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# TECHNICAL REPORT

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## Shanghaied?

### The Economic and Political Implications of the Flow of Information Technology and Investment Across the Taiwan Strait

MICHAEL S. CHASE, KEVIN L. POLLPETER,  
JAMES C. MULVENON

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## **SUMMARY**

This report examines the controversial issue of flows of information technology and investment between Taiwan and China, with a particular focus on the semiconductor industry. The goals of this report are threefold: (1) to comprehensively analyze the investment and IT transfer dynamic between Taiwan and China; (2) to assess the impact of these developments for cross-Strait relations, the global semiconductor industry, and the advancement of science and technology development in China; and (3) to evaluate the implications of the findings for U.S. government analysis and policymaking, particularly in the area of high-technology export controls.

### **OVERALL TRENDS IN CROSS-STRAIT FLOWS OF CAPITAL AND TECHNOLOGY**

#### **IT Production and Trade**

The scope and scale of trade and investment flows across the Taiwan Strait has increased dramatically in recent years, driven in large part by the increasing integration of the information technology sectors of Taiwan and the People's Republic of China (PRC). Taiwanese IT companies began to shift production of labor-intensive products--including keyboards, mice, monitors, motherboards, and power-supply units--to offshore locations in the late 1980s and early 1990s to take advantage of lower labor costs in China and Southeast Asia.

- In 2002, more than 49 percent of Taiwan's IT hardware was made in China, and Taiwanese-invested companies produced more than 70 percent of the electronics made in China.
- The share of Taiwan's IT hardware production in mainland China reached 60 percent in 2003, while the share of Taiwan's IT hardware production remaining in Taiwan declined further, to about 26 percent, according to industry analysts.
- China's displacement of Taiwan as the world's third-largest producer of IT hardware items has touched off a debate in

Taiwan about the supposed "hollowing out" of the island's economy.

On the demand side, China now accounts for 13 percent of the world's demand for semiconductors, up from 7 percent in 2000. In addition, in the first quarter of 2003, China accounted for 11 percent of worldwide purchases of semiconductor manufacturing equipment.

- Manufacturers in China purchase \$12 billion worth of semiconductors annually, of which approximately two-thirds are used in exports and one-third is used for goods sold domestically.
- Current domestic Chinese production is estimated to be able to supply a mere 10-20 percent of domestic demand.
- By 2010, China will become the world's second-largest semiconductor market, and by the end of 2003 it will have 12 percent of the production capacity of all semiconductor foundries worldwide, making it an increasingly important player in the global market for made-to-order chips.<sup>1</sup>
- It has been estimated that as of 2004 China will require \$24 billion worth of semiconductors. China's semiconductor market is estimated to increase at an annual rate of 25 percent.

### **Investment**

Taiwanese investment on the mainland has been growing rapidly in recent years, although widespread circumvention of Taipei's restrictions on money flows makes the actual level of investments difficult to estimate.

- In early 2003, the Taiwanese government estimated that total approved investment in China by Taiwanese firms had reached about \$30 billion.

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<sup>1</sup> Foundries are companies that produce semiconductors on order for chip designers.

- The most recent Chinese government estimate of total Taiwanese investment in the mainland is about \$61.5 billion, ranking Taiwan as China's third largest source of foreign direct investment.<sup>2</sup>
- Some economists and Western banking analysts estimate the total Taiwanese investment in the mainland may be as high as \$70-100 billion.
- Most observers expect Taiwanese businesses--especially companies in the island's IT sector--to continue to skirt regulations while at the same time pressing Taipei for further concessions.

Taiwanese companies are investing in China for several reasons: to take advantage of lower production costs, especially land, labor, and construction costs; to take advantage of the increasingly large pool of skilled Chinese engineers and technicians; to gain access to the Chinese domestic market; as part of an "investment cluster effect;"<sup>3</sup> and because of preferential tax policies and other incentives offered by the Chinese central government and local governments.

The most prominent change in regional investment patterns is a shift in the concentration of Taiwanese investment from the Pearl River Delta to the greater Shanghai region.

- As a result of this growing influx of investment, Jiangsu by the end of 2002 had surpassed Guangdong in terms of total approved investment from Taiwan.
- As for the impact of severe acute respiratory syndrome (SARS) on cross-Strait ties, some analysts predicted that the crisis would slow economic integration between China and Taiwan.

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<sup>2</sup> *Foreign direct investment* refers to investment by foreign companies in companies, facilities, and equipment. It does not include investments made in stocks or equities.

<sup>3</sup> *Investment clustering* refers to the concentration in some geographic area of firms that are engaged in various aspects of a given business. Investment clusters form because the concentration of firms in a given location supports the development of specialized suppliers, allows labor market pooling, cuts down on transportation, and facilitates knowledge spillovers, all of which help to reduce costs.

Rather than causing cross-Strait economic ties to unravel, however, the SARS crisis ultimately underscored their durability and resilience.

## **POLICY RESPONSES IN TAIPEI AND BEIJING**

### **Taipei**

For the Taiwanese government, growing trade with China raises concerns that the island's economy is becoming too dependent on the mainland. The economic relationship between China and Taiwan has thus become a sensitive issue in Taiwanese politics. Domestically, President Chen Shui-bian faces a difficult political balancing act. He faces pressure from the business community and from the opposition parties--the Kuomintang and People's First Party--to further ease restrictions on investment and to pursue the establishment of direct cross-Strait links. He also faces countervailing pressure from some of his own Democratic Progressive Party (DPP) constituents and allies in the pro-independence Taiwan Solidarity Union who fear that increasing economic integration with the mainland will increase unemployment among grassroots DPP supporters and diminish Taiwan's prospects for political independence.

- Taipei has agreed to the "mini-three links," which permit direct shipping and passenger travel between the Taiwanese-held offshore islands of Kinmen and Matsu and the mainland cities of Xiamen and Fuzhou, and some Taiwanese analysts expect Chen to cave in to pressure to establish the full "three links,"<sup>4</sup> which would allow direct shipping and air travel between the island and the mainland.
- In the months before Taiwan's March 2004 presidential election, however, President Chen resisted demands to permit direct cross-Strait shipping and air travel as part of an election

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<sup>4</sup> The term "three links" (*santong*) refers to the direct transportation, trade, and postal links between Taiwan and China. These links were severed in 1949, when the Nationalist government retreated to Taiwan after losing control of the mainland to the Communists, and have not yet been reestablished.

strategy designed to solidify the support of his pro-independence constituents.

However, Taipei has relaxed other longstanding restrictions on cross-Strait economic interaction. After more than a year of acrimonious political debate and extensive lobbying efforts by major Taiwanese semiconductor companies, including industry leaders Taiwan Semiconductor Manufacturing Corporation (TSMC) and United Microelectronics Corporation (UMC), the Taiwanese government early in 2002 relaxed its ban on investment in semiconductor facilities on the mainland.

- In September 2002, TSMC became the first Taiwanese semiconductor company to apply for permission to set up a manufacturing plant in China. TSMC plans to start production at its Shanghai plant in late 2004, but its sense of urgency has diminished given the relatively slow maturation of potential Chinese competitors.

The debate over chip policy brought to the forefront longstanding concerns about loss of technology and skilled personnel to the mainland. In response, the Taiwanese government in April 2002 began drafting a National Technology Protection Law (*guojia keji baohu fa*).

- Taiwanese executives seem resigned to the eventual passage of the law, although many say it is unnecessary.
- Given concerns about the difficulties of protecting intellectual property in China, TSMC and UMC would not build semiconductor fabrication facilities (or "fabs" for short) in China to produce 12-inch semiconductor wafers (the new standard for integrated circuits [ICs]) even if they were allowed to do so, according to industry executives.
- Taipei is also facing pressure from the business community to permit Chinese nationals to work for high-technology companies in Taiwan, which is prohibited by current regulations. Taiwanese executives say that Chinese engineers are needed to

fill jobs left vacant by a shortage of qualified specialists in Taiwan.

### **Beijing**

Chinese leaders have recognized semiconductors as a strategic high-growth industry because of the fundamental role they play in information technology and high-technology weaponry. They view the development of the semiconductor industry as being vital to economic development and national security and are unwilling to cede the growing Chinese chip market to foreign companies or to depend on foreign suppliers for the chips China needs for defense and intelligence applications. Until recently, however, semiconductors had remained the weakest link in the Chinese electronics industry, as measured by the Chinese IT industry's progress toward the global state of the art.

According to the 10th Five Year Plan, the goal for national IC production is to reach 20 billion wafers by 2005, with sales between 60-80 billion Renminbi (RMB), constituting 2-3 percent of worldwide sales of wafers. The plan also calls for meeting 30 percent of domestic demand, with IC production for national defense and national economic security being principally domestic based. The 10th Five Year Plan also calls for the following:

- Eight-inch wafers with 0.25-micron process technology will become the new standard.<sup>5</sup> In pursuit of this goal, China plans to build
  - o Two or three 6-inch wafer fabs
  - o Three to five 8-inch wafer fabs capable of manufacturing 0.18-micron to 0.35-micron process technology
  - o One or two 12-inch wafer fabs capable of manufacturing 0.13-micron to 0.18-micron process technology.
- Companies investing more than 8 billion RMB to build IC fabs capable of manufacturing wafers with better than 0.25-micron process technology are taxed at a lower rate of 15 percent, along

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<sup>5</sup> The worldwide semiconductor manufacturing industry, meanwhile, is moving toward a more advanced standard of 12-inch wafers and 0.13-micron to 0.18-micron and lower process technology, placing China's planned efforts at least one generation behind state-of-the-art levels.

with a partial refund of the 17 percent value-added tax (VAT), resulting in a net rate of 6 percent tax. The United States has charged that the higher VAT on imported semiconductors violates China's World Trade Organization commitments and gives an unfair advantage to companies that locate their manufacturing facilities on the mainland.

Other policies have been developed to promote the Chinese IC industry. For example, IC manufacturers and software enterprises are eligible to receive a two-year corporate tax exemption starting from the first profit-making year, followed by a 50 percent reduction the next three years. This benefit, known as the "2 + 3 plan," will be withdrawn if a company ceases operation within the first ten years.

Intense competition exists among Chinese cities to attract semiconductor industry investment, with the competition mainly between Shanghai and Beijing.

- Shanghai has a "5 + 5" policy of offering wafer manufacturers a five-year tax holiday and an additional five years at half the tax rate, in addition to other incentives.
- Beijing offers a mix of incentives, including a "Shanghai + 1" plan, which offers to better any financial incentive offered by Shanghai by an additional year.

Both Shanghai and Beijing have announced goals of attracting certain numbers of IC fabs that far exceed the goals announced in the 10th Five Year Plan.

- Beijing, for example, plans to build five to eight 8-inch wafer fabs capable of producing 0.25-micron technology by 2005 and plans to build another ten advanced-product lines by 2010.
- Shanghai, by comparison, plans to build approximately ten IC fabs capable of manufacturing 8-inch wafers with 0.35-micron technology by 2005.

- If both plans are realized, the total number of IC fabs in Shanghai and Beijing alone could increase the original plan for building ten fabs to as much as 15 fabs by 2005.

## **ASSESSMENT OF KEY ANALYTICAL QUESTIONS AND POLICY IMPLICATIONS**

### **Is the Mainland "Hollowing Out" Taiwan's Economy?**

Taiwan's economy faces serious structural problems, but these problems cannot be entirely blamed on flows of technology and investment to the mainland. Instead, government budget deficits, state dominance of the banking sector and an excess of non-performing loans, and the effects of the global economic downturn--especially given Taiwan's dependence on IT exports to the United States, which is also in the midst of a sluggish economy--are the real culprits. The cross-Strait dynamic has instead led to a new division of labor across the Strait, with the Taiwanese conducting research and development (R&D), producing key components, and taking orders on the one side, and the mainland producing and assembling products on the other side.

### **What Are the Implications of Increasing Economic Integration for Cross-Strait Relations?**

Many commentators have argued that China's desire to attract investment and technology from Taiwan will decrease the likelihood of conflict in the Taiwan Strait by making the costs of any potentially provocative move prohibitively high for both sides. Yet increasing economic integration is far from a guarantee of peace in the Taiwan Strait. Chinese leaders might very well be willing to bear the economic costs of a conflict if they calculated that military action was necessary to prevent the permanent separation of Taiwan from the mainland. Moreover, Beijing might believe that only minimal economic disruption would result from a coercive use of force against the island designed to achieve limited political objectives.

### **What Are the Implications of Cross-Strait IT Flows for the Greater China Semiconductor Industry?**

While the global IT market continues to be depressed, China is a notable outlier as one of the few growth markets. In semiconductors, the

greater China region will increasingly be the locus for the global IC foundry industry. Successful integration of the greater China semiconductor industry will therefore likely have a dramatic effect on the trajectory and ultimate recovery of the global semiconductor market. Yet, domestic Chinese semiconductor companies will face serious challenges as they attempt to compete with established Taiwanese foundry giants. Concerns about intellectual property security are making some chip designers reluctant to outsource production to mainland-based firms. Meanwhile, Taiwanese companies will likely rise to a higher place on the technology food chain, moving lower-end design and production to China and conducting cutting-edge R&D on the island.

In terms of technology levels on the mainland, at least one fab in China (Semiconductor Manufacturing International Corporation) is currently producing near-state-of-the-art 8-inch wafers with 0.18-micron technology, which is roughly one generation behind efforts at Intel, IBM, UMC, and TSMC, which are already producing chips with 0.13-micron technology and have plans to produce chips with 90-nanometer technology. Intel does not have any plans to move their most advanced fabs to China, and TSMC and other Taiwanese-based chipmakers are approaching China slowly. Even after they receive approval from the Taiwan government, it will take some time for Taiwanese companies to move their fabs to China.

Meanwhile, many companies are slowing down their plans for production of state-of-the-art 12-inch wafers due to sluggish global demand. The reason that companies are producing 12-inch wafers at present is largely that they are trying to position themselves in the market so that they are ready when the global IC market picks up, according to industry analysts. As a result of the high costs associated with 12-inch wafer facilities and production, few players will be successful and stay in the market. In fact, costs of production at that level are so high that they will likely prevent many aspirants from breaking into the field even if they can acquire the necessary technology.

### **What Are the Implications of Cross-Strait Integration for Hong Kong?**

Hong Kong has been the most important conduit for cross-Strait trade for more than two decades. Yet, Hong Kong would be the single largest loser as a result of direct links between China and Taiwan. The establishment of direct transportation links between China and Taiwan would result in a loss of about 5 to 6 percent of the shipping traffic in Hong Kong and several nearby Chinese ports for the first few years. Air traffic through Hong Kong, such as Cathay Pacific's daily Hong Kong-Taipei flight, would be much more heavily affected.

Some analysts remain optimistic about Hong Kong's future role in cross-Strait economic relations and believe the city will be able to weather the potential impact on its economy from the establishment of the three links, given that there are more than 900 companies with regional headquarters in Hong Kong. Moreover, Guangdong Province is still involved in about half of all cross-Strait trade, and it is likely that many of the shipments destined for the Pearl River Delta will still be shipped via Hong Kong. In addition, Taiwanese firms exporting their products from their manufacturing bases in the Pearl River Delta will continue to rely on Hong Kong's port facilities.

Overall, the establishment of the three links would mark a political breakthrough in China-Taiwan relations and would therefore be good for trade and business, which would in turn ultimately be good for Hong Kong and would offset the loss in shipping traffic. Indeed, investment bank analysts predict that cross-Strait trade will increase by about 50 percent after the opening of direct links between Taiwan and China.

### **Implications for Export Controls**

The rise of the information technology sector in China, combined with concerns about the modernization of the Chinese military and the possibility of U.S.-China military conflict over Taiwan, has ignited a new debate in Washington about export controls on IT-related technology to China. Our research and fieldwork strongly confirm that controls on IT would be both detrimental to the U.S. economy and impossible to enforce in a global economy. Moreover, export controls on information

technologies would not have a meaningful impact on the trajectory of the IT sector's growth or technology levels in China. American companies do not have a measurable technological lead, and European and Japanese competitors have historically shown a willingness to place less of a priority on security concerns as a determinant of export policies.