

## CURRENT ISSUES

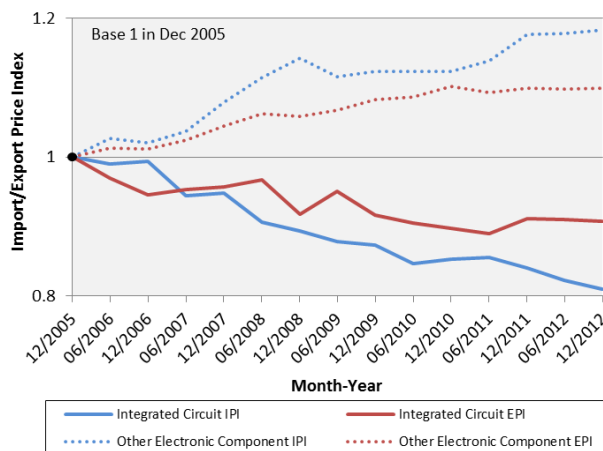
## No. 32: A Reality Check for the U.S. Semiconductor Industrial Base (04/30/13)

The U.S. semiconductor industrial base is critical to the nation's continued leadership in advanced defense technologies. The importance of this industry adds urgency to declining cost-competitiveness among U.S. manufacturers and diverging alignment between global demand and domestic production capacity. This paper discusses these trends in the semiconductor supply chain, investigates their implications for the broader defense industry, and offers recommendations for preserving the domestic semiconductor industrial base in the long-term.

### Headwinds in the U.S. Semiconductor Market

Challenges to U.S. companies supplying large contractors with semiconductors and integrated circuits (IC) have been growing over the past five years. One problem contributing to U.S. suppliers' troubles is downward price pressure and increased cost-competitiveness from overseas competitors. Price pressure in itself is not new—wafer prices trend downward due to the declining cost of a unit of computing power over time described by Moore's Law. However, foreign firms have been able to reduce their prices at a faster rate since about 2006, as demonstrated in the Import Price Index (IPI) and Export Price Index (EPI) comparison in Figure 1.

**Figure 1: U.S. v. Rest of World Semiconductor Import/Export Price Index Comparison, 2005-2012\***



\* Import and Export Price Indexes measure changes in cost of U.S. (export) and import (foreign) goods. They are benchmarked against a score of '1' for at a chosen start date. Here, December 2005 is the chosen base year.

Source: Bureau of Labor Statistics; Analysis by Defense-Industrial Initiatives Group.

Compared against the IPI and EPI for other electronics, where U.S. companies have remained competitive on cost, U.S. semiconductor suppliers appear to be losing ground to foreign competitors.

Low growth in domestic fabrication capacity has also hurt U.S. semiconductor suppliers. North America's monthly production capacity of 200mm wafers, a common type of semiconductor, grew at a compound annual growth rate (CAGR) of 3.5 percent between 2007 and 2012, while the rest of the world grew at more than double that rate over the same period. China and South Korea in particular outpaced the U.S., with CAGRs of 15.7 percent and 13.2 percent respectively (See Figure 2). While 200mm wafers represent just one measure of capacity, declining consumption of raw materials supports the conclusion that U.S. fabrication is hurting.<sup>1</sup>

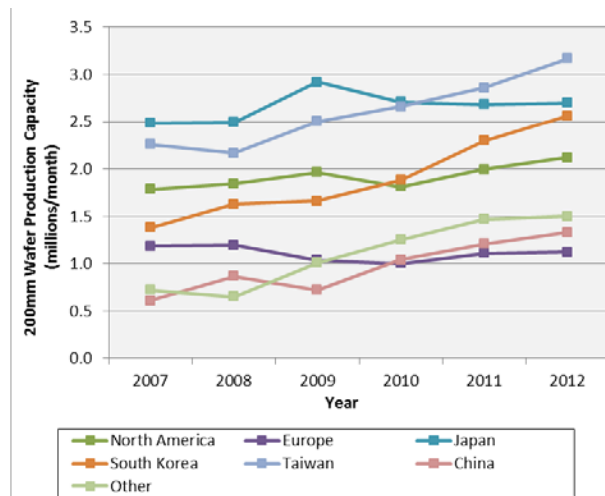
Much of the reduction in domestic capacity is the result of U.S. companies moving fabrication plants, or "fabs," overseas and opting to focus on more profitable semiconductor packaging and design services.<sup>2</sup> However, if capacity growth rates remain low relative to growth in demand, the result could be an increasingly "fabless" U.S. semiconductor industry that outsources production to non-U.S. producers, mostly in East Asia.

These two problems are not fatal to U.S. semiconductor companies, but do suggest that further action is needed to preserve competitiveness and innovation in the semiconductor industry in the long-term. The nation still leads in IC design and in the development of advanced materials like gallium-nitride. Established U.S. suppliers can also do more to improve their profitability and cost-competitiveness, such as consolidating manufacturing processes and renegotiating raw material contracts. In the end, though, this might only slow the gradual movement of U.S. fabrication to overseas plants.

<sup>1</sup> China's consumption of raw materials for semiconductor manufacturing surpassed U.S. consumption in 2012 for the first time. See: Mims, Christopher. "China just surpassed the US in semiconductor manufacturing—and the trend is likely to accelerate." *Quartz*, April 9, 2013. <http://qz.com/72542/>.

<sup>2</sup> See *The Decline in Semiconductor Manufacturing in the United States*. Center for Public Policy Innovation. June 2010, <http://cppionline.org/docs/The-Divide-of-Semiconductor-Manufacturing.pdf>.

**Figure 2: Installed 200mm Wafer Fabrication Capacity (Millions/Month) 2007-2012**



Source: "Global Wafer Capacity," IC Insights; SEMI World Fab Forecast.

### Trends Spell Danger for Defense Electronics

On its surface, the relocation of U.S. fabrication capacity is not all bad. Reduced wafer prices could help component subcontractors control their own costs, creating a multiplier effect up to the platform level. This is an appealing scenario for cost-cutters at the Pentagon.

However, there is some cause for alarm. Counterfeit products in particular have captured the attention of policy makers. These semiconductors and ICs are cheaper substitutes for their branded versions, and can often be salvaged from throw-away or defective parts. IHS, a business analytics firm, reports that cases of counterfeit parts have skyrocketed in recent years, reaching 1,363 in 2011.<sup>3</sup> This trend could heighten the risk that platforms, munitions, and weapons systems contain faulty or dangerous components.

Semiconductors sourced from defense rivals are an additional source of concern. Confirmed cases of foreign components being used in major defense platforms are fewer in number than counterfeit incidences. Still, some worry about the presence of subcomponent products from China.<sup>4</sup> Control of upstream products by rival nations could also compromise resource security and increase the risk of malware.

### Supporting Semiconductor Supply Chain Integrity

Defense planners have sought to address the problem of counterfeit and foreign parts in the past. Most notably, a provision to encourage defense contractors to source

electronics from certified Trusted Suppliers was included in the language of the FY 2012 National Defense Authorization Act.<sup>5</sup> However, that legislation contains no enforcement mechanisms, and for contractors, the added cost of buying the Trusted Supplier brand may exceed the benefits.

In order to make material progress on this issue, defense contractors need to work more closely with suppliers to find further cost-cutting opportunities. For example, contractors could pass on incentives for cost-performance to suppliers. On the punitive side, lower cost limits on cost-plus contracts could encourage suppliers to more seriously consider profitability.

Suppliers also have a role to play in ensuring their own long-term integrity. More effective communication about the implications of process changes for contractor products would help ease contractors into the changing realities of the global wafer market. Suppliers have kept many out-of-date and inefficient manufacturing processes because of protest from contractors about sunseting them. This resistance has in turn contributed to suppliers' declining competitiveness.

Finally, policy makers should enhance their efforts to strengthen the U.S. semiconductor industry. Trusted Supplier legislation is a good start, but it should be supported by improved enforcement mechanisms. Semiconductor companies would also benefit from international joint-development programs with defense allies in the area of advanced materials. A collaborative effort between Japan and the U.S. would pair the world's second and fourth largest manufacturers, respectively, and could produce bleeding edge technologies to compete in niche defense markets, regardless of cost.

The U.S. semiconductor industrial base is at a critical juncture. The measures outlined here could help industry internalize downward price pressure while protecting innovation. This will allow defense planners to keep high-tech electronic components from becoming prohibitively costly. It will also contribute to reduced risk of counterfeit products and foreign control of resources. Ultimately, suppliers cannot escape the changing realities of the semiconductor industry. Taking measures to adjust to those realities now will help ensure the integrity of the national semiconductor supply chain in the uncertain future.

—Joshua Archer

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<sup>3</sup> "Reports of Counterfeit Parts Quadruple since 2009." EBN. February 14, 2012, [http://www.ebnonline.com/document.asp?doc\\_id=239219](http://www.ebnonline.com/document.asp?doc_id=239219).

<sup>4</sup> In one recent high-profile case, a stop-work order was issued against the Army's Light Anti-Armor Weapon (LAAW) when it was found that a small component of the system was sourced from China. See: Mishory, Jordana. "Chinese Part Found In USMC Anti-Tank Weapon Prompts Stop-Work Order." *Inside the Pentagon*. February 14, 2013.

<sup>5</sup> See "SEC. 818(c)(3).Trusted Suppliers." *National Defense Authorization Act for Fiscal Year 2012*. Accessed on March 1, 2013 at <http://thomas.loc.gov/cgi-bin/query/z?c112:H.R.1540>.