An Evaluation of the Economic Impact of the Foxconn Proposal

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Abstract

In this paper I evaluate the potential economic impact of the Foxconn plant on the Wisconsin economy. I consider factors affecting both the direct impact of the Foxconn plant, as well as the additional broader impacts that it may have. If implemented as planned, the direct impact of the plant will be substantial, and the broader impacts could go far beyond typical fiscal policies. In particular, the opening of a large scale high tech manufacturing operation by a multinational corporation has the potential to generate significant spillovers. Drawing on the economic literature on plant openings and foreign direct investment, I analyze the magnitude of these potential gains. While direct employment multipliers in the literature range from 1.7 to more than 3, those most relevant in this case are in the 2.5-3.0 range. Thus if Foxconn accounts for 13,000 direct jobs, it may generate a total of 32,000-39,000 jobs through its supply chain, suppliers of employees, spillovers on existing firms, and new investments. I also review the economic evaluations which have been previously carried out, and evaluate some of the concerns that have been raised about the proposal. In the overall evaluation of the Foxconn package, the uncertain but potentially large gains in jobs, wages, output, and incomes must be weighed against the certain fiscal costs.

Introduction

The announcement of Foxconn's $10 billion dollar planned investment in Wisconsin with up to 13,000 new jobs was broadly hailed as "transformational." At the same time, many have raised concerns about the potential $3 billion cost of the state incentive package and whether the promised jobs will ultimately materialize. These direct costs, and the opportunity cost of forgoing other expenditures, must be weighed against the potential that Foxconn may help southeast Wisconsin to develop as a hub of high tech industry which could generate gains far beyond the direct jobs created.

In this paper I quantify the potential impact of Foxconn on the Wisconsin economy, including discussing some potential benefits of Foxconn's investment which have not been previously analyzed. In particular, the opening of a large scale high tech manufacturing operation, bringing a new industry to the United States, has the potential to generate significant spillovers. Drawing on the economic literature on plant openings and foreign direct investment, I analyze the magnitude of these potential gains. I also review the economic evaluations which have been previously carried out, and evaluate some of the concerns that have been raised about the proposal.

Much of the recent discussion has focused on the cost of the incentive package, in comparison to either the number of jobs created or to the future tax revenue which may be generated. By contrast, the economics literature typically evaluates changes in fiscal policy by their consequences for output or incomes. Viewed in these terms the estimated "fiscal multiplier" -- the ratio of how much additional income is generated for each dollar of revenue spent or forgone -- for this project is much larger than most estimates. This remains true even when only considering Foxconn's direct contribution to the Wisconsin economy. Consideration of the additional economic activity generated by Foxconn's suppliers, employees, spillovers to existing firms, and potential spinoffs resulting from the project would only increase the gains further.

The projections and quantitative evaluation in this paper are limited by time and available information. I focus only on the impact of the ongoing plant investment and employment, not on the impact of the plant construction. I draw heavily on the previous analyses done by the Legislative Fiscal Bureau (LFB), EY, and Baker & Tilly. Since the EY study was commissioned by Foxconn I use it to estimate the structure of the planned plant. The LFB analysis then gives a timeline for how investment and employment in the plant would evolve over time. As I discuss, the EY and Baker-Tilly studies use related input-output models to estimate the economic impact of the new Foxconn plant. I use these analyses to calibrate a very simple model to evaluate alternative scenarios and gauge their impact. This allows me to address some important issues related to the project, but abstracts from other details. While work is underway at the Center for Research On the Wisconsin Economy (CROWE) to develop a fully dynamic empirical model of the Wisconsin economy for purposes like this, it is not yet complete.

The Direct Impact of Foxconn

I begin by analyzing the direct impact of Foxconn on Wisconsin, evaluating the additional output and income which would be generated by the investment and employment at the Foxconn plant. I begin with the baseline scenario from the EY and LFB analysis, and then discuss how this impact may change under different assumptions. In particular, I evaluate the concerns that Foxconn would hire fewer workers than in the baseline scenario, finding that changes in scale would be more likely than changes in

the planned capital/labor ratio. I also analyze the flows of workers between Wisconsin and Illinois, which suggest that Illinois residents may make up a minor share of the new jobs at the Foxconn plant.

Baseline Scenario

EY Direct Fully operating		Share of Gross Y	Share of VA
Labor Income	956	0.125	0.284
GDP	3361		
Output	7625		
Materials	4264	0.559	
Gross Surplus	2405	0.315	0.716

First, I construct a simple production function which I use to calculate the demand for capital, labor, and materials, and the resulting output under different assumptions. Since the EY study relied data from Foxconn management, I assume that this reflects firm technology. Thus I use the income statement from the EY analysis to calibrate a constant returns to scale production function where labor expenses account for 12.5% of gross output, materials 55.6%, with the remainder going to gross operating surplus.

	Employment	Capital	K/L	Materials	Output	GDP	Labor Income
2018-19	257						
2019-20	2600	1286	0.49	817	1469	652	19
2020-21	6500	2443	0.38	1553	2889	1337	191
2021-22	10400	3484	0.34	2215	4181	1966	478
2022-23	13000	4422	0.34	2811	5296	2485	764
2023-24	13000	5265	0.41	3347	6170	2823	955
2024-25	13000	6024	0.46	3830	6941	3111	955
2025-26	13000	6708	0.52	4264	7625	3361	955
…	…	…	…	…	…	…	…
2032-33	13000	6708	0.52	4264	7625	3361	955
Cumulative					$87,946	$39,262	$11,007
Cumulative Subsidy		$2,840.62		Multiplier	31.0	13.8	3.9

Then I construct the baseline scenario, relying on the timetable of outlays from the LFB analysis. From the payroll subsidy, I calculate planned employment. Then I use the capital expenditure subsidy to calculate planned investment. I cumulate this investment using a standard permanent inventory approach assuming a 10% depreciation rate, which is roughly equal to the average depreciation rate in the manufacturing sector in Wisconsin according to recent estimates at CROWE. I also assume that there is continuing investment to offset depreciation and maintain capital stock at a constant level from 2025 onward. Under these assumptions, we get the schedule in the above table, which agrees with the EY analysis from the year 2025 on.

The table shows that under the baseline scenario, over the 15 year period of the enterprise zone Foxconn would account for a cumulative $39 billion in additional value added (GDP) for the Wisconsin economy, and an additional $11 billion in labor income. This compares to the direct subsidy payments of $2.84 billion, which as in the LFB analysis only includes the capital expenditure and payroll subsidies and not the sales tax exemptions or other fiscal costs. Even if all of the additional value added from the plant except the labor income paid to employees goes out of state, this results in a cumulative multiplier of 3.9 on the subsidy cost. Moreover although the enterprise zone payments stop after 15 years, the plant is planned to continue well beyond that.

Fiscal Multipliers

Much of the discussion since the Foxconn announcement has focused on the costs per job or the time it would take the state to recover its tax revenue. However a more common approach to evaluating the economic impact of a change in fiscal policy, such as a tax cut or an increase in government spending, is to focus on the output multiplier. Relatively few changes in taxes or spending end up generating enough revenue to pay for themselves. In addition, the objective of government policy usually taken to be to improve the welfare of citizens, and output or income is a common (albeit imperfect) summary measure of welfare.

There is considerable disagreement in the economics literature on the empirical magnitude of the fiscal multiplier. The vast literature from changes in federal fiscal policy find estimates that are typically less than one, although many estimates are significantly greater than one (typically around 1.5) during recessions. There is also a recent literature, including Nakamura and Steinsson (2014) and Serrato and Wingender (2016), analyzing variation in state fiscal policies, finding larger multipliers generally in the range of 1.5-1.8. While there is certainly variation across states and across the use funds for different tax and spending programs, this suggests that on average we would expect a change in fiscal policy to have an output effect of at most twice the size of the change.

However the Foxconn income multiplier is not directly comparable to the usual estimates in the literature, which measure the general equilibrium impact of the policy change. The income multiplier above only accounts for the direct income from the project, but does not account for either the cost of subsidy funds or the adjustment of prices and associated reallocation of resources that would follow the investment. This multiplier also assumes wages and interest rates are fixed, or equivalently that there is excess capital and labor that is either idle or will flow in from outside the state. Nonetheless, this analysis does suggest relatively large potential gains from the subsidy expenditure, albeit concentrated among the workers. The indirect and additional effects discussed later include some of these adjustments, and lead to gains that would be distributed more broadly across the state.

Capital Intensity and the Impact of Wage Changes

Under the baseline scenario discussed above, the proposed plant in Wisconsin is significantly more capital intensive than the industry average, and is in line with Foxconn's existing operations. For the proposed plant, labor costs are a smaller share of value added than the industry averages. In particular, using the industry NAICS 334413 (Semiconductor and Related Device Manufacturing) for comparison as EY did, from the 2007 Input-Output tables, we see that compensation of employees accounted for 49% of value added in the industry. More recent input-output data is only available at the three digit level, where in 2015 in industry 334 (Computer and Electronic Products) employee compensation was

50.9% of value added. In comparison, compensation accounts for 28.4% of value added at the proposed plant. Further, Foxconn's 2016 financial statement shows that accrued payroll costs were 10.3% of gross plant and equipment. If we assume a $9 billion gross investment, a $956 million payroll (accounting for benefits and overtime) amounts to 10.6% of gross plant and equipment.

Some recent commentaries on the potential costs of the incentive package have focused on scenarios where Foxconn would invest substantially (up to $9 billion) but hire fewer workers (perhaps 3000), which would increase the cost per job of the subsidy package. While such a scenario would be possible with significant automation, it is seems implausible given the already high degree of capital intensity in the planned operations.

If the entry of Foxconn into Wisconsin did bid up wages, then the plant would likely increase its capital intensity. For example, suppose that wages increased by 10%, which is on the high end of likely wage impacts, but the scale of the project remained the same. Then under the assumptions on production, the capital/labor ratio in the plant would increase by 10%, which would be accomplished by a small increase in capital and an 8.75% fall in employment. In that case, rather than employing 13,000 when fully operational, the plant would only employ 11,863. This would increase the cost-per job of the subsidy package, but nowhere near as much as previous analyses have suggested.

Absent substantial variation in the capital/labor ratio, the relevant factor in determining the impact of the plant is the scale of production. Therefore uncertainty over the scale of the plant may be more important than concerns about automation. However the project costs and outputs all scale proportionately with the overall production scale, so the fiscal impact of scale changes are minimized. For example, suppose that Foxconn stopped hiring at 3000 workers but kept the same target capital/labor ratio as in the baseline scenario. Rather than $9 billion, this would mean an investment of roughly $1.7 billion. Under the same assumptions about production, then when fully operational the plant would generate roughly $1.76 billion in output and add $775 million to GDP each year. The total subsidy cost would be proportionately scaled down, to $636 million, for the same cost per job as under the baseline scenario.

Flows of Workers between Wisconsin and Illinois

Given the relatively low growth of the labor force in Wisconsin, which only grew by 1% in total between 2010 and 2016, new migrants to the state may be expected to fill some jobs. Wisconsin has experienced persistent outmigration, losing on net over 7000 residents per year in recent years to other states according to IRS data. So increased job opportunities may also retain some workers in the state who would otherwise move. But beyond migrants, the role of out-of-state commuters has gained attention in recent discussion, with the potential for residents from Illinois to fill a portion of the Foxconn jobs. Data on existing flows of workers between Wisconsin and Illinois suggests that this impact may be relatively small, with the magnitude depending on the location of the plant.

In particular, I used the Public Use Micro Sample of the 2015 American Community Survey to calculate the flows of workers between Wisconsin and Illinois. I particularly focused on the Public Use Micro Areas (PUMA) of Racine and Kenosha Counties, which have been discussed as the likely locations of the Foxconn plant. The table below gives the results. There we see that the net flow of workers across the border in 2015 went from Wisconsin to Illinois, and this was especially true in Kenosha County. On the other hand, the net flow of migrants went from Illinois to Wisconsin.

State	Workers	Work in IL/WI	Moved from IL/WI
Wisconsin	2,920,096	43,701	23,738
Illinois	6,087,125	24,624	10,800

PUMA	Work in IL	IL work in PUMA	Moved from IL
Racine	3,152	2,482	236
Kenosha	23,237	7,618	5,494

In both key counties, commuters from Illinois make up a relatively small fraction of the workforce, and this is particularly true for Racine County. While this data is only illustrative, it suggests that increased employment opportunities in Kenosha or Racine Counties may have a bigger impact on reducing number of the local residents who commute to Illinois than on drawing in Illinois residents. The increased travel time from Illinois to Racine County also suggests a particularly minimal Illinois component if the plant were placed there.

The Additional Impact of Foxconn on the Wisconsin Economy

Indirect and Induced Economic Activity

The existing studies by EY and Baker-Tilly used different input-output models to estimate the additional economic impact of Foxconn on the Wisconsin economy. These studies focus on two sources of economic impact: indirect effects which result from the additional output which is generated in state by Foxconn's suppliers, and induced effects which are generated by the additional income and hence spending that Foxconn's workers carry out in the state. The LFB analysis then used these estimates to account for the additional tax revenue which was generated. The overall employment multiplier in this analysis was 2.7, consistent with the multiplier for the industry and the average for the Wisconsin manufacturing sector.

As discussed above, the input-output models derive their levels of indirect and induced jobs under the assumption of fixed wages, prices, and interest rates, and do not account for the opportunity cost of the use of funds. The assumption of fixed prices can be rationalized by viewing the state as a small open economy, where workers and capital flow in or out until local markets clear at the given (national) prices. Imperfect factor mobility would mean that prices would adjust. For example, with imperfect mobility, Foxconn's hiring would bid up the wage of manufacturing workers, as discussed above. In addition, the reallocation of workers from existing firms to Foxconn would reduce the available labor supply for incumbent firms, and bid up overall wages as well. The calculations of the impact of wage changes on direct employment above suggested that there would be at most a 9% reduction in employment. The magnitude of wage impacts on indirect and induced employment would be similar.

Accounting for the source of funds would also reduce the indirect impact of the Foxconn investment. At least when viewed in a static framework, in order to fund the subsidies for Foxconn, either other types of government spending would have to be reduced, or taxes would have to increase. For example, suppose that the subsidies were offset by reductions in other government spending. Then the additional demand for goods generated by Foxconn's suppliers would be partly offset by the lower demand from government purchases. This demand reduction would be a cost in addition to the forgone benefits of the government purchases themselves.

Productivity Gains and Spillovers

Recent research has shown that large plant openings can have important spillover effects, known as agglomeration, which may increase the productivity of incumbent firms. These agglomeration effects can come from many sources. The new technology in the plant can diffuse to existing firms in the same industry, increasing their productivity. Moreover the new plant may draw in complementary investments by other high productivity firms, and may also attract more high-skilled workers. There is at least some evidence that such changes are underway, as there has already been discussion of increased education and worker training to accompany Foxconn plant, as well as some initial complementary investments.

In particular, Greenstone, Hornbeck, and Moretti (2010) showed that existing manufacturing firms in counties that have won large investment projects have seen productivity increase by 12% five years after the new plant opening. Greenstone and Moretti (2004) also found that industry labor earnings in winning counties increased by an average of 9% five years after the plant opening, with similar increases in related industries and neighboring counties. Property values, a proxy for the overall net benefits of the investment package, increased by roughly 7% in the five year span. Moreover they found no reduction in government services, suggesting the incentives did not crowd out other government expenditure.

While large plant openings led to gains on average, there was significant heterogeneity. A leading successful example is BMW, who in 1992 was promised $115 million in incentives by South Carolina for an initial investment with 2000 planned jobs. Adams (2015) showed that within five years the plant was supporting over 3500 supplier jobs. By 2014 a study by the University of South Carolina documented that employment at the plant had grown to over 7600, with an estimated additional 22,000 indirect and induced jobs throughout the state. By contrast, in 1993 Mercedes opened a plant in Alabama, with $450 million in incentives for 1500 promised jobs. Within five years, the area around the plant had lost more than 800 supplier jobs as Adams (2015) showed. Thus agglomeration and the resulting productivity gains may be significant on average, but cannot be taken for granted.

Impact of Foreign Direct Investment

In addition to the literature on plant openings, there is a substantial literature on foreign direct investment (FDI) which also documents that investment by multinationals typically increases the host country productivity. Harrison and Rodriguez-Clare (2010) summarize the evidence as showing: (1) firms with FDI are generally more productive than existing firms in the market, (2) there is evidence of positive spillovers from foreign buyers to domestic suppliers as well as from foreign suppliers to domestic buyers, and (3) there is less evidence overall on spillovers to firms within the same industry. While much of this literature focuses on investment in developing countries, Keller and Yeaple (2009) study FDI in US manufacturing, finding significant evidence of intra-industry spillovers. They

estimated that FDI spillovers accounted for 14% of the productivity growth in US manufacturing from 1987-1996, with the effect particularly strong in high-tech sectors.

The recent paper by Alfaro and Chen (2017) highlights that in addition to spillovers, multinational production increases productivity though selection and market reallocation that results from increased competition. Entry by more productive multinational firms may drive out the less productive domestic firms, increasing average productivity. In addition, factors of production and revenue are reallocated to more productive uses. Foxconn will not compete directly with incumbent Wisconsin firms in its output market, but the competition for labor and other inputs may lead to a shakeup in the domestic market. While this would be costly for some incumbents, it would lead to higher productivity overall.

Estimates of the Additional Impacts

While there is uncertainty about projecting the direct impact of Foxconn, there is much less clarity in projecting the additional impacts.

There is heterogeneity in the estimates of the employment impacts. As mentioned above, the EY study had an employment multiplier of 2.7, so the 13,000 direct jobs translated into over 35,000 total jobs. Baker & Tilly used a different input-output model with an employment multiplier of 2.4 in their base case. They also considered a scenario with more of the indirect impacts to be sourced from out-of-state, resulting in a multiplier of 1.9.

In addition to these input-output multipliers, which have the drawbacks discussed above, there is some direct evidence of estimated employment multipliers which incorporate price adjustments as well as agglomeration effects. Edmiston (2004) found employment multipliers generally less than one for new plant openings in Georgia, but 1.7 for the high tech sector. Moretti (2010) found much larger employment multipliers on a local level: 3.5 for skilled manufacturing jobs, 5.9 for skilled manufacturing jobs in the high tech sector, and 2 for unskilled manufacturing jobs. Using the EY breakdown of the distribution of planned employment at the (high tech) Foxconn plant, assuming engineers are skilled jobs and all others to unskilled, these estimates suggest a multiplier of 2.7.

Further, Greenstone, Hornbeck and Moretti (2010) found that labor hours increased by 7.8% in incumbent manufacturers in counties with plant openings. Greenstone and Moretti (2004) also found that labor earnings increased by 1.5% per year in the same sample, suggesting that the adjustment came through employment rather than wages. Greenstone and Moretti (2004) also found earnings increases of 1.2% per year for manufacturers in neighboring counties, 1% for other industries in the winning county, and 0.7% for other industries in neighboring counties. I applied these estimates assuming all adjustment in employment with Kenosha and Racine as the winning counties, Walworth a neighboring county, and assuming half of the estimated neighbor county impact on Milwaukee and Waukesha since they neighbor Racine but not Kenosha. (These estimates also suggest significant impact for the Lake and McHenry Counties in Northern Illinois.) This resulted in a gain of roughly 6,500 additional manufacturing and 18,900 non-manufacturing jobs, for a total gain of 25,400 jobs, and thus a multiplier of 3.0.

Quantifying the Additional Impacts

Finally, I used a simple model of the Wisconsin economy to gauge the consequences of these additional impacts on employment. In particular, at CROWE we have recently estimated an aggregate production

function for the Wisconsin economy, which is a standard Cobb-Douglas function with capital's share of income 0.36. I calibrate the indirect effects by assuming that, as in the EY analysis, suppliers' output accounts for 23.5% of the materials requirements of Foxconn, then calculating the required capital inputs to attain this production. I calibrate the induced effects by supposing that 90% of the labor income generated by Foxconn is spent in-state, and calculate the required inputs to finance this. This results in an employment multiplier of 2.5, a value between the EY and Baker-Tilly studies. Assuming that government spending falls to accommodate the subsidy payments leads to a lower indirect activity estimate, and cuts the employment multiplier to 2.2.

To account for agglomeration effects which increase total factor productivity, I assume capital mobility which means that the capital/labor ratio would increase proportionately. Thus an increase in productivity will increase wages by a factor of 1/(1-0.36) =1.56. The impact on employment will depend on the elasticity of labor supply. Assuming an elasticity of 0.5 as in Kennan and Walker (2011), employment will increase by a factor of 0.78 times the change in productivity. Thus even a 0.5% increase in total factor productivity would lead to an additional 12,000 jobs and increase the employment multiplier to 3.2.

Conclusion

Foxconn has the potential to generate broad gains that go far beyond the direct job estimates and tax revenue costs which have dominated the recent discussion. But they are by no means certain – they require that high tech investment by Foxconn in Wisconsin would induce other firms to invest in the area, cause high productivity workers to relocate there, and lead current workers to improve their skills. In evaluating the Foxconn package, the uncertain but potentially large gains in jobs, wages, output, and incomes must be weighed against the certain fiscal costs.