



## PRIVATE EQUITY PERFORMANCE IMPROVEMENT

# Beyond the CHIPS Act: Nearshoring Semiconductor Packaging and Testing as an Emerging Investment Opportunity

The CHIPS and Science Act of 2022 aimed to shift some of the semiconductor manufacturing and packaging capacity from Asia, where it has flourished for decades, back to the United States. So far, it has been doing just that.

Some nearby countries are now emerging as attractive investment opportunities as the industry looks for reliable, lower-cost partners. One of the most promising regions will most likely be Latin America, where U.S. Automotive and Aerospace industries already have a proven track record of establishing high-end supply chains with a growing, talent-rich workforce.

In our prior paper, we made the case that now is the time for Private Equity to invest in Semiconductors.<sup>1</sup> In this paper we are specifically suggesting Private Equity (PE) firms and other investors should investigate the Latin America region as the U.S. ramps up incentive programs encouraging investment in the semiconductor sector, which the government deems vital to its national security. Semiconductor packaging and testing facilities are emerging as the most attractive entry point.

## The CHIPS Act and Asia's Stronghold on Semiconductor Production

Several countries in Asia have become critical for semiconductor wafer manufacturing (front-end manufacturing), centered mostly in Taiwan, South Korea and Japan with China constantly expanding its share. Asia has also become the center for semiconductor packaging and test activities (back-end manufacturing), with Taiwan, China and Southeast Asia hosting more than 80 percent of the worldwide outsourced semiconductor assembly and test (OSAT) sales.<sup>2</sup>

Locating back-end activities close to front-end manufacturing in areas where lower-cost and skilled labor is available has been critical to ensure the economic viability of these arrangements.

As the U.S. and other western governments look to diversify the semiconductor supply chain away from its current state and to re-shore or near-shore capabilities, they need to look beyond front-end manufacturing. Initially, the \$52 billion CHIPS and Science Act and similar programs in Europe have focused primarily on the need to bring front-end semiconductor manufacturing back to the U.S. or Europe respectively. In November 2023, the U.S. government announced an additional \$3 billion for semiconductor packaging investment in the U.S.<sup>3</sup> While this last move has been welcomed by the industry — with several assembly and test industry leaders announcing new investment in the U.S.<sup>4</sup> — it addressed only part of the challenge. This move will allow some back-end capacity to be re-shored and to be located close to the new wafer manufacturing capacity that is being added in the U.S., creating a hub for the more advanced packaging solutions needed to overcome Moore's law challenges at the smaller nodes. But since back-end manufacturing is traditionally a lower-margin activity, any cost saving is critical for the long-term viability of the plan, and lack of lower-cost skilled labor will remain a challenge to the industry.

Latin America is therefore emerging as a viable nearshoring alternative and offers feasible investment opportunities for both corporate and PE funds.

1. [\*Now Is the Time for Private Equity to Make a Play in Semiconductors\* | Alvarez & Marsal, February 2023](#)

2. [\*The Semiconductor Supply Chain - Issue Brief\* \(georgetown.edu\)](#)

3. [\*CHIPS for America Releases Vision for Approximately \\$3 Billion National Advanced Packaging Manufacturing Program\* | NIST](#)

4. [\*Amkor Announces US Advanced Packaging and Test Facility\* | Amkor Technology](#)

## Asia is a Critical Hub for Semiconductor Assembly and Testing

The semiconductor industry has long relied on Asia not only for front-end manufacturing but also for assembly and testing capabilities. Companies such as Intel and Texas Instruments set up operations in Asia in the early days of the industry to reduce labor costs.<sup>5</sup> Subsequently, companies such as ASE, Amkor, UTAC and others set up operations in Southeast Asia and Taiwan as OSAT vendors to semiconductor companies.<sup>6</sup>

The concentration has only increased in the last decade as more back-end capacity was added in Asia to support the semiconductor industry, which grew to an all-time high of \$574 billion in 2022.<sup>7</sup> Today, more than 600,000 workers are employed in Taiwan alone,<sup>8</sup> with companies supporting both the front and back ends of the semiconductor supply chain.

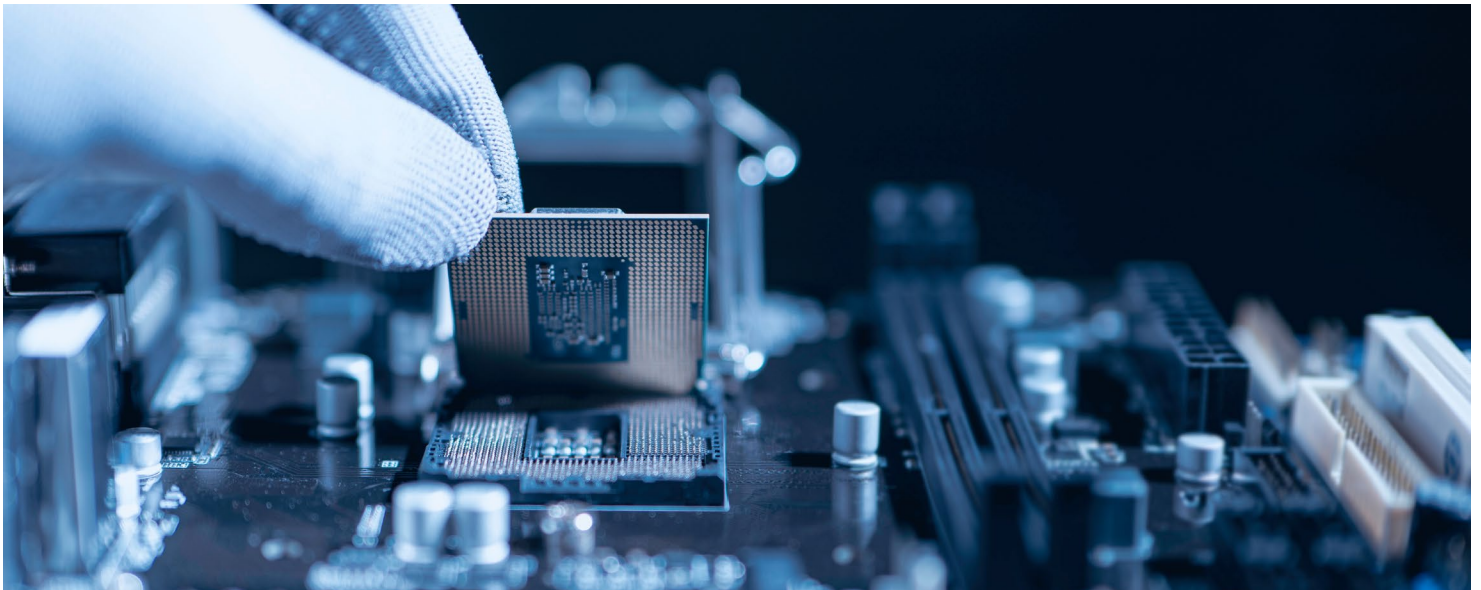
Back-end manufacturing has benefited from the combination of skilled labor at competitive wage levels as well as accommodating government policies that encourage investment from international and local companies. This is why nine of the top 10 OSAT vendors are headquartered in China and Taiwan.

## The U.S. Government is Incentivizing Re-shoring of Some Semiconductor Manufacturing Capacity

Multiple factors triggered semiconductor shortages during the past few years, making it clear how much the supply chain — critical both for national security and economic advancement — depends on foreign countries. The U.S. responded with a number of actions to protect sensitive intellectual property, restrain exports and incentivize investment in semiconductor manufacturing on U.S. soil.

While the CHIPS and Science Act promised \$52 billion in government incentives targeting mostly front-end manufacturing, it also covers ancillary sectors such as equipment and research and development (R&D) centers that may include chip design, process technology development or critical technologies. With the recently announced advanced packaging initiative, even more private investments are expected.

Despite these recent developments, packaging remains a very cost-competitive area.<sup>9</sup> Therefore, except for the most advanced and higher-margin package types, situating all additional capacity in the U.S. might create an economic challenge for the industry.



5. *CHIPS+ and Semiconductor Packaging | Perspectives on Innovation | CSIS*

6. *Top 10 OSAT (Outsourced Semiconductor Assembly and Test) Companies - Utmel*

7. *The 2023 SIA Factbook: Your Source for Semiconductor Industry Data - Semiconductor Industry Association (semiconductors.org)*

8. *Meet Taiwan's Little-Known But Elite Semiconductor Makers (forbes.com)*

9. *The Semiconductor Supply Chain - Issue Brief (georgetown.edu)*

## Central and Latin America as a Credible Alternative

Selected semiconductor companies such as Intel and International Rectifier (now part of Infineon) have long had near-shore semiconductor packaging and testing capacity in Costa Rica and Mexico respectively and continue to invest in the region.<sup>10</sup>

Other industries like Automotive and Aerospace have proven the viability of the region on an even bigger scale.

The evolution of the automotive industry in Mexico can serve as a model for how the U.S. might look to near-shore resources for back-end semiconductor services. American automotive original equipment manufacturers (OEMs) have century-old roots in Mexico, as Buick and Ford established manufacturing facilities there in the 1920s.<sup>11</sup>

Over the years, access to skilled labor and resources fostered growth in the country. Regulatory actions such as the North American Free Trade Agreement (NAFTA) and the Manufacturing Industry, Maquiladora and Export Service (IMMEX) were catalysts for expansion beyond the American “Big 3” Automakers. Their presence in the region now includes Volkswagen, Renault, Mazda and Toyota, for example. Collaboration and co-investment were also accelerated, with OEMs like Ford and Mazda constructing a joint plant in Hermosillo, Sonora in 1986.<sup>12</sup>

The aerospace industry has also looked to Mexico as a means of boosting manufacturing capacity and capability. Through a mix of collaboration across government, industry and private organizations, training and education centers have been established in Jalisco, Sonora, Chihuahua and Queretaro. OEMs including Cessna, Honeywell, Beachcraft, Bombardier and Airbus have aligned to build out a network of suppliers as a means of both lowering costs and providing robustness to their supply chains.

Using Mexico as a springboard, the broader region can represent a great opportunity to establish a semiconductor packaging and testing ecosystem in Latin America similar to what has been established in Asia over the past 30 years. Latin America has a labor force that can be tapped to support a back-end supply chain to complement the domestic wafer production that the U.S. is bringing online in the next five to seven years.

The U.S. government appears to be backing Latin America as an option for the industry. The State Department is already partnering with Costa Rica and Panama to explore semiconductor supply chain opportunities, indicating there is real interest and concern.<sup>13,14</sup> Several U.S. government representatives, including Senators Bill Cassidy, R-LA, and Michael Bennet, D-CO, have highlighted the attractiveness of the region.<sup>15</sup>

Some countries' governments are also indicating support, including Brazil.<sup>16</sup> There is some historic precedent here, too, as Intel opened a testing and assembly plant and an R&D facility in Costa Rica in 1997. In 2021, Intel announced plans to invest \$1.2 billion to further-expand operations.<sup>17</sup>

The opportunity is not without risks, but it could represent an option for certain investors.

## Opportunity for Investors

Building out this ecosystem could represent a major opportunity for investors. PE Funds have already expressed strong interest in participating in the build out of front-end manufacturing capabilities through direct investments not only in foundries and equipment suppliers but also in companies that service the semiconductor manufacturing ecosystem such as gas and chemicals suppliers, construction services, facility maintenance and workforce development support.<sup>18</sup>



10. [\(1\) Intel to invest \\$1.2 billion in Costa Rica over next two years | LinkedIn](#)

11. [The Mexican Automotive Industry's Long History \(tetakawi.com\)](#)

12. [Complete Overview of the Ford Hermosillo Stamping and Assembly Plant \(tetakawi.com\)](#)

13. [New Partnership with Costa Rica to Explore Semiconductor Supply Chain Opportunities - United States Department of State](#)

14. [New Partnership with Panama to Explore Semiconductor Supply-Chain Opportunities - United States Department of State](#)

15. [Senators Pitch Americas Act as Win-Win, Win-Lose - Lexology](#)

16. [Brazil pursues a new semiconductor policy \(brazilian.report\)](#)

17. [Intel to invest \\$1.2 bln in Costa Rica over next two years](#)

18. [Now Is the Time for Private Equity to Make a Play in Semiconductors | Alvarez & Marsal | Management Consulting | Professional Services \(alvarezandmarsal.com\)](#)

OSAT companies typically have lower, but still healthy, gross and EBITDA margins compared to wafer foundries,<sup>19</sup> which can create significant differentiation for the most advanced applications where packaging facilities help overcome Moore's Law challenges, and require significantly less CAPEX and R&D to support their business, somewhat lowering barriers to entry.

This combination can create a business model that may be attractive to PE investment and that would offer similar financial performance to front-end semiconductor manufacturing.

The OSAT and advanced packaging market in Latin America should outpace growth in the semiconductor market as the region takes market share from Asia and positions itself to support the public and private investments being deployed in front-end manufacturing in the U.S.

A&M estimates that the new capacity coming online from investments in front-end manufacturing will require approximately \$40 billion in investments in advanced packaging and assembly and test facilities through 2030.

## A Perfect Storm Means New Opportunities

PE firms have largely avoided investments in semiconductor companies in the recent past over concerns about the high capital requirement and R&D costs coupled with the sector's cyclical demand pattern. But the CHIPS and Science Act, together with a perfect storm of supply chain shortages and a robust demand, are providing new ways for PE firms and investors to participate in the sector.

Semiconductors are now more in line with the typical investment frameworks that PE firms prefer. As the perception of cyclical demand patterns changes along with increasing levels of capital and R&D, more PE funds will begin investing in parts of the semiconductor value chain. One enticing strategy could include leveraging Latin America — and its favorable workforce skills and costs — for OSAT vendors, which can only benefit from the \$40 billion packaging and assembly and testing investment expected through the rest of the decade.

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19. Company financials

## CONTACT US

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