matching exercise captures), and in that some sectors of the official sector classification system may contain both strategic emerging industry aspects and other aspects (an issue the NBS cannot address).<sup>29</sup> No such NBS regulations were issued in the case of “Made in China 2025,” possibly following the Party’s recent attempts to downplay the policy.<sup>30</sup>

In 2013, in response to the Twelfth Five-Year Plan and to a guiding opinion of the State Council Office of 2011 on accelerated development of the high tech service sector, the NBS issued a trial sector classification scheme for high tech *service* industries (*gaojishu chanye (fuwuye)*). In a separate document on high tech *manufacturing* industries, also of 2013, the NBS identified six manufacturing categories as high-tech industries (pharmaceuticals, aviation, electronics and communication equipment, computer and office equipment, medical equipment, “information chemical” manufacturing (*xinxi huaxuepin zhizaoye*)) and matched them into 69 second through fourth-digit manufacturing sectors.<sup>31</sup>

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<sup>29</sup> By way of an example for the latter case, the NBS selects *all* of “agriculture” in the sector classification system to match “agricultural biotechnology applications” in the strategic emerging industries policy.

<sup>30</sup> Li and Alon (2019) point out that following the reactions abroad to the PRC’s “Made in China 2025,” the Party has banned the media from discussing “Made in China 2025.”

<sup>31</sup> For the documents see NBS (2013a,b). Both the manufacturing and service classifications of high tech sectors were later revised in accordance with the new sector classification system introduced in 2017 (NBS (2017) and NBS (2018a)). In the case of the high tech manufacturing industries, the one second-digit and the six third-digit sectors simply capture *all* (also separately identified) underlying fourth-digit sectors, The particular second-digit sector, pharmaceuticals, exceptionally comprises no third-digit sectors but seven fourth-digit sectors.

**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; data on the aerospace sub-sector are missing	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				

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. The symbol "x" means that the policy favors investment in this sector and "(-)" that the policy constrains investment in this sector.

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: "Made in China 2025" (2015). F: Thirteenth Five-Year Plan (2016–20).

Source: See discussion of industrial policies in text.

The focus of this chapter is on the impact of industrial policies on investment. Investment in the following is measured as “Fixed Asset Investment” (FAI, *guding zichan touzi*). FAI is the sum of all fixed asset investment spending by firms.<sup>32</sup> Detailed sector and ownership data are available for a significant but changing subset of FAI over time: (i) in 2003-2010, “urban” investment, accounting for 82 to 88 percent of FAI; and (ii) since 2011, “investment, except by rural households,” accounting for 97 to 99 percent of FAI.<sup>33</sup> In the following, the label “urban” investment will be used for both of these (sequential) subsets, independent of whether these are data of the years prior to 2011 or since 2011.

Due to three statistical breaks between 2009/2010 and 2012—with precise years depending on source and type of statistic—the investment data are best analyzed separately for the periods before and after the statistical breaks.<sup>34</sup> The investment data are in nominal terms; sector-specific investment deflators are not available.<sup>35</sup>

## Industrial Policies and Investment Growth

The question of if industrial policies affect sector investment patterns is addressed in the following through regression analysis. Industrial policies are captured by dummy variables for each of the six policies identified above. But factors other than industrial policies may also affect investment. A prime competing explanatory variable for the observed investment patterns is profitability.

Investment and profitability data can be matched for mining, manufacturing, and utilities (“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

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<sup>32</sup> A detailed discussion of the investment data can be found in Holz (2019), with issues of data quality discussed in Holz (2017). The key sources of investment data are the *Statistical Yearbook*, the *Investment Statistical Yearbook*, and the NBS database available online.

<sup>33</sup> The difference between the two subsets is that the earlier subset excludes not just investment by rural households but also by rural non-households, i.e., it excluded *all* rural investment.

<sup>34</sup> The three statistical breaks are: (1) In 2011, the urban-rural distinction evolved into a distinction between “investment, except by rural households” (for which detailed data are available) and “investment by rural households,” accounting for 97 percent and 3 percent of total investment respectively. (2) Since 2011, the new minimum urban investment size to be included in the statistics is CNY5 million, ten times higher than the size criterion previously applied through 2010 to “urban investment,” of CNY500,000. (3) The sector classification system was adjusted in 2012 with a switch from the earlier GB2002 to the latest GB2011. At the first- and second-digit sector level, GB2002 and GB2011 are similar, though not fully identical. For details on the transition in the classification system, statistical breaks, and coverage changes over time see Holz (2013).

<sup>35</sup> Neither nominal nor real (inflation-adjusted) FAI data are an obviously preferred choice.

approximately 90 percent of industrial value-added.<sup>36</sup> If profitability of above-norm industrial enterprises in a particular sector is representative of the profitability of all industrial enterprises in that sector, and if investment in industry is exclusively conducted by industrial enterprises, then the two datasets can be combined. Fourth-digit sector industry data are available for 2012-2016 and fourth-digit sector investment data for 2003-2012 and 2014-2017.<sup>37</sup> Given the 2010 and 2015 policy interventions, the analysis is conducted separately for the two periods 2012-2015 and 2015-2017.

Profitability is measured by return on assets (RoA).<sup>38</sup> Several control variables are included: (i) Sales growth represents market demand, with changes in market demand potentially triggering changes in investment. (ii) Different ownership forms, measured by their share in investment, may come with different investment behavior. (iii) Investment per employee controls for capital intensity, with investment potentially shifting away from or towards sectors with high capital intensity. It is measured in CNY million per employee, while all other variables are measured in percentages.

For the first period (2012-2015), due to data limitations, sales growth data are those of 2013.<sup>39</sup> RoA is also of 2013. For consistency, the ownership data should be of 2013, too, but because fourth-digit sector investment data are not available for 2013, those of 2014 are used. (Ownership shares are quite stable between adjacent years and the particular choice of year should have little effect.) Data on investment per employee can only be constructed for 2014 because the 2012 industry data do not report employment values and fourth-digit sector investment values for 2013 are not available. For the second period (2015-2017), sales growth data are those of 2015 compared to 2013, while RoA, ownership data and investment per employee are of 2015.

Table 2 reports the Ordinary Least Squares regression results for the first period of analysis (2012-2015) across fourth-digit sectors plus those third-digit sectors for which no

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<sup>36</sup> Above-norm industrial enterprises are industrial enterprises with annual sales revenue from principal business above (since 2011) CNY20 million. The data source is the *Industry Statistical Yearbook* series.

<sup>37</sup> The data sources are documented in more detail in an appendix available upon request. The availability of data coincides with the consistent use of one sector classification system (GB2011) during the period 2012-2017. A new sector classification system was introduced in 2017 (GB2017) but the published 2017 fourth-digit sector investment data still adhere to the previous classification system.

<sup>38</sup> Alternatively, one could use return on equity (with near-identical results).

<sup>39</sup> With investment growth measured for the period 2012–2015, a preferred sales growth measure might cover the period 2012 vs. 2011, but 2011’s fourth-digit sector industry data are not available (and data for earlier years follow the different, earlier sector classification system).

fourth-digit sector data are available.<sup>40</sup> Profitability has a significant positive impact on investment growth, as do sales growth and capital intensity (first column of **Table 2**).<sup>41</sup> The investment share of state-owned and state-controlled units (SOSCU) has a negative impact, while the shares of foreign-funded units (FFUs) and of Hong Kong, Macau and Taiwan units (HKMTUs) have no impact (second column); the omitted ownership group is all non-state domestic units, for which no further breakdown is available.<sup>42</sup>

Of the six sets of industrial policies, the supply-side structural reform program of 2015 and “Made in China 2025” have a significant effect with the expected signs. Both effects occur in the three years (2012-2015) *before* the policy was initiated.

The NBS measure of strategic emerging industries (with a dummy variable for 236 fourth-digit sectors in industry identified by the NBS) shows no significant impact of this 2010 policy on the investment patterns of 2012-2015.<sup>43</sup> The 62 high tech fourth-digit manufacturing sectors identified by the NBS in 2013 also have no significant impact.

Table 3 reports the regression results for investment growth between 2015 and 2017. Sales growth and ownership matter as before. The share of investment by FFUs and at times by HKMTUs is now also significant, with a positive impact on investment growth. The coefficient of capital intensity is consistently significant but now with a negative sign, indicating investment growth away from high capital intensity sectors, in contrast to the previous period of 2012-2015.

Profitability in 2015 consistently plays no role in explaining investment growth. Data problems led the NBS to stop publishing detailed industry data starting 2017, indicating potentially problematic (especially, for political reasons) profitability data. Otherwise, if the lack of significance reflects a real world phenomenon of profitability having no impact on investment patterns, this would open wide the door to alternative explanations including industrial policies.

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<sup>40</sup> The NBS’ sector classification systems presents these third-digit sectors with two numbers: a third-digit sector number, and the same number with a zero added at the end to denote a fourth-digit sector.

<sup>41</sup> Holz (2019) reports further results for the first period, including for return on equity as profitability measure and using a dataset limited to third-digit sectors.

<sup>42</sup> Ownership can also be measured by the registration-based share of different ownership forms in paid-in equity. The shares of the state and of “individuals” tend to be negative and significant, while those of FFUs and HKMTUs tend to be positive and significant. All other registration forms have no significance.

<sup>43</sup> The NBS identifies an additional eight second-digit sectors. These are not made use of because the NBS typically has identified a selection of fourth-digit sectors (within these second-digit sectors) as relevant. The two third-digit sectors not further used here but identified by the NBS are spices and fermented products, and the manufacture of wine, sectors one would probably not readily consider strategic emerging industries. In regressions, the coefficient of a slightly adjusted NBS measure (making common sense adjustments to the NBS selection of sectors) is also insignificant.



The supply-side structural reform program of 2015 has a barely significant (negative) correlation with investment growth in 2015-2017, indicating a possible policy effect, except that changes in the industries targeted by the supply-side structural reform program had already been well underway for years before the policy was issued and the policy may simply coincide with an ongoing trend determined years earlier. “Made in China 2025” and the Thirteenth Five-Year Plan, both of 2015, have a *negative* impact on investment growth in 2015-2017, i.e., carry the wrong sign.<sup>44</sup>

Combining all six policies in one and the same regression attests the pre-2010 industrial policies a *negative* impact—perhaps the policies are outdated as of 2015-2017—and the Strategic Emerging Industry policy of 2010 a positive impact on investment growth in 2015-2017, i.e., half a dozen years later. The coefficient of the NBS’ (2012) strategic emerging industries continues to be insignificant, while that of the NBS’s (2013) high-tech sectors is significant, again with a considerable time lag.

To summarize the findings: In the first period, profitability, market demand, ownership characteristics, and capital intensity exert an unambiguous influence on investment growth. Industrial policies, in the rare instances that they matter, *do so after the fact*. In the second period, the effect of market demand and ownership characteristics persists, while the effect of capital intensity turns negative. Profitability has no effect and neither do industrial policies; in the few instances that the industrial policies are significant they either carry the wrong sign, or the effect occurs so many years later it is doubtful it can still be attributed to the policy.<sup>45</sup>

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<sup>44</sup> Across all regressions involving a dummy variable for the Thirteenth Five-Year Plan, the dummy variable is assigned the value one only for those sectors *favoured* by the Thirteenth Five-Year Plan. Interaction terms of individual industrial policies and the investment share of SOSUCs tend to be insignificant.

<sup>45</sup> The explanatory power of the regressions (as measured by the  $R^2$ ) is relatively low throughout. In 2015-2017, variation in the explanatory variables typically explains about 15 percent of the variation in investment growth. This suggests that other sector-specific characteristics may play an important role for investment growth.

**Table 2: Explaining Investment Growth 2012–2015**

	Dependent variable: growth rate of investment 2012-2015 in %										
RoA 2013	***2.75 (0.75)	***2.21 (0.80)	***2.12 (0.81)	***2.19 (0.81)	**2.10 (0.82)	***2.16 (0.80)	***2.16 (0.80)	***2.21 (0.80)	**1.87 (0.82)	***2.33 (0.81)	***2.20 (0.80)
Sales growth 2013	***0.74 (0.24)	***0.64 (0.24)	***0.63 (0.24)	***0.64 (0.24)	***0.63 (0.24)	**0.62 (0.24)	***0.65 (0.24)	***0.64 (0.24)	**0.60 (0.25)	**0.62 (0.24)	**0.62 (0.24)
SOSCU 2014 share in investment		***-0.83 (0.31)	***-0.87 (0.31)	***-0.84 (0.31)	***-0.85 (0.31)	** -0.77 (0.31)	***-0.84 (0.31)	***-0.83 (0.32)	***-0.83 (0.32)	***-0.88 (0.31)	***-0.84 (0.31)
FFU 2014 share in investment		-0.22 (0.92)	-0.20 (0.92)	-0.19 (0.93)	-0.13 (0.93)	-0.31 (0.91)	-0.34 (0.91)	-0.22 (0.92)	-0.49 (0.95)	-0.30 (0.92)	-0.55 (0.95)
HKMTU 2014 share in inv.		0.14 (1.29)	0.07 (1.29)	0.14 (1.2)	0.14 (1.29)	0.08 (1.29)	0.32 (1.29)	0.13 (1.29)	-0.07 (1.31)	0.13 (1.29)	-0.14 (1.30)
Investment / em- ployee 2014	***9.69 (2.74)	***11.9 (2.86)	***11.9 (2.86)	***11.9 (2.87)	***12.0 (2.87)	***11.6 (2.86)	***11.8 (2.85)	***11.9 (2.87)	***11.3 (2.91)	***11.9 (2.86)	***12.0 (2.86)
<i>Policy dummies</i>											
Pre-2010 ind. policies			-6.92 (10.1)						-23.8 (18.8)		
Strategic Emerg. Industries				-1.80 (9.45)					22.3 (24.0)		
12 <sup>th</sup> FYP					-5.35 (9.13)				-11.6 (18.8)		
Supply-side structural ref.						*-53.3 (30.6)			-49.1 (31.5)		
Made in China 2025							**32.2 (15.7)		**38.6 (16.5)		
13 <sup>th</sup> FYP								-0.74 (22.0)	-13.5 (22.8)		
NBS Strategic Em. Industries										9.27 (8.96)	
NBS High-tech											19.8 (15.2)
Intercept	*16.4 (9.61)	*30.5 (12.0)	***33.6 (12.9)	**31.3 (12.7)	**33.5 (13.1)	***32.4 (12.1)	**28.3 (12.1)	**30.5 (12.1)	***37.6 (13.3)	**26.7 (12.6)	***30.7 (12.0)
Obs.	563	563	563	563	563	563	563	563	563	563	563
R <sup>2</sup>	0.063	0.075	0.076	0.075	0.064	0.080	0.071	0.075	0.092	0.078	0.078

RoA: return on assets.

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

SOSCU: State-owned and state-controlled unit; FFU: foreign-funded unit; HKMTU: Hong Kong, Macau, Taiwan unit.

FYP: Five-year plan.

NBS: National Bureau of Statistics.

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

Investment data cover “investment, except by rural households.” Industry data cover the above-norm industrial enterprises.

The sector coverage is fourth-digit sectors plus those third-digit sectors for which no fourth-digit sector data are available.

Values in parentheses are standard errors.

Significance levels: \* 10%, \*\* 5%, \*\*\* 1%.

Sources: *Investment Statistical Yearbook 2013, 2015, 2016; Industry Statistical Yearbook 2013, 2014, 2015.*

**Table 3: Explaining Investment Growth 2015-2017**

	Dependent variable: growth rate of investment 2012-2015 in %										
RoA 2015	-0.07 (0.30)	-0.20 (0.31)	-0.27 (0.31)	-0.20 (0.31)	-0.25 (31.7)	-0.25 (0.31)	-0.19 (0.31)	-0.23 (0.31)	-0.34 (0.32)	-0.20 (0.32)	-0.22 (0.31)
Sales growth 2015	***0.48 (0.06)	***0.46 (0.06)	***0.46 (0.06)	***0.46 (0.06)	***0.46 (0.06)	***0.44 (0.06)	***0.47 (0.06)	***0.47 (0.06)	***0.44 (0.06)	***0.46 (0.06)	***0.44 (0.06)
SOSCU 2015 share in investment		***-0.28 (0.10)	***-0.31 (0.10)	***-0.28 (0.10)	***-0.29 (0.10)	***-0.27 (0.10)	***-0.27 (0.10)	** -0.24 (0.10)	** -0.27 (0.11)	***-0.29 (0.10)	***-0.30 (0.10)
FFU 2015 share in investment		***1.08 (0.32)	***1.11 (0.32)	***1.08 (0.33)	***1.12 (0.33)	***1.06 (0.32)	***1.18 (0.32)	***1.16 (0.32)	***0.99 (0.34)	***1.08 (0.32)	***0.88 (0.34)
HKMTU 2015 share in inv.		*0.88 (0.52)	0.79 (0.52)	*0.88 (0.52)	*0.87 (0.52)	0.85 (0.52)	0.75 (0.52)	0.78 (0.52)	0.40 (0.53)	*0.88 (0.52)	0.75 (0.52)
Investment / em- ployee 2015	***-3.53 (0.94)	** -2.27 (0.97)	** -2.25 (0.97)	** -2.27 (0.97)	** -2.19 (0.97)	** -2.25 (0.97)	** -2.23 (0.96)	** -2.17 (0.97)	** -2.39 (0.97)	** -2.26 (0.97)	** -2.14 (0.97)
<b>Policy dummies</b>											
Pre-2010 ind. policies			-5.04 (3.49)						***-17.4 (6.51)		
Strategic Emerg. Industries				0.30 (3.25)					**18.7 (8.29)		
12 <sup>th</sup> FYP					-2.21 (3.14)				-4.83 (6.5)		
Supply-side structural ref.						*-18.0 (10.7)			*-18.25 (10.9)		
Made in China 2025							** -12.7 (5.4)		-8.55 (5.68)		
13 <sup>th</sup> FYP								** -16.0 (7.61)	*-13.5 (7.82)		
NBS Strategic Em. Industries										0.22 (3.13)	
NBS High-tech											**10.5 (5.26)
Intercept	0.27 (3.11)	-1.58 (3.82)	0.56 (4.09)	-1.69 (4.03)	-0.38 (4.18)	-0.53 (3.87)	-0.92 (3.81)	-1.36 (3.81)	2.86 (4.25)	-1.68 (4.12)	-1.30 (3.81)
Obs.	565	565	565	565	565	565	565	565	565	565	565
R <sup>2</sup>	0.106	0.151	0.154	0.151	0.152	0.155	0.159	0.158	0.180	0.151	0.157

For notes see previous table.

Sources: *Investment Statistical Yearbook 2016, 2018; Industry Statistical Yearbook 2014, 2016.*

The list of sectors that the NBS in 2012 deemed to correspond to strategic emerging industries is not limited to industry. Across the tertiary sector and construction, investment in the fourth-digit sectors (including those third-digit sectors that do not contain fourth-digit sectors) which the NBS deems the subject of the strategic emerging industry policy grew faster than those not deemed to be subject to industrial policy, in both the 2012-2015 and the 2015-2017 periods, but the difference is not statistically significant. The high tech tertiary sectors identified by the NBS in 2013 perform no different than other tertiary sectors, in both periods.<sup>46</sup>

<sup>46</sup> The comparisons are based on the mean of investment growth rates across individual policy sectors vs. non-policy sectors. For the strategic emerging industry sectors identified by the NBS in services and construction, the average sector investment growth rate of 2015 (vs. 2012) is 145 percent compared to 132 percent in the case of non-policy sectors, and in 2017 (vs. 2015) it is 27 percent compared to 16 percent. (Each sector is given equal

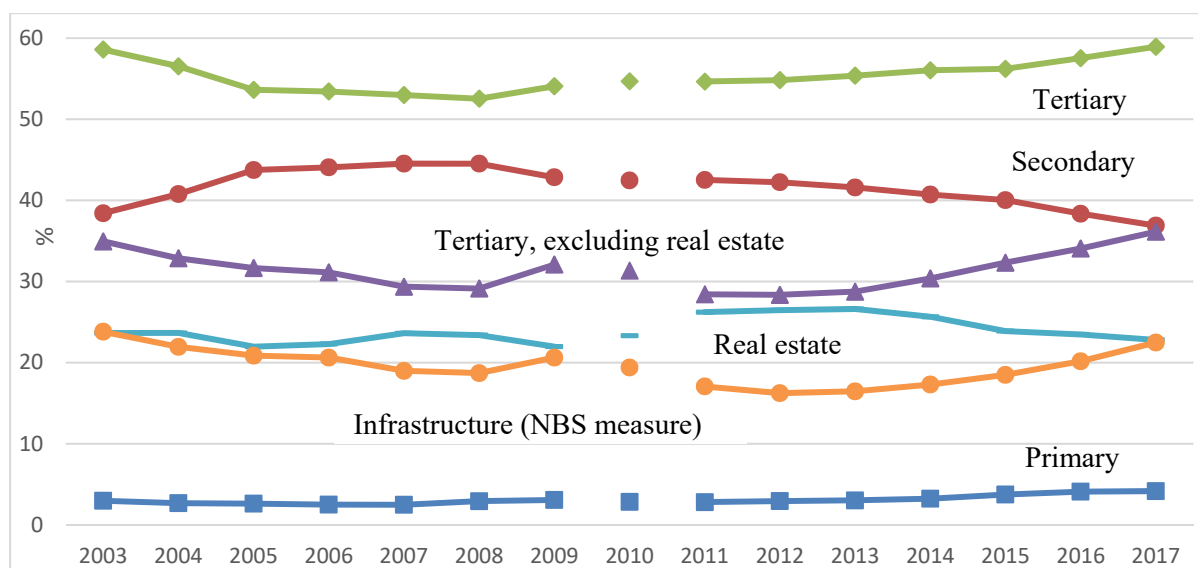
## Sector Distribution of Investment

The patterns of investment across economic sectors can be examined at different levels of aggregation, providing additional insights into the effects of industrial policy on investment.

### Primary, Secondary, and Tertiary Sectors

At the aggregate level of primary, secondary, and tertiary sectors, changing investment patterns reflect predominantly macroeconomic developments. Between 2003 and 2016, the share in FAI of the secondary sector—industry (mining, manufacturing, and utilities) and construction—rose from 38 percent in 2003 to 45 percent in 2008 before gradually falling back to 37 percent in 2017 (Figure 1). The primary and tertiary sectors (agriculture and services) exhibit the reverse pattern, with declining shares through 2007/2008, and then increasing shares.

**Figure 1: Sector Investment (FAI) Shares 2003–2017 (%)**



Real estate constitutes a tertiary sector sub-sector. Infrastructure is the sum of several tertiary sector sub-sectors. The share of infrastructure in investment is based on data on “urban” investment, following NBS practice (as elaborated in an appendix). Infrastructure investment is the sum of investment in most sub-sectors of transportation (rail, road, water, air, pipeline), information technology, and public facilities.

Source: NBS database, *Statistical Yearbook 2017, 2018*.

weight.) The average investment growth rate in high tech service sectors is 133 percent in 2015 (vs. 2012) compared to 137 percent in non-high tech sectors, and 20 percent compared to 19 percent in 2017 (vs. 2015). None of these differences is statistically significant in a student t-test, due to the wide dispersion of investment growth rates across sectors.

The tertiary sector—transport, trade, real estate development, and a host of other services ranging from business services to public administration—has always accounted for the bulk of investment (59 percent in both 2003 and 2017), albeit with a U-shaped trend. The recovery in the tertiary sector investment share in 2009 coincided with overall FAI growth of 30 percent, the highest growth rate in the period covered. Such drastic investment growth in the tertiary sector is in line with a 2007 policy to accelerate service-sector development, but also follows the investment push after the U.S. financial crisis of 2008, and precedes a *later* Twelfth Five-Year Plan policy favoring an increase in the tertiary sector share in GDP.

While the Twelfth Five-Year Plan (2011-2015) suggested raising the share of the tertiary sector in GDP by four percent percentage points, in fact the share rose only by one percentage point (between 2010 or 2011 and 2015). Much of this tertiary sector investment growth, furthermore, appears driven not by industrial policy: Real estate investment, one sub-sector of the tertiary sector, accounted for almost half of tertiary sector investment in 2011 through 2013, which suggests a macroeconomic policy rationale. Infrastructure investment, a combination of sub-sectors of the tertiary sector and also not an industrial policy target, contributed significantly to tertiary sector investment growth between 2013 and 2017.

### **First-digit Sectors**

In 2015, more than half of FAI was concentrated in two of the exhaustive 19 first-digit sectors: manufacturing (32 percent) and real estate (24 percent). These were followed by public facilities including environment (10 percent) and transport (9 percent). I.e., one-quarter of the first-digit sectors accounted for three-quarters of FAI (Figure 2). The corresponding percentages in 2012 and 2017 were similar (35/30, 26/23, 8/13, and 9/10 percent). Information technology (IT) accounted for only 1 percent of economy-wide investment in 2012, 2015, and 2017.

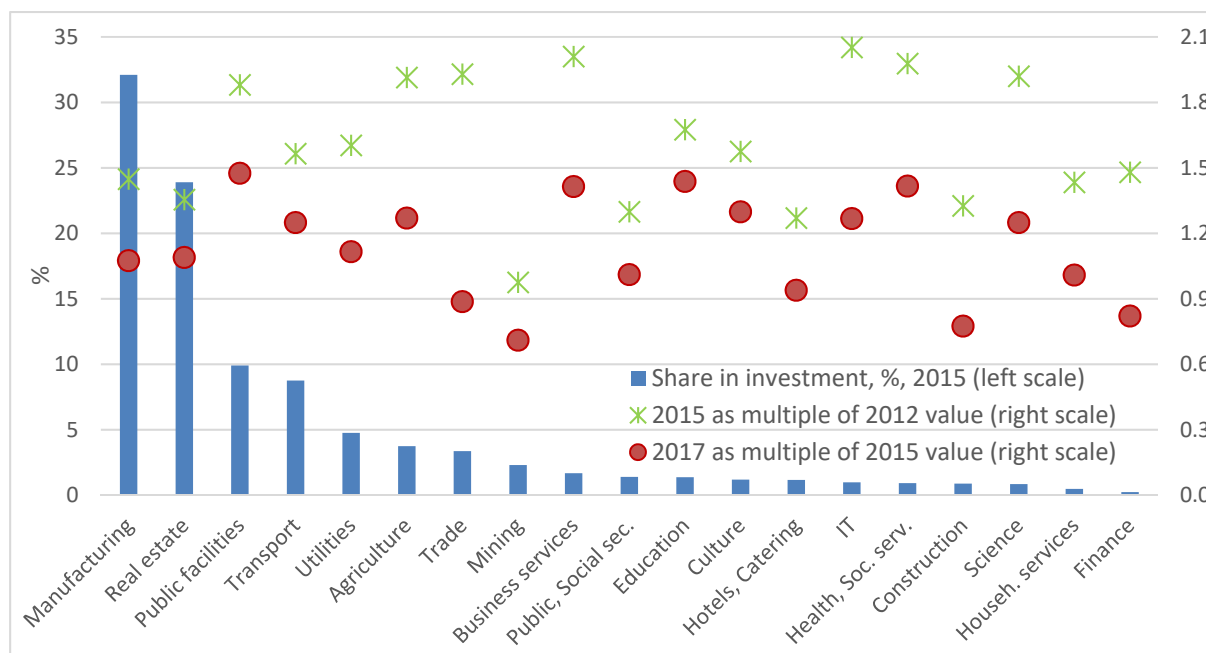
In the period 2012–2015, investment in mining was stagnant (crosses in Figure 2), predating the 2015 supply-side structural reform agenda. Manufacturing investment does not show any impact from the various industrial policies favoring individual manufacturing sectors promulgated in the Twelfth Five-Year Plan. Investment in 2012-2015 grew fastest in IT, business services, health, trade, and science (the latter, at 1.5 percent, was triple its 2010 share in FAI).<sup>47</sup> Growth in IT and science conforms with the 2010 strategic emerging

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<sup>47</sup> In contrast, between 2003 and 2010, among these five sectors, the growth rate of IT had been far below the average FAI growth rate, and only business services and trade somewhat exceeded the average.

industries policy. In 2015-2017, the fastest-growing sectors were public facilities, business services, education, and health, none of which is a sector favored by industrial policies (dots in Figure 2). These are followed by IT and science—sectors targeted by industrial policies—but also by culture and agriculture.

**Figure 2. Sector Investment Shares and Growth Rates, 2012-2015, 2015-2017**



IT: Information technology. (For sector labels, see note to Figure 4, below.)

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.

Source: NBS website; *Statistical Yearbook 2016, 2017, 2018* (Table 10-6).

### Second- to fourth-digit sectors

At the second-digit sector level, investment growth and industrial policies are not clearly aligned. Data are available for approximately 100 second-digit sectors for the subset of “urban” investment. Examining the periods 2003-2008, 2008-2010, 2012-2015, and 2015-2017, the growth rates of urban investment correlate with industrial policies for some sectors but not for others; many sectors exhibit high investment growth rates despite not being industrial policy sectors.<sup>48</sup>

The coefficient of variation in investment growth rates over the four periods decreased from 0.76 in 2003-2008 to 0.32, 0.34, and 0.25 in 2008-2010, 2012-2015, and 2015-2017.

<sup>48</sup> See Holz (2019) for a detailed discussion of the periods 2003-2008, 2008-2010, 2012-2015, and 2015-2016.

This suggests a trend towards broad-based, economy-wide investment growth rather than any form of specialization that could be the outcome of targeted industrial policies.

Figure 3 graphically extracts the second-digit *industry* sectors with their 2015 shares in investment—including an ownership breakdown that is discussed below—as well as the sector growth rates in percent between 2012 and 2015 (crosses) and between 2015 and 2017 (dots), both measured on the right-hand side axis. All mining sectors experienced significant investment declines between 2015 and 2017, including a 23 percent fall in investment in oil and natural gas extraction, a sector *favored* by the Thirteenth Five-Year Plan for 2016-2020. Investment in both coal and ferrous metals, key sectors targeted by the Supply-side Structural Reform Program of 2015, already fell significantly before 2015.

In manufacturing, a broad range of light industry sectors (the approximately first dozen manufacturing sectors) experienced above-average growth rates in both periods, even though industrial policies addressed none of these sectors except for the textile industry in the Twelfth Five-Year Plan. Both the furniture industry and the manufacture of cultural goods stand out with exceedingly high growth rates in both periods (“culture” being the focus of a 2009 policy).

Investment growth in 2015-2017 was (newly) highest for computers (including communication and other electronic equipment) at 43 percent, an industrial policy sector, followed by the furniture industry, not the target of industrial policy. The 18 percent growth rate of electrical machinery and apparatuses may be somewhat in line with high-end manufacturing being promoted as a strategic emerging industry (2010) or numerical control tools and robotics being promoted by “Made in China 2025” (2015), but investment in general purpose machinery and in special purpose machinery was unchanged (negative 1 percent, 0 percent). Investment in the automobile industry—the Strategic Emerging Industry policy (2010) promoted the development of electric vehicles, and “Made in China 2025” the development of new energy vehicles—rose an unremarkable 14 percent in 2015-2017 and an equally average rate of 43 percent in 2012-2015.

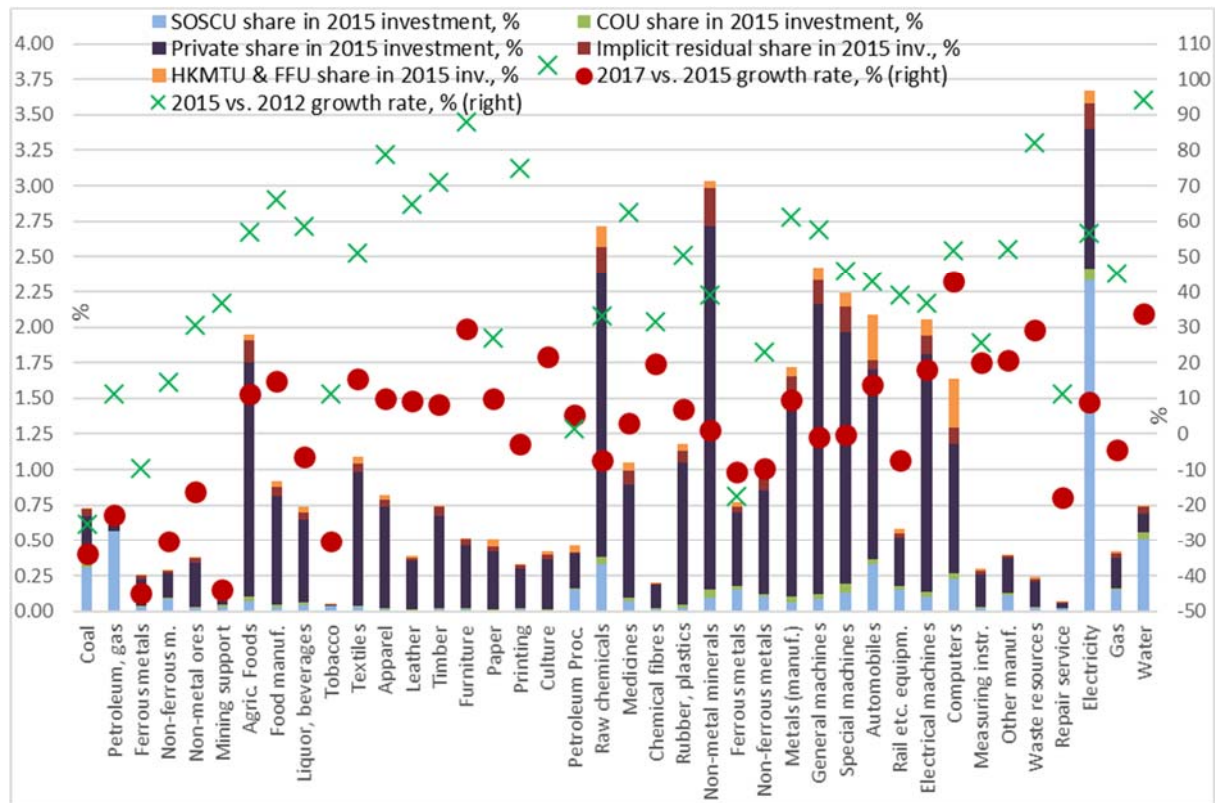
Extending the analysis to the third- and fourth-digit sector levels, changes in investment patterns across many of the sectors predate the respective industrial policies, and in some sectors concur.<sup>49</sup> The fact that the 30 fastest-growing sectors together account for an ever smaller share of “urban” investment over time, by 2015 equal to only one-thirtieth of what one would expect that share to be given the average sector share, suggests that fast-growing

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<sup>49</sup> Details are provided in Holz (2019) for the years through 2016.

investment in a particular sector primarily serves to develop a previously underdeveloped sector, implying a catch-up process or the completion of an industrial structure more than any kind of specialization that would be favored by targeted industrial policies.

**Figure 3. Industry Investment Patterns (incl. by ownership) 2015, and 2015 and 2017 growth rates (%)**



SOSCU: State-owned and state-controlled unit. COU: Collective-owned unit. HKMTU: Hong Kong, Macau, Taiwan unit. FFU: Foreign-funded unit.  
 Data coverage: Investment, except by rural households, for industry (mining, manufacturing, and utilities). The sum of all bars across sectors (left-hand side scale) equals 39.9% of (economy-wide) “urban” investment. In each bar, the ownership distribution begins from the bottom up. Thus, SOSCUs occupy the lowest segment of the bar, with private units the next segment up. (The shares of HKMTUs, FFUs, COUs, and of the residual tend to be relatively small and may not be easy to decipher in the chart.)  
 Source: NBS database, *Statistical Yearbook 2016, 2017, 2018*.

### Central Influence on Investment

Central influence over investment extends in two respects: the level of central-local subordination of investment, and sources of investment funding. Official statistics classify investment according to the level of government under which the investment occurs. “Central” investment denotes investment by enterprises, administrative facilities (*shiye danwei*), and administrative organs (*xingzheng danwei*)—in short, by “units”—directly subordinate to the Chinese Communist Party Central Committee, the National People’s



Congress, and the State Council’s ministries, commissions, offices, and companies.<sup>50</sup> All other investment is “local:” all projects by enterprises, administrative facilities, and administrative organs that are directly led and administered by provincial, municipal, and county governments and their relevant departments,<sup>51</sup> as well as private and foreign investment that is not subordinate to any administrative tier.

The central share in FAI declined from 13.3 percent in 2003 to a mere 4.7 percent in 2015 and 4.1 percent in 2017, less than one-twentieth of FAI.<sup>52</sup> This extremely low share of central investment means that the central government’s direct impact on investment via units subordinate to the central government is small and near-negligible.

The “urban” investment data come with a more detailed breakdown of local investment by tier. In 2015, the center accounted for 5 percent of investment, the provinces for 4 percent, the municipalities for 8 percent, the counties for 17 percent, and “others” for 65 percent (Figure 4).<sup>53</sup> The center has a relatively high investment share in mining, utilities, and transport; the provinces in transport; the municipalities in transport and across all tertiary sectors; and the counties in construction, transport, “water conservancy, environment, and public facilities,” education, health, and public management. These sectors are unrelated to industrial policies. The provision of public goods can plausibly explain the observed investment patterns.<sup>54</sup>

“Other” investment—principally the private sector—is the dominant form of investment in more than half of all first-digit sectors, in particular in manufacturing (where it accounts for 87 percent of investment) and in real estate (69 percent). These two sectors are also the largest sectors by investment volume (together they account for 56 percent of FAI). “Other” investment further accounts for approximately three-quarters of investment in agriculture, trade, business services, science, and household services. The share of “other” investment is lowest in transport (29 percent), education (34 percent), and public management (34 percent), i.e., in public goods sectors.

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<sup>50</sup> For the definition see the NBS ([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). The website gives examples of such units, including the NBS local survey teams (directly subordinate to the NBS), the Industrial and Commercial Bank of China, China Telecom, and PetroChina.

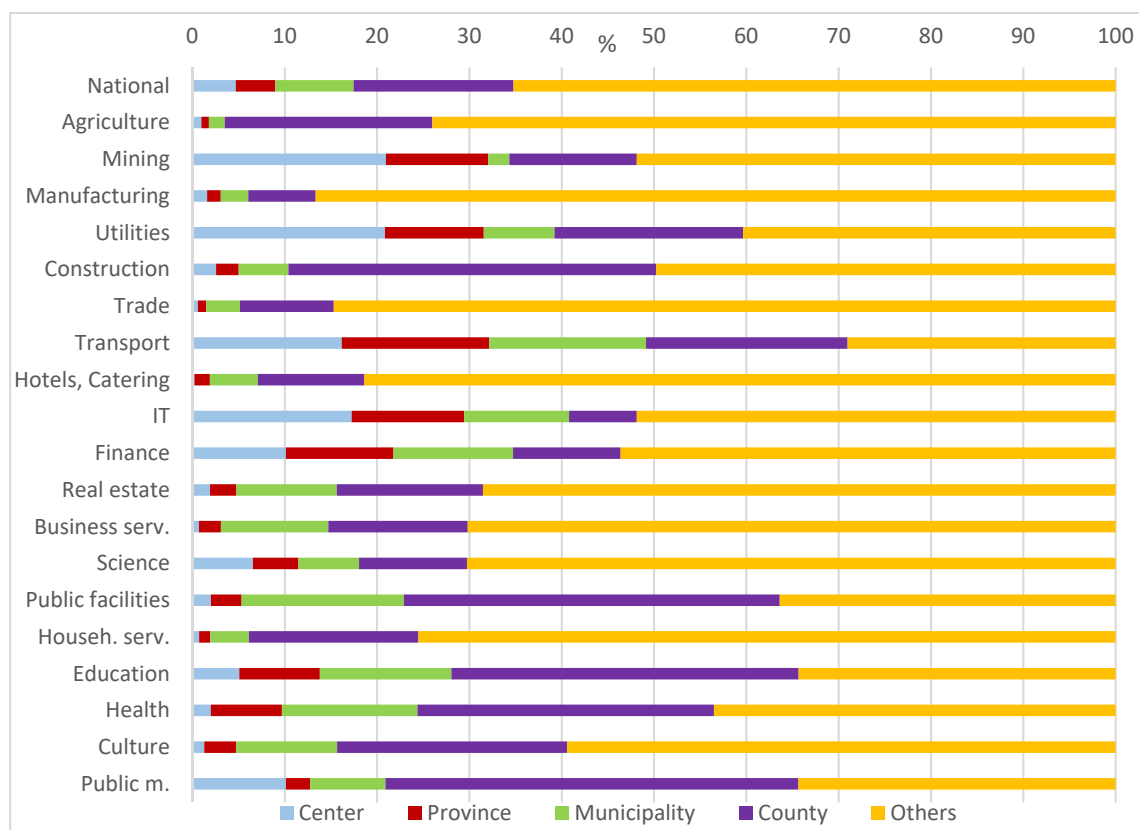
<sup>51</sup> Presumably, local Party organs and people’s congresses are included in “local,” just as the central counterparts are officially included in “central.”

<sup>52</sup> NBS database and *Investment Statistical Yearbook*.

<sup>53</sup> In 2017, the percentages were similar with 4, 4, 10, 20, and 62 percent.

<sup>54</sup> The center’s 21 percent share in mining may be a historical remnant, with land a key state resource, while the center’s 21 percent share in utilities reflects ownership of the nationwide electricity grid and gas supply.

**Figure 4: Central vs. Local Shares in “Urban” Investment, 2015 (%)**



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; Business Services and Leasing; Scientific Research and Technical Services; Management of Water Conservancy, Environment and Public Facilities; Service to Households, Repair and Other Services; Education; Health and Social Services; Culture, Sports and Entertainment; Public Management, Social Security and Social Organizations. Source: *Investment Statistical Yearbook 2016*.

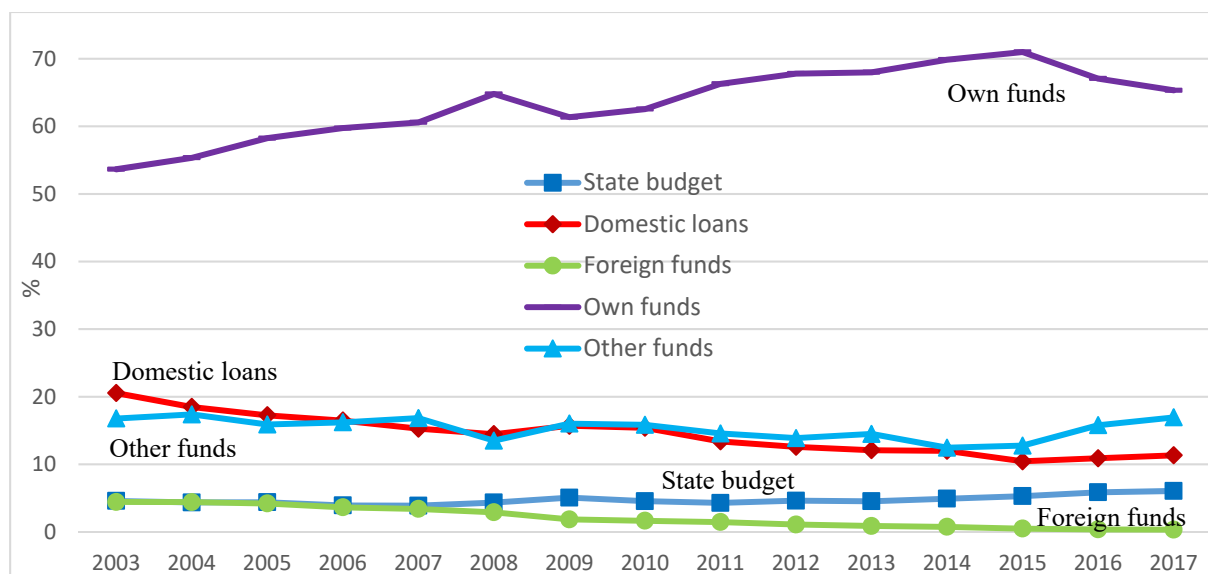
Across sectors, central investment is highly correlated with provincial investment (Pearson correlation coefficient of 0.93), and correlated to a continuously decreasing degree with municipal, county, and then “other” investment (other: 0.27). The same pattern holds for the correlation between provincial investment and municipal/county/“other” investment, and finally municipal investment (vs. county, “other”). This gradation in correlations suggests the existence of tier-specific—rather than industrial policy—investment preferences, with some flexibility in investment assignments between adjacent tiers.

Even if the center wanted to implement industrial policies via local government investment, implementation would face three problems: (i), the transmission and enforcement of downward directives may not be flawless (lower-level governments may have no interest in implementing central policies); (ii), the provincial units’ share in investment is limited (4.3 percent of “urban” investment in 2015); and (iii), although the investment shares of the

municipal- and county-level units are slightly higher (8.5 percent and 17.3 percent), these tiers are furthest removed from the center and therefore likely least responsive to central policies. The municipal and county tiers also have a stronger presence in sectors such as education, health, and public management, which are not subject to industrial policies.

Data on sources of investment funding paint a similar picture of limited direct government influence on investment. In 2017, the share of state budget appropriations in investment financing was only 6 percent (Figure 5). Inevitably, much of that is expended on public goods projects. Domestic loans accounted for 11 percent of investment funding. Policy lending—subject to individual bank lending decisions—could target firms in industrial policy sectors of the economy, thereby increasing the share of potentially policy-directed funding by a few percentage points. “Industrial guidance funds”—such as the Integrated Circuit Industry Fund, funded through the state budget, bank loans and financial contributions by various state-owned enterprises and state entities—may seem large in size but pale in comparison to overall state investment, which in turn pales in comparison to economy-wide investment.<sup>55</sup>

**Figure 5. Sources of Investment Funding (shares in total in %)**



The same statistical breaks as noted earlier for the years 2010-2012 apply but are ignored here since the data here represent shares in the (variably defined) totals.

Source: *Investment Statistical Yearbook 2018*.

The shares of “own” and “other” funds in 2017 were 65 and 17 percent (and that of foreign funds 0.3 percent). The allocation of “own” funds would seem solely at the discretion

<sup>55</sup> On such industrial guidance funds see, for example, Naughton (2019), Wuebekke et al. (2016), and Zenglein and Holzmann (2019).

of the investing unit. One caveat, however, is that “own” funds include—besides “private capital” (*ziyou zijin*) of firms and institutions (presumably retained earnings)—funds collected from other units. Thus, some of the “own funds” could have been obtained by, for example, issuing bonds, which could be subject to government approval. The funding statistics offer no further breakdown. “Other” funds cover everything not included in the other four categories, from “funds collected from society” and funds collected from individuals to donations and transfers from other units.

## Ownership Distribution of Investment

A breakdown of investment by ownership is available for “urban” investment. A first distinction is between domestic investment vs. investment by “Hong Kong, Macau, and Taiwan units” (HKMTUs) and by foreign-funded units (FFUs). Domestic investment accounted for 89 percent of “urban” investment in 2003 and continuously increased to 96 percent in 2017. The investment shares of HKMTUs and FFUs correspondingly decreased, from 5 percent and 6 percent in 2003 to 2 percent each in 2017 (Figure 6).

A breakdown of domestic investment—available since 2008—shows investment by private units on a steady upward trend and exceeding investment by state-owned and state-controlled units (SOSCU) starting in 2010.<sup>56</sup> By 2015, private units accounted for more than half of investment (51 percent),<sup>57</sup> SOSCU, after a phase of decline, for 32 percent, and collective-owned units (COUs) for 4 percent. An undefined implicit residual increased from 1 percent in 2008 to 8 percent in 2015. (The implicit residual presumably reflects an inability of the NBS to properly classify some units.) The 2016 and 2017 values show a slight reversal of the earlier trend away from SOSCU investment towards private investment. This could be the outcome of a real-world trend or of a statistical break, (or both).<sup>58</sup>

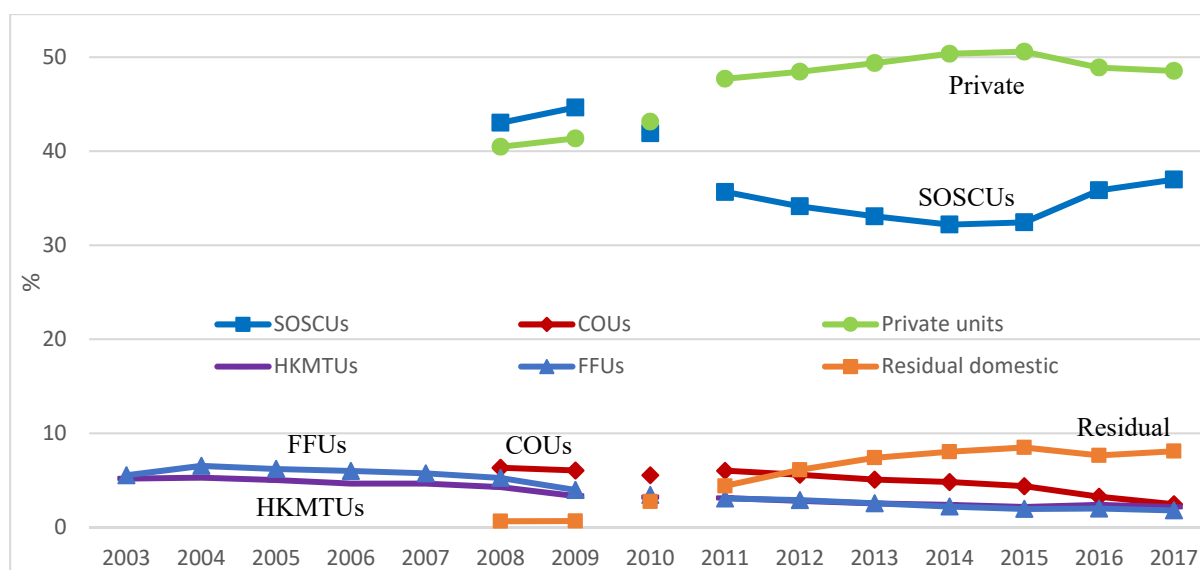
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<sup>56</sup> “State-owned and state-controlled units” refers to the following units: traditional (unincorporated) state-owned units, joint state-state units, 100 percent state-owned limited liability companies, and all other units (typically limited liability and stock companies) in which the state has an absolute or de facto controlling stake. For a discussion of the impact of the statistical breaks on the ownership shares see Holz (2019).

<sup>57</sup> Between 2010 and 2017, “urban” investment accounted for 97-98 percent of FAI, and the missing rural household investment should by definition be private investment. Thus, the share of private investment in FAI is likely 2-3 percentage points higher than in the case of “urban” investment.

<sup>58</sup> The increase in the SOSCU share in 2016 went hand in hand with a decline by one percentage point each in the COU share (4.4 percent to 3.3 percent) and in the share of (implicit) residual investment (8.5 percent to 7.6 percent), the first reduction in the share of residual investment since the beginning of these statistics, suggesting at least some degree of reclassifications. Private investment in 2016 grew 4.5 percent over 2015 while SOSCU investment grew 19.5 percent, compared to an aggregate “urban” investment growth rate of 8.1 percent. The aggregate growth rate seems plausible and the private investment growth rate possible, but the SOSCU investment growth rate appears high. For further discussion of the 2016 data see Holz (2019).

**Figure 6: Investment Shares by Ownership, “Urban Investment” 2003-2017 (%)**



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

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 coverage switched from urban investment to “investment, except by rural households.”

The HKMTU and FFU shares are indistinguishable after 2010.

Source: NBS database, *Statistical Yearbook 2018*.

Combining ownership with second-digit sector investment data suggests a certain degree of domestic herd behavior in that all ownership forms increase their investment in the same sectors of fast-growing investment. I.e., there are no ownership-specific sector investment trends.<sup>59</sup>

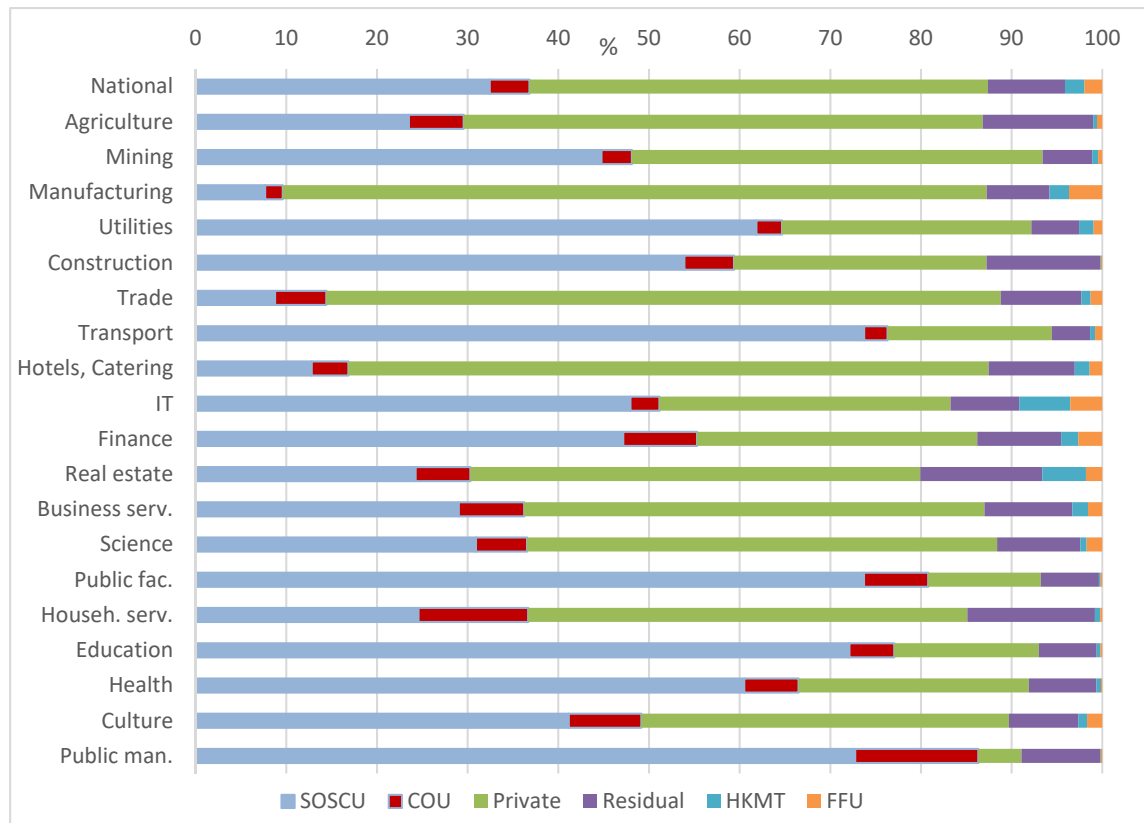
To graphically illustrate the principal ownership patterns across sectors at one point in time, Figure 7 shows the ownership shares within each first-digit sector in 2015. The extent of private investment in manufacturing and in real estate—the two largest sectors, together accounting for more than half of investment—is immediately apparent. In manufacturing, SOSCUs in 2015 accounted for only 7 percent of investment, while private units accounted for 78 percent. Private investment, further, is strong in agriculture, trade, hotels and catering, real estate, business services, science, and household services, and accounts for a fair share of investment in mining and culture. Altogether, private investment is dominant across half of all sectors, with a lower presence in typical public goods sectors.<sup>60</sup>

<sup>59</sup> For details, see Holz (2019).

<sup>60</sup> The charts for 2012 and 2017 look very similar and a time series comparison is therefore omitted.

Investment by SOSUCs is strong in utilities, construction, transport, information technology, finance, public facilities, education, health, culture, and public management, none of which except for information technology are industrial policy sectors. Investment by COUs is spread across all sectors, accounting for 4 percent of economy-wide investment in 2015, while small shares of investment by FFUs and HKMTUs are present across two-thirds of all sectors, mostly in manufacturing, IT, and real estate.

**Figure 7: Investment (Except by Rural Households) by Sector and Ownership, 2015 (%)**



For unabbreviated sector labels, see note to Figure 4.

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

Source: NBS database.

Figure 3 (above) includes ownership information for the second-digit *industry* sectors in 2015. SOSUCs are the dominant investors in the extraction of petroleum and natural gas, in the tobacco industry, in electricity production, and in water supply. Otherwise, sector by sector, private units provide the lion’s share of investment.<sup>61</sup> COUs play a negligible role

<sup>61</sup> Private units tend to play a dominant role except in traditional state monopoly sectors, of which some can be found within almost every first-digit sector. For example, in the first-digit information technology sector, SOSUCs account for 80 percent of telecommunication, radio and television and satellite transmission services. In the first-digit sector “water conservancy, environment, and public facilities,” SOSUCs account for 60–85 percent of investment across all second-digit sectors.

across all sectors (barely visible in the figure), while FFUs and HKMTUs (together) play a minor role in half a dozen sectors and have a minimal presence across other sectors.<sup>62</sup>

The distribution of private investment across sectors and its dominance in the non-public goods sectors implies that implementation of industrial policy, to a very large degree, has to rely on private entrepreneurs. Shih (2014), in a monograph on the PRC's industrial policy programs from 1978 through 2013, concluded that industrial policy in the PRC was introduced to replace imperative planning and therefore *exclusively* targeted state-owned enterprises. The industrial policies of the last decade appear to be more inclusive and are—at least in language—not limited to state-owned enterprises. But forcing or incentivizing private entrepreneurs to do the state's (policy) bidding is likely difficult, while the scope of state enterprises in the favored industrial policy sectors is limited.

## Conclusions

Private investment has come to account for just over half of all investment in the PRC. Across specifically manufacturing second-digit sectors, state-owned and state-controlled units by 2017 accounted for only 7 percent of investment in contrast to domestic private units with 78 percent. Only in a few, small sectors do state units still play a dominant role, not astonishingly in typical public goods sectors (such as utilities, transport, public facilities, education, health, and public management). Investment funding likewise is predominantly outside direct control of the government, and investment that is explicitly subordinated to the government tends to fall into tier-specific categories of public goods provision. Industrial policy implementation then has to rely on the private economy, which one can expect to be motivated more by profitability than by government exhortations. Overall, the observed patterns of investment favors the development of a broad economic structure more than specialization through targeted industrial policies.

Regression analysis suggests that industrial policies indeed have little or no effect on investment outcomes in industry; at least through 2015, investment is driven primarily by profitability considerations. When industrial policies have an effect, the investment patterns *precede* industrial policy. Similarly, Naughton (2019, p. 183) in a different context finds that “policymakers are happy to pick winners after the event.” And Wang (2018) argues that

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<sup>62</sup> Yet 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 manufacturing or computer manufacturing, FFUs do not account for more than 15 percent of investment.

“China’s technological success is driven by its top companies rather than government planning.”<sup>63</sup> A caveat would be that industrial policies could have been circulated internally *well before* being formally announced.

Breakthroughs such as those envisaged by “Made in China 2025” may be more likely to occur if the government offers profitability-enhancing measures, but with competing interests among central government departments and localities and with policy documents that number in the hundreds, supporting measures could well end up supporting everything and (thereby) nothing, or be misallocated (for which there is some evidence). The NBS’ difficulty in matching policies into the sector classification system suggests that clearly identified target sectors do not exist.

The PRC’s industrial policy measures keep evolving. On 14 August 2019, the NBS issued a circular on the classification of the “Three New” (new industry, new undertakings, new commerce, *xin chanye xin yetai xin shanghe*). The circular mentions Party and State Council “guidance” on acceleration of the development of the “Three New.” The matching into the sector classification system is based on the Thirteenth Five-Year Plan, “Made in China 2025,” and further, listed documents.<sup>64</sup> I.e., industrial policies in the PRC are continuously augmented, multifaceted, expansive in coverage, and possibly so diffuse as to have no unambiguous application.

The impression arises that a government bureaucracy with the most varied interests frantically creates industrial policy document after document while the economy largely develops according to market principles. Only when some part of the central bureaucracy manages to command significant financial resources towards a particular end (or enterprise) may its policy have some impact (if it does not fail and is quietly forgotten).<sup>65</sup>

The findings in this chapter contrast with evidence of the effects of the PRC’s industrial policies provided elsewhere in this volume and in the literature. For example, state sponsorship helped Huawei develop its 5G capabilities (via practically free 5G spectrum, research funding, and state-led demand for Huawei products) and helped the China Railway Rolling Stock Corporation (CRRC) modernize and compete globally; it created the PRC’s

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<sup>63</sup> Wang (2018) uses Huawei as an example to show how the government in earlier years hampered the growth of a well-run company in order to advantage a state-owned rival (that ultimately was not successful).

<sup>64</sup> These are the “Guiding Opinion of the State Council on Actively Promoting the ‘Internet Plus’ Initiative” (2015), and the “Opinions of the State Council on Promoting Certain Policies and Measures for Popular Business Creation and Sweeping Innovation” (2015).

<sup>65</sup> As FU Xiaolan reports in this volume, possibly half of all of the PRC’s R&D occurs in little more than 500 firms. Narrow targeting of industrial policy measures would match such a concentration of R&D.



telecommunications behemoths and the PRC's solar photovoltaic panel industry; and it turned the PRC's shipbuilding industry into a global force. But at the macro level examined in this chapter, industrial policy does not have a decisive effect on resource allocation. That implies either that these examples are exceptions (highly selective cases) or that industrial policy was not crucial for the success in these cases, to begin with.

The PRC's industrial policy contains explicit anti-foreign elements. Evidence of PRC industrial policy measures that discriminate against foreign enterprises abounds. Yet other countries also conduct industrial policies, from research funding to regulatory measures, government-supported financing vehicles, and trade policies, differing perhaps in degree only from those implemented in the PRC. 'Retaliatory' measures against the PRC for its "Made in China 2025" program may hardly be justifiable.<sup>66</sup> They may also hurt the West's long-run interests. For example, Japan's "Voluntary Export Controls" of the 1980s turned Toyota into a formidable long-run competitor to the U.S. car industry.

Media reports suggest that the West, in order to compete with the PRC, needs to adopt "modern" industrial policy with an all-society endeavor encompassing favorable financing, a favorable regulatory framework, and mandates to ensure demand (Tran, 2019). But the fact that the PRC's industrial policy may have little to do with whatever economic success individual firms or economic sectors in the PRC achieve should make one pause. The PRC's industrial policies are not a magic weapon. If anything, the long-term consequences of the PRC's industrial policies, if they have any effect at all, could well be mis-investment and overinvestment. It may be time to return to more traditional views of central planning or of large-scale state interference as likely leading to wasteful investment, soaring credit volumes (with future debt problems) and limited productivity improvements.

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<sup>66</sup> The U.S. trade representative's office in early 2018 announced that U.S. tariffs will target China's industrial policy, especially those industries included in Beijing's "Made in China 2025" plan (Wildau, 2018).

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