A Study of the Economic Impact of GLOBALFOUNDRIES

By

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Executive Summary

GLOBALFOUNDRIES's decision to locate the world's most advanced semiconductor fabrication facility in Saratoga County, New York is quickly proving to be a landmark event in both the economic development of what is called "Tech Valley" (the area of eastern New York stretching from just north of New York City to the Canadian border) and in the global semiconductor industry. The schedule and design specifics for Fab 8, as the facility is called, have all been met or exceeded since AMD first announced that it would commence construction in October, 2008. The manufacturing facility itself is larger than originally planned, an additional office building has been announced, it is being built ahead of schedule, the technology it will contain has already been upgraded (as measured by the density of the devices GLOBALFOUNDRIES will produce there), it will reach commercial production sooner, and GLOBALFOUNDRIES has the prospect of a dramatic expansion of production facilities at the site if circumstances – including the state of the world market and the quality of the partnership between GLOBALFOUNDRIES and federal, state and local officials – lead them to do so.

GLOBALFOUNDRIES's Fab 8 will lead to about 6,500 new (annual, steady-state) jobs in the Saratoga County area, at the site, at companies that provide needed services to the site, and at local businesses that are the beneficiaries of added income in the area. These estimates are very similar to those found in an initial economic impact analysis performed on the fab location decision in October 2008 when AMD announced plans to spin-off its manufacturing operations and create GLOBALFOUNDRIES as a new semiconductor manufacturing foundry company through a joint venture with the Advanced Technology Investment Corporation (ATIC).[1]

The major differences from the time of that initial report and the economic analysis contained in this report are twofold. First, GLOBALFOUNDRIES has already expanded the site, creating the potential for hundreds of added jobs in the next few years and many more in the time frame beyond that. In fact, on February 21, 2011, GLOBALFOUNDRIES announced it would build a second administration building on site to house the additional workforce associated with various site expansions. And, second, the effects of GLOBALFOUNDRIES's location decision on the development of a nanotechnology "cluster" in New York's Tech Valley are unfolding rapidly. Key suppliers of engineering services and production inputs to the Fab 8 facility are beginning to locate in the area in order to be near the facility. GLOBALFOUNDRIES has also developed the Integrated Technology Development Center, a 6,000 square foot manufacturing

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[1] See **Manufacturing, Competitiveness and Technological Leadership in the Semiconductor Industry, October, 2008, available from GLOBALFOUNDRIES**

test and automation laboratory at the New York State Energy Research and Development Authority's Saratoga Technology + Energy Park (NYSERDA STEP) campus immediately adjacent to the Fab 8 campus. Local educational institutions are updating and improving education programs, and in some cases initiating entirely new programs to train workers and staff for the facility and many other new jobs that are expected to be created in the region.

FAB 8 - RELATED EMPLOYMENT AND INCOME, SUMMARY		
Category	**Annual Employment**	**Annual Payroll**
Permanent Fab 8 facility-based jobs	~ 1,465	~ $88 M
Services provided to Fab 8 (computer maintenance, fab garment cleaning, and other on-site activities)	~ 550	~ $22 M
"Indirect" Fab 8- related employment (using multiplier of 2.25, as used by New York ESDC)	~ 4,500	~ $180 M
TOTAL	**~ 6,500**	**~ $ 290 M**

This type of "cluster-building" was part of the State of New York's intention when it first sought to induce AMD to locate to the region, and a reason why semiconductor fabs are sought after by nations from around the world. By any measure, the State's strategy has been a success. The co-location of new services around Fab 8 not only will create more jobs than is captured in any static estimate of jobs, but will create a vibrant base for future economic growth in the region.

Introduction

In October, 2008, Advanced Micro Devices (AMD) announced its plans to create GLOBALFOUNDRIES and to begin construction of a new, state-of-the-art semiconductor manufacturing facility ("Fab 8") in Saratoga County, New York. At that time, it commissioned an analysis that looked at the decision from a variety of perspectives: from that of the U.S. semiconductor industry; the economic development of New York State and region; the employment effects generated by the plant; and others.[2]

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[2] See **Manufacturing, Competitiveness and Technological Leadership in the Semiconductor Industry: An assessment of the economic impacts of the proposed joint venture project of AMD and the Advanced Technologies Investment Corporation to**

This paper updates that first analysis, focusing on local employment, new and further trends in the semiconductor industry, and developments in the nanotechnology "cluster" in the Hudson Valley. It notes that: the facility is ahead of the original plan in all major aspects; that (as a consequence) its long-term employment potential is now higher than it was thought in 2008; and that the "Tech Valley" regional economic "cluster" is rapidly taking shape and adding employment and income above the levels anticipated in this paper.

Project History and Timeline

On June 23, 2006, then-governor of New York George Pataki, together with bipartisan leaders of the New York State Legislature and the Chairman and CEO of Advanced Micro Devices, announced plans to build, under AMD's auspices and with the State's active and significant support, the world's most advanced semiconductor manufacturing facility at the Luther Forest Technology Campus in Saratoga County.

The non-binding announcement contemplated creating approximately 1,200 direct jobs and approximately 3,000 indirect jobs at a new, $600 million, 1.2 square foot facility designed to produce 300 mm wafers using (initially) 32 nm process technology. Construction was due to begin sometime between July 2007 and July 31, 2009, and the facility would be fully operational sometime before the end of 2014.

A variety of circumstances have changed since that announcement, including the reorganization of AMD and the economy undergoing its worst downturn in a lifetime. Yet the project not only has commenced, but every key parameter contemplated in the 2006 agreement has been met or exceeded.

- The original plan called for the creation of 1,205 direct jobs at the facility. Because of expansion plans and additional investment in the site, this number has increased to 1,450, and could be raised again if GLOBALFOUNDRIES takes advantage of the opportunities to expand further at the site;

- The original plan contemplated 3,000 "indirect" jobs. An analysis of the project conducted in late 2008 calculated that, between jobs directly related to servicing the Fab (such as facility maintenance, security, cleaning, delivery, computer repair and

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build and operate the Fab 4X semiconductor foundry manufacturing project in Saratoga County, New York, available from GLOBALFOUNDRIES.

equipment installation and maintenance) and those triggered by expanded economic activity, a total of over 5,000 additional jobs would be created in the area and, again, this could be increased if all the opportunities for expansion are realized;

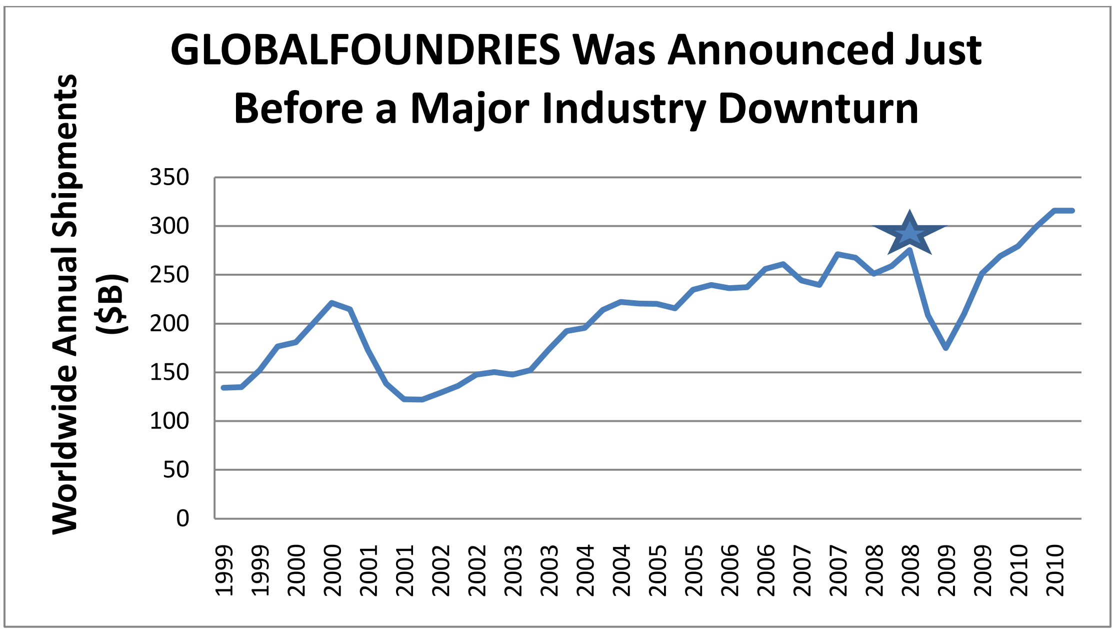
- The original plan forecast construction beginning by July 31, 2009, with the facility becoming fully operational sometime before December 31, 2014. In fact, construction activity began in June, 2009, and the first manufacturing tools will be installed in June 2011, with the initial manufacturing to begin in 2012. According to GLOBALFOUNDRIES current schedule, the second half of 2012 will be used to identify and correct defects in the manufacturing process, with volume production for revenue beginning in early 2013;

- The facility itself was originally designed to be 1.2 million square feet, but the manufacturing component of the structure has already been expanded. In July, 2010, the clean room facility – the highly specialized space in which device etching and manufacturing actually takes place - was expanded from 210,000 to 300,000 square feet, an increase of over 40 percent. This expansion together with the necessary increase in support structures now means that the overall size of the project is now approximately 1.7 million square feet. Were this new capacity to be fully tooled (which itself would require an investment of approximately $2.2 billion) and brought into production, the Fab's production capacity would go from 40,000 to 60,000 wafers a month, with the additional workers hired at the facility bringing the all-in employment impact would be approximately 1,655 full-time workers;

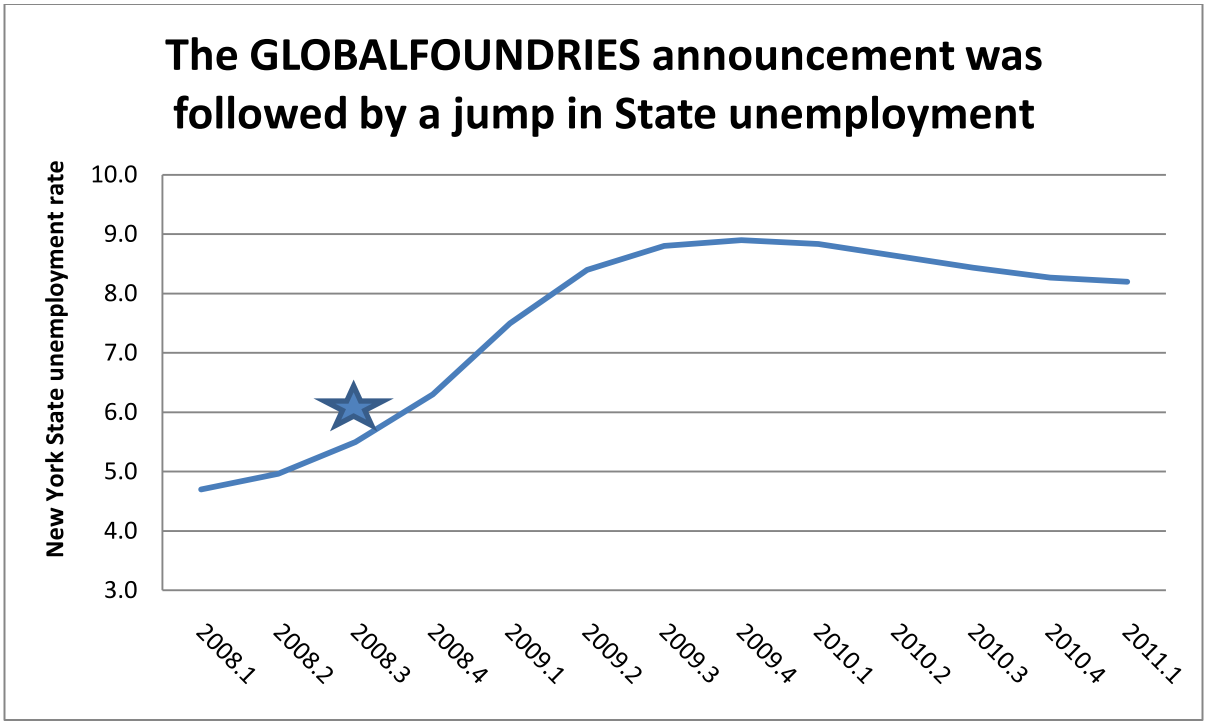
- Because of the expansion of the project and site activities, and the growth of the company's global business, GLOBALFOUNDRIES announced in February, 2011 that it will build a second administration building on site that can house up to 1,500 additional workers. They intend to fit-out space for 450 workers for now, with the additional space providing room to grow;

And the plant's technology has already been advanced. Most semiconductor fabrication facilities around the world are now operating at a geometry of 45 to 65 nanometers, that is, the circuits they etch into a wafer are that wide. (By way of reference, a human hair is 5,000 nanometers wide.) The GLOBALFOUNDRIES facility was initially designed to operate at a geometry of 32 nanometers, leading to

22 nanometers over time. But it has changed its initial target to 28 nanometers, reflecting technological progress since the announcement. The fact that GlobalFoundries has met or exceeded its construction schedule is notable given the timing of its 2008 announcement, that is, an instant before the most significant economic downturn in most people's lifetimes, and certainly the lifetime of the semiconductor industry. The chart below looks at U.S. semiconductor industry shipments, quarter-by-quarter, beginning in 1999. Shipments rose until the fourth quarter of 2000, and began to slow along with the economy, leading into the brief recession of 2001-02, bottoming out in the fourth quarter of 2001. The industry's full recovery in shipments did not occur until the third quarter on 2003, and once it did, it was fairly strong; between the third quarter of 2003 and the third quarter of 2008, industry shipments rose at an annual rate of approximately 12.5 percent.



But the precipitous decline in the economy in late 2008 was immediately felt by the semiconductor industry. Shipments fell over a third in the six months following the third quarter 2008 peak. New York State employment followed a similar path. In August, 2008, at the economy's peak and around the time of the GLOBALFOUNDRIES announcement, New York state employment totaled 9,153,888, with an unemployment rate of 5.5 percent. By the end of 2009, employment had dropped to 8,858,651 – a loss of 300,000 jobs – and the unemployment rate had risen to 8.3 percent, below the national average, but considerably higher than its level of two years before.



Thus, the economic environment deteriorated substantially in the months immediately following the GLOBALFOUNDRIES announcement. In fact, the entire Computer and Electronic Products Industry (SIC 334, of which the Semiconductor Industry, SIC 3344 plays a leading role), reduced its level of investment by 13 percent in 2009, while GLOBALFOUNDRIES was proceeding with this major new commitment.

Moreover, a marked characteristic of the 2008 downturn was the risk premium associated with private lending. The fragility of the banking system led to a massive shift away from private lending and into Treasury securities. This led to a far higher spread between corporate borrowing and the risk-free Treasury rate, raising dramatically the cost of capital to corporations. Private investment dropped in response, threatening many projects of the cost and scope of Fab 8, yet GLOBALFOUNDRIES carried out its plan to build the facility nonetheless.

In contrast to 2000, however, the rebound in shipments in this downturn was more robust – while it took the industry four years to regain the level of shipments that preceded the 2000 downturn, the 2008 peak was achieved in only eighteen months. But industry participants would have been justified in expecting a recovery as lethargic as the one earlier in the decade. In fact, when GLOBALFOUNDIRES broke ground in July, 2009, industry shipments were still fully 20 percent below their September, 2008 peak. Yet the project proceeded on time, and is now slated to be larger and more sophisticated than originally conceived.

GLOBALFOUNDRIES's commitment to the Fab 8 facility is in part based on a different view of the plant location decision in the semiconductor industry, as will be discussed below. But it must be noted that GLOBALFOUNDRIES was ultimately able to locate in Saratoga County because of the State of New York's incentive package and the patient capital provided by the Advanced Technology Investment Company, the partner with which AMD spun off GLOBALFOUNDRIES. As Paul Otellini, CEO of Intel, and the Semiconductor Industry Association have estimated, it costs approximately a billion dollars more to build a facility such as Fab 8 in the US when compared to other regions of the world. This is particularly true in Asia, where the appetite for development and the availability of state-sponsored capital are both substantial. In that light, the New York State grant and incentive package was a key factor in leveling the playing field. Absent that support, Fab 8 could not have been built in the State.

Will the U.S. Have a Semiconductor Industry?

The U.S. semiconductor industry is an important contributor to the national economy. In 2010, it shipped over $110 billion of product and employed about 182,000 people. Moreover, the semiconductor industry is the largest net exporter in the manufacturing economy outside of aircraft – it sells abroad fully 77 percent of its output, and has been the number one export industry on average over the last 5 years. U.S. semiconductor exports totaled $52.4 billion in 2006 and produced a trade surplus of $25 billion. According to the Semiconductor Industry Association (SIA), the semiconductor industry invested approximately $17 billion in research and development last year, or over 15 percent of sales. This constitutes about one out of every 12 dollars spent on R&D in the U.S. by private industry, and one out of every 8 dollars spent by U.S. manufacturing.[3]

[3] In addition to these levels of output, research and investment, the industry plays an important and innovative role in education and training. The SIA reports that over the past three years the semiconductor industry has spent a combined $220 million on K-12 programs, trained over 300,000 teachers and reached more than 14 million students. But industry investment in programs and funding are just a start. As an example of how much the industry is engaged in improving our nation's education system, GLOBALFOUNDRIES is leading a 21st Century Education and Workforce Development Initiative throughout 13 counties in Upstate in NY. The initiative is engaging all stakeholders in developing a vision of tomorrow's education system and creating a large scale "laboratory" in 92 school districts including institutions from Pre-K through higher education in which the most innovative practices today will be trialed and roadblocks identified and eliminated. This first of its kind large scale initiative, which began through discussions with Administration officials in Washington DC, is intended to be a pilot which can be used as a model to help change the education system nationally.

Beyond its economic importance and its contributions to research, innovation, and the development of future technologies, the semiconductor industry plays a central role in US national security. Most of the technologies that play a decisive role in security are driven by the semiconductor industry. Going back to the Very High Speed Integrated Circuit programs in the early 1980s, the Defense Department has recognized the role of microelectronics and nanotechnology in military capability and security. But as we reach the limits of the current technology employed by the commercial semiconductor production, the race to develop the next generation of integrated circuit "switch" will have important security repercussions. The US has always led this race and from both an economic security and national security standpoint, cannot afford to lose its leadership position. Yet, at the same time, the U.S. industry is at a critical juncture, and some have questioned whether the U.S. will have a semiconductor industry in the future.

What economic rules govern the evolution of the semiconductor industry? In 1966, the economist Raymond Vernon first presented the "product life cycle" view of trade. In it, he posited that newer, more advanced products are initially exported by the countries that developed them, but that as they matured and their technologies stabilized and became more known, their production was liable to migrate to other parts of the world, where the advantages of cost were more important. The evolution of semiconductors has much of this character. They were invented here, first manufactured by the firms that would use them, evolved into a market in their own right as independent companies such as Intel and AMD rose to prominence, and began to migrate to other locations as the product's technology became better understood and natural labor cost advantages (and often government-subsidized capital-cost relief) made those locations suitable.

Economists generally support this "natural" evolution in the location of production absent some compelling motive that is not reflected in market-based outcomes. To do otherwise is to invite inefficiency into the economy, primarily by misdirecting investment resources and penalizing the producers of other goods that use semiconductor devices. The protection of memory chips during the Voluntary Restraint Agreement of the mid-1980s, for example, did not materially affect the long-term condition of the industry – memory devices migrated to lower-cost locations while more sophisticated products had a higher likelihood of staying in the U.S. – but it did penalize the U.S. producers of the computers that needed these devices.

Another reason why economists share this view is that the same companies that relocate commoditized production maintain control of the process, locating higher-value production and design and engineering services in the U.S., much as Vernon's theory predicted. Thus, U.S. flag-affiliated semiconductor companies have a global market share of about 50 percent, but a rising share of their production is sited abroad. Output originating in the United States fell to 25 percent in 2005 and to 14 percent in 2009. To be sure, U.S. output trends toward the higher end of the semiconductor product slate – for example, microprocessors rather than lower-end memory devices. But it has nonetheless declined on both a unit and value basis.

This decline stems from both sides of the location equation – new capacity is being built around the world, but capacity in the U.S. is not. In fact, U.S. semiconductor capacity has not only been static, but as the technology of semiconductor manufacture improves both continually and dramatically, U.S. capacity is increasingly uncompetitive in terms of cost and product sophistication. Older plants use smaller wafers on which to etch circuits on chips; for example, the industry is now moving from 10 inches to 12 inches (more precisely, 300 millimeters). A 12 inch wafer allows for more than 40 percent more surface area than does its 10 inch counterpart, with obvious implications for yields and therefore unit cost. Many U.S. plants cannot live up to this rising standard. TIME magazine recently reported that, of the 27 fabs that closed around the world in 2009, 15 were in the U.S. and as the pace of innovation continues, more U.S. capacity will find its relevance challenged.

In that context, the GLOBALFOUNDRIES facility is unique. In fact, once Fab 8 achieves its production objectives, it may be the only facility in the United States that produces circuits with a 22 nanometer width and the potential of producing even more advanced geometries in the future. To be sure, the location of production facilities is only part of the equation as to whether the U.S. "has" a semiconductor industry. Much of U.S.' company production is located abroad; as mentioned, GLOBALFOUNDRIES itself has seven operating facilities around the world – one in Germany and six in Singapore. While production may have migrated to those locations over the decades in which semiconductors have matured as a product, much of the design and engineering of these devices is still done in the U.S., much in the manner that AMD chose to focus on this business while spinning off GLOBALFOUNDRIES so that the new company could raise the capital needed to make the massive investments required to build a state-of-the-art foundry.

But to some extent, the relocation of production and, specifically, the rise of foreign competitors, create risks for these scientific and engineering services. As one analyst said in a press report, "We are probably ten years away from seeing a Chinese or Indian semiconductor company that's really competing against the other leading companies in the world.[4] But there is no question it's going to happen." Moreover, the educational institutions that train tomorrow's semiconductor engineers are greatly advantaged by having production facilities available for their tasks. This "clustering," as will be discussed below, allows both students and companies to benefit from each other's presence.

The GLOBALFOUNDRIES decision to locate a new state-of-the-art facility in New York represents a new approach to competition in the semiconductor industry, one that moves beyond the traditional notions of cost advantage. In the new, GLOBALFOUNDRIES view, the natural cost advantages of cheaper labor found abroad have been marginalized in part by considerations of product quality, the enormous capital requirements of building and tooling a new Fab, and by the technological issues that underlie yield, and therefore the base of production over which fixed capital costs are spread. The cost advantages that occur because foreign governments are willing to provide new Fabs with tax concessions or other cost or capital advantages, of course, remain. However, by working with the State of New York, AMD, and later GLOBALFOUNDRIES, was able to undo this artificial advantage without penalizing semiconductor customers.

The relocation of semiconductor manufacturing to higher-cost environments is also made possible by an ever more important dimension of competition in the market for electronic devices – product design cycle and time to delivery. The digital devices into which semiconductors go – from personal computers, laptops, and mobile telephones to automobiles, TV's and "smart" appliances, and the like – were once thought of as fairly stable. But rapid technological progress in all of the components going into these products – memory, microprocessors, flat screens, power supplies, and so on – have made their shelf life much shorter. Computers were once produced for inventory. But the rise of Dell, Gateway, and other new-model computer manufacturers has been premised on their view that computers are less like furniture (which generally sits in inventory without losing value) and more like strawberries, capable of going rapidly into obsolescence while waiting for shipment.

Mobile devices are moving in the same direction, as seen by the wave of innovation beginning with the Blackberry device and now continuing in a world of iPhones, iPads, Androids, Kindles, Nooks, and other

[4] "Save Our Semiconductors," TIME Magazine, November 8, 2010

devices. New product models are introduced rapidly and continually, and consumers have learned to anticipate this kind of ongoing change. Moreover, these devices have burgeoning amounts of processing power, not only to improve signal speed and reliability, but to power a growing range of applications, an entirely new feature of these devices in the past several years. In addition, environmental concerns are playing a growing role in the design and performance of semiconductor products, as these products are continually improved to consume less electricity per unit of compute power and to produce less waste heat. This adds to the pace of new product introductions and the need for fast-cycle production.

As a result, the new determinants of competitive advantage in semiconductor markets may well be those associated with proximity to the customer – speed to delivery, the ability to change designs quickly, and the ability to adjust production levels as customer product sales levels change. With the onset of “smart” devices of all kinds – meaning embedding information technology capabilities into products that had previously not incorporated them -- there will be exponential growth in the use of semiconductors, which further enhances the effect of this dynamic.

Employment Effects

As disclosed in the Grant Disbursement Agreement with the State of New York, AMD committed to hire a minimum of 1,205 full-time employees at its facility by the beginning of 2014. But GLOBALFOUNDRIES has expanded the scope of the original project and now estimates that the full-time employment could reach 1,465 by the end of that year. We use the latter number in this analysis.

In a related analysis of the employment generated by fabrication facilities, the research firm Semico demonstrated that for each eight manufacturing jobs at a fab, approximately three other jobs are created in on-site services in such areas as computer sales and maintenance, fab garment cleaning, delivery services, maintenance, security and others. This suggests about 550 jobs related to the fab over and above its direct manufacturing employment of 1,465. These are not “multiplier” or other spending-related jobs – they are related to services that are integral to running a fab, but are provided by external vendors in order to optimize the management of the facility.

Both of these classes of jobs would create income and economic activity in the local economy, a phenomenon known as the “multiplier effect.” In the Grant Disbursement Agreement, the State of New York concluded that “for each permanent, direct job generated by this project, an additional 2.25 indirect jobs are anticipated in the state’s economy.” This means that the 1,465 manufacturing jobs and

550 on-site service jobs created by the AMD plant, or slightly over 2,000 jobs in all, would produce an additional 4,500 jobs in the overall economy.

In the 2008 analysis, the construction workforce was assumed to be entirely local. However, in practice, about 35 percent of these jobs will occur outside the local area due to the highly specialized nature of the work involved and the availability of a local workforce. Thus, during the construction of the wafer fabrication facility and associated administration, engineering, and central utility buildings, the estimated construction related workforce would reach about 1,000 employees over the life of the project. In fact, 1,600 people have worked on the facility construction at its peak. Following the estimating convention used by Semico (which is distinct from New York State's analysis of full-time workers), construction jobs are estimated to have a multiplier of 1.7, so that construction-related employment, including multiplier effects, could total as high as 2,700 while the facility is being built.

To calculate payrolls, an annual wage of $60,000 was assumed for all fab employees; this is lower than the national average for the semiconductor industry because a fabrication facility may not employ as many highly-paid engineers as would say, a design facility. But the high average salaries at the GLOBALFOUNDRIES facility can be understood by looking at the composition of projected employment. Approximately 30 percent of the Fab 8 staff will be engineers, with bachelors or advanced degrees in such areas as electrical engineering, physics, chemistry or mathematics. They will oversee and maintain the quality of the Fab's operations, and perform research and development. An additional 10 percent of the Fab's staff will be administrative and managerial workers, with bachelors or advanced degrees in engineering, science, business, or other areas. The remaining 60 percent of the permanent staff are manufacturing operatives – wafer fabrication technicians – who manage the sophisticated etching and fabrication equipment that make chips and who generally hold associates degrees or better, and who often have separate certifications in electrical engineering, instrumentation, or other programs administered by colleges or firms in the industry. This is a far more sophisticated employment mix than is found in most other manufacturing industries.

An average annual wage of approximately $64,000 was assumed for construction employment, and a wage of $40,000 was assumed for on-site service and "multiplier" jobs.

The relevant wage rates were then multiplied by the estimated job creation to arrive at payrolls. Thus, the 1,000 construction jobs yield a total payroll of $62 million, and the associated 1,700 "indirect" jobs will lead to a total payroll of $68 million during the construction phase. The 1,450 manufacturing jobs are projected to produce a payroll of $88 million, and the 550 associated, on-site service jobs an added $22 million, with the 4,500 “indirect” jobs adding $180 million, yielding a sustained *annual* payroll of $290 million during Fab 8 operations.

What If Fab 8 Expands To Phase 2? As mentioned above, GLOBALFOUNDRIES chose during the early stages of construction to expand its clean room from 210,000 to 300,000 square feet. (In contrast, a football field, including end zones, is about 58,000 square feet.) The company estimates that such an expansion would increase employment from about 1,465 to 1,655 full-time jobs.

Using this methodology, an increase in primary fab employment of 190 jobs would create an additional 70 jobs in the provision of services required to operate the fab. Using the wage assumptions above, this would lead to added payroll of over $14 million. In addition, using the 2.25 multiplier assumed by New York State, these 260 added jobs would lead to 360 second-round jobs, with a payroll of an additional $14 million. Thus, all told, the expansion of production into Phase 2 would create 620 added full-time jobs in the area, with total additional payroll of over $28 million.

Further Expansion at Luther Forest. There is then the possibility of dramatic expansion of the GLOBALFOUNDRIES facility beyond the expansion of Fab 8 into Phase 2. GLOBALFOUNDRIES owns 222 acres of the 1,300 Luther Forest Technology Campus, and this site is zoned for two additional facilities over and above Fab 8 but roughly equal to it in capacity. While the design – including the production capabilities - of any possible new facilities is not known in detail, and while some of the overhead of these new facilities could be managed by the existing operations and staff, two new production facilities could lead to thousands of new jobs in the Saratoga County area. Given the persistent cost differences involved in locating a facility in the U.S. rather than Asia, it is likely that further partnership between GLOBALFOUNDRIES, the federal government, the State of New York and local governments would be required to realize this result. However, were GLOBALFOUNDRIES able to execute the full build-out of the Luther Forest site, the Hudson Valley corridor would clearly be positioned as a leader in the U.S. and international semiconductor industry, along with such “cluster” locations as Silicon Valley, Austin, and Portland, Oregon.

A final comment on employment estimates is in order. These static estimates of direct employment and second-order spending effects cannot fully capture the effect of the GLOBALFOUNDRIES fab location decisions on regional employment. That is because GLOBALFOUNDRIES is an integral part of a “cluster” in the area of nanotechnology that includes GLOBALFOUNDRIES, IBM, and other primary private employers in the semiconductor industry, local educational institutions such as SUNY Albany and Rensselaer Polytechnic Institute that train their labor force and support their research, service providers who locate in the area to support both sets of entities, companies in such related fields as instrumentation or computer systems that draw off the same set of abilities and other employers. The next section expands on this concept.

The Regional Nanotechnology "Cluster"

GLOBALFOUNDRIES has described their reasons for locating to New York State as the "three E's" - education, ecosystem and economics. Education refers to the presence of premier education and research universities where GLOBALFOUNDRIES can recruit partners in solving on advanced technology problems; among those partners are Rensselaer, as stated, SUNY Albany and its Nanotechnology Center, Colgate, Clarkson and Cornell. "Economics" includes the State of New York's active involvement in securing GLOBALFOUNDRIES's location.

Ecosystem, the third component, refers to the "cluster" of other high-tech companies and institutions in the region, as they were first referred to by the economist Michael Porter. Regions are subject to the same economic forces as nations – they must develop competitive advantages and sustain them through unrelenting innovation and investment in order to thrive.[5] The alternative is to compete by continually lowering costs – wages – to the detriment of all involved. When firms with similar interests and competencies locate in the same area – as semiconductor companies have in California's Silicon Valley, in Austin, Texas, and now in the Albany region - suppliers, skilled workers, investors, and other groups associated with the industry locate near them, for obvious reasons. This improves the economic fertility of the region and, in turn, produces a virtuous cycle of growth.

The "Tech Valley" corridor is rapidly becoming one of the primary such clusters for semiconductor-related activity in the U.S. This "Tech Valley" corridor currently has over $15 billion invested in technology-related facilities, either by corporations or local and regional educational and technical training institutions that graduate thousands of highly skilled workers each year, and over 250 companies now operate in the area. GLOBALFOUNDRIES's decision to locate Fab 8 – one of the most advanced production facilities in the world - will accelerate dramatically the development of this cluster, further strengthening the region's long-term competitive prospects.

[5] Michael Porter, The Competitive Advantage of Nations, 148-165 (1990).

In the late 1990's, New York State first committed itself to an economic development program based on the state's incipient advantages in semiconductor technology. The state's development strategy sought out candidates for this type of clustering using three criteria: a technologically intense sector; the ability to serve global markets; and a reliance on skills found in the state. The nanotechnology focus logically fits this bill and is now bearing fruit. Working with industry – notably, IBM, whose semiconductor facility at Fishkill was a long-standing establishment in the area – the State established the College of Nanoscale Science and Engineering (CNSE) at the State University's Albany campus which, together with a group of firms including AMD, IBM, Intel, Microsoft, Sematech, SONY, Toshiba, and others, created a Nanotech Complex to work on pre-competitive engineering and production matters, as well as to train a highly-skilled labor force. Moreover, the contribution that a new, state-of-the-art facility will make to further the strategy raises the possibility that even more advanced manufacturing facilities will be constructed in the region.

"Clusters," as stated, reach beyond groups of firms that manufacture a common set of products. They incorporate the firms and other entities that service those manufacturers. The examples of this phenomenon occurring in the Hudson Valley, in response to GLOBALFOUNDRIES's location decision, are many:

- Twenty miles to the south of the GLOBALFOUNDRIES site at Malta, M+W Group, Inc., the general contractor for the Fab 8, Module 1 construction project, has relocated its headquarters, moving their offices from the Dallas area to the Watervliet Arsenal near Albany, NY. M+W Group is a global leader in the engineering, production, and maintenance of semiconductor facilities, from concept and design to turnkey services and retrofit of late-cycle facilities and has constructed many cleanroom and semiconductor related facilities in New York, including facilities for IBM in East Fishkill, NY and CNSE at SUNY Albany.
- An hour further south, in Kingston, NY, FALA Technologies develops prototypes for precision machine building and assists manufacturers in integrating precision machine components and subsystems with software controls, electronics, and optical positioning systems.
- In January, 2011, KLA-Tencor, a San Francisco-area based supplier of process control and yield management systems for the semiconductor industry, leased about 4,200 square feet of office space in Saratoga County. Another GLOBALFOUNDRIES supplier, Tokyo

Electron, which designs semiconductor manufacturing tools, is leasing 7,400 square feet of space in the same structure. A further GLOBALFOUNDRIES supplier, the French gas company Air Liquide, is building a two-acre gas yard to serve Fab 8; the firm also has worked in the area of hydrogen-based clean energy, strengthening the region's capabilities in a related but different area as well. This is precisely how regional economic clusters evolve and diversify.

- Within walking distance of GLOBALFOUNDRIES's Fab 8, Hudson valley Community College, with support from New York State, created TEC-SMART (Training and Education Center for Semiconductor Manufacturing and Alternative and Renewable Technologies), where the workforce for many of these production facilities will be trained; the Albany Center for Nanoscale Science and Engineering provides advanced degrees in related science and engineering with many of its graduates staying in the area.

Finally, GLOBALFOUNDRIES's own parallel activities illustrate the growing regional economic development synergies of the cluster phenomenon. In August 2009, GLOBALFOUNDRIES announced the relocation of its manufacturing systems technology group from Austin to the Fab 8 site. This group of about 100 engineers (all of whom hold bachelors or advanced degrees) performs advanced process research and development regarding factory automation in support of manufacturing for GLOBALFOUNDRIES around the world. They are not part of the Fab 8 operations staff, but support Fab 8 in addition to other sites around the world. These new jobs did not have to be moved to the Saratoga area for Fab 8 to operate, but they were relocated because GLOBALFOUNDRIES felt it was advantageous to have them close to the new Fab 8 start-up.

And in October, 2010, GLOBALFOUNDRIES announced the opening of the Integrated Technology Development Center at the Saratoga Technology + Energy Park (STEP) campus adjacent to the HVCC TEC-SMART campus and Fab 8. This multi-million dollar facility will support GLOBALFOUNDRIES's manufacturing operations worldwide and assist with the start-up of Fab 8. This facility is run by GLOBALFOUNDRIES's Manufacturing Systems Group and, again, represents added employment in the region, as does GLOBALFOUNDRIES' recent unanticipated announcement of the construction of a new administrative office building. Nor did GLOBALFOUNDRIES receive any additional consideration from New York State for either of these activities.

These are the real elements of a job-creating regional economic cluster – not just world-class manufacturers, but a skilled workforce, colleges and universities with highly competitive engineering and related programs, a growing number of technology firms and research and development efforts, service companies that allow the primary manufacturers to concentrate their resources on problems that are particular to their own efforts, proximity to strategic partners, and competitive incentives to attract investment and job creation. All of these activities produce employment and income in the area – even in cases in which GLOBALFOUNDRIES or one of its suppliers relocates operations and transfers key personnel, the income they generate leads to added employment in the Saratoga area. Thus, the static estimates of employment and income generated by GLOBALFOUNDRIES's location of Fab 8 are underestimated, as they do not include new jobs and income that are drawn to the Hudson Valley tech cluster following GLOBALFOUNDRIES's new facility.

Conclusion

Thus, for all of the aforementioned reasons, the U.S.' ability to support the semiconductor industry will have important repercussions in a wide range of areas. GLOBALFOUNDRIES Fab 8 project is an important part of the response to that challenge. Despite its launch at the beginning of a severe economic downturn, Fab 8 has so far met or exceeded all of its targets as it prepares for commercial production in 2012. Moreover, it has already strengthened the Hudson Valley regional nanotechnology "cluster," as suppliers, service providers, educational institutions, and GLOBALFOUNDRIES itself have expanded operations around the site.

This activity provides a strong validation for New York State's strategy of building regional economic development around existing assets in the Hudson Valley. The area now demonstrates the capacity to become a leading location in the U.S. semiconductor industry alongside other successful areas such as Silicon Valley, Austin, Texas, and Portland, Oregon, and in the event that further development is undertaken by GLOBALFOUNDRIES at its Malta site in the future, NY could be positioned to be the world's leader in technology development and semiconductor production.

Given the inherent cost advantages of foreign production locations, the success of NY's investment in the industry and the new global model established by GLOBALFOUNDRIES will require ongoing co-operation between GLOBALFOUNDRIES, other local partners, and federal, state and local governments, The success of the GLOBALFOUNDRIES Fab 8 may provide a springboard for the region to reach this new level. Indeed there is a potential for this new “Tech Valley” to position New York State, and the United States, to be a leader in technology-based, global economy of the future.

Biography of Everett M. Ehrlich

Dr. Everett M. Ehrlich is one of the nation's leading business economists. His firm, ESC Company, combines economic analysis, business development, and communications skills to solve a wide range of business problems. ESC's diverse clientele have included leading firms in the financial, accounting, pharmaceutical, automotive, and other industries, and such diverse organizations as the Pew Center for Global Climate Change and the Major League Baseball Players Association. He also recently served as Executive Director of the CSIS Commission on Public Infrastructure under co-chairmen Felix Rohatyn and Warren Rudman; a bipartisan bill to enact their recommendations was introduced in the 110th Congress.

Dr. Ehrlich served in the Clinton Administration as Under Secretary of Commerce for Economic Affairs, the principal economic policy official for Commerce Secretaries Brown and Kantor and chief executive of the nation's statistical system. As such, he led the first comprehensive strategic review of the nation's economic statistics in four decades, leading to a major modernization of featured measures of the economy. He supervised the redesign of the 2000 decennial census. He co-chaired the White House working group on the restructuring of the U.S. economy in the face of information technology, was a leader in the U.S. planning effort of the two G-7 "Jobs Summits," and oversaw the Administration's economic analysis of global climate change.

Prior to his service as Under Secretary, Dr. Ehrlich was Vice-President for Economic and Financial Planning, and for Strategic Planning, of Unisys Corporation, from 1988 to 1993. As such, he had responsibilities concerning corporate development and finance, formulating business strategy, and economic forecasting. He reported directly to two chairmen of the company. He has also been the Senior Vice-President and research director of the business-based think tank, the Committee for Economic Development.

Dr. Ehrlich earlier served as Assistant Director of the Congressional Budget Office, where he directed the CBO program in trade and technology, infrastructure and space transportation, energy and the environment, and agriculture. He joined CBO in 1977, after having served as a Legislative Aide to Congressman John Conyers, Jr., and having briefly taught economics at the university level.

Dr. Ehrlich is the author of two critically-acclaimed novels: Big Government (1998), and Grant Speaks (2000), both by Warner Books. He was, for eight years, a regular economics commentator on National Public Radio's Morning Edition, and his writings have appeared in The Financial Times, Investors

Business Daily, The Christian Science Monitor, The Washington Post, The International Economy, The New York Review of Books¸ and other publications.

Dr. Ehrlich was born in New York City in 1950 and is a product of its public schools. He received a B.A. in 1971 from S.U.N.Y. Stony Brook and a Ph.D. in economics in 1975 from the University of Michigan. He lives in Bethesda, Maryland, where he and his wife of thirty years follow the exploits of their three grown children and root for the Washington Nationals.