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# Regional institutions, ownership transformation, and migration of industrial leadership in China: the case of the Chinese synthetic dye industry, 1978–2008

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Scholars have emphasized the gradual ownership transformation of enterprises as a key driver of the Chinese economy's unprecedented growth. However, little work has been done on the issue of whether this transformation process takes place evenly across the various regions in China. This article describes the important role of regional institutions in shaping the ownership-based competitiveness of local enterprises and the migration of industries across regions. In the case of the Chinese synthetic dye industry, the passing of leadership from state-owned enterprises (SOEs) to collectively owned enterprises (COEs) and then to private enterprises (PEs) was accompanied by a concurrent leadership migration from one region to another. The article contends that this simultaneous occurrence was not accidental. Four institutional constraints—the degree of central supervision, the local labor arrangements, the local social welfare provision, and the degree of ambiguity in property rights—retarded the rise of new ownership forms in the previously dominant regions. This gave other regions the opening to take over leadership positions by providing a more favorable institutional context for new ownership forms. These findings are likely to apply to all of the Chinese manufacturing industries

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that existed prior to 1978 and that subsequently did not experience significant technological changes and were not highly protected by the government.

**JEL classification:** L65, M13, O14, P31.

## 1. Introduction

Scholars from many disciplines, including management (Chan, 1995; Boisot and Child, 1996; Peng and Heath, 1996; Peng, 2003), sociology (Walder, 1995a; Peng, 2001), and economics (Naughton, 1994; Walder, 1995b; Lin *et al.*, 1996) have become increasingly interested in China for two principal reasons: (i) China has experienced rapid and extensive industrial growth over the past 30 years, and (ii) its incremental transition trajectory starkly differs from the “shock therapy” that was applied in the former Soviet Union and many Eastern European countries (Naughton, 2006). In this gradual privatization process, three different ownership forms—(i) state-owned enterprises (SOEs), (ii) collectively owned enterprises (COEs), and (iii) private enterprises (PEs)—were and are in competition with each other. While COEs outperformed the other two between 1978 and 1992 in terms of growth rates and market share, PEs grew quickly after 1992 and accounted for over 30% of the nation’s industrial output in 2007 (Dougherty *et al.*, 2007). Little research to date has examined whether ownership transformation proceeded evenly in China, or how regional growth rates of existing industries were affected by different speeds of ownership transformation. In this article, we report an inductive historical case study of the determinants and consequences of different rates of ownership transformation in the Chinese synthetic dye industry in three regions—Shanghai, Jiangsu, and Zhejiang.

### 1.1 *Ownership reform and ownership forms in China*

Previous work has extensively documented the incremental ownership transformation in China (Nee, 1992; Walder, 1995a) and has explained the natures and comparative competitiveness of the three ownership forms (Nee, 1992; Chang and Wang, 1994) in that context. Scholars largely agree that the year 1992 was a crucial turning point in China’s economic transition. Ownership reform of enterprises had not been widely launched until that year (Bai *et al.*, 2006; Naughton, 2006), up to which time SOEs had remained significant in the economy (Walder, 1995a). COEs<sup>1</sup> proliferated

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<sup>1</sup>We do not use the common term “TVEs” (township and village enterprises) in this study. TVEs are sometimes defined by their location in rural areas, sometimes by their collective ownership, and some other times by both. To avoid confusion, we use “COEs” to refer to collectively owned enterprises that can be located in urban or rural areas. We report later in this article that the Shanghai municipal government set up a COE in an urban area in 1980.

and became significant after the first wave of economic change in 1978. In some industries, they even took over the leadership position from SOEs. The period since 1992 has been characterized by the rise of PEs. At the same time, strong efforts were made to reform the traditional SOEs and COEs.

Scholars generally agree that among the three principal ownership forms treated here, the COE is a special hybrid form (Nee, 1992) in the Chinese context. However, a much smaller number of observers have noticed that within COEs there is often not a unity between who are the registered owners and who are the *de facto* controllers (Liu, 1992; Nee, 1992; Woo, 1999). We contend that this fact is indeed very important in understanding the process of ownership transformation in China. According to the difference between registered ownership and *de facto* control, Chinese COEs can be divided into two groups: Type-I COEs and Type-II COEs. Type-I COEs (which include provincially owned enterprises) are real COEs in the sense that they are primarily funded and strongly controlled by local governments. Type-II COEs are *de facto* PEs registered as COEs for economic and political protection in the uncertain context of the early years of Chinese privatization and general economic reforms. Because they differ in the degree of ambiguity in property rights, these two types of COEs performed quite differently in the post-1992 phase of the Chinese ownership transformation process.

### 1.2 Actors in regional ownership transformation

To avoid potential confusion, we use “ownership transformation” in this study as an umbrella term for a change in the frequencies of ownership forms in a population of enterprises at the national or the regional level. We use the term “ownership reform” to refer to firm-level ownership changes of given enterprises. Ownership transformation in a region is achieved either through (i) ownership reform of existing enterprises, whereby SOEs transform into COEs or SOEs/COEs become PEs, or (ii) the establishment of new enterprises of different ownership forms. These two processes together change the frequencies of different ownership forms in a region, and they also determine the extent to which ownership transformation will occur in a region. Therefore, at a micro-level, the actors in ownership transformation are exactly the actors in ownership reform and in new enterprise formation. In the Chinese context, these actors are local government officials (including dual-role cadre managers<sup>2</sup> of

<sup>2</sup>The term “cadre” is a Leninist concept that initially referred to professional communist revolutionists. Later in Communist China, the term was used to refer to government officials, most of whom would be members of the Chinese Communist Party. Some cadres play a dual role, in that they are both officials in local government and managers in local SOEs or COEs, whereas other cadres are simply government officials. The dual-role cadres are thus also “cadre managers” of SOEs or COEs. They are not the owners of SOEs or COEs that they manage, even if they establish these enterprises, since they are only managerial agents of the government. This distinguishes “cadre

SOEs/COEs) and non-cadre entrepreneurs. These actors can have different, sometimes directly competing interests.

Local government officials (in our use of the term they can be either regular non-manager officials or cadre managers) are dual-motive actors in regional ownership transformation. Not only are they participants in ownership reform of local SOEs/COEs, but also they, if they desire, can be founders of Type-I COEs. On the one hand, these officials care about issues of the public good (Li and Rozelle, 2003, 2004), such as local economic growth, local employment, and social stability. Based on that motive, they might want to protect local SOEs or establish new Type-I COEs. On the other hand, they could be driven by private motives, and might appropriate rents by reforming SOEs/COEs and/or by establishing new Type-I COEs. As such, they sometimes come into conflict with each other. This is especially so in those instances of ownership reform where cadre managers and/or non-manager officials try also to become registered owners through ownership reform, whereas other officials, who are unable to benefit personally as much, try to frustrate those intentions.

Non-cadre entrepreneurs establish Type-II COEs or PEs for profit. But many of them also are concerned about the economic security of their investments. This latter interest was very important before 1992, and indeed, many entrepreneurs registered their new PEs as Type-II COEs in order to secure political protection. For this reason, they often got involved not only in setting up new enterprises, but also in COE ownership reform.

### 1.3 *Research question and argument*

The following research question guided our study: Did the process of ownership transformation from SOEs to PEs take place evenly across the regions in China? This question was prompted by our observation of a large gap in the literature. Many studies, mostly utilizing institutional theory, have provided deep macro-level insights into the ownership transformation in China. They explain a wide range of phenomena such as the influence of national contexts on incremental privatization (Naughton, 1995), the relative competitiveness of the three ownership forms (Boisot and Child, 1988; Peng, 2001), the special role of COEs in the transition process (Nee, 1992; Naughton, 1994; Chow, 1997), the principal-agency problem in SOEs (Lin *et al.*, 1998), as well as SOEs' inefficiency (Wang and Szirmai, 2008) and underperformance (Wei and Lau, 2008). Social network theorists have identified additional factors, such as kinship networks (Peng and David, 2004), as playing a role in the rise of new ownership forms in China.

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managers" from "non-cadre entrepreneurs", who have no official function and who initiate or run PEs on their own.

Taken together, the existing studies have confirmed the broad picture, which is that the leadership position in the past 30 years, in all industries unsheltered by the government, has shifted, firstly from SOEs to COEs, and then from COEs to PEs. The existing studies have helped also in furthering our understanding of the causes behind the migration of leadership across ownership forms. Previous research, however, has not examined concurrently the leadership migration between ownership forms and the leadership migration across regions and inquired whether there is a systematic connection between the two phenomena. The few papers that discuss regional variations focus only on a narrow range of topics. The most frequently treated are the changes of income distribution in China due to the recent industrialization (Yang, 1999). Also, a simple urban–rural classification, rather than detailed regional characteristics, is used to distinguish one region from another.

Given that previous research did not study the connection between regional ownership transformation and industrial migration across regions, we wanted to determine whether it indeed existed, and why. When we looked into the different regions, even those close to each other and located in the most developed area in China, we discovered an uneven pace of ownership transformation, prompting us to ask a follow-up question: How did the regional institutional and economic arrangements influence the local frequency of ownership forms within an existing industry during China's economic transition?

Based on fieldwork and interviews, we arrive, in this article, at an institutionalist interpretation of a two-stage migration of the leadership position in Chinese synthetic dye industry across three neighboring regions from 1978 to 2008. Contrary to conventional wisdom, rapid industrial growth was achieved not in regions where know-how was locally available and where spillover effects were expected to be higher, but rather in regions where there was little such knowledge and where the cost of acquiring it would be expected to be higher at the beginning. Although the three ownership forms co-existed in each region at every stage of the transformation, COEs typically first outperformed SOEs and then PEs outperformed COEs, in terms of growth rates and market shares. Due to local institutional constraints, however, the ownership form that became more prevalent always first gained legitimacy in an industrially weaker region rather than in a stronger region, and the leadership position in the synthetic dye industry shifted as a result.

Our paper unfolds as follows: we first explain our methods and data. Next, we provide an overview of the Chinese synthetic dye industry, which serves as the industrial context for our analysis. On this basis, we identify the interesting phenomenon to be explained: regions differed in their rates and patterns of ownership transformation and this had economic consequences for the development of the synthetic dye industry in each region. Then, we offer an institutional interpretation of this phenomenon. Finally, we discuss the implications of our findings, and we

conclude by suggesting how they can be tested systematically across additional Chinese regions and industries in future research.

## 2. Methods and data

### 2.1 *Qualitative approach*

As there is no existing theory on whether and how the process of transformation from SOEs to PEs differed across regions in China's economic transition, we necessarily adopted an inductive historical case study approach (Stinchcombe, 2005). In this approach, neither theories nor hypotheses are established prior to research (Creswell, 1994: 162) but emerge from engagement with the focal phenomenon. Furthermore, historical investigation, as in qualitative research in general, often is concerned with processes, as well as outcomes (Tilly, 2008). For these reasons, the inductive approach is particularly appropriate for investigating how the ownership transformation took place in the synthetic dye industry from 1978 to 2008 in our sample of Chinese regions. As we will discuss more at the end of the article, the Chinese synthetic dye industry is likely to be representative of all manufacturing industries that existed in China before 1978, that were not highly protected afterwards, and that did not experience significant technological changes.

### 2.2 *Sample*

Three province-level regions—Shanghai (a municipality under national supervision), Jiangsu (a province) and Zhejiang (a province)—were chosen as the sample for this study, for several reasons. First, the three regions are located in the Yangtze River Delta, the traditional center of textile manufacturing. As 95% of dyes are used for textiles, this area was and continues to be the major domestic market for synthetic dyes in China. This means that none of the three regions were disadvantaged in their growth prospects by being geographically far from the center of demand, which is the case with the other production regions (Jilin-Liaoning, Shandong, and Tianjin) that were established in China prior to 1978, during the central planning period. Second, the three sample regions, accounting for 80% of all dye manufacturing in 2008, are representative of the entire industry. Third, throughout the study period, the three regions possessed all of the three ownership forms but differed in terms of which form dominated. This made it possible for us to compare the rates of change in ownership forms throughout the period and to look for causes to explain them. Fourth and most importantly, the three regions are located so close to each other that they possess similar cultural and social characteristics. This fact, effectively controlling for cultural and social impacts, allowed our study to focus on institutional and economic arrangements influencing regional ownership transformations.

Utilizing various data sources (SRI, China Dyestuff Industry Association, Shanghai Coatings and Dyestuff Trade Association<sup>3</sup>), we initially determined the number of enterprises that were active in the Chinese synthetic dye industry between 1978 and 2008. After selecting the three regions for our sample, we chose seven primary dye enterprises that collectively represented the full range of enterprises, SOEs, Type-I COEs, Type-II COEs, and PEs, including both successful and unsuccessful ones. During our data collection process, we encountered certain failing enterprises (mostly SOEs and Type-I COEs) that were especially informative. All of this helped us to discover and examine in detail the causal factors that shaped the ownership form an enterprise would transform into, or adopt if it was a start-up during the 1978–2008 period.

### 2.3 Data

Given the paucity of published and archival materials on the enterprises in the industry, and considering our explicit goal to be led by empirical phenomena, we chose interviews as our main data source. More specifically, we conducted unstructured, open-ended interviews so as to be more sensitive to emerging information (Patton, 1990: 281–282). A prepared interview guide ensured that we would not forget any salient topics during the interviews. One of us, a native Chinese trained in a Western PhD program, carried out, from December 2009 to November 2010, a total of 47 interviews on the development of the major synthetic dye enterprises in Shanghai, Jiangsu, and Zhejiang. We either tape-recorded the interviews if permitted, or took detailed notes. To enhance internal validity and ensure the accuracy, trustworthiness, and coherence of information on each enterprise (Lincoln and Guba, 1985), multiple interviews were undertaken with informants occupying various positions. Our interviewees included general managers, R&D directors, retired research chemists, university professors, managers in competing enterprises, chemists in other enterprises, and industry association officials. Most of the interviewees had worked in the industry for at least 15 years. The person with the longest industrial experience had joined the industry as early as 1950. To protect confidentiality, we refer to our subjects not by name but by position, as shown in the Appendix Table A1. For the same reason, we rewrote interview transcripts in areas where the original text would reveal sensitive information such as university names and institutional names.

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<sup>3</sup>Interested readers can learn more about these organizations via the following web links:

SRI: <http://www.sriconsulting.com/>.

China Dyestuff Industry Association: <http://www.dychina.com/>.

Shanghai Color & Dyestuff Association: <http://www.sdta.org.cn/>.

## 2.4 Coding and Analysis

All of the 47 interviews were fully transcribed and imported into NVIVO 8<sup>4</sup> for coding. We conducted a preliminary coding of these interviews, as well as archival documents in order to combine information regarding each pertinent enterprise, and then, to facilitate categorization, we assigned to every case (enterprise) such attributes as ownership form, location, success/failure, and establishment year. The results of the preliminary coding showed that the highest performing dye enterprises between 1978 and 1992 were mostly COEs in Jiangsu, and that the highest performing enterprises between 1993 and 2008 were PEs in Zhejiang. This observation led us to the realization that there were two simultaneous leadership shifts in the Chinese dye industry, a fact that is consistent with the patterns we observed later in some other industries in China. Considering the importance of ownership transformation for China's economic growth, as well as the lack of research on the two-stage simultaneous leadership shifts and their implications for regional economic growth, we decided to use the Chinese dye industry to study the pattern in detail and identify its causal mechanisms.

To explore the mechanisms, we conducted three rounds of coding for the 47 interviews and archival documents using NVIVO 8. We did not use automatic coding because the interviews were unstructured and therefore, automatic coding might make us miss crucial information. None of the nodes (key words) used in coding were set *a priori* based on a literature review, but emerged from the coded materials. In the first round of coding, we extracted, from the interview transcriptions, any causal factors behind high or low performances of individual enterprises. We did this to determine whether there were any patterns for enterprises with the same attributes (i.e. ownership forms, locations, establishment years). We found that cross-regional differences in enterprise performance were attributed by interviewees primarily to the different dominant ownership forms in the different regions. The faster and earlier ownership transformation was accomplished in a given region, the higher the performance the local enterprises would achieve. Intrigued by this finding, we conducted a second round of coding to further identify any causal factors mentioned for enterprises' early or late ownership reforms. Of all the factors that were identified, we extracted those that were most frequently or consistently mentioned. These factors were set in NVIVO 8 as new nodes (key words), based on which we coded the archival documents.

We carried out a third round of coding, using archival data to verify the validity of the causal factors identified in the second round. Several factors that could not be verified were discarded in this third round. For instance, some informants from Shanghai referred to the (low) degree of intellectual property right protection

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<sup>4</sup>More details on the functions of NVIVO can be found at: [http://www.qsrinternational.com/products\\_nvivo.aspx](http://www.qsrinternational.com/products_nvivo.aspx).



as an influential causal factor for the early ownership transformation in Jiangsu, but the informants from Jiangsu did not agree. Despite the inconsistency of the comments, we entered this factor on the rationale that it was frequently mentioned. The archival materials revealed that the informants from Shanghai had a bias, but confirmed the comments of the informants from Jiangsu. The (low) degree of intellectual property right protection, though it enabled new enterprises to start production more easily, did not increase the actors' incentives to launch ownership reforms. For this reason, we discarded this factor as a systematic cause. Only four institutional factors and one economic factor were derived from the three rounds of coding and analysis as key causal factors; not only were they frequently mentioned, they also showed strong consistency across the data sources. These factors were used to map the dynamics of the two simultaneous leadership shifts.

### 3. Industrial context: the synthetic dye industry

#### 3.1 *Leadership Shift from Germany to China*

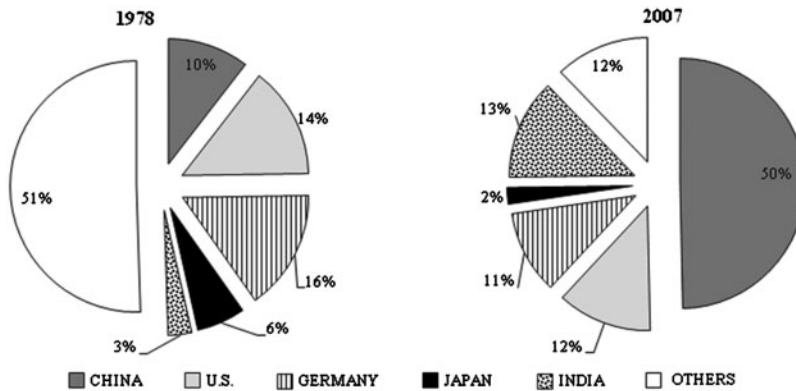
The rise of the Chinese synthetic dye industry after 1978, as is the case with many other Chinese industries during the past three decades, has dramatically transformed the global landscape. Synthetic dyes were invented in Britain in 1856. Although British and French enterprises led the industry for the first 10 years (Murmans and Homburg, 2001), German enterprises dominated for the next 120 years, from the 1870s to the 1990s (Murmans and Landau, 1998). The leadership position started to shift from German enterprises to Chinese ones in 1995, when China became the largest synthetic dye supplier in the global market. The Chinese share of the global synthetic dye output increased from 10% in 1978 to over 50% in 2008, as shown in Figure 1, though German enterprises remained technologically superior. When Lonsen<sup>5</sup> acquired Dystar<sup>6</sup> from bankruptcy in 2010, it symbolized the consolidation of leadership by Chinese PEs in this industry. Now, Lonsen owns probably the world's most technologically advanced firm, which boasts of 145 years of experience in dye innovation and production.

#### 3.2 *Overall growth of dye industry in China since 1978*

The growth of the Chinese synthetic dye industry in the post reform era can be divided into two clearly distinct phases, 1978–1992 and 1993–2008. The real output

<sup>5</sup>Lonsen is the largest Chinese synthetic dye manufacturer today, and is one of the enterprises we focus on in this study.

<sup>6</sup>Dystar was formed in 1995 initially to merge the dye businesses of Hoechst and Bayer, two of the largest German dye enterprises. In the years that followed, Dystar absorbed the third major German company, BASF, along with several other large global dye suppliers such as ICI.



**Figure 1** Country shares of global synthetic dye output (in volume). Data source: Appendix A2.

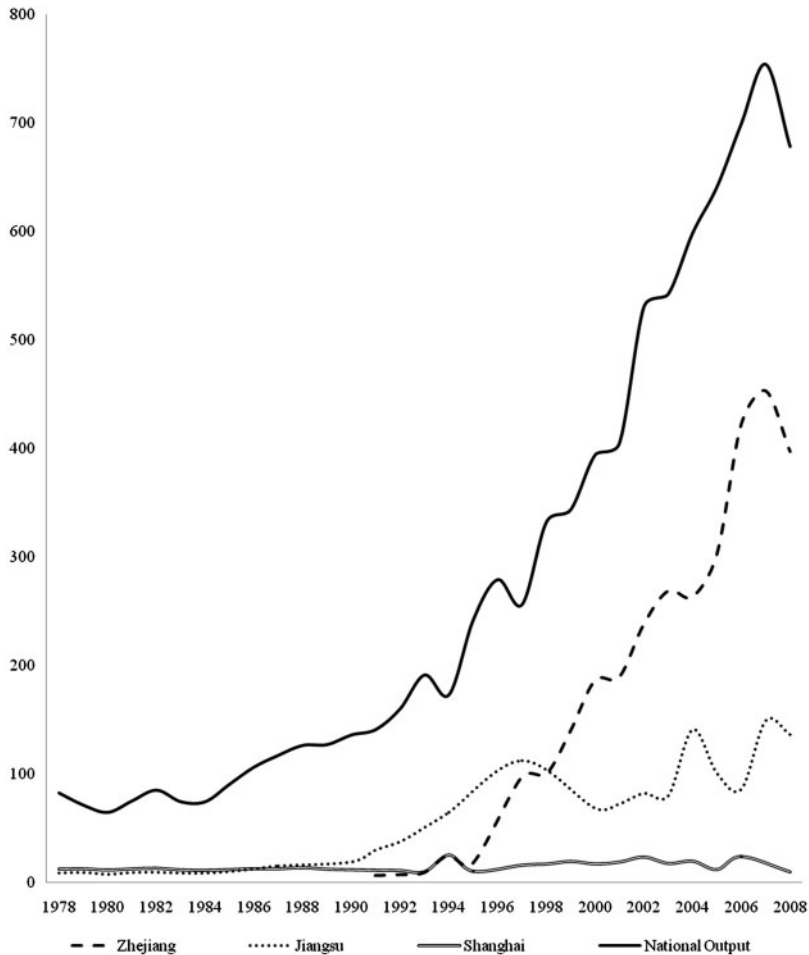
boom took off only after 1992, when the private sector began its rapid growth. As shown in Figure 2, in the first phase, Chinese dye output almost doubled, growing from 82,900 tons in 1978 to 160,400 tons in 1992. But in the second phase, it more than quadrupled, from 160,400 tons in 1992 to 753,700 tons in 2007. Consistent with the view shared by most scholars that economic growth in China was fueled much more by privatization in the 1990s than in the 1980s (Naughton, 2006: 90–91), the acceleration after 1992, indeed, was strongly coincident with the launch of privatization.

### 3.3 Shifts in ownership form of leading enterprises and in regional location of production

The growth of the Chinese synthetic dye industry after 1978 was characterized by two shifts, one involving the ownership form of the leading enterprises and the second involving the regional location of production. Leadership shifted from state ownership to collective ownership in the period 1978–1992, and again from collective ownership to private ownership in 1993–2008. Concurrently, leadership shifted within three neighboring regions, first from Shanghai to Jiangsu in 1978–1992, and then from Jiangsu to Zhejiang in 1993–2008. Note the striking pattern: the shift in leadership to a different ownership form was accompanied in each case by a production leadership shift to a different region. Let us take a closer look at what happened during the two periods.

#### 3.3.1 The first period: 1978–1992

The leadership shift from SOEs to COEs and concurrently from Shanghai (Region 1 in our three-region sample) to Jiangsu (Region 2) characterized the first period of



**Figure 2** National and regional dyestuffs output in China (in 1000 tons). Data source: Appendix A2.

growth in the Chinese synthetic dye industry. Once the post-1978 economic reform changed the resource allocation mechanism, allowing market forces to decide to a considerable extent where production growth would take place, the Chinese dye industry became increasingly centered in the Yangtze River Delta, where Shanghai, Jiangsu, and Zhejiang (Region 3) are located. Shanghai, compared with the other three pre-1978 centrally planned synthetic dye manufacturing hubs (Jilin-Liaoning, Shandong, and Tianjin), was lucky in that it happened to be located within the district that would continue to be the center of textile production, and thus prosper in the period after 1978. But, importantly, Shanghai did not capitalize on having been a center of dye production and know-how for decades. As the dye industry

started to grow in the period after 1978, the leadership position in the industry shifted from Shanghai-based SOEs to Jiangsu-based COEs that entered the industry after 1978, initially possessing little know-how. Shanghai-based SOEs witnessed no total output increase at all during this phase (12,670 tons in 1978; 11,308.6 tons in 1992), and indeed, they lost their leadership position to Jiangsu-based COEs in 1987 when Jiangsu became, for the first time, the largest dye supplier in China. More specifically, dye output in Jiangsu more than tripled, from 8 937 tons in 1978 to 37,800 tons in 1992. Most of this growth can be attributed to the rising of COEs in the region. In the same period, dye output in Zhejiang (Region 3) grew to 7 700 tons by 1992, still very small in comparison with Shanghai and Jiangsu.

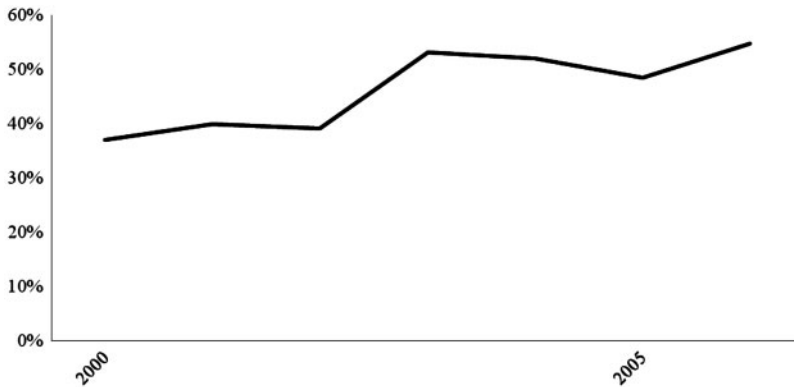
### 3.3.2 The second period: 1993–2008

In the second phase, the growth leadership position shifted once again, this time from COEs to PEs and from Jiangsu (Region 2) to Zhejiang (Region 3). COEs, increasingly, lost their competitiveness to PEs, as the political discrimination against the private sector gradually disappeared after 1992.<sup>7</sup> COEs' higher costs caused production in the dye industry to shift from Jiangsu-based COEs (mostly Type-I COEs) to Zhejiang-based PEs. As a consequence, Zhejiang, in 1998, became the largest synthetic dye manufacturing region. Although dye output in the previously leading region, Jiangsu, continued to increase at a considerable pace during this phase (from 37,800 tons in 1992 to 136,710 tons in 2008), Zhejiang experienced a much more dramatic increase in output (from 7 698 tons in 1992 to 397,190 tons in 2008). The dye output boom in China after 1992 and the establishment of China's leadership in the global dye industry can be attributed to the private dye enterprises in Zhejiang, whose combined Chinese production share increased from 36.92% in 2000 to 54.68% in 2006 (Figure 3.)

### 3.4 *The phenomenon to be explained*

As described in Section 2, transformation of the leadership position in an established industry, from SOEs to COEs and then to PEs, was not uncommon in China's incremental economic transition post-1978. Scholars have used institutional theory to explain the differing performances between ownership forms in the two phases (Nee, 1992; Naughton, 1994; Peng, 2001). This established research thread however, albeit capturing the general trend of privatization in China, does not explain the striking pattern in the synthetic dye industry. For each shift in the ownership form of the leading enterprises, there was a shift of region. SOEs were the leading form when Shanghai was the leading region. The COEs that later became the leading enterprises

<sup>7</sup>1992 was a watershed year in the recent history of China. In October 1992, the 14th Congress of the Chinese Communist Party officially endorsed a "socialist market economy" and declared that market mechanisms must be extended to almost all industrial sectors. From this date on, the private sector has been officially endorsed and actively sponsored by the central government.



**Figure 3** CR3 (Concentration ratio 3) of PEs 2000–2006 (in output volume). Data source: Appendix A2.

were located in another region (Jiangsu). Finally, once PEs became the leading enterprises, so too did the region, again, change (to Zhejiang).

Whenever such a striking correlation arises, it is important to ask whether there is a causal connection. Why did COEs not flourish in the Shanghai dye industry in the period from 1978 to 1992, given that this region was the leader in 1978? And, why did PEs not flourish as much in Shanghai and Jiangsu as they did in Zhejiang, when the latter became the leading producer of dyes in the period from 1993 to 2008? As the remainder of this article will reveal, the different speeds of ownership transformation in the three regions—regions notably similar in cultural, social, and market characteristics—were shaped by existing institutional and economic arrangements.

## 4. Institutional and economic arrangements driving regional ownership transformation

### 4.1 *Key causal factors*

From the three rounds of coding and analysis of the 47 qualitative interviews, the degree of central supervision, local labor arrangements, social welfare provisions, the degree of ambiguity in property rights, and the degree of industrialization were extracted as the primary region-specific institutional and economic arrangements that determined the pace of regional ownership transformation in the Chinese synthetic dye industry. Before we discuss the causal roles of these factors in the shifts of leadership position across regions, it will be helpful to explain them in some detail. This will make it easier for the reader to understand the empirical data and analysis we present below.

#### 4.1.1 Degree of central supervision

The degree of central supervision in one region refers to the degree to which the central government has control over and concerns itself with local economic and social affairs. Central supervision in China tended to be stronger in more urbanized regions that were planned to be industrial and economic centers, and weaker in less urbanized regions.

#### 4.1.2 Labor arrangements

A key distinguishing factor is the extent to which people rely on industrial jobs for subsistence. In more urbanized regions, most residents in the 1980s were affiliated with SOEs or COEs. People enjoyed permanent job tenure in SOEs and sometimes even in COEs. This arrangement was referred to as “iron rice bowls” because in urbanized regions it was the only way to make a living. Since, in the first period, SOEs provided higher wages and better welfare than COEs, managers and workers in SOEs would not voluntarily join new COEs unless they were ordered by the government to do so. In less urbanized regions, by contrast, a large proportion of farm laborers took industrial jobs as a way to make extra money. The situation was particularly convenient in that these workers could go back to farming if they were laid off.

#### 4.1.3 Social welfare provision

Regions also differed in their social welfare provision when economic reforms began in 1978. As mentioned above, in more urbanized regions, most residents worked for the in-plan SOEs and COEs, and were accustomed to the “cradle-to-grave” welfare system as channeled through those organizations.<sup>8</sup> In less urbanized regions with fewer in-plan SOEs and COEs, local residents were mostly farmers or self-employed, and thus typically not covered or, at best, much less covered by any social welfare system.

#### 4.1.4 Degree of ambiguity in property rights

In the period from 1978 to 1992, the property rights of Chinese SOEs became increasingly ambiguous as it became unclear who could legitimately lay claim to controlling assets. PEs, in contrast, were characterized by low property right ambiguity, in that they were owned by easily identifiable individual people. Between the two extremes were the Type-I and Type-II COEs. In the case of the Type-I COEs, actual investment and control were ambiguously distributed among multiple social actors. Whereas these enterprises were nominally owned by local governments, the exact share owned by each actor (i.e. governments of different levels, villagers, etc.)

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<sup>8</sup>One of the authors experienced the “cradle-to-grave” welfare system of SOEs until entering university, having attended SOE kindergarten, elementary, and middle schools on account of the fact that both parents were employed by an SOE.

was quite unclear and left open for contention. In the case of Type-II COEs, those who provided the initial funding also had secure control because the assets were deemed the individual property of the investors. Local government officials understood that they could not successfully claim rights to those assets.

The concept of property rights ambiguity, more commonly applied to individual assets such as enterprises, can also be applied at the aggregate level of an industry in a given region. In this sense, the degree of ambiguity in property rights can be understood as the extent to which property rights are clear regarding the entire population of local enterprises within a focal industry in a given region. The degree is higher when SOEs and Type-I COEs form the largest proportions of the local enterprise population, and lower when Type-II COEs and PEs are the majority.

#### 4.1.5 Degree of industrialization

The degree of industrialization refers to the scale of the existing industrial economy in a region. Some regions, by 1978, already had a large share of people working in industries. Other regions possessed little industry, as their economies were still based mainly on agricultural production. This latter factor is not an institutional characteristic of a region but rather an economic one.

#### 4.2 1978–1992: *Jiangsu versus Shanghai*

In this section, we will explain a leadership shift in the synthetic dye industry that occurred in the first phase from Shanghai-based SOEs to Jiangsu-based COEs. On the eve of the 1978 economic reforms, SOEs and Type-I COEs existed in both Shanghai and Jiangsu. However, COEs outperformed SOEs in both regions. As the economic reforms rolled on, the frequencies of SOEs and COEs in Shanghai between 1978 and 1992 hardly changed, whereas that of COEs in Jiangsu rose sharply.

These different speeds of ownership transformation in Shanghai and Jiangsu were not the results of ownership reforms that turned SOEs into COEs or PEs. Ownership reform of SOEs was in principle possible but actually rarely took place in the 1980s, owing to the fact that the central government simply did not wish to pursue it. The only exception was the Shanghai No. 4 Dyestuff Factory belonging to the state-owned Shanghai Dyestuff Co., Ltd. This factory was reformed, in 1980, from an SOE to a Type-I COE for a specific reason, namely, to provide employment to the great number of youths who had been sent to the countryside during the 1966–1976 Cultural Revolution. In general, Shanghai and Jiangsu did not differ in their proclivity to reform SOEs in this period.

What caused the much faster change in the frequencies of ownership forms in Jiangsu, in fact, was the establishment of additional new Type-I dye COEs.<sup>9</sup> But this

<sup>9</sup>Some COEs were already existing before 1978, but launched dye and auxiliary production only after that year. Hence, we classify them also as new dye COEs.

raises an important question: why did local government officials in Shanghai not set up new COEs at the same rate as local government officials in Jiangsu? After all, Shanghai had many more dye technicians and researchers, and on purely technical grounds, therefore, it would have been easier to set up new COEs there. Our analysis revealed that central government supervision, local labor arrangements, social welfare provisions, and the degree of industrialization were the primary causal factors behind this regional difference in COE formation.

4.2.1 How central government supervision influenced the formation of new COEs  
Central government supervision was much stronger in Shanghai than in Jiangsu during the 1980s because, Shanghai was the most important planned industrial center in China and an important source of tax revenues for the central government. According to a former director of Shanghai No. 3 Dyestuff Factory, who started his career in the industry in the 1950s (Interviews 28 and 29; for details see Appendix Table A1), and whose statements were confirmed by several former managers of the state-owned Shanghai Dyestuff Co., Ltd. (I. 11, 15, 19, 20), SOE managers “participated in the national annual output planning meetings in Beijing every year.” These meetings continued at least till 1988 (I. 28, 29).

Stronger central supervision led the local government officials in Shanghai to care more about aiding the local dye SOEs than their counterparts in Jiangsu. That is, due to the heavy tax burden imposed by the central government on Shanghai-based SOEs, municipal government officials in this city had powerful incentives to ensure the stability of the SOE-derived tax base and, therefore, to protect the SOEs against competition. Although they could not take effective actions to lower the SOEs’ costs, these officials overtly protected existing SOEs. A former deputy factory director in charge of R&D at the Shanghai Dyestuff Co., Ltd., who had been working there since the 1960s (I. 31), revealed that the Shanghai local government officials and SOE cadre managers “started some COEs together with lower-level commune governments in the suburban districts of Shanghai, but they only let these COEs produce old products that the SOEs intended to discontinue.” This restriction on Shanghai-based COEs was corroborated by other former factory managers and engineers who had had at least a 25-year tenure (I. 10, 12, 18, 32, 39, 40).

The municipal government officials in Shanghai carefully avoided forming new local COEs as competitors of existing SOEs. A former director of Shanghai No.9 Dyestuff Factory working in the industry since 1953 (I. 39) recalled: “There were clear rules about what products could be produced in the [Shanghai-based new] COEs, and what could not. Say, we were going to produce advanced light-fast direct dyes, and so some old products such as Red Base RC could be produced in COEs.” The tight control of SOE competition was further confirmed in the interview with a former supply chain manager working in this industry since the 1970s (I. 40, 41), who recalled that only when SOEs found these products no longer very profitable



was a COE in Zhuqiao (a small suburban town in Shanghai) allowed to produce benzocarbazole-2-3-acid and some food color materials.

On the other hand, given the weaker central supervision in many rural Jiangsu counties where no economically important SOEs were located, local governments there were much less concerned about the economic well being of those SOEs. Therefore, lower level governments started COEs whenever they deemed the opportunity sufficiently lucrative. The former secretary general of the Shanghai Color & Dyestuff Association, who joined the industry in the 1970s (I. 27), estimated that there were “no fewer than 200 COEs established in Jiangsu to produce dyes in the 1980s” though “no exact statistics are available for the number of these out-of-plan enterprises.” These “enterprises could not compete with the Shanghai-based SOEs in scale, but there were so many. [...] Meanwhile] they could produce any products as long as they could find technicians and obtain funding.” This greater willingness to start COEs was further corroborated in interviews with directors and managers of Jiangsu-based COEs, who had entered the industry in the early 1980s (I. 25, 34, 37, 38). They chose products simply based on the principle of “the best-selling products” or “those products in shortage. [...] We produced any dyes for which we could find technical assistance. [...] With no exception, the technical assistance came from technicians from Shanghai-based or Jiangsu-based SOEs who worked in these COEs during [the] weekend.”

Stronger central government control also limited the opportunity for local government officials in Shanghai to appropriate rents from local COEs. According to a former director in a Shanghai-based urban COE, who had worked in the industry for over 50 years (I. 43, 44), the officials of Shanghai Municipal Chemical Industry Office could at best get some dinners and fresh flowers paid for by his COE; that was all. Lower-level officials in small/suburban towns under less central supervision, however, could benefit more, but still to a limited extent. According to a former manager of No. 9 Dyestuff Factory, who started his career there in the early 1970s (I. 12), and whose testimony was confirmed by some managers in Shanghai Dyestuff Co., Ltd. (I. 40, 41), the director of a COE in Zhuqiao cooperated with the No. 9 Factory and “assigned two of the director’s relatives to the best positions in the COE,” where they could breathe better air and get a little money from canteen kickbacks.

On the other hand, local officials in Jiangsu, especially those officials in small villages and towns, could appropriate much larger private benefits from COEs, and thus had a considerable interest in forming them. Consistent with the interviews of several former managers from Shanghai Dyestuff Co., Ltd. who worked in the industry for over 30 years (I. 5, 10, 14, 15, 18), a former director in Shanghai No.1 Dyestuff Factory (I. 43, 44) said, “They [the COE managers in Jiangsu] could reimburse any costs from the COE and dining costs accounted for just a small portion” because “there was no formal financial or accounting management in these COEs at all. [...] The officials said we need something, and the COEs gave money for it.” Many expenditures were off the books. A former state-owned factory director in

Shanghai who joined the industry in the 1950s (I. 28, 29) recalled: “Once a director of a COE (to protect our source we withhold the enterprise name) came and told me he could personally reimburse 50,000 CNY [about 9,000 U.S. dollars at that time] without any invoices or receipts. It was a serious financial matter or might be deemed a crime in Shanghai, but they just did not care [in other regions].”

4.2.2 How the degree of industrialization influenced the formation of new COEs  
 Given that the degree of industrialization in Jiangsu was much lower than that in Shanghai at the beginning of this period, the local government officials in Jiangsu were much more eager to bring about local industrial growth, and were thus more willing to try any possible avenue, even if difficult and risky. When they realized that COEs could be a mechanism for rapid growth, they pursued this strategy vigorously. As revealed in many interviews (I.1, 10, 11, 13, 14, 16, 18), government officials encouraged the development of existing COEs and the establishment of new COEs, fully accepting that many COEs not only would fail but also cause pollution in the region. According to a previous director of Shanghai No.8 Dyestuff Factory (I. 28, 29), who had worked in the industry since the early 1950s, at least two underdeveloped villages in Jiangsu, one in Nantong and the other in Hai’an, collected respectively one million CNY and 0.4 million CNY—the entire savings of the government and villagers—and erected new dye COEs, even though they knew nothing about the industry. The government officials and villagers were too keen on industrial growth to refuse the risky opportunity promoted by a university teacher who claimed to have developed a new way of making the popular F-type reactive dyes. Both COEs purchased a technology they were not familiar with and never got any real production off the ground, simply because the technology did not work. Both COEs had to shut down within 2 years of their establishment.

4.2.3 How local labor arrangements influenced the formation of new COEs  
 At the beginning of the reform period in 1978, approximately 97%<sup>10</sup> of the non-agricultural working population in the urban areas of Shanghai was employed with SOEs and much less frequently with Type-I COEs. This is partly why there was very little reason for the municipal government to form new COEs for the purposes of providing industrial jobs to those laborers not already covered by SOEs and COEs. Local residents in Shanghai were accustomed to being ensured life-long careers once they had joined a SOE or COE. Establishing a new Type-I COE in Shanghai meant that the government would have to take on the burden of guaranteeing employment for the newly employed COE workers, most of whom previously were self-employed, if a dye venture should not succeed. Meanwhile, workers in larger COEs in Shanghai

<sup>10</sup>This figure is estimated based on data from (1) *Xin Zhongguo Liushi Nian Tongji Ziliao Huibian 1949–2008* (*China Compendium of Statistics 1949–2008*), (2) *Shanghai Tongzhi*, and (3) *Chinese National Census 1982*.

could hardly be laid off. Putting these two considerations together, it was better for local officials to avoid pulling more local workers into the COE system.

A former director (I. 43, 44) of Shanghai No.4 Dyestuff Factory, who had worked in the industry since 1950 and whose factory was the most important dye COE in Shanghai in the 1980s, recalled the impossibility of laying off even the most poorly performing workers after the factory had been turned into a Type-I COE. "Our factory was created to employ 400 workers who were either youths returning to Shanghai (73%) or former prisoners (27%) from Hongkou [an urban district in Shanghai]. On Aug. 20th, or perhaps 22th, 1983 [three years after the factory was reformed as a COE], ten workers, all former prisoners, were arrested again. But we could not lay off these ten permanent workers. We even sent new working suits and food to prison, and the union people visited them frequently, promising them that 'you'll be back to work soon'."

Similar workforce problems affected the new small COEs in Shanghai. Pulling people into a new COE and then firing them could cause great trouble for lower level local governments. This happened in a small COE in a suburban area of Shanghai, according to a retired manager at Shanghai Dyestuff Co., Ltd, who had worked in the industry since 1968 (I. 45), and whose statement was confirmed by his colleagues (I. 40, 41): "When the founding director [of the small COE] was promoted, a new director arrived and fired five workers who seldom came to work. These laid-off workers complained to the municipal government, and the municipal government ordered the village government to solve the problem. Eventually, the COE was shut down by the village government officials, and all the workers were assigned to another existing COE where they were not needed."

In contrast, local government officials in Jiangsu, especially those in the rural areas, did not need to worry about providing life-long employment to newly hired workers in new COEs. A much smaller proportion (in comparison with Shanghai) of the local population was working within the planned regime on the eve of the economic reform in 1978. The majority of the labor force in Jiangsu was farmers. Since farms were also collectively owned, this gave local governments great autonomy to found new COEs by moving laborers from the collective farms to COEs. Furthermore, new COEs in Jiangsu needed to provide far lower wages to workers with a farm background than what new enterprises in Shanghai were obliged to pay their workers. Where local farmers in Jiangsu did not rely on jobs in COEs for a living, they were willing to work in the new COEs for extra income. This enabled local government officials to start new COEs at a much lower initial cost. All of the interviewees in Jiangsu (I. 24, 25, 34, 37, 38, 46), mostly factory directors or managers in COEs who had joined the industry in the 1980s, agreed with the words of the vice general manager of a dye COE in Jiangsu (I. 24) that "our initial workers were actually local farmers. When we got orders, we produced; when there were no orders, several managers stayed and most workers just left work and farmed. No one complained."

#### 4.2.4 How social welfare provisions influenced the formation of new COEs

Local officials in Shanghai also tended to limit new Type-I COEs because they would be an increasing potential burden in terms of social welfare provision in the event they failed. On the one hand, Type-I COEs provided to their employees much less social welfare than SOEs did. For instance, some large SOEs founded their own technical schools to ensure careers for employees' children, whereas Type-I COEs never provided such opportunities. These SOE-affiliated technical schools admitted exclusively the children of their employees, who would be selected through entrance exams, then be trained for two or three years, and then be offered a job in the SOEs at their graduation. Therefore, as mentioned above, managers and workers in SOEs would not voluntarily join new COEs, and most workers in new Shanghai-based COEs were previously unemployed and thus not covered by the social welfare system. On the other hand, most Type-I COEs in Shanghai still needed to provide some social services and benefits, including low-cost precollege education, free medical care, pensions and even funeral costs to their workers. Local residents, moreover, took these benefits for granted once they had joined a COE. Taken together, the formation of a new Type-I COE in Shanghai meant the incorporation of unemployed residents into the social welfare system, along with the potential social unrest if the government simply cut welfare services after the COE failed. Therefore, it was better for the government to limit the number of unemployed residents who would be incorporated into the COE system.

We have no direct evidence for this rationale. But there is strong, indirect evidence that the Shanghai government wanted to avoid taking on responsibility for the welfare of additional people. One reason for turning Shanghai No.4 Dye-stuff Factory from a SOE into a COE was to incorporate youths who were returning to Shanghai. Rather than incorporating these people into existing SOEs, according to the first director of Shanghai No.4 Dye-stuff Factory (I. 43, 44), the government's rationale for changing the enterprise form was that "COEs need to provide fewer welfare than SOEs to their workers. It would be easier for [the] government."

The local government officials in Jiangsu, however, did not have to worry that a failed COE would cause social instability, since the new workers having a farming background would not complain if they did not receive social services and benefits expected from SOEs. If they simply farmed, they would never be covered by the social welfare system and hence were not worse off by joining a new COE. New COEs in Jiangsu thus did not need to provide Shanghai-level welfare provisions or even Shanghai-level working conditions to attract local farmer-background workers, and represented much smaller start-up costs or potential closing costs for the local government. Furthermore, in the early 1980s, newly erected COEs in those rural towns of Jiangsu did not have to support retired people or other affiliated institutions such as schools. Given their short history and small scale, COEs would not impact the local society if they closed. According to a former SOE director from Shanghai who had joined the industry in the 1960s (I. 30), whose testimony was confirmed by his

colleagues in Shanghai Dyestuff Co., Ltd. (I. 14, 16 and 17), some previous R&D engineers in Shanghai Dyestuff Co., Ltd. “were invited to visit many township and village enterprises in Jiangsu in the 1980s” and came to the same conclusion: these Jiangsu-based COEs “did not offer medical care to workers at all. And workers did not ask for that. They were farmers and never thought of free medical care.” Although these newly erected Type-I COEs in Jiangsu, as they grew prosperous, started to take over more and more responsibility for social services and welfare, including the building of new houses for villagers, and turned out to be important in the local welfare system in the 1990s, most low-level government officials in the 1980s did not expect much in this respect from them.

To summarize the period from 1978 to 1992, the aforementioned four institutional and economic factors lowered the incentives of Shanghai local government officials to establish new COEs but increased the incentives of Jiangsu local government officials to do the same. As a consequence, the frequency of COEs in the population of dye enterprises in Jiangsu rose sharply, and indeed COEs became dominant in the dye industry in this region. The major dye manufacturers in Shanghai in 1992 remained SOEs, the Shanghai Dyestuff Co., Ltd. being by far the most important one. Furthermore, whereas the much smaller dye output in Jiangsu in 1978 was also mostly produced by local SOEs, in 1992 the output was produced mostly by COEs. The statistics for 1992 are unavailable, but already by 1987, the share of township and village enterprises (mostly COEs) in the total dye output in Jiangsu had risen to about 45% (Lu, 1999: 229). Given this rate of growth, the output share of COEs would have surpassed 50% by 1992.

#### 4.3 1993–2008: Zhejiang versus Jiangsu

In this section, we will explain the leadership shift from Jiangsu-based Type-I COEs to Zhejiang-based PEs during the period from 1993 to 2008. Before doing this, it is useful to point out that most SOEs in the now unprotected dye industry in Shanghai became insignificant once the entry of new enterprises transformed the market from a state of undersupply to one of oversupply in the early 1990s. The SOEs suffered from higher costs in part because of rent seeking by cadre managers (Zhou and Wang, 2000; Peng, 2001) and weak budget discipline (Lin *et al.*, 1998; Zhang *et al.*, 2002; Li, 2008). Even reforms and the establishment of joint ventures with foreign companies did not restore their competitiveness sufficiently to save many of them. By 2010, only one out of the 16 dye subsidiary factories of the state-owned Shanghai Dyestuff Co., Ltd. was still in operation; the others had either closed out-right or gone bankrupt.

We also need to provide some background on what happened in Zhejiang (Region 3 of our study) during the 1978–1992 period. Although Zhejiang’s COE sector did not grow in importance during this time, one major development occurred that

played an important role in the period we are now analyzing: many Type-II COEs were established. In the 1980s, because there were relatively fewer Type-I COEs, and given that Zhejiang's population had a strong desire to supplement their incomes, the people there founded their own enterprises. However, because they were concerned about potential policy changes regarding PEs, and because there were clear benefits accruing to COEs in terms of easier access to raw material supplies, most private ventures initiated in Zhejiang chose to register as a COE. They did this by colluding with the local government, which allowed individuals to fully control a Type-II COE. This would soon have a significant impact, specifically in causing another shift in the leadership positions of enterprises and regions after the central government, in 1992, committed itself definitively to a policy of privatization.

Based on our fieldwork and interviews, most of the top enterprises in the Chinese dye industry are now Zhejiang PEs that were reformed from COEs after 1992. Since the actors in Jiangsu, which had become the leader in the first phase of economic reform, were also reforming their COEs into PEs after 1992, the key question that needs to be answered is this: Why did the ownership reform of COEs start earlier and progress more quickly in Zhejiang than in Jiangsu? Our analysis revealed two institutional factors to be the primary causes of these developments: (i) the degree of ambiguity in property rights, and (ii) the local welfare provision.

#### 4.3.1 How the different degrees of ambiguity in property rights influenced the pace of COE ownership reform

In Jiangsu, there were more conflicts among local government officials over when and how COEs were to be reformed as PEs. The reason for this was that the region experienced higher ambiguity in property rights, due to the higher frequency of Type-I COEs in the population of local enterprises. In trying to bring about economic reforms, local governments that owned Type-I COEs generally fell into two conflicting groups: officials who did not have the required social connections to be in the position to acquire the property of Type-I COEs, or who did not want to do so; and officials who wanted to and would be able to do so. The boundary between these two groups was not necessarily fixed, because a particular person might initially be a candidate for membership in a COE-acquiring group on the basis of adequate social connections, only to be excluded as the deal was negotiated. Given the coexistence of these two groups in a particular COE, when and how that COE would be reformed depended on the relative political strengths of the groups. Officials who moved between these two groups would speed up or slow down such reforms.

Reforms could be slowed down, for example, by officials who initially thought that they were able to acquire an ownership stake by privatizing a COE, but then were excluded from the deal. In such a case, they would likely then join the ranks of government officials wanting to maximize the government's gains and, thus,

negotiate longer.<sup>11</sup> On the other hand, potential buyer groups would want to speed up privatization to maximize their personal gains. A retired head engineer of a Shanghai-based state-owned dye factory, who was born in Jiangsu and worked in the industry for over 50 years (I. 32), describes just how profitable privatization was for many buyer groups:

If a COE was evaluated [as] worth ten million CNY, former cadre top managers would [...] ask for installment payments. In the first year, they only needed to pay 500,000 CNY, and they paid by loans from the bank. [...] In the first year they might make a profit of one million CNY. After paying back the 500,000-CNY loan, the owners still could make 500,000 CNY for themselves. So, basically they paid nothing of their own to get an enterprise and made quick money. If they had good relations with the bank, they could extend the loans over and over.

Given their conflicting interests, local government officials in the case of Type-I COEs in Jiangsu could spend years arguing over what should happen with these COEs. The example of a COE producing direct dyes in Jiangsu is very revealing in this regard. An interviewee who joined the industry in the early 1980s and worked in this COE (I. 37, 38) told us:

[The conflicts between different cliques in the village government became] so serious that the factory director, also the deputy village governor, was forced to leave the enterprise in 1995. A deputy director close to this director was isolated by officials [in other cliques], and was assigned to another COE where he found nothing to do. He resigned at the beginning of 1996, but was asked by the government to return in October because the COE was losing money. He returned with the condition that he would contract<sup>12</sup> the enterprise for three years. The COE became lucrative within four months, and the officials cancelled the contract

<sup>11</sup>Li and Rozelle (2003, 2004), who—unlike us—see government official as always solely motivated by the public good, describe different contractual arrangements used to protect government interests in the privatization process.

<sup>12</sup>The “contract responsibility system,” as it is called in the literature, was popular in China in the 1980s–1990s. It was first adopted in agriculture in 1981 and later extended to industrial sectors. By contracting with a local government to run the COE for a stipulated period, the manager would be held responsible for its profits and losses even though the government was still the owner of this enterprise. Usually, the manager was allowed to run the enterprise independently during the contracted time period for as long as s/he paid the government the contract fee (a fixed annual fee, and/or a quota of the enterprise’s profits). If the enterprise was losing money, the manager would have to bear all losses, but the government would still get paid the fixed annual fee. If the enterprise was making profits, the manager and the government could receive the contracted proportions of the total profits.



immediately because they did not want all the money to go into his pocket. They then merged this COE with another COE into a group company, and moved the management to the town government [because it was more convenient for them to appropriate rents]. Management costs sky-rocketed and the 'group' was losing money. Eventually the government launched ownership reform in the dye COE in 1998, but still held many shares [of this enterprise] after that. The officials continued to have the enterprise pay bills incurred by themselves and their friends. Another three years passed [it was now 2001] and all the government's shares were purchased by the enterprise managers. However, due to its historical connections with the government, the enterprise still covers annually 160,000 CNY of whatever bills the government officials want to get paid.

This long statement describes in great detail the painfully slow process, with many false starts, by which Type-I COEs were turned into PEs.

In contrast, ownership reform was launched earlier and went on more rapidly in Zhejiang. The region had a higher frequency of Type-II COEs than did Jiangsu, and as a consequence, the process of reforming COEs there was easier, given the lesser ambiguity in property rights.<sup>13</sup> The much greater clarity of property rights of Type-II COEs compared with Type-I COEs improved the incentives for and capability of non-cadre entrepreneurs to enforce their rights after 1992.

For instance, ownership reform was never a problem for the Ruan family who established Lonsen, now the largest dye enterprise in the world. According to several inside informants (I. 2, 3, 4) and a retired factory director in Shanghai who was born in Shangyu (Lonsen's location) and worked in the industry from 1950 (I. 43, 44), Lonsen obviously "belonged to the Ruan family although it was registered [as] a COE in the 1980s." Consistent with several outside informants from Shanghai, the general manager of the Lonsen R&D division, who joined Lonsen in 1993 (I. 4), said:

Our old board president [the founder of Lonsen, Ruan Shui-long] invested with 13 farmers in the predecessor of our firm, a pesticide mill in 1970. Of course, it was registered as a COE [given the environment in China then]. It was a money-losing business, and it only had 3.81 CNY [about 2 U.S. dollars then] cash on the books in 1978. Only four of the

<sup>13</sup>There were more Type-II COEs in Zhejiang than in Jiangsu at the beginning of the second period, owing to two factors. First, central supervision in Zhejiang in the first period (before 1992) was the weakest among the three regions. Second, the local industrial economy in Zhejiang, in the first period, was the least developed among the three regions. Taken together, officials in Zhejiang, compared with their counterparts in the other two regions, found it not only politically less dangerous but also economically more necessary to promote privately controlled enterprises. Hence, they were more willing to help non-cadre entrepreneurs cloak their PEs as Type-II COEs.



14 farmers, including Ruan Shui-long himself, stayed. Ruan sold two family-raised pigs, got 135 CNY [about 80 U.S. dollars then] and went to Shanghai to look for [production] techniques. [...] He and the other remaining founders borrowed a lot of money and started to produce dye auxiliaries in the 1980s.

The aforementioned retired director in Shanghai remarked: “Who in the government could say that they had a legitimate claim on Lonsen? The local government got some shares after its ownership reform, but no more than 5%. This was more a favor by the Ruan family and perhaps due to their concern about public relations.” The interviews with another retired factory director in Shanghai (I. 28, 29) revealed a similar story of easy ownership reform in Donggang, a Zhejiang-based enterprise that is the largest and only dominant producer of Reactive Blue KN-R in China. All of this painted the same picture, which is that Zhejiang benefited from having a higher frequency of Type-II COEs that could more readily be converted into PEs.

#### 4.3.2 How COE-affiliated welfare services influenced the pace of COE ownership reform

The propensity of local officials in Jiangsu to launch ownership reform of COEs also decreased on account of their intention to keep Type-I COEs for the purpose of social welfare provision. First, though Type-I COEs provided less social welfare than SOEs upon their initial establishment, they grew into a social welfare provision scheme once they turned prosperous between 1978 and 1992; in fact, many local governments, especially lower-level ones, relied at least partly on them for social welfare provision. For instance, a small dye COE that we visited in Jiangsu, according to an outside informant who is now a vice general of a dye enterprise (I. 25), “used to support over 100 disabled workers when they had in total no more than 400 workers. Disabled workers did not work if they didn’t want to, but could still get paid 360 CNY a month. Retirement funding was also provided. [...] This was the only lucrative COE in our village, and the government just threw all the disabled here. Then the government did not need to extract money from their own budget for the disabled.” Second, by the 1990s, COEs that had been unburdened in the 1980s were supporting many “retired” or “affiliated” workers. Based on the words of several COE managers in Changzhou, Jiangsu (I. 24, 34), “Officials and cadre managers drew their relatives and friends into lucrative COEs. Some of them did not aim to work for money, but to be affiliated with the enterprise for a while and then asked for early retirement or long sick leave. The enterprise still needed to pay them.”

On the other hand, the majority of the enterprises in Zhejiang, Type-II COEs, did not generate such concerns regarding social welfare provision because these enterprises took almost no such responsibilities prior to ownership reform. Local government officials there understood that they should rely on the governments’ own tax base for social welfare provision, even if this meant a relatively low overall level of

support when the local economy was not sufficiently developed. They could not depend on SOEs or Type-I COEs for these responsibilities, since there was an insufficient number of strong local ones. Also, they realized it was better not to force local Type-II COEs to take on such responsibilities, because, first, they did not have any managerial control over these enterprises, and second, they decided to promote the rapid growth of PEs by not burdening them with social welfare provision requirements. For instance, Lonsen, the largest PE dye manufacturer in China and which used to be a Type-II COE, only had 20 retired people to support when it employed 3 130 workers at the end of 2003, according to the company's 2003 annual report.

In summary, the degree of ambiguity in property rights and social welfare provision both slowed down the pace of COE ownership reform in Jiangsu compared with Zhejiang, with property right clarity playing the most important role at this stage in providing enterprises with a competitive advantage. As a result, the frequency of PEs in the population of dye enterprises rose more quickly in Zhejiang, and Zhejiang came to dominate the Chinese dye industry, surpassing the other two regions. Jiangsu and Shanghai are still catching up in the reform of their enterprises. A former dye factory manager in Suzhou, Jiangsu (I. 37, 38, confirmed by interviews 18, 22, 35, 42) commented that "we (Jiangsu-based COEs) were three to five years slower than our counterparts in Zhejiang in launching ownership reform." In 2010, the top two Chinese synthetic dye enterprises, Lonsen and Runtu, both Type-II COEs before 1992, were producing over 40% of the dye output in China.

## 5. Discussion and conclusions

The basic argument emerging from our inductive historical case study is that differences in regional institutional and economic arrangements provided different incentives to actors to either reform existing SOEs or COEs, or start new enterprises in the Chinese synthetic dye industry. This, in turn, influenced changes in the frequencies of different ownership forms in a particular region, thereby determining the industrial strength of the region in the industry. To our knowledge, the striking pattern according to which leadership shifted at the same time across ownership forms and across geographic regions has not been previously documented. Our article attempts to identify the causal connection between the two shifts. Instead of discussing again the entire chain of causation, we focus in this section on the key insights provided by our study, after which we articulate how generalizable our findings are likely to be. Finally, we identify future research directions.

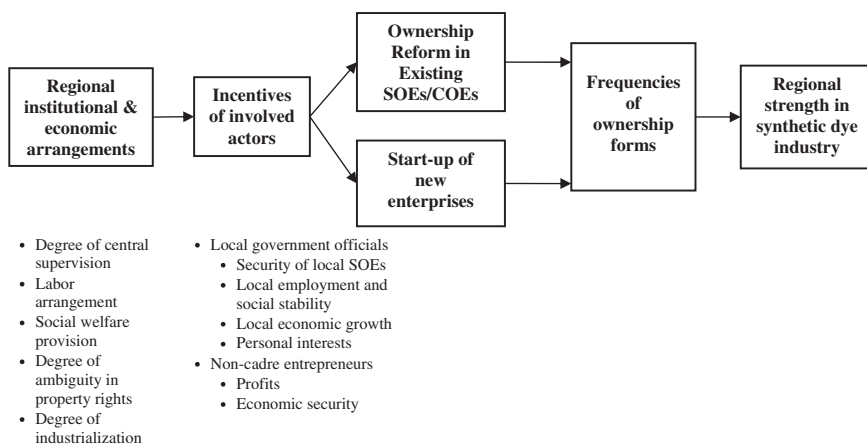
### 5.1 Contributions

The leadership migration from SOEs to PEs in some Chinese industries is not a new finding, and the ownership transformation in China has been researched extensively.

Yet, this article has made two important contributions: first, we discovered in the Chinese synthetic dye industry a simultaneous occurrence of a leadership shift across ownership forms and a leadership shift in production across regions. Second, we established a causal link between these two shifts by providing an institutionalist interpretation of their simultaneous occurrence.

Institutions—the standardized patterns of interactions between social actors (Nelson and Sampat, 2001)—typically display considerable inertia. Institutional change is path-dependent, and for this reason existing institutions are not necessarily even close to efficient. As time passes, previously favorable institutions might become unfavorable in that they no longer serve present requirements. This means that a region that possesses more favorable institutions at a particular moment is, to a considerable degree, advantaged (and lucky).

Our analysis revealed that the pace of ownership transformation in the dye industry in a particular Chinese region was heavily constrained by the existing regional institutions there. Four regional institutional factors (the degree of central supervision, labor arrangement, social welfare provision, and the degree of ambiguity in property rights) played a key role in shaping the pace of local ownership transformation that in turn determined the relative strength of regional synthetic dye industries (Figure 4). Between 1978 and 1992, the degree of central supervision, labor arrangements, and social welfare provisions in Jiangsu favored rapid ownership transformation from SOEs to COEs. This affected a shift of the synthetic dye industry to this region from Shanghai, where regional institutions hindered local enterprises from carrying out the early and rapid ownership transformation required for growth in the industry. Then, between 1992 and 2008, Jiangsu lost its position to Zhejiang in this industry, because the degree of ambiguity in property rights and social welfare provisions in Jiangsu were unfavorable for the COE-to-PE



**Figure 4** Summary of causal drivers of regional transformation in synthetic dye industry.

ownership transformation necessary to bring about new growth, and because the actors in Jiangsu could not immediately free themselves of those institutional constraints.

### *5.2 Generalizability and future research*

Based on our analysis of the Chinese synthetic dye industry and our observations of other Chinese industries, we induced a general proposition with clear boundary conditions: “There was a systematic connection after 1978 between leadership migration across ownership forms and leadership migration across regions in all of the Chinese manufacturing industries that already existed in China before 1978, that subsequently did not experience significant technological changes, and that were not highly protected by the government.” We expect that the impressive simultaneity of the two leadership shifts holds widely within this entire subset of Chinese industries. Our fieldwork reveals that the key institutional factors might vary across industrial sectors and across regions; nonetheless, we predict that the institution-centered causal mechanisms underlying this pattern will hold true.

Although we provide only a single industry case in this article, we did additional, limited follow-up work on other Chinese industries, such as the steel sector, to help confirm the generalizability of our proposition. Because of the far stronger government protection in the Chinese steel industry, the leadership shift in terms of output volume in this industry was not as rapid or dramatic as in the Chinese dye industry. Notably though, it experienced a quick rise in PEs immediately after the government only marginally relaxed some control over the industry in 1998. Just as in the Chinese synthetic dye industry, the Chinese steel industry existed before 1978 and did not experience significant technological changes subsequently. It is true that in the steel industry, owing to government action, a relatively later leadership shift took place across ownership forms from SOEs to PEs and yet, this industry experienced the same pattern as those in the synthetic dye industry: a simultaneous leadership shift in terms of the location of production across regions. Specifically, leadership shifted from Liaoning, Shanghai and Hubei, where regional institutions were favorable in the SOE era, to Hebei and Jiangsu, where regional institutions were more favorable to PEs. All in all, the aggregate evidence indicates that our proposition is a conjecture eminently testable with large sample data comprising many sectors and regions in China. More importantly, ours is a conjecture that opens exciting research avenues. Certainly it is worthwhile testing, as the two simultaneous shifts have significant implications for regional economic growth in China over the past 30 years.

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**Appendix 1**  
**Table A1** Interview list

No.	Interview time	Tenure in the industry	Position	Working experiences		
				Enterprise/affiliation	Enterprise/affiliation location	Segment
1	December 30, 2009	1960s to present	Secretary General	China Dyestuff Industry Association	Beijing	Industrial society
2	January 05, 2010	1998 to present	Director of Corporate management Department	The top Chinese dye firm	Zhejiang	Type-II COE→PE
3	January 07, 2010	1999 to present	Engineer in charge	The top Chinese dye firm	Zhejiang	Type-II COE→PE
4	January 08, 2010	1993 to present	General Manager of the R&D subsidiary company	The top Chinese dye firm	Zhejiang	Type-II COE→PE
5	January 10, 2010	1970s–1990s	Engineer	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
6	January 14, 2010	1980s to present	R&D Director	A top-10 Chinese dye firm	Zhejiang	Type-I COE→PE
7	January 15, 2010	1993 to present	General Manager of Technology Division and vice General Manager of the Company	A top-3 Chinese dye firm	Zhejiang	Type-II COE→PE
8	January 18, 2010					
9	January 22, 2010	1990s to present	Deputy R&D Director	A top-10 Chinese dye firm	Zhejiang	PE
10	January 25, 2010	1970s to present	Deputy Director of Engineering center	Shanghai Dyestuff Research Institute Co., Ltd.	Shanghai	SOE
11	January 26, 2010	1970s to present	Engineer Secretary General	Shanghai Dyestuff Co., Ltd. Shanghai Coatings and Dyestuff Trade Association	Shanghai Shanghai	SOE Industrial society
12	January 29, 2010	1970s to present	Director of a subsidiary factory Information Director	Shanghai Dyestuff Co., Ltd.	Shanghai Shanghai	SOE Industrial society

(continued)



Table A1 Continued

No.	Interview time	Tenure in the industry	Position	Working experiences		
				Enterprise/affiliation	Enterprise/affiliation location	Segment
13	February 01, 2010	1963 to present	Editor of <i>Shanghai Dyestuffs</i>	Shanghai Coatings and Dyestuff Trade Association	Shanghai	Industrial society
14	February 08, 2010	1966 to retirement	Senior engineer Head Engineer of Shanghai Dyestuff Co., Ltd./Professor	Shanghai Coatings and Dyestuff Trade Association Shanghai Dyestuff Co., Ltd. Shanghai Dyestuff Co., Ltd.	Shanghai Shanghai	SOE SOE
15	February 10, 2010	1980s to present	Owner and General Manager	Self-owned dye production company	Shanghai	PE
16	February 25, 2010	1950s to present	Engineer, General Manager Engineer Professor in Organic Dyestuffs (teaching almost all the later head engineers in Shanghai-based dyestuff factories)	The top Chinese dye firm Shanghai Dyestuff Co., Ltd. Shanghai Textile Industry University East China University of Science and Technology	Zhejiang Shanghai Shanghai	Type-II COE→PE SOE University
17	July 29, 2010	1950s to present	Engineer/Professor	Shenyang Dyestuff Research Institute	Shenyang	Research institute
18	August 02, 2010	1960s to present	Technical Consultant Senior Engineer	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE

(continued)

Table A1 Continued

No.	Interview time	Tenure in the industry	Position	Working experiences		
				Enterprise/affiliation	Enterprise/affiliation location	Segment
19	August 06, 2010	1950s to present	Technical Consultant	A Swiss company in China	Foreign company	
20	August 08, 2010		Engineer in Shanghai No.3 Dyestuff Factory (synthesizing the first cationic dye in China)	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
21	August 12, 2010	1970s to present	Engineer in Shanghai No.5 Dyestuff Factory	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
22	August 17, 2010	1980s to present	Chairman and General Manager	A medium-size Chinese dye firm	Zhejiang	Type-I COE→PE
23	August 18, 2010	1970s to retirement	Sales Manager in Shanghai No.9 Dyestuff Factory	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
24	August 20, 2010	1980s to present	Director of Quality Control Department	A top-20 Chinese dye firm	Jiangsu	Type-I COE→PE
25	August 22, 2010	1980s to present	Vice General Manager	A top-20 Chinese dye firm	Jiangsu	Type-I COE→PE
26	August 24, 2010	1960s to present	Vice Secretary General	China Dyestuff Industry Association	Beijing	Industrial society
27	August 31, 2010	1970s to present	Technical Consultant	Self-owned service company	Shanghai	PE
			Secretary General in the 1980s	Shanghai Coatings and Dyestuff Trade Association	Shanghai	Industrial society
28	August 31, 2010	1950s to present	Engineer in a subsidiary factory	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
			General Manager	Self-owned trading company	Shanghai	PE
			Director of the Planning Division	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
29	November 10, 2010		Director of Shanghai No.8 Dyestuff Factory			
			Director of Shanghai No.3 Dyestuff Factory			
30	September 03, 2010	1960s to present	Director of Shanghai No.8 Dyestuff Factory	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE

(continued)

Table A1 Continued

No.	Interview time	Tenure in the industry	Position	Working experiences		
				Enterprise/affiliation	Enterprise/affiliation location	Segment
31	September 13, 2010	1961 to present	Technical Consultant Director of Shanghai No.8 Dyestuff Factory	Self-owned service company Shanghai Dyestuff Co., Ltd.	Shanghai Shanghai	PE SOE
32	September 19, 2010	1953 to retirement	Head Engineer of Shanghai No.10 Dyestuff Factory	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
33	September 21, 2010	1950s to present	Professor of Fine Chemistry	Tianjin University	Tianjin	University
34	September 22, 2010	1980s to present	Vice General Manager in a top-20 Chinese dye firm	A top-20 Chinese dye firm	Jiangsu	Type-I COE→PE
35	September 22, 2010	1990s to present	R&D Manager	A medium-size Chinese dye firm	Zhejiang	PE
36	September 28, 2010	1950 to present	Technical Consultant Head Engineer of Shanghai No.9 Dyestuff Factory	A major Chinese direct dye firm Shanghai Dyestuff Co., Ltd.	Jiangsu Shanghai	Type-I COE→PE SOE
37	September 28, 2010	1980s to present	Manager	A major Chinese direct dye firm	Jiangsu	Type-I COE→PE
38	November 03, 2010		Supply Manager	A dye factory	Jiangsu	Type-I COE
39	September 03, 2010	1953 to retirement	Director of Shanghai No.9 Dyestuff Factory	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
40	October 11, 2010	1970s to retirement	Sales and Supply Manager	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE

(continued)

Table A1 Continued

No.	Interview time	Tenure in the industry	Position	Working experiences		
				Enterprise/affiliation	Enterprise/affiliation location	Segment
41	October 12, 2010					
42	October 20, 2010	1980s to present	General Manager	A top-5 Chinese dye firm	Zhejiang	Type-II COE→PE
43	October 26, 2010	1950 to present	Technical Consultant Technical Consultant	A major Chinese dye firm A division of Everlight Chemical Industrial Co., Ltd.	Zhejiang Jiangsu	PE Foreign company
44	October 31, 2010		Director of Shanghai No.4 Dyestuff Factory	Shanghai Dyestuff Co., Ltd.	Shanghai	SOE
45	October 26, 2010	1968 to present	Director of Shanghai No.1 Dyestuff Factory Technical Consultant Manager in the corporation Senior Engineer Workshop Director in Shanghai No.1 Dyestuff Factory	A major Chinese dye firm Shanghai Dyestuff Co., Ltd.	Zhejiang Shanghai	PE SOE
46	November 09, 2010	1960s to present	Technical Consultant and Shareholder Engineer	A major Chinese direct dye firm Shanghai Dyestuff Co., Ltd.	Jiangsu Shanghai	Type-I COE→PE SOE
47	November 23, 2010	1963 to retirement	Government official	The State Chemical Industry Office	Beijing	Central government

## Appendix 2

Data sources for Figures 1–3.

Figure A1 The percentage figures were generated based on Chinese national dye outputs and global dye outputs. The output figures in 1978 are respectively from (i) China: *Chinese Industry Economy Statistical Yearbook 2003* (Beijing, 2004: 42); (ii) United States: *Synthetic Organic Chemicals, United States Production and Sales, 1978* (US Government Printing Office, Washington, 1979, p. 4), and *Chemical Economic Handbook, Dyes, 1995* (SRI Consulting), and both sources are consistent in this figure (113,750 tons and 113,760 tons, respectively); (iii) Germany: *Chemiewirtschaft in Zahlen*, published yearly by the Association of the Chemical Industry ([https://www.vci.de/Die-Branche/Strukturdaten-Statistiken/Seiten/CHIZ\\_Online.aspx](https://www.vci.de/Die-Branche/Strukturdaten-Statistiken/Seiten/CHIZ_Online.aspx)); (iv) Japan: *Japan Statistics Yearbook 1979* (Bureau of Government Statistic, Tokyo); (v) India: *Social Cost of Incentives: A Case Study of Dyestuff* (New Delhi, 1982, pp. 26); and (vi) worldwide: *Dui Dangqian Jinkou Ranliao De Fenxi Tantau [Analysis of the Imported Dyestuffs, Dyestuff Industry, 1981 (3): pp. 1–11, 26]* and *Jinnian Shijie Ranliao Shengchan Xingshi Qianxi [Analysis of the Recent Trend in the Global Dyestuff Industry, Dyestuffs and Coloration, 1988 (1): pp. 10–14]*. The two sources are inconsistent in this figure (830,000 tons and 759,000 tons, respectively). We used the average, 794,500 tons, for the purposes of the graph. The output figures in 2007 are, respectively, from (i) China: *Chinese Industry Economy Statistical Yearbook 2007* (Beijing, 2008), and *2007 Nian Woguo Ranliao Ji Youji Yanliao Fazhan Huigu Yu Zhanwang [Analysis of the Chinese Synthetic Dye and Organic Pigment Industry in 2007, Dyeing and Finishing, 2008(10): p.42]*. The two sources are inconsistent in terms of this figure. After consulting the China Dyestuff Industry Association, we used the figure in the latter source (753,700 tons), because the figure in the former is likely to have included auxiliary and organic pigment output; (ii) United States, India and worldwide: *the Chemical Economics Handbook - SRI Consulting 2008*; (iii) Germany: *Chemiewirtschaft in Zahlen*, published yearly by the Association of the Chemical Industry ([https://www.vci.de/Die-Branche/Strukturdaten-Statistiken/Seiten/CHIZ\\_Online.aspx](https://www.vci.de/Die-Branche/Strukturdaten-Statistiken/Seiten/CHIZ_Online.aspx)); and (iv) Japan: We estimated the 2007 figure using the average of the nation's annual outputs from 2004 to 2006, provided by *the Chemical Economics Handbook - SRI Consulting 2008* (pp.146).

Figure A2 Regarding the national output, for the years from 1978 to 1992, the *Chinese Industry Economy Statistical Yearbook 2003* (Beijing, 2004: pp. 42) was used as the major data source. Other data sources for these years include (i) *2000 Nian Ranliao Gongye Fazhan Yuze [Forecast for the Chinese Dye Industry in 2000, Dyestuffs and Coloration, 1988(4), pp. 1–8]*, providing figures for the years from 1980 to 1987, consistent with the major source; (ii) *Zhongguo Huaxue Gongye Nianjian 1993/1994 (China Chemical Industry Yearbook 1993/1994, pp. 126)*, providing figures for the years from 1983 to 1993, consistent with the major source; (iii) *the Chemical*

*Economics Handbook - SRI Consulting 2008*, providing figures for the years from 1989 to 1993, consistent with the major source. For the years from 1994 to 2008, four major data sources were used: (i) *China Chemical Industry Yearbooks*, (ii) *The Chemical Economics Handbook - SRI Consulting 2008*, (iii) statistics from the China Dyestuff Industry Association, and (iv) *Chinese Industry Economy Statistical Yearbooks*. We did not rely on *Chinese Industry Economy Statistical Yearbooks* solely as the major data source for this period because, according to the China Dyestuff Industry Association, the data in that source is likely to have included auxiliary and organic pigment output. Compared with the figures from other data sources, the national output figures from the *Chinese Industry Economy Statistical Yearbooks* are indeed higher. For the years when the figures from the four sources are inconsistent, we used the averages of the various figures. Regarding the regional outputs, the figures for Zhejiang are from (i) statistics from the China Dyestuff Industry Association and the Shanghai Color & Dyestuff Association; (ii) statistics from the China Dyestuff Industry Association; (iii) the series *Zhongguo Huaxue Gongye Nianjian* (*China Chemical Industry Yearbook*); and (iv) the series *Chinese Industry Economy Statistical Yearbook*. The figures for Jiangsu are from (i) *Jiangsu Shengzhi-Huaxue Gongye Zhi* (*The Historical Book of Jiangsu Chemical Industry*, 1999, pp. 239); (ii) the series *Chinese Industry Economy Statistical Yearbook*; (iii) statistics from the China Dyestuff Industry Association; (iv) the series the *Chinese Industry Economy Statistical Yearbook*; and (v) statistics from the China Dyestuff Industry Association and the Shanghai Color & Dyestuff Association. For Shanghai, the figures are from (i) *Shanghai Huaxue Gongye Zhi* (*The Historical Book of Shanghai Chemical Industry*, Shanghai, 1997); (ii) *Zhongguo Huaxue Gongye Nianjian 1994/1995* (*China Chemical Industry Yearbook 1994/1995*, pp. 24); (iii) *Zhongguo Huaxue Gongye Nianjian 1999/2000* (*China Chemical Industry Yearbook 1999/2000*, pp. 30); and (iv) statistics from the China Dyestuff Industry Association and the Shanghai Color & Dyestuff Association. We used the averages of the various figures where the figures from different sources are inconsistent.

Figure A3 National output figures are from the same sources used for Figure 2. The three enterprises' output figures are respectively from: (i) 2000: *Zhongguo Xin Cailiao Fazhan Nianjian* (*China's New Materials Development Yearbook*). (ii) 2001–2005: (1) Tian Li-ming, *Woguo Ranliao, Youji Yanliao Gongye "Shiwu" Fazhan Huigu Ji "Shiyi Wu" Fazhan Fangxiang* (*Review of Chinese Dye & Organic Pigment Industry During the Tenth Five-Year Plan, and Development Potential in the Eleventh Five-Year Plan, Part One*), *Fine and Specialty Chemicals*, 2007, 15(15), pp. 26, and (2) *Guojin Zhengquan Gongsì Yanjiu Baogao: G Longsheng* (*Sinolink Securities Report: G Lonsen*), 2006 (iii) 2006: Tian Li-ming, *2006 Nian Quanguo Ranliao, Youji Yanliao Gongye Fazhan Huigu (Yi)* (*Review of the Development of Chinese Dye & Organic Pigment Industry in 2006, Part One*), *Fine and Specialty Chemicals*, 2007, 15(7), pp. 28.