The Affordable Care Act's Excise Taxes: Impact on Medical Device Manufacturers

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Abstract. The Affordable Care Act (ACA) levies a 2.3% excise tax on the sale of medical devices. This paper examines the impact of this tax on tax liabilities, output and employment in the medical device manufacturing industry. Using data from the Annual Survey of Manufacturers and Country and Product Trade data compiled by the U.S. Census that spans 2007-2014, we employ the synthetic control method which compares medical device manufacturers to similarly situated industries. The results suggest that the medical device excise tax led to increases in tax liabilities in the medical device industry, and declines in output and employment.

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1. Introduction

As part of the funding mechanism for the Affordable Care Act (ACA), a 2.3% excise tax was levied on medical device manufacturers. Basic economic theory would suggest that such a tax would lead to an increase in the price and decrease in the quantity of such goods, with the potential for secondary declines in employment, wages, and exports. However, no study to date has examined the impact of this tax on such outcomes using a convincing identification strategy. This paper, then, utilizes data spanning 2007-2014 from the Annual Survey of Manufacturers and Country and Product Trade data compiled by the U.S. Census to estimate the effects of the ACA medical device tax on such outcomes using synthetic control methods.

The medical device tax was passed as part of the ACA in 2010, and became effective on January 1, 2013. The tax applies to sales of medical devices in the United States, regardless of whether the device was manufactured in the U.S. or whether it was imported for use in the U.S. The tax is equal to 2.3% of the manufacturer's price, and is reported by manufacturers or importers on IRS Form 720 – Quarterly Federal Excise Tax Return.

The medical devices subject to the tax are those that are listed under section 510(j) of the Federal Food, Drug, and Cosmetic Act and 21 CFR part 807. However, eyeglasses, contact lenses, and hearing aids are exempt from the tax, as are "devices that are generally purchased by the general public at retail for individual use."[1]

[1] See https://www.irs.gov/uac/medical-device-excise-tax-frequently-asked-questions

Since its passage, medical device manufacturers lobbied heavily for repeal of the tax, arguing that the tax resulted in a decrease in hiring and investment in the industry, and would shift production overseas. The House of Representatives passed a number of resolutions that included repeal of the tax, and the Senate passed a nonbinding resolution favoring repeal of the tax.[2] These efforts came to fruition on December 18, 2015, when Consolidated Appropriations Act of 2016 was signed into law, which contains a two year suspension of the tax, from January 1, 2016 to December 31, 2017.

A simple static theoretical model predicts that an excise tax on an item will lead to an increase in the gross (pre-tax) price, a decrease in the net (after-tax) price, and a decrease in the equilibrium quantity. A voluminous literature has studied such taxes,[3] and has come to conclusions consistent with this theory.

The few existing studies on the ACA medical device excise tax have primarily examined secondary effects of the tax. For example, if net price and quantity decline, one would expect sales and profit margins to decline as well, along with stock prices. Further, declining profits from sales might result in firms cutting back on R&D spending. Finally, if quantities decline, to the extent that output is an increasing function of labor, one might expect employment to decline.

The limited set of studies on the effects of the excise tax finds mixed results. Two of these studies provided simulations or models of potential effects, without utilizing data on these outcomes post-implementation. Furchtgott-Roth and Furchtgott-Roth (2011)

[2] See https://www.washingtonpost.com/news/wonk/wp/2014/11/07/how-killing-the-medical-device-tax-became-one-of-washingtons-top-priorities/

[3] See, for example, Boyd and Uri (1994) on fuel excise taxes, Young and Bielinska-Kwapisz. (2002), Cook et al. (2005) and Kenkel (2005) Stehr (2007) Chetty et al. (2009) on alcohol excise taxes, and Wasserman et al. (1991), Meier and Licari (1997) Farrelly et al. (2003) Huang and Chaloupka (2012) on cigarette excise taxes.

predicted that the tax will lead to declines in employment in excess of 43,000 jobs and a $3.5 billion decline in compensation, while Gravelle and Lowry (2015) projected output and employment falling by less than 0.2%. Two studies use some post-implementation data. Advamed (2014) surveyed 38 companies about their response to the excise tax and extrapolated the results to the entire industry, and estimates that employment decreased by 33,000, 31% of companies reduced R&D, and that three-quarters reduced or postponed capital investment or expansion. On the other hand, Silcox (2015) uses data from SEC annual reports of the 12 largest medical device companies in the United States, and finds that employment, stock prices, and sales increased between FY2012 (before the tax) and FY 2014 (after the tax was implemented), while R&D expenditures held steady.

However, none of these studies uses a convincing methodology to estimate the causal impact of the tax, as it is unclear whether the firms used in the Advamed (2014) and Silcox (2015) studies are representative of the industry. Further, neither study uses a suitably chosen control group to ensure that any effects found did not simply reflect economy-wide trends or the continuation of pre-existing trends.

In this paper, we utilize industry-level data spanning 2007-2014 from the American Survey of Manufacturers and the Census Bureau's Country and Product Trade data. We estimate the impact of the medical device excise tax using synthetic control methods, in which the medical device industry is compared to a weighted combination of other industries that closely followed the trend in the medical device industry before the implantation of the tax. The results suggest that the medical device excise tax led to increases in tax liabilities in the medical device industry, and declines in output and employment.

The paper proceeds as follows. Section 2 describes the data, and Section 3 outlines the estimation method. Section 4 presents the results, and Section 5 concludes.

2. Data

Data for this study come from the 2007-2014 waves of the Annual Survey of Manufactures (ASM) and from 2007-2014 Country and Product Trade data compiled by the U.S. Census. We use data from 2007 to 2014 for two reasons. First, this time period is sufficient long to capture pre-reform trends and estimate post-reform effects. Second, consolidation and separation of several industries across years makes us impossible to consistently merge some industries across earlier years.[4]

Each year, the ASM compiles industry-level statistics on employment, payroll, worker hours, cost of materials, selected operating expenses, value added by manufacturing, capital expenditures, inventories, and energy consumption for industries in the manufacturing sector. The ASM uses the North American Industry Classification System (NAICS) to identify industries, and tabulates statistics at the 3, 4, 5 and 6 digit NAICS levels.

We create our panel by merging industries based on 6 digits NAICS codes. Because NAICS codes were reclassified in 2002, 2007 and 2012, in order to create industries that are comparable across years, we conduct two steps. First, from 2007 to

[4] For example, before 2007, the Laboratory Apparatus and Furniture Manufacturing industry was classified as an independent industry. However, NAICS codes starting in 2007 divided this industry into related specialized industries such as Air-conditioning and warm air heating equipment and commercial and industrial refrigeration equipment manufacturing, Scale and balance manufacturing, or Instrument manufacturing for measuring and testing electricity and electrical signals. This makes it not possible to create equivalent measures of ouutcomes among those specialized industries pre- and post-2007.

2011, the ASM contains a variety of industries that were coded by 5 digits and one letter.[5] We convert these industries into 6 digit NAICS codes using the ASM Industry Grouping file, which allows us to trace lower levels of those industries.[6] Second, after converting all 2007-2011 industry codes into 6 digits NAICS codes, we use a 2007-2012 NAICS Code Crosswalk file to match each of the 2007 NAICS code industries to the equivalent 2012 NAICS code industries. In some cases, NAICS 2012 industries are more comprehensive and larger than the related NAICS 2007 industries. In these cases, we aggregate the industries before 2012 and code them equivalently to the NAICS 2012 industries.[7]

From the ASM data, we utilize information on total taxes and license fees (as one would expect the excise tax to increase the amount of taxes paid), the value of shipments (since the excise tax would theoretically be expected to decrease the quantity sold), the total number of employees and the number of production workers (since employment, and particularly employment engaged in the manufacturing of products, may decline if output declines), and the annual work hours and annual wages among production workers (since firms may cut labor on the intensive margin, rather than the extensive margin).

[5] For example, Flour Milling and Malt Manufacturing industry was coded as 31121M.
[6] For example, Flour Milling and Malt Manufacturing industry example, 31121M contains 311211, 311212 and 311213.
[7] For example, the Seafood Canning (311711) and Fresh and Frozen Seafood Processing (311712) industries in the 2007 NAICS codes were merged into the Seafood product preparation and packing industry (311710) in the 2012 NAICS 2012 codes. So, for data year from 2007 to 2011, we sum up these two industries into one and coded as 311710 so that they are comparably equivalent to this industry for 2012 and afterwards. In some cases, industries classified based on NAICS 2012 are more comprehensive and larger than those on NAICS 2007. And therefore, we mostly aggregate industries before 2012 and code them equivalently as those in 2012.

Data on exports come from Country and Product Trade data compiled by the U.S. Census Bureau.[8] Similar to the way we constructed the ASM data, our final sample contains exports value for period from 2007 to 2014, which are merged with ASM data using the NAICS industry codes as described above. However, unlike the ASM data, exports are not reported for all industries in all years during this period.[9] As noted by the Census, values are withheld to avoid disclosing data of individual companies, because they are not available or not comparable, or because estimates did not meet the Census Bureau's publication standard. In such cases, we treat those data as missing.

We deflate all monetary values to 2010 levels using the Consumer Price Index.

We follow Gravelle and Lowry (2015) in considering the following industries as being involved in medical device manufacturing, and so treated by the medical device manufacturing excise tax:

- 325413 In-Vitro Diagnostic Substance Manufacturing
- 334510 Electromedical and Electrotherapeutic Apparatus Manufacturing
- 334517 Irradiation Apparatus Manufacturing
- 339112 Surgical and Medical Instrument Manufacturing
- 339113 Surgical Appliance and Supplies Manufacturing
- 339114 Dental Equipment and Supplies Manufacturing
- 339115 Opthalmic Goods Manufacturing

In our pecifications, we perform analyses at the 5-digit industry level by combining this set of industries into an aggregate "5-digit" industry.

Figure 1 presents the time trends in the medical device industry, and compares this time trend to the average of all other manufacturing industries in the ASM and International Trade data. As can be seen across these panels, the medical device industry

[8] See https://www.census.gov/foreign-trade/statistics/country/index.html.
[9] For example, the In-vitro Diagnostic Substance industry (325413) has reported exports values for only three years: 2012, 2013 and 2014. Therefore, we treat the unavailable values for years before 2012 as missing data.

does not closely track all other industries in the pre-2012 period. As a result, an estimation specification comparing medical device manufacturers to all other manufacturers is not a plausible identification strategy for estimating the effects of the medical device excise tax, as any differences in the post-tax period may simply reflect differences in pre-existing trends. As a result, we utilize the synthetic control method of Abadie et al. (2010), which provides for a more convincing identification strategy.

3. Method

The synthetic control method of Abadie et al. (2010) compares the time trend in an outcome variable for the unit affected by an intervention (in our case, a medical device industry) to the time trend of the same outcome variable for a synthetic control group. The synthetic control group is created by assigning weights to potential control industries so that the weighted average of some descriptive statistics matches as closely as possible to those in the treatment industry in the years before the medical device excise tax was implemented. Ideally, the time trend in the outcome variable in this synthetic control group in the pre-reform period will closely match the trend in the medical device industry during the pre-reform period, and the estimated impact of the intervention is the difference between the trends in the medical device industry and the synthetic control group in the post-reform period.

To implement the synthetic control method, we include in the set of industries that can be used to create the synthetic control group (known as the "donor pool") all

manufacturing industries that do not include medical device manufacturing.[10] For the set of descriptive statistics for which the weighted averages in the synthetic control should match the averages in the medical device manufacturing industry, we include the dependent variable in each of the years before the excise tax was imposed. [11]

To infer whether any post-reform differences are significant, we also follow Abadie et al. (2010) in performing placebo tests that iteratively apply the synthetic control method to every other industry in the donor pool (and where the medical device manufacturing industry is included in the placebo donor pools). In doing so, we create estimated "effects" for industries that did not face the excise tax. If the tax had a significant impact on the outcomes of interest, one would expect the difference trend for the medical device industry to lie above (or below) all (or most) of the placebo trends.

In our main specifications, we treat 2013 as being the first treatment year, as it was the first year in which the ACA's medical device excise tax was in effect. For these specifications to generate causal estimates of the impact of the excise tax on our variables of interest, it must be the case that the industries chosen to be in the synthetic control group accurately reflect what the trends in the medical device industry would have been absent the excise tax. Table 1 presents the industries that are used to form the counterfactual in each specification, along with the weight attributed to each of these industries.

However, one may be concerned that other parts of the ACA that expanded health insurance coverage (for example, the young adult mandate, the Medicaid expansion, the

[10] When doing the analysis at the 5-digit industry level, we exclude from the donor pool any 5-digit industry that includes one of the medical device manufacturing 6-digit industries. This results in the exclusion of industries 32541, 33451, and 33911.
[11] This method is implemented using the synth command in Stata.

creation of health insurance exchanges, or the individual and employer mandates) may have also expanded the demand for medical devices, which would be expected to counteract the effect of the excise tax. Even if the synthetic control states fit the trends in the medical device industry well in the pre-reform period, they might not represent a good counterfactual in the post-excise tax period if other provisions were also affecting the medical device industry. With the exception of the young adult mandate (which primarily came into effect in 2011), these provisions came into effect in 2014, and so one could view the effect in the second year of the excise tax as being a downward biased estimate of the full impact of the excise tax. However, one might still be concerned that part of the pre-excise tax period was also affected by other provisions of the ACA, and so any estimated impact on the medical device industry is not a pure excise tax effect.

Thus, as an alternative specification, we consider 2011 as the first treatment year, and consider the treatment to be the entire package of reforms in the ACA. In these specifications, the impact of the excise tax would be expected to show up in 2013.

4. Results

4.1 Main Specification

We first examine whether the ACA medical device excise tax increased the total tax liability of the medical device industry. Panel a of Figure 2 presents the trends in the medical device industry along with the trend in the synthetic control states, under the assumption that the treatment period starts in 2013. Looking across years 2007-2012, it appears that the synthetic control method has created a synthetic "medical device

industry" that matches the trend in tax liabilities in the pre-excise tax period. Looking at 2013 and 2014, those trends diverge substantially, with the synthetic control group remaining around $270,000 while the medical device industry increases to around $370,000 in 2013 and $430,000 in 2014. Panel b presents the estimated difference between the medical device industry and the synthetic control group, along with estimates from the placebo runs. In this graph, the estimated difference for the medical device industry is a clear outlier, suggesting that the increase in tax liability for the medical device tax is likely to be statistically significant. Table 2 summarizes these estimated effects, showing that the excise tax is estimated to have increased the tax liability of the medical device industry by $102 million in 2013 and $181 million in 2014, and that both estimates lie outside the 95% confidence interval of the placebo runs.

We now turn to an examination of whether the ACA medical device excise tax led to declines in output or employment. Figure 3 presents the trends in our six dependent variables (values of shipments, values of exports, number of employees, number of production workers, annual work hours, and annual wages) for the medical device industry and the synthetic control group. Across these panels, the synthetic control group tends to fit the pre-reform trends better for the employment variables than the output variables. However, for all of the outcome variables, the trend line for the medical device industry drops below that for the synthetic control group in 2014, and in some cases in 2013 as well.

Figure 4 and Table 3 quantify the estimated effects and compare these to the placebo runs. For the output variables, the value of shipments is not estimated to be significantly impacted by the excise tax in 2013, but is estimated to decline by almost $6

billion in 2014. The value of exports, on the other hand, is estimated to have declined by $547 million in 2013 and $1.74 billion in 2014. All three of these estimates lie outside the 95% CI of the placebo runs.

Given the declines in the value of shipments and exports, one might expect that employment in the medical device industry would also be affected, and these expectations are confirmed by the estimates in Figures 3 and 4 and Table 3. By 2014, the estimates imply that the number of employees in the medical device industry declined by 11,000 and the number of production workers declined by 14,500. Commensurate with these declines, annual hours of work among production workers are estimated to have fallen by 22.9 million hours and annual wages declined by $438.9 million. Again, all of these estimates lie outside the 95% CI of the placebo runs.

These results, then, imply that the medical devise excise tax negatively impacted the medical device industry, leading to higher tax liabilities, lower output, and lower employment and wages.

4.2 Alternative Specification

As noted above, one might be concerned that, during both the pre-excise tax and post-excise tax periods, the medical device industry may have been affected by other components of the ACA, and so the foregoing estimates might not be a clean estimate of the medical device tax per se. Thus, as an alternative specification, we consider 2011 as the first treatment year, and consider the treatment to be the entire package of reforms in the ACA.

Results for tax liabilities are presented in Figure 5 and Table 4. These results suggest that total tax liabilities actually declined relative to the synthetic control group in the first two years after passage of the ACA, but that by 2014, the total tax liability of the medical device industry was $35 million higher than it would have been absent passage of the ACA.

Results for output and employment are presented in Figures 6 and 7 and Table 5. These results tell a mixed story. The output variables exhibit a decline relative to the synthetic control group that is pretty consistent over the 2011-2014 period, with the value of shipments declining by around $14 billion to $18 billion and the value of exports declining by around $9 billion. Employment, on the other hand, does not exhibit an immediate decline, with the numbers of employees and production workers falling relative to the synthetic control only in 2014, by 13,000 and 3,000, respectively. Consistent with this, annual wages of production workers also only declines in 2014, by an estimated $239 million. Annual work hours, on the other hand decline relative to the synthetic control group starting in 2012, ultimately decreasing by 25 million hours by 2014.

Although the results in the alternative specification suggest some positive effects of the ACA on the medical device industry, by 2014 we find negative impacts across all of our outcome variables, with increases in tax liabilities, and decreases in output and employment.

5. Conclusion

The Affordable Care Act (ACA) levies a 2.3% excise tax on medical device manufacturers. This paper examines the impact of this tax on the medical device industry, using data from the Annual Survey of Manufacturers as well as U.S. International Trade data spanning 2007-2014.

Estimates from synthetic control methods suggest that, as theory would predict, the medical device excise tax negatively impact the medical device industry. Total tax liabilities for the industry increased by $100 to 200 million following the implementation of the excise tax, and output decreased by almost $6 billion. Workers in the industry also felt the impact of the tax, as total employment fell by 11,000 and the number of production workers fell by 14,500. Production workers' annual hours and wages all fell as well, with wages of production workers falling by $438 million.

These results are consistent in sign with the findings in Furchtgott-Roth and Furchtgott-Roth (2011) and Advamed (2014), who predicted employment declines of 33,000 to 43,000 jobs and a $3.5 billion decline in compensation, though our estimated effects are considerably smaller. Our employment decline estimates are about a third of theirs, and our wage declines are less than one seventh of their estimated payroll impact.

Though the excise tax has been suspended for 2016 and 2017, this moratorium is scheduled to lapse at the end of the year. In deciding to whether to reinstate or permanently repeal the tax, policymakers would do well to consider the negative output and employment effects that this tax generates.

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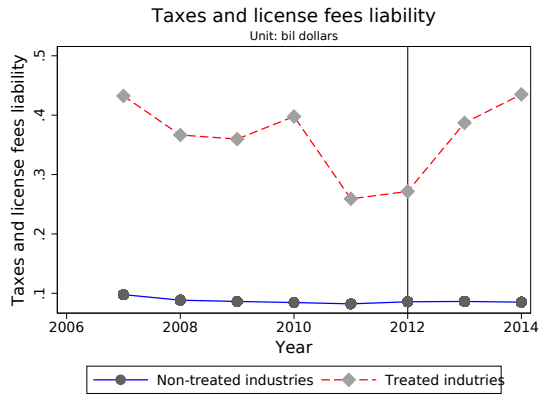
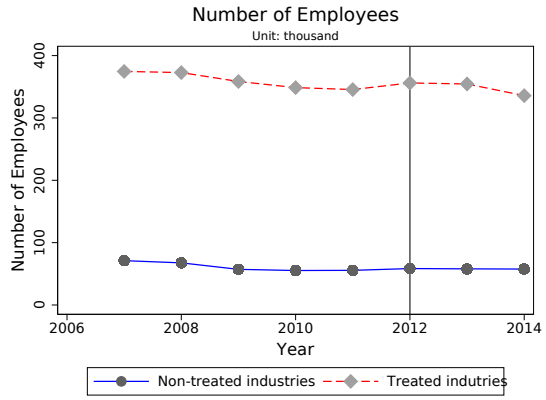
Figures

Figure 1. Time Trends in Medical Device vs. Other Manufacturing Industries

a.



b.



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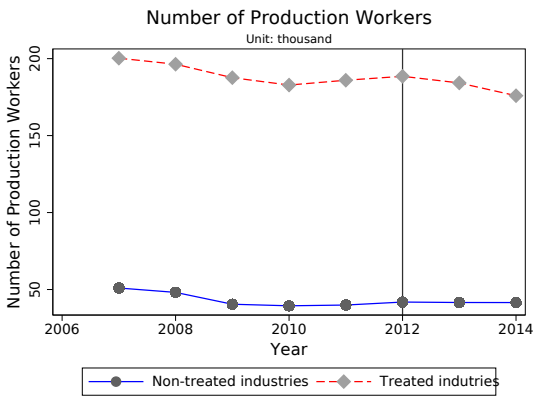

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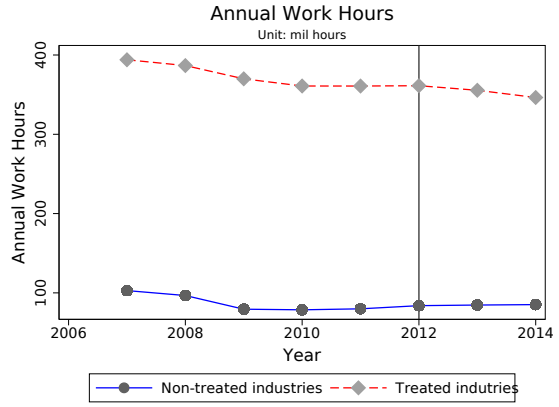

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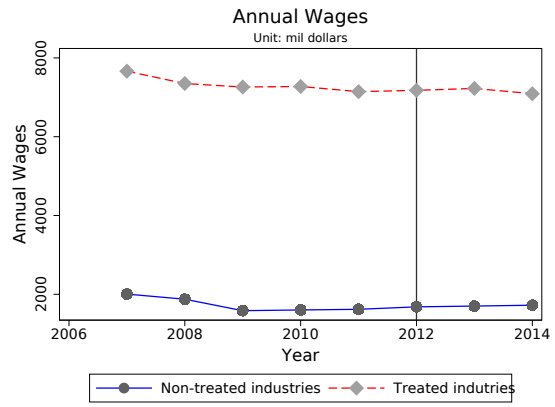

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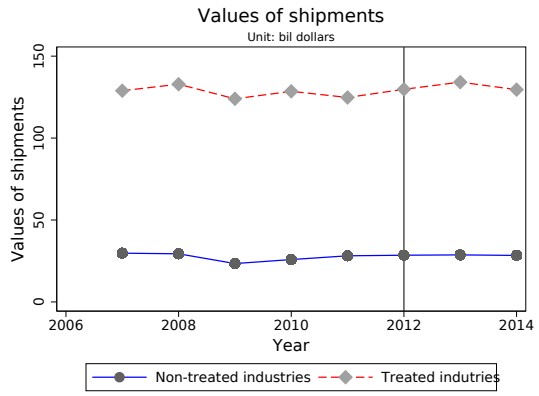
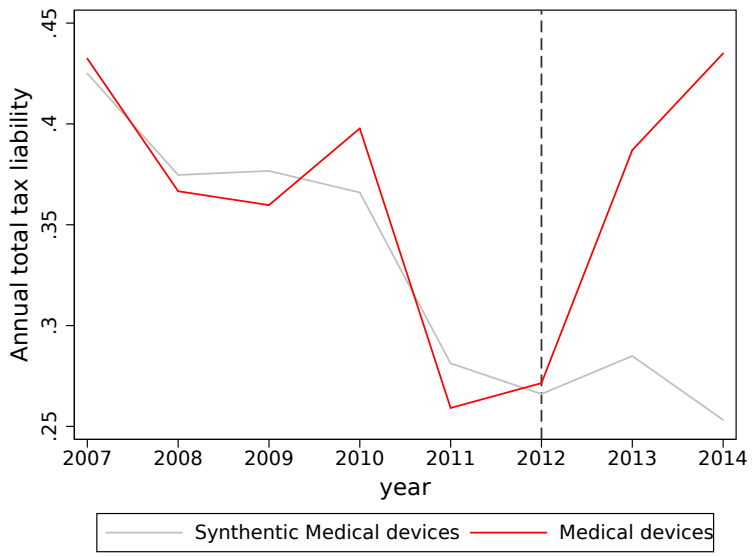


g.

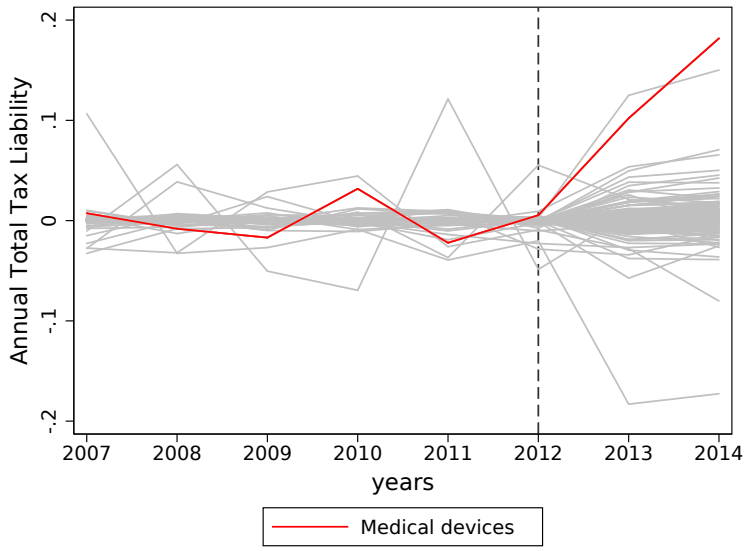
Notes: Data from Annual Survey of Manufacturers and U.S. International Trade data. All monetary values in 2010 $.

Figure 2. Impact on Taxes and License Fees - Assumed Treatment Year 2013

a. Trends in Medical Device Industry and Synthetic Control Group ($ billions)



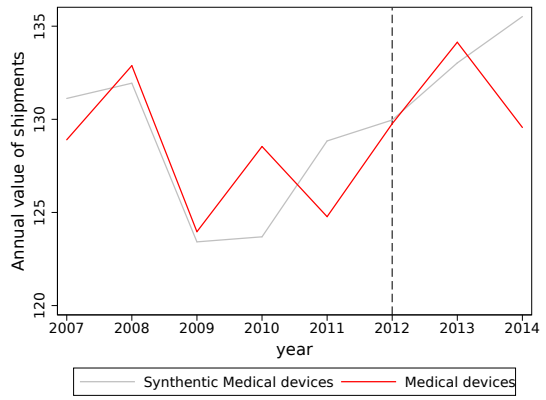
b. Estimated Impact and Placebo Runs ($ billions)



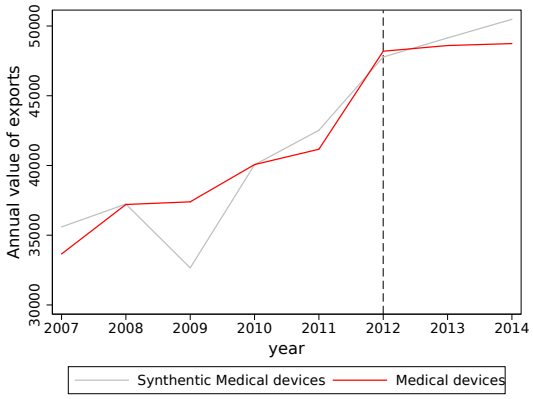
Notes: Data from Annual Survey of Manufacturers. All monetary values in 2010 $.

Figure 3. Impact of Excise Tax on Output and Employment – Assumed Treatment Year 2013: Trends in Medical Device Industry and Synthetic Control

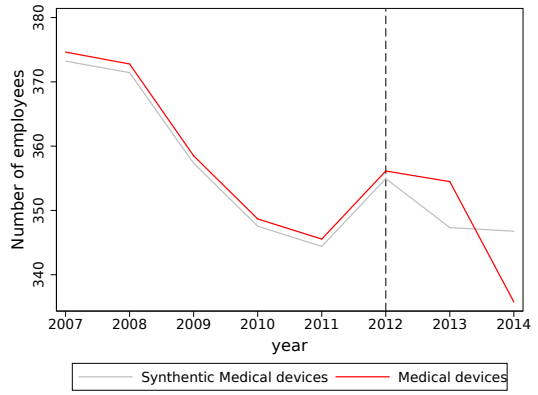
a. Value of Shipments ($ billions)



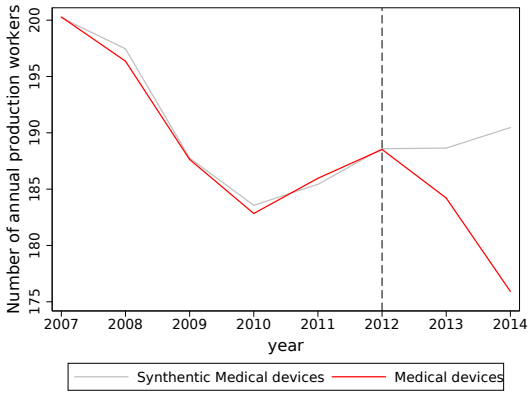
b. Value of Exports ($ millions)



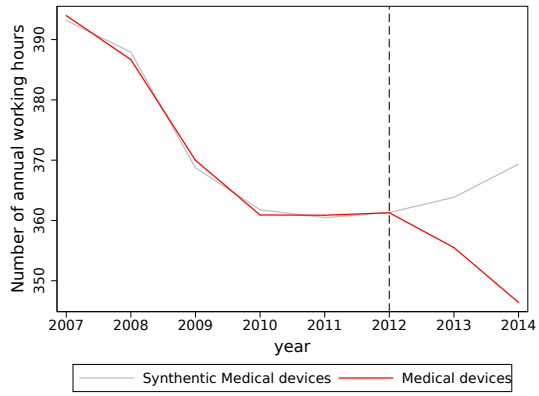
c. Number of Employees (thousands)



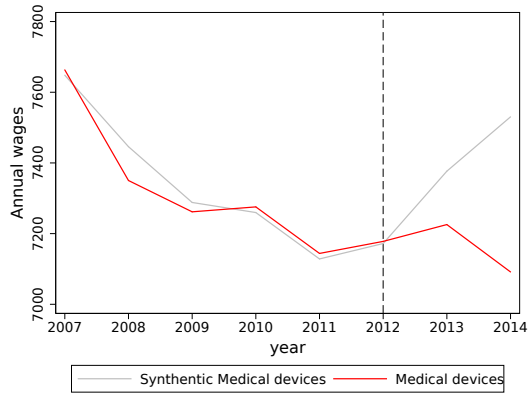
d. Number of Production Workers (thousands)



e. Production Annual Work Hours (millions)



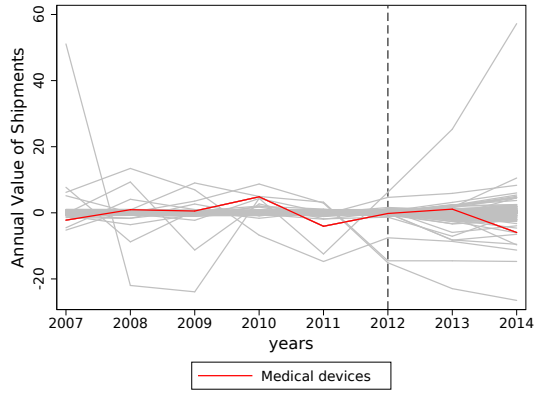
f. Production Annual Wages (millions)



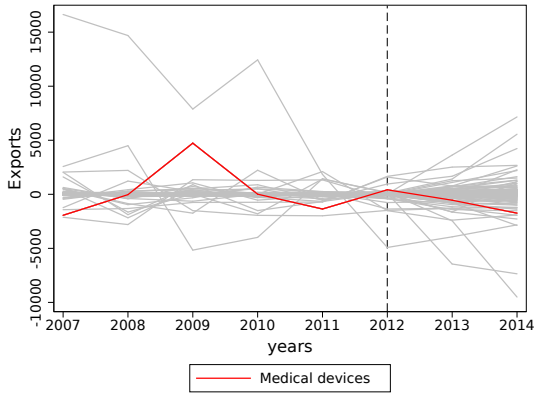
Notes: Data from Annual Survey of Manufacturers and U.S. International Trade data. All monetary values in 2010 $.

Figure 4. Estimated Impact of Excise Tax on Employment and Output and Placebo Tests – Assumed Treatment Year 2013

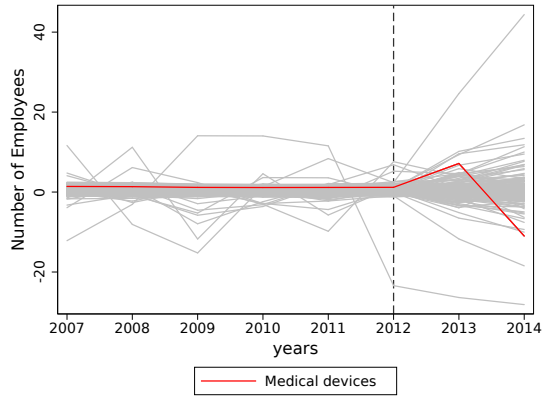
a. Value of Shipments ($ billions)



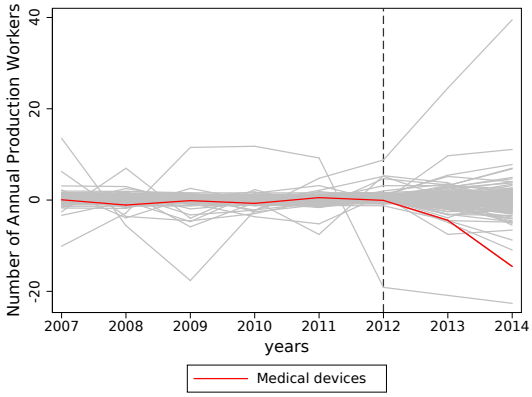
b. Value of Exports ($ millions)



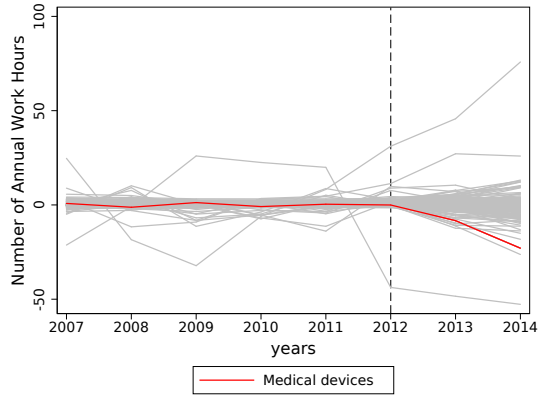
c. Number of Employees (thousands)



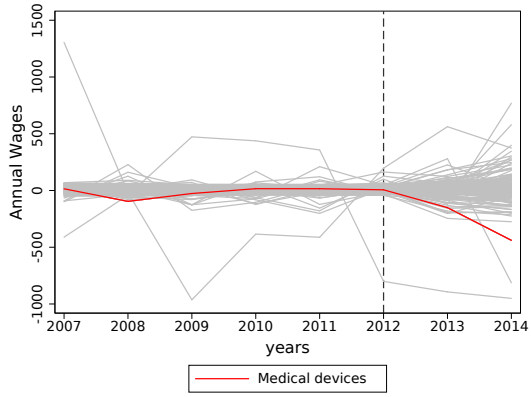
d. Number of Production Workers (thousands)



e. Production Annual Work Hours (millions)



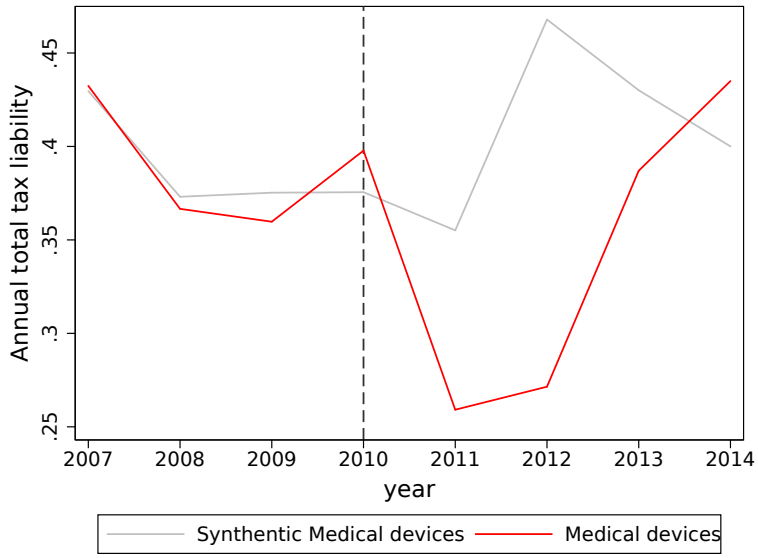
f. Production Annual Wages ($ millions)



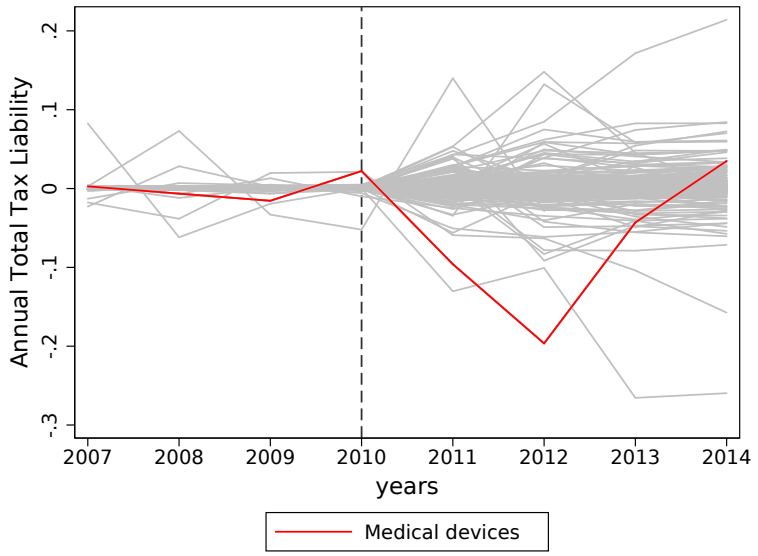
Notes: Data from Annual Survey of Manufacturers and U.S. International Trade data. All monetary values in 2010 $.

Figure 5. Impact on Taxes and License Fees – Assumed Treatment Year 2011

a. Trends in Medical Device Industry and Synthetic Control Group ($ billions)



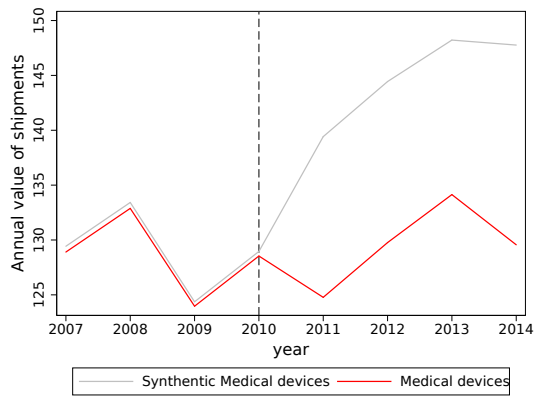
b. Effect of Affordable Care Act - Assumed Treatment Year 2011 ($ billions)



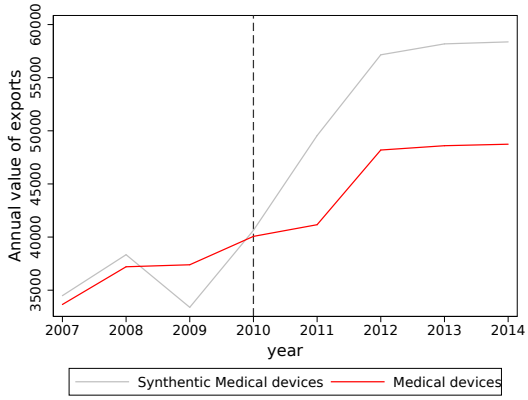
Notes: Data from Annual Survey of Manufacturers. All monetary values in 2010 $.

Figure 6. Impact of Affordable Care Act on Employment and Output – Assumed Treatment Year 2011

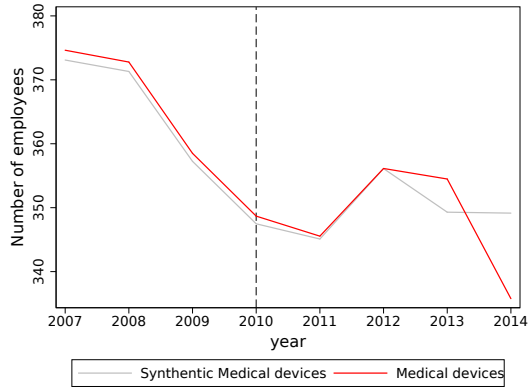
a. Value of Shipments ($ billions)



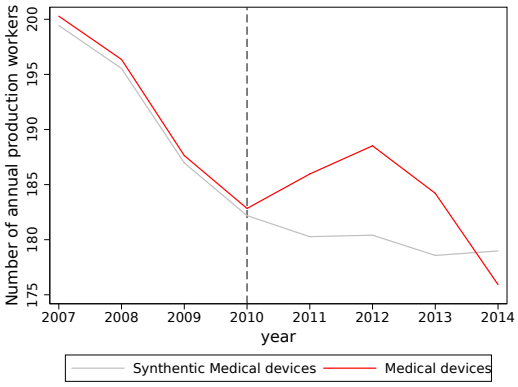
b. Value of Exports ($ millions)



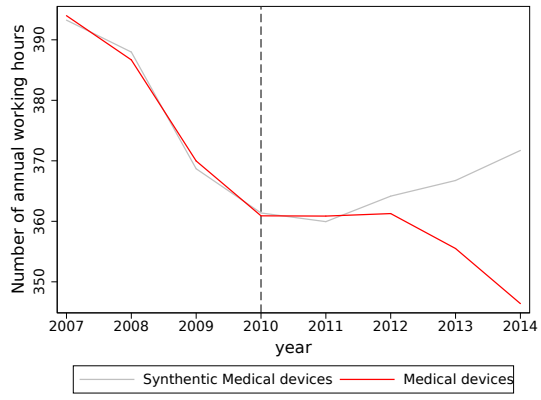
c. Number of Employees (thousands)



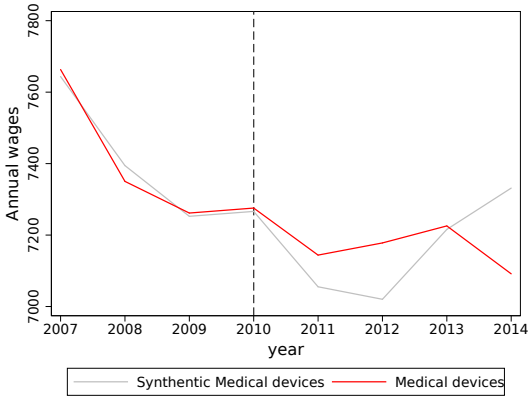
d. Number of Production Workers (thousands)



e. Production Annual Work Hours (millions)



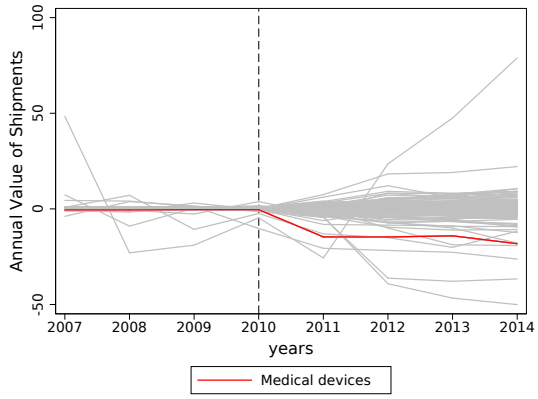
f. Production Annual Wages ($ millions)



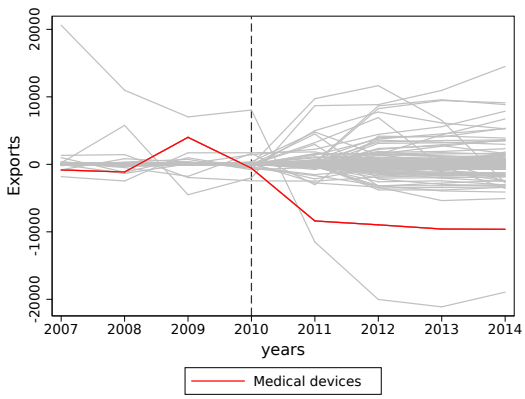
Notes: Data from Annual Survey of Manufacturers and U.S. International Trade data. All monetary values in 2010 $.

Figure 7. Impact of Affordable Care Act: Placebo Tests – Assumed Treatment Year 2011

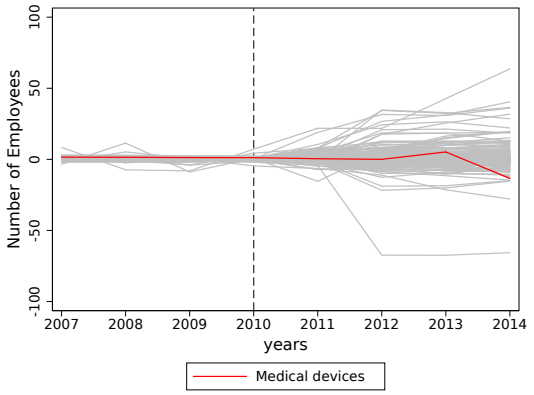
a. Value of Shipments ($ billions)



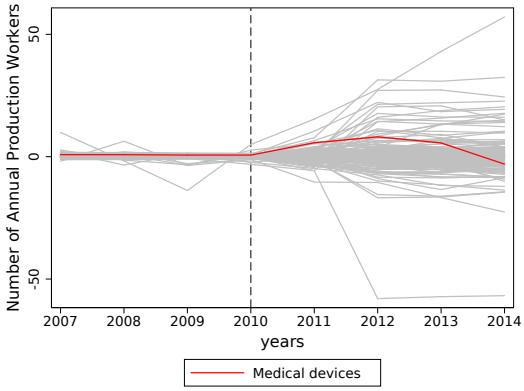
b. Value of Exports ($ millions)



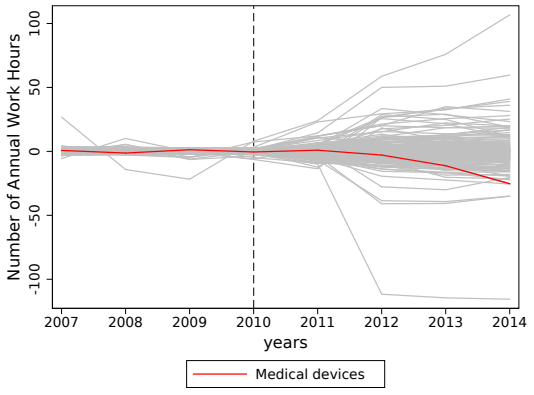
c. Number of Employees (thousands)



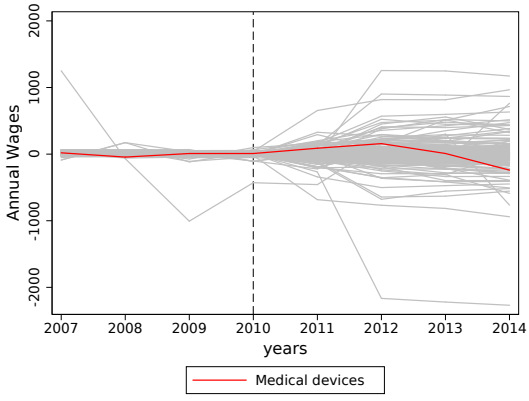
d. Number of Production Workers (thousands)



e. Production Annual Work Hours (millions)



f. Production Annual Wages (millions)



Notes: Data from Annual Survey of Manufacturers and U.S. International Trade data. All monetary values in 2010 $.