Pontifícia Universidade Católica
do Rio de Janeiro

Yifan Lin

Corporate Taxation, Investment and Market Power

Dissertação de Mestrado

Thesis presented to the Programa de Pós–graduação em Economia, do Departamento de Economia da PUC-Rio in partial fulfillment of the requirements for the degree of Mestre em Economia.

Advisor: Prof. Yvan Bécard

Rio de Janeiro
September 2023

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Rio de Janeiro, September 13th, 2023

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B.A., Economics, Fundação Getúlio Vargas (FGV-EPGE), 2020

Bibliographic data

Lin, Yifan

Corporate Taxation, Investment and Market Power / Yifan Lin; advisor: Yvan Bécard. – 2023.

36 f: il. color. ; 30 cm

Dissertação (mestrado) - Pontifícia Universidade Católica do Rio de Janeiro, Departamento de Economia, 2023.

Inclui bibliografia

1. Economics – Teses. 2. Política Fiscal. 3. Impostos Corporativos. 4. Investimento. 5. Poder de Mercado. I. Bécard, Yvan. II. Pontifícia Universidade Católica do Rio de Janeiro. Departamento de Economia. III. Título.

CDD: 004

To my parents, brother, and family,
for their unwavering support and boundless love.

Acknowledgments

I am deeply grateful to my advisor, Yvan Bécard, for your continuous guidance and support throughout my master's program.

I thank my parents for their countless sacrifices they've made to help me reach this point in my journey.

I also thank the professors and staff of the Department of Economics at PUC-Rio

Finally, I thank CNPQ and PUC-Rio for the financial support, which made this work possible

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

Abstract

Lin, Yifan; Bécard, Yvan (Advisor). **Corporate Taxation, Investment and Market Power**. Rio de Janeiro, 2023. 36p. Dissertação de Mestrado – Departamento de Economia, Pontifícia Universidade Católica do Rio de Janeiro.

The large 2017 reduction in the corporate income tax in the United States has not led to a surge in business investment. This dissertation studies the role of market power in the transmission of corporate tax changes to investment. We introduce firm heterogeneity and imperfect competition in a neoclassical growth model modified to account for several features of the US tax system. We find that following a corporate tax cut, capital-intensive firms increase investment expenditure while labor-intensive firms keep investment constant. Capital-intensive firms use the tax benefit to increase their market share, while labor-intensive firms opt to increase their markup. The model matches the aggregate elasticity of investment with respect to a tax rate cut and its distributional implications appear to find some support in the data.

Keywords

Fiscal Policy; Corporate Taxes; Investment; Market Power.

Resumo

Lin, Yifan; Bécard, Yvan. **Tributação Corporativa, Investimento e Poder de Mercado**. Rio de Janeiro, 2023. 36p. Dissertação de Mestrado – Departamento de Economia, Pontifícia Universidade Católica do Rio de Janeiro.

A grande redução na tributação de renda corporativa nos Estados Unidos em 2017 não resultou em um aumento significativo no investimento empresarial. Esta dissertação estuda o papel do poder de mercado na transmissão das mudanças na tributação corporativa para o investimento. Introduzimos a heterogeneidade nas empresas e a concorrência imperfeita em um modelo neoclássico de crescimento, modificado para levar em conta várias características do sistema tributário dos EUA. Descobrimos que, após uma redução nos impostos corporativos, empresas intensivas em capital aumentam os gastos com investimentos, enquanto empresas intensivas em mão de obra mantêm os investimentos constantes. Empresas intensivas em capital usam o benefício fiscal para aumentar sua participação de mercado, enquanto as intensivas em mão de obra optam por aumentar as suas margens de lucro. O modelo corresponde à elasticidade agregada do investimento em relação a uma redução na taxa de imposto, e suas implicações distribucionais parecem encontrar algum respaldo nos dados.

Palavras-chave

Política Fiscal; Impostos Corporativos; Investimento; Poder de Mercado.

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O senhor... Mire veja: o mais importante e bonito, do mundo, é isto: que as pessoas não estão sempre iguais, ainda não foram terminadas - mas que elas vão sempre mudando. Afinam ou desafinam.

João Guimarães Rosa, *Grande Sertão: Veredas.*

1
Introduction

In 2017, the Tax Cuts and Jobs Act (TCJA) was enacted, marking the most significant alteration to the U.S. tax system since the 1980s. This complex and far-reaching reform had a significant impact, particularly on corporate taxes; it reduced the statutory corporate income tax rate from 35 percent to 21 percent. Despite high expectations for investment growth spurred by this reform, it ultimately fell short of achieving them.[1]

Studies conducted by Gale & Haldeman (2021) and Kopp et al. (2019) found that the supply-side incentives implemented by the TCJA had a limited effect on investment growth. The timing of the investment response did not align with what would be expected from a supply-side stimulus, as there was no significant increase in business formation following the enactment of the TCJA. Additionally, surveys indicate that only a small fraction of businesses responded to the TCJA by increasing their investment expenses.

One contributing factor to this muted investment response was identified as increased corporate market power. Interestingly, the existing literature on the macroeconomic effects of tax changes does not thoroughly investigate market power as a significant factor. This leaves open the following question: How does market power influence firms' investment behavior after corporate tax changes?

This paper focuses on examining the impact of a permanent corporate tax rate cut on business investment within an imperfect competition setting. Building upon the work of Occhino (2023), which includes debt and equity financing, interest deductibility, and accounting depreciation in a neoclassical model, we extend the model by incorporating firm heterogeneity and oligopolistic competition.

In response to a reduction in the corporate tax rate, the model predicts an increase in aggregate investment, indicating an investment elasticity to the tax rate of -0.15, which aligns with empirical data. Notably, the investment response is sector-specific: capital-intensive sectors exhibit increased investment with an elasticity of -0.23, while labor-intensive sectors maintain their investment expenses, approximating an elasticity of 0. This significant disparity in the sectors' reactions can be attributed to the capital-intensive sector capitalizing on the reduced user cost of capital resulting from the tax rate

[1] Mertens & Smetters (2018) encapsulates the literature's predictions on the effects of the TCJA on output, which are notably substantial.

reduction to expand their market share. Meanwhile, the labor-intensive sector chooses to enhance its markup.

Our results align well with the empirical findings presented by Cloyne et al. (2023). Their research revealed that while a corporate tax rate reduction leads to a surge in both investment and employment within the broader economy, the benefits are not uniformly distributed across sectors. Notably, firms in goods production, which are typically capital-intensive firms, ramp up their investment and employment following a tax cut. Conversely, firms in the service sector, which tend to be less capital-intensive, do not register similar increases in either investment or employment. Despite these findings, the underlying reasons for these dynamics remain unexplained in their research. Our model, in contrast, proposes a plausible rationale for this behavior.

The extension of the effects from competition for market share depends on two key factors: the market size of the respective sectors and the elasticity of substitution among the products. When sectors are small in size, there is minimal competition for market share because these sectors possess limited influence over the market. However, as their market share expands, the effects of this competition become more pronounced, eventually reaching a threshold. Beyond this threshold, sectors have already acquired a substantial market share, making it progressively more difficult for the capital-intensive sector to gain additional market share and for the labor-intensive sector to relinquish its existing market share.

With respect to the elasticity of substitution among goods, an elevated level of elasticity is associated with heightened market competition. Consequently, under conditions of increased competitiveness within the model, sectors exhibit more differentiated reactions to modifications in corporate tax rates. Furthermore, the overall responsiveness of investment to corporate tax changes intensifies as the competitiveness of the model escalates. Therefore, it is plausible to contend that market power could have been a significant contributing factor to the Tax Cuts and Jobs Act's ineffectiveness in stimulating corporate investment.

This paper connects to two strands of literature. First, there is literature that studies the macroeconomic effects of corporate tax changes. For example, Romer & Romer (2010) employs a narrative approach to study the impacts of tax changes, pinpointing exogenous tax changes from U.S. tax reforms. Mertens & Ravn (2013) examines the short-term effects of changes in the average corporate income tax rate. The macroeconomic implications of the 2017 TCJA are further explored by Mertens & Olea (2018), Barro & Furman (2018), and Occhino (2022). This introduces market share competition as another mechanism that can influence a firm's investment decisions following corporate tax changes.

Second, this paper contributes to the literature that researches the distributional effects of corporate tax changes. Notable works in this area include Serrato & Zidar (2016), Saez et al. (2019), Nallareddy et al. (2022), Ohrn (2023), and Cloyne et al. (2023). In comparison to these studies, we identify the significance of market power as a crucial factor in analyzing the distributional effects. Our model reveals that, due to competition for market share, capital-intensive firms tend to derive greater benefits from corporate tax changes than labor-intensive firms.

This paper is organized as follows: Section 2 provides a description of the model used in this study; Section 3 explains the effects of a tax rate cut under a competitive market setup; Section 4.1 discusses the main results; and Section 5 offers the conclusion.

2
The Model

We extend the framework from Occhino (2023) by incorporating firm heterogeneity and imperfect competition. The model is a neoclassical growth model that includes debt and equity financing, interest deductibility, and accounting depreciation. The economy consists of a representative household, firms, and a fiscal authority.

2.1
Households

The household setup is standard. Households consume c_t at the price p_t and save into a riskless corporate bond, b_t, at the rate r_t. Households supply labor h_t and earn a wage w_t. They also receive d_t as dividend. Moreover, they pay a lump-sum tax T_t to the government. The budget constraint of households can be expressed as follows:

$$p_t c_t + b_t + T_t = w_t h_t + (1 + r_{t-1}) b_{t-1} + d_t \ . \tag{2-1}$$

Households maximize the expected utility of intertemporal consumption, given by $E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{c_t^{1-\sigma}}{1-\sigma} - \frac{h_t^{1+\varphi}}{1+\varphi} \right)$, subject to the household's budget constraint. In this expression, β is the discount factor, σ is the inverse intertemporal elasticity of substitution and φ is the inverse labor supply elasticity.

2.2
Firms

The economy consists of n sectors. Each sector is operated by a representative firm that specializes in producing a unique good. At the start of period t, each firm owns a capital stock $k_{j,t}$ and hires labor $h_{j,t}$ at a wage rate of w_t, producing $y_{j,t}$ that is sold at a price $p_{j,t}$. The production function is given by:

$$y_{j,t} = A_j k_{j,t}^{\alpha_j} h_{j,t}^{1-\alpha_j} \ , \tag{2-2}$$

where $A_j > 0$ is total factor productivity and $\alpha_j \in (0, 1)$ is the output elasticity of capital. Firms accumulate capital according to their investment expenses $i_{j,t}$. The accumulation of capital evolves according to:

$$k_{j,t+1} = (1 - \delta) k_{j,t} + i_{j,t} \ , \tag{2-3}$$

where δ is the capital depreciation rate.

Firms must pay taxes on their taxable income to the fiscal authority. The calculation of taxable income depends on accounting depreciation and the deductibility of interest payments on debt. A portion of investment expenses, $\chi_{j,t} \in [0,1]$, can be immediately deducted from taxable income in the same period they are incurred.[1] Once a fraction of these investment expenses is deducted, it cannot be claimed as depreciation in subsequent periods. This fact results in a distinction between the capital relevant for tax purposes, referred to as accounting capital, and the capital relevant for production, denoted as economic capital. Let $\tilde{k}_{j,t}$ represent the accounting capital in period t. The accounting capital evolves according to the following rule:

$$\tilde{k}_{j,t+1} = (1-\delta)\tilde{k}_{j,t} + (1-\chi_{j,t})i_{j,t} \ . \tag{2-4}$$

Let $D_{j,t}$ represent the accounting depreciation in period t. Accounting depreciation is calculated as the sum of economic depreciation on accounting capital, taking into account the fraction of investment that can be deducted.

$$D_{j,t} = \delta\tilde{k}_{j,t} + \chi_{j,t}i_{j,t} \ . \tag{2-5}$$

To incorporate both debt financing and equity financing in our model, we follow Barro & Furman (2018).[2] In period t, firms make interest payments on their outstanding debt, $b_{j,t-1}$, at a rate of r_{t-1}, while also issuing new debt, $b_{j,t}$. These interest payments are advantageous for firms, since they are tax-deductible. To introduce a trade-off, we consider the presence of bankruptcy costs. Without these additional costs associated with debt financing, firms would exclusively rely on corporate bonds or other forms of debt to finance their operations. The bankruptcy cost function is:

$$\Phi_j\left(\frac{b_{j,t}}{k_{j,t}}\right) = \nu_j\left(\frac{b_{j,t}}{k_{j,t}}\right)^{\omega_j} \ , \tag{2-6}$$

where ω_j is the elasticity of Φ with respect to the debt-asset ratio and ν_j is the bankruptcy cost scalar. The bankruptcy cost function is increasing in relation to the debt-asset ratio and is convex, $\Phi' > 0$ and $\Phi'' > 0$.

Define $I_{j,t}$ as the taxable income, which is determined by deducting labor costs, accounting depreciation, and interest expenses on corporate debt from the total revenue.

[1]This deductibility incorporates various provisions of the existing tax system. These provisions include the half-year convention, which allows for the immediate deduction of half-year depreciation. It encompasses the temporary 100 percent bonus depreciation of equipment, enabling the immediate deduction of all investment expenses related to equipment.

[2]The structure of debt and equity financing as proposed by Occhino (2023) is not a feasible option within the context of our scenario.

$$I_{j,t} = p_{j,t}y_{j,t} - w_t h_{j,t} - D_{j,t} - r_{t-1}b_{j,t-1} \ . \tag{2-7}$$

Besides the tax deductions, firms also receive an investment tax credit from the fiscal authority. This tax credit enables them to deduct a fraction $\gamma_{k,t} \in [0,1)$ of their investment expenses from their tax payments. The tax paid by the firms is determined by the following equation:

$$X_{j,t} = \tau_t I_{j,t} - \gamma_{j,t} i_{j,t} \ . \tag{2-8}$$

In period t, the after-tax expected cash flow of the firm is determined by subtracting labor costs, investment costs, tax payments, debt payments, and transaction costs from the sales revenue and financial inflows.

$$\Psi_{j,t} = p_{j,t}y_{j,t} + b_{j,t} - w_t h_{j,t} - i_{j,t} - X_{j,t} - (1+r_{t-1})b_{j,t-1} - \Phi_j\left(\frac{b_{j,t}}{k_{j,t}}\right)k_{j,t} \ . \tag{2-9}$$

Substituting equations (2-7) and (2-8) into equation (2-9), we obtain the cash flow.

$$\begin{aligned}\Psi_{j,t} = (1-\tau_t)(p_{j,t}y_{j,t} - w_t h_{j,t}) - (1-\tau_t\chi_{j,t} - \gamma_{j,t})i_{j,t} + \delta\tau_t\tilde{k}_{j,t} + b_{j,t} \\ -(1+r_{t-1}(1-\tau_t))b_{j,t-1} - \Phi_j\left(\frac{b_{j,t}}{k_{j,t}}\right)k_{j,t} \ .\end{aligned} \tag{2-10}$$

In this economy, every firm faces the following demand:

$$y_{j,t} = \theta_j\left(\frac{p_{j,t}}{P_t}\right)^{-\varepsilon} y_t \ , \tag{2-11}$$

where θ_j is the weight from sector j and the sum of all weights equals to 1, $\varepsilon > 1$ is the elasticity of substitution between sector goods, y_t is the aggregated output and P_t is the price of the aggregated output.[3]

Moreover, we assume that firms are aware of the impacts from their production activities on aggregated output.

$$y_t = \left[\sum_{j=1}^{n} \theta_j^{\frac{1}{\varepsilon}} y_{j,t}^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}} \ . \tag{2-12}$$

Firms maximize the after-tax expected intertemporal cash flow $E_0\sum_{s=0}^{\infty}\beta^s(c_t/c_{t+s})^{\sigma}\Psi_{j,t+s}$ subject to (2-2), (2-3), (2-4), (2-10), (2-11) and (2-12). By solving the firm problem and combining the first-order conditions, we obtain the following equation:

$$(1-\tau_t)p_{j,t}\left(1 - \frac{1}{\varepsilon} + \frac{\theta_j^{\frac{1}{\varepsilon}}}{\varepsilon}\left(\frac{y_{j,t}}{y_t}\right)^{\frac{\varepsilon-1}{\varepsilon}}\right) = \lambda_{j,t} \ . \tag{2-13}$$

Consider that $\lambda_{j,t}$ represents the marginal cost of the firm, equation (2-13) indicates that, in this model, the markup is endogenous. We define $\mu_{j,t}$

[3]We normalize P_t to be equal to 1

as the markup from sector j at period t.[4] The value of $\mu_{j,t}$ is determined by several factors: the elasticity of substitution between goods within the sector, denoted by ε; the weighting of sector j, represented by θ_j; and the ratio of sector output to total output, or $y_{j,t}/y_t$.

It is important to note that as the elasticity of substitution between sector goods becomes infinitely high ($\varepsilon \to \infty$), the markup converges to 1 ($\mu_{j,t} \to 1$). In other words, the firm behaves as though it were operating within a perfectly competitive environment.[5] Firms are aware of how demand for their products is established and how their production affects total output. They understand that their markup is intrinsically linked to their market share. This insight informs them that increasing their market share would necessitate charging a lower markup, and conversely, a smaller market share would allow for a higher markup.

A larger value of θ_j amplifies the firm's impact on total production, incentivizing it to aim for a larger market share. As a result, an increase in θ_j usually leads to a decrease in the markup.

2.3 Government

We adopt a simple framework for the government. The government taxes corporate income, receiving X_t, and rebates the proceeds as a lump-sum tax to households, T_t. Therefore, the government's budget constraint can be expressed as follows:

$$T_t = X_t \ . \tag{2-14}$$

2.4 Equilibrium

Gross domestic product (GDP) in the economy is given by the sum of the aggregate consumption, investment, and the cost associated with bankruptcy.

$$Y_t = p_t c_t + \sum_{j=1}^{n} i_{j,t} + \sum_{j=1}^{n} \Phi\left(\frac{b_{j,t}}{k_{j,t}}\right) k_{j,t} \ . \tag{2-15}$$

The equilibrium in the labor market equates labor demand from firms with labor supply from households:

$$h_t = \sum_{j=1}^{n} h_{j,t} \ . \tag{2-16}$$

[4]Mathematically, $\mu_{j,t}$ is given by $1/\left(1 - \frac{1}{\varepsilon} + \frac{\theta_j^{\frac{1}{\varepsilon}}}{\varepsilon}\left(\frac{y_{j,t}}{y_t}\right)^{\frac{\varepsilon-1}{\varepsilon}}\right)$

[5]In simpler terms, as the similarity among the produced goods increases, the market becomes more competitive.

2.5 Calibration

We define each period as a year in this model. The parameter values employed in this model are described by Table 2.1.

Table 2.1: Calibration

	Value	Description	Source/Target
β	0.9615	Household discount factor	$r = 0.04$
σ	1	Inverse intertemporal elasticity of substitution	Literature
φ	1	Frisch elasticity of labor supply	Literature
ε	6	Elasticity of substitution between sector goods	Maximum markup percentage 20%
α_l	0.2	Output elasticity of capital for labor-intensive sector	
α_k	0.4	Output elasticity of capital for capital-intensive sector	
δ	0.08	Capital depreciation rate	Literature
τ	0.35	Corporate tax rate	Pre-TCJA corporate tax rate
χ	0.48	Investment expensing fraction	Occhino (2022)
γ	0.01	Investment tax credit fraction	Occhino (2022)
ω	2	Bankruptcy cost exponent	Barro and Furman (2018)
ν	0.0306	Bankruptcy costs scale	$\frac{b}{k} = 0.225$

To target a steady state with a 4 percent interest rate, we set the household's discount factor to 0.9615. The Frisch elasticity of labor supply is assumed to have the conventional value of 1. We choose an inverse elasticity of substitution of 1, which results in a logarithmic utility function.

The elasticity of substitution between sector goods, ε, is specified as 6. By looking at equation (2-13), it can be inferred that firms achieve a maximum markup percentage of 20%, which aligns with the usual value established in the literature.

We consider a scenario involving two sectors, denoted by $n = 2$. The heterogeneity among sectors arises from the distinction between the labor-intensive nature of one sector and the capital-intensive nature of the other. In the labor-intensive sector, the parameter α is set to 0.2, whereas in the capital-intensive sector, it is assigned a value of 0.4. These specific values were deliberately chosen to align the overall investment elasticity concerning tax rate from our model with the elasticity observed in a perfect competition model with only one sector. In order to avoid additional interference with the effects being examined, we standardize the values of other parameters that could introduce more variability across sectors. For example, we assign the same value of 0.08 to the capital depreciation rate, δ, in both sectors.

The tax policy parameters in our model are established based on the values predating the TCJA. Specifically, we set the steady-state tax rate to 35%, which corresponds to the corporate tax rate prior to the 2017 tax reform. We assign the values of 0.48 and 0.01 to investment expensing fraction, χ, and investment tax credit fraction, γ, respectively, based on Occhino (2022).

Occhino considers four distinct categories of investment expenses, namely R&D, equipment, software, and structure. During the pre-TCJA period, immediate deductions were allowed for all R&D investment expenses, 50% of investment expenses in equipment and software, and no deductions were permitted for structure investment expenses. Combining χ from different types of investment with their respective size on private fixed nonresidential investment, leads to the value of 0.48. Regarding the parameter γ, Occhino utilizes the investment tax credit fraction parameter to represent the R&D tax credit, which is around 6 percent of R&D investment expenses prior to the 2017 tax reform. Considering that R&D investment constitutes 17 percent of private fixed nonresidential investment, this yields a value of γ equal to 0.01.

The bankruptcy cost parameter ω is set at 2, following Barro & Furman (2018). As a result, the scale of bankruptcy costs ν is chosen to be 0.0306, targeting a steady-state debt-to-asset ratio of 22.5%. This value corresponds to the average debt-to-asset ratio observed in the nonfinancial corporate business sector from 2012 to 2017.

3
Tax changes in a perfect competition model

Before understanding the effects of imperfect competition and heterogeneity, it is crucial to comprehend the implications of changes in tax rates within a perfect competition model featuring a single firm. In this section, we explore this simplified framework, while the main results from our study can be found in section 4.1.

To model a competitive environment, we assume that $n = 1$ and $\varepsilon \to \infty$. For α, we set its value to 0.38 in order to align with the most recent value obtained from the data set documented by Fernald (2014).

One of our focuses in the model is the elasticity of investment to a change in the corporate tax rate. In this analysis, we calculate an elasticity of:

$$E = \frac{\partial i}{i}\frac{\tau}{\partial \tau} = -0.14. \tag{3-1}$$

Our model predicts a 0.14% increase in investment following a permanent 1% tax rate cut, a finding that is in line with the literature. This claim is supported by Occhino (2023), who identifies an investment elasticity of -0.25. This difference between the elasticities may be the result of the different approach taken to the modelling of debt financing. The literature consistently finds that a permanent cut in tax rates tends to increase investment expenditures. This effect arises due to the proposed models suggesting that a permanent tax rate cut lowers the user cost of capital and subsequently encourages more extensive capital accumulation.

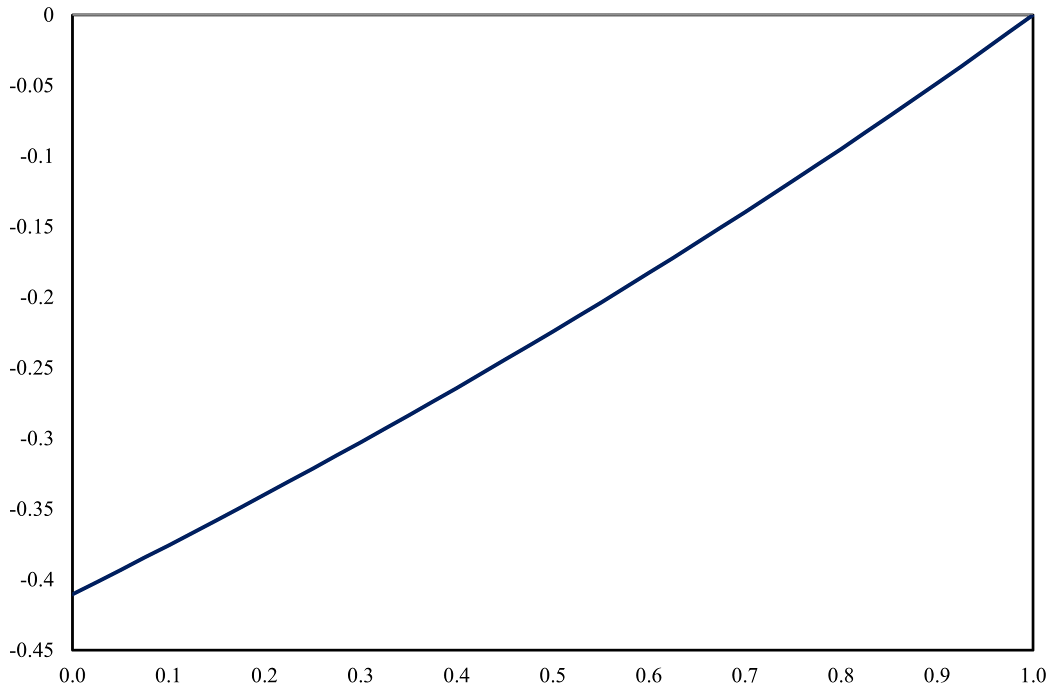
Despite this negative elasticity, a permanent reduction in corporate taxes generates two diverging partial-equilibrium effects on business investment. Accounting depreciation and debt financing are key to understanding these opposing effects. To comprehend these opposing effects, we use the after-tax expected intertemporal cash flow equation from firms and divide it on both sides by $(1 - \tau_t)$.

$$\begin{aligned} \frac{\Psi_t}{1-\tau_t} = (p_t y_t - w_t h_t) - \frac{1 - \tau_t \chi_t - \gamma_t}{1-\tau_t} i_t + \delta \frac{\tau_t}{1-\tau_t}\tilde{k}_t + \\ \frac{1}{1-\tau_t}\left(b_t - (1 + r_{t-1}(1-\tau_t))b_{t-1} - \Phi\left(\frac{b_t}{k_t}\right)\right) k_t \ . \end{aligned} \tag{3-2}$$

Using equation (3-2) instead of equation (2-10) in the firm's problem does not alter the solution. As a result, the variables related to investment expense, i_t, accounting capital, $\tilde{k}_t$, and the level of corporate debt, b_t, are the ones directly affected by changes in corporate tax rate.

Firstly, we examine the effects that directly impact the investment variable, i_t. In equation (3-2), the investment is multiplied by the factor $\frac{(1-\tau_t\chi_t-\gamma_t)}{(1-\tau_t)}$. As this factor increases with τ_t, it causes the corporate tax to take on characteristics akin to a tax on investment. Specifically, when investment expenses are not immediately deductible ($\chi_t \in [0, 1)$), the business income tax functions as a tax burden on investment. A reduction in this tax consequently diminishes the user cost of capital, thereby encouraging corporate investment. This effect on investment is highly dependent on the investment expensing fraction parameter, χ. Figure (3.1) depicts the relationship between the elasticity of investment with respect to the tax rate and the parameter χ. The impact of a tax rate change on investment is most pronounced when $\chi = 0$ and gradually wanes as this parameter rises. This can be seen as a result of the multiplied factor being a decreasing function of χ. Notably, in scenarios where investment is fully expensed, changes in the tax rate have no impact on investment decisions.

Figure 3.1: Investment Elasticity of Tax Rate vs. Parameter χ



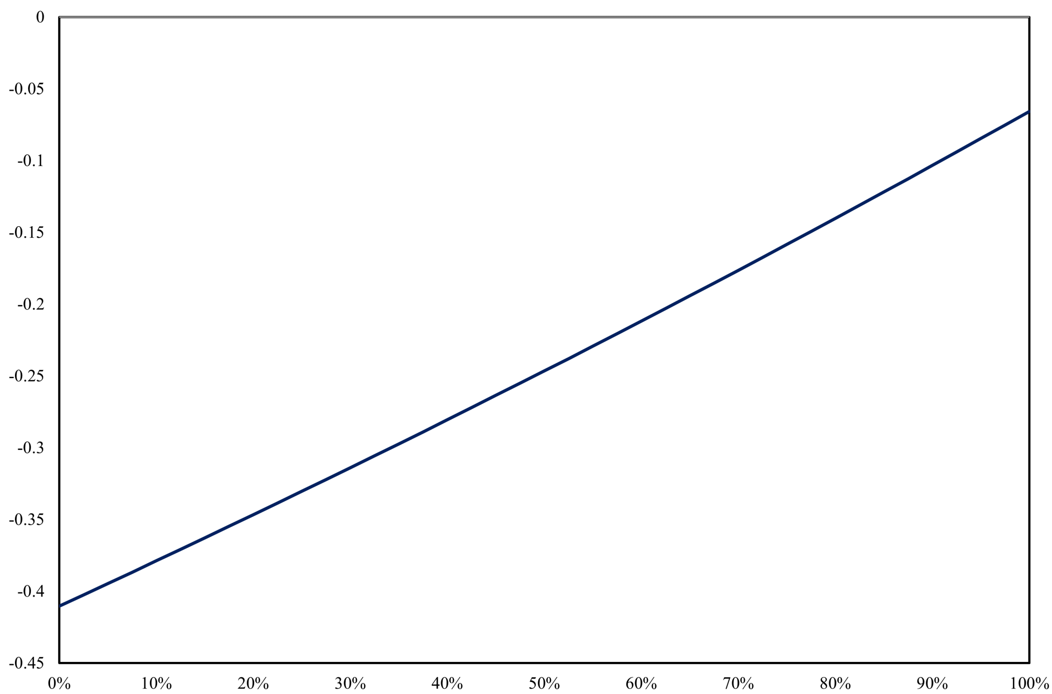
Note: The y-axis of the graph represents the investment elasticity with respect to the tax rate. The x-axis represents the fraction of investment expenses that can be immediately deducted

Changes in tax rates can also affect investment decisions by impacting the depreciation of accounting capital. This arises from the fact that firms are allowed to deduct accounting depreciation from their taxable income. As a result, a reduction in the tax rate reduces the tax benefit associated with capital depreciation. This in turn heightens the user cost of capital, potentially deterring investment expenditures.

The magnitude of this effect is also contingent on the value of χ. By the rule of accounting capital accumulation, we can delve deeper into this relationship. When investment expenses are not deductible ($\chi = 0$), the accounting capital coincides with the economic capital, optimizing the tax benefits from capital depreciation. However, as χ increases, forming accounting capital becomes more costly, leading to a diminished tax benefit from its depreciation. Notably, in cases where full expensing of investment is permitted, deductions for capital depreciation are not allowed. Therefore, this effect through capital depreciation does not affect investment.

Lastly, debt financing serves as another channel through which changes in the corporate tax rate can affect investment. This channel is similar to the one described above. The decision to finance investments through debt considers both the benefits of taking on debt and the costs of doing so. The benefit of incurring debt is the ability to deduct interest payments on the debt from tax payments. When there is a reduction in the corporate tax rate, the tax benefit derived from interest deductions decreases. As a result, this raises the user cost of capital and reduces investments financed through debt.

Figure 3.2: Investment Elasticity of Tax Rate vs. Debt to Asset Ratio



Note: The y-axis of the graph represents the investment elasticity with respect to the tax rate. The x-axis represents the debt to asset ratio

Figure (3.2) illustrates the impacts of the debt level on investment elasticity concerning tax rate changes. It is possible to discern an increasing relationship between the two variables; the higher the firm's debt level, the lower the investment elasticity in absolute terms. This occurs because a greater level of debt results in a more significant tax benefit, thereby amplifying the effect mentioned earlier.

When tax rates decrease, two contrasting effects emerge on the user cost of capital: one promotes investment expense by reducing its costs, while the other discourages it due to decreased tax benefits from depreciation deductions and interest payments on debt.[1] The net impact of a tax rate change on corporate investment depends on which of these effects dominates. Therefore, the investment expensing fraction (χ) and the debt-to-asset ratio play a key role in determining the final outcome from a corporate tax change. Depending on their values, a corporate tax rate reduction can lead to a decrease in corporate investment.

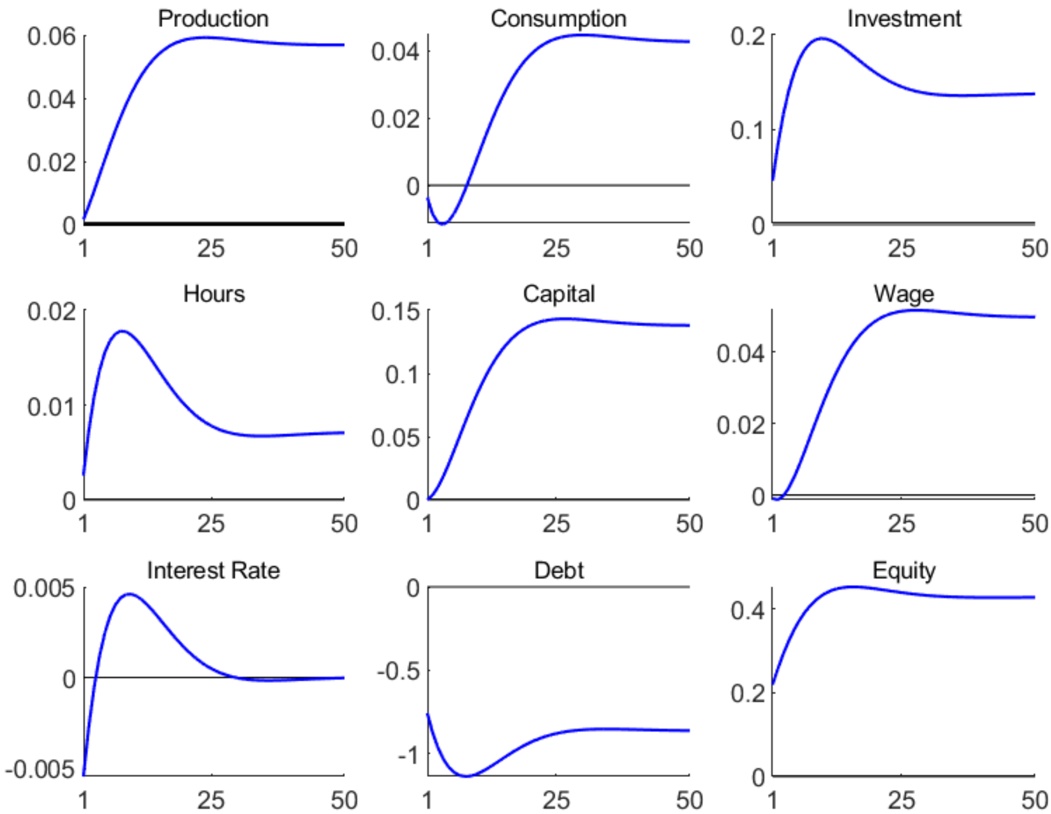
Figure (A.1) illustrates a counter-intuitive response to a reduction in the tax rate, where the investment expenses unexpectedly decrease. This phenomenon occurs as the tax benefits, derived from capital depreciation and interest payments on debt, dominate the opposing partial effects. Consequently, in an environment with fewer tax benefits, firms lower their capital stock, leading to a corporate investment reduction. Alongside this decline in investment, we also witness a corresponding drop in both employment level and overall economic output.

Considering that our model describes an investment elasticity with respect to the tax rate of -0.14, it demonstrates that the effect which fosters an increase in investment is dominant when a decrease in the tax rate is introduced. Figure (3.3) depicts the effects of a permanent reduction in the tax rate. The reduction in tax rate effectively lessens the user cost of capital, thereby stimulating the accumulation of corporate capital and an increase in investment expenses. In the context of a tax rate reduction, financing investments through debt becomes less appealing as the tax shield provided by debt interest payments diminishes. Conversely, financing via equity emerges as a more appealing option. This dynamic leads to a contraction in the corporate debt level and an expansion in corporate equity.

As firms accumulate a greater amount of capital stock, their demand for labor surges, stemming from the complementary nature of labor and capital in the production process. However, this increased demand is met with a counteraction as households require higher remuneration for additional work hours. Initially, households experience a contraction in consumption, primarily due to the rate of investment growth outpacing the rate of production growth. Nonetheless, as output expands, so does the level of consumption.

[1] Hall & Jorgenson (1967), Auerbach & Hassett (1992) and Hassett & Hubbard (2002) suggest that corporate tax alterations influence investment predominantly through the user cost of capital.

Figure 3.3: Effects of a Permanent Corporate Tax Rate Cut



Note: The size of the shock is 1. Variables are represented in log, except for the interest rate. $\chi = 0.48$, $b/k = 22.5\%$.

This consumption trend initially prompts households to bolster their savings, subsequently driving interest rates downward.

Reflecting on the permanent reduction in the corporate income tax rate in the United States from 35% to 21% brought by the Tax Cuts and Jobs Act, the model anticipates a corresponding rise in investment, labor and GDP as a direct consequence of this fiscal policy change.

4
Main Results

4.1
Tax changes in an oligopolistic competition model

In this chapter, we investigate the effects of firm heterogeneity and imperfect competition on the transmission mechanisms of changes in corporate tax rates to investment expenses. We consider a two-sector model; one sector is capital-intensive with $\alpha_k = 0.4$, while the other is labor-intensive with $\alpha_l = 0.2$. The effects of imperfect competition emerge from each sector's knowledge of its demand for goods and its production impacts on overall production. Guided by these adaptations, we derive equation (2-13). Within this framework, firms recognize the inverse relationship between market share and markup: to secure a more dominant market position, they must opt for a reduced markup.

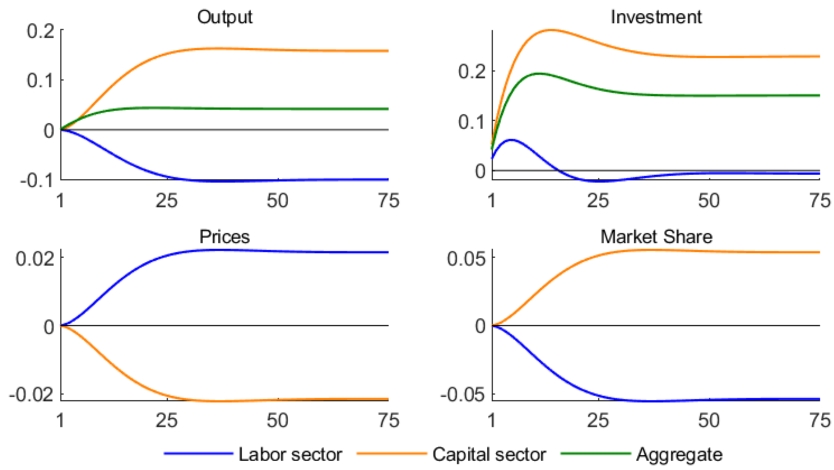
The model predicts an aggregate investment elasticity with respect to the tax rate of approximately -0.15. However, the investment behavior varies significantly across sectors. Specifically, the labor-intensive sector exhibits an elasticity of approximately 0, indicating a negligible response to changes in the tax rate. On the other hand, the capital-intensive sector demonstrates a negative elasticity of -0.23, implying a relatively more pronounced sensitivity to fluctuations in the tax rate.

The partial effects of a tax rate reduction detailed in section 3 persist within the model. The effect that bolsters corporate investment following a decrease in corporate income tax is more dominant than its counteracting effect for both sectors. Through a reduction in the user cost of capital, both sectors are stimulated to increase their corporate investment. Additionally, another channel emerges by which a firm's investment decisions are influenced by this tax cut. Specifically, sectors are now engaged in a competition for market share.

It's crucial to recognize that a decrease in the tax rate offers unequal advantages across the economy sectors. While this tax adjustment doesn't directly spur greater labor demand, it does encourage corporate investment by reducing the user cost of capital. As both sectors undergo the same reduction in user cost of capital, the capital-intensive sector benefits more due to its greater efficiency in employing capital during the production process. As a result, the capital-intensive sector amplifies its investments, capitalizing on this advantage to secure a greater market share. In contrast, the labor-intensive sector chooses to relinquish some market share by not increasing its investment expenses, opting to elevate its markup and price.

Figure (4.1) depicts the response of the labor-intensive sector, capital-intensive sector, and the overall economy, respectively, to a 1% permanent reduction in corporate tax. Except for the market share, other variables are presented in logarithmic terms, allowing their responses to be interpreted as percentage changes.

Figure 4.1: Response to a permanent tax rate cut



In the oligopolistic competition model, there is a discernible difference in sectoral responses to a permanent corporate tax cut. This difference is attributed to the competition for market share. The capital-intensive sector, upon expanding its production, finds that it can seize a larger market share due to the declining output of the labor-intensive sector. Conversely, the labor-intensive sector identifies an opportunity: rather than competing for market share, it can reap benefits by reducing its output, subsequently boosting its markup. This leads the labor-intensive sector to reduce its production, investment, and demand for labor, as depicted in the figure.

Despite the boost in the economy investment provided by a permanent tax rate cut as seen in the figure, we found very different responses from each sector. In our model, capital-intensive firms raise their investment expenses and their labor demand, while labor-intensive firms respond less in investment expenses and labor demand. This result is consistent with the findings presented in Cloyne et al. (2023). Estimating the impacts of changes in U.S. corporate tax system on firm's behavior, they find that a corporate tax rate cut produces a notable increase in investment and employment in the overall economy, although the advantages are distributed unevenly across sectors. Specifically, companies involved in goods production, such as manufacturing firms, expand both investment expenditure and employment in response to a corporate tax reduction. In parallel, service sector firms, which have a lower reliance on capital, do not experience a rise in investment or employment.

Our model offers an intuitive insight into the empirical findings presented by Cloyne et al. (2023). The authors do not provide an explanation for the stronger response from capital-intensive firms. Thus, the market competition mechanism in our model might elucidate the contrasting reactions of capital-intensive firms versus labor-intensive ones following a tax rate reduction, as evidenced in the data.

Another source of heterogeneity not explored in this paper is the variation in financial leverage between sectors. Capital-intensive sectors often have higher levels of leverage than labor-intensive sectors. As a result, these capital-intensive sectors would likely show a more subdued response to a cut in corporate tax rates. As a result, when there is a cut in corporate tax rates, capital-intensive sectors show a more muted investment response. This muted response can be attributed to the fact that the tax benefit are reduced by the tax cut, as seen in chapter 3. Acknowledging this particular form of heterogeneity would serve to reduce the observed disparities in how the sectors respond to tax rate changes.

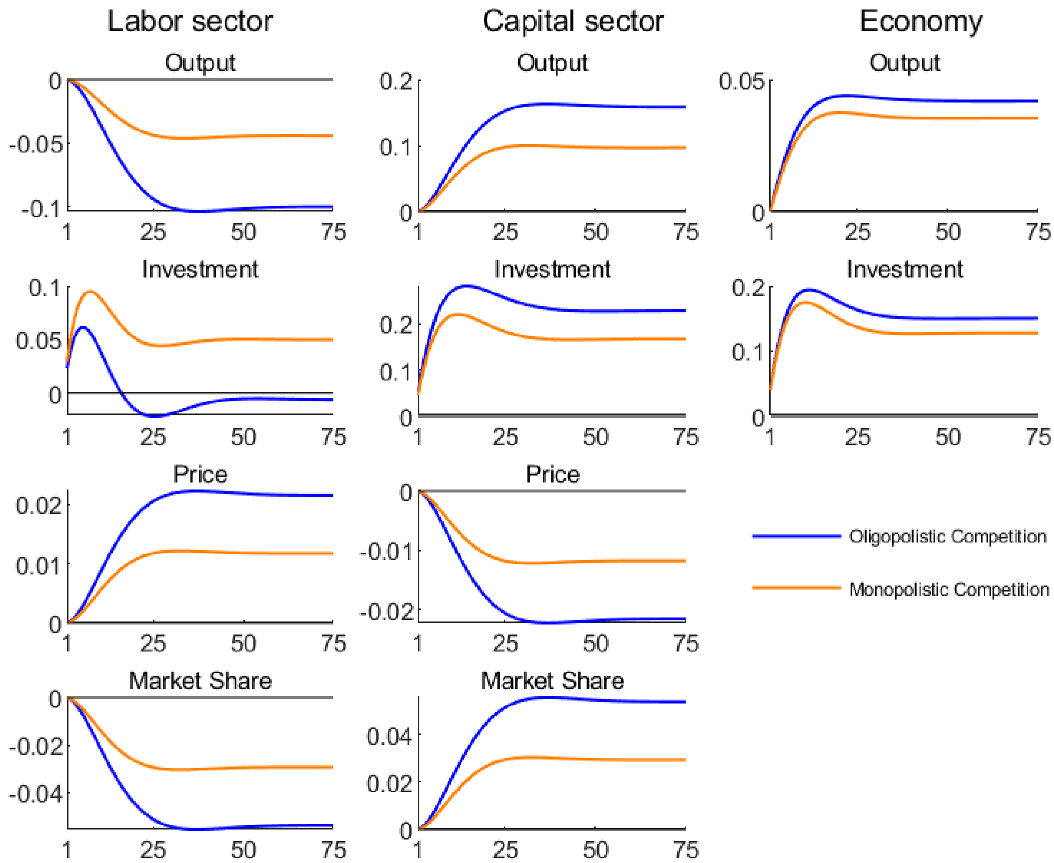
A pertinent discussion our model addresses is the criticism surrounding the 2017 U.S. tax reform's rate cut. Critics argue that such cuts would primarily be channeled into dividend distributions and stock buybacks, rather than fostering increased investment and employment. Considering that firms are aware of the new equilibrium, our model predicts capital-intensive companies would chiefly amplify their investments and employment. Meanwhile, labor-intensive entities might lean towards disbursing the benefits via dividends or stock buybacks. Hence, our model finds partial agreement with these critiques.

4.2 Discussion

To gain a deeper understanding of the additional mechanisms in our model, we compare our results with those derived from a monopolistic competition model. The crucial difference between these two models arises from the absence of equation 2-12 in the firm's optimization problem, resulting in an externally determined markup percentage for firms. For our analysis, we calibrate the markup to be 20%. This comparison allows us to discern the impact that our imperfect competition framework has on firms investment decisions.

In the context of a monopolistic competition model, a reduction in the corporate tax rate leads to a decline in the user cost of capital across both

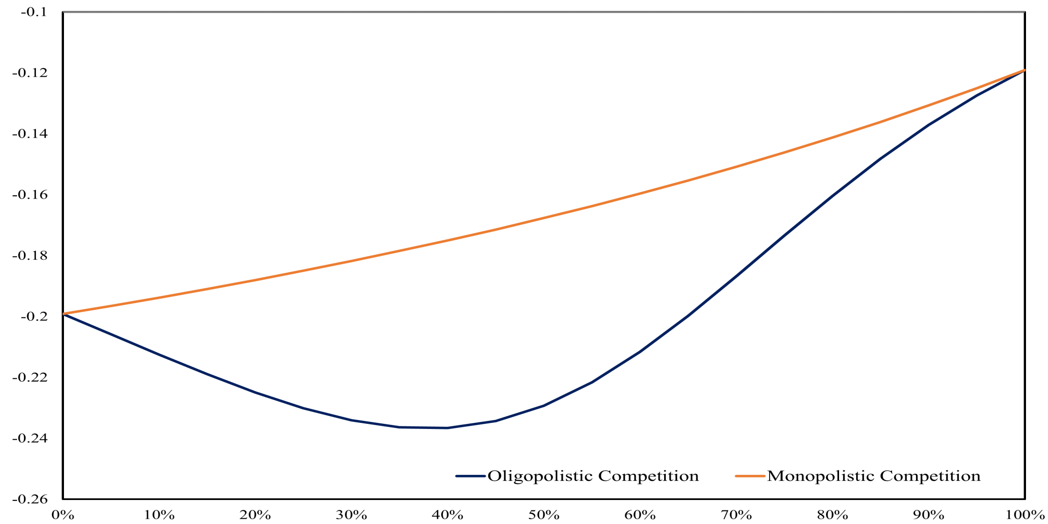
Figure 4.2: Response to a permanent tax rate cut



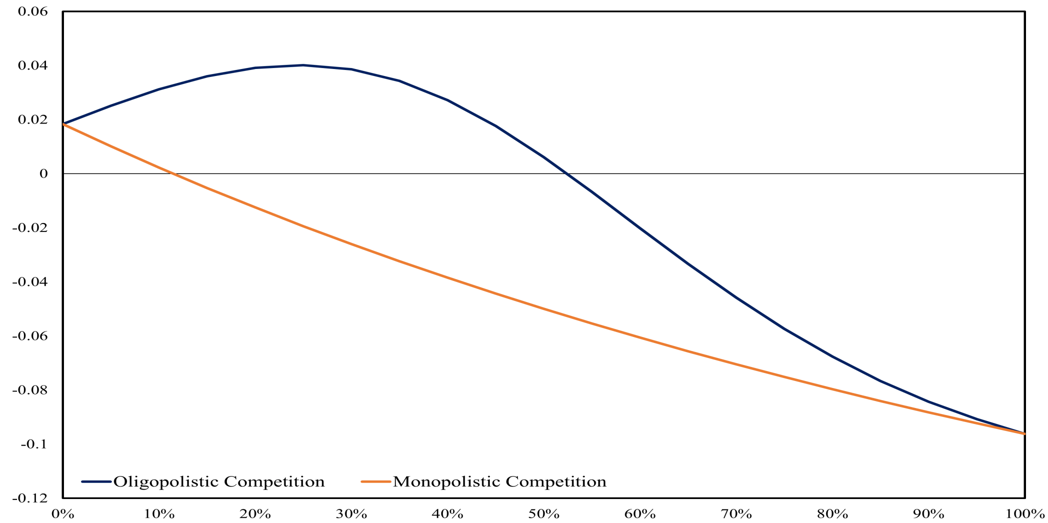
sectors. This results in an increase in investment expenditure, resulting in a greater capital stock for each sector. Concurrently, there is a shift away from debt financing in favor of equity financing.

The capital-intensive sector, benefitting more substantially from the tax cut, is able to offer its products at a more competitive price than the labor-intensive sector. This leads to an increase in production and a greater demand for labor, driving down the prices of its goods. Given the substitutability between the goods from these sectors, consumers tend to opt for the capital-intensive good over its labor-intensive counterpart. As this shift in preference from households is more pronounced than the decrease in the user cost of capital for the labor-intensive sector, their production decreases. This dynamic results in the labor-intensive sector increasingly relying on capital over labor in its production processes.

With the shock in fiscal policy, households increase their consumption. Feeling wealthier, households are inclined to work less hours and seek higher wages. As firms ramp up their investments and households boost their consumption, output expands in response to a permanent reduction in the tax rate.



(a) Capital-intensive sector



(b) Labor-intensive sector

Figure 4.3: Investment Elasticity of Tax Rate vs. Market Share

In the model of oligopolistic competition, the dynamics observed under monopolistic competition are still present, but notable divergences arise between the two models. These differences are primarily attributed to the competition for market share. In contrast to the monopolistic competition framework, the capital-intensive sector demonstrates a more pronounced response in terms of investment, production, and labor demand, as depicted in figure (4.2). On the other hand, the labor-intensive sector shows a more substantial reduction in production, investment, and labor demand, also illustrated in the same figure.

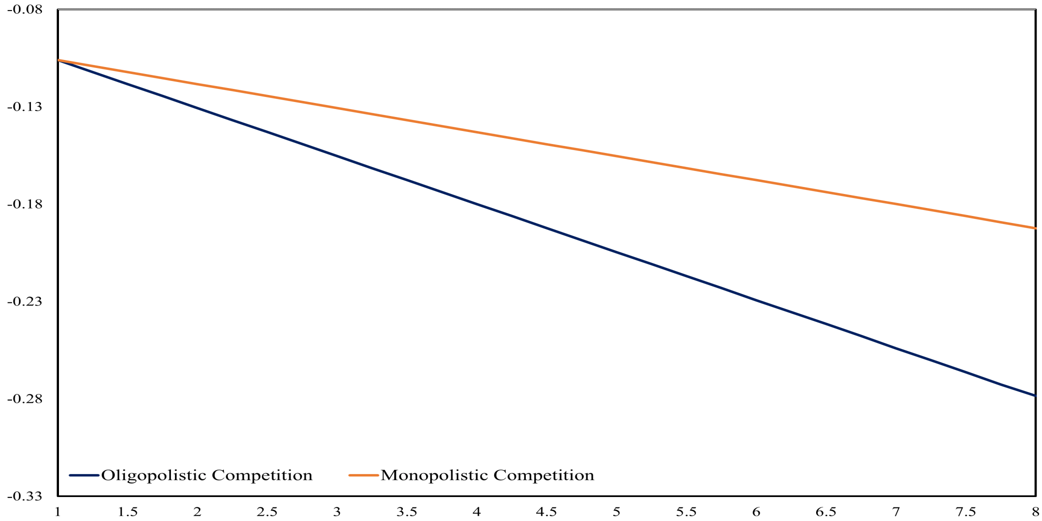
The effects of this channel depend on two key factors: the market size of the respective sectors and the elasticity of substitution among the products. When firms have minimal market share, the impact of oligopolistic competition remains limited, as they lack the leverage to influence the market. However, as market share expands, the effect of oligopolistic competition becomes more pronounced, reaching a threshold. Beyond this point, firms have already gained a significant market share, making it increasingly costly for capital-intensive firms to capture additional market participation and labor-intensive firms to relinquish their existing market share. Figure (4.3) depicts the correlation between investment elasticity in relation to tax rates and market size in both the capital-intensive and labor-intensive sectors, under scenarios of oligopolistic and monopolistic competition.

Figure (4.4) depicts the dynamic between investment elasticity in response to tax changes and the elasticity of substitution among goods across sectors. As the elasticity of substitution between these goods, ε, increases, the competitive effects on investment elasticity for market share becomes more pronounced. Put simply, when goods are more easily substituted for one another, competition intensifies for a larger market share. As a result, capital-intensive firms increase their investments more to secure a larger share of the market. In contrast, labor-intensive firms reduce their investments, aiming to boost their markup.

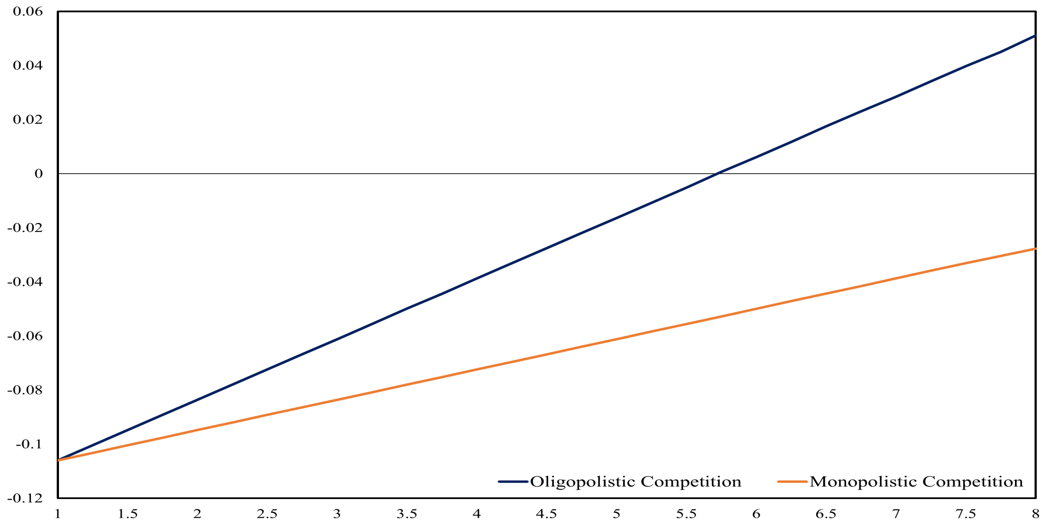
Interpreting ε as a competitiveness parameter,[1] the overall elasticity of investment in relation to tax rate changes sees an uptick. Our model suggests that in settings characterized by low competition, there is a subdued investment reaction to tax reductions. As a result, market dominance could be a contributing factor to the TCJA's inability to bolster investment.

While the model provides clear intuition and results, its realistic application proves to be complicated. To ensure that the goods produced are sufficiently substitutable, one would have to disaggregate the sectors the goods within them display notable similarities. After establishing these, the challenge lies in reconstructing the sectors and appropriately calibrating their market sizes. The endeavor to gather data for such calibration is formidable.

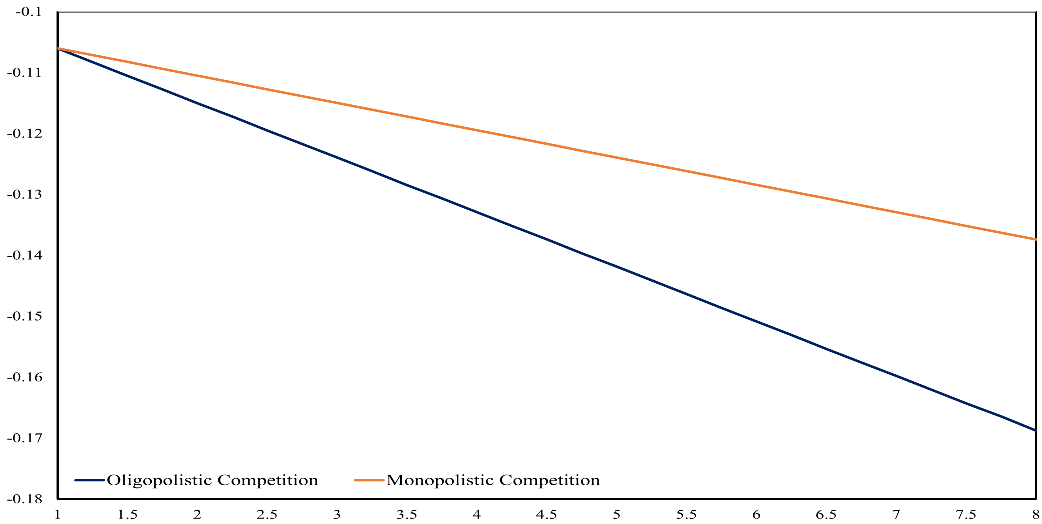
[1] A higher ε indicates more competition in the model.



(a) Capital-intensive sector



(b) Labor-intensive sector



(c) Economy

Figure 4.4: Investment Elasticity of Tax Rate vs. Elasticity of Substitution between sector's goods

5
Conclusion

This dissertation studies the effects of a permanent corporate tax rate reduction on business investment in an imperfect competition environment. We extend the neoclassical growth model of Occhino (2023) by introducing firm heterogeneity and oligopolistic competition. According to the model, a permanent corporate tax rate cut produces a general increase in total investment. However, this surge in investment is not evenly spread across all industries. Capital-intensive firms boost their investment expenditures, while labor-intensive firms maintain their investment levels. This significant divergence in sectoral reactions can be attributed to the capital-intensive sector leveraging the reduced cost of capital resulting from the tax rate reduction to expand its market share, while the labor-intensive sector chooses to enhance its markup. This result is consistent with the empirical findings from Cloyne et al. (2023) and provides an explication for the phenomena observed in data.

This mechanism revealed by our model that affects investment following a tax rate reduction relies on two key factors: market size and the elasticity of substitution between goods. When sectors have a small market size, there is minimal rivalry for market control because their influence over the market is limited. However, as their market share grows, the effects of this competition become increasingly apparent, eventually reaching a critical point. Beyond this threshold, sectors have already attained a significant market share, making it more challenging for capital-intensive sectors to gain additional market share and for labor-intensive sectors to relinquish their existing market share.

As for the elasticity of substitution between goods, the more easily goods can be substituted for one another, the fiercer the competition for market share becomes. This means that as the model's competitiveness rises, there is a pronounced disparity in how sectors react to changes in corporate tax rates. Furthermore, the aggregate elasticity of investment in response to a corporate tax rate shift grows more substantial with increasing model competitiveness. Thus, market power could have been a key factor in the TCJA's shortcomings.

6
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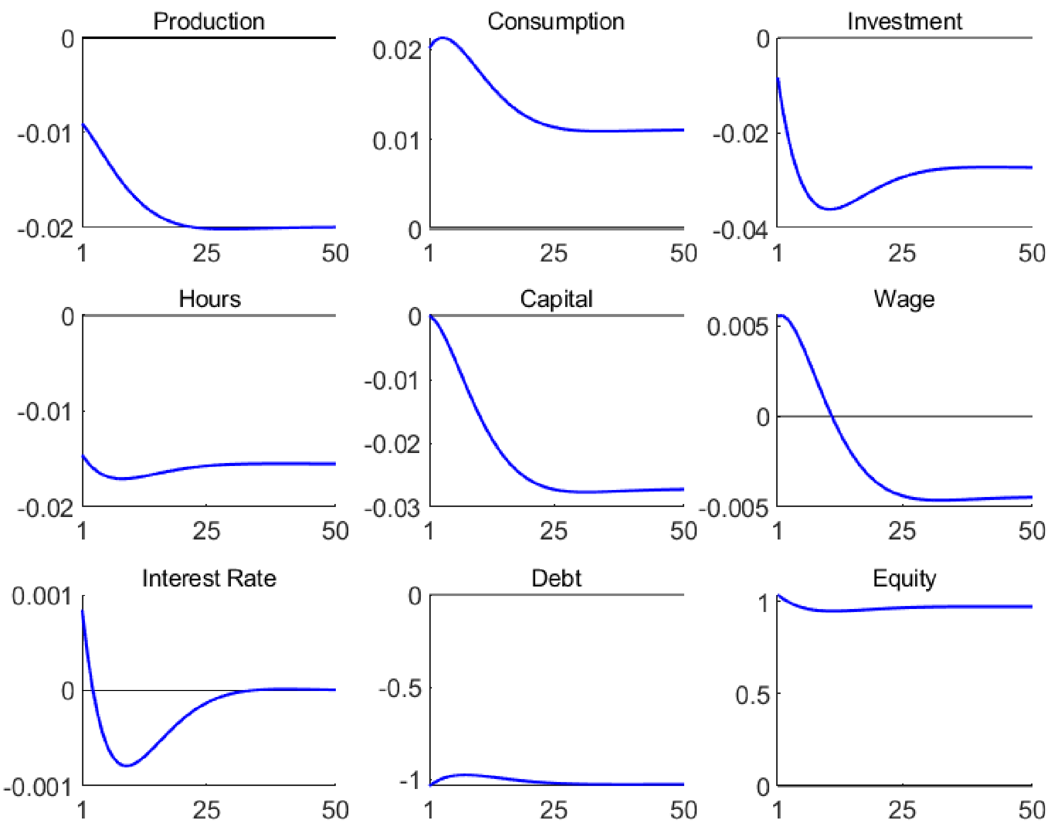
A
Figure

Figure A.1: Effects of a Permanent Corporate Tax Cut Rate



Note: The size of the shock is 1. Variable are represented in log, except for the interest rate. $\chi = 0.6$, $b/k = 50\%$

B
Firm's Problem

$$\max_{\left\{y_{j,t},p_{j,t},h_{j,t},i_{j,t},\tilde{k}_{j,t+1},k_{j,t+1},b_{j,t}\right\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t \Psi_{j,t}$$
$$\text{subject to (2-2), (2-3), (2-4), (2-10), (2-11) , (2-12)} \tag{B-1}$$

By solving the firms problem, we get the following first-order conditions for $y_{j,t}$, $p_{j,t}$, $h_{j,t}$, $i_{j,t}$, $\tilde{k}_{j,t+1}$, $k_{j,t+1}$, $b_{j,t}$, respectively :

$$(1-\tau_t)p_{j,t} = \lambda_{j,t} + \zeta_{j,t}\left(1 - \theta_j^{\frac{1}{\varepsilon}}\left(\frac{y_{j,t}}{y_t}\right)^{\frac{\varepsilon-1}{\varepsilon}}\right) \tag{B-2}$$

$$(1-\tau_t)p_{j,t} = \varepsilon\zeta_{j,t} \tag{B-3}$$

$$(1-\tau_t)w_t = \lambda_{j,t}(1-\alpha_k)\frac{y_{j,t}}{h_{j,t}} \tag{B-4}$$

$$(1-\tau_t\chi_{j,t}-\gamma_{j,t}) = \eta_{j,t} + (1-\chi_{j,t})\kappa_{j,t} \tag{B-5}$$

$$\kappa_{j,t} = E_t\left\{\beta(\delta\tau_{t+1} + (1-\delta)\kappa_{j,t+1})\right\} \tag{B-6}$$

$$\begin{aligned}\eta_{j,t} = E_t\{\beta(\lambda_{j,t+1}\alpha_j\frac{y_{j,t+1}}{k_{j,t+1}} + \eta_{j,t+1}(1-\delta)+ \\ \Phi_k'\left(\frac{b_{j,t+1}}{k_{j,t+1}}\right)\frac{b_{j,t+1}}{k_{j,t+1}} - \Phi_j\left(\frac{b_{j,t+1}}{k_{j,t+1}}\right)\}\end{aligned} \tag{B-7}$$

$$\Phi_j'\left(\frac{b_{j,t}}{k_{j,t}}\right) = E_t\{1-\beta(1+r_t(1-\tau_{t+1}))\}\ , \tag{B-8}$$

where $\lambda_{j,t}$, $\eta_{j,t}$, $\kappa_{j,t}$ and $\zeta_{j,t}$ are the Lagrange multipliers related to equations (2-2), (2-3), (2-4) and (2-11). Combining equations (B-3) with (B-4), we get the following equation:

$$(1-\tau_t)p_{j,t}\left(1 - \frac{1}{\varepsilon} + \frac{\theta_j^{\frac{1}{\varepsilon}}}{\varepsilon}\left(\frac{y_{j,t}}{y_t}\right)^{\frac{\varepsilon-1}{\varepsilon}}\right) = \lambda_{j,t} \tag{B-9}$$