WHY COMPANIES INVERT AND WHAT LEGISLATORS DO ABOUT IT

A MODEL OF A FIRM'S DECISION TO INVERT AND THE IMPACT OF THE 2004 JOBS ACT

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Abstract

I model a company's decision to invert overseas, using company size, industry, intangible asset intensity, and foreign income intensity as the parameters of interest. Then, using the 2004 JOBS Creation Act as a touch point, I analyze the effect that legislation has on the size of companies that invert. By determining the effect that the 2004 JOBS Creation Act had on inversions, I am able to gain insights about the nature of firms that invert and, by proxy, the cost and benefits that firms weigh during an inversion decision. These insights inform my logit model, where I estimate the probability of a firm inverting.

Ultimately, I hope to answer two questions: how do inverting firms differ from their non-inverting counterparts? Does legislation have an impact on these characteristics? If so, how? By highlighting factors important to company's decision to invert and the effect size of these factors, I hope to inform the policy debate.

1. Introduction

Corporate tax inversions—the process by which a U.S.-based company reincorporates in a foreign country—are, according to a 2014 estimate by the Joint Commission on Taxation, responsible for the loss of $19.5 billion in tax revenues over the next decade (Joseph Walker, 2014). These events have been the subject of much popular, academic, and legislative debate.

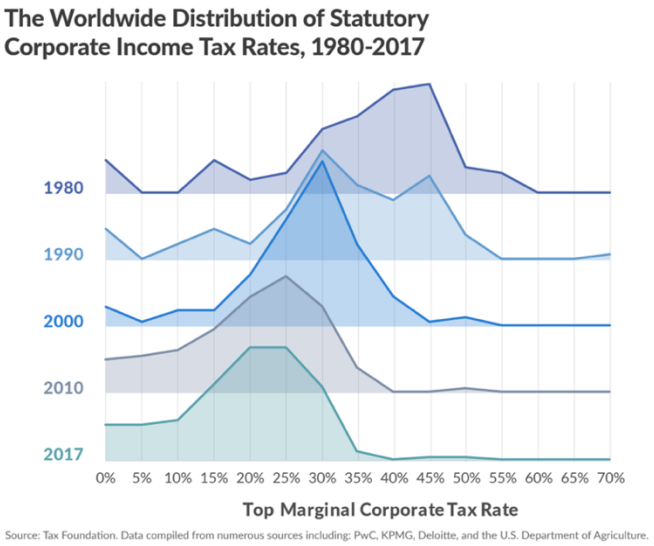

Figure 1

Among the incentives that push companies to invert, the chief reasons are to lower the effective tax rate of the firm, increase financial flexibility, and facilitate earnings stripping. Before the Tax Cuts and Jobs Act of 2017[1] (officially known as "An Act to provide for reconciliation pursuant to titles II and V of the concurrent resolution on the budget for fiscal year 2018"), the United States had the highest statutory corporate tax rate in the OECD (38.92%), a rate that has not significantly changed since 1980. In contrast, globally there has been a worldwide lowering of corporate income tax since 1980, with the global unweighted average falling 41% from 38.68% in 1980 to 22.96% in 2017. In general, countries have moved towards rates below 30%, with the greatest reduction in rates coming from 2000-2010 (Pomerleau) (Figure 1). The countries I focus on—the countries that inverting firms relocate to—experienced a similar reduction in rates[2] (Figure 2).

Several features are notable about the trajectory of tax rates depicted in Figure 2: the overall decline in the average rate (denoted by the bold black line) from 30% to 18%, the relative stagnation of the U.S. rate after 1986 (denoted by the bold red line), and the steep decline of Ireland's rate (denoted by the bold yellow line). Such a contrast in the United States' corporate income tax, as compared to other countries, partially explains companies' decisions to invert—especially the high volume of inversions (16 total, excluding spinoffs) to Ireland, which lowered its rate from 45% in 1981 to 12.5% in 2003. Unsurprisingly, Bermuda's 0% corporate tax rate has attracted 17 inverting firms.[3]

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[1] The Act, passed in December 2017, lowers the statutory corporate tax rate to 21% (Pomerleau and Potosky, 2016).

[2] This graphic omits Panama, Singapore, Israel, and Luxembourg, for which data are not available until after 2003. Jersey, Bermuda, Cayman, and the British Virgin Islands all sit at the x-axis because of their 0% corporate income tax rate. The time frame that this graph spans (1981-2015) approximates the time frame that I am looking at inversions (the first inversion was in 1982; the last inversion took place in 2016).

[3] These graphs do not capture the various loopholes and intricacies of each country's tax code. For example, Jersey taxes *most* companies at a 0% corporate tax rate, but taxes financial services firms at a 10% rate and utilities at a 20% rate as of 2018 ("Taxation in Jersey," 2018). In a particularly resourceful maneuver utilized by the technology

The United States also (prior to December 2017) operated on a worldwide system of taxation, which required corporations pay US taxes on both domestic earnings (at the US corporate tax rate) and foreign earnings[4] (Dittmer). However, firms could defer paying U.S. taxes on their foreign earnings by delaying repatriation of said earnings. Upon repatriation, the firm was obligated to pay the difference between the U.S. tax rate and the foreign tax rate (a so-called "repatriation tax") (Gunn).

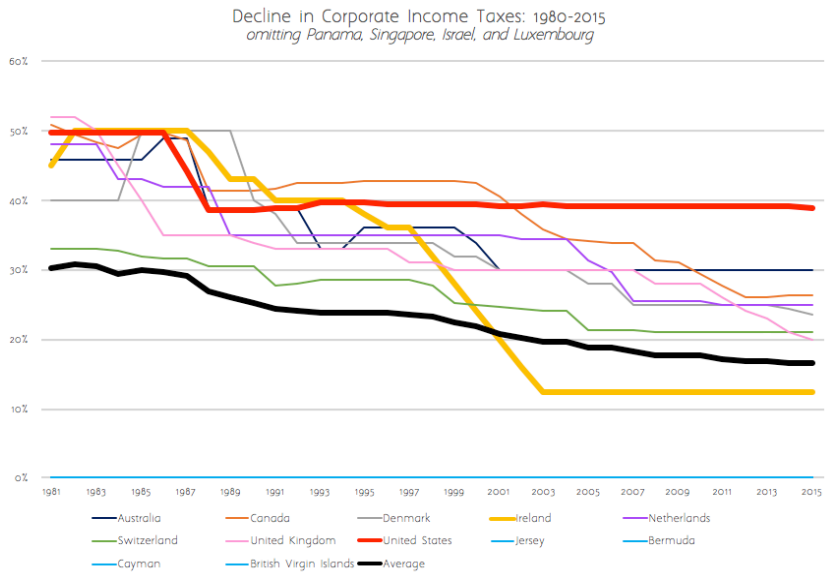

Figure 2

Firms find these repatriation taxes, which average around 13.38% (Gunn and Lys, 2016) to be simply too steep a cost to repatriate funds, leading to inefficiencies in financing. Inverted firms thus enjoy more financial flexibility than their non-inverted counterparts. In "Repatriation Taxes and the Value of Cash Holdings," Chen (2014) concludes that repatriation taxes cause foreign earnings to be "less accessible," causing "internal financing frictions." They also "motivate excessive investments in financial assets, for which the rate of return is usually lower than firms' cost of capital."

While non-inverting multinationals can (and do) lower their effective tax rate by never repatriating funds, in "Corporate Inversions: a case of having the cake and eating it too?" (2015) Felipe Cortes et. al find that firms that invert, on average, lower their effective tax rate by 7-8% (as compared to the multinational counterparts), thus showing that inverting allows corporations to lower their effective tax rate with more ease than their counterparts.

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industry, called the "Double Irish with a Dutch Sandwich," a U.S. company can route profits through an Irish subsidiary by paying royalties on patents that the Irish subsidiary owns. If this Irish subsidiary's management is located in a tax haven (such as Bermuda), it doesn't have to pay any taxes on these profits. If the product is sold overseas, the profits are sent to a second subsidiary. These profits are then transferred through the Netherlands (due to agreements that allow for tax-free inter-European transfers), then back to the first Irish subsidiary, which sends the profits to its management's tax haven ("Double Irish", 2012). The Double Irish with a Dutch Sandwich is just one of many loopholes that companies take advantage of while conducting business overseas that distort the statutory corporate tax rates described above. However, these graphs do give us a general idea of the environment in which these firms operate.

[4] The Tax Cut and Jobs Act shifts the United States to a territorial system, which only taxes businesses on income earned on U.S. soil.

Inverted firms also take advantage of earnings stripping, a process whereby the firm reduces the amount of domestic income tax payable. This can be accomplished in several different ways. Common methods include the domestic subsidiary taking a loan out from the foreign parent then paying interest on these loans and deducting the interest expense from its domestic tax return; the domestic subsidiary transferring an intangible asset, such as a patent, to a foreign parent then paying the foreign parent to use the the asset and deducting the expense from its domestic tax return; and the domestic subsidiary stripping earnings by expensing items such as advertising and research and development to the foreign parent (Gunn and Lys). Thus, net taxable domestic income is reduced, even though the overall company's level of debt stays constant—money is simply being shifted around within the company. This behavior is quite common: "According to the Treasury report on inversions, 'a feature common to many inversions is the presence of substantial indebtedness from the former U.S. group to the new foreign parent or one of its foreign subsidiaries'" (Brumbaugh 6).

Inverting can be costly. Inversions are far from popular—Pfizer's planned merger with Allergan, which would result in the pharmaceutical giant relocating to Ireland, was decried in the press and ultimately halted (Humers and Pierson, 2016). Cortes et. al also note that inverted firms are more likely to be acquired for less than they are asking (larger bid-ask spread) and that investors value the firms lower than firms with similar financial statistics[5]. They conclude that "firms less dependent on market liquidity and valuation should invert" (p.6).

I will further investigate the costs and benefits of inverting and how they evolve through time in order to answer two questions: how do firms that invert differ from firms that do not invert? How does legislation affect these characteristics? In order to answer these questions, I conduct a study of all inverted firms (using a definition of inversion adopted from Zachary Mider of Bloomberg, which he crafted while he was reporting his Pulitzer Prize-winning piece "Tracking Tax Runaways"):

- A U.S.-based company reincorporates abroad while maintaining majority ownership or
- A U.S.-based company "acquires a foreign address through other means, such as a sale to a leveraged-buyout firm"[6]

First, I describe the costs and benefits of inverting for these firms quantitatively by describing their global profit equation. Then, I give a brief overview of the legislative history of inversions, with a focus on Section 7874 of the 2004 American JOBS Creation Act, elaborating on how this legislation could affect a multinational firm's optimization problem. Next, in my data selection, I review how I collected my sample and cleaned my data. I then describe my empirical model, a logistic regression predicting the likelihood of inversion and t-tests examining

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[6] While Mider includes spinoffs of inverted firms in his list of "corporate expatriates," I exclude them from my paper because I am interested in the characteristics of firms pre (not post) initial inversion.

the effect of legislation on characteristics of inverting firms. I also outline the motivation behind my variable selection. I describe and discuss the results of the model. I then perform an analysis of the effect of the 2004 JOBS Act on the characteristics of inverting firms using t-tests and other measures of statistical significance. Finally, I conclude with a note about policy implications.

2. Costs and Benefits of Inverting: An Empirical Model

To begin our analysis of inverting firms, we write out the global profit equation of a multinational firm:

$$\pi^G = (\pi - r\beta)(1 - t) + (\pi^* + r\beta)(1 - t^*)\lambda$$

where

$\boldsymbol{\pi^G}$	*global profits*	$\boldsymbol{\pi}$	*domestic profits*	$\boldsymbol{r}$	*interest rate*	$\boldsymbol{\beta}$	*Amount borrowed by the domestic company from the foreign company*
$\boldsymbol{t}$	*domestic tax rate*	$\boldsymbol{\pi^*}$	*foreign profits*	$\boldsymbol{t^*}$	*foreign tax rate*	$\boldsymbol{\lambda}$	*Scale variable representing the value of dollar overseas. <1 for non-inverting firms, =1 for inverting firms*

This model relies on the following assumptions:

- Non-inverting multinational firms will value a foreign dollar less because it is inaccessible to them domestically ($\lambda < 1$).
- Inverting firms are available to repatriate foreign profits without facing a repatriation tax, thus the value of a dollar overseas will be equivalent to the value of a dollar domestically ($\lambda = 1$).
- The domestic tax rate is greater than the foreign tax rate, $t > t^*$.

β, the amount borrowed by the domestic company from the foreign company, captures the earnings stripping behavior described in the introduction. When β indicates loans from the foreign company to the domestic company, r is assumed to be the interest rate on those loans. When β indicates earnings stripping through the use of intangible assets—for example, patents—$r\beta$ represents the royalty payments paid from the domestic company to the foreign firm to use those assets.

Holding β constant, π^G is maximized according to the following derivative:

$$\frac{d\pi^G}{d\beta} = r((1 - t) + (1 - t^*)\lambda)$$

r is the multiplier for the marginal return—the higher it is (indicating a high interest rate on a loan or high royalty payments for use of an intangible asset), the greater the marginal return on β and the more profitable earnings stripping behavior is for a multinational firm. Firms can further

increase the marginal return by inverting, which increases the value of λ to 1[7]. Thus, earnings stripping is more profitable for inverted firms than non-inverted firms.

As described in the introduction, however, there are costs attached to inverting: firms may suffer public relations ramifications and (depending on the nature of the business and the legislative environment the firm is operating in) have to forgo the cost of relocating or building new capital equipment and factories (pertinent legislation is detailed further in Section 3, Legislative History of Inversions). Companies that are able to minimize these costs (large firms that can lower the per unit impact of the cost of relocating through economies of scale) and companies that benefit most from raising the value of λ are the firms most likely to invert. We take the derivative with respect to λ to determine the characteristics of the latter:

$$\frac{d\pi^G}{d\lambda} = \pi^* + r\beta - t^*(\pi^* + r\beta)$$

We see that firms with a high value of foreign earnings (π^*) and firms in industries structured to facilitate high β (for example, industries that allow for intercompany expensing for an intangible asset, such as a patent) stand to benefit more from maximizing λ.

3. Legislative History of Inversions

How does legislation attempt to shift this equation?

As of March 1st, 2017, 73 companies have inverted their tax bases abroad ("Tracking Tax Runaways," 2017). The first company to invert was McDermott in 1982: it made its foreign subsidiary in Panama the parent company. This maneuver enabled McDermott to avoid paying $220 million in taxes on foreign earnings (Zachary Mider, 2014). The majority of companies in the 1990s and early 2000s followed McDermott's lead and established a shell company in a country with either a low corporate tax rate (such as Panama) or no corporate tax rate at all (such as the Cayman Islands and Bermuda).

These early inversions are called "naked" inversions because they do not result in any actual shift of economic activity: the U.S. corporation establishes a foreign subsidiary in a country. Then, the two companies exchange stock with each other in proportion to the relative business activity of each branch. This stock exchange results in the foreign subsidiary becoming the parent of the U.S. corporation (Gravelle and Marples, 2016). There is essentially no change in individual ownership of the stock, only the company name under which the stock is sold.

These early inverters also faced no restrictions on earnings stripping. Thus, in addition to the tax benefits described above, these firms could increase both r and β at will, thus stripping a considerable amount of earnings from their domestic tax return and significantly reducing their effective domestic corporate tax rate.

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[7] Both t and t^* are assumed to be less than one. For inverting firms in my sample, the average statutory t^* is 15.4%. Assuming this as t^*, a pre-December 2017 domestic tax rate of 38.92%, and an interest rate of 7%, firms make 11 cents of extra profit for every dollar borrowed, β.

In an attempt to curb this behavior, Congress acted as early as 1989 to pass the Revenue Reconciliation Act, of which Section 163(j) aimed to place restrictions on the amount of deductions that companies could take on intercompany interest payments: the company must be within a 1.5:1 debt-to-equity safe harbor ratio (there is an upper limit on β), interest expenses to related parties "wholly or partially exempt from US income tax" (Knipe et. al., 2009) are not allowed to be deducted ("disqualified interest") ($r = 0$ for intercompany loans), and if net interest expense is higher than 50% of adjusted taxable income, it is defined as un-deductible "excess interest expense" ($r\beta$ cannot be excessive).

However, Section 163(j) was hard to enforce. Companies responded to the related party provision (aimed at preventing interest expenses on overseas intercompany loans) by switching from direct-related party debt (where the domestic subsidiary directly negotiates the loan with the foreign parent) to guaranteed debt (where the domestic subsidiary negotiates the loan from the parent through a third party, such as a bank). Eric Solomon of the U.S. Treasury acknowledged in a 2007 report that "there is strong evidence that ICs are stripping. Seida and Wempe (2004) state that section 163(j) is ineffective in stopping the stripping of essentially 100 percent of their income of of the United States by the four ICs for which sufficiently detailed data are available" (Eric Solomon, 2007). In "Earnings Stripping under 163(j): status quo vadis" Knipe et. al found that inverted companies shift "substantially all of their income out of the United States through interest payments on intercompany debt" (p. 100). They concluded that this contributed to inverted companies reducing their effective worldwide tax rate by, on average, 33%. Ultimately, Section 163(j) failed to stop earning stripping

The next step was to target the nature of the "naked" inversions: the lack of a significant shift of real economic activity. In 2004, Section 7874 of the American JOBS Creation Act attempted to do just that by mandating that

1. If more than 80% of stock was still owned by the shareholders of the domestic company after the merger with the foreign parent, the company is treated as a domestic company by the tax code (Knipe et. al, 2009).
2. If 60 to 80% of stock remains continuity of ownership, "any U.S. toll taxes (taxes on gains) that apply to transfers of assets to the new entity are not permitted to be offset by foreign tax credits or net operating losses" (Gravelle and Marples, 2016).
3. Alternatively, a firm must have "substantial" business activity in the destination country as in compared to its worldwide activity (10% or higher).

The first two provisions apply when a company leaves the country via a mechanism such as a merger, acquisition, or the previously mentioned "sale to a leveraged-buyout firm" (Mider). In these cases, the most popular avenue has been to merge with companies that have placed continuity at or slightly underneath 60% (Richard Rubin, 2016).

If a company leaves the country via reorganization, the third provision applies—they must have substantial business in the destination country. Gunn and Lys (2016) trace the evolution of this provision:

> In 2004, substantial business presence was not properly defined in the American Jobs Act. In 2006, substantial business presence was redefined with a "facts and circumstances test" and supplemented with a safe harbor provision. The facts and circumstances test allows all of the facts and circumstances surrounding the transaction to be considered in determining whether a substantial business presence exists. The safe harbor provision applied to transactions that result in a corporation with 10% or more of employees in number and compensation, 10% or more of income derived, and 10% or more of assets located in the new country of domicile. In 2009, the safe harbor provision was removed. In 2012, the definition of substantial business presence was redefined with a bright-line rule requiring the resulting corporation to have 25% or more of employees in number and compensation, 25% or more of income derived, and 25% or more of assets located in the new country of domicile. Thus, there is some ambiguity in what is and will be sufficient to qualify as substantial business presence. (p. 7)

This ambiguity makes the effects of the substantial business provision difficult to analyze. I will therefore focus on foreign income intensity (percentage of pretax income that is foreign sourced) as a proxy to substantial business.

4. Data

For my sample of inverted firms, I consulted "Tracking Tax Runaways," an article published in Bloomberg by Zachary Mider and last updated March 1, 2017. He includes the following three definitions of inverting firms:

1. "A US company shifts its place of incorporation to another country without undergoing a change in majority ownership" (n=57)
2. "A division of a previously inverted U.S. company becomes independent" (n=9)
3. "A U.S. company gets a foreign address through other means, such as a sale to a leveraged-buyout firm" (n=16)

Because I am interested in the behavior of firms before they invert, and not after, I omit the spinoffs from my sample, leaving me with n=73[8].

In order to generate my control data, I used the R package TTR to download all of the current stock symbols (as of Fall 2017) listed on Yahoo finance (see code in Appendix). I then randomly sampled 1000 companies using a random number generator (R adds a column of

[8] I also omit DE Master Blenders, Convatec B Sarl, and Tyco from my data because of a lack of data in Compustat.

numbers whenever it gene rates a csv file). This became the subset of companies to which I compare the inverted group. I then created a loop that utilized the CompanyInfo from the TTR package that matched each company name to its Central Index Key (CIK—a unique identifier used by the Securities and Exchange Commission). In the cases where no CIK was returned, I manually searched the company's ticker on the Edgar website to return the CIK. I omitted the following types of stocks from my control group in order to generate the most comparable sample: exchange-traded funds (ETFs), any stock with the word "fund" or "portfolio" in the title (in an attempt to capture real firms), exchange traded notes (ETNs), index funds, the NASDAQ test stock, and any companies that did not have their financials listed after 2017. I manually corrected several stock tickers (including Morgan Stanley to MS and Citigroup to C).

Data for both the control group and sample of inverted firms were collected from Compustat with the help of Rita Gunn of the Owen School of Management. Multiple gvkeys (Compustat's unique identifier) needed to be manually looked up for firms, and gvkeys for 8 of the control firms and 1 of the variable firms were unable to be located.

After the data cleaning, I am left with n=926 in my control group and n=73 in my group of inverted firms. Availability of specific variables varies, and any firm that held its initial public offering after 2016 does not have data in Compustat (at the time of data harvesting, only 2016 financials were available)[9]. Data for the control group was taken from 2016, and data from the inverted group was taken from the year n-1, where n is the year of inversion. I choose to look at year n-1 instead of year n or taking a cross section of all inverted companies in year 2016 in order to get the most accurate picture of the firms' financials during their decisions to invert. In order to ensure comparability, I scale all numeric variables to 2009 values using a GDP deflator from the Federal Reserve (FRED).

5. Empirical Model- Modeling a Firm's Decision to Invert

How do firms that invert differ from their non-inverting counterparts?

In an attempt to answer the first question, I consider the benefits of inversion discussed in the introduction to this paper: reduction of effective tax rate, earnings stripping, and financial flexibility. I select five variables of interest. Below, I list five hypotheses I test that revolve around these benefits next to the variable I use to proxy them:

1. *Total Assets*- Larger firms benefit from economies of scale that allow them to minimize the fixed costs of inverting. This will have a positive effect on the likelihood of inverting.

[9] It should be noted that because Compustat takes values from public financial reports such as the 10-K (a company's annual financials), it is possible that the values used could be slightly different than the values reported to the IRS by the firms (which are not public). However, it is the standard in economic analyses that utilize financial data to rely on Compustat—these differences should be negligible in the aggregate, and I do not anticipate that they have significantly affected my results.

2. *Total Assets Squared*- If a company is too large, it will not invert because of negative publicity (there is a degree of monotonicity to the size effect). I incorporate this variable to account for the companies large enough to have name recognition on the level of Pfizer (which, as noted in the introduction, did not end up inverting).
3. *Foreign Income Intensity*- Companies that earn a higher percentage of their income abroad are more likely to invert because they will be deriving tax benefits on a higher percentage of their income. This will result in greater reductions of these firms' effective tax rates. This will have a positive effect on the likelihood of inversion.

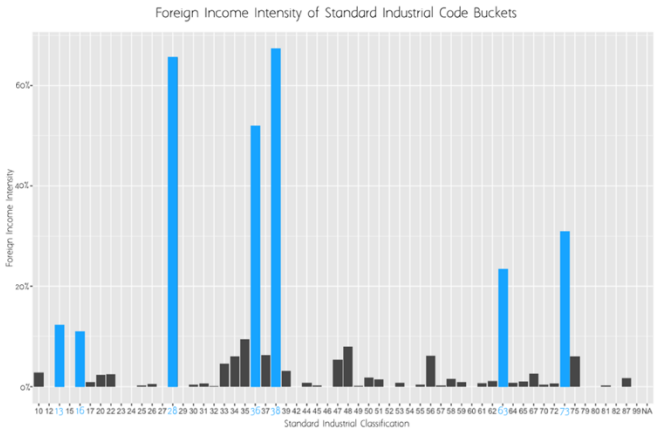

Figure 3

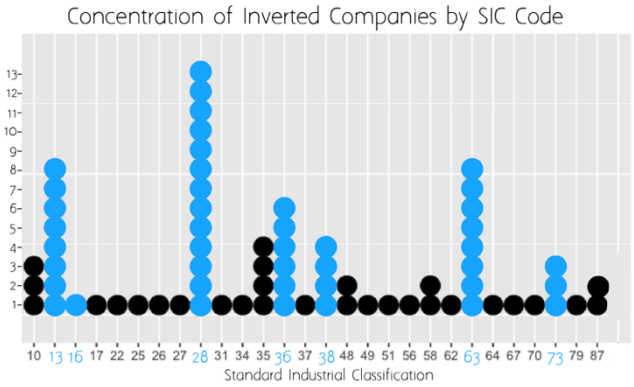

Figure 4

4. *Intangible Asset Intensity*- A high proportion of intangible assets to total assets indicates earnings stripping behavior. Intangible assets include things such as patents, which, as illustrated in the Double Irish with a Dutch Sandwich example, facilitates earnings stripping for multinational firms. Because the benefits of earnings stripping are greater for inverted firms, this will have a positive effect on the likelihood of inversion.
5. *Industry Dummies*- Companies that invert will be concentrated in industries that conduct a large amount of business overseas. With the industry dummies, I attempt to capture aspects of industries not necessarily reflected in a firm's financials that make inverting more attractive. To select these companies, I added a dummy for each Standard Industrial Classification code (for simplification purposes, I bucketed the four digit SIC codes based on their first two digits) with greater than 10% foreign income intensity (n=360 due to reduced availability of the foreign income intensity variable) (Figure 3).

These industries are SIC code 13 (oil and gas), 16 (construction, excluding special trade contractors), 28 (pharmaceuticals and other chemical manufacturing), 36 (electronics

manufacturing, including many tech companies), 38 (scientific instruments, which includes many healthcare device manufacturers), 63 (insurance), and 73 (business services). Unsurprisingly, this graph roughly mirrors a dot plot of inverted companies by SIC code (Figure 4).

With these hypotheses in mind, I crafted the primary model of my paper to investigate the first question: how to firms differ from their non-inverting counterparts? The model is a logit probability model of the form

$$Prob(Inversion) = Log(TA) + ForIncIntensity + IntanAIntensity + IND13 + IND16 + IND28 + IND36 + IND38 + IND63 + IND73 + e$$

Equation 1

I log total assets in order to account for the large scale and asymmetric distribution of the variable. I exclude the log of total assets squared because of a collinearity issue[10]. However, because I wanted to examine the possible monotonicity of the total asset variable, I ran a separate regression with the levels of total assets and total assets squared:

$$Prob(Inversion) = TotalA + TotalASquar + ForIncIntensity + IntanAIntensity + IND13 + IND16 + IND28 + IND36 + IND38 + IND63 + IND73 + e$$

Equation 2

A table explaining all variables is included in the appendix.

RESULTS

I find that participation in the oil and gas or pharmaceutical industries and scale of log of total assets significantly increase the likelihood of inversion ($p<.05$).

Final Regression Results Table- Logs, no Total Assets Squared

Variable Name	Coefficient	Std. Error	P-Value
e	-5.35	1.21	0.00
Log of Total Assets	0.19	0.09	**0.04**
Foreign Income Intensity	0.01	0.04	0.84
Intangible Asset Intensity	0.18	0.82	0.83
IND13 (Oil and Gas)	2.02	0.63	**0.00**
IND16 (Construction)	1.11	1.17	0.34
IND28 (Pharmaceuticals)	1.04	0.48	**0.03**
IND36 (Electronics)	0.56	0.57	0.32
IND38 (Scientific Instruments)	0.56	0.71	0.43
IND63 (Insurance)	14.69	794.89	0.99
IND73 (Business Services)	0.66	0.80	0.41

Table 1

[10] See correlation matrices in the index.

If a firm is a pharmaceutical firm, it is 74% likely to invert; an oil and gas firm is 88% likely to invert; and an increase in total assets by a factor of e (a 1-off increase in the log of total assets) means the firm is 55% likely to invert. It is possible that the other variables are not significant because there were not enough observations to render them statistically significant—data on SIC codes and assets are more plentiful than data on income (n(industry dummies) = 884, n(log(TA)) = 880, n(ForIncIntensity) = 360, n(RDExp) = 457).[11]

Final Regression Results Table- Levels, including Total Assets Squared

Variable Name	Coefficient	Std. Error	P-Value
e	-2.93	0.41	0.00
Total Assets	0.00	0.00	**0.02**
Total Assets Squared	0.00	0.00	**0.06**
Foreign Income Intensity	0.01	0.04	0.73
Intangible Asset Intensity	0.31	0.84	0.71
IND13 (Oil and Gas)	1.94	0.64	**0.00**
IND16 (Construction)	1.06	1.18	0.37
IND28 (Pharmaceuticals)	1.12	0.49	**0.02**
IND36 (Electronics)	0.41	0.56	0.47
IND38 (Scientific Instruments)	0.46	0.71	0.52
IND63 (Insurance)	-15.65	1762.00	0.99
IND73 (Business Services)	-0.77	0.81	0.34

Table 2

I then ran the regression with the levels of Total Assets Squared and Total Assets (the correlation of Log of Total Assets and Log of Total Assets Squared was too high to include them both in the same regression) to determine if monotonicity could be observed. While the coefficient on Total Assets squared is negative and approaches statistical significance at the .05 level, it is not large enough to be considered economically significant (Table 2). Total Assets remains significant but reduced in size due to the high correlation between Total Assets and Total Assets Squared (.95). IND28, the dummy variable for the pharmaceutical industry, and IND13, the dummy variable for the oil and gas industry, continue to be both economically and statistically significant.

Why are inverting firms disproportionately concentrated in the pharmaceutical and oil and gas industries, the only significant industry dummies in our logit model? Both pharmaceuticals and oil and gas rank high on the DHL's global connectedness index, which compares the ratio of exports or imports to total consumption (oil and gas is sixth on this list, with pharma ranking eighth) (Figure 5).

[11] See appendix for an extended table depicting the effects of adding variables to the regression equation on the coefficients and p-values (beginning with Log(TA), then adding ForIncIntensity, then IntanAIntensity, then the industry dummies) in the appendix. I find that Log(TA)'s significance is robust for 3/4 combinations.

Such globally connected firms have more of an incentive to invert, because a higher proportion of their taxable income is foreign sourced ($\pi^*/_{\pi G}$ is high). This also speaks to the significance of the positive coefficient on Log of Total Assets in the logit model (a size approximation)—multinationals are larger than US-only firms. Thus, if prerequisite to inverting is being a multinational (which, I would argue, it is, since non-multinational companies have far reduced incentives because of a lack of foreign earnings), then only larger-than-average companies will even consider the decision to invert.

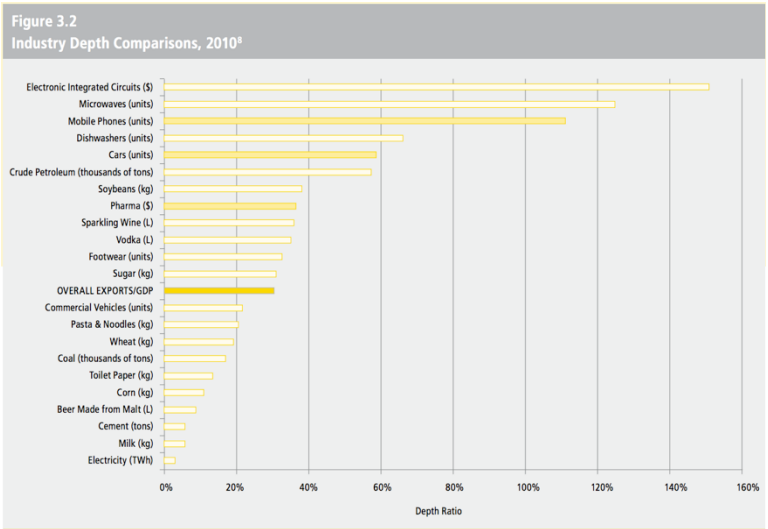

Figure 5. from 2012 DHL Connectedness Index

Additionally, both the pharmaceutical and oil and gas industries are especially conducive to earnings stripping (these industries have the potential for high β): "On average, pharmaceutical companies dedicate approximately 18% of their budget to R&D . . . many of the largest pharmaceutical firms spend nearly 20% on R&D. Of the 20 largest R&D spending industrial companies in the world, pharmaceutical companies make up nearly half the list. . . the overall average spending on R&D by industrial firms engaged in developing new products is a mere 1.3% of sales revenues" ("How Much?", 2018). This hypothesis is reinforced by the fact that the industry that spends the second highest amount on R&D (an average of 12%), electronics (SIC code 36), has the third highest number of inversions. Oil and gas, a high fixed cost industry, participates in earnings stripping by using intercompany loans to invest in building factories, oil rigs, and other equipment. In a study conducted by Taxpayers for Common Sense that looked at the financials of the 20 largest U.S. oil and gas companies, researchers found that

> Most of the companies deferred more than they actually paid. . . the independent oil and gas companies in the bottom half of our list, excluding the ones that recorded losses for the period, deferred almost all of the federal income taxes they accrued during the last five years. . . their deferral was almost entirely from "plant, property and equipment" (Alexander, 2014).

David Solomon, writing for the New York Times, argues that the domestic tax reductions garnered by earnings stripping is the primary incentive to invert (2016). In order to test his hypothesis, I wanted to compare the relative impact of my earnings stripping proxy (Intangible Asset Intensity) with Foreign Income Intensity, my proxy for the relative tax deductions a firm gains on foreign-sourced income. I thus conducted a t-test (two-sample, unpaired because they

T-Test: Total Sample				
Variable Name	**Num of Observations**	**Mean Inverted**	**Mean Non Inverted**	**P-Value**
Log of Total Assets	880	7.58	6.82	**0.00**
Foreign Income Intensity	360	0.49	0.20	0.26
Intangible Asset Intensity	868	0.21	0.16	0.09

Table 3

are independent samples) to see if the means of these variables, considered alone, were significantly different for inverting companies and non-inverting companies (Table 3).

The t-test (two-sample, unpaired) reveals that the mean of the Log of Total Assets for inverting companies is statistically significantly higher than their non-inverting counterparts. This follows intuitively from the results of the logit model.

However, boxplots of these variables (outliers have been removed from Foreign Income Intensity for clarity) reveal that the distribution of Intangible Asset Intensity and Foreign Income Intensity are positively skewed and that the distribution of Log of Total Assets is roughly normal[12]. Given the positive skew of Intangible Asset Intensity and Foreign Income Intensity and my limited sample size (n=73 for inverted companies), the t-test is not an appropriate determinant of statistical significance because it assumes a normal distribution. Thus, I perform the Mann-Whitney-Wilcoxon test as a nonparametric alternative to compare the differences between the groups and discover that both Intangible Asset Intensity and Foreign Income Intensity are statistically significant (Table 4).

Mann-Whitney-Wilcoxon Results: Total Sample		
Variable Name	**W Value**	**P-Value**
Foreign Income Intensity	4808	**0.01**
Intangible Asset Intensity	20158	**0.04**

Table 4

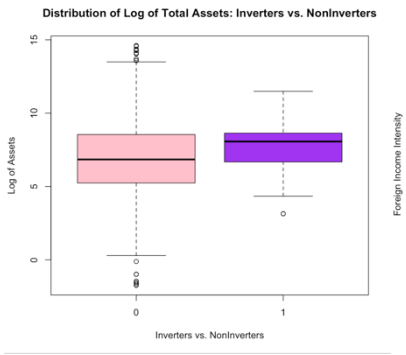

Figure 8

Figure 9

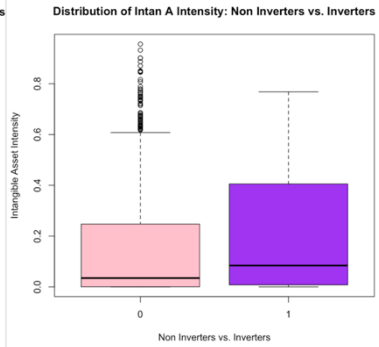

Figure 10

[12] I performed the Shapiro-Wilks test for normality to validate these assumptions. Log of Total Assets: W = 0.99 and p=0.00, indicating a roughly normal distribution (though p is below 0.05, the high W value indicates that the sample approaches normality). Intangible Asset Intensity: W=0.75, p=0.00. Foreign Income Intensity: W=0.24, p=0.00 (the lower W values in the cases of the latter two justify a different treatment with a nonparametric test, i.e. the Mann-Whitney-Wilcoxon test (which is designed for independent, unmatched samples).

6. 2004 JOBS Act Analysis

What effect does legislation have on the characteristics of inverting firms? I chose to compare firms that inverted after 2004 with firms that inverted prior to 2004. 2004 was selected because Section 7874 of the American JOBS Act (while imperfect) had more extensive and enforceable provisions than the only other significant piece of legislation to deal with inversions, Section 163(j) of the Revenue Reconciliation Act. Specifically, I am interested in the effect that the significant business provision and ownership thresholds have on the nature of firms that invert—where firms invert, which industries inverting firms are concentrated in, and the effect on the numeric variables discussed above (total assets, foreign income intensity, and intangible asset intensity).

To investigate these effects on the aforementioned numeric variables, I conduct unpaired two-sample t-tests on all numeric variables (I leave the tests unpaired because of the difference in sample size—more firms inverted post 2004 than pre). I employ the use of descriptive graphs to illustrate the effects on the distribution of the following categorical variables:

1. *SIC Code*- How does the distribution of firms by industry change after 2004? Specifically, does the specific business provision push the distribution towards industries with higher average foreign income intensities?
2. *Destination Country*- Which countries attract the most inversions, and how does this shift after 2004? Specifically, is the 2004 JOBS Act successful in reducing "naked" inversions to 0% corporate income tax havens, and is this reflected in a change in statutory corporate tax rate of destination country?

Finally, I look at the interplay between these two variables—do certain countries attract certain industries? If so, when? And what does that tell us about the nature of those countries and industries?

RESULTS

Contrary to expectations, the only characteristic of inverting firms that appeared to be significantly impacted by Section 7874 is intangible asset intensity ($p < .05$).

T-Test: Pre 2004 vs. Post 2004

Variable Name	Num of Observations	Mean Pre 2004	Mean Post 2004	P-Value
Log of Total Assets	60	7.69	7.51	0.66
Foreign Income Intensity	41	0.67	0.37	0.14
Intangible Asset Intensity	59	0.13	0.27	**0.02**

Table 5

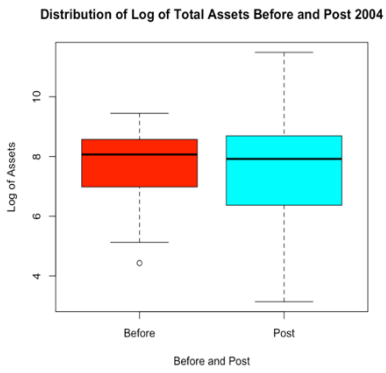

Figure 10

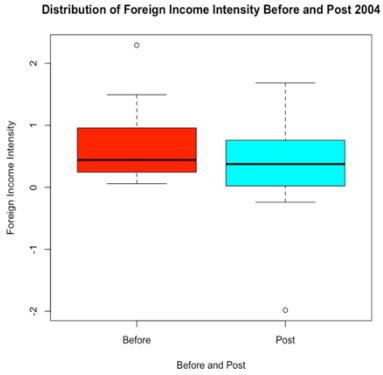

Figure 11

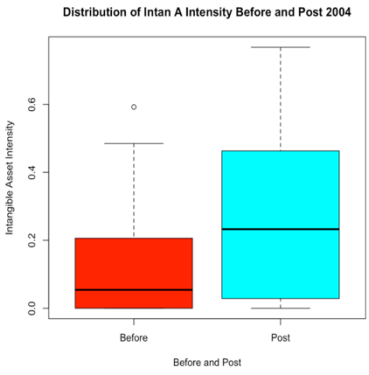

Figure 12

First, I compare companies that inverted prior to 2004 with companies that inverted post 2004 in order to capture the effect that Section 7874 had on the characteristics of inverting firms (Table 5). I find that, contrary to my initial hypothesis, the mean of Total Assets decreases after 2004. However, the p-value of this change is high (0.66), indicating a lack of a statistically significant trend. Potentially contributing to this is the large amount of variability in the total asset size of the firms (as reflected in Figure 10). Foreign Income Intensity also decreases, but not at a statistically significant level. In contrast, Intangible Asset Intensity—a variable associated with earnings stripping—increases with significance.

Boxplots (Figures 10-12) reveal that Log of Total Assets, Foreign Income Intensity, and Intangible Asset Intensity are roughly normally distributed[13]. Thus, the t-test is an acceptable measure of statistical significance. It is noteworthy that, while the mean of Log of Total Assets is higher before 2004 than after 2004, the spread of total assets varies much more after 2004 than before. The same is true (to a lesser degree) for Foreign Income Intensity.

[13] Here again, I performed the Shapiro-Wilks test for normality to validate the visual evidence from the boxplots. I find the distribution of all of variables roughly normal with approximately the same W statistic. Log of Total Assets: W=0.95, p=0.01. Intangible Asset Intensity: W=0.84, p=0.00. Foreign Income Intensity: W=0.88, p=0.00.

I am also interested in the effect that Section 7874 had on the categorical variables of inversion, such as destination of inversion and industry.

Country	Industry Mode	Count
Bermuda	63	17
Ireland	28	15
England	13	10
Canada	10	8
Netherlands	87, 17, 27, 36, 28, 38	6
Cayman	13	5
Luxembourg	31, 73, 28	3
Switzerland	13, 16	2
British Virgin Isla	56	1
Denmark	48	1
Jersey	37	1
Israel	35	1
Australia	28	1
Panama	13	1
Singapore	36	1

Table 7

The most common destination country for inverting firms is Bermuda, which attracted primarily insurance companies and was the most popular destination pre-2004. Seven out the eight insurance firms that have inverted are located in Bermuda, which leads to the hypothesis that this is not an artifact of the insurance industry, but rather how Bermuda handles insurers: 36% of the global reinsurance market is based in Bermuda as of 2017. The benefits, as enumerated by Kenneth Archibald Forbes for bermuda-online, include:

> There are few restrictions as to how Bermuda companies can invest their assets and deploy capital. . .island's close proximity to the largest insurance market in the world, the USA. They are presently free to accept contingent commissions, which are payments to brokers from insurers based on the volume of business steered to them. . . They are exempted from Bermuda's domestic company requirements of being at least 60% beneficially owned by Bermudians. . . The regulatory environment is exceptionally favorable to them in Bermuda . . . They come mostly - but not solely - from the USA. . . reasons to relocate to Bermuda as corporate inversions arise out of the USA's own tax code and/or similar taxation policies of the UK, Canada, China, Russia and other countries.

Ireland is the second most popular destination overall, attracting primarily pharmaceutical companies, and is the second most popular destination both pre- and post-2004 (after England). In addition to having a low statutory corporate tax rate (12.5% since 2003), Ireland offers 25% tax credit on research and development. This effort has been successful in attracting pharmaceutical companies—nine of ten of the world's largest pharmaceutical firms operate out of Dublin, and six of the thirteen inverting pharmaceutical firms relocated in Dublin (Innopharma Education, 2017).

England, with an industry mode oil and gas, is the third most popular destination overall and the most popular destination post-2004.

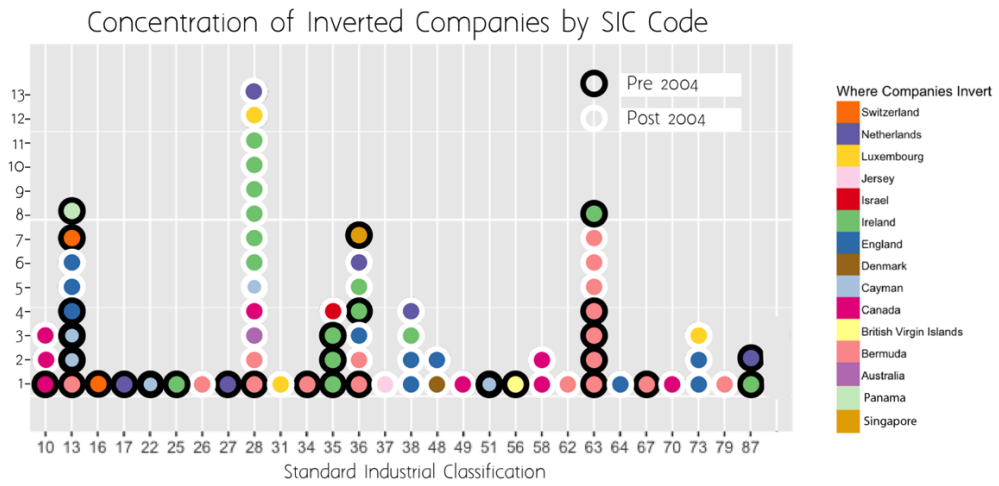

Figure 13

Figure 13 reveals that some SIC codes are concentrated almost entirely within one country (such as the aforementioned insurance industry, 63, in Bermuda and pharmaceutical industry, 28, in Ireland), while others are more spread out geographically (such as electronics, 36). Figure 13 also depicts a shift in the industry mode after 2004, from oil and gas (13) to pharmaceuticals (28). This shift could be caused by the higher costs imposed by the stricter regulations of the JOBS Act (specifically the ownership guidelines)—many firms were faced with having to undergo a merger or acquisition, instead of simpler re-organization, in order to invert. These firms were also required to have significant business in their destination country. I hypothesize that oil and gas firms, a high fixed cost industry, found the cost of relocating a sufficient amount of their production to the destination country too high to justify inverting. The nature of the very category of expenditures that oil and gas's earnings stripping behavior revolves around—Property, Plant, and Equipment—makes inverting in a post-2004 world difficult.

Furthermore, the passage of the legislation signified the increase in stigma around inverting and the growing threat of a negative public backlash. The firms that would be most willing to swallow these as well as the previously mentioned increased costs are those for which the benefits are immense—ones which can not only lower their foreign tax receipts, but also

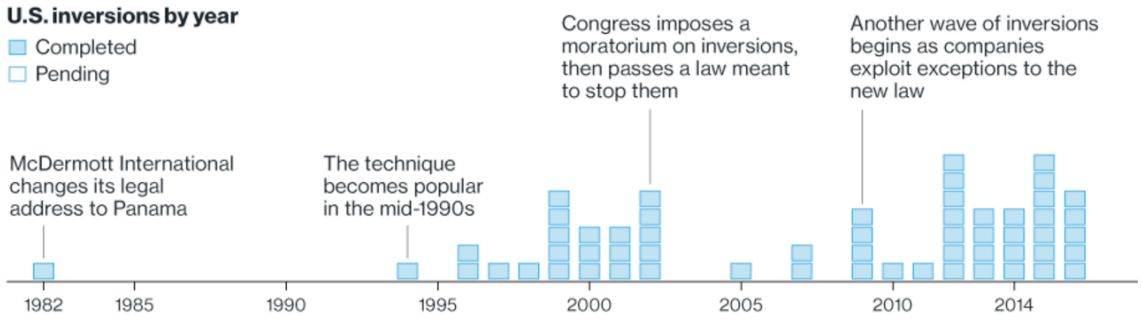

Figure 14. Bloomberg. "Tracking Tax Runaways". March 2017.

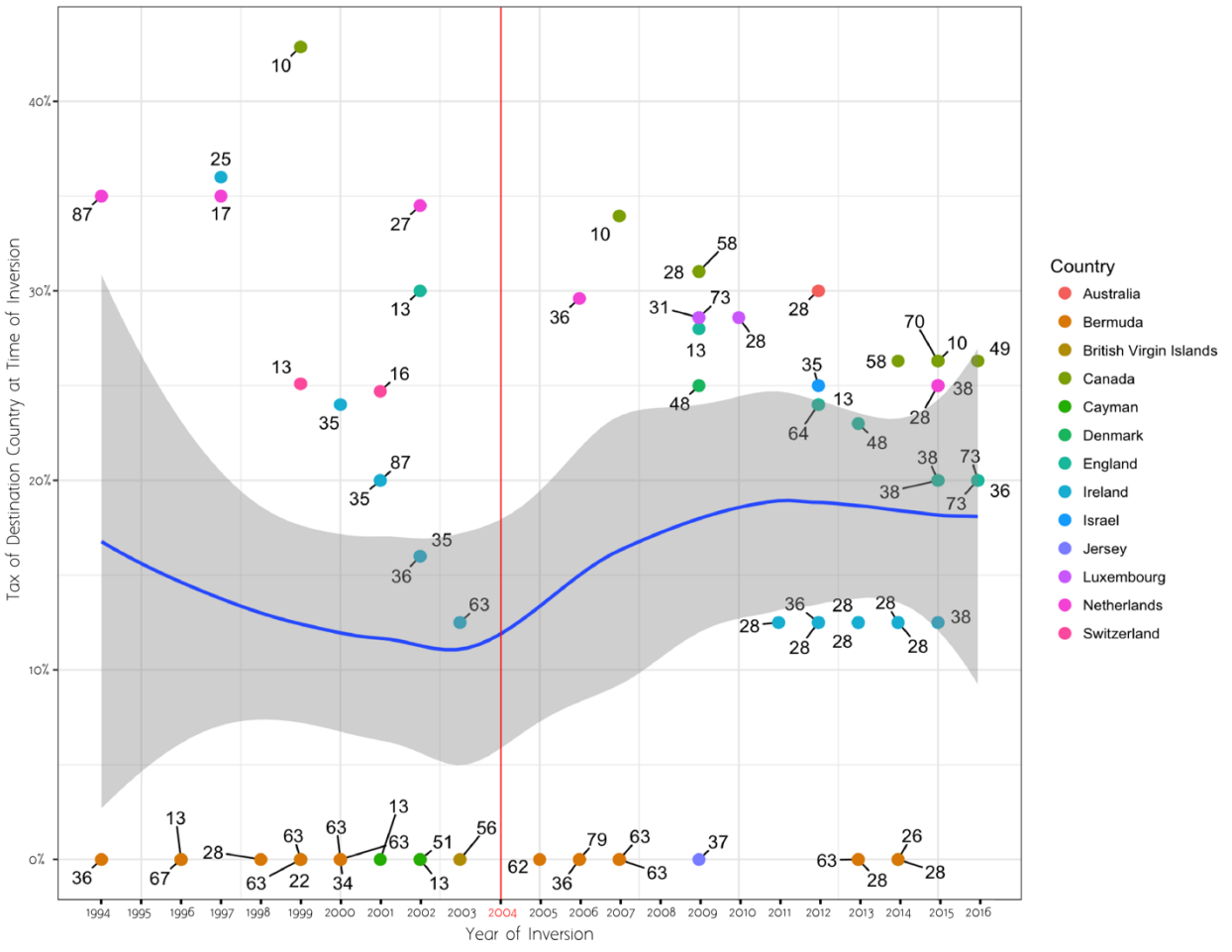

Figure 15

significantly lower their domestic tax receipts. The increase in intangible asset intensity indicates that firms are doing just that—offsetting the increased costs and higher average foreign tax rate of the destination countries by heightening earnings stripping activity.

Despite these increased costs, firms that invert after 2004 outnumber firms that invert prior to 2004 4:3 (n=43, n=30). However, I dismiss this as an artifact of inertia: Bloomberg explains the effect that time, including legislation-induced lags, has on the frequency of inversions (Figure 14). This time effect is also partially explained by the decline in global tax rates that peaked from 2000-2010. Nonetheless, companies paid (on average) higher taxes in their destination company after the 2004 JOBS Act (Figure 15). I attribute this to firms' decisions to invert to low tax but economically active countries, such as England (eight inversions post 2004) instead of zero tax rate countries (located along the y-axis), which are typically small, low GDP nations. This follows fairly clearly from the provisions of the bill: firms either have to have significant business in the destination country (firms are more likely to already be doing business in economically active countries) or ensure that no more than 60% of ownership maintains continuity during an inversion in order to avoid negative tax ramifications (in order to satisfy this stipulation, a firm would have to engage in a merger with a company that is more likely to be located in an economically active country than not).

7. Conclusion

In this paper, I find that an increase in the log of total assets and involvement in the pharmaceutical or oil and gas industries (defined by SIC codes 28 and 13) makes a firm more likely to invert. Firms that invert have significantly larger intangible assets, a behavior typical of firms that participate in earnings stripping. The 2004 JOBS Act amplifies this effect: firms that invert after 2004 have higher intangible asset intensity. These firms locate to countries with higher GDPs (such as Ireland and England) and pay a higher average tax rate in their destination country as a result. Pharmaceutical companies tend to congregate in Ireland, while insurance companies tend to congregate in the zero corporate tax haven of Bermuda.

However, every implication discussed above has been been dramatically affected by the Tax Cuts and Jobs Act of 2017. Consider the following note, from 21 December 2017, that was included in Forbes' description of the inverting environment on bermuda-online:

> US tax reforms approved this week by the US Congress will be "credit negative" for the Bermuda re/insurance market (sic). . .The US credit rating agency added that it expected the tax reforms. . .to benefit US reinsurers at the expense of Bermudian and other international reinsurers serving the US. The Tax Cuts and Jobs Act will cut the US corporate tax rate to 21 per cent from 35 per cent, reducing Bermuda's tax advantages over US rivals, and a new tax on premiums ceded by US insurers to foreign affiliated reinsurers will be levied.

Insurance is just one of the industries that will be radically affected by the JOBS Act. The incentives discussed in this paper—lower the effective tax rate of the firm, increase financial flexibility, and facilitate earnings stripping—have been flipped on their heads. The average statutory corporate tax rate of countries firms relocate to at the time of inversion is 15.4%, and the average rate since 2010 is 17.5%, only 3.5% lower than the current U.S. rate (21%). Furthermore, the law moved the U.S. from a territorial system to a worldwide system. Will companies stop inverting all together?

Kyle Pomerleau of the Tax Foundation argues that inversions will continue, albeit at a reduced rate. While the U.S. is nominally a territorial system, it is not a pure territorial system:

> The law introduced a minimum tax on foreign-source profits called "GILTI." Under GILTI, high-return foreign profits of U.S. multinationals are subject to annual U.S. taxation at a 10.5 percent rate. The foreign tax credit would be limited to 80 percent of foreign taxes paid on those profits. In addition, the new law would provide a reduced rate (13.125 percent) to export-related high-return profits called "FDII." (Inversions Under the New Law, 2018)

FDII and GILTI, while small in comparison to what companies owed on foreign earnings previously, are still an incentive to invert—foreign-based companies are exempt from them. These taxes are likely what led Dana Inc., an automobile manufacturer (cars are fifth on DHL's

Global Connectedness Index), to announce that it was relocating its headquarters to the U.K. in early March 2018.

Dana Inc.'s move shows us that companies will continue to seek the path of least tax liability, even if the difference in tax liability is marginally smaller than it was previously. Like the 2004 JOBS Act, the American Tax Cut and Jobs Act will lead to a shift in the composition of inverting firms as incentives shift.

I began this paper by asking two questions: which companies invert? Can, and does, legislation have an impact on inversions? Or are there too many loopholes in the tax code? The Tax Cut and Jobs Act was an attempt to close these loopholes. Like the 2004 JOBS Act, it will be successful in some areas, and fail in others—the results of my analysis have clearly shown that placing mandates on ownership continuity, which is traceable by the SEC, and significant business cutoffs, can and does have an impact on where the companies invert, and the industries that invert. Whether this legislation accomplishes the end goal of the legislation, however, remains ambiguous—it is likely that companies that inverted after 2004 participated in more earnings stripping behavior.

Section 163(j) was critiqued because it failed to impact the amount of earnings that inverted companies stripped offshore. The 2004 American JOBS Creation Act impacted how companies do business, but fell short of curbing earnings stripping or stemming the flow of inversions. Dana Inc. hints that the Tax Cut and Jobs Act might have a similarly complicated legacy.

8. Appendix

I. Variable Table

Variable Name	Method Derived
Prob(Inversion)	A binary variable that assumes 1 if the firm inverted and 0 otherwise
Log(TA)	Total assets logged. Converted to 2009 values using a GDP deflator.
ForIncIntensity	Foreign income intensity. Measured by dividing pretax foreign income by total pretax income. Converted to 2009 values using a GDP deflator.
IntanAIntensity	Intensity of intangible assets. Measured by dividing intangible assets by total assets. Converted to 2009 values using a GDP deflator.
IND13	Industry dummy for SIC codes beginning with 13. Indicates that the company is in the oil and gas industry.
IND16	Industry dummy for SIC codes beginning with 16. Indicates that the company is in the construction industry (excludes special trade contractors).
IND28	Industry dummy for SIC codes beginning with 28. Indicates that the company is in the pharmaceutical industry (and assorted other chemical manufacturing).
IND36	Industry dummy for SIC codes beginning with 36. Indicates the company is in the electronics industry.
IND38	Industry dummy for SIC codes beginning with 38. Indicates the company is in the scientific instruments industry. Includes many healthcare device manufacturers.
IND63	Industry dummy for SIC codes beginning with 63. Indicates the company is in the insurance industry.
IND73	Industry dummy for SIC codes beginning with 73. Indicates the company is in the business services industry.
TotalA	Total assets. Converted to 2009 values using a GDP deflator.
TotalASquar	Total assets squared. Converted to 2009 values using a GDP deflator.
E	Error term

II. Extended Regression Results

Variable Name	Regression Run	Coefficient	Std. Error	P-Value
Error Term	Inverted ~ Log(TA)	-3.49	0.43	0.00
	~ " + ForIncIntensity	-3.17	0.63	0.00
	~ " + " + IntanAIntensity	-3.17	0.63	0.00
	~ " + " + " + " + Industry Dummies	-5.35	1.21	0.00
Log(TotA)	Inverted ~ Log(TA)	0.12	0.05	**0.02**
	~ " + ForIncIntensity	0.15	0.08	0.06
	~ " + " + IntanAIntensity	0.16	0.08	**0.05**
	~ " + " + " + " + Industry Dummies	0.19	0.09	**0.04**
ForIncIntensity	Inverted ~ Log(TA) + ForIncIntensity	0.02	0.04	0.61
	~ " + " + IntanAIntensity	0.02	0.04	0.62
	~ " + " + " + " + Industry Dummies	0.01	0.04	0.84
IntanAIntensity	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity	-0.29	0.72	0.69
	~ " + " + " + " + Industry Dummies	0.18	0.82	0.83
IND13	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity + Industry Dummies	2.02	0.63	**0.00**
IND16	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity + Industry Dummies	1.11	1.17	0.34
IND28	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity + Industry Dummies	1.04	0.48	**0.03**
IND36	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity + Industry Dummies	0.56	0.57	0.32
IND38	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity + Industry Dummies	0.56	0.71	0.43
IND63	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity + Industry Dummies	14.69	794.89	0.99
IND73	Inverted ~ Log(TA) + ForIncIntensity + IntanAIntensity + Industry Dummies	0.66	0.80	0.41

III. Correlation Matrix Tables

Correlation Matrix of Regression without Total Assets Squared and with Total Assets Logged

Basic	Log(TotalA)	IntanAIntensity	ForIncIntensity	IND13	IND16	IND28	IND36	IND38	IND63	IND73
Log(TotA)	1.00	0.09	-0.02	0.00	0.01	-0.28	-0.05	-0.08	0.17	-0.12
IntanAIntensity	0.09	1.00	0.11	-0.13	0.01	-0.01	0.06	0.10	-0.09	0.28
ForIncIntensity	-0.02	0.11	1.00	0.02	0.06	-0.08	-0.04	0.17	-0.09	0.02
IND13	0.00	-0.13	0.02	1.00	-0.02	-0.08	-0.05	-0.04	-0.04	-0.06
IND16	0.01	0.01	0.06	-0.02	1.00	-0.03	-0.02	-0.02	-0.02	-0.03
IND28	-0.28	-0.01	-0.08	-0.08	-0.03	1.00	-0.10	-0.09	-0.08	-0.13
IND36	-0.05	0.06	-0.04	-0.05	-0.02	-0.10	1.00	-0.05	-0.05	-0.08
IND38	-0.08	0.10	0.17	-0.04	-0.02	-0.09	-0.05	1.00	-0.04	-0.07
IND63	0.17	-0.09	-0.09	-0.04	-0.02	-0.08	-0.05	-0.04	1.00	-0.06
IND73	-0.12	0.28	0.02	-0.06	-0.03	-0.13	-0.08	-0.07	-0.06	1.00

Correlation Matrix of Regression with Log Total Assets Squared and Log Total Assets

Logs	Log(TotalA)	Log(TotalASquar)	IntanAIntensity	ForIncIntensity	IND13	IND16	IND28	IND36	IND38	IND63	IND73
Log(TotalA)	1.00	1.00	0.09	-0.02	0.00	0.01	-0.28	-0.05	-0.08	0.17	-0.12
Log(TotalASquar)	1.00	1.00	0.09	-0.02	0.00	0.01	-0.28	-0.05	-0.08	0.17	-0.12
IntanAIntensity	0.09	0.09	1.00	0.11	-0.13	0.01	-0.01	0.06	0.10	-0.09	0.28
ForIncIntensity	-0.02	-0.02	0.11	1.00	0.02	0.06	-0.08	-0.04	0.17	-0.09	0.02
IND13	0.00	0.00	-0.13	0.02	1.00	-0.02	-0.08	-0.05	-0.04	-0.04	-0.06
IND16	0.01	0.01	0.01	0.06	-0.02	1.00	-0.03	-0.02	-0.02	-0.02	-0.03
IND28	-0.28	-0.28	-0.01	-0.08	-0.08	-0.03	1.00	-0.10	-0.09	-0.08	-0.13
IND36	-0.05	-0.05	0.06	-0.04	-0.05	-0.02	-0.10	1.00	-0.05	-0.05	-0.08
IND38	-0.08	-0.08	0.10	0.17	-0.04	-0.02	-0.09	-0.05	1.00	-0.04	-0.07
IND63	0.17	0.17	-0.09	-0.09	-0.04	-0.02	-0.08	-0.05	-0.04	1.00	-0.06
IND73	-0.12	-0.12	0.28	0.02	-0.06	-0.03	-0.13	-0.08	-0.07	-0.06	1.00

Correlation Matrix of Regression with Levels of Total Assets and Total Assets Squared

Levels	Total Assets	TotalASquar	IntanAIntensity	ForIncIntensity	IND13	IND16	IND28	IND36	IND38	IND63	IND73
Total Assets	1.00	0.95	-0.06	-0.11	-0.03	-0.01	-0.05	-0.03	-0.03	0.04	-0.04
TotalASquar	0.95	1.00	-0.06	-0.06	-0.02	-0.01	-0.04	-0.02	-0.02	0.00	-0.03
IntanAIntensity	-0.06	-0.06	1.00	0.11	-0.13	0.01	-0.01	0.06	0.10	-0.09	0.28
ForIncIntensity	-0.11	-0.06	0.11	1.00	0.02	0.06	-0.08	-0.04	0.17	-0.09	0.02
IND13	-0.03	-0.02	-0.13	0.02	1.00	-0.02	-0.08	-0.05	-0.04	-0.04	-0.06
IND16	-0.01	-0.01	0.01	0.06	-0.02	1.00	-0.03	-0.02	-0.02	-0.02	-0.03
IND28	-0.05	-0.04	-0.01	-0.08	-0.08	-0.03	1.00	-0.10	-0.09	-0.08	-0.13
IND36	-0.03	-0.02	0.06	-0.04	-0.05	-0.02	-0.10	1.00	-0.05	-0.05	-0.08
IND38	-0.03	-0.02	0.10	0.17	-0.04	-0.02	-0.09	-0.05	1.00	-0.04	-0.07
IND63	0.04	0.00	-0.09	-0.09	-0.04	-0.02	-0.08	-0.05	-0.04	1.00	-0.06
IND73	-0.04	-0.03	0.28	0.02	-0.06	-0.03	-0.13	-0.08	-0.07	-0.06	1.00

IV. Code (R Programming Language)

```
#Load necessary libraries
library(aod) #Library used for the logit model analysis
library(gridExtra) #Library used to print results to a table
library(ggplot2) #Library used to make graphs
library(TTR) #library used to sample control group
library(mapdata) #Used to make map plot of SIC codes
library(ggmosaic) #Used to make country mosaic plot


#Create control group
#Pull up all stock symbols on Yahoo Finance
listings <- stockSymbols()
write.csv(listings, file = "masterstocktickers.csv") #writes csv with all stock tickers
listings <- read.csv("masterstocktickers.csv")
#outside of r: created column numbering them; going to use random number generator
set.seed(1)
randomnum <- sample(1:6754, 1000, replace=F) #sample 1000 companies without replacement from
the list of stock tickers
subsetcompanies <- filter(listings, Number %in% randomnum) #now is a sample of 1000 random
companies
write.csv(subsetcompanies, file = "controlgroup.csv")

#Get CIK numbers for control group
d <- data.frame()
for(i in 1:nrow(subsetcompanies)){
  tryCatch({
    d <- rbind(d, CompanyInfo(subsetcompanies[i,2]))
    stop ("invalid company symbol") #stops error
  }, error = function(e){})
}
df <- merge(x = subsetcompanies, y = d, by.x = "Name", by.y = "company", all.y = TRUE)
write.csv(df, file = "controlwithCIK.csv") #this is my control group that I cleaned in excel
and then put through Compustat

#Load data
logitdata <- read.csv("masterdata2009.csv")

#Run Logit models
#Base Model
logit1 <- glm(Inverted ~ log(TotalA2009), data = logitdata, family = "binomial")
summary(logit1)

#Add Foreign Income Intensity
logit2 <- glm(Inverted ~ log(TotalA2009) + ForIncIntensity, data = logitdata, family =
"binomial")
summary(logit2)

#Add Intangible Assets
logit3 <- glm(Inverted ~ log(TotalA2009) + ForIncIntensity + IntanOverTotA, data = logitdata,
family = "binomial")
summary(logit3)

#Add Industry Dummies
logit4 <- glm(Inverted ~ log(TotalA2009) + ForIncIntensity + IntanOverTotA + IND13 +IND16 +
+IND28 +IND36 +IND38 + IND63 +IND73, data = logitdata, family = "binomial")
summary(logit4)

#Logit coefficients to probabilities
logit2prob <- function(logit){
  odds <- exp(logit)
  prob <- odds / (1 + odds)
  return(prob)
}
prob <- logit2prob(coef(logit4))
prob

#Run final logit model with levels
```

```
logit6 <- glm(Inverted ~ TotalA2009 + TotalASquar + ForIncIntensity + IntanOverTotA +IND13
+IND16 + +IND28 +IND36 +IND38 +IND63 +IND73, data = logitdata, family = "binomial")
summary(logit6)


#Run t-tests for variables comparing inverted to non inverted
t.test(logitdata$RD2009~logitdata$Inverted)
t.test(logitdata$IntanOverTotA~logitdata$Inverted)
t.test(logitdata$ForIncIntensity~logitdata$Inverted)
t.test(log(logitdata$TotalA2009)~logitdata$Inverted)

#Run t-tests for skewed variables
wilcox.test(logitdata$ForIncIntensity~logitdata$Inverted)
wilcox.test(logitdata$IntanOverTotA~logitdata$Inverted)
wilcox.test(loga~logitdata$Inverted)
wilcox.test(jobsdata$ForIncIntensity~jobsdata$PrePost2004)
wilcox.test(jobsdata$IntanOverTotA~jobsdata$PrePost2004)
wilcox.test(logav~jobsdata$PrePost2004)

#Run JOBS Act T-Tests
t.test(logitdata$RD2009~logitdata$PrePost)
t.test(logitdata$IntanOverTotA~logitdata$PrePost)
t.test(logitdata$ForIncIntensity~logitdata$PrePost)
t.test(log(logitdata$TotalA2009)~logitdata$PrePost)

#Make graph of foreign income intensity
ggplot(logitdata, aes(x = factor(SIC1st2), y = abs(ForIncIntensity))) +
geom_bar(stat="identity")

#Make graph of SIC codes for variable group
#import data with just variable data
jobsdata <- read.csv("variable2009.csv")

#Boxplots All
boxplotTA2 <- boxplot(log(TotalA2009)~Inverted,data=logitdata, main="Distribution of Log of
Total Assets: Non Inverters vs. Inverters",
                      xlab="Non Inverters vs. Inverters", ylab="Log of Assets",
col=(c("pink","purple")))
boxplotFII2 <- boxplot(ForIncIntensity~Inverted,data=logitdata, main="Distribution of Foreign
Income Intensity: Non Inverters vs. Inverters",
                       xlab="Non Inverters vs. Inverters", ylab="Foreign Income Intensity",
col=(c("pink","purple")), outline=FALSE)
boxplotIAI2 <- boxplot(IntanOverTotA~Inverted,data=logitdata, main="Distribution of Intan A
Intensity: Non Inverters vs. Inverters",
                       xlab="Non Inverters vs. Inverters", ylab="Intangible Asset Intensity",
col=(c("pink","purple")), outline=FALSE)
boxplotRD2 <- boxplot(RD2009~Inverted,data=logitdata, main="Distribution of Research and Dev
Exp: Non Inverters vs. Inverters",
                      xlab="Non Inverters vs. Inverters", ylab="Research and Development
Expense", col=(c("pink","purple")), outline=FALSE)

#Boxplots PrePost
boxplotTA <- boxplot(log(TotalA2009)~PrePost2004,data=jobsdata, main="Distribution of Log of
Total Assets Before and Post 2004",
                     xlab="Before and Post", ylab="Log of Assets", col=(c("red","cyan")))
boxplotFII <- boxplot(ForIncIntensity~PrePost2004,data=jobsdata, main="Distribution of
Foreign Income Intensity Before and Post 2004",
                      xlab="Before and Post", ylab="Foreign Income Intensity",
col=(c("red","cyan")))
boxplotIAI <- boxplot(IntanOverTotA~PrePost2004,data=jobsdata, main="Distribution of Intan A
Intensity Before and Post 2004",
                       xlab="Before and Post", ylab="Intangible Asset Intensity",
col=(c("red","cyan")))
boxplotRD <- boxplot(RD2009~PrePost2004,data=jobsdata, main="Distribution of Research and Dev
Exp Before and Post 2004",
                       xlab="Before and Post", ylab="Research and Development Expense",
col=(c("red","cyan")), outline=FALSE)

#Make industry graph
indata <- read.csv("industrydata.csv")

ggplot(data = indata, aes(x = year, y = TaxTimeInv)) + theme_bw() +
  geom_text_repel(aes(label = SIC1st2),
```

```
                  box.padding = unit(0.45, "lines")) +
  geom_point(aes(color=Country), size = 3) +
  geom_smooth(model = lm)

#Test to see if populations are normally distributed
## Perform the test
loga <- log(logitdata$TotalA2009)
shapiro.test(loga)
shapiro.test(logitdata$IntanOverTotA)
shapiro.test(logitdata$ForIncIntensity)
shapiro.test(jobsdata$IntanOverTotA)
shapiro.test(jobsdata$ForIncIntensity)
logav <- log(jobsdata$TotalA2009)
shapiro.test(logav)
```

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