

Revisiting Economic Development in Post-war Taiwan: The Dynamic Process of Geographical Industrialization

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Abstract

The post-war economic growth of Taiwan has been spectacular and became particularly dazzling in East Asia after 1997 economic turmoil. While neo-classicists interpret Taiwan Miracle as a model of free market economy, the Statists put the government policy to the core of the stage. However, neither the neoliberalists nor the statist take the phenomena of uneven development serious. By ignoring the process of geographical industrialization, both discourses won't be able to reveal the dynamic rhythm, and more importantly the diversity and possibility, of the capitalist development. This paper will tackle the issue by unravelling the spatial fix of capitals and the resulting geographical and social embeddedness in post-war Taiwan.

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While the issue of how to decode the East Asian Miracle had not been settled, the concern of how to interpret the 1997 turmoil forcefully came to East Asian researcher's mind. Those who believe the success of East Asia comes from the liberation of market force conceive the 1997 disaster was caused by the incompleteness of the market release by the governments (IMF 1998). In contrast, those who buy the idea of "developmental state" tend to see the crisis as the conspiracy of the Wall Street-Treasury-IMF complex, which pushed the well-done East Asian governments to abandon their on-the-right-track regulations on their own financial system, and believe the governments have to bring the rules back to weather the storm (Wade 1998). In appearance, these two perspectives of East Asian economic development take extremely different stances: while the neo-classic theories advocate for the retreat of the state, the political economy approaches campaign for the empowerment of the government. However, in reality they reach an unexpected agreement: both of them converge on the idea that national development is a spatially homogeneous process, and the regulation (or deregulation) of state policy will lead the nation to a new economic growth stage. Within the new stage, new leading sectors emerge, and new employments increase.

But this is wrong, or at most incomplete. Capitalist economy never grows in a spatial vacuum, but in a process of geographical industrialization (Storper & Walker 1989). To handle over the crisis of overaccumulation, different kinds of capital nomad over diverse regions, manipulate various locational factors, construct numerous worlds of production, and shape divergent geographical configuration. As Harvey (1982) argues, capitalist development discloses itself among the divergent institutional embeddedness, structural coherence, geographical organizations, and scalar connections.¹ Space is

¹ Here I agree to use the term "spatial fix" originated by Harvey, rather than the term "spatio-temporal fix" which was proposed by Jessop (2000) in a recently published paper. Jessop based his criticism on Harvey's ignorance of the time dimension in the capitalist regulation of accumulation regime. In Harvey's idea, the temporal dimension of capital fixity and motion was incarnated in the discussion of the process of change structural coherence between regions. Therefore, I still use "spatial fix" which is familiar within critical geographers. Besides, labour geographers such as Herod (1997) argued that we should pay more attention to labour's role in the making of spatial fix. It's true that labour as the active agent in the process of could use space as the resource to fight against the capital accumulation strategy which might endanger the survival and prosperity of the worker community. However, it should not pretend that labour as a collectivity possesses the same capacity and stands on equal footing with capital in shaping economic landscape, since there exist different collective logics between these two agents. Herod's argument should be treated as the complementary, rather than substitutive, with Harvey's.

treated as a resource to temporarily fix the necessary contradiction of capital accumulation. From geographical perspective, the industrialization process should not be taken as a temporal sequence of industrial substitution, but as a course of regional accumulation regimes. In the sense, both statist and neoliberalists commit the same fault in taking the national development as universal phenomena, and buying the idea that the policy will put regular, either positive or negative, effects on the industrial system. In contrast, we will differentiate the divergent developmental trajectories in different regions, even in the same country. By doing so, we will be able to illustrate the rhythms of industrial change and the related geographical organizations, and then provide a clearer understanding of the multiple modes of regional industrialization in the presumed monolithic national development.

In 1949, the defeated Kuomintang (KMT) party was expelled from Mainland China and relocated to Taiwan, with over two million refugees. Unemployment and inflation were very serious problems² and a massacre of Taiwanese civilians only two years before added to the social unrest. The ruling party devised an ambitious land reform program to encourage social and political stability and increase agricultural production. The short “import-substitution” between 1953 and 1957 was actually a first-aid measure to simultaneously preserve Taiwan’s scarce foreign exchange and to produce essential consumer goods for self-sufficiency. It was not import-substitution in a strict policy sense, but better conceived as a part of the economic restoration immediately after the war.

The economic growth of post-war Taiwan was driven primarily by the expansion of manufacturing exports that came after 1960. It has become a commonly accepted framework to divide the post-war economic development of Taiwan into three stages: the early push toward manufacturing exports in the 1960s, the import-substitution industrialization in the 1970s, and the industrial upgrading toward high-tech industries in the 1980s (Gereffi 1990). Variables like the Japanese colonial legacy (Barnett and Whyte 1982), government policy (Wade 1990), the international political economy (Cumings 1987), the vulgar Confucianism (Berger 1986), labour suppression (Deyo 1989), and networked production (Shieh 1992) have been selectively combined to offer explanations to the country’s economic success. The research does not aim to play an impartial jury or to retell the history by reshuffling the variables. Instead, this study starts off from the observation that those variables did not evenly shape the evolution of the Taiwanese economy as if it is a homogeneous unit. Questioning the hidden assumption of

² The Taipei wholesale price index increased 260% in 1946, 360% in 1947 and 3500% in 1949 (Ho 1978, p. 104)

nation-state as the unit of analysis is not entirely an academic exercise. It is also a timely response to the pressing issues facing people in the turbulent world of global economy.

As we approach the next millennium, the unleashed global economy has become an overwhelming challenge to human development in every corner of the world. A freer global economy is touted to bring prosperity to those who courageously embrace it—although reality often shows the opposite result (Dicken 1998; Ohmae 1995). Paradoxically, local spaces of growth poles on the sub-national settings of regional agglomerations also increasingly gain attention (Lipietz 1995; Storper 1997, Scott 1998). The global and local perspectives, though often in heated debate, do share a consensus that the nation state has ceased to be the only legitimate or even the most productive analytical unit for studying economic development. This however does not imply that the sovereign state has lost the battle with the global market but that its effectiveness *varies in different industries* and must be examined *along with other* institutional forces. Porter's well-known study on national competitiveness (1990) is just a salient example among many. The international comparative study started from an observation that no country can perform well in every industry, and those good-performing industries are often concentrated *only* in a small sub-national region (1990).³

Economic development is a historical result of the socially embedded interaction between region and industry. Industry represents a world of products in which local firms are connected with the environment of global challenge. In order for firms to survive and prosper under severe competition, they must find ways to cope with the uncertainties that derive from industry-specific modes of technological, production, and market changes. However, firms do not cope with the uncertainties in an isolated fashion. They deal with challenges in a socially constructed space where they interact with each other held up by institutional supports of various kinds. The industrial agglomeration (or, to reverse the order of wording, “regional industrialization”) is both empirically *and* conceptually a legitimate subject for developmental study.

Contrary to what it might appear, history actually regains its analytic importance under the approach. History is itself explanatory in two of its common but seemingly contradictory denotations: *path dependence* and *unexpected turn*. The two connotations of history are built into the work of institutions. Institutions, which were built over time

³ While studying national development through industrial cases is now gaining popularity, we need to be aware that the regional industry should not be reduced to only a reflection of the national economy conceived as a linearly evolved homogenous space. In that case, the regional and industrial differences are still remotely assumed in the background, not as analytical categories but only as a source of empirical data.

in the space where an industry developed, both set limits on and make possible the consequential course of its residing firms. As to the unexpected turn, institutions often exert unintended influences out of their original purpose or adjacent field. Some growth-fostering institutions are not even “economic” by nature (e.g., family structure and social convention). State policies, as a strategic source of institution, must be examined historically as such. To summarize, economic development is a historical question about socially embedded industrial space and *therefore* also a challenge about turning limits into prosperity through our choices.

Revisiting Local Economies of Post-war Taiwan

In the following sections, I argue that economic development is a historical result of the socially embedded interaction between region and industry. Three industries are chosen as study subjects because they are representative of the major stages *and* regions of Taiwan’s post-war economic growth. They are the footwear industry, petrochemical industry, and semiconductor industry.

The footwear industry, once the third largest exporting industry of Taiwan, grew in massive scale in the export-oriented industrialization of the 1960s. Central Taiwan, especially the townships around its largest city, Taichung, was called the “shoe nest” because it accommodated most of Taiwan’s footwear manufacturers.⁴ The petrochemical industry was a representative industry of the import-substitution industrialization, which was ignited in the mid-1970s. Over 90 percent of the petrochemical plants were concentrated around Kaohsiung port in southern Taiwan.⁵ The semiconductor industry became a rising star of industrial upgrading ever since the mid-1980s. All the semiconductor plants and most of their domestic manufacturing-buyers were located in northern Taiwan.⁶

The selection certainly does not mean to say that the industries have no presence outside their respective regions, nor does it imply that they monopolize the regional economies. The cases are selected because of their *historical affinities* with development

⁴ I learn much about Taiwan’s footwear industry from Lu-lin Cheng, who has done his research for more than 8 years and is an excellent scholar in economic sociology (see Cheng 1996).

⁵ I base my arguments about Taiwan’s petrochemical industry on the fieldwork conveyed in my graduate years, from 1987-1992 (see Hsu & Hsia 1997).

⁶ I started my research about Taiwan’s semiconductor from 1995 for my Ph. D. dissertation at UC, Berkeley (see Hsu 1997).

strategy and regional space. This study intends to disentangle the *social content* of the affinities. I put forth the following questions: What were the social conditions that spatially and historically gave birth to those representative industries of Taiwan's post-war economic development? And conversely, how did the development of those industries shape the social landscapes of regional Taiwan?

It must be admitted from the beginning that a detailed, full-blown examination of the subject is impossible to accomplish in a short paper. The discussions to follow are inevitably sketchy and only give some broad strokes on the general features of the three industries in Taiwan. However, I hope that they are sufficient for us to at least reach an empirically grounded conclusion that there were multiple paths of growth in a country as small as Taiwan geographically. More importantly, this research would reveal there was an inconstant industrialization process in capitalist development, and regions served as the fix for the over-accumulation crisis. In the sense, geographical configurations of capitalist development were key to decoding the post-war economic miracle in Taiwan.

The Footwear Industry in Central Taiwan (1960s~)

Taiwan was the world's largest footwear exporter between 1972 and 1988. The industry, especially its export sector, has been concentrated in central Taiwan. The Taichung area, with over 80 percent of footwear firms, was the ultimate powerhouse of the footwear industry, the "Shoe Nest," as people in the industry called it. The centre that enjoyed the commanding height in the area was unarguably Taichung City, where most of the buyers are located.

The spatial distribution of footwear firms reveals the historical origin of the industry. In the delta area of the Dachia River, located about sixteen miles north of Taichung City, rushes flourished along the riverbank. Straw-hat production, which was based on women's household labour developed in the adjacent villages as a by-product of agriculture early in the 18th century. During Japanese colonialism, straw-hat production reached its historic high in 1934, mainly through exporting to Japan (Hsieh 1964:335-6). After the devastation of World War II, the straw hat weaving industry emerged again, relying on the same female household labour. In the early 1960s, some businessmen started to experiment by exporting slippers made with straw-weave uppers and plastic soles. This marked the beginning of the footwear export industry in Taiwan.

In 1967, there were about thirty footwear companies registered in Taiwan. They were concentrated in the area between Dachia and Chingshui, two towns located on either side of the Dachia River. Profound production and marketing networks developed among

the early entrepreneurs, who shared market opportunities and technological know-how through informal networks (TFMA 1989). The president of a footwear factory reflects upon what was happening during the early days of his business.

At that time, Taiwan had just begun to push exports. People were amazed by how making shoes could earn them a little fortune. They were groping for manufacturing exports in a learning-by-doing fashion (*Bien-Juo-Bien-Shieh*). Market Information was passed around friends and relatives. For example, a glue maker would tell his relatives about opportunities for shoe-making which he got from his customers. A shoe maker would tell his best friend to set up a carton factory, you know, making money together (*You-Chien-Da-Chia-Chuan*). Things like that were very normal at the time and people were extremely hard-working then. (Informant MFC).

Another one described the scene from a different perspective:

I was then working for the CITC (i.e., the footwear section of Mitsubishi) as an inspector. It was really interesting to see how people made shoes at that time. They made shoes inside the duck huts along a stream, beside a hog house, or in the backyard of a farmhouse. One time, the high-frequency moulding of plastic shoes shut down the electric supply of entire village for a while, and some even interfered the operation of Taichung military airport where US air forces were stationed. Military officers were surprised that the source of interruption came from the hog houses. As an inspector, I had seen all these. We, the inspectors of trading companies, were the unsung heroes of Taiwanese footwear industry. We moved around like bees spreading pollens among separated manufacturers so that innovations in manufacturing spread quickly.” (Informant MCA).

The industry grew rapidly in the late 1960s and then expanded into the hinterland of the Changhua plains in the 1970s. In the very beginning, the majority of footwear exports were sold through the Japanese trading companies. However, the intermediate role of the Japanese trading companies diminished quickly. Documents show that Taiwanese footwear producers had developed direct connections with American buyers by the mid-1960s. The footwear industry in Taiwan was developed in the hands of the local capital and out of indigenous networks of peasant economy.

The footwear industry in Taiwan was mainly composed of numerous medium-to-small-sized firms each specializing in a certain range of tasks and together constituting a highly responsive and competitive system. This was due to the fact that

almost all the steps in footwear production except final assembly can be subcontracted. Firms working as subcontractors for the principal factories can be roughly classified into two broad categories: part and processing firms. The former provided components or tools for footwear assembly, like outsoles, moulds, embroidery, pattern making, and cutting dies. The production of those components frequently requires investment in sophisticated machines or higher technical expertise, what Holmes calls “specialized subcontracting” (Holmes 1986). The other group comprised processing firms that often did simple labour processing with less skill and machinery involved. Two major contracted steps were upper stitching and lining cementing. In the 1970s, the contractors often passed additional work down to smaller workshops or households in the next tier. It was close to what Holmes calls “capacity subcontracting” in the sense that it provided extra production capacity that principal firms mobilized when market demand surged. The vertically and horizontally disintegrated production network lies at the core of the industry’s flexible expansion.

The industry’s first association, the Taiwanese Plastic Shoes Exporter’s Association (TPSEA), was not established until 1968. Built upon its networks with the weaving and plastic industries,⁷ the TPSEA proposed a “minimum price agreement” in a national industrial conference with the Ministry of Economic Affairs (MOEA). The government responded to the proposal cautiously. It agreed to link export licensing with private pricing only if written agreements were reached among all association members. In addition, it agreed to block export permits only in a passive fashion by routinely following the approval stamps that exporters must first get from the association. It was the industry association that intentionally made use of the governmental authority for a project that was initiated, coordinated, and actually enforced by itself. The aggressive image of developmental state was never existent in the footwear industry. It was a passive institutional supporter, not a far-sighted active participant. Both export volume and value doubled in the following year 1970. From 1969 to 1976, up until the eve of the Orderly Marketing Agreement (OMA), the average annual volume increase rate was 64 percent, despite the oil crises in the early 1970s.

Under mounting pressure from domestic footwear producers, the U.S. government imposed quota restrictions on Taiwanese and Korean footwear exports between 1977 and

⁷ The executive director of the association held the same position at the Taiwanese Hat Exporter’s Association (THEA). The counselling committee of TPSEA was composed of the chairman of THEA and owners of the five major plastic companies (TFMA 1989). They showed the networking efforts of the industry in its infancy to assure the stability of the resource environment.

1980. Shocked by the quota, Taiwanese footwear producers still managed to upgrade and build even stronger ties with major footwear buyers.⁸ The number of registered footwear factories increased from just 75 firms in 1969 to 708 firms in 1981. As the industry grew over the years, a well-integrated local industrial base, composed of supporting industries like machinery, synthetic leather, components, printing, and mould making, was gradually formed, mainly around Taichung City. In the marketing side, following the steps of the early footwear importers, brand-name athletic shoe marketers came to Taiwan mostly in the late 1970s and early 1980s. By 1986, all the major athletic shoe brand names had well-established original-equipment manufacturing (OEM) supply lines in Taiwan.⁹ Central Taiwan had become an indispensable hub for the densely connected networks of the world footwear industry.

The abrupt appreciation of the Taiwanese currency against the US dollar hit directly the engine of footwear exports in 1986. The success story seemed to be drawing to an end. The number of registered firms reached its peak about 1245 in 1988 and then fell to 627 firms in 1994 hardly. In just a few years, Taiwanese footwear producers led the first wave of offshore investment in post-war Taiwan, a challenge that both the Taiwanese firms and the state had never before experienced. Years after being a backbone of Taiwan's post-war economic growth, the footwear industry became the forerunner of Taiwan's international investment in the 1990s.

After the panic and frustration that once plagued Taiwanese footwear producers dissipated, a pattern of international operation began to emerge. The new structure is evidenced by several features: 1) About 85 to 90 percent of footwear exports from China are now controlled by the Taiwanese. 2) Chinese state enterprises were actually discouraged from footwear exporting by Taiwanese producers. 3) Major footwear buyers, surprisingly even those volume retailers who are very sensitive to cost margin, remained in Taiwan. 4) Taiwan has become the world centre of footwear material and machinery supply. And 5) Footwear sourcing transactions now operate in a triangle system where orders are received, materials are procured, and models are developed in Taiwan, while production is carried out in the coastal towns (e.g., new shoe nests, like Dongguang of Guandong Province) of southern China, and finished goods are shipped from Hong Kong.

⁸ To save space, the role of the Taiwanese Footwear Manufacturer's Association (TFMA), a more integrative association which replaced TPSEA, in quota management and upgrading promotion is skipped. Please refer to Cheng (1996) for detail.

⁹ The first brand buyer to place orders in Taiwan was Adidas early in 1971, bringing in the most advanced production technology at the time.

A new spatial strategy that globally connects sub-national regions into transnationally defined regional networks is in sight (Cheng 1998).

The Petrochemical Industry in Southern Taiwan (mid-1970s~)

The petrochemical industry has two major sources of material- crude oil and natural gas. Crude oil can be cracked into naphtha, refinery gas and reformat. Naphtha is the primary material that can be turned into many secondary materials (for example, DMT and DTA) after the required steps of processing. In Taiwan, this first-processing stage has been conducted exclusively by the state-owned China Petrochemical Company. The second-processing of polymerisation turns those to products like PVC, PE, or Nylon, which are then sold to the downstream textile or plastic factories in the third-processing sector. It is estimated that the petrochemical industry, including the downstream third-processing, occupies over one third of the total manufacturing output of Taiwan. The following discussion will focus only on the first and second-processing, a narrower but commonly accepted definition of the petrochemical industry

The American Standard Oil Company first developed the cracking technology of the petrochemical industry in the 1920s. The industry was globally expanding during WWII, when countries facing a scarcity of resources struggled to develop their own petrochemical refineries. Japan strove successfully to become the world's largest producer by the early 1960s. It started to invest offshore after that to control material supply and reduce the domestic problems of environmental pollution and land shortage. In the 1970s, especially after the oil crises, a window was opened for Taiwan and other developing countries to develop their own petrochemical industries. At the time, the area around Kaohsiung port in southern Taiwan was, without doubt, the first priority. Kaohsiung was already turned into a manufacturing base for heavy industries by the Japanese colonial government after the military invasion of Southeast Asia was aggressively pursued. The Japanese colonial government historically paved a path for the post-war development of the Taiwanese petrochemical industry as it expanded around the Kaohsiung seashore.

The nationalist government confiscated the Japanese petrochemical plants after the war. It was estimated at the time that only one fortieth of the imported crude oil was cracked for additional usage, a serious waste in the restoration period when resources were precious. The fact that most countries adopted protectionism measures to block foreign imports of petrochemical materials encouraged Taiwan to adopt the strategy of reversed vertical integration in developing the industry. However, investing a large

amount of capital in new refinery plants was a great risk because of insufficient or unstable domestic demand. In 1968, a small-scale project of the so-called “first naphtha refinery” was nevertheless conducted. The government urged private capital to simultaneously invest in the second-processing plants so that the state-owned refinery could be assured of a domestic outlet for its products. Facing great uncertainty, no private capital dared to invest in the risky business. The KMT government ended up building two downstream second-processing plants by the financial arms of its party machine. Studies do not generally regard the early small-scaled plan as the point of take-off for Taiwan’s petrochemical industry. The genuine growth of the industry in Taiwan waited until that a large downstream export sector (including the footwear industry) was created by the successful export-oriented industrialization.

However, the influence of the first-naphtha plan should not be dismissed. With aggressive state intervention on both sides of the market, the plan helped to reduce the tremendous uncertainty of “mutual externality” between supply and demand by offering a model of success (Chu 1997:116). The sheer reality of creating an industry through cross-sector coordination of investments had triggered an imitation effect on the industry’s later development. The private capital became less hesitant in joining projects with much larger scale. The direct costs in constructing large networks of pipelines and the indirect costs of the potential hazard in transporting petrochemical materials over long distances were factors crucial to the geographical agglomeration of factories in adjacent sectors of the petrochemical processing chain. The petrochemical industry, after its initial landing in Kaohsiung during the colonial period, was further “caged” to the area after the first-naphtha plan.

The two raiding oil crises in the early 1970s shocked Taiwan into suddenly realizing that its economic growth was based on a fragile dependence on oil imports. The rising costs of oil worsened the problem of its under-utilization. In 1976, the Ten Great Constructions, which were generally regarded as the beginning of import-substitution industrialization, were launched to strengthen the infrastructure of Taiwan and to promote the country’s upstream supply of basic materials. The plan for constructing the third naphtha refinery and its downstream industrial complex for the first time marked the petrochemical industry as a target for industrial policy. Its scale was massive, with estimated capital investment at close to NT\$ 4 billion (Tsai, 1996:65,90). The state capital was still the major investor and the private and semi-private (i.e., KMT party) capital, which was encouraged by both the success of the first refinery and the expansion of the downstream export sector, stood at the tier of second-processing.

An institutional framework for governing the development of the industry was

constructed under the auspice of the KMT government. First, the estimated outputs of the third naphtha cracker were pre-allocated to the prospectus second-processing firms through extensive coordination to ensure sufficient demand and supply. Second, foreign competitors were discouraged from entering the domestic market by high tariffs. Third, the international sourcing of petrochemical materials on the firm level was subject to regulation that ordained domestic supply if its prices were similar. Fourth, price fixings were conducted through long-term supply contracts between sectors of the petrochemical chain in the name of cushioning international market fluctuation.

The uncertainty that these institutional arrangements were to cope with was specific to the industry's techno-production basis. The automated process of continuous production on a massive scale has a fundamental influence on the petrochemical industry. The demand must be assured and stabilized for the industry's continuous expansion. The above-mentioned institutional features were in functional equivalence to the labour-capital compromise, mass consumption, and welfare expenditure in a Fordist regime of developed societies. The petrochemical industry in Taiwan can be seen as a nationalistic Fordist regime under the developing context of late industrialization. As the export-oriented economy recovered from the oil crises slower than expected, the consequential scale of the third-naphtha cracker was shrunk by nearly half. The original plan was eventually divided into two stages with the fourth naphtha cracker in the planning stages to make up the difference. The fourth naphtha cracker was not finished until 1983 (Hsu 1990).

After the mid-1980s, the development of the petrochemical industry in Taiwan was facing a new structural conflict between a freer market with unleashed private capital and an awakened society fuelled by political democratisation. Under authoritarianism, the high pollution petrochemical industry had been developing in Southern Taiwan without social resistance, which was geographically distant from the political centre of Taipei. Years of air and water pollution had caused serious human suffering to the people living in Kaohsiung City, not to mention those residents who lived close to the petrochemical industrial zones. Facing waves of labour and environmental protests in the 1980s, the plan for the fifth naphtha refinery was originally passed in 1986, but was finished late in 1994 (Wang 1995:28-9; Chu 1995:46). Unlike the decentralized production networks in central Taiwan, which absorbed social conflicts by household self-exploitation, labour in the formal sector of the petrochemical industry was highly unionised and had greater labour consciousness and higher leverage to bargain with capital. The labour movements and environmental movements in the southern region of the petrochemical economy were destined to play the spearheads of social protection struggling against the social costs of

the miracle economy in Taiwan (Hsu 1995, Hsu & Hsia 1997).

Facing the social struggles, the KMT government once announced that they would refrain from further expansion of the petrochemical industry and move towards upgrading the economy toward high-tech industries in the mid-1980s. However, democratisation also unleashed the power of private capital, which was able to turn over the governmental plan. The liberalization and globalisation of the economy, combined with political democratisation, have weakened the power of the developmental state, which is now often under the threat of capital sabotage or in flight from big capitals, led by the largest private capital group, Formosa Plastics. Formosa Plastics' plan for the sixth naphtha cracker became a highly politicised stake. Kaohsiung was no longer a suitable place for the plan not because of economic reasons, but because of the strong local resistance. The private petrochemical capital adopted a new spatial strategy, skilfully manoeuvring its advantageous bargaining position between two under-industrialized counties-Ilan and Yunlin. Ilan, a county controlled by the political opposition (now the ruling party-Democratic Progress Party) for decades and with a strong local commitment toward sustainable development, was Formosa Plastics' first choice. The prime minister, who was a military strong man before taking the civic position, supported the company and threatened to withdraw a highway construction plan connecting Ilan with Taipei, which local people had long been waiting for, if the naphtha plant continued to be resisted. The opposition party won the election under the difficult situation, and disappointed Formosa Plastics turned to Yunlin.

The Semiconductor Industry in Northern Taiwan (1980s~)

The aggregate value produced by the semiconductor industry in Taiwan was NT\$2.1 billion in 1993. It is a representative case of a developing country closing its gap with developed countries in a high-tech industry. The foundry strategy of Taiwanese semiconductor plants was an innovation that helped to shape the competition in the global information industry. The most important strategic site of Taiwan's semiconductor industry is without a doubt the Science-based Industrial Park in Hsinchu City. The Hsinchu Science-based Industrial Park (HSIP) and the high-tech corridor has become a successful regional model of learning in the developing world. Compared with the two other regional industries, the developments of the information industry in Hsinchu show many interesting similarities and differences. The uniqueness of the regional industry is challenging our existing conceptions that have been deeply rooted in increasingly obsolete industrialism.

Hsinchu County is a small basin located in northern Taiwan, separated from Taipei to the north by Taoyuan terrace and from Taichung to the south by the hilly area of Miauli. It was a secondary administrative unit subordinated to Tainan, the political centre of Taiwan during the Ming and Ching dynasties. It was later turned into a satellite of Taipei after the political centre of Taiwan moved north during the Japanese colonialism.

Economically, Hsinchu has been a secondary agricultural site lagging behind the “Rice Barns” of the Chianan and Changhua plains. Light industrialization, basically food processing and its related machinery, began in the area during WWII. After the war, natural gas, the other resource of the petrochemical industry besides crude oil, were found in Hsinchu. The by-products of natural gas were much more limited than crude oil (basically ethanol and chemical fertilizer) and only found on a small scale in Hsinchu. It was only a secondary site for the petrochemical industry in Taiwan, lagging far behind Kaohsiung.

The rudimentary basis of light industry, together with the petrochemical supply of natural gas, created the light bulb industry a major export industry in Hsinchu before the birth of the information industry. The cheap power supply of natural gas gave rise to the glass industry which then evolved into the light bulb industry, with Christmas string lights as the major product. The amount of light bulb factories in Hsinchu grew from only 3 in 1964 to over 500 in 1980. A large number of household labour was utilized through subcontracting networks that reached deep into the peasant-economy-based countryside. The Hsinchu area manufactured over 80% of the total light bulb exports from Taiwan and helped the country reach the top in world light bulb output in 1980. Before the manufacture of light bulbs started to decline due to an exhausted supply of cheap labour and natural gas, Hsinchu was an interesting mixture of the two regional economies that we discussed earlier- a secondary region with a vague character. In the same year (1980), the Hsinchu Science-based Industrial Park, the first of its kind in Taiwan, was opened on the edge of Hsinchu City. A brand-new chapter of local industrial history unfolded.

Retrospectively, the Hsinchu Science-based Industrial Park was without the slightest doubt a success. However, could it have happened in other places as well? To put it differently, how “local” was the industry? Answer one: the park and its subsequent development could not have been conceived without the top-down state-intervention in strategic promotion. Therefore it represented an abrupt transformation of Hsinchu into a new industrial space by design. In fact, even when considering the demand side of the equation, the personal computer industry, which is the major downstream domestic demand of semiconductors, has been concentrated (estimated at about 90%) in the

suburbs of Taipei City, not in Hsinchu.¹⁰ Answer two: the industry's development was based on a local "tradition" rediscovered and strengthened by a government-initiated spatial realignment. The first answer is obvious following our previous discussion, but the second may have more truth to it. It all depends on how we define the words "tradition," "local," "production," and "factor."

Three institutes prepared Hsinchu as an ideal site for the scientific park. Tsinghua University, famous in the area of natural science and engineering, was founded in 1911 in Beijing, China. The expelled nationalist government re-established the university in Hsinchu in 1956. Chiaotung University, a pioneer institute of professional education specializing in applied science, was originally founded in Shanghai in 1896. It was reestablished close to Tsinghua University in Hsinchu only two years later in 1958. In 1968, Chiaotung University gave out the first Ph.D. degree in Taiwan. In the same year, the minister of MOEA mentioned for the first time the idea of building a scientific park in Hsinchu during a speech in the States. It took a middle-stop of another institutional innovation to realize the Science-based Industrial Park. In 1973, to overcome the limited capability of Taiwan's small to medium-sized enterprises in research and design, the Taiwanese government established the Industrial Technology Research Institute (ITRI) in Hsinchu. The Electronics Research and Service Organization (ERSO), one of its subunits, proved to be an important greenhouse, breeding the seeds for the information industry in Taiwan.

In 1976, ERSO signed a five-year technology transfer agreement with RCA on IC design and manufacturing. A group of 37 top Taiwanese electronic engineers, including local graduates and overseas returnees, was formed to execute the project. In 1980, United Microelectronics Corp. (UMC), the first wafer fabrication factory in Taiwan, was established at the Hsinchu Science-based Industrial Park, with wholesale assistance in technology, personnel, and equipment transference from the ERSO team. Under pressure from the government, the private capital reluctantly agreed to invest under the condition that ERSO controlled 55% of equity share (Hsu 1997). Similar to the petrochemical industry, the government was leading the market (Wade 1990). The strategy of UMC was

¹⁰ The electronics industry, which paved the early ground for the PC industry in Taiwan and was the other major source of demand for semiconductors, has a wider geographical dispersion, including Taoyuan. It can be traced back to the investment of General Instruments at Shindien of Taipei County and RCA in Taoyuan. The former started its local centre-satellite system in 1975. In 1991, it was estimated that about two thirds of its 120 close satellites were in Taiwan. After 1980, many former employees of the electronic factories set up their own business in the personal computer industry around. (Wang 1996)

to specialize in the fabrication and testing stages, cooperate with other firms in the other steps (for example, packaging), and focus on the niche market of ASIC (application specific integrated circuit), which allowed it great flexibility.¹¹ The company was an instant success, reaching the break-even point only in two years.

Table 2 A Wave of Wafer Plants in the HSIP

Company	Plant	Investment (billion NT\$)	Date of construction	Date of operation	Capacity (thousand)	Types of products
VISC	1 st Plant A	18	-	Dec., 1994	45	DRAM, SRAM
	1 st Plant B	20	Jul., 1995	Dec., 1996	15	DRAM, SRAM
TSMC	3 rd Plant	25	Dec., 1993	Aug., 1995	35	Foundry
	4 th Plant	30	Apr., 1995	Oct., 1996	30	Foundry
	5 th Plant	25	Nov., 1995	1997	25	Foundry
TI-Acer	1 st Plant B	13	Aug., 1994	Jun., 1995	20	DRAM
	2 nd Plant	35	Oct., 1995	1997	25	DRAM
UMC	3 rd Plant	25	Dec., 1994	Sep., 1995	25	DRAM, Foundry
Lein-Chen	1 st Plant	27	Jun., 1995	Jun., 1996	25	Foundry
Lein-Jia	1 st Plant	27	Dec., 1995	1998	25	Foundry
Lein-Rui	1 st Plant	30	Dec., 1995	1997	25	Foundry
Nan-Ya	1 st Plant	20	Jan., 1995	Sep., 1996	24	DRAM
Powerchip	1 st Plant	20	Mar., 1995	Sep., 1996	25	DRAM
Chia-Chu	1 st Plant	11	Jun., 1994	1997	15	Memory, ASIC
MXIC	2 nd Plant	30	Jun., 1995	1997	30	NV Memory, Logic
Winbond	3 rd Plant	35	Jun., 1995	1997	40	DRAM, SRAM
Mosel	2 nd Plant	40	Oct., 1995	1997	25	DRAM
ASIAN	1 st Plant	20	Jun., 1996	1998	30	Foundry

¹¹ In a sense, it is quite similar to the strategy that the firms of more traditional industries in Taiwan have been following.

Holtek	2 nd Plant	20	Jan., 1996	1997	25	MCU, ASIC
Total	19	471			494	

Source: Hsu (1997): 83.

In 1983, climbing a steeper learning curve, ERSO forged a joint research agreement with Vitelic, a VLSI design house in Silicon Valley founded by an overseas Chinese, to develop advanced CMOS DRAM technology. The project was initially successful with the 256K DRAM. However, limited by Taiwan's capability to mass produce VLSI, its designs and those of smaller design houses in Taiwan were taken to Japanese or Korean IC factories for fabrication work or sold to them. In 1986, TSMC (Taiwan Semiconductor Manufacturing Corporation), another spin-off of ERSO, began to produce VLSI on a commercial scale. Morris Chang, the former head of ITRI and now president of TSMC, designed a unique strategy for making TSMC the world's first pure fabrication factory with a high yield rate, good defect control, and responsiveness to customer demand.¹² The local design houses, no longer worrying about fab capability, consequently flourished and their sales revenue increased from NT\$32 million in 1987 to NT\$236 million in 1990.¹³

The semiconductor industry in Taiwan entered a new "phase of returnee establishments" (Hsu 1997) in the 1990s. Taiwan's PC industry reached a top position in the early 1990s, clearly surpassing Korea and Japan. The time lag between the introduction of new CPU by Intel and the commercialisation of the PC in Taiwan has been shortened from three years in 1982 (80286DX), six months in 1989 (80486), to under one month (Pentium II). The vertically disintegrated networks, composed of specialized firms manufacturing various peripherals and add-on cards, created a potential market for the semiconductor industry. Many wafer plants were established in the HSIP in the 1990s, as shown in Table 2. Some of them were new investments undertaken by capital of other industries, who missed out on earlier opportunities (e.g., Formosa Plastics), some were an expansion of UMC and TSMC, and others represented backward

¹² The similarity of the so-called "specialized subcontracting" to OEM, which has been the model of manufacturing exports in Taiwan, hints of a profound industrial convention in Taiwan.

¹³ Following the greenhouse strategy, a spin-off of a new mask production company based on advanced technology was built in 1988. Over 100 engineers and staff from the mask division at ERSO were transferred to the new company, Taiwan Mask Corporation (TMC). The company has enjoyed revenue growth of 15-20%, from around NT\$ 300 million in 1989 to around NT\$ 500 million in 1994.

integration of PC makers (e.g., Acer). The spin-offs of ERSO were no longer the only source of technological transference and knowledge commercialisation. Returnee start-ups, relied on the embodied knowledge of the founding teams, and joint ventures with foreign high-tech companies became increasingly important.

Although governmental intervention was the single most important factor in the early phase, the regional agglomeration of firms in the Hsinchu-Taipei corridor and the social networking that facilitates learning and innovation are gaining autonomous influence.¹⁴ Recently, a Software Industrial Park (SIP) has been under construction on the outskirts of Taipei City and is scheduled to open in 1998. The Second Northern Highway, which connected the SIP with HSIP at the two ends and the military research base of Chung Shan Institute of Science and Technology (CSIST) Institute in the middle, was opened in 1997 and would certainly provide an infrastructure to strengthen the learning networks in the Hsinchu-Taipei corridor.¹⁵

Tsinghua University, Chiaotung Universities, and ERSO were the institutions that provided not only high-quality human resources but, more importantly, the information and learning networks of friends and colleagues. These networks, added with the frequent turnovers of personnel and returnee connections, became far more dynamic and complex in the industrial world of HPIS. The semiconductor industry in Hsinchu was both locally chained (the Hsinchu-Taipei corridor) and globally connected (Hsinchu-Silicon Valley, see Saxenian & Hsu 1999). Compared with the traditional networks of friends and relatives in the footwear industry, the social networks in the information industry are based more on the achieved networks that originate from the formal institutions of college education, workplace experience, business dealings, and industrial associations. The networks are so dynamic and far reaching that they are able to create a local advantage while preventing the rigidity and inertia that tend to associate with local cohesion but are detrimental to a knowledge-intensive industry.

¹⁴ A comparative study on the high-tech industries in Taiwan shows that information industry was the only one that had significant evidence of regional agglomeration (and was also the one that performed best). The study also finds that the capability in product innovation and learning, instead of the traditional static factors like material or market factors, is explanatory (Shi 1993).

¹⁵ Acer, for example, had already moved its headquarters to the Taipei end of the new highway, built an Acer Aspiration Park for the education, recreation, and residence of its employee middle in Taoyuan County, and consolidated its manufacturing basis at the HSIP.

Conclusion

Although Taiwan is a country with relatively little land area, there are at least three distinctive regional economies with their own unique trajectories and crucial conjunctures of industrial development. This research argues that industries, regions, and institutions are the three forces that together shape the economic development in a path-dependent fashion. Industries refer to each specific world of products with its unique market and technological sources of uncertainty. Regions refer to the social mechanisms underlying the spatial concentration of industrial networks. They provide tempo-spatial context for social embeddedness and the locale for economic contests. Finally, institution refers to the various social forces that provide the means for economic coordination and governance. As illustrated above, Table 3 summarizes the content in a concise format.

The existing explanations on the economic development of Taiwan, as well as other East Asian miracles, which often ignore the regional and industrial differences, have their own preferred industries and explanatory variables. Theories are more valid when they deal with the industry and the stage of development that have the strongest affinity with their core variables. They fall short when stepping out of their territory, and lead to convince their own true believers only. While statisticians base their arguments about the aggressive roles played by the late-industrializing states on the case studies of petrochemical (Amsden 1985) and semiconductor (Wade 1990, Mathews 1997), Neoliberalists refute them by using data about small-medium sized enterprises in labour-intensive sectors to illustrate the flexibility advantage, which is equivalent as void of government spoiling subsidies and disturbing regulation. Given the complexity of regional economies, as shown above, we need a set of concepts to picture the overall structures of regional industries. Only in a highly heuristic way, that the ideal types of genuine Fordism, late Fordism, and post Fordism, each with their distinctive source of uncertainty and technological imperative, may provide some useful hints to help us place the governance of the three regional industries under sharper focus.

Besides academic advancement, there is another cause for studying economy locally. Nowadays, people have increasingly realized that “development” can no longer be measured quantitatively by a monetary scale like GNP per capita (Block 1990; Cobb et al. 1995; Sen 1987). The joy and pain of economic development can only be truly evaluated by closely examining the locales where people struggle to make a decent and sustainable living. The economic development of Taiwan is not a single story. The footwear industry of central Taiwan, the petrochemical industry of southern Taiwan, and the semiconductor industry of northern Taiwan represent three possibilities for economic development and three social landscapes of human consequences. The regional economies are where the

stories of development begin, turn, and twist. The endings, whether happy or sad, are ultimately in the hands of the people who write their own history.

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Table 3: The Formation of the Three Regional Industries in Taiwan

	Footwear Industry	Petrochemical Industry	Semiconductor Industry
Technological Characteristics	Labour Intensive	Capital (/Tech) Intensive	Knowledge (/Capital) Intensive
Labour Process	Variable batch, fragmented process	Large batch, continuous process	Sophisticated but dividable automation
Market Characteristics	Price-sensitive but seasonal and fashion fluctuation with increasing value-added	Standardized materials, long product cycle, stable market demand crucial	Big waves between DRAM transition; investment timing crucial; ASIC chip emphasizing design capability
Marketing Positioning	OEM based manufacturing exports	Supplying downstream domestic processors	Contract manufacturing to specialized foreign and domestic buyers
Bottleneck for Early Entry	Foreign orders and international trade practice	Large scale of both stable demand and capital inputs	Technological and capital barrier
Major Competitor	S. Korea	S. Korea	S. Korea, Japan
Growth Period	1960s-1980s	1970s-1990s	1980s-1990s
National Development Strategy in Background	Export-oriented industrialization	Import-substituted industrialization	Industrial upgrading toward high-tech industries
Space of Industrial Development	Chanhua plain of central Taiwan	Industrial zones in Kaohsiung County of southern Taiwan	Information corridor between Shindien and Hsinchu in northern Taiwan
Regional Centre	Taichung City	Kaohsiung City	Taipei City
Dynamism of Geographical Concentration	Transaction costs mainly (Intensive coordination under vertical and horizontal disintegration)	Transportation costs mainly (close to the port for crude oil import and the safety transportation of processed oil)	Learning costs mainly (knowledge and information diffusion and acquisition)
Historical Legacy	Peasant economy gradually consolidated from Ming and Ching dynasties to Japanese colonialism, post-war political squeeze of resource from agricultural to	Japanese colonialism turned the Kaohsiung port into a heavy industry centre for supporting southward expansion into the southeast Asia, early petrochemical	Political centre since Japanese colonialism, post-war strengthening of the cultural-political centre, major universities and research centres, global linkages through

Embeddedness in the Local Society	industrial sector High	plants were constructed Low	metropolitan Taipei Medium
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Table 3: The Formation of the Three Regional Industries in Taiwan
(Continued from the previous page)

	Footwear Industry	Petrochemical Industry	Semiconductor Industry
The Role of the State	Passive supporter	Aggressive player	Ardent gardener
Policy Tools	Export licensing and tariff deduction	Market protection and direct investments	Establish research institutes and scientific park (speeding entrepreneurial spin-off, innovation diffusion, and commercialisation)
The Role of Industrial Association	Quota management and trade negotiation	Coordinating market order and stabilizing prices	Promoting strategic cooperation and participating in international standard setting
The Trade Union	Underdeveloped	Highly developed	Professional individualism
Industrial Crisis	Rising labour costs, new competitors, protectionism since the 1980s	Environmental protest, Offshore investment of downstream industries since 1980s	Sudden global stagnation in the late 1990s; economic recovery deterred; design capability still to be improved
Destinations for Internationalisation	Southern China, Vietnam, and Indonesia (for cheap labour)	Fu-Jen (China), Thailand, Malaysia (close to market or materials)	China, Western Europe, and US (human resource, knowledge and market access)
Explanatory Variables	Managing logic of peasant economy, networked form of labour control	Industrial policy, market intervention, development alliance	Organizational alliance, technological diffusion, professionalism
Taiwanese Researchers	Ka (1993) and Shieh (1992)	Chu (1995) and Chu (1995)	Chen (1997) and Hsu (1997)
Ideal-typical Governance	Late Fordism (vertically disintegrated flexible mass production)	Genuine Fordism (continuous production and the governing on mass consumption)	Post-Fordism (local learning district and global cooperative networks)

Map 1: Taiwan and the Three Regional Industries

