THE GE EXIT AND THE DECLINE IN EMPLOYMENT

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Abstract

On January 2016, General Electric announced it was moving its headquarters from Fairfield, Connecticut to Boston, Massachusetts. The political impact on the state of losing a storied, blue-chip manufacturing and technology conglomerate was significant. But what about the economic impact? In this paper we gauge the economic impact of GE's departure. Specifically, we examine the performance of Total Non-Farm Employment for the Bridgeport-Norwalk-Stamford area. We compare performance before and after January 16, 2016. We do so against the performance of the same series at the national level.

Over the period between January 2016 and February 2017, we find a cumulative decline of 66,000 jobs in the Bridgeport-Stamford-Norwalk Area. This is considerably more than the specific (and oft-cited) 200 jobs that GE moved to Boston.

However, while the impact on Total Employment measured above is statistically significant and attributable to GE, a simple glance at the time series reveals that the environment in Connecticut had turned for the worse prior to GE's announcement. Looking back via a formal statistical change-point analysis of the same Total Employment series we find statistical evidence that conditions did turn worse in the region in November 2013. Thus, we surmise that GE's exit was a company bailing a flailing ship.

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Grasping the GEXIT

The Europeans had their Brexit. The Greeks pondered a Grexit. The French considered the Frexit. Here in Connecticut we had the GExit: General Electric's January 2016 announcement that it would move its headquarters from Fairfield to Boston.

GE's departure from Connecticut was a "punch in the gut," as the Hartford Courant characterized it (Singer, Possible GE Departure Called a 'Glaring Black Eye' for the State, 2016). Combined with years of weak job growth in Connecticut and a sluggish economic expansion the Gexit became a powerful rallying cry for business groups and conservatives seeking to arrest the downward spiral and improve the "business climate."[1] Others dismissed the GExit as (relatively) inconsequential – primarily because the relocation, when all was said and done, was going to result in about 200 jobs leaving Connecticut, out of a workforce of 4,000.[2] Indeed, the "200 jobs lost" refrain seems to have cemented itself in our collective understanding as the sole consequence of GE's departure. This minimal number of jobs lost appears to deter any reckoning over the poor management of the state economy.

But did GE's departure cost us "only" 200 jobs? To be sure, the true effects are still to be fully understood (Zimmerman, 2017). But it is important to know the full impact of the Gexit because its true costs can serve to inform any future consideration of policies proposed by legislative leaders; policies likely to influence individual and business decisions. A cost benefit analysis of prospective legislation can only be consistently carried out if it contains a clear measure of the costs of our actions, alongside any purported benefits.

[1] For a good understanding of the fiscal and political situation in Connecticut today, see the 5-part series by Keith M. Phaneuf in the Connecticut Mirror [https://ctmirror.org/2017/01/30/a-legacy-of-debt-connecticut-standing-on-its-own-fiscal-cliff/]. See, also, the report titled, "Connecticut Economic Competitiveness Diagnostic," published by the Business Council of Fairfield County (April 8, 2016).

[2] Stephen Singer covering the Gexit for the Hartford Courant puts a positive spin on it with his title: "Despite Departure, GE Leaving 600 Jobs in Norwalk." (Singer, Despite Departure, GE Leaving 600 Jobs in Norwalk, 2016) Singer cites Mike Tetreau the first selectman of Fairfield downplaying the effects, "thankful the impact hasn't been worse;" and, a spokesperson for Governor Malloy eagerly setting forth a positive frame, "We are obviously thrilled that GE will be keeping the vast, vast majority of its headquarters jobs in Connecticut."

In this study, we report our efforts at gauging the impact on employment of GE's departure from its long-time home in Fairfield County, Connecticut. We describe the methodology and derive some results. Specifically, we examined Total Non-Farm Employment in the Bridgeport-Stamford-Norwalk region. This is the region where GE was once headquartered. Succinctly, we find that the impact on total employment was considerably higher than the "200 jobs" that is often tossed around.

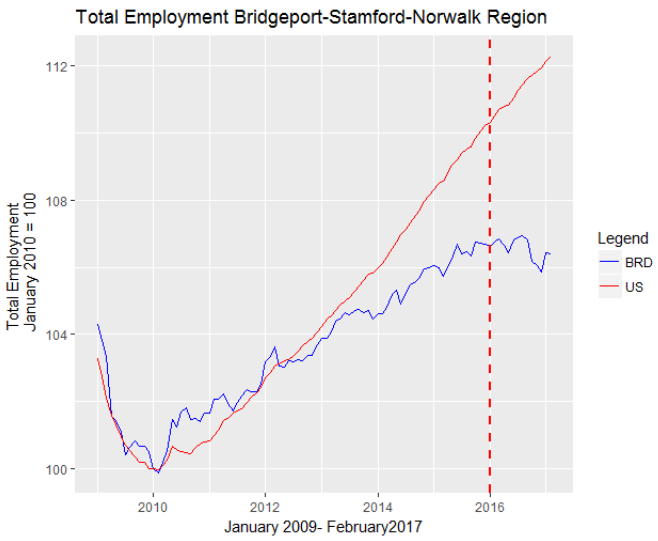
Appraising Impact: The Scope of the Study

Impact is an elastic concept, so it is important to delineate the features and scope of this study. We look for the effect of the GEXIT on Total Non-Farm Employment in the Bridgeport-Norwalk-Stamford region; the region that housed GE headquarters. More precisely we examine the impact of the Gexit on Total Employment before and after January 2016 for the Bridgeport-Norwalk-Stamford (BRD) region. The Bridgeport-Stamford-Region is the 58th largest in the nation with a combined population of approximately 948,053.[3]

Impact and performance are all about comparisons. To what we compare performance of employment in the region examined is a key feature of the analysis; perspective changes with the benchmark. We look at the performance of Connecticut variables relative to its equivalent at the national level. This, in effect, benchmarks Connecticut's performance to that of the US. We then examine whether there is any difference in the performance of the selected variables before and after January 2016. Figure 1 shows Total Employment for the Bridgeport-Norwalk-Stamford ("BRD") region and for the United States for the period January 2009 through February 2017.

[3] https://datausa.io/profile/geo/bridgeport-stamford-norwalk-ct-metro-area/

Figure 1



The BRD region is where GE's headquarters were located; data is Bureau of Labor Statistics data, seasonally adjusted and rebased to equal 100 in January 2010. The vertical dashed line is set at January 2016, the date of the Gexit announcement.

Two features stand out. First, the US has dramatically outperformed the region over the last three or four years; and second, CT appears to have taken a turn for the worse before the January 2016 Gexit announcement.

With these observations in mind we fit a model on data before January 2016 using the US as a covariate; the model is a dynamic structural time-series model as outlined by Broderson et al, and earlier by Scott & Varian (Broderson, Galluser, Koehler, Remy, & Scott, 2015) (Scott & Varian, 2014) (Scott & Varian, 2013). We use that model to construct a forecast of what each of the series would have been had GE not left town (known as a "but-for" or a "counterfactual" forecast). The difference between actual performance and expected (forecast) performance over the subsequent twelve months is cumulated. If the difference between actual and expected is statistically significantly different at the 10 percent level of significance we conclude that there was an impact and the cumulated amount stands as its measure. Thus, we are able to estimate the cumulative impact over a year after the Gexit, specifically, from February 2016 through February 2017.

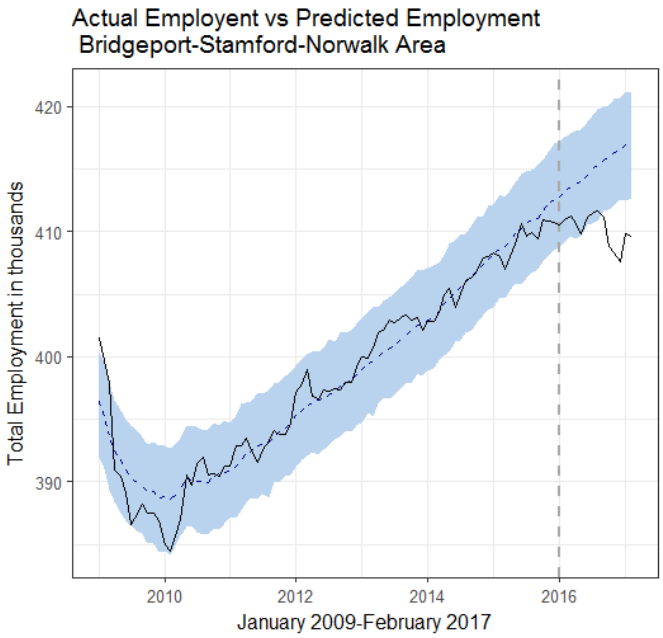
The Gexit announcement had a statistically significant impact on Total Non-Farm Employment. Our results suggest that the impact of the Gexit went far beyond the 200 jobs announced. The GE departure amounted to over 60,000 cumulative jobs lost.

Appraising Impact: Methodology

We measure the impact of GE's January 2016 announcement that it was moving its headquarters from Fairfield, Connecticut to Boston, Massachusetts. The approach turns on measuring the event's impact on an outcome metric of interest. The causal impact of an event (the treatment) is the difference between the observed value of the response and the unobserved value (the counterfactual) that would have occurred but for the event (the effect of treatment on the treated) (Morgan & Winship, 2014).

Figure 2 displays two time-series. The first, the darker, thicker line, is the original BRD employment data. The second, dashed times series is the predicted estimate of a statistical model fit on historical data for the BRD region and using US employment as a covariate. The vertical dashed line is January 2016, the date of the Gexit announcement. To the right of the vertical line, the period after the announcement, the line representing *predicted* Total Employment and the line representing *actual* Total Employment diverge. The monthly difference between the two series represents the jobs that would have existed but-for the Gexit. The cumulated sum of this difference represents the total impact of the GE move and the amount we report here.

Figure 2



The key to assembling a successful counterfactual, rests with three sources of information. The first is the time-series behavior of the outcome variable itself, prior to the event date. The second is the behavior of other time series that were predictive of the outcome series prior to the event, the control series. Such control series can be based on the same series for a region or area distinct from the examined one. But the key feature of the analysis is that the control variable need not be affected by the event. As long as the control series was not impacted by the event, it is reasonable to assume the relationship between the outcome variable and the control series that existed prior to the intervention will continue afterwards.

Appraising Impact: Results of the Gexit

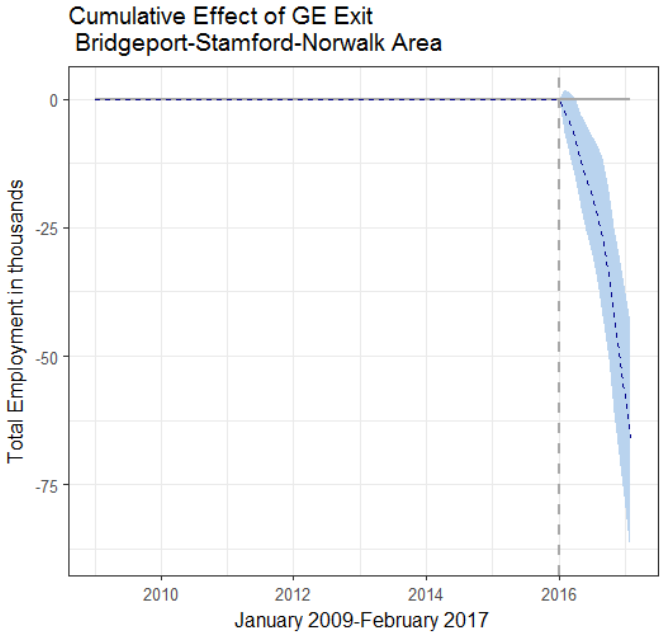
Table 1 provides summary results of the cumulative impact of the Gexit. All results obtained are statistically significant as can be seen on the fourth column where the significance threshold is 10 percent. The results also indicate that the event has a high posterior probability of a causal effect (not shown).

Table 1
Measured Cumulative Impact of the Gexit: January 2016 – February 2017

Economic Series	Cumulative Change, percent	Cumulative Change, Total	one-sided p-value
Total Employment, Bridgeport-Stamford-Norwalk (NECTA)	-1.2%	-66,000	0.001

Figure 3 is a visual depiction of the cumulated jobs lost in the region, following the announcement of GE's departure on January 2016. This amounts to a cumulative loss of 66,000 jobs.

Figure 3



During the post-intervention period, the outcome variable, Total Employment, had an average value of approximately 410,000 people employed in the BRD region. By contrast, in the absence of the GE announcement, we would have expected an average response of 415,000. Subtracting this prediction from the observed response yields an estimate of the causal effect the Gexit had on Total Employment in the region (-5,100 monthly jobs) – on average.

The cumulative amount of Total Employment is obtained by adding up the individual monthly data points during the post-Grexit period. The cumulative Total Employment amounted to 5322. By contrast, had the intervention not taken place, we would have expected Total Employment to sum to approximately 5398. These numbers are in thousands. This effect amounts to a *loss* of 66,000 jobs in absolute terms.

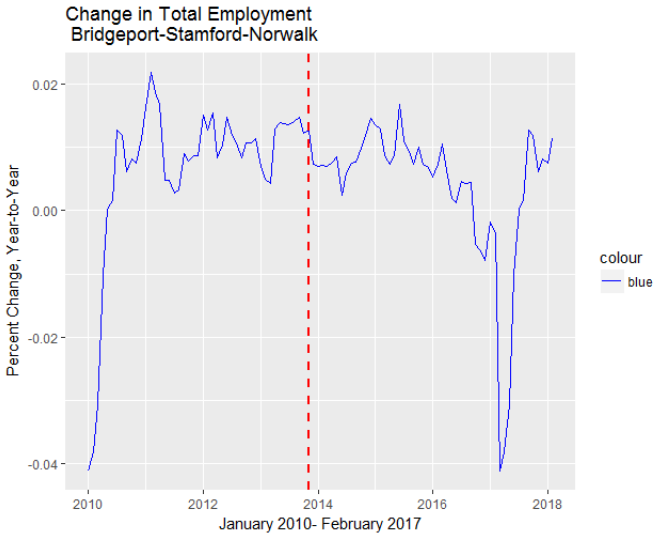
In relative terms, the response variable showed a decrease of -1.2 percent. The negative effect observed during the intervention period is statistically significant. The probability of obtaining this effect by chance is very small (Bayesian one-sided tail-area probability p = 0.001). This means the causal effect can be considered statistically significant.

Change Point Analysis

When exactly did the region's fortunes turn? Economic activity had been declining in the region (and in Connecticut) prior the GE announcement. A change-point analysis estimates the location of any change-points that may exist in the employment series together with the underlying change probability between change-points.[4]

We look at Total Non-Farm Employment historical data to identify change-point or points in the series. Figure 3 shows the Percent Change from Year to Year for the Total Employment Series for the Bridgeport-Norwalk-Stamford region.

Figure 4



[4] There are several change-point methods in use across several fields. Chib models the underlying latent state as a discrete time, discrete state Markov process (Chib, 1998). Hawkins develops maximum likelihood estimates of change-points and associated parameters (Hawkins, 2001). A more common method and the general one we use in this study relies on partition models (Barry & Hartigan, 1993) (Loschi, Pontel, & Cruz, 2010) (Killick & Eckley, 2014).

We identify at least one significant break in the series: November 2013. This can be seen in the Figure 4 as a red, vertical, dashed line.

Notwithstanding the statistically significant change-point identified it is difficult to attribute the subsequent downturn to whatever event can be associated with this date - exclusively. The roots of the realized poor performance could lie elsewhere and certainly be more than one. Tellingly, there seem to be plenty of underlying reasons – and, of course, opinions - for the seeming secular decline in Connecticut's fortunes; we received comments from readers of our first draft suggesting the following as possible culprits, in no special order: the Weicker imposition of income tax on wages; the Grasso-O'Neill political climes in which Connecticut empowered municipal and state bargaining units and became their de facto bargaining agent; the choking of the financial industry once thriving in Stamford by the post-great-recession regulatory excesses of Dodd-Frank, the re-election of governor Malloy and the subsequent increase in taxes and spending for the biennial budget 2015-2017.[5] Again, all of these events may have a bearing; all may not.

Some Caveats

[5] See, e.g. https://www.nytimes.com/2015/07/26/business/dealbook/wall-street-pulls-in-its-horns-in-connecticut.html?_r=0

Second Order Effects

The impact on a particular region following an event like the Gexit may take time to appear. It's been a bit over a year since the announcement. And there may be consequences still to come. The effects recorded here may increase, or not. In addition, impact can encompass indirect effects on the same variable as well as direct and indirect effects on other economic variables; the question becomes one of where to delimit the concentric circles representing levels of impact. For instance, the Gexit may have spooked prospective entrepreneurs or investors who were considering establishing operations in the state; or perhaps pondering an expansion of their operations. These second order effects may increase over time – especially with no discernible, credible response from Hartford. In still another possible wrinkle, impact could be distorted by the influence of a third factor that is affecting the economy at both the county, state, and national level; the national election comes to mind, which may have asymmetric consequences on our state relative to the United States. Clearly, this is an influence that is not being controlled for in this study.

The US as Control Variable

The selection of the control or benchmark variable is a key element of the results obtained. We chose the United States as the control variable. This entails an expectation that Connecticut should perform at least as well as the US. As long as the control series was not impacted by the event studied, it is reasonable to assume that the relationship between the US and Connecticut that existed prior to the event to continue afterwards. Historically, Connecticut was more likely than not, to resemble the United States' economic performance.

The Propagation Mechanism

What was the propagation mechanism that resulted in 66,000 jobs lost? We don't address this question directly in this study but we conjecture that the sentiment noted by the various commentators and critics may have broad resonance. For instance, comments by Fred Carstensen a noted analysist and academic underscore the negative signaling and damaging reputational consequences. Cartensen characterizes the GE departure as: "very, very damaging," and "it will underline for every business looking to come to Connecticut the problematic environment." Don

Klepper-Smith another well-known economist in the state notes that the impact could be more than psychological and, in January 2016, presciently noted that the loss of headquarters jobs "could lead to the loss of other jobs, such as manufacturing work dependent on GE." (Singer, Possible GE Departure Called a 'Glaring Black Eye' for the State, 2016).

Technical Tweaks

Several commentators of earlier drafts of this report mentioned the possibility that the "GE effect" may have commenced operating several months and even years before the announcement date -suggesting that the observed job deterioration may have started much earlier. We agree; moving the announcement date backwards in time does increase the jobs-lost measure while remaining statistically significant.

Another commentator suggested that our reliance a 10 percent significance was uncommon. However, the significance level proved inconsequential. Registered p-values were in the hundredths.

The measure of the but-for is somewhat model dependent. In addition to the model we report, we also modeled the counterfactual with an ARIMAX model, an exponential smoothing model, a linear model and a differences-in-differences model. The associated cumulative amount of jobs varies depending on the model selected - but it proved to be considerably larger than 200 jobs lost every single time.

Concluding Comments

In reality it is unlikely that GE can be held solely responsible for the 66,000 jobs lost in the region. GE did not "cause" this job lost. There is plenty to suggest that the Connecticut economy had been deteriorating rapidly for several years now – leading to the deteriorating job performance: our change point analysis attests to this. What we can be sure of is that the impact was considerably more than the 200 jobs GE specifically moved away.

A full impact of GE departing may still be unwinding and a complete assessment may require time to let all the political and economic effects play out. Fully understanding the downsides of these events are necessary to inform the tallying of costs and benefits of political actions and political decisions. An effective democracy demands government accountability whereby elected and non-elected officials are obliged to publicly explain their decisions, actions, and, critically, the consequences of these decision and actions.

Our results suggest that GE's departure announcement in January 2016 had a significant impact on Total Employment in the Bridgeport-Norwalk-Stamford region, an impact far beyond the 200 jobs directly impacted by GE's move.

As should be clear, the degree to which we can attribute causality relies on the strength of our underlying assumptions and the methodology used. Specifically, that our control variable is unaffected by the Gexit; put differently, that the relationship of the control variable to the examined variable, Total Non-Farm Employment in Connecticut is unchanged. All causal impact analyses are limited in their ability to identify external properties or forces that might have played a role in the changes observed.

In our case, our current analysis cannot, for example, identify secondary and nonlinear effects derived from the Gexit that are yet to emerge. In addition, we do not factor any endogenous actions undertaken by decision-makers in the BRD region in response to the Gexit. However, if such an external factor does have a significant effect, then our causal impact analysis may detect it in a subsequent examination.

Our change point analysis suggests that the state took a turn for the worse around November 2013, a trend that apparently continued into 2016. This suggests that GE's departure from Connecticut may have been simply a studied move in anticipation of worsening state economic and fiscal conditions.

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Appendix

The model we use is a stochastic generalization of the classic constant-trend regression model where each of the model components is recast as stochastic. Specifically, the following structural time series model (state space model) is created for the pre-intervention period:

$$Y_t = \mu_t + \beta x_t + e_t$$

$$\mu_{t+1} = \mu_t + \eta_t$$

$$e_t \sim N(0, \sigma^2)$$

$$\eta_t \sim N(0, \sigma^2)$$

Where:

x_t denotes the control variables (regions) we use; in this study we use the United States; and,

μ_t is the *local level* term.

The local level term defines how the latent state evolves over time. μ_t is often referred to as the *unobserved trend*. The linear regression term, βx_t, "averages" over the selected control markets. We initially train a Bayesian structural time-series model on the Total Employment data using a set of unaffected data vectors unaffected by the GE event; this is our control set. We use US and Maine Total Non-Farm Employment as our control set. Once this model is fit, the algorithm creates a synthetic control series by predicting the values for the post period and then compare to the actual values to estimate the impact of the event. Posterior intervals are created through sampling in a pure Bayesian fashion.

We use the CausalImpact R package of Broderson, Gallusser, Koehler, Remy, and Scott to estimate the causal impact of the January 2016 announcement on Total Non-Farm Employment.

We use the R package bsts of Steven L. Scott to deploy an initial econometric model subsequently passed to CausalImpact.

We use the R package BreakoutDetection and Killick and Eckley's changepoint package to identify the location of changepoints.

Data Sources

Total Nonfarm Employment in Bridgeport-Stamford-Norwalk, CT (NECTA), Monthly, Seasonally Adjusted Source: Federal Reserve Bank of St. Louis (Series ID: BRID909NA)

All Employees: Total Nonfarm Payrolls, Monthly, Seasonally Adjusted
Source: Federal Reserve Bank of St. Louis (Series ID: PAYEMS)