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Eric Orhn
Grinnelll College

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Eric Ohrn
Grinnell College

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Abstract

The paper examines how corporate investment responds to the Domestic Production Activities Deduction, a U.S. federal tax regulation that is currently the third largest U.S. corporate tax expenditure. The deduction effectively lowers the corporate tax rate on manufacturing income by 3.15 percentage points. To study the impact of the deduction, plausibly exogenous variation created by the interaction of industry-level manufacturing activity and the phase-in of the policy is exploited. Results indicate investment by publicly traded firms increased by approximately 7% once the deduction was fully implemented. Further analysis suggests this strong response is, at least in part, driven by the interaction of the deduction and another concurrent incentive, the 2004 tax holiday on repatriated foreign earnings.

Keywords : Domestic production activities deduction, taxation, investment
JEL Classification : H25; H32; E22

1 Introduction

In the past several years, significant research efforts have been directed towards studying the impact of corporate tax reform on corporate behavior. A particularly large amount of attention has been given to the impacts of the "Bush Tax Cuts," which significantly reduced the top rate on individual dividend and capital gains income, and to "Bonus Depreciation," a policy that accelerates the deduction of new investment expenditures from taxable income. In contrast, relatively little attention has been paid to a third major corporate tax expenditure that has been in place for more than 10 years: the Domestic Production Activities Deduction.

Implemented in 2005, the Domestic Production Activities Deduction (DPAD) allows businesses to deduct a percentage (up to 9%) of income derived from domestic manufacturing activities from their taxable income. As a result, DPAD eligible firms face a 3.15% lower corporate income tax rate on domestic manufacturing income and a lower blended tax rate on all taxable income after the implementation of the deduction.

The main contribution of this paper is to quantify the impact of the DPAD on corporate investment behavior. I find that, once fully phased in, the DPAD increased investment activity by approximately 7%. As investment is "of paramount importance for both business cycle fluctuations and long term economic growth,"[1] these results suggest that the DPAD, and directed corporate income tax rate reductions more generally, may represent both effective short-run counter-cyclical levers and long-run growth stimulants to be further considered by policymakers.

To estimate the investment response the DPAD, I implement a differences-in-differences empirical design that exploits industry-level variation in the percentage of income that is eligible for the deduction. Firms that belong to industries that derive a large portion of income from domestic manufacturing activities (such as construction and agricultural firms) see a significant reduction in their average effective corporate income tax rate while firms residing in industries that are not domestic manufacturing intensive (such as real estate and transportation) are left essentially unaffected by the policy.

To construct this industry-level variation, I use data provided by the IRS Statistics of Income Division. The Statistics of Income Division publishes the aggregate annual dollar values of the DPAD and Net Taxable Income for businesses in 77 unique industries. Using these numbers, I derive industry-level percentages of income eligible for the DPAD, which are generally are consistent over time. The industry-level variation in treatment intensity and temporal variation in the DPAD deduction rate combine to create plausibly exogenous shocks which can be used to uncover the impact of the DPAD on investment.[2]

[1] Language taken from Goolsbee (1998).

[2] Although this research design may seem innocuous, this paper is, as far as the author is aware, the first to estimate the impact of a corporate tax policy by relying on directly observable industry-level variation in take-up of the the policy itself and may provide a useful framework with which to analyze future tax incentives.

The core empirical result of this research is that, a one percentage point reduction in the effective corporate income tax rate via the DPAD increases investment activity by more than 12% for the average publicly traded U.S. corporation. After accounting for a heterogeneous effect across firms of different sizes these estimates suggest, once fully implemented, the DPAD increased U.S. corporate investment by approximately 7%. The findings also provide a plausible, albeit large, estimate of the potential response of investment to a cut in the statutory corporate income tax rate.

To establish the stability of this core result, I test whether industry-level macroeconomic shocks may be driving the estimated investment response to the DPAD I find that macroeconomic factors do not seem to differentially affect treatment and control industries. Furthermore, when I attempt to control for any such differences, the estimated effect of the policy increases suggesting that macroeconomic trends are not generating estimates and instead may be masking them. Including sector-by-year fixed effects and sector-level trends also increase estimates.

To further test for other potential forces driving investment responses to the DPAD, the interactions of the deduction with (1) the Extraterritorial Income Exclusion (ETI) which the DPAD was designed to replace and (2) 2004 Dividends Received Deduction (DRD), which was designed to work in tandem with the DPAD to increase domestic investment are explored. Results how that the while the ETI has no impact on investment or the elasticity of investment with respect to the DPAD, the DRD worked as designed; those firms which took advantage of the tax holiday on foreign repatriations created by the DRD were more responsive to the DPAD.

Investment to the DPAD is heterogeneous along the dimensions of financial constraint and tax status. I find that some evidence that firms which are financially constrained are more responsive tot he DPAD suggesting that the policy works, at least in part, by creating financial slack for constrained firms. Results of this analysis also suggest that those firms which have low MTRs and mechanically will benefit less from the DPAD may be more responsive to it. This counter-intuitive finding may suggest that firms that are most responsive to the DPAD are those most engaged in tax avoidance activities.

The findings in this research are most directly related to two concurrent working papers: Blouin, Krull and Schwab (2014) and Lester (2015). Blouin et al. (2014) examines the payout behavior of 77 corporations which explicitly stated on financial reports whether they repatriated funds in 2004 in response to the DRD and whether they benefited from the DPAD relative to the ETI. The authors find that the firms that benefited from the DPAD were less likely to increase payouts suggesting a possible investment response to the DPAD. Lester (2015) also uses financial statements to identify a subsample of firms that report receiving the DPAD. Among these 767 firms, Lester finds evidence that firms shift income across time and reclassify income to fit the DPAD definition. She also finds that firms in her subsample of the corporate population increased investment relative to firms that did not report the deduction.

My project differs from these studies in methodology and scope. Whereas these papers use firm-

level, self-reported financial statement data to identify and study a small subset of firms, this study uses plausibly exogenous variation in the the DPAD constructed from industry-level administrative data to study the investment response for all corporations listed on U.S. stock exchanges. Although Blouin et al. (2014) and Lester (2015) use different methods to examine the DPAD, results from their subsample analyses, which may suffer from selection biases, both complement and reinforce the findings presented here.

This work is indebted to and humbly contributes to another much larger literature concerning both the theoretically and empirically effects of tax policy on business investment. The theoretical foundations of this literature are provided by Hall and Jorgenson (1967), King (1977), Auerbach (1979), Bradford (1981), Summers (1981), Poterba and Summers (1985), and Desai and Goolsbee (2004). The empirical study of tax incentives and investment response is highlighted by Cummins, Hassett and Hubbard (1994), Goolsbee (1998), Edgerton (2010), Yagan (2013), and Zwick and Mahon (2014).

The remainder of the paper is organized as follows: Section 2 provides an in-depth explanation of the DPAD. Section 3 provides a simple conceptual framework that captures the effect of the policy on investment behavior paying close attention to potential heterogeneous responses to the policy based on financial constraint and taxable status. The framework produces several testable hypotheses which are subsequently taken to the data. Section 4 discusses the data sources, construction of key variables, and descriptive statistics. Section 5 describes the empirical strategy and key identifying assumptions necessary to estimate the investment effects of the DPAD. Baseline investment results are presented in Section 6. Section 7 presents several robustness check on these estimates. In Section 8 the interaction of the DPAD and other tax policies is explored. Section 9 tests for heterogeneity of investment response to the DPAD along financial constraint and tax status dimensions. Section 10 concludes.

2 The Domestic Production Activities Deduction

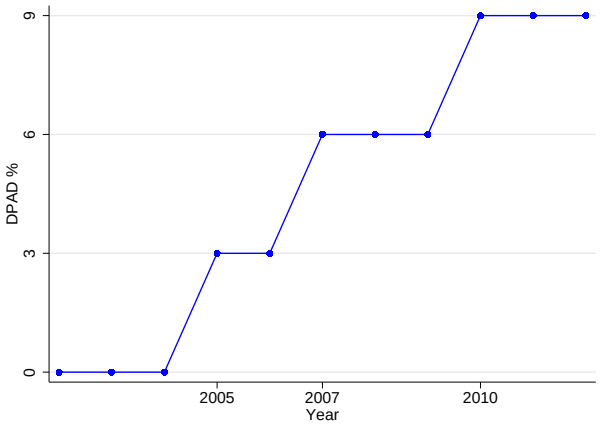
The Domestic Production Activities Deduction was enacted as part of the American Jobs Creation Act of 2004.[3] In its simplest form, the DPAD is a federal corporate tax deduction that allows firms to deduct a percentage "Qualified Production Activities Income" from their taxable income. The DPAD effectively lowers the corporate tax rate on income derived from domestic manufacturing. The policy was not implemented at its maximum rate, but was instead phased in during the years 2005 to 2010. Three pieces of information are key to understanding the policy: the rate of the deduction, the definition of Qualified Production Activities Income (QPAI), and other factors limiting DPAD application.

[3]The DPAD was designed to replace the Extraterritorial Income Exclusion deduction (ETI). Appendix 8.1 examines the interaction of the two policies.

Figure 1: DPAD Phase-In

For QPAI Earned		DPAD %
After	Before	
	01/01/2005	0%
05/05/2004	01/01/2007	3%
12/31/2006	01/01/2010	6%
12/31/2010		9%

Notes: Figure 1 lists and plots the percentage of qualified production activities income that may be deducted from taxable income via the DPAD.



The deduction was implemented at a rate of 3% in 2005, increased to 6% in 2007, and reached its maximum rate of 9% in 2010. Figure 1 presents the DPAD rates during the phase-in period. Given a statutory corporate income tax rate of 35%, these rates reduced the effective tax rate on QPAI by 1.05% in 2005 and 2006, by 2.10% in 2007–2009, and ultimately by 3.15% in years 2010 and beyond. How much these rates affect behavior depends on the percentage of income that a firm derives from QPAI (its QPAI %). If a firm has 100% QPAI, then their effective rate drops 3.15% when the DPAD is fully phased in at 9%. Firms that claim 50% of income as QPAI see an effective rate drop of 1.575%. Effective tax rates of firms that derive no income from domestic production are completely unaffected (at least in partial equilibrium).

QPAI is equal to the excess (if any) of the firm's Domestic Production Gross Receipts (DPGR) over the Domestic Production Gross Costs (DPGC). DPGR is defined as any income that is derived from

- Lease, rental, license, sale or exchange of goods manufactured in the United States
- Construction and engineering and architectural services performed in the United States
- Except sale of prepared foods and energy transmission

And DPGC are defined as

- Costs of goods allocable to DPGR
- Other deductions, expenses or losses directly allocable to DPGR or
- A ratable portion of other expenses not directly allocable to such receipts

An item qualifies as produced in the United States if at least 20% of the total costs are the result of direct labor and overhead costs from US–based operations.

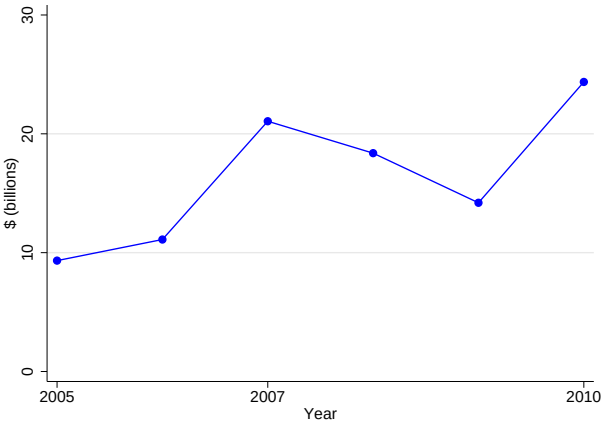
Finally the deduction is limited in two ways. First, the deduction may not exceed 50% of W-2 wages paid by the firm. Second, the deduction may not exceed gross adjusted income (taxable income).

While the 3.15% maximum rate reduction may not seem large on firm-by-firm basis, the policy actually constitutes a significant tax expenditure at the national level. Figure 2 details the total taxable income deductions resulting from the DPAD and total tax expenditure on the policy during the phase-in time period (assuming a corporate rate of 35% on all income). In 2010 when the DPAD reached 9%, corporations were able to deduct more than $24 billion from their taxable income at a cost of more than $8.5 billion to US government.

FIGURE 2: DPAD DEDUCTION

YEAR	$ (BILLIONS)	$(BILLIONS) $\times\tau$
2005	9.332	3.266
2006	11.106	3.887
2007	21.058	7.3703
2008	18.374	6.320
2009	14.198	4.970
2010	24.365	8.528

Notes: Source: IRS Statistics of Income. Corporate statutory rate $\tau = .35$



3 Conceptual Framework and Empirical Hypotheses Generation

To guide the empirical analysis carried out in Sections 6 and 9, this section presents a simple model of investment in the presence of the Domestic Production Activities deduction, investment incentives, financial constraints, and heterogeneous tax positions. The model presented here follows the recent work by Zwick and Mahon (2014) which nicely combines the Neoclassical investment models of Abel (1982) and Hyashi (1982) with the Stein (2003) model of costly external finance. The model produces several testable implications. First, investment increases due to the Domestic Production Activities Deduction and increases more for firms that derive a larger proportion of income from Qualified Production Activities. This baseline result is complemented by two predictions of investment response heterogeneity: (1) firms that are financially constrained will be less responsive to the policy, and (2) firms that are less likely to be taxable when income is derived from investment activities will be less responsive to the deduction.

3.1 Framework Primitives

Consider a firm making a one shot investment decision. The firm begins with initial retained earnings R_0 and chooses the level of investment I in an effort to maximize after tax profits. Future profits are increasing in I according to the function, $\pi(I)$. Future profits are taxed at the proportional rate τ. The DPAD allows the firm to deduct a percentage d of qualified income from its taxable income. The percentage of income that qualifies for the deduction is ρ.[4] The firm discounts the after-tax profits at the risk-adjusted rate r, thus the firms discounted after tax profits can be written as

$$\frac{[1-\tau(1-\rho d)]\pi(I)}{1+r}.$$

The DPAD may be further generalized to consider a state in which the firm is nontaxable. When the next dollar of income does not increase the firm's tax bill, then the firm can only realize the benefit of the deduction if it is carried forward to decrease taxable income in a future taxable state. The generalized version of d can be written as

$$d(\beta,\gamma) = \gamma d(\beta) + (1-\gamma)\beta\phi d(1),$$

where $\gamma \in \{0,1\}$ is an indicator for current tax state and ϕ is a discounter that reflects both the expected arrival time of the taxable state and the discount rate applied to the future and subsequent periods when the firm switches. Note that for the nontaxable firm, β applies to all future deductions; even when β equals one, ϕ is less than one and the value of the deductions are lower when the firm is nontaxable.

In additional to the DPAD, the firm can deduct a portion of the cost of the investment over time as the investment depreciates for tax purposes. The value of the deduction z is worth more to the firm if the investment can be written off more quickly or the firm discounts the future less aggressively.[5] Additional theoretical discussion of z and bonus depreciation is left out here as it is not central the DPAD analysis.[6]

External finance matters for all investment exceeding current cash flow. During the investment

[4] In this simple framework, ρ is assumed to be fixed over time. One can imagine a more complicated version of the model in which firms may expend resources in an effort to increase ρ by changing its business model or reclassifying earnings as qualified income. Empirically, QPAI is stable over time both at both the population and industry level. See Figure 3.

[5] During the last decade, the rate at which investment depreciates for tax purposes has been accelerated in an effort to stimulate investment. This largely counter-cyclical policy is known as Bonus Depreciation. Bonus Depreciation allows firms to write off a percentage of the purchase price of new capital in the first year in addition to write-offs specified in the statutory tax depreciation schedules. The empirical analysis will control Bonus Depreciation by empirically constructing z and simultaneously estimating its effect of investment.

[6] For an in depth treatment of z, including its construction both analytically and empirically and its impact on investment see Ohrn (2014), Edgerton (2012), and Zwick and Mahon (2014).

period, the firm faces an external finance wedge that is linear in expenses net of cash flows, that is,

$$c(I) = \lambda[(1 - \tau z)I - R_0],$$

where λ can be thought of as the shadow price on a borrowing constraint that may or may not bind now or in the future. Thus, a dollar of cash inside the firm is worth $1 + \lambda$ due to costly external finance.

3.2 Optimal Investment

The firm's optimal investment condition is found by maximizing the firm's objective function,

$$\max_I \left\{ \frac{[1 - \tau(1 - \rho d)]\pi(I)}{1 + r} - (1 - \tau z)I - \lambda(1 - \tau z)I \right\},$$

with respect to I, where terms not involving I have been suppressed. Under the assumption of concave π, the problem yields a unique interior solution characterized by the first order condition

$$\frac{[1 - \tau(1 - \rho d)]\pi'(I^*)}{1 + r} = (1 + \lambda)(1 - \tau z).$$

The optimal investment rule is intuitive; the firm chooses I to set the after-tax discounted future benefits of the marginal dollar of investment equal to the after tax price of investment and the cost of external finance. The DPAD increases d and thereby increases the benefits to investment. How much d increases the marginal benefit of a dollar of investment depends on the ρ, percentage of income to which the DPAD applies. The effects of an increase in d are only distinct from the effects of a decrease in τ in that a decrease in the statutory rate would be mitigated to some degree by a reduction in the tax benefits to investment through τz.

3.3 Testable Hypotheses

The DPAD increases the after-tax marginal benefit of investment and thus increases the firm's level of investment; $\partial I/\partial d > 0$. From this intuitive result, three testable hypotheses may be derived. The first may be considered the baseline empirical hypothesis. The second and third testable hypotheses describe heterogeneity in the baseline response based on financial constraint and tax status.

Hypothesis 1. *Investment responds more strongly to the DPAD for industries that derive a larger percentage of income from QPAI;* $\partial^2 I/\partial d\partial\rho > 0$.

When the DPAD is offered or increased, d, the percentage of QPAI that may be deducted from taxable income increases. The effect of the policy is amplified by the percentage of income that may

be classified as QPAI, ρ. This result is intuitive – firms that are more domestic production intensive effectively receive a more generous per dollar deduction and as a result increase their investment more in response to the introduction or increase in the DPAD. This hypothesis is empirically testable because ρ varies substantially across industries. Section 4 describes the construction of industry level ρ and its variance across both the population of corporate taxpayers and across listed firms. If the DPAD does effectively stimulate investment, then the elasticity of investment with response to the DPAD should be higher for industries with high levels of ρ.

The second empirically testable hypothesis concerns how investment response to the DPAD varies based on a firm's cost of external financing or more generally its level of financial constraint.

Hypothesis 2. *Investment responds more strongly to the DPAD for firms that are financially constrained;* $\partial^2 I/\partial d\partial\lambda > 0$.

For both the constrained and unconstrained firms, the DPAD increases the marginal return on investment. For the constrained firm, the policy is doubly beneficial as it also provides for additional investment slack. The change in the optimal level of investment is thus larger for firms that are financially constrained. Empirically, the level of financial constraint that a firm faces will be represented by the financial constraint index created by Hadlock and Pierce (2010) Index. Construction of the HP Index is discussed in Section 4. If financial constraints do affect the investment response to the DPAD, then the elasticity of investment with respect to the DPAD $\partial^2 I/\partial d\partial\lambda$ should be larger for firms with higher HP Index scores. If, on the other hand, financial constraint does not play a role in investment response then there should be no heterogeneity in the investment response to the DPAD across the HP Index.

The third testable hypothesis concerns the heterogeneity in response to the DPAD across tax status and future tax status.

Hypothesis 3. *Investment responds more strongly to bonus depreciaiton for firms that expect to be taxable when income is subject to DPAD;* $\partial I/\partial d|_{\gamma=1} > \partial I/\partial d|_{\gamma=0}$.

The third hypothesis relates strongly to earlier research by Auerbach (1986) and Edgerton (2010). These studies elucidate the idea that the effectiveness of counter-cyclical fiscal stimulus in the form of investment tax incentives may be undermined if firms are non-taxable either due to their possession of tax loss carry-forwards or a less than zero amount of taxable income. The papers provide two key incites: First, investment response to investment tax stimulus is heterogeneous across tax status - firms that are currently taxable are more responsive to the credit. Second, when these polices are used in a counter-cyclical manner, then they are employed when firms are most likely to have tax losses and therefore the mean level impact of the policy is dragged down.

The hypothesis differs slightly in that the heterogeneity in response is across future, not current tax status. This is because the DPAD effectively lowers the tax rate on earned income only if

the firm is taxable when the income derived from investment is earned, not upon the investment itself. This prediction suggests that lowering the tax rate on earned income instead of providing tax incentives to lower the cost of investment may be a better counter-cyclical policy option.

While this hypothesis provides a very exciting policy implication, it has been challenging to examine empirically because tax status is hard to measure. [7] In this study current tax status cannot be used as a source of heterogeneity because tax status is itself a function of the DPAD. Thus analysis will test whether tax status prior to DPAD implementation affect investment response to the policy. The interpretation of the results will depend on how a firm's tax status evolves over time.

4 Data Sources, Construction, and Descriptive Statistics

In order to empirically examine the investment response to the DPAD and test the hypotheses presented in Section 3, data from several sources must are compiled. Industry level data on the DPAD are taken from the IRS Statistics of Income Corporate Tax Statistics website. Data on firm level financial statement variables are taken from the COMPUSTAT North American Annual database. Data needed to construct a measure of present value tax depreciation allowances for new investment are taken from the BEA and the IRS. Finally, marginal tax rates as computed in Blouin et al. (2010) are available on the Wharton Research Data Services (WRDS) Platform.

4.1 QPAI Percent

The effect of the DPAD differs across firms based on the percentage of income derived from qualified production activities (ρ in Section 3). For example, at a 35% statutory corporate income tax rate, a 9% DPAD deduction would result in an effect rate drop of 3.15% for a 100% QPAI firm but in only a 1.575% for a 50% QPAI firm. The effect of the DPAD policy may therefore be estimated by comparing the impact of the policy across firms with different QPAI %.

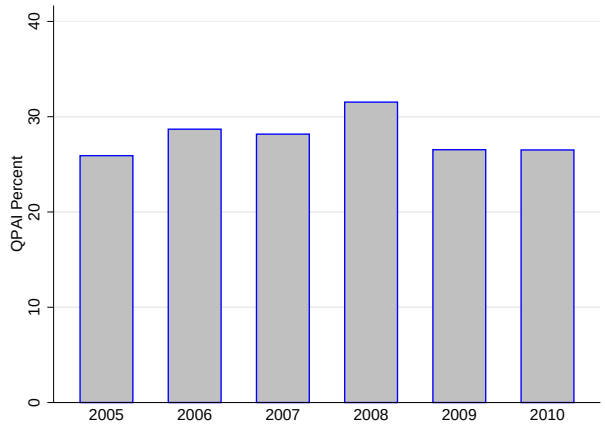
QPAI % can be constructed at the industry level using information provided by the IRS Statistics of Income Division; specifically, the data are taken from the SOI Tax Stats Table 7: "Corporate Returns with Net Income;" years 2005 - 2010. Table 7 provides information on net taxable income and the DPAD for 17 sectors and 77 more finely defined industries.[8] Data in Table 7 are compiled from all Corporations that filed a tax return during the year. The IRS sectors and industries correspond to NAICS 4-digit industries which allow IRS data to be matched to financial statement data at the industry level. QPAI % is equal to qualified income divided by total income. To find qualified income, the DPAD in total dollars is divided by the DPAD rate, which varies during years 2005-2010 as described in Section 2.

[7] See Graham (1996), Graham (2000), Plesko (2003), Edgerton (2010), and Blouin, Core and Guay (2010).

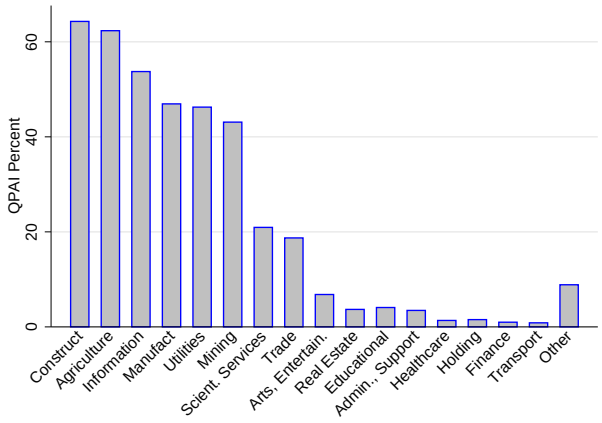
[8] Appendix A provides definitions of DPAD and Net Income from the IRS Statistics of Income.

Figure 3: QPAI Percent

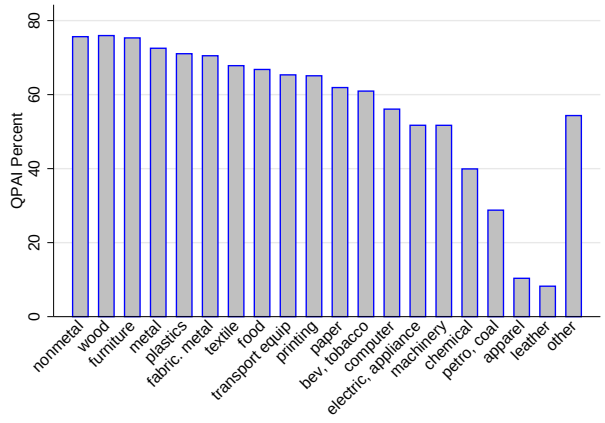
(A) QPAI Percent 2005-2010



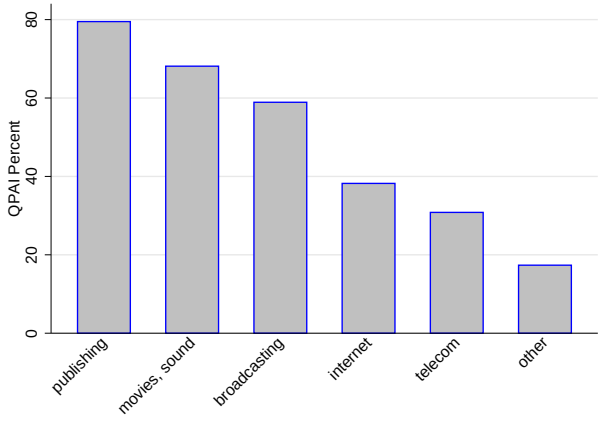
(B) QPAI by Sector



(C) Manufacturing Industries

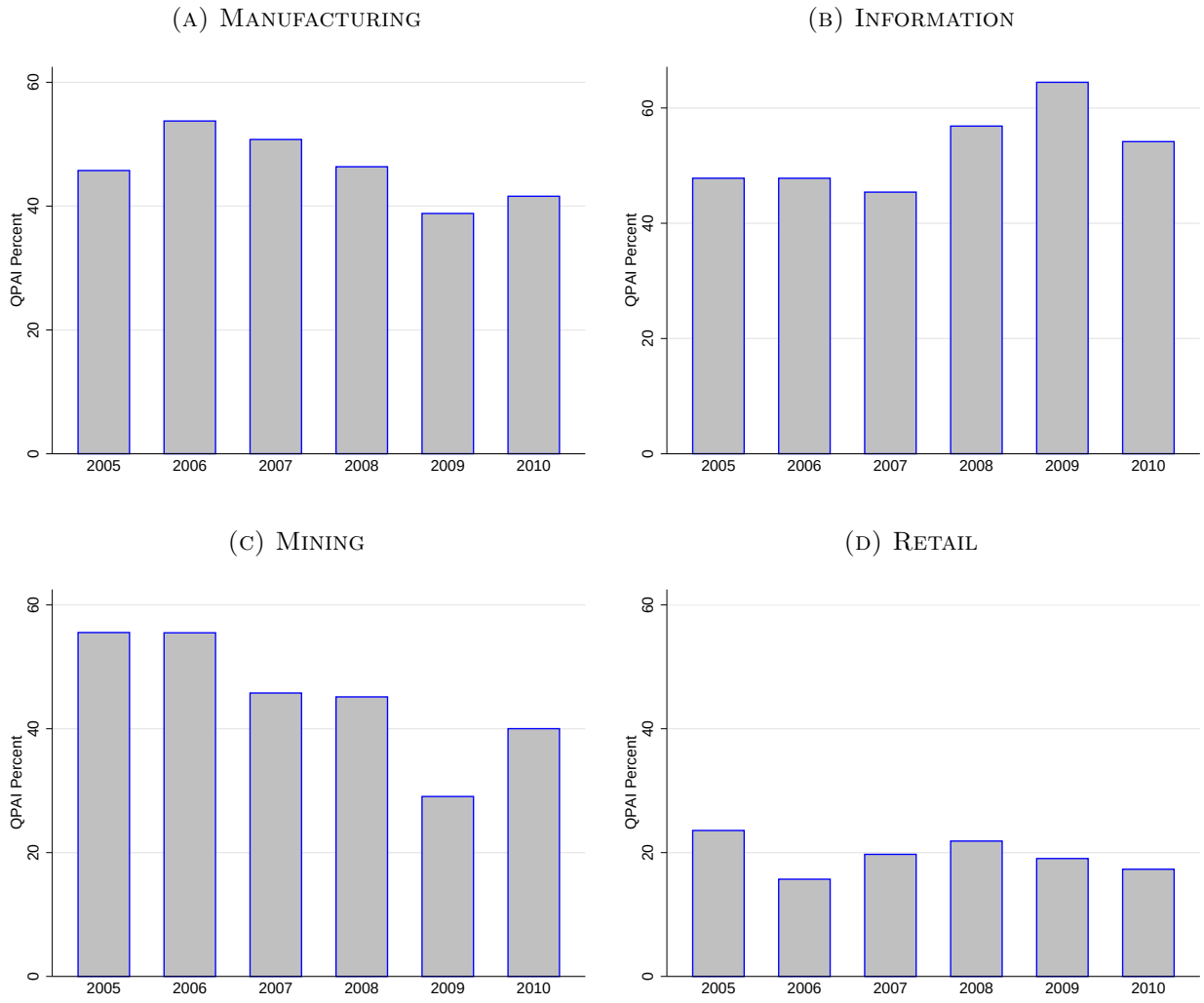


(D) Information Industries



Note: Figures 3(A) - 3(D) present percentages of Qualified Production Income as a percentage of total income. QPAI percentage is calculated as the Domestic Production Deduction divided by Income Subject to Tax as defined by the IRS Statistics of Income Division. Panel (A) presents QPAI averaged across all corporations for years 2005 - 2010. Panel (B) presents QPAI for each major production section averaged across all years 2005 - 2010. Panel (C) presents QPAI for each major industry in the manufacturing sector averaged across all years 2005 - 2010. Panel (D) presents QPAI for each major industry in the information sector averaged across all years 2005 - 2010.

Figure 4: Sector Level QPAI Evolution



Note: Figures 4(A) - 4(D) present percentages of Qualified Production Income as a percentage of total income for during years 2005-2010 for the four largest sectors IRS sectors. QPAI percentage is calculated the Domestic Production Deduction divided by Income Subject to Tax as defined by the IRS Statistics of Income Division.

Table 1 and Figure 3(A) present descriptive statistics for QPAI % over time, across sectors, across industries within the manufacturing and information sectors, and over time. Figure 4 presents QPAI% over time for the four largest IRS sectors. The average QPAI % during all years 2005 - 2010 is 25.528%. The percentage is lowest in 2005, the first year the DPAD was available, but then is stable at a percentage percentage between 25.487 and 27.588 during years 2006-2010. As depicted in Figure 4, the relative stability of QPAI % over time as also present within individual sectors and industries. The stability of the trend both for the economy as a whole and at the

sector level (especially after the first year) suggests that firms' domestic manufacturing vs. non-domestic manufacturing mixes are relatively fixed over time. If firms were able to easily manipulate this mix in response to tax incentives, then as the deduction increased, QPAI % would have also increased. Critically, the stability of QPAI % over time suggests that industry-level variation in manufacturing intensity combined with the temporal variation in the rate of the deduction create a source of plausibly exogenous variation with which to test the empirical hypotheses.

% If investment behavior increased QPAI %, and therefore the intensity of the treatment, QPAI % would increase over time for the economy as a whole and more for industries that investment more. The stability ot QPAI % is in-line with these predictions at neither economy nor industry level suggesting QPAI % is an acceptable tool to analyze the impact of the DPAD on investment.

Not only does QPAI % seem to be stable when the DPAD is implemented, but it also varies significantly across major economic sectors and even within sectors at the industry level. Figure 3(B) presents the average QPAI % over years 2005-2010 for each of the 17 economic sectors. The most QPAI intensive sector is construction followed closely by agriculture, information, and manufacturing. While the construction and agricultural sectors report more than 60% of their income as QPAI, eight sectors including real estate, healthcare, and finance reports less than 10% of their income as QPAI (The financial sector is excluded from the formal empirical analysis.). The variation within sector and across industries is almost as striking. Figures 3(C) and (D) present average QPAI % over years 2005-2010 for the industries contained in the manufacturing and information sectors. In the manufacturing sector, the majority of industries report more than 50% of income as QPAI but several industries including oil and gas, apparel, and leather manufacturing reports less than 30% of income as QPAI. In the information sector, QPAI % varies from just less than 80% QPAI to less than 20%. The within sector variation is especially appealing because it suggests the impact of the DPAD may be identified even when sector fixed effects and trends are included in the analysis.

DPAD is the variable that measures the deduction in the empirical analysis. DPAD is equal to the QPAI % multiplied by the deduction percent and the statutory corporate income tax rate ($d\rho\tau$ in Section 3). DPAD is the effective percentage point reduction in the corporate income tax rate that results from the DPAD. Here QPAI % is the average within each industry over years 2005-2010. For a 100% QPAI industry, the DPAD is equal to the DPAD rate but for a 50% QPAI industry, DPAD is only equal to half of the statutory deduction. DPAD varies over time because the deduction increases over time and across industries because they differ in their QPAI %.

Table 2 reports average QPAI % and DPAD for the Compustat Sample both over all years 2005-2010 and for each year 2005 to 2012. The average QPAI % is significantly higher for the Compustat Sample than for all corporate taxpayers meaning that firms in the Compustat sample are more concentrated in high QPAI % industries than the general population of corporate tax filers. However, because the lion's share of investment behavior is undertaken by listed firms contained

Table 1: QPAI % for IRS Sample

Variable	Year(s)	Median	Mean	10th pctile	90th pctile
QPAI %	2005-2010	9.39	25.54	0.29	71.13
QPAI %	2005	7.98	21.10	0.10	67.01
QPAI %	2006	9.57	25.49	0.16	74.92
QPAI %	2007	9.36	27.59	0.37	68.32
QPAI %	2008	10.70	26.22	0.52	70.17
QPAI %	2009	8.59	27.05	0.31	77.86
QPAI %	2010	10.01	25.88	0.28	73.81
Industries		77			
Industries x Years		462			

Notes: Table 1 provides descriptive statistics for the variable QPAI % for the IRS Sample – all corporations that filed a tax return during the year in question. QPAI % is defined as the percentage of taxable income that is derived from Qualified Production Activities.

in the Compustat Sample, results from the empirical analysis describe a large majority of the corporate population.

Mean DPAD increases from 0.44 to 0.85 to 1.24 percentage points as the deduction rate increases from 3% to 6% to 9% . Again, because QPAI% is relatively stable over time, increase in the effective reduction over time is driven primarily by the increase in the DPAD rate.

4.2 Bonus Depreciation

During the time period that will be considered in the empirical analysis, another tax policy which potentially affects investment, Bonus Depreciation, must be controlled for in order to accurately estimate the effects of the DPAD. Bonus depreciation works by increasing the present value of tax depreciation allowances available on $1 dollar of investment, here called the **Z Tax Term**. If firms can immediately expense investment (bonus equal to 100% as in 2011) then the Z Tax Term is equal to 1 because the firm can deduct $1 from its current tax bill. If firms cannot immediately deduct the entire purchase price of the investment from taxable income and must deduct some portion of the cost in the future, then the present value of tax depreciation allowances is less than $1 because future deductions are worth less in a present value sense. For details on the construction of the Z Tax Term, please refer to Ohrn (2014). The average value of the Z Tax Term for the investment sample is 0.917.

Table 2: QPAI, DPAD %; Corporate Sample

Variable	Years	Median	Mean	10th pct	90th pct
QPAI%	2005 - 2012	44.4	40.02	3.03	69.39
DPAD	2005 - 2012	0.84	0.87	0.071	1.776
DPAD	2005 - 2006	0.45	0.438	0.04	0.749
DPAD	2007 - 2009	0.90	0.85	0.08	1.44
DPAD	2010 - 2012	1.239	1.24	0.098	2.15
Firms		8,132			
Firms x Years		59,126			

Notes: Table 2 presents QPAI % and DPAD for years 2005-2012 for the Corporate Sample - listed firms with non-zero financial statement variables needed for baseline regression analysis. QPAI % is the percentage of income derived from qualified production activities and eligible for the domestic production activities deduction. DPAD is equal to QPAI % multiplied by the statutory rate of the deduction multiplied by the corporate income tax rate. DPAD can be interpreted as the effective rate corporate income tax deduction received by a corporation as a result of the DPAD. This varies at the industry level based on QPAI %.

4.3 Firm Level Financial Statement Variables

Compustat provides financial statement data for firms listed on a major stock exchange and required to file their financial information annually with the U.S. Securities and Exchange Commission. Compustat data easily allows for the construction of the dependent investment variable and determinants of investment in addition to DPAD.

The dependent variable in all regressions is **Investment Percent** which is equal to capital expenditure in the current year scaled by the lagged value of property plant and equipment.[9]. Table 3 provides descriptive statistics for Investment Percent as well as other investment control variables. The mean value of investment percent is 0.432 meaning that for the average firm capitial expenditure is euqal to 43% of the value of installed property, plant, and equipment. The skew of this variable is consistent with lumpy investment behavior; firms engage in large investment projects but not every year.

The additional controls that are included in the analysis and may be derived directly from Compustat data are **Marg Q** and **Cash Flow**. Marg Q controls for a firm's investment opportunities and Cash Flow controls for any investment response that may be driven by new cash on hand. Both controls have been empirically linked to investment behavior.

[9]Investment Percent is chosen as the dependent variable, in part, so that results are directly comparable to prior research on investment behavior among Compustat firms (Cummins et al. (1994), Desai and Goolsbee (2004), Edgerton (2010), Ohrn (2014))

4.4 HP Index of Financial Distress

A measure of financial distress is included in the analyses to control for the effects of financing on investment in the baseline analyses and to examine the heterogeneity of investment response across firms with varying levels of financial constraint to support the second empirically testable hypothesis generated by the conceptual framework. The empirical analysis with rely on the **HP Index** as derived in Hadlock and Pierce (2010). Hadlock and Pierce (2010) find measures of financial constraint that have been used in the past (investment cash-flow sensitivity from Fazzari, Hubbard and Petersen (1988), the KZ Index from Kaplan and Zingales (1997), the Whited Wu Index from Whited and Wu (2006)) are not particularly effective at predicting financial constraint as measured by detailed qualitative information contained in financial filings. Instead, Hadlock and Pierce find that firm size and age are particularly useful predictors of financial constraint. They construct an aggregate measure of financial constraint that decreases at a decreasing rate in firm size and decreases linearly in firm age. The exact construction of the HP Index is described in Appendix B. Table 3 reports descriptive statistics for the HP Index.

4.5 Tax Status Variables

Blouin et al. (2010)'s simulated marginal tax rates, **MTR**, will be used to approximate tax status. The rates are both a function of a firms current taxable status and whether the growth trajectory of the firm will make the firm taxable in the future. The average MTR for the investment sample is 0.195 meaning the simulated tax rate on the marginal dollar of income is 19.5%. The MTRs generated by Blouin et al. (2010) are only available for years 2000-2010.

4.6 Fiscal Year Ends and Foreign Operations

Two variables are used to limit the full sample to several groups of interest. The first, **Dec Fiscal Year**, is an indicator equal to 1 if the firm's fiscal year ends in December and equal to 0 if the firms fiscal year ends in another month (usually March, June, or September). If firms have a December fiscal year, then the information contained in their financial statements lines up perfectly with the implementation of the DPAD – for instance, all qualified income earned in fiscal year 2004 was not subject to the DPAD and all qualified income earned in 2005 was eligible. On the other hand, qualified income earned during fiscal year 2005 for firms with June fiscal years ends may or may not be eligible for the deduction. Limiting the analysis to Dec Fiscal Year firms removes this potential source of measurement error from the analysis. 68.2% of the investment sample have fiscal years ending in December.

The analysis is also sometimes limited to **Domestic** or **Multinational** firms. If a firm reports positive foreign in years 2002–2004 then that are classified as a Multinational. If a firm reports no foreign income then they are classified as Domestic. 67.2% of firms in the investment sample

Table 3: Additional Descriptive Statistics; Corporate Sample

	Median	Mean	10th pctile	90th pctile
Investment Percent	0.187	0.432	0.039	0.787
Z Tax Term	0.923	0.915	0.875	0.952
Marg Q	1.523	3.974	.864	5.165
Cash Flow	0.190	-9.195	-9.183	1.915
HP Index	-4.356	-4.253	-6.711	-1.677
MTR	0.210	0.195	0.019	0.350
Dec Fiscal Year	1.000	0.690	0.000	1.000
Domestic	1.000	0.646	0.000	1.000
Multinational	0.000	0.354	0.000	1.000
Firms			9,184	
Firms x Years			60,178	

Notes: Table 3 reports the mean, median, 10th percentile, and 90th percentile statistics for the outcome variable (investment percent), control variables (Z Tax Term, Marg Q, Cash Flow, and HP Index), and sample splitting variables (Foreign, Foreign percent, and December Fiscal Year) for the main investment analysis sample. Tax Loss is measured in millions of dollars.

report no income from foreign operations.

4.7 Winsorizing

Variables that potentially suffer from misreporting are Winsorized at the 1st and 99th percentiles to limit the effects of misreported data. All results are robust to both more aggressive Winsorizing at the 5% level and to the absence of Winsorizing. The Winsorized variables are Investment Percent, Marg Q, Cash Flow, HP Index, and Tax Losses.

5 Empirical Design and Identification

The investment impact of the DPAD may be empirically estimated because the policy differentially affects firms based on the percentage of income that they derive from QPAI. When the deduction is implemented and subsequently increased, the investment behaviors of the high QPAI firms may be measured against the investment behaviors of the low QPAI firms.

This differences-in-differences (DD) estimation strategy may be carried out using standard OLS regression techniques. The baseline DD specification is given by

$$\frac{I_{it}}{K_{i,t-1}} = \beta_0 + \beta_1 DPAD_{jt} + \sum_{s=2}^{n} \beta_s \text{Control}_s + \eta_i + \gamma_t + \epsilon_{it} \tag{1}$$

where i indexes firms, j index industries, and t indexes time. η and γ are firm and year fixed effects. In this DD specification, $DPAD$ is akin to the interaction term because it is equal to ρd in terms corresponding to the conceptual model or equal to the treatment (d) multiplied by the intensity of the treatment (ρ). ρ, which varies by firm but is fixed over time, and d, which varies over time but not by firm, are not included in the regression separately as they are captured by firm and year fixed effects.

Variation in $DPAD$ is at the industry-by-year level, so identification of the β_1 coefficient is generated from how different industries respond to the policy. The key identifying assumption is that the policies are independent of other industry-by-year shocks. Section 7 addresses this concern, by performing placebo analyses, controlling for macroeconomic industry-level trends, and estimated policy effects while including sector-by-year fixed effects, sector specific time trends in regression. When sector level controls are added, identification of the β_1 coefficient comes from how different industries within the same sectors respond to the DPAD. For example β depends on how apparel manufacturing, a low QPAI % industry in the manufacturing sector, responds to the policy compared to how furniture manufacturing, a high QPAI % industry in the manufacturing sector, responds to the policy. Reassuringly, included sector-by-year fixed effects or time trends actually increases the estimated magnitude of the policy, suggesting that sector-by-year trends do not drive empirical identification.

To test for heterogeneity in investment response across varying level of financial constraint and tax status, the DD estimation strategy is implemented for different groups of firms (high vs. low financial constraint / currently taxable vs. currently untaxable). The β_1 coefficient is then compared across the groups of firms. This technique implements a differences-in-differences-in-differences (DDD) strategy; the DD coefficient is again differenced across groups that potentially respond heterogeneously to the policy. This DDD implementation is more flexible and therefore preferably to simply including a DDD term ($DPAD \times$ group) and cross terms in the regressions because it allows for controls to to have different coefficients in each sample.

6 The Effect of the DPAD on Investment

6.1 Baseline Empirical Results

Table 4 presents estimates of coefficients from Equation (1). These baseline specifications, as well as all other estimates, include year and firm fixed effects. Standard errors are clustered at the industry level [10]

Overall, baseline results indicate a statistically and economically significant impact of the DPAD on corporate investment. Specification (1) estimates the impact of the DPAD on investment percent when no control variables are present. Without controls, a one percentage point reduction in a firm's effective corporate income tax rate via the DPAD increases investment percent by 0.40. In specification (2), when industry-level controls for bonus depreciation and firm level controls for financial constraint, cash flows, and investment opportunities are added, the impact increases to 0.053. The impact of the DPAD is even larger in Specification (3) when the sample is limited to corporations with December Fiscal Years – those firms whose fiscal years are temporally aligned with changes in the DPAD deduction rate.

In Specifications (3) and (4), Equation (1) is estimated separately for domestic firms and multinationals. The results suggest investment activity by multinationals is relatively more responsive to the DPAD. For multinationals, a one percentage point decrease in their effective U.S. corporate income tax rate via the DPAD increases investment percent by 0.053. For domestic corporations the same tax rate drop increases investment percent by 0.039.[11] The real difference in investment responsiveness is most likely larger as financial statement data for multinationals is aggregated across all subsidiaries worldwide. Thus, assuming the estimated response is driven only by U.S. investment and understanding that a large majority of investment is not done in the U.S., the responsiveness of only U.S. investment by multinationals would be larger than the observed 0.053.

From Specification (2), $\mathcal{E}\{I\%, (1-\tau\rho d)\}$, the estimated elasticity of investment with respect to the net of tax rate, $(1-\tau\rho d)$, is 7.8.[12] This estimate is 8% larger than the 7.2 elasticity estimated by Zwick and Mahon (2014) and indicates that, on average corporate investment is more responsive to the DPAD than business investment is to accelerated depreciation. For domestic firms, the elasticity of investment with respect to the net of tax rate is equal to 6.14 while for multinationals, the elasticity is equal to 8.45.

[10] Industry-level clustered standard errors are larger and statistical significance is more conservative than when standard errors are clustered by firm or two-way clustered by industry and year.

[11] Lester (2015) estimates this same number as 0.022 by comparing self-reporting DPAD firms to a matched sample firms that do not mention the DPAD in their financial reports. The divergence in the two estimates indicates that firms in her control groups are increasing investment in response to the DPAD but are not reporting their take-up of the deduction, leading to downward biased estimates.

[12] This estimate is based on a mean investment percent of 0.43 and at a net of tax rate half way between 0.65 and 0.6185, the net of tax rate with no DPAD and with a full 9% DPAD. The statutory tax rate, τ, is assumed to be 0.35.

Table 4: Investment Response to DPAD

Dependent Variable:	Investment Percent				
Specification	(1)	(2)	(3)	(4)	(5)
DPAD	0.040***	0.053***	0.062***	0.039**	0.053***
	(0.014)	(0.014)	(0.017)	(0.019)	(0.016)
Z Tax Term		0.147	0.362	0.276	-0.202
		(0.164)	(0.257)	(0.202)	(0.193)
HP Index		-0.168***	-0.166***	-0.186***	-0.113***
		(0.019)	(0.025)	(0.021)	(0.016)
Marg Q		-1.1×10^{-4}	-3.9×10^{-4}	4.1×10^{-5}	0.002
		(0.001)	(0.001)	(0.001)	(0.002)
Cash Flow		-0.004***	-0.004***	-0.004***	-0.005***
		(2.5×10^{-4})	(3.0×10^{-4})	(2.3×10^{-4})	(0.001)
December Fiscal Year			✓		
Domestic Firms Only				✓	
Multinationals Only					✓
Firms	8,132	8,132	5,750	5,259	2,873
Firm x Years	59,126	59,126	40,739	38,267	20,859
$\mathcal{E}\{I\%, (1 - \tau\rho d)\}$	5.85	7.82	9.87	6.14	8.46

Notes: Specifications (1) through (6) present coefficients from regressions of the form

$$\frac{I_{it}}{K_{i,t-1}} = \beta_0 + \beta_1 DPAD_{jt} + \sum_{s=1}^{n} \beta_s \text{Control}_s + \epsilon_{it}.$$

In specifications (2) – (5), controls for bonus depreciation, financial distress, marginal Q, and cash flows are included. In specification (3) the analysis is limited to firms with fiscal years that end on December 31st. In specification (4), analysis is limited to Domestic Firms. In specification (5), the analysis is limited to Multinationals. All specifications include firm and year fixed effects. Standard errors are clustered at the industry level. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

Section 8.2 investigates whether this divergence in responsiveness is due to the DPAD or due to the contemporaneous Dividend Received Deduction which potentially stimulated U.S. investment by multinational corporations.[13]

These elasticities translate into substantial investment responses for the average firm. The average firm in the sample derives 40% of their income from domestic production activities. When the DPAD was fully phased in, the average firm received a 1.24% (3.15 x .4) decrease in their average effective income tax rate. Based on these numbers, the Specification (2) results suggest that the average firm in the sample increased their investment activity by approximately 15% in response to the DPAD. The average increase for a domestic firm was 10% and the average multinational increased activity by 17.5%. Because responsiveness is heterogeneous along the dimension of financial constraint, these average responses based on count-weighted estimates do not describe the economy-wide impact of the DPAD. Section 9 describes this heterogeneity and re-weights estimates to describe the overall corporate investment response to the DPAD.

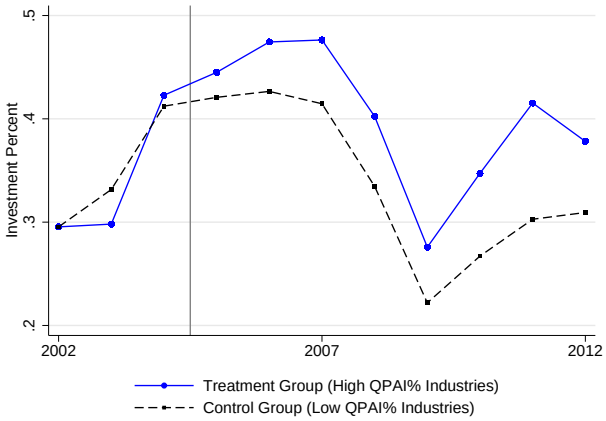
6.2 Graphical Analysis

Figure 5 presents a visual implementation of the difference-in-difference research design described in Section 5 and empirically estimated in Section 6.1. To create these graphs, first, a separate regression is run for each year in which investment percent is regressed on firms and industry level control variables. From these regressions, residuals are generated and then averaged for treatment and control groups where firms are considered treated if more than 40% of their income is derived from qualified production activities. The residual group means are then added to average investment percent in each year then equalized in the pre-treatment period to ease comparison of trends. Finally, these adjusted group residuals are plotted. The visuals that result from this procedure match the fixed-effects regressions with firm level covariates presented in Table 4. The increase the residual treatment group relative to the residual control group means after the DPAD is implemented can be interpreted as a visual the difference-in-difference estimate. On the whole, the graphical evidence complements the baseline empirical analysis and suggests that the DPAD has a strong and lasting impact on corporate investment. All four panels which limit the graphical analysis to difference subgroups show an increase in investment by the high QPAI firms relative to the low QPAI firms once the DPAD is implemented. This divergence occurs immediately in 2005 and persists through 2012 (except for multinational firms in 2008 and 2009). The divergence does not increase sharply in 2007 or 2010 when the DPAD rate is increased to 6% then 9% but does steadily grow over time. Investment trends in years 2002–2004 are similar between treatment and control groups suggesting pre-trends are not responsible for the empirical results.

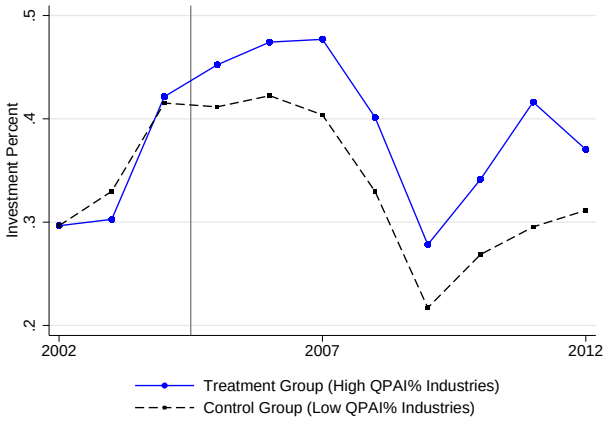
[13] Appendix C presents estimates using data averaged at the industry-level in an effort to alleviate concern that outliers may be driving estimates of the investment response to the policy. Results indicate a slightly smaller investment response across all firms; $\mathcal{E}\{I\%, (1 - \tau\rho d)\} = 6.62$. Using the industry-averaged data, point estimates indicate that domestic firms are more responsive to the policy than multinationals.

Figure 5: Investment Response Graphical Diff-in-Diff

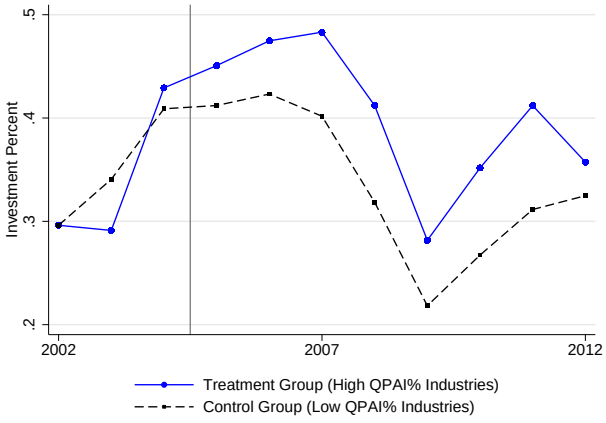
(a) All Firms



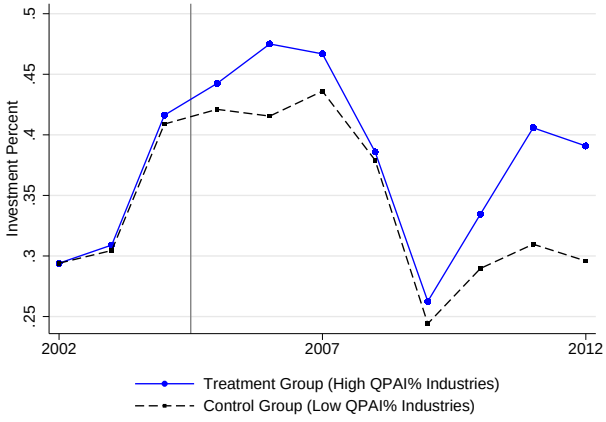
(b) December Fiscal Year Firms



(c) Domestic Firms



(d) Multinationals



Notes: Figures 5(A) - 5(D) plot the mean investment percent over time for groups sorted according to their industry-based treatment intensity. The Treatment Group (Control Group) is defined as firms within industries in which more than (less than) 40% of income is derived from Qualified Production Activities. The treatment years are years 2005-2012 as the DPAD increases from 0 to 3 to 6 to 9% in 2005, 2007, and 2010. The averages plotted here are derived through the following procedure: cross-sectional regression of investment percent on controls for tax depreciation allowances, cash flows, and financial constraint are run in each year. Residual group means for the treatment and control group are then calculated and added to the mean investment percent for each year. Finally, group means prior to implementation are equalized to ease comparison of trends. All means are count weighted.

7 Robustness of Baseline Results

Before exploring further heterogeneity in responsiveness to the DPAD and the interaction of the DPAD with other contemporaneous tax policies, it seems prudent to assure ourselves that the baseline empirical results presented in Table 4 and Figure 5 are not generated by industry-level variation in investment that is unrelated to the DPAD. To test for robustness such shocks, this section presents placebo analyses, and reproduces baseline estimates while controlling for industry-level investment cyclicality and sector-level trends and shocks.

7.1 Investment Placebo Tests

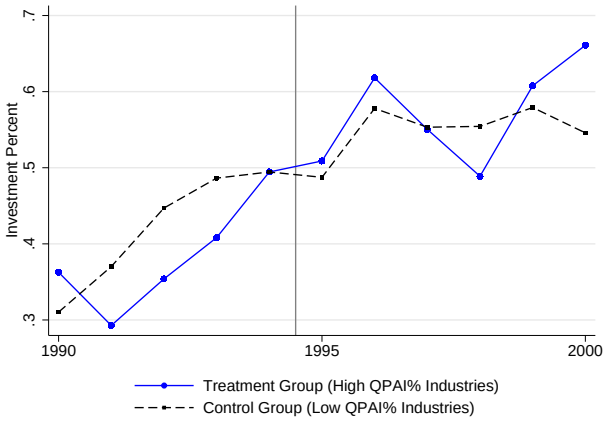
One potential issue with using industry-level time series data to estimate the impact of the DPAD policy is that different industries may respond differently to the business cycle and these different responses may produce spurious results. The simplest way to explore this potential issue to is to explore how high and low QPAI industries have responded to past business cycles. Figure 6 does this visually by following the exact procedure outlined in Section 6.2 to compare high and low QPAI industries during the years 1990-2000. In all four panels of Figure 6, no sharp and lasting divergence between high and low QPAI industries is obvious suggesting that high and low QPAI industries do not respond differently to the business cycles.

To create Figure 6, investment levels were equalized in 1994. This equalization, in essence, assumes that a placebo DPAD policy is implemented in 1995. This year was chosen because, business cycle conditions were comparable around 2005 and around 1995; like years 2003–2006, the economy was expanding during years 1993–1996. Thus, a second interpretation of Figure 6 is that a placebo policy introduced in 1995 does not yield similar graphical difference-in-difference results to analysis of the real DPAD.

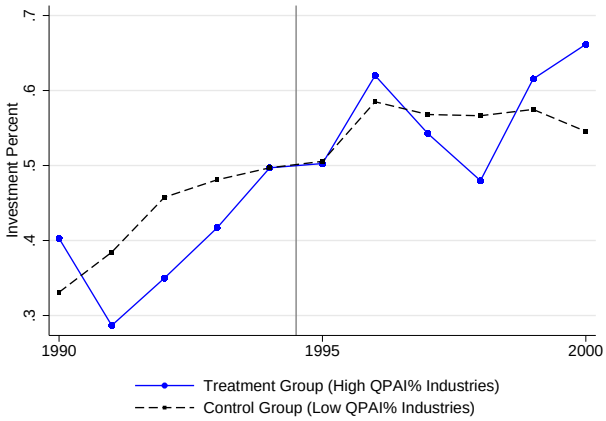
This 1995 placebo may also be explored empirically. Table 5 presents estimates from the same baseline regression models as in Table 4 but, now, assumes the DPAD was implemented at a rate of 3% in 1995 and subsequently increased to 6% and 9% in 1997 and 2000. The Table 5 results show no statistically significant effect of the placebo policy on investment and echo the visual differences-in-differences placebo. Taken together, these placebo analyses are an important first step in demonstrating that industry-level trends are not confounding estimated effects of the DPAD.

FIGURE 6: INVESTMENT RESPONSE PLACEBO 1990-2000

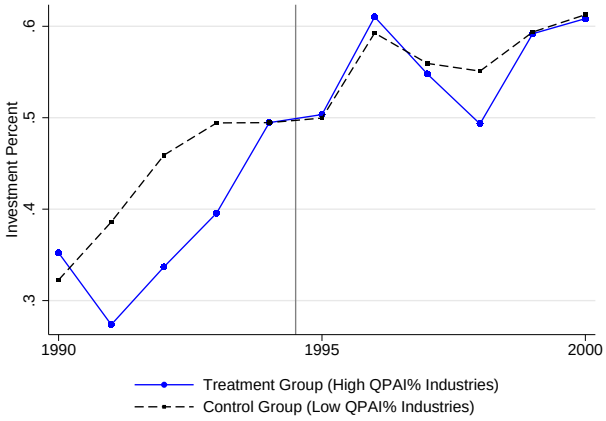
(A) ALL FIRMS



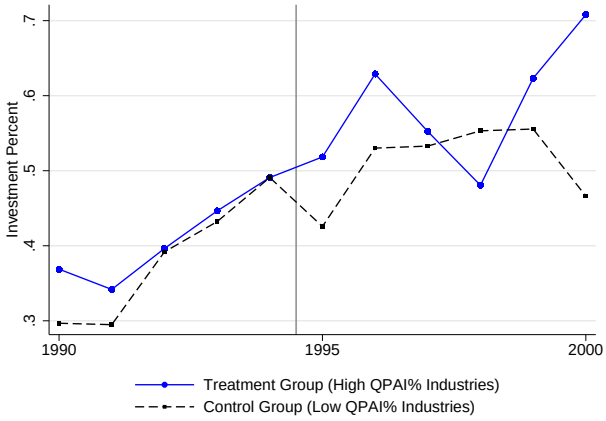
(B) DECEMBER FISCAL YEAR



(C) DOMESTIC FIRMS



(D) MULTINATIONAL FIRMS



Notes: Figures 6(A) - 6(D) plot the mean investment percent over time for groups sorted according to their industry-based treatment intensity. The Treatment Group (Control Group) is defined as firms within industries in which more than (less than) 40% of income is derived from Qualified Production Activities. The placebo policy is "enacted" in 1995, The averages plotted here are derived through the following procedure: cross-sectional regression of investment percent on controls for tax depreciation allowances, cash flows, and financial constraint are run in each year. Residual group means for the treatment and control group are then calculated and added to the mean investment percent for each year. Finally, group means in year 1994 are subtracted from all observations and the overall mean investment percentage is added to ease the comparison of trends before and after the placebo policy is implemented. All means are count weighted.

Table 5: Investment Response to 1995 DPAD Placedo

Dependent Variable:	Investment Percent				
Specification	(1)	(2)	(3)	(4)	(5)
DPAD	0.005	0.012	0.013	0.021	-0.038
	(0.034)	(0.038)	(0.050)	(0.026)	(0.077)
HP Index		-0.163***	-0.170***	-0.128***	-0.204***
		(0.017)	(0.021)	(0.019)	(0.020)
Marg Q		0.004**	0.004	0.003*	0.005**
		(0.002)	(0.002)	(0.002)	(0.002)
Cash Flow		-0.019***	-0.019***	-0.016***	-0.022***
		(0.001)	(0.001)	(0.001)	(0.001)
December Fiscal Year			✓		
Domestic Firms Only				✓	
Multinationals Only					✓
R-Squared	0.023	0.104	0.108	0.072	0.147
Firms	12,815	12,815	8,648	6,415	6,400
Firm x Years	118,269	118,269	74,953	64,497	53,772

Notes: Specifications (1) through (6) present coefficients from regressions of the form

$$\frac{I_{it}}{K_{i,t-1}} = \beta_0 + \beta_1 DPAD_{jt} + \sum_{s=1}^{n} \beta_s \text{Control}_s + \epsilon_{it}.$$

Where DPAD is a placebo policy initiated in 1995 and phased in over years 1995-2000. In specifications (2) – (6), controls for financial distress, marginal Q, and cash flows are included. In specification (3) the analysis is limited to firms with fiscal years that end of December 31st. In specification (4), analysis is limited to Domestic Firms. In specification (5), the analysis is limited to Multinationals. All specifications include firm and year fixed effects. Standard errors are clustered by industry. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

7.2 Correcting for Industry-Level Investment Cyclicality

To further address potentially confounding industry-level investment responses to the macroeconomy, one can attempt to control for such cyclicality while estimating the investment impact of the DPAD. To do this, a two-stage procedure is followed to eliminate business cycle effects from the investment outcome variable. First, for each of the 77 IRS industries, firm level annual Investment % is estimated as a function of annual % change in GDP using data from the years 1980–2000 as in the following equation:

$$\text{Investment } \%_{it} = \alpha_j + \beta_j[\%\Delta\text{GDP}_t] + \gamma_j[\%\Delta\text{GDP}_t^2] + \epsilon_{it}. \tag{2}$$

Second, from the regressions, industry-level estimates of α, β and γ are recovered and used to predict an expected investment ($\widehat{\text{Investment}}$ %) for each industry during each year 2002–2012. Panel (A) of Figure 7 plots ($\widehat{\text{Investment}}$ %) over the levels of %ΔGDP observed during 2002–2012 for both High QPAI and Low QPAI industries. The plot demonstrates that different industries do, on average, responds differently to the business cycle. When the economy is expanding, High QPAI industries are predicted to invest slightly more than Low QPAI industries. When the economy moves into a recession, however, High QPAI industries are predicted to invest significantly less than Low QPAI industries. Therefore, as shown in Panel (B), in absence of the DPAD, High QPAI industries are predicted to invest similarly to Low QPAI industries in years 2002–2007 and in years 2010–2012 but significantly less than Low QPAI industries in 2008 and 2009.

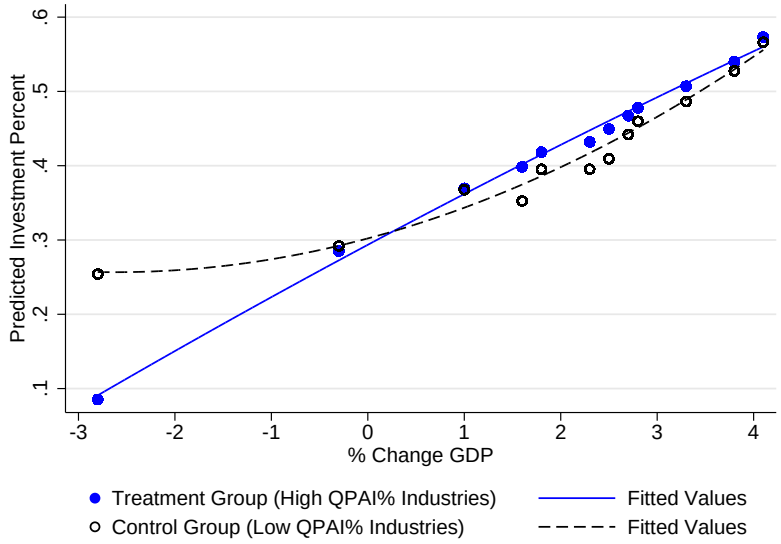
To incorporate these predictions into the baseline DPAD analysis, a residual investment variable is created where

$$\text{Residual Investment } \%_{it} = \text{Investment } \%_{it} - \widehat{\text{Investment}} \ \%_{jt}. \tag{3}$$

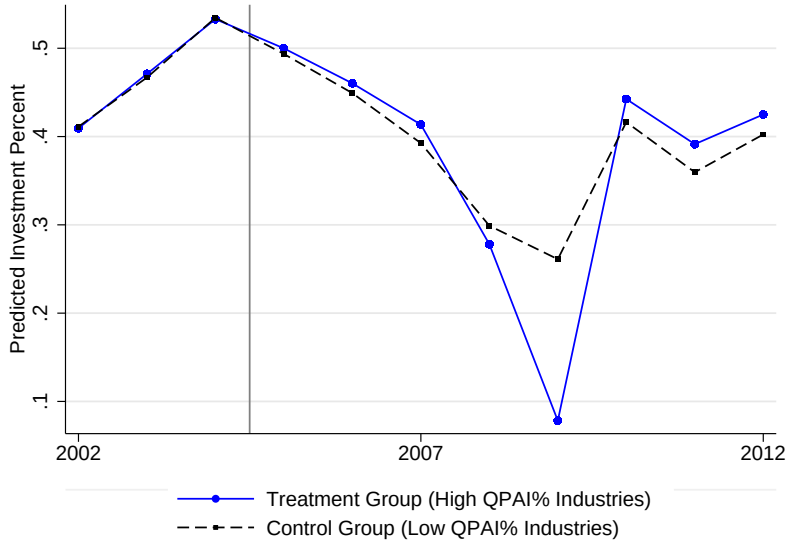
For the empirical analysis, Residual Investment % is normalized to increase its interpretability. Residual Investment % represents only the portion of a firm's annual investment activity that is unrelated to the responses of it's industry to the macroeconomy. When this new outcome variable is used instead of Investment % as the outcome variable in DPAD analyses, concerns of confounded estimates due to differences in industry-level responses to the business cycle are eliminated.

Figure 7: Predicting Investment Percent

(a) Predicted Investment Percent



(b) Predicted Investment Percent Over Time



Notes: Figure 7(A) plots the predicted investment percent for Treatment and Control Groups where the Treatment Group (Control Group) is defined as firms within industries in which more than (less than) 40% of income is derived from Qualified Production Activities. Figure 7(B) plots the Predicted Investment Percent % for High and Low QPAI industries over the years 2002–2012.

Table 6: Residual Investment Response to the DPAD

Dependent Variable:	Residual Investment %				
Specification	(1)	(2)	(3)	(4)	(5)
DPAD	0.099***	0.122***	0.132***	0.091**	0.133***
	(0.034)	(0.032)	(0.037)	(0.036)	(0.040)
Z Tax Term		0.346	0.781*	0.645*	-0.416
		(0.345)	(0.469)	(0.388)	(0.425)
Additional Controls		✓	✓	✓	✓
December Fiscal Yr			✓		
Domestic Firms Only				✓	
Multinationals Only					✓
Firms	8,040	8,040	5,668	5,202	2,838
Firm x Years	57,574	57,574	39,486	37,129	20,445

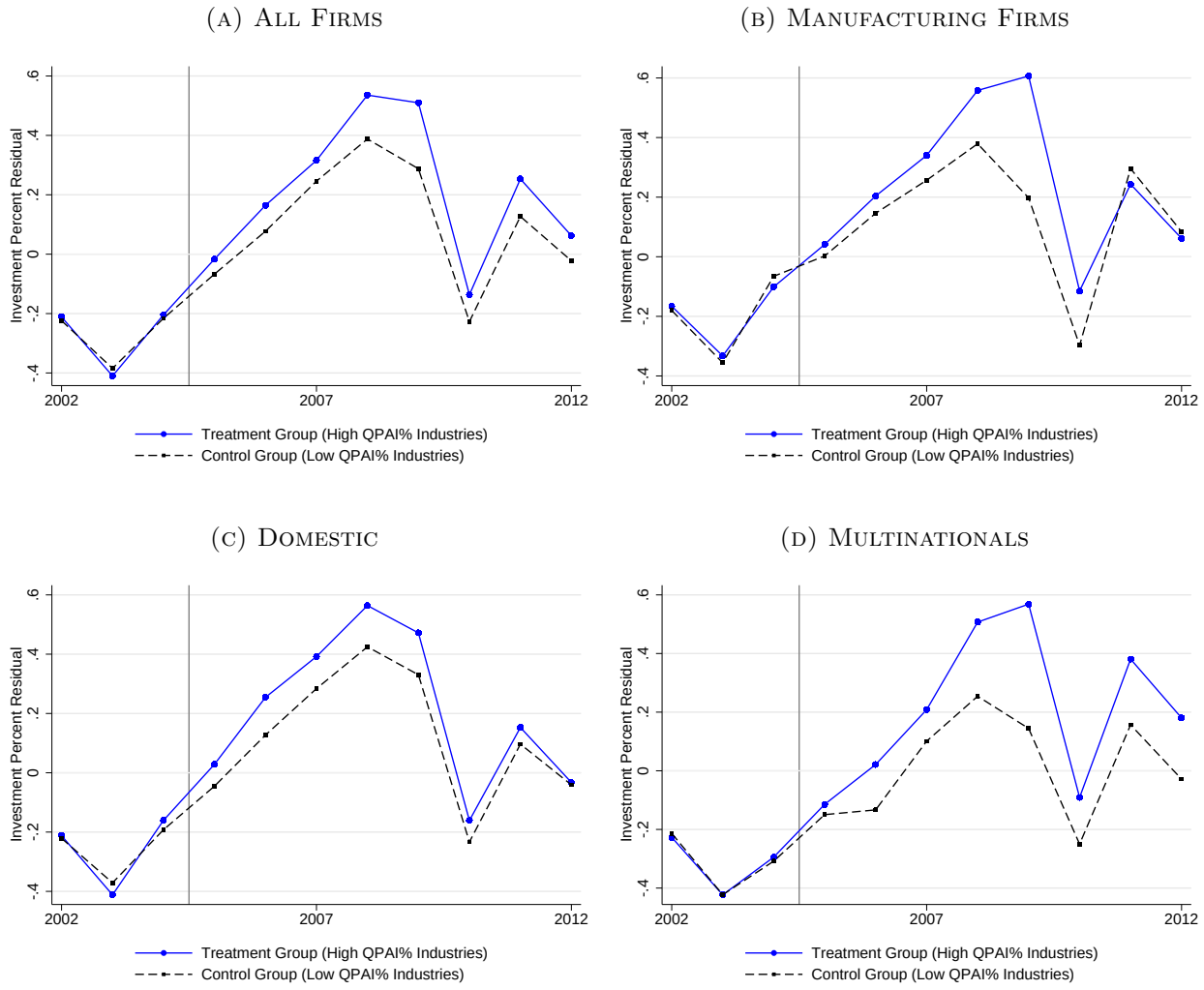
Notes: Specification (1) through (5) presents coefficients from regressions of the form

$$\text{Residual Investment } \%_{it} = \beta_0 + \beta_1 DPAD_{jt} + \sum_{s=2}^{n} \beta_s \text{Control}_{it} + \epsilon_{it}$$

where Residual Investment % is defined as the difference between observed and predicted investment as defined in Equation 2. All specifications include firm and year fixed effects and control for bonus depreciation, financial distress, marginal Q, and cash flows. Standard errors are clustered at the industry level. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

Estimates using residual investment as the outcome variable are presented in Table 6. These estimates indicate that after controlling for industry-level investment responses to the business cycle, the DPAD continues to have a strong positive effect on investment activity. The Specification (2) results suggest that, controlling for firm level determinants of investment and bonus deprecation, a one percentage point decrease in a firm's effective corporate income tax rate via the DPAD increases residual investment activity by 12% of one standard deviation. As was the case in the baseline regressions using the unaltered outcome variable, investment activity is more responsive to the DPAD when firms have December fiscal years and when firms operate in more than one country.

Figure 8: Graphical Diff-in-Diff Residual Investment



Notes: Figure 8 plots the mean residual investment over time for groups sorted according to their industry-based treatment intensity. The Treatment Group (Control Group) is defined as firms within industries in which more than (less than) 40% of income is derived from Qualified Production Activities. The treatment years are years 2005-2012 as the DPAD increases from 0 to 3 to 6 to 9% in 2005, 2007, and 2010. The averages plotted here are derived through the following procedure: cross-sectional regression of residual investment percent on controls for tax depreciation allowances, cash flows, and financial constraint are run in each year. Residual group means for the treatment and control group are then calculated and added to the mean investment percent for each year. Finally, group means in year 2002 are subtracted from all observations and the overall mean investment percentage in added to ease the comparison of trends. All means are count weighted.

To compare these estimates to the baseline model, we start with the standard deviation of Investment %, which is 1.077. A 0.12 standard deviation increase is roughly equivalent to an increase in investment percent of 0.13. Relative to baseline results, these effects are large. This suggests that different industry-level responses to business cycles mask or downward bias estimates of the investment impact of the DPAD.[14]

Figure 8 presents the graphical implementation of the differences-in-differences research design using Residual Investment % as the outcome variable. Upon DPAD implementation in 2005, Residual Investment by High QPAI firms increases relative to Residual Investment by and Low QPAI firms. This gap persists through the end of the sample period except for in the Manufacturing Firms panel. Theses visual results reinforce the empirical findings; industry-level responses to business cycles are not responsible for the corporate investment response to the DPAD.

7.3 Robustness to Sector Fixed-Effects and Trends

The analysis is Sections 7.1 and 7.2 demonstrate that industry-level co-movements with the macroeconomy do not confound estimates of the effect of the DPAD on corporate investment. This analysis, however, is unable to show that there exist *no* differences in industry-level trends investment response estimates. Instead of attempting to account for another specific type of shocks as in Section 7.2, the analysis now turns to accounting for trends and shocks at the sector level. By controlling for sector-level trends and shocks, this section attempts to eliminate any concerns that differences in investment by High and Low QPAI sectors are responsible for the observed response to the policy.

Specification (1) of Table 7 limits the analysis to only firms within the manufacturing sector. As these firms all experience the same sector level shocks, the year-fixed effects provide effective control and allow the impact of the policy to be estimated in the absence of such shocks. The Specification (1) DPAD coefficient estimate suggests a large investment response to the DPAD among manufacturer firms. However, the coefficient is not statistically significant, perhaps due to the reduced sample size.

In Specification (2), sector-by-year fixed effects are added to the regression for the full smaple of firms. With sector-by-year fixed effects, the impact of sector-level annual shocks to investment are eliminated and identification of the impact of the DPAD on investment comes from how investment by different industries with varying levels of QPAI within a sector responds to the DPAD. The point estimate is larger than in the baseline model indicating that sector-by-year shocks, like macroeconomic conditions, may obscure the impact of the DPAD policy. The estimated coefficient

[14]Results in Table 6 also suggest that bonus depreciation has a substantial and marginally statistically significant effect on residual investment for December fiscal year firms and domestic firms. In past studies, the corporate investment response to bonus depreciation has been more or less non-existent. That these estimates show signs of a positive impact suggests that industry-level responses in investment to the business cycle may have obfuscated the estimates of the impact of the policy in the past.

is significant at the 10% level.

Specifications (3) and (4) report results from regressions that include sector-level linear and quadratic time. While these time trends are less flexible that the sector-by-year fixed effects, they eliminate any concerns that different trends in High and Low QPAI sectors generated the estimated investment response. In both regressions, the DPAD is estimated to have a large and statistically significant effect on corporate investment activity.

Overall, the results presented in Table 7 suggest that baseline estimates are robust to sector-level time trends and sector-level shocks which potentially differentially affect Low and High QPAI sectors. Having demonstrated that the baseline empirical results are not driven by macro-economic factors or sector trends, the analysis now proceeds to investigate the interaction of the DPAD with two contemporaneous tax polices, the Extraterritorial Income Exclusion and the Dividends Received Deduction.

Table 7: Robustness to Sector FE, and Sector Trends

Dependent Variable:	Investment Percent			
Specification	(1)	(2)	(3)	(4)
DPAD	0.126	0.105*	0.092***	0.079***
	(0.079)	(0.053)	(0.019)	(0.020)
Manufacturing Only	✓			
Sector x Year FE		✓		
Sector Linear Time Trends			✓	
Sector Quad Time Trends				✓
Firms	3,921	8,944	8,944	8,944
Firm x Years	27,243	58,647	58,647	58,647

Notes: Specifications (1) through (4) present coefficients from regressions of the form

$$\frac{I_{it}}{K_{i,t-1}} = \beta_0 + \beta_1 DPAD_{jt} + \sum_{s=1}^{n} \beta_s \text{Control}_s + \epsilon_{it}.$$

All specifications include firm and year fixed effects and controls for bonus depreciation, financial distress, marginal Q, and cash flows. Specification (1) presents estimates using only data from the manufacturing sector. Specification (2) includes sector x year fixed effects. Specification (3) includes sector specific linear trends. Specification (4) includes sector specific quadratic time trends. Standard errors are clustered at the industry level. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

8 Interactions with Contemporaneous Tax Policies

The DPAD was introduced to replace the Extraterritorial Income Exclusion and was implemented in tandem with the 2004 Dividends Received Deduction. This section explores the interaction of the DPAD with both of these federal tax incentives that also potentially affect corporate investment. The goal of this section is to isolate the effect, if any, that these policies have on the estimates of the DPAD's effect.

8.1 The Extraterritorial Income Tax Incentive

Before 2004, Extraterritorial Income Exclusion (ETI) allowed firms to deduct a percentage of income from exports from their taxable income.[15] The ETI was abandoned because, in 2002, the World Trade Organization (WTO) definitively ruled that the ETI was an export subsidy that violated international free trade agreements. As a result, the WTO gave trade partners permission to apply sanctions to U.S. goods. In the face of pressure from members of the European Union, U.S. lawmakers discontinued the ETI but sought a cost neutral replacement that created similar advantages for U.S. manufacturers without violating WTO standards. The DPAD was this replacement.

The mechanics of the ETI are similar to those of it's replacement. While the DPAD allowed firms to deduct a maximum of 9% of income derived from domestic manufacturing activities, the ETI allowed firms to deduct 15% income derived from domestic manufacturing *and* exporting activities. Thus, the ETI offered a higher statutory deduction rate but a more narrow base than the DPAD.

8.1.1 ETI Data

As in the DPAD analysis, industry-level ETI treatments can be constructed and used to investigate the repeal of the ETI . The impact of the policy on different industries is captured by **Export Percent**, the percentage of income derived from domestic exporting.[16] To calculate Export Percent, industry-level gross export receipts from USA Trade Online[17] are divided by industry-level total

[15] Products could qualify as exports only if they were manufactured or significantly altered (more than 50% of values added) in the U.S.

[16] The income on which the ETI applies defined as income derived from the export of domestic produced or altered goods.

[17] USA Trade Online is the official source for U.S. merchandise trade data. Industry-level export values are constructed from census export data

receipts from IRS tax data.[18][19] Like QPAI Percent, Export Percent is multiplied by the statutory deduction rate (0.15) then the corporation income tax rate (0.35) to transform it into an industry-level measure of the percentage point reduction in the corporate income tax rate via the ETI (denoted **ETI**).

Figure 9 graphs Export Percent across NAICS 3-digit industries and Table 8 presents summary statistics for Export Percent and ETI across the Corporate Sample. On average, 9% of income is derived from exporting activities translating into a corporate income tax rate reduction of 0.477 percentage points. Like QPAI, Export Percent varies widely across industries; the agricultural industry derives more than 40% of income from exporting activities while a significant number of industries derive less than 10% of income from exports. The correlation between Export Percent and QPAI Percent is equal to -0.4. This negative correlation suggests that the industries which were most hurt by the repeal of the ETI are not the same industries that most benefited from the introduction of the DPAD. This means that estimates of the investment response to the DPAD may be generated not by a positive investment response by high QPAI industries but rather by a negative investment response by high ETI industries.

Table 8: ETI Descriptive Statistics; Corporate Sample

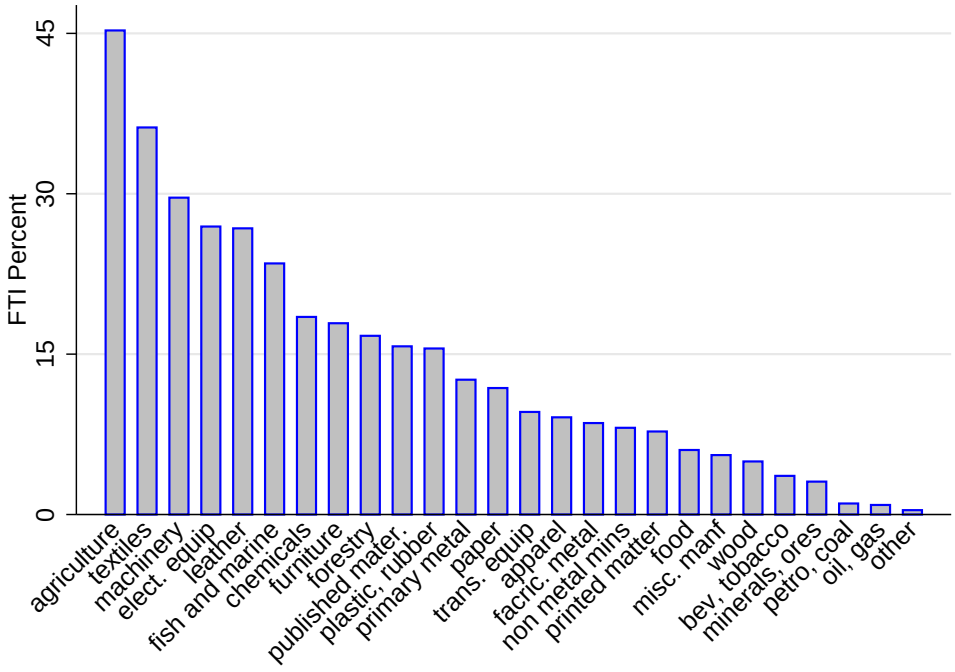
	Median	Mean	10th pctile	90th pctile	Max
Export Percent	0.895	9.068	0.000	26.937	45.275
ETI	0.047	0.477	0.000	1.414	2.377
Firms			7,104		
Firms x Years			22,656		

Notes: Table 8 reports the mean, median, 10th percentile, and 90th percentile statistics for the percent of income derived from exporting activities and ETI, the effective tax rate reduction that firms received via the ETI.

[18]USA Trade Online does not record exporting data on every NAICS 3-digit industry. Data is not recorded for many industries because they produce zero or a negligible amount of products for export. Examples of industries that do not appear in the USA Trade Online data are transportation, healthcare, and real estate. For the purposes of estimating the impact of the ETI on investment, these industries are assigned an Export Percent of 0.

[19]The ETI applies only to the net income from exporting activities. However, only data on gross exports are available. If net income from exporting activities were available it could be divided by (net) taxable income in order to derive the percentage of income to which the ETI applies. Because only the gross numbers are available, they are divided by total receipts from the IRS. Under the assumption that profit margins are the same for domestic exports and other forms of income generation, this process yields accurate percentages of income derived from domestic exporting activities.

FIGURE 9: EXPORT PERCENT BY INDUSTRY



Notes: Figure 9 presents the Export Percent across industries for year 2004. Export Percent is defined as the ratio of domestic exports divided by the total receipts. Domestic export data is taken from US Trade Online. Total receipts is taken from the IRS SOI business statistics database.

8.1.2 Investment Response to the ETI and DPAD

The impact of the ETI on corporate investment and its interaction with the DPAD is explored empirically in Table 9. Specification (1) regresses Investment % on ETI while controlling for firm level determinants of investment and industry level bonus depreciation incentives. Specification (1) results suggest the repeal of the ETI has no impact on corporate investment. In Specification (2), DPAD is added to the regression model. When both ETI and DPAD are included, the DPAD has a positive effect on investment. The DPAD coefficient point estimate is slightly larger than in the baseline estimation. Introducing the DPAD increases the magnitude of the ETI coefficient point estimate but it is not statistically significant. Specification (3) regresses investment on a combined DPADETI variable. When both policies are combined into a single effective tax rate reduction variable, the point estimate suggests that a 1 percentage point corporate tax rate reduction via either the DPAD or ETI increases investment activity by 0.40 or by just under 10%. Specifications (4) and (5) repeat the Specification (2) model but limit the analysis to only domestic and only

multinational firms. In both specifications the ETI coefficient is not statistically significant and the DPAD coefficient estimates are slightly larger than in baseline regressions.

Overall, several conclusions can be drawn from the combined the combined DPAD ETI analysis. First, although the DPAD was designed to replace the ETI, the industries that benefited most from the ETI were not the same as those that benefit the most from the DPAD. Second, corporate investment behavior does not seem to be responsive to the ETI. Finally, the repeal of the ETI is not responsible for the estimated effects of the DPAD. If anything, like the industry-level cyclical investment patterns and sector-level trends, exclusion of the ETI from the DPAD analysis downward biases estimates of the corporate investment response.

Table 9: Investment Response to the ETI and DPAD

Dependent Variable:	Investment %				
Specification	(1)	(2)	(3)	(4)	(5)
ETI	-0.001	0.019		0.019	0.027
	(0.023)	(0.025)		(0.043)	(0.017)
DPAD		0.059***		0.044*	0.061***
		(0.017)		(0.023)	(0.016)
DPADETI			0.040**		
			(0.019)		
December Fiscal Year			✓		
Domestic Firms Only				✓	
Multinationals Only					✓
Firms	9,117	9,117	9,183	5,217	2,846
Firm x Years	58,817	58,817	60,176	37,251	20,512

Notes: Specifications (1)–(4) present coefficient from regressions of Investment Percent on ETI, ETI and DPAD, or DPADETI. In all specifications the dependent investment variable is Capital Expenditure scaled by lagged Property, Plant, and Equipment. All specifications include firm and year fixed effects. All specifications include controls for bonus depreciation, financial distress, marginal Q, and cash flows. Standard errors are clustered at the industry level. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

8.2 The Dividends Received Deduction

The American Jobs Creation Act of 2004 introduced both the DPAD and the Dividends Received Deduction (DRD) which allowed firms to repatriate foreign earnings at an 85% reduced tax rate. The DPAD and DRD were designed to work in tandem to provide incentives for firms to finance new domestic investment with foreign holdings. Thus far the analysis has shown that multinational firms were more responsive to the DPAD than domestic firms. Furthermore, the difference in investment responsiveness is most likely downward biased because multinational investment data includes investments in foreign subsidiaries which should be unaffected by DPAD. The goal of this section is to determine whether the difference in investment responsiveness is due to the DRD which decreased the tax costs of foreign financing for multinationals.

8.2.1 DRD Data

From fiscal year 2004 and 2005 financial statements, Sebastien Bradley has recorded the repatriation behaviors of all firms that reported repatriating foreign earnings as a direct result of the 2004 tax holiday created by the DRD.[20] For use in this analysis, these repatriations numbers are translated into a simple indicator variable, **Repatriator**. Repatriator is equal to 1 (in all years) if a firm repatriated earning as a direct result of the DRD and if they are defined as a multinational in the preceding analysis (reported positive foreign income in years 2002–2004). Repatriator is equal to 0 if a multinational firm did not repatriate earnings in response to the DRD. In total, there are 100 firms that report DRD repatriations. These 100 Repatriators represent is 4.3% of the 2,320 multinationals if the corporate sample in 2004.

8.2.2 Investment Responsiveness to the DPAD and the DRD

In order to determine whether the combination of the DPAD and DRD incentives is responsible the larger investment response to the DPAD among multinational firms, a difference-in-difference-in-difference (DDD) empirical design is implemented. In this instance, the DDD design is preferable to a split-sample analysis because investment behavior by only the 100 Repatriator Firms is a very small sample from which to draw meaningful empirical conclusions. The DDD allows all 2000+ multinational firms to be used to estimate Repatriator vs. non-Repatriator responses to the DPAD. The DDD model can be written as

$$\text{Investment } \% = \beta_0 + \beta_1 DPAD_{jt} + \beta_2[DPAD_{jt} \times \text{Repatriator}_i] + \sum_{s=3}^{n} \beta_s \text{Control}_s + \epsilon_{it}.$$

[20] Bradley (2013) and Bradley (2014) detail the collection of this data as well as use the data to estimate stock price responses to repatriations and uncover a "Round-Tripping" Effect of the DRD.

In this DDD model, the β_1 coefficient is interpreted as the Investment % response to a one percentage point decrease in the effective corporate income tax rate via the DPAD for a Non-Repatriator. $\beta_1 + \beta_2$ is interpreted as the response by a Repatriator.

Estimates from Repatriator DDD models are presented in Table 10. In Specification (1) the DDD model is estimated without any control variables. Without controls, multinationals are estimated to increase investment percent by 0.049 in response to a one percentage point reduction in the effective effective corporate income tax rate via the DPAD. Repatriating multinationals are estimated to be no more responsive.

In Specification (2), control variables are added to the model. With control variables, investment by multinationals increases by 0.50 in response to the policy and investment by Repatriators is estimated to increase by 0.86 in response to the policy. The Specification (2) results suggest that firms that took advantage of the DRD were 172% as responsive to the DPAD as multinationals that did not. In terms of elasticities, the estimated elasticity of investment with respect to the net of tax rate for non-repatriating multinationals was 7.47 (similar to the baseline multinational elasticity) while the elasticity for repatriating multinationals was 13.0. While the repatriating firms were more responsive to the DPAD, their behavior alone was not responsible for the differential domestic and multinational responses to the DPAD; as evidenced by Specification (2), investment by non-repatriating multinationals was more responsive to the DPAD than investment by domestic firms. Specification (3) limits the analysis to multinationals in the manufacturing sector. Results indicate that, in this sector, non-repatriating multinationals are unresponsive to the policy but repatriating multinationals invest in response to the DPAD.

Blouin et al. (2014) found that repatriating firms that benefited from the DPAD were less likely to increase corporate payouts. Their results suggested that perhaps these manufacturing firms were using the retained funds to increase investment. The Table 10 results suggest that, indeed, those firms that took advantage of the DRD and benefited from the DPAD increased investment substantially. Thus, for a small number of firms, the DRD and the DPAD worked in concert and as designed to increase on investment in domestic manufacturing.

Table 10: Investment Response to the DPAD by Repatriating Firms

Dependent Variable:	Investment Percent		
Specification	(1)	(2)	(3)
DPAD	0.049***	0.050***	0.026
	(0.017)	(0.016)	(0.038)
Repatriator x DPAD	0.016	0.036***	0.049***
	(0.011)	(0.012)	(0.011)
Additional Controls		✓	✓
Manufacturing Firms Only			✓
Multinational Firms Only	✓	✓	✓
Firms	2,894	2,894	1,527
Firm x Years	21,067	21,067	12,008

Notes: Specifications (1) through (5) present coefficients from regressions of the form

$$\frac{I_{it}}{K_{i,t-1}} = \beta_0 + \beta_1 DPAD_{jt} + \beta_2[DPAD_{jt} \times \text{Repatriator}_i] \sum_{s=3}^{n} \beta_s \text{Control}_s + \epsilon_{it}.$$

All specifications are limited to the Multinational subsample and include firm and year fixed effects. Specifications (2) and (3) include controls for bonus depreciation, financial distress, marginal Q, and cash flows. Specification (3) limits the analysis to firms in the Manufacturing sector. Standard errors are clustered by industry. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

9 Heterogeneity of Response

Now that the empirical analysis has shown that the estimated investment response to the DPAD was not due to macroeconomic shocks, sector-level trends, or other tax policies that might affect corporate investment, the investigation can move to addressing **Hypothesis 2** and **Hypothesis 3**, which predict a stronger response to the DPAD amongst financially constrained and amongst firms that have positive taxable income. The heterogeneity of response at these margins informs not only *who* responds to the policy but also *how* the policy works to increase corporate investment activity.

9.1 Heterogeneity of Response by Financial Constraint

Specifications (1)–(6) from Table 11 estimate the response of investment to the DPAD for subsamples split by financial constraint. Across all splits, point estimates are larger for the more financially constrained firms although the difference between point estimates is not always statistically significant, as shown by the Equality Test numbers. Specifications (1) and (2) estimate the response to the DPAD for the lower 75% and top 25% of the population of all firms in the corporate investment sample in terms of financial constraint. The lower 75% of firms increase investment percent by 0.26 or approximately 6% when the DPAD lowers the effective corporate income tax rate by 1 percentage point. The top 25% of firms are much more responsive and increase investment by 0.077 – three times more than the unconstrained firms response. Although these point estimates are economically very different, they cannot be distinguished from each other statistically with any real confidence. A similar story is told in Specifications (3) and (4) and Specifications (5) and (6) which look only at domestic and only at multinational firms. In these specifications, however, a statistically significant investment response to the DPAD cannot be detected for the least financially constrained firms. Among multinationals, the response is larger for the financially constrained firms than those that are not constrained.

These results suggest that perhaps the DPAD increases investment primarily by providing financial slack to constrained firms. As a reality check, one may compare the magnitude of the estimated investment response to the magnitude of the financial slack created by a one percentage point reduction in the effective income tax rate created by the DPAD. If Investment % increases by 7.82 %, then for the average firm in the corporate sample, investment must increase by $17.6 million.[21] The 1 percentage point decrease in the effective tax rate, however, only generates $2.62 million in additional after-tax earnings for the average firm in the sample.[22] These figures suggest that the financial slack created by the DPAD can only explain 15% of the average firm's response to the policy. Therefore, despite the financial constraint heterogeneity findings, the DPAD policy works, at least in part, by increasing the after-tax return on new investments.

These results also suggest that because investment response to the policy is larger among more constrained firms – those that are the smaller and younger firms – elasticities must be re-weighted in order to establish an economy wide estimate of response to the policy. Firms in the top 25% of the constraint distribution, on average, report $1.85 million installed property plant and equipment during the sample period whereas firm in the bottom 75% of the distribution report $1,800 million. If the elasticities derived in Specifications (1) and (2) are weighted by property plant and equipment, then the average elasticity of investment percent with respect to the net of tax rate for corporate investment is 5.66. Once fully implemented, the DPAD decreases the effective tax rate for all corporations by 1.26 percentage points and increases investment activity 7.13%.

[21] Mean PPENT is equal to $1,462.4 million and mean CAPX is equal to $247.0 million for the corporate sample.
[22] Mean pretax income is equal to $262.8 million for the corporate sample

Table 11: Heterogeneity of Investment Response to the DPAD

Dep. Variable:	Investment Percent					
Specification	(1)	(2)	(3)	(4)	(5)	(6)
	All Firms		Domestic Firms		Multinationals	
HP Index Split	Low 75%	Top 25%	Low 75%	Top 25%	Lor 75%	Top 25%
DPAD	0.026***	0.077*	0.015	0.100*	0.007	0.146**
	(0.010)	(0.046)	(0.016)	(0.054)	(0.010)	(0.072)
Equality Test	P = 0.260		P = 0.136		P = 0.052**	
Firms	4,760	1,862	3,216	1,263	1,549	594
Firm x Years	39,617	12,990	25,876	8,491	13,708	4,532

Dep. Variable:	Investment Percent					
Specification	(7)	(8)	(9)	(10)	(11)	(12)
	All Firms		Domestic Firms		Multinationals	
Tax Rate Split	Low 50%	Top 50%	Low 50%	Top 50%	Low 50%	Top 50%
DPAD	0.060**	0.022*	0.049	0.024	0.065**	0.008
	(0.028)	(0.011)	(0.035)	(0.017)	(0.033)	(0.011)
Equality Test	P = 0.208		P = 0.515		P = 0.123	
Firms	2,485	2,494	1,685	2,179	832	988
Firm x Years	22,118	17,509	14,513	14,972	7,751	7,611

Notes: Specifications (1)–(12) present coefficient estimates from regressions run on different subsamples of firms. All Specifications include controls for bonus depreciation, marginal Q, and cash flows. The equality test measures whether the *DPAD* coefficient is equal in specifications in adjacent specifications; P-values are presented. All specifications include firm and year fixed effects. Standard errors are clustered at industry level and are robust to heteroskedasticity. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

9.2 Heterogeneity of Response by Tax Status

Specifications (7)–(12) from Table 11 address heterogeneity in response to the DPAD policy by tax status where tax status is measured using the 2002–2004 Blouin et al. (2010) simulated marginal tax rates (MTR). For all firms, for domestic firms, and for multinational firms, point estimates indicate that the strongest response to the policy occurs among those firms in the bottom half of the 2002-2004 average simulated MTR distribution.[23] This suggestive evidence speaks against **Hypothesis 3** but may offer some interesting insights. First, if tax rates were uncorrelated across time, then one might expect to see no difference in response across groups based on MTRs. The observed heterogeneity of response suggests otherwise.

Assuming MTRs are correlated over time, then there are several explanations for the findings. First, MTRs may be negatively correlated over time. If this is the case, then those firms which have lower MTRs prior to DPAD implementation may be those with higher MTRs after implementation; those which should be most responsive to the policy. If, on the other hand, MTRs are positively correlated over time, then the most responsive firms to the policy are those with the lowest MTRs, which is the opposite of the Hypothesis 3 prediction. Here, it could be that firms with low MTRs are those which most aggressively engage in tax avoidance behavior. Intuitively, these firms might be the most sensitive to tax policies such as the DPAD and therefore be the most responsive. Similarly, it could be that firms with MTRs below the statutory 35% rate might simply be those firms with access to tax avoidance activities (such as high leverage) and have enough tax avoidance flexibility to respond to the DPAD. Dyreng, Hanlon and Maydew (2008) show that some firms are able to maintain low tax rates over time but that there exists substantial variation annual variation in tax rates suggesting that all of the above possible explanations for the additional responsiveness by firms with low 2002–2004 MTRs are plausible.

10 Conclusion

Using a plausibly exogenous source of variation, this paper has found that U.S. corporate investment responds strongly to the Domestic Production Activities Deduction. Empirical results indicate that investment increased by approximately 7% to the fully implemented policy. These results are not driven by macroeconomic factors or sector level trends. The investment response is not due to the elimination of the Extraterritorial Income Exclusion but may be driven, in part, by its interaction with the 2004 tax holiday on repatriated earnings. Response to the policy is strongest among financially constrained firms but is not driven exclusively by the additional after-tax earnings that the policy creates. It is hard to over-exaggerate the centrality of these results to a growing debate surrounding U.S. corporate income tax reform.

[23] However the response across MTR splits is never statistically different.

As corporate income tax rates around the world have steadily declined, the top rate in the U.S. has held firm at 35% for the last 20 years. U.S. business leaders have argued that the growing divergence in top rates has hurt the ability of U.S. firms to compete internationally and has stymied domestic U.S. investment. In response to these claims, lawmakers have called for decreases in the corporate income tax by 15 and even 20 percentage points, claiming that a reform of this magnitude would lead to substantial growth of U.S. production at home and abroad.

This research is the first to speak to directly to these claims. Because few tax policies prior to the DPAD have been targeted at specific types of corporate income, past studies have estimated the investment response to corporate income not by relying on variation in effective statutory rates but by using variation in the the timing of depreciation allowances. This study, in contrast, directly estimates the corporate investment response to a change in the effective statutory corporate income tax rates. Thus, the results presented here should be weighed heavily in any arguments to change the corporate income tax rate.

However, the extent to which the response estimated here can predict how corporate investment might react to a decrease in the corporate income tax rate depends on whether firms have an international presence. For domestic firms, the DPAD was very similar to a decrease in the statutory tax rate. The strong investment response by these firms to the DPAD suggests that U.S. investment by domestic firms would respond strongly to a rate cut.

On the other hand, the DPAD was not as similar to a rate cut for multinationals due to the worldwide tax regime that governs the tax liability on foreign source income for U.S. multinationals. For multinationals, a statutory rate cut would decrease the tax liability on income earned not just in the U.S. but anywhere in the world. The DPAD, in contrast, only decreased the rates on U.S. income. The response to the DPAD by multinationals is therefore partly an increase due to the lower rate itself and partly due to a shifting of investment to the U.S. from foreign locations due to the relatively lower rate. This second effect would not occur in response to a statutory rate cut.

References

Abel, Andrew, "Dynamic Effects of Permanent and Temporary Tax Policies in a q Model of Investment," *Journal of Monetary Economics*, 1982, *9*, 352 – 373.

Auerbach, Alan J., "Wealth Maximization and the Cost of Capital," *Quarterly Journal of Economics*, 1979, *93(3)*, 433–436.

___ , "The Dynamic Effects of Tax Law Asymmetries," *Review of Economic Studies*, 1986, *53(2)*, 205–225.

Blouin, Jennifer L., L. Core, and Wayne R. Guay, "Have the Tax Benefits of Debt Been Overestimated?," *Journal of Financial Economics*, 2010, *98(2)*, 195–213.

Blouin, Jennifer, Linda Krull, and Casey Schwab, "The Effect of the Domestic Production Activities Deduction on Corporate Payout Behavior," 2014.

Bradford, David F., "The Incidence and Allocation Effects of a Tax on Corporate Distributions," *Journal of Public Economics*, 1981, *15*, 1–22.

Bradley, Sebastien J., "Investor Responses to Dividends Received Deductions: Rewarding Multinational Tax Avoidance?," 2013.

___ , "Round-tripping of Domestic Profits under the American Jobs Creation Act of 2004," 2014.

Cummins, Jason G., Kevin A. Hassett, and R. Glenn Hubbard, "A Reconsideration of Investment Behavior Using Tax Reforms as Natural Experiments," *Brookings Papers on Economic Activity*, 1994, *1994(2)*, 1–74.

Desai, Mihir A. and Austan D. Goolsbee, "Investment, Overhang, and Tax Policy," *Brookings Papers on Economic Activity*, 2004, pp. 285–355.

Dyreng, Scott D, Michelle Hanlon, and Edward L Maydew, "Long-run corporate tax avoidance," *The Accounting Review*, 2008, *83* (1), 61–82.

Edgerton, Jesse, "Investment Incentives and Coporate Tax Asymmetries," *Journal of Public Economics*, 2010, *94(11-12)*, 936–952.

Edgerton, Jessie, "Investment, Accounting, and the Salience of the Corporate Income Tax," *FEDS Working Paper*, 2012.

Fazzari, Stven M., R. G. Hubbard, and B. P. Petersen, "Financial Constrains and Investment," *Brookings Papers on Economic Activity*, 1988, *1*, 141–195.

Goolsbee, Austan D., "Investment Tax Incentives, Prices, and the Supply of Capital Goods," *Quarterly Journal of Economics*, 1998, *113(1)*, 121–148.

Graham, John R., "Debt and the Marginal Tax Rate," *Journal of Finance*, 1996, *41(1)*, 41–73.

___ , "How Big are the Tax Benefits of Debt?," *Journal of Finance*, 2000, *55(5).*

Hadlock, Charles J. and Joshua R. Pierce, "New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index," *Review of Financial Studies*, 2010, *23(5)*, 1909–1940.

Hall, Robert E. and Dale W. Jorgenson, "Tax Policy and Investment Behavior," *American Economics Review*, 1967, *57*, 391–414.

Hyashi, Fumio, "Tobin's Marginal q and Average q: A Neoclassical Interpretation," *Econometrica*, 1982, *50(1)*, 213–224.

Kaplan, Steven N. and Luigi Zingales, "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?," *Quarterly Journal of Economics*, 1997, *112(1).*

King, Mervyn, *Public Policy and the Corporation*, Chapman and Hall, 1977.

Lester, Rebecca, "Made in the U.S.A.? A Study of Firm Responses to Domestic Production Incentives," 2015.

Ohrn, Eric, "Does Corporate Governance Induce Earnings Management? Evidence from Bonus Depreciaiton and the Fiscal Cliff," 2014.

Plesko, George, "An Evaluation of Alternative Measures of Corporate Tax Rates," *Journal of Accounting and Economics*, 2003, *35(2)*, 201–226.

Poterba, James and Lawrence Summers, *Recent Advances in Corporate Finance*, Richard D. Irwin Publishers, 1985.

Stein, Jeremy C., "Agency, Information, and Corprate Investment," in "Handbook of the Economics of Finance" 2003.

Summers, Lawrence, "Taxation and Corporate Investment: A Q-Theory Approach," *Brookings Papers on Economics Activity*, 1981, *1981(1)*, 67–140.

Whited, Toni M. and Guojun Wu, "Fincial Constraints Risk," *Review of Financial Studies*, 2006, *19*, 531–559.

Yagan, Danny, "Capital Tax Reform and the Real Economy: The Effects of the 2003 Dividend Tax Cut," 2013.

Zwick, Eric and James Mahon, "Do Financial Frictions Amplify Fiscal Policy? Evidence from Business Investment Stimulus," 2014.

Appendix A Data Definitions from IRS "Corporate Returns - Explanation of Terms"

Income Subject to Tax: This was generally the amount of income subject to tax at the corporate level. For most corporations, income subject to tax consisted of net income minus the "Statutory Special Deductions" described in this section. However, there were certain exceptions. S corporations were usually not taxable at the corporate level and so did not have income subject to tax. Some, however, had a limited tax liability on capital gains and so were included in the statistics for this item. Likewise, regulated investment companies and real estate investment trusts generally passed their net income on to be taxed at the shareholder level; but any taxable amounts not distributed were included in income subject to tax. Because insurance companies were permitted to use reserve accounting for tax purposes, insurance income subject to tax was based on changes in reserve accounts; life insurance companies could also have been allowed an additional special deduction (discussed in Statutory Special Deductions). Consolidated returns that contain life insurance subsidiaries were not allowed to offset all of the life insurance subsidiarys gains by losses from nonlife companies, so it was possible for such a consolidated return to show no net income but still have a positive amount of income subject to tax.

Statutory Special Deductions: Statutory special deductions in the tables was the sum of the deductions for net operating loss carryovers from prior years and the special deductions for dividends and other corporate attributes allowed by the Code. These deductions were in addition to ordinary and necessary business deductions and were shown in the statistics as deductions from net income. In general, net income less statutory special deductions equaled income subject to tax. The following components of Statutory Special Deductions are shown separately in Table 20.

Domestic Production Deduction: The Domestic Production Deduction (DPD) was added as part of the American Jobs Creation Act and is available for Tax Years beginning after December 31, 2004. By keeping manufacturing and software development activities in the United States, exporters may claim a deduction for a percent of their income from qualified exports. The provision, which can be found under code section 199, was largely written to satisfy WTO objections to Extraterritorial Income (ETI) and Foreign Sales Corporation provisions. The credit is figured on Form 8903.

Appendix B Investment Control Variables

- **Marg Q**

  Marginal Q or Tobin's Q is the marginal value of an additional dollar of investment. Marg Q is empirically measured as the ratio of the market value of equity plus the book value of liabilities excluding deferred taxes, divided by the book value of assets,

  $$Q_t = \frac{\text{prcc}_t \times \text{csho}_t + \text{at}_t - \text{ceq}_t + \text{txdb}_t}{\text{at}_t},$$

  Where prcc is the price of outstanding shares, csho is the number of outstanding shares, at is total assets, ceq is outstanding equity and txdbt is the differed tax liabilities.

- **Cash Flow**

  The measure of cash flow is constructed following Kaplan and Zingales (1997). "Cash Flow/PPE" is defined as

  $$\text{Cash Flow}_t = \frac{\text{ib18}_t + \text{dp14}_t}{\text{ppent8}_{t-1}}.$$

  This ratio is the income before extraordinary items plus depreciation and amortization, scaled by the capital stock at the beginning of the year.

- **HP Index**

  Hadlock and Pierce (2010) propose a measure of financial constraint based on firm size and age.

  $$\text{HP Index} = -0.737 * \text{size} + 0.043 * \text{size}^2 - 0.04 * \text{age}$$

  where size = min{assets in 2004 dollars, \$4.5 billion} and
  age = min{years on Compustat tapes, 37}.

Appendix C Industry-Averaged Estimates

Table 12: Investment Response to DPAD

Dependent Variable:	Investment Percent				
Specification	(1)	(2)	(3)	(4)	(5)
DPAD	0.036**	0.036***	0.047***	0.052***	0.034**
	(0.014)	(0.014)	(0.018)	(0.015)	(0.016)
December Fiscal Year			✓		
Domestic Firms Only				✓	
Multinationals Only					✓
Groups	105	102	106	106	106
Firm x Years	1,210	1,207	1,255	1,255	1,245
Firms	8,132	8,132	5,750	5,259	2,873
Firm x Years	59,126	59,126	40,739	38,267	20,859
$\mathcal{E}\{I\%, (1-\tau\rho d)\}$	6.62	8.63	9.87	9.54	6.62

Notes: Specifications (1) through (5) present coefficients from regressions of the form

$$\frac{I_{it}}{K_{i,t-1}} = \beta_0 + \beta_1 DPAD_{jt} + \sum_{s=1}^{n} \beta_s \text{Control}_s + \epsilon_{it}.$$

In specifications (2) – (5), controls for bonus depreciation, financial distress, marginal Q, and cash flows are included. In specification (3) the analysis is limited to firms with fiscal years that end of December 31st. In specification (4), analysis is limited to Domestic Firms; those firms that report no foreign in years 2002–2004. In specification (5), the analysis is limited to Multinationals; those firms that report some foreign source income in years 2002–2004. All specifications include firm and year fixed effects. Standard errors are two-way clustered by industry and year. *** indicates statistical significance at the 1% level, ** at 5%, and * at 10%.

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