Common Agency Lobbying: Theory and Empirical Applications

A Common Agency Approach to Lobbying: Theory and Empirical Applications

by

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Abstract

This thesis explores lobbying as an important political economy dimension of policymaking. It exploits theoretical, empirical, and numerical approaches and methods to investigate the possibilities of engaging in costly lobbying and how lobbying by special interests affects the setting of minimum wage and small business tax rates. The theoretical modeling relies on the common agency framework - a situation with multiple principals who are simultaneously and non-cooperatively interacting with a single agent - of public policy lobbying and a simpler principal agent model. Empirical analysis employs panel data regression methods in the context of Canadian provinces to identify causal relationship. Both minimum wage and small business taxation invite a considerable amount of activity from various special interest groups in Canada, which engage in lobbying for a policy stance more favorable to their members. After providing a brief overview of lobbying issues and literature in the first chapter, in the second one I show that initial lobbying cost can be a clear entry barrier, that lobbying competition can have properties of a high-stakes game and that lobbying can take place simply to preserve the status quo and not lose ground. In the pure rivalry sense, to not allow the opponent to gain ground in the policy arena.

In the third chapter, I formulate a model of minimum wage determination based on the common agency lobbying framework to evaluate how the competition for political influence between unionized workers and firm owners affects the minimum wage determination. A binding minimum wage is a function of the policymaker's political ideology, the labor demand elasticity and the skill composition of union members. Specifically, when the elasticity of labor demand is large, the benefit of lobbying against (for) an increase in the minimum wage is greater since a potential minimum wage increase has a larger negative (positive) effect on firms' (unionized workers') income. Lobbying is successful in inducing the policymaker to set the minimum wage in accordance with her political preference; a more business (labor) friendly

policymaker reduces (increases) the minimum wage. However, lobbying can also induce the policymaker to go against its ideological preference. Empirical analysis on a panel data for ten Canadian provinces over the 1965-2013 period gives considerable support for theoretical predictions. Preferred panel data regression specifications, controlling for unobserved province and year effects, and various province specific, time varying factors, indicate that real minimum wage decreases in skill-adjusted union density and a measure of political ideology, and increases with technological progress. Greater labor demand elasticity reinforces the influence of political ideology in the presence of lobbying. In the fourth chapter, I focus on the issue of small business tax determination and the effect of lowering its rate on income inequality. In Canada, where the small business income tax rate is considerably lower than the top individual rate, higher income individuals are able to reduce their personal taxes by retaining and shifting income via privately owned small businesses. Therefore, because the small business owners benefit from an increasing difference between the small business and top individual tax rates, I show using a principal-agent model that by lobbying as a special interest group they can always 'buy' a lower corporate tax rate from the government. However, a lower business income tax, relative to a given personal income tax rate, is not income inequality neutral and unambiguously increases the income share of the highest earning individuals in the economy, specifically those who own small corporations.

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Contents

List of Tables

List of Figures

Chapter 1

Introduction

This thesis investigates the possibility and purpose of lobbying, its theoretical and empirical effects on minimum wage and small business taxation policies, and the public goods distribution. Furthermore, it considers the effect of a reduction in the small business tax, which could be an outcome of lobbying activity, on income inequality. This particular policy aspect is especially relevant in the context of the Canadian economy.

Lobbying is a fact of political life in democratic countries. It is a legal, albeit regulated, activity of petitioning the government about certain grievance. It is also a way for special interests to influence a government's decisions through the use of political contributions, reveal their economic preferences and secure favorable policies.

For example, business lobbying has a significant effect on tax policy in the United States and, as discussed further below, companies that engaged in lobbying paid a lower average effective tax rate than those that did not lobby. Such 'favorable' policies, tailored to the firms' industry or markets in which they operate, raise their profit, employment, wages, etc. but may come at the expense of the rest of the population who has to pay higher overall consumption and/or income taxes. Furthermore, the

costs of such policies are dispersed across all taxpayers, each of whom ends up paying a small portion and, thus, has little incentive to engage in lobbying for their removal.[1]

Chapter 2 addresses the question of when an individual's willingness to engage in costly lobbying makes economic sense. I explore this issue in a simple model of common agency policymaking: a situation with multiple principals acting as lobbyists and one agent, in the role of a "semi-benevolent" government policymaker. Lobbyists, with heterogeneous preferences for a public good, simultaneously and non-cooperatively lobby the policymaker.

I derive explicit conditions for lobbying equilibria with either a single or multiple competing lobbyists and demonstrate the rationale behind a positive relationship between the degree of policy preference heterogeneity and willingness to pay to engage in lobbying. With high policy preference heterogeneity, lobbying competition has the characteristics of a high-stakes game: engaging in lobbying is costly, but the opportunity cost of withdrawing from the lobbying is potentially even higher. This means that the opportunity cost of not lobbying can exceed the initial cost of initiating lobbying. Then, the willingness to pay a potentially high lobbying cost reflects the high-stakes involved and is justified; lobbying is worth in order to be able to influence the provision of public good toward a personally preferred level. Under a symmetric lobbying cost, the equilibria in which all players lobby - or no one does - are possible. Policy preference heterogeneity is necessary in generating an equilibrium in which two individuals simultaneously and non-cooperatively lobby the policymaker.

There is also the possibility of multiple equilibra which can lead to a coordination failure outcome; no lobbying is Pareto superior, but inability to coordinate to not lobby can lead to a Pareto inferior equilibrium. With an asymmetric lobbying cost, the single-lobbyist equilibrium is a possible outcome; only the individual with the lowest

[1]Policies characterized by concentrated benefits and dispersed costs are know and studied as a 'common pool problem' and are extensively discussed in Persson and Tabellini [2002], while the subject of special interest politics and their various influence mechanisms is the focus of Grossman and Helpman [2001].

cost engages in lobbying. With only one lobbyist, however, the provision of public good in the economy is Pareto inefficient. Using a numerical analysis circumstances under which each equilibrium is realized are analyzed.

In Chapter 3, I employ the common agency framework to model the political economy of minimum wage as being determined through lobbying activities by multiple Special Interest Groups (SIGs).[2]

I demonstrate how lobbying can induce the policymaker to introduce and increase the minimum wage in accordance with her political ideology; a more business (labor) friendly policymaker reduces (increases) the minimum wage, despite the negative effects it has on aggregate welfare and some economic actors. However, I am also able to show under what conditions the policymaker will set the minimum wage against its political preference when being lobbied. In addition, the theory relates the minimum wage level to labor demand elasticity, union density and technological progress in a given jurisdiction. Empirical analysis on a panel data for ten Canadian provinces, who each set their own minimum wage over the 1965-2013 period, gives considerable support for theoretical predictions.

Chapter 4 analyzes the implications of income shifting between the corporate and personal tax bases by small business owners. This has been investigated as an important aspect of widening income inequality in Canada. My paper provides a new theoretical framework and results to show that when the small business income tax is below the top individual rate, a further reduction of the small business tax rate is not income inequality neutral. A reduction in the small business tax unambiguously increases the income shares of the highest earning individuals in the economy, the top 1%, specifically by enriching those who own small businesses and are able to

[2]Even though lobbying in chapter 3 is modeled as if performed by SIGs and in chapter 2 as done by individuals, the idea and methodology behind this seemingly different approach is the same. Individual interests on a single policy issue, such as minimum wage or tax rate, can be personal but also shared between organizations, firms or groups. As such, a SIG represents and behaves as an individual lobbyist.

retain more income within their businesses. Further, I supplement the model with small businesses lobbying the government as a special interest group, for lower small business taxes and show that by doing so they can 'buy' a lower tax rate, regardless of the government's political ideology. An empirical investigation on a panel of Canadian provinces shows that small business tax rates are strongly negatively related with the top income shares. I also explore the possibility that lobbying by small business influenced small business tax rate setting. I find evidence that lobbying was an important factor in reducing the small business taxes across Canadian provinces since the 1970s.

Chapter 2

Costly Endogenous Lobbying

"If maximization to shareholders is the only priority we're going to look [at], then lobbying is really good because it is maximizing shareholder value."

- Larry Fink, CEO, Blackrock

2.1 Introduction

In modern representative democracies, lobbying government policymakers is a legitimate activity through which various special interest groups (SIG), especially corporations but individual organizations as well, petition the government about their grievances and attempt to influence economic policies in their favour. These involve obtaining favourable tax treatment (Alexander et al. [2009], Chirinko and Wilson [2010], Richter et al. [2009]), financial assistance or regulations (Blau et al. [2013], Igan and Mishra [2014]), government contracts (Witko [2011]), and regulated prices (Duso [2005]). Cooper et al. [2010], Igan et al. [2012] show lobbying can improve stock returns too, confirming the above quote.

Tax policies are the most prominent lobbying issue and firms that lobby pay lower average effective tax rates.[1] Richter et al. [2009] show that a 1% increase in strategic lobbying expenditure by an average firm, decreases the effective tax rate between .5 and 1.6 percentage points. In dollar terms, this translates to $6 - $20 in tax benefits for each additional $1 spent on lobbying. Chirinko and Wilson [2010] find that every $1 of business campaign contributions lowers the state corporate tax by $6.65. Lastly, Alexander et al. [2009] find an astonishing $220 tax savings for every $1 corporations spent on lobbying for the tax holiday on repatriated earnings provision in the American Jobs Creation Act of 2004.

Besides tax breaks, large companies lobby for subsidies and regulatory policies that benefit them at the expense of their competitors, and act as barriers to entry in the market and industry. This can create a competitive environment that discriminates against innovative newcomers, with lower competition resulting in higher prices, lower wages and lower quality goods and services.

Given that lobbying is influential and can be lucrative with a relatively high marginal return, a question often asked is, why isn't there more lobbying activity? This question was first indirectly posed by Tullock [1972]. Tullock's puzzle is discussed by Ansolabehere et al. [2003] with a focus on campaign contributions and by de Figueiredo and Richter [2014] with a focus on direct lobbying expenditures. One possible and simple reason is that lobbying is a costly activity. The full cost of political participation through lobbying is greater than 'just hard money' spent to convince policymakers to take actions and enact policies that secure benefits and rents to lobbying interests. Before political contributions are made, whether as direct lobbying or campaign expenditures, a would-be lobbyist faces certain initial setup costs. These can consist of various fixed costs: registering with the appropriate federal or local government's lobbying regulator, hiring experts in regulatory environment and legal

[1] (See *The Economist* 'Special Report: Companies and the State', Feb. 22, 2014.)

rules surrounding the lobbying process, as well as covering the costs of maintaining a lobbying operation (administrative overhead expenses, transparency and disclosure requirements, fundraising costs). There are further costs of finding which policymaker to contact, establishing a 'working' relationship and providing non-monetary favours to signal commitment.

Individual special interests lacking resources to cover these fixed upfront lobbying costs are less likely to engage in lobbying. It seems intuitive that larger special interests (e.g., firms, banks, unions) are more likely to be able to afford these fixed organizational expenses of lobbying than the smaller ones (citizen groups, think-thanks, small-businesses). Indeed, empirical evidence reviewed in de Figueiredo and Richter [2014] shows that lobbying activity is more likely to be carried out independently by large corporations and interest groups. Thus, high organizational costs can be a clear entry barrier and a sufficient reason not to engages in lobbying.

However, a more interesting question is: what motivates individual interests to engage in lobbying beyond the availability of resources to cover the initial cost? It is not immediately clear under what conditions the willingness to pay a the upfront cost and engage in lobbying competition for influence makes economic sense and has a positive payoff. Then, more fundamentally, when is it justified and necessary to engage in lobbying competition despite the potentially high upfront cost?

To elaborate on those questions, in this paper I study endogenous lobbying engagement and investigate the *true* cost of lobbying - its opportunity cost. This seems understudied in the current literature, where the initial costly decision to engage in lobbying competition, relative to the cost of not lobbying, is not explicitly considered. The paper is also motivated by some empirical observations and regularities. For instance, Baumgartner et al. [2009] indicate that there is always a status quo policy in place and lobbying is about changing an existing policy, not establishing a new one. Further, an unsurprising empirical regularity is that lobbying is most prominent when

the stakes based on the policy outcomes are high.[2] Thus, it would appear reasonable that incurring the potentially high initial cost of lobbying is justified only when the stakes are high.

However, a lot of lobbying is also done 'defensively', simply to maintain some status quo. As Baumgartner et al. [2009] find, there is almost always someone who *likes* the status quo. This contributes to stability and persistence of public policies.[3] A firm that observes its competitors lobbying will follow suit to avoid losing out. In that case, as indicated by de Figueiredo and Richter [2014], lobbying payoffs are hard to measure. Then, the decision to engage in lobbying is necessary in order to not lose ground, rather than to affect policy or establish a new one to obtain a net gain.

In this paper, I develop simple theoretical rationale and intuition behind such observations. I postulate the existence of individual based interests with heterogeneous policy preferences, who have to decide whether to engage in lobbying by paying an upfront fixed cost. Lobbying is based on the common agency[4] framework of Dixit et al. [1997] in which principals are interpreted as lobbyists offering political contributions to their common agent, a policymaker responsible for the policy, a level of public good provided. Political contributions take the form of a payment commitment conditional on the implemented policy. The policymaker has twin objectives. On the one hand, she values the lobbyists' contributions and is responsive to their demands. On the other, assuming she is a lawmaker seeking reelection, she is obliged to increase all individuals' welfare. The policymaker's objective is therefore a weighted sum of

[2]For example, lobbying efforts increase around the time of the government's yearly budget deliberations or when a change to a specific legislation is being discussed. See Kerr et al. [2014].

[3]Baumgartner et al. [2009] provide evidence on policy resilience. For models of policy persistence induced by lobbying see Braillard and Verdier [1994], Morris and Coate [1999].

[4]The foundations of the modern literature on lobbying as common agency were initiated by the work of Bernheim and Whinston [1986a,b] on menu auctions and subsequently popularized by the seminal Grossman and Helpman [1994] model of endogenous tariff determination. For an overview of theory and literature on lobbying see Grossman and Helpman [2001] book, Persson and Tabellini [2002]'s Chapter 7 and more recently Martimort [2006]. Also Dixit [1998] is a more general treatment of policymaking. The classical, older studies of special interests influence and lobbying are Olson [1965] and Becker [1983].

political contributions and aggregate welfare. Such a policymaker could provide either the socially optimal level of public good or some under-the-influence level that favours a lobbyist's preference over the non-lobbyist one.

This can be interpreted as a fairly general model of policymaking with public good provision serving the role of a general public issue or a policy dimension over which heterogeneous individuals have different ideal points (assuming single-peaked preferences). By explicitly stating the asymmetry in public good preferences I am highlighting a simple structure of conflict over the public policy and its financing.[5] By lobbying each individual can influence the provision of public good toward his most preferred level, changing the initial status quo. The resulting under-the-influence level of public good can be either greater or lower from the level others in the economy would prefer to consume and pay for, and thus from the socially optimal level.

In the current literature on such lobbying games without the entry cost, multiplicity of equilibria is a standard result. Specifically, what is not well established is who becomes a lobbyist in equilibrium. By endogenizing the decision to become a lobbyist and join the lobbying competition through an explicit entry cost, I characterize the circumstances under which it is advantageous to incur the lobbying cost in order to either secure the most preferred public good or to prevent another lobbyist from disproportionately influencing the public good provision. This is in contrasts to the current common agency lobbying literature in which initiating lobbying is not costly.

In the theoretical part I show that with identical public good preferences and a positive initial lobbying cost, not lobbying is a dominant strategy. Preference heterogeneity is necessary to generate an equilibrium with at least one active lobbyist. This provides simple conditions under which a firm, for example, would engage in lobbying competition even in the presence of a high upfront cost. Lobbying competition has the property of a high-stakes game, in the sense that the opportunity cost of

[5] Although the result is a zero-sum setting, this type of interest-group game with pure rivalry is more appropriate for policy questions.

not lobbying can be even higher than the fixed cost of initiating lobbying. In other words, under some conditions, the direct upfront cost of lobbying does not necessarily outweigh the opportunity cost of paying for and consuming a less preferred quantity of public good. This provides the rationale for the observed defensive lobbying: the motivation to enter the lobbying competition is simply to preserve the status quo and not lose ground in the policy dimension. In the pure rivalry sense, lobbying aims to prevent the opponent from influencing the policy toward his preference. For fear of losing out, individuals are drawn into the lobbying competition simply to check the influence of the other lobbyists and balance the provision of public good toward their most preferred level. From this process, even a socially optimal provision of public good can be achieved. When the heterogeneity in policy preferences is high, meaning that the stakes in policy outcomes are also high, paying the high initial cost of lobbying is justified. A high lobbying cost reflects the high-stakes of lobbying competition if heterogeneity in public good valuation is also high.

Additional insights on the lobbying game outcomes are provided by a simple numerical analysis of the model. First, for a fixed level of preference heterogeneity, only the individual facing the lower lobbying cost engages in lobbying. A high cost discourages all individuals from lobbying. Second, I explore how the combined variation in preference heterogeneity and lobbying cost determines which of the lobbying equilibria will be realized. Under the symmetric lobbying cost, only the equilibria where everyone lobbies or noone does are realized, while under the asymmetric cost the outcome with only one individual lobbying is also possible. With only one active lobbyist, public good provision is not socially optimal: the lobbyist disproportionately influences the provision of public good by pulling it toward personally desirable but non-Pareto efficient quantity.

Furthermore, the numerical analysis indicates a positive relationship between the degree of preference heterogeneity and the maximum initial lobbying cost individuals

are willing to pay. With high preference heterogeneity the conflict over the level of public good provided and consumed is high. The high lobbying cost then reflects what individuals are willing to pay in order to obtain a more favourable public policy or the need to correct the influence of the other lobbyist.

Finally, the numerical analysis delivers an additional insight of the model. For some values of the lobbying cost and preference heterogeneity a coordination failure outcome can emerge in equilibrium. Multiple equilibria, where everyone is either lobbying or not, can be Pareto-ranked, with no lobbying always a superior equilibrium in terms of welfare. I surmise that strategic interaction does not rest only on the conflict between players. Gains from strategic interaction could be realized if players could coordinate and commit to not lobby; they could achieve a higher Pareto-ranked equilibrium. Given the characterization of lobbying as a high-stakes game, however, it is unlikely that such coordination will arise. Alternatively, if the lobbying cost is set high enough, individuals can be 'forced' not to lobby and a Pareto superior equilibrium can be imposed.

2.1.1 Related Literature

This paper is related to a strand of literature that focuses on the issues of endogenous lobbying and selection into lobbying. The fundamental issue of who engages in lobbying and under what circumstances, although recognized by the current literature, has not been studied thoroughly. A likely reason is the difficulty with modeling the process by which groups become organized to engage in lobbying - the collective action problem outlined by Olson [1965]. A more basic difficulty, however, lies with the non-uniqueness of the lobbyists' equilibrium payoffs. As Laussel and Le Breton [2001] point out, deriving precise conditions which are necessary and sufficient to characterize the unique structure of equilibrium payoffs in common agency lobbying is challenging and often intractable. In this paper, once I establish the uniqueness of

lobbyists' equilibrium payoffs, I endogenize the decision to lobby by introducing an additional stage to the game in which players have to decide whether to pay an initial fixed cost to become lobbyists.

Martimort and Semenov [2008] and especially Martimort and Semenov [2007b] consider some related issues, although from a different perspective. Both of their papers consider the effects presence of asymmetric information between SIGs and the policymaker. Although they do not directly model an endogenous entry into the lobbying process - thus all organized interests actively lobby - they consider the equilibrium payoff characterization of interest groups and their common agent in a situation where the agent has private information about his ideology. Characterizing the equilibrium payoffs in an environment with incomplete information also matters for endogenizing groups active in political lobbying. If the entry in the lobbying process involves some initial fixed cost, then, similar to this chapter, there is a threshold beyond which the interest group does not lobby. In this paper the cutoff increases with the degree of public good preference heterogeneity, while in Martimort and Semenov [2007b] it would decreases with the ideological bias or ideological uncertainty of the policymaker.[6] In Martimort and Semenov [2008] a form of 'endogenous entry' in the lobbying process arises when SIGs target only those policymakers who are close to their ideological point and can thus be easier to influence.

With sufficiently large ideological uncertainty of the policymaker, interest groups might choose not to lobby, which leaves the policymaker free to implement his ideal point. In their models, similar to this paper's, there is the possibility of inefficiencies in policy choices. However, unlike this paper's model where a Pareto efficient level of public good is implemented when lobbying competition is perfect, i.e., all interests are lobbying, in Martimort and Semenov [2008] competition between interests can lead to inefficient policies because of asymmetric information about policymaker's

[6]The policymaker has private information about his own ideal point and thus the ideological bias relative to lobbyists. See Martimort and Semenov [2007b] page 160 for a discussion on this.

ideological bias. The policymaker has private information on his ideology and interest groups' competition is dependent on the amount of ideological uncertainty. In my model, SIGs competition is dependent on the entry cost and heterogeneity of their own public good preference, not information about the policymaker's ideal point.

In an important contribution, Felli and Merlo [2006] consider problematic, as does this paper, the implicit assumption of the common-agency literature that all exogenously given lobbyists compete in the equilibrium of the policymaking process. Thus, to endogenize lobbying they do not model it as a menu-auction, but rather propose a model in which an elected policymaker selects, from a set of pre-existing lobbies, a coalition to bargain with in a post-election stage. This endogenous coalition choice is embedded in a citizen-candidate model that builds on Besley and Coate [2001].

An important feature of citizen-candidate models is that all individuals are allowed to run for office to become the policymaker, but doing so is costly. Both Besley and Coate [2001] and Felli and Merlo [2006] consider this costly decision and through an election stage endogenize the policymaker's preferences. However, despite the similarity between the cost of becoming a lobbyist and the cost of becoming a policymaker, neither paper considers that it is also costly to initiate lobbying. In Besley and Coate [2001] the individual citizen's willingness to participate in the lobby group is not considered and each member (i.e., lobbying citizen) is assumed to contribute the same amount to lobbying expenditure. Felli and Merlo [2006] restrict the analysis to three lobby groups ("non-elected agents") with heterogeneous policy preferences.

In this paper, consistent with Besley and Coate [2001] but contrary to Felli and Merlo [2006], I model lobbying as a menu-auction. But, contrary to Besley and Coate [2001] I do not assume that all exogenously existing lobbyists participate in the policymaking process and influence the policy. I explicitly consider the costly decision whether to initiate the lobbying process and influence the policy decision. As

a result, similar to Felli and Merlo [2006], I show that in equilibrium, under specific circumstances, not all lobbyists necessarily take part in the policymaking process.[7] In this paper, that is the case when the fixed entry cost of engaging in lobbying is high or when the individuals' preference heterogeneity over policy is low.

However, since the Felli and Merlo [2006] framework does not evaluate lobbying within a menu-auction paradigm, the results are not straightforward to compare. A standard property of the menu-auction lobbying models is that the agent is a passive player and the game is played through the principals. Felli and Merlo [2006] 'empower' the agent by assuming that she has all the bargaining power. Nonetheless, lobbying in their framework moderates the outcome toward the middle of the policy space. This is similar to the rationale for lobbying I develop within the common-agency framework: individuals become lobbyists in order to not lose ground in the policy space and to correct the one-sided influence an active lobbyist has. On the other hand, a result of their lobbying stage is that in the equilibrium lobbying *always* occurs and influences the policy choice. This is not the case in this paper and an equilibrium with no lobbyists is possible. This allows for the possibility that some policies simply do not attract any lobbying. Furthermore, it is not fully satisfactory to disregard the potential lobbyist's *willingness* to participate in the political process given the costly nature of initiating lobbying and the circumstance that influence this decision.

This upfront participatory cost is in the same vein as the entry cost to run for office. Mitra [1999] considers this entry cost in the lobbying game by extending the Grossman and Helpman [1994] model of tariff determination by adding a stage in which individuals have to incur an initial cost of getting organized into a lobby. He asks how organized lobbies come into existence. The focus is on the incentives to form a lobby group by individuals with identical preferences, who each has to contribute to the financing of the lobby formation cost. This is a step before the Besley and Coate

[7] The Felli and Merlo [2006] equilibrium result is that an elected policymaker never includes all available lobby groups in the bargaining process over the policy decision.

[2001] and Felli and Merlo [2006] considerations. It also implies that by contributing to the financing of organizing a lobby the individuals design a mechanism for overcoming the free-rider problem discussed by Olson [1965].

In essence, Mitra [1999] investigates the formation of a trade association with the goal of lobbying on a particular issue,[8] whereas in this paper I investigate the willingness of an individual based interest, such as a private corporation, bank, etc., to lobby on a public policy that shapes the business environment to its advantage.[9] Because I am focused on a different question - when is it justified to pay the potentially high upfront cost to engage in lobbying - I simplify the approach by considering lobbyists and the policymaker in the lobbying game as individualistic utility maximizers.

Mitra [1999], like Grossman and Helpman [1994]'s lobbying game, however, does not have uniquely determined equilibrium payoffs of lobbies. Only under some special conditions is he able to derive the number of active lobbies in the equilibrium. In contrast, I show that is not the case in this paper. Due to the simple nature of the lobbying game, I am able to obtain an outcome with a unique structure of equilibrium payoffs in every sub-game. This facilitates deriving simple necessary conditions for an equilibrium with a single, multiple or no lobbyists to be realized.

The rest of the chapter is organized as follows. Section 2.2 outlines the basic elements of the lobbying model. Section 2.3 characterizes all possible sub-game perfect Nash equilibria while Section 2.4 solves for its equilibrium outcome and derives the necessary conditions for each SPNE to be realized. Section 2.5 performs the numerical analysis as an illustration of the results. Section 2.6 concludes.

[8]For example, the Internet Association was formed by the major internet companies for the purpose of lobbying in favor of 'net-neutrality'. Similarly, Homeland Investment Coalition was a group of firms formed in 2004 to lobby for a tax holiday on the U.S. repatriated profits.

[9]For example, General Electric's ability to obtain tax breaks through individual lobbying eliminated almost all of it corporate tax liabilities in the U.S..

2.2 The Model

Consider an economy consisting of two individuals, denoted by $i = 1, 2$ throughout. Each individual has preferences of the quasi-linear form $x^i + \eta^i v(G)$, where x is the private good and $G \in \mathcal{R}^+$ a policy that has public good properties. Thus, the policy dimension is captured by the level of public good provision. The sub-utility function $v(\cdot)$ is increasing and strictly concave. The parameter η^i is a policy preference parameter that captures the degree of heterogeneity between the two individuals. It could also be interpreted as capturing the degree of polarization over a policy issue, indicating different ideal points over a public policy.[10] For tractability it is assumed that $\eta^i = 1$ for $i = 1$ and can be arbitrary for $i = 2$. That is, $\eta^2 > 1$ ($\eta^2 < 1$) indicates that individual 2 has a higher (lower) marginal valuation of the public good than individual 1.

Individuals are endowed with a fixed amount y^i of the private good, which is allocated to private consumption x^i and financing G units of the public good. The cost of providing G is shared equally between the two individuals, which results in a per-capita tax $\frac{cG}{2}$, where cG is the cost of producing the public good in terms of private consumption. Although such a per-capita tax is not realistic, the point is that employing a lump-sum tax will always give an efficient outcome, while we are interested in the potential policy inefficiency that could arise as a result of lobbying. It is assumed that the tax system is determined and agreed upon before lobbying starts. By including the term $\frac{cG}{2}$ in the payoff, so that individuals always pay for the public good, we can obtain the efficient G and explore the inefficiencies of lobbying. Also, assuming that the two individuals could have a different preference for the public good, something I do model, imposing a uniform lump-sum tax would result in redistribution between them. In other words, facing the same tax price, the individual with high

[10] An example of such a highly polarizing policy issue, that elicited considerable lobbying efforts, is 'net-neutrality'. Internet service providers, who are penalized by net neutrality lobby against it, while the internet companies such as Google and Facebook, lobby in favor.

willingness-to-pay would be subsidized by the low willingness-to-pay individual.[11] An alternative approach would use a payoff setup as in Martimort and Semenov [2007a,b] with $v()$ being a single peaked function.

To become a lobbyist and be in the position to potentially influence the policy outcome, each individual has to pay an upfront fixed cost γ^i. Throughout the analytical part the lobbying cost is considered different for the two individuals and accordingly labeled as γ^1 and γ^2. Symmetric lobbying cost, i.e. $\gamma^1 = \gamma^2 = \gamma$, does not change the derivations. Different effects of symmetric and asymmetric lobbying cost are explored in section 2.5.

As a lobbyist, the individual wants to induce the policymaker to provide his most preferred policy. For example, we can think of a firm owner seeking improvements in public good provision, such as transportation infrastructure, a more de-regulated access to air transportation (use of public air space) or a more favorable treatment of industry specific intellectual property rights.[12] In order to achieve that he[13] designs and offers the policymaker an optimal political contribution schedule as a function $P_i(G)$. The type of political contribution schedule offered is discussed in the next section. Regardless of whether he is lobbying or not, each individual pays the head tax.

By substituting for x^i from his budget constraint and taking into account the possibility of incurring lobbying expenditures, each individual's objective function is:

$$U^i(G; y^i, \eta^i, s) = y^i + \eta^i v(G) - \tfrac{cG}{2} - I(s)\big[P_i(G) + \gamma^i\big], \quad \text{where } \eta^i = \begin{cases} 1 & \text{if } i = 1, \\ \eta & \text{otherwise.} \end{cases} \tag{2.1}$$

[11] Redistribution is not of concern here give that the consumption of G is independent of income.

[12] See for example the report on lobbying by Amazon in Kang [2016]. Companies are quintessential lobbying entities and in case of private corporations, it is the owners who decide whether to engage in lobbying and over which policies.

[13] Throughout the paper the pronoun 'he' is used for lobbyists and 'she' in relation to the policymaker.

$I(s)$ is an indicator function. If the individual is not lobbying $s = N$ and $I(N) = 0$. If the individual is lobbying $s = L$ and $I(L) = 1$; the individual is paying the lobbying cost γ^i and offering a contribution $P_i(G)$ to the policymaker. For a clearer exposition throughout, I denote by u^i the lobbyist's *net* of contribution payoff and by $U^i(G)$ the non-lobbyist's payoff.[14]

The classical narrative is that money buys access which secures influence and influence buys results. The literature on special interest politics sometimes distinguishes between political contributions, made to a preferred incumbent lawmakers to influence the outcome of policymaking, and campaign contributions, made to a candidate to increase her (re)election probability. Both, however, involve transfers of income from SIGs to policymakers in order to obtain policy outcomes. In the end, lobbying is about buying results.[15] Hence, I do not make a particularly strong distinctions between these two here and simply assume that political contributions are always valued, either as lobbying expenditures or campaign contributions.[16] These are essentially binding, full commitment contracts, promising a payment for the chosen policy.[17]

An alternative story is that lobbying is really informational, i.e., collecting and transferring valuable information about alternative policies to the policymaker in private meetings. As many other papers in the menu-auction approach to lobbying, I focus on the influence-buying role of lobbyists and abstract from the informational aspects of lobbying.[18]

[14] Explicitly, based on eq. (2.1), $u^i = U^i(G; y^i, \eta^i, L)$ and $U^i(G) = U^i(G; y^i, \eta^i, N)$. Notice that the parameter η^i, the indicator $s = [N, L]$, and the endowments y^1 and y^2 are suppressed in the case of no lobbying.

[15] The channel through which lobbying exerts influence and obtains results might be more interesting empirically, where campaign contributions vs. direct lobbying expenditure can be distinguished in the data.

[16] This could be either by adding to a personal reelection fund or by directing a portion of them toward the party reelection fund, as a way for the policymaker to "buy" a more favorable standing within the party and be appointed to a more influential policymaking position.

[17] Viewed as campaign contributions, with no commitment issues, they can also represent a promise of contribution toward a future reelection campaign.

[18] For an overview, by no means an exhaustive one, of the literature on informational lobbying and persuasion see Lagerlof [1997], Austen-Smith [1995], Austen-Smith and Banks [2002], Bennedsen

The policy decision regarding the level of public good provided is in the hands of a policymaker who cares about total political contributions she receives as well as the aggregate welfare. Her consideration for aggregate welfare stems from possible reelection concerns or simply reflects some measure of social benevolence. Her objective function is assumed to be linear in these two elements and takes the form of a weighted sum of aggregate, gross-of-contributions welfare, $\sum_i U^i(G) = \mathcal{W}(G)$, and the sum of lobbyists' contributions,[19] $\sum_i P_i(G)$. Specifically,[20]

$$U^0(G) = \lambda \mathcal{W}(G) + (1-\lambda) \sum_{i=1}^{2} P_i(G), \tag{2.2}$$

where $\lambda \in (0,1)$ is the weight the policymaker assigns to gross aggregate welfare $\mathcal{W}(G)$, and captures the policymaker's benevolence relative to her preference for contributions.[21] There are three decision stages in the game.

Stage 1 Individuals decide whether to pay an irreversible transaction cost γ^i and engage in lobbying.

Stage 2 Lobbyist simultaneously offer non-negative political contribution schedules $P_i(G)$ to the policymaker.

and Feldmann [2002, 2006] and more recently Cotton [2009, 2012], Cotton and Dellis [2015] and references therein.

[19] Referring to $\mathcal{W}(G)$ as 'social welfare' is imprecise and possibly confusing. Given that the policymaker wants to maximize the amount of political contributions she receives from the lobbyists, she is not concerned with maximizing individuals' *net-of-contributions* welfare. In line with the literature, [see Grossman and Helpman, 2001] I refer to $\mathcal{W}(G)$ as aggregate welfare, gross of contributions. Alternatively, define $V^i(G) = \eta^i v(G) - cG/2$ as the surplus enjoyed from consuming public good G by $i = 1, 2$. Maximizing $\mathcal{W}(G)$ is then equivalent to maximizing the aggregate surplus $\sum_i V^i(G)$.

[20] Grossman and Helpman [1996] discuss how such an additively separable policymaker's objective function arises in a political system with competing parties. Even in authoritarian regimes, where reelection concerns essentially do not matter, government policymakers that accept lobbyists' contributions might also care about general welfare of their citizens and want to increase their living standard to prevent social discord.

[21] See Grossman and Helpman [1994], footnote 5. Maximizing eq. (2.2) is equivalent to maximizing $\hat{U}^0(G) = \lambda_2[\sum_i U^i(G) - \sum_i P_i(G)] + \lambda_1 \sum_i P_i(G)$, where $\lambda_1 = \frac{1}{1+\lambda}$ and $\lambda_2 = \frac{\lambda}{1+\lambda}$, effectively giving a higher weight to political contributions.

Stage 3 The policymaker observes the contribution schedule(s) offered and selects the set of lobbyists and then G in order to maximize her objective function in eq. (2.2).

The last two stages represent the standard common agency game[22] in which the principals are interpreted as two lobbyists trying to influence their common agent, the policymaker. Selection of the set of lobbyists in the last step is important because the politicians can also refuse the contributions offered, i.e., choose neither of the lobbyists.[23] The first step adds an additional consideration for both individuals.

2.3 Sub-game Analysis

There are four possible sub-game perfect Nash equilibrium cases to characterize. The first case is straightforward: the policymaker decides on the public good to provide without the lobbyists' influence. In the second and third case, I investigate the situation when either individual 1 or 2, respectively, act as lobbyists. These two cases are set in the framework of a principal-agent problem. The fourth case takes the form of a common-agency game.

2.3.1 No Lobbyists

Without lobbying, the policymaker receives no political contributions and her only concern is to maximize gross aggregate welfare. Let G_{NN} denote the policymaker's optimal policy choice in this case, where NN stands for each individual being a *Non-lobbyist*.

[22] Lobbying as common agency became a state-of-the-art approach for modeling endogenous policy formation and was applied to several policy topics: commodity taxation (Dixit [1996]), labor market policies (Aidt and Hwang [2008], Rama and Tabellini [1998]), environmental policy (Aidt [1998]), local public goods (Persson [1998]), fiscal federalism (Bordignon et al. [2008], Esteller-Moré et al. [2012]), and capital levy problem (Marceau and Smart [2003]).

[23] I thank Aggey Semenov for highlighting this point.

Lemma 2.3.1. *G_{NN} is the Pareto efficient level G°.*

Proof. With no lobbyists, the policymaker's objective function in eq. (2.2) reduces to $U^0(G) = \lambda \mathcal{W}(G)$ indicating that the public good provision is

$$G_{NN} = \arg\max_{G \geqslant 0} \Big\{ \lambda \sum\nolimits_i U^i(G) \Big\}. \tag{2.3}$$

Using eq. (2.1), public good level G_{NN} satisfies the first-order condition:

$$(1 + \eta) v'(G) = c \tag{2.4}$$

where $v'(\cdot)$ denotes the derivative of v. Under quasi-linear preferences $\eta^i v'(G)$ is each individual's marginal rate of substitution. Therefore eq. (2.4) represents the Samuelson condition and G_{NN} is the Pareto efficient level of public good provided, denoted as G°. □

Notice that λ does not appear in the first-order condition. Without any 'interference' from the lobbyists, the policymaker is behaving as a fully benevolent social planner, providing the first-best level of public good. Finally, a non-lobbying individual neither pays a fixed transaction cost γ^i nor a political contribution, obtaining the non-lobbying payoff

$$u^i_{NN} = U^i(G^\circ) = y^i + \eta^i v(G^\circ) - \tfrac{cG^\circ}{2}, \quad \text{for } i = 1, 2. \tag{2.5}$$

Recall that individuals have quasi-linear preferences, meaning that the marginal utility of the private good is one. Each individual's marginal rate of substitution between the private and public good depends only on G and takes the form of $v_G(G, \eta^i)$. Furthermore, the total cost for the society in forgone private consumption of producing level G is cG, meaning that the marginal cost of producing public good is c. The Pareto efficient level of the public good, G°, must satisfy the Samuelson condition

given by $\sum_i MRS^i = MC$. By using the form of MRS in the case of a quasi-linear utility, the Samuelson condition equals:

$$v_G^1(G, \eta^1) + v_G^2(G, \eta^2) = c \tag{2.6}$$

which is exactly the condition derived in equation (2.4) for the public good level G_1. Therefore, we have that $G_1 = G^\circ$.

2.3.2 One Lobbyist

When only one individual (i) attempts to influence the policymaker's policy decision the situation takes the form of a full information *principal-agent* problem. The non-lobbyist $(-i)$ consumes the public good provided and pays the head tax. To influence the policymaker's choice of G in his favor, the lobbyist has to design a contract $\{G, P_i\}$. With only one lobbyist present, the political contribution offered takes the form of a *take-it-or-leave-it* offer (denoted as "tol" below), a fixed transfer of the private good from the lobbyist to the agent, denoted as P_i^{tol}.[24]

Let G_l be the policymaker's choice of the public good provided with one lobbyist present, where the subscript $l = [LN, NL]$ indicates that either player 1 or 2, respectively, is the sole lobbyist. Lemma 2.3.2 captures the implication of having one lobbyist for the public good provision.

Lemma 2.3.2. *With player i as the only active lobbyist offering a take-it-or-leave-it political contribution, the policymaker's equilibrium choice of the public good is*

$$G_l = \arg\max_{G \geqslant 0} \Big\{ U^i(G) + \lambda U^{-i}(G) \Big\}, \quad \textit{where } l = \begin{cases} LN & \textit{if } i = 1, \\ NL & \textit{if } i = 2. \end{cases} \tag{2.7}$$

[24] In this full-information case, it is irrelevant whether the payment is based on the final level of public good or some policy the agent can take to provide that amount. I focus only on the final level of public good provided and do not model any specific policy or action the agent can take to provide that level.

Proof. To demonstrate this we simply have to solve a full information principle-agent problem. Both the lobbying and non-lobbying individuals' utility functions are as defined in eq. (2.1). However, in the presence of a lobbyist the agent's objective function is now

$$U^0(G) = \lambda \mathcal{W}(G) + (1-\lambda) P_i^{tol},$$

indicating that she cares about gross aggregate welfare and the political contribution P_i^{tol}. After paying the fixed cost γ^i, the lobbyist problem is to choose an optimal incentive payment P_i^{tol},

$$\max_{(G, P_i^{tol})} \; y^i + \eta^i v(G) - \tfrac{cG}{2} - \gamma^i - P_i^{tol} \quad \text{subject to} \tag{2.8}$$

$$\lambda \sum_{j=1}^{2} U^j(G) + (1-\lambda) P_i^{tol} \geqslant \lambda \max_{G} \sum_{j=1}^{2} U^j(G) \equiv \lambda \sum_{j=1}^{2} U^j(G^\circ) \tag{2.9}$$

Condition (2.9) is the policymaker's *participation constraint* (PC). It imposes the requirement that by accepting the contribution P_i^{tol} the policymaker should receive at least her reservation level of utility, what she can obtain by refusing the lobbyist's contract and providing the Pareto efficient level of public good G°. The lobbyist wants to set P_i^{tol} as small as possible to satisfy the PC. Therefore, from the binding equation (2.9) it follows that the policymaker must be paid:

$$P_i^{tol} = \frac{\lambda}{1-\lambda} \left[\sum_{j=1}^{2} U^j(G^\circ) - \sum_{j=1}^{2} U^j(G) \right], \quad \text{for } i = 1, 2. \tag{2.10}$$

Substituting eq. (2.10) into the principal's objective function and simplifying gives eq. (2.7). □

The under-the-influence equilibrium public good level in eq. (2.7) differs from the Pareto efficient level G° in eq. (2.3). The policymaker is still maximizing gross aggregate welfare when providing the under-the-influence quantity of public good, but

since $\lambda < 1$ the non-lobbyist $-i$'s preference is given less consideration. Lobbying shifts the welfare weight in favor of the lobbyist's preference and under-weights the non-lobbyist's preference. If the policymaker cared only about aggregate welfare, i.e., if $\lambda = 1$, both G_{LN} and G_{LN} levels would converge to the Pareto efficient level G°. The first-order conditions for eq. (2.7) indicate how lobbying makes a difference by reweighing the individuals' MRS. Specifically,

$$\frac{2\eta^{i}}{1+\lambda}v'(G) + \frac{2\lambda\eta^{-i}}{1+\lambda}v'(G) = c \quad \begin{cases} \frac{2}{1+\lambda}v'(G) + \frac{2\lambda\eta}{1+\lambda}v'(G) = c, \text{ if } i = 1 \\ \frac{2\eta}{1+\lambda}v'(G) + \frac{2\lambda}{1+\lambda}v'(G) = c, \text{ if } i = 2. \end{cases} \tag{2.11}$$

Comparing eq. (2.11) and eq. (2.4) we can see how lobbying modifies the Samuelson condition; only the lobbyist's marginal valuation of public good is given full weight when $\lambda < 1$. With the equilibrium level G_l, eq. (2.10) indicates that the lobbyist's equilibrium political contribution is proportional to the welfare loss that providing an under-the-influence level of public good imposes on the society. In other words, from the policymaker's perspective, the first-best level of public good yields political utility $\lambda\mathcal{W}(G^{\circ})$. By providing G_l the policymaker incurs some political cost because of the loss of aggregate welfare. The political payment must then compensate her for the difference between the utility she achieves when providing the first-best level G° and the under-the-influence level G_l.

Furthermore, from eq. (2.10) notice that if the policymaker did not care about aggregate welfare at all ($\lambda = 0$), the political payment would also be zero. It means that with a very low λ a very small political contribution would suffice to move the policymaker in the direction favorable to the lobbyist, and away from maximizing 'only' aggregate welfare.

Finally, individuals' equilibrium net-payoffs are determined as follows. The non-lobbyist $(-i)$ consumes the public good level provided, always pays the tax according

to that level and, since he does not pay the lobbying cost nor the political contribution, receives the payoff according to eq. (2.1). The lobbyist (i), on the other hand, after paying the initial registration cost γ^i and the contribution P_i^{*tol}, receives the net-payoff u^i. Specifically, the respective payoffs are:

$$u_l^{-i} = U^{-i}(G_l) = y^{-i} + \eta v(G_l) - \tfrac{cG_l}{2}, \tag{2.12}$$

$$u_l^i = \tfrac{1}{1-\lambda}\Big[U^i(G_l) + \lambda U^{-i}(G_l) - \lambda \mathcal{W}(G^\circ)\Big] - \gamma^i. \tag{2.13}$$

Preference heterogeneity highlights the conflict between individuals over the level of public good and its financing. By lobbying each individual pushes the provision of public good toward his most preferred level and the optimal level G° is always a compromise between the preferences of the two individuals. For example, when $\eta < 1$ and individual 1 is the only lobbyist, $G_{LN} > G^\circ > G_{NL}$, indicating that the lobbying individual is able to disproportionately influence the provision of public good. Financing is shared equally, however, and the non-lobbying individual 2 ends up paying a higher share of the cost of public good provision, i.e. a higher tax bill, than is his willingness to pay.

Therefore, the decision by individual 2 to enter the lobbying competition is influenced not just by the upfront cost of lobbying γ^2, but also the opportunity cost that by not lobbying he will end up paying for and consuming a higher level of public good.[25] This is the rationale behind lobbying to not lose ground, i.e., so that the public policy is not changed in an undesirable way. It reflects lobbying competition as a high-stakes game. On the one hand, by deciding to lobby each individual pays a fixed registration cost, but also influences the equilibrium level of public good. On the other hand, by deciding not to lobby he 'enables' the other individual to distort

[25] With a strictly concave sub-utility function $v(G)$, we have $v(G_{LN}) > v(G^\circ) > v(G_{NL})$. Then, even though the welfare for both individuals is higher when more of public good is provided, given that the cost of public good provision is shared equally, with $\eta < 1$ the surplus from consuming the public good, defined as $\eta v(G) - \frac{cG}{2}$, is always lower for individual 2 than 1 for any $G \in \mathcal{R}^+$.

the equilibrium public good provision and its cost of financing away from his most preferred level. It is then reasonable to expect that both individuals might choose to lobby simultaneously, although that may occur only under specific conditions. The equilibrium of the two lobbyists sub-game is characterized next and the subsequent section derives conditions under which it is realized.

2.3.3 Two Lobbyists

The situation when both individuals are lobbyists and non-cooperatively and simultaneously offer the policymaker contributions in exchange for chosen policy, takes the form of a common-agency game. The equilibrium of this game is defined.

Definition 1. The political equilibrium of the common-agency game with two lobbyists is a SPNE in the vector of political contribution schedules $\mathbf{P}^*(G) = \{P_i^*(G)\}_{i=1,2}$ and the public good level G^*.

I restrict each lobbyist's contribution strategy to the set of non-negative and differentiable political contribution schedules, i.e. $\mathbf{P}^*(G) \geqslant 0$, $\forall G \in \mathcal{R}^+$. These are always accepted by the policymaker in the equilibrium. Even with that restriction, however, each lobbyist has considerable latitude in designing an optimal contribution schedule, and many different schedules can induce different equilibrium levels of public good, both efficient and inefficient ones. Therefore, the solution to the common-agency game may have multiple SPNE, which means that the lobbyists' net-payoffs would not be uniquely determined. I show that is not the case in this model.

Following the common-agency literature I focus on the *Truthful Nash Equilibrium* (TNE), in which every lobbyist offers the policymaker a truthful contribution schedule. Formally,

Definition 2. A truthful contribution schedule offered by a lobbyist i is

$$P_i^T(G, b_i) = \max[0, U^i(G; y^i, \eta^i, s) - b_i], \quad \text{for } i = 1, 2, \tag{2.14}$$

where b_i is the welfare anchor chosen optimally in equilibrium.[26]

The contribution is reduced by a constant b_i since it is reasonable, at least at the outset, that a lobbyist would not transfer his entire payoff to the policymaker. This way each lobbyist retains some of the gains from lobbying, without breaking the truthfulness condition.[27]

Let G_{LL} be the policymaker's equilibrium choice of public good when both individuals are simultaneously lobbying. Proposition 2.3.1, an application of proposition 3 from Dixit et al. [1997], provides a specific characterization of the equilibrium with truthful political contribution schedules.

Proposition 2.3.1. *If* $\left[G_{LL}, \{P_i^T(G_{LL}, b_i^\circ)\}_{i=1,2}\right]$ *is a truthful equilibrium of the common agency game with complete information, in which* b_i° *is the equilibrium lobbying payoff, then* $\left[G_{LL}, \{b_i^\circ\}_{i=1,2}\right]$ *are characterized by:*

(a) Policymaker's optimization decision

$$G_{LL} = \arg\max_{G \geqslant 0} \left\{ \lambda \mathcal{W}(G) + (1-\lambda) \sum_{i=1}^{2} P_i^T(G, b_i) \right\}. \tag{2.15}$$

(b) Policymaker's binding participation constraint, for $i = 1, 2$

$$U^0\left[G_{LL}, P_{-i}^T(G_{LL}, b_{-i}), P_i^T(G_{LL}, b_i)\right] = U^0\left[G_{-i}, P_{-i}^T(G_{-i}, b_{-i})\right]. \tag{2.16}$$

The formal proof of proposition 2.3.1 is in Dixit et al. [1999]. Specifically, condition (a) is part of the standard definition of an SPNE for a two-stage common-agency

[26] These are *globally* truthful contribution schedules. Notice that the shape of the truthful schedule exactly follows the shape of the lobbyist's utility function and so it exactly reflects his marginal valuation of the public good provided.

[27] Bernheim and Whinston [1986b] and Dixit et al. [1999] prove that a truthful contribution schedule is part of each principal's best-response set to his opponent's strategies and therefore does not involve any cost in playing that strategy. More about the role anchor b_i plays is discussed in Grossman and Helpman [1994] part IV. See also Dixit et al. [1997] for a discussion of and justification for using truthful contribution schedules.

game. The additional stage I introduce does not alter this definition. Condition (b) says that the policymaker's payoff in equilibrium with two lobbyists is the same as the payoff she receives when one lobbyist deviates and offers nothing. In response the policymaker contracts with the remaining lobbyist and chooses G_{-i} as the alternative level of public good provided formally defined as:[28]

Definition 3. The policymaker's most preferred level of public good after she 'refuses' principal i's contribution offer and contracts only with the remaining principal, who maintains his truthful contribution schedule, is defined as

$$G_{-i} = \arg\max_{G \geqslant 0} \Big\{ \lambda \mathcal{W}(G) + (1-\lambda) P^T_{-i}(G, b_{-i}) \Big\}. \tag{2.17}$$

For the subsequent analysis it is important to note that G_{-i} is the level of public good that corresponds to eq. (2.7) level for $-i = 1, 2$.[29] For the reminder of the paper $G_{-i} = G_l$, for $-i = 1, 2$ and $l = LN, NL$ respectively. Using eqs. (2.15) to (2.17) we obtain the common-agency equilibrium level of public good provided and each lobbyists' net-payoff. The following lemma derives the common agency equilibrium level of public good G_{LL}.

Lemma 2.3.3. *In a common-agency truthful equilibrium G_{LL} is the Pareto efficient level G°.*

[28] An explicit proof of this condition is the proof of Corollary 1 in Dixit et al. [1999].

[29] We can show that by substituting $P^T_{-i}(G, b_{-i})$ in eq. (2.17) with eq. (3.6) and by simplifying

$$G_{-i} = \arg\max_{G \in \mathcal{G}} \Big\{ \lambda U^i(G) + U^{-i}(G) \Big\} - (1-\lambda) b_{-i}.$$

Notice that the first-order condition for this expression is the same as in eq. (2.11), with higher weight placed on the lobbyist MRS. Note that here $-i$ is the lobbyist with whom the policymaker contracts.

Proof. From the policymaker's optimization decision in Proposition 1, the public good level G_{LL} means that for some other $G \in \mathcal{R}^+$

$$\lambda \sum\nolimits_j U^j(G_{LL}) + (1-\lambda) \sum\nolimits_j P_j^T(G_{LL}) \geqslant \lambda \sum\nolimits_j U^j(G) + (1-\lambda) \sum\nolimits_j P_j^T(G)$$

Using the definition of the truthful contribution function $P_j^T(G, b_j)$ from (3.6) we obtain:

$$\sum\nolimits_j U^j(G_{LL}) \geqslant \sum\nolimits_j U^j(G)$$

Therefore, for $G \in \mathcal{R}^+$

$$G_{LL} = \arg\max_{G \geqslant 0} \Big\{ \sum_{j=1}^{2} U^j(G) \Big\} = G^\circ.$$

Using eq. (2.1) we see that G_{LL} satisfies the Samuelson condition, just as G_{NN} from Lemma 2.3.1

$$(1+\eta) v'(G_{LL}) = c. \tag{2.18}$$

□

When both individuals are lobbying through truthful contribution schedules, the socially optimal provision of public good is the equilibrium outcome. Recall that in section 2.3.1 the policymaker is acting as a completely benevolent planner, providing a socially optimal level G° by maximizing only the sum of utility functions of the two non-lobbying individuals. Therefore, the level of public good provided in the political equilibrium with two lobbyists coincides with the Pareto efficient provision in the equilibrium with no lobbyists. This optimality result of the TNE is not particularly surprising given that it emerges in the Grossman and Helpman [1994] paper, as well as in Persson [1998] who considers the influence of lobbying on the provision of local

public goods. Dixit, Grossman, and Helpman [1997] establish a general result that an equilibrium in which everyone is actively lobbying through truthful contribution functions, the policy implemented will be Pareto efficient one.

However, even though both G_{NN} and G_{LL} correspond to the same Pareto efficient public good outcome, in the latter case, in order to support the political equilibrium outcome LL, the two lobbyists must expend income. Each is required to pay the initial lobbying cost γ^i and offer a positive political contribution $P_i^T(G)$. Therefore, as lobbyists they fare worse than if they coordinated not to lobby. Entering the lobbying competition, however, by either individual neutralizes the other's lobbying influence.[30] In terms of G provided then, two wrongs make a right; lobbying competition corrects the provision of public good to the Pareto efficient level.

Lastly, I derive the lobbyists' equilibrium net-payoffs and show they are unique. According to Dixit, Grossman, and Helpman [1997], *Stage 2* competition in truthful contributions means that lobbyists non-cooperatively choose the welfare anchor b_i. By Definition 2 a lobbyist's payoff is $b_i = U^i(G) - P_i^T(G)$. What influences the lobbyist's choice of b_i? Following the intuition from Grossman and Helpman [1992], each lobbyist wants to make b_i as large as possible, without giving the policymaker a reason to provide an alternative level of public good, different from G_{LL}. Accordingly, every lobbyist has the following problem:

$$\max \; b_i \quad \text{subject to} \quad U^0(G_{LL}, b_i, b^\circ_{-i}) \geqslant \max_{G \geqslant 0} \; U^0(G, b_i, b^\circ_{-i}), \quad \text{for } i = 1, 2. \tag{2.19}$$

The inequality in eq. (2.19) represents the policymaker's participation constraint. The term $U^0(G_{LL}, b_i, b^\circ_{-i})$ on the left-hand side of the constraint represents the policymaker's payoff when the lobbyist i chooses his best-response level b_i, while the other lobbyist sets his equilibrium welfare anchor b°_{-i}. The term $\max_{G \geqslant 0} U^0(G, b^\circ_{-i})$ on the right-hand

[30] For example, depending on the level of parameter η^i, we can think of the demand for a higher level of the public good being matched by an opposing demand for a lower provision and thus the financing cost.

side represents the policymaker's payoff when she sets some level G *other* than the G_{LL}, for the same anchors. Because of the latent threat that the policymaker can refuse the contribution, a lobbyist facing this constraint has to carefully think about the policymaker's response when determining the optimal b_i. If he sets b_i too high, i.e. offers a very small political contribution, he runs the risk that the policymaker will underweight his preferences when deciding on the level of public good to provide. For the policymaker this situation is equivalent to providing an alternative level of public good as if principal i is offering no political contribution, while the other principal $-i$ maintains his truthful contribution schedule with the optimal value b°_{-i}. In other words, the alternative level of public good that results when the policymaker accepts the truthful contribution from one lobbyist and refuses the other's is G_{-i}. It follows then that player i has to set b_i such that through his political contribution he secures the policymaker the payoff equal to her outside opportunity. It would not be optimal for a principal to provide the policymaker with any more. Therefore, for the optimal welfare anchor b°_i the policymaker receives the same payoff for setting the level G° as when setting an alternative level by accepting the truthful contribution from principal $-i$ and refusing i's contribution.

By defining the alternative level as G_{-i} from eq. (2.17), the constraint in eq. (2.19) is just the binding participation constraint already introduced in proposition 2.3.1. It represents the latent threat that the policymaker can provide the alternative G_{-i} by accepting the truthful contribution from one lobbyist and refusing the other's. Then, G_{-i} will be the policymaker's preferred choice for all $b_i \geqslant b^{\circ}_i$. Using eq. (2.16) and the definition of G_{-i} from eq. (2.17), we can derive each player i's equilibrium lobbying payoff b°_i and the subsequent equilibrium net-payoff u^i_{LL}. Lemma 2.3.4 shows this result.

Lemma 2.3.4. *In any Truthful Nash Equilibrium of the common agency game the net-payoff from lobbying is uniquely determined as:*

$$u^i_{LL} = b^\circ_i - \gamma^i = \tfrac{1}{1-\lambda}\Big[\mathcal{W}(G^\circ) - \big(\lambda U^i(G_{-i}) + U^{-i}(G_{-i})\big)\Big] - \gamma^i, \quad \textit{for } i = 1, 2. \tag{2.20}$$

Proof. First we need to establish what the equilibrium lobbying payoff b°_i is. The net-payoff u^i_{LL} follows immediately. From condition (b) in proposition 2.3.1 and the above discussion we know that b°_i, for $i = 1, 2$, is determined such that the policymaker's participation constraint is binding. So,

$$\lambda\mathcal{W}(G_{LL}) + (1-\lambda)\big[P^T_{-i}(G_{LL}, b^\circ_{-i}) + P^T_i(G_{LL}, b^\circ_i)\big] = \max_{G \geqslant 0}\big\{\lambda\mathcal{W}(G) + (1-\lambda)P^T_{-i}(G, b^\circ_{-i})\big\}.$$

The truthful contribution schedules from eq. (3.6) are best-responses to each other and by definition yield lobbying payoffs $(b^\circ_i, b^\circ_{-i})$. From the Lemma 2.3.3 we know that $G_{LL} = G^\circ$. Also, as discussed above, $\max_{G\geqslant 0}$ on the right-hand side yields G_{-i} as defined in eq. (2.17). Then, after simplifying and rearranging, the equilibrium lobbying payoff is

$$b^\circ_i = \tfrac{1}{1-\lambda}\Big[\mathcal{W}(G^\circ) - \big(\lambda U^i(G_{-i}) + U^{-i}(G_{-i})\big)\Big], \quad \text{for } i = 1, 2. \tag{2.21}$$

Finally, by subtracting the fixed cost of lobbying γ^i the net-payoff u^i_{LL} is as in eq. (2.20). □

Lemma 2.3.4 establishes that in a TNE with non-identical preferences the principals' net-payoffs are uniquely determined. Given $\lambda < 1$ the lobbying payoff in eq. (2.21) is positive because

$$\mathcal{W}(G^\circ) \equiv U^i(G^\circ) + U^{-i}(G^\circ) \geqslant U^i(G_{-i}) + U^{-i}(G_{-i}) > \lambda U^i(G_{-i}) + U^{-i}(G_{-i}).$$

Furthermore, with the gross utility function $U^i(G)$ from eq. (2.1) assumed to be strictly concave, the public good levels G° and G_{-i} are uniquely determined. This implies that the lobbying payoff b_i° is unique for $i = 1, 2$. In comparison, the model in Grossman and Helpman [1994] is based on individuals with identical quasi-linear preferences but different endowments, while the insights and results in Dixit et al. [1997]'s paper are based on the general form, non-identical preferences. The results here are in between those two, employing non-identical quasi-linear preferences but equal endowments of the private good, in order to facilitate the uniqueness of payoffs.

2.4 Equilibrium Analysis

Figure 2.1 summarizes the results from Section 2.3. The 2×2 matrix indicates each player's net-payoffs according to the level of public good provided and whether he is a lobbyist or not in one of four possible SPNE. For example, the northeast square represents the SPNE payoffs eqs. (2.12) and (2.13), when player 1 is the only lobbyist. The northwest square represents eq. (2.20) common-agency SPNE net-payoffs. In a

Individual 1 \ Individual 2	L	N
L	$u^2_{LL} = b^\circ_2 - \gamma^2$ $u^1_{LL} = b^\circ_1 - \gamma^1$	$u^2_{LN} = U^2(G_{LN})$ $u^1_{LN} = U^1(G_{LN}) - \gamma^1$
N	$u^2_{NL} = U^2(G_{NL}) - \gamma^2$ $u^1_{NL} = U^1(G_{NL})$	$u^2_{NN} = U^2(G^\circ)$ $u^1_{NN} = U^1(G^\circ)$

Figure 2.1: Payoff Matrix

common agency equilibrium each principal i's political contribution schedule must be a best-response to the equilibrium political contribution function of principal $-i$.

Therefore, $-i$'s choice of the contribution function influences the choice i makes. In other words, for each possible equilibrium there is an element of an arbitrary decision regarding the political contribution schedule by one principal that affects the action of the other. More importantly, given the four sub-game results, the payoff structure in the matrix is unique, which facilitates solving the equilibrium of the game. We want to know if and under what conditions is common agency the equilibrium outcome of this 2×2 game and if it is a unique equilibrium.

I first briefly consider the equilibrium outcome with identical public policy preferences and then move on to a more interesting situation with heterogeneity. When individuals agree on public good provision, the equilibrium outcome in Figure 2.1 collapses into a singleton; (N,N) is the unique equilibrium outcome. Assuming homogeneous public good preferences in this model means that $\eta^i = 1$ in eq. (2.1), for $i = 1, 2$. Then, the first-order condition for both eqs. (2.7) and (2.17) is the Samuelsonian $2v'(G) = c$ and the G_l and G_{-i} correspond to the Pareto efficient level G°. Each principals payoff simply equals gross utility received when not lobbying, i.e., $U^i(G^\circ)$. Therefore, lobbying would not affect the public policy, but would reduce welfare by the cost of lobbying γ^i. It is straightforward to conclude that when there is no conflict of interest, N is a strictly dominant strategy for each player if $\gamma^i > 0$.

2.4.1 Heterogeneous principals

Heterogeneity in public good preferences, meaning $\eta^i \lesseqgtr 1$, is necessary for the equilibrium outcome where at least one individual becomes a lobbyist. I establish the necessary condition for each sub-game case to be realized as the equilibrium in case of heterogeneity.

Lemma 2.4.1 characterizes the specific conditions that must be simultaneously satisfied for each player in order for (N,N) to be the equilibrium of the lobbying game with heterogeneous preferences.

Lemma 2.4.1. *(N,N) is an equilibrium outcome if the following conditions are satisfied:*

$$u^1_{LN} - u^1_{NN} = \tfrac{1}{1-\lambda}[(1+\eta\lambda)v(G_{LN}) - \tfrac{(1+\lambda)c}{2}G_{LN} - \big((1+\eta\lambda)v(G^\circ) - \tfrac{(1+\lambda)c}{2}G^\circ\big)] - \gamma^1 \leqslant 0, \tag{2.22}$$

$$u^2_{NL} - u^2_{NN} = \tfrac{1}{1-\lambda}[(\lambda+\eta)v(G_{NL}) - \tfrac{(1+\lambda)c}{2}G_{NL} - \big((\lambda+\eta)v(G^\circ) - \tfrac{(1+\lambda)c}{2}G^\circ\big)] - \gamma^2 \leqslant 0. \tag{2.23}$$

Proof. These conditions follow directly from Figure 2.1 by a simple comparison of the lobbying (L,N) or (N,L) and non-lobbying (N,N) payoff expressions, and I omit the details. □

In the same manner the conditions for which at least one individual becomes a lobbyist, the case that corresponds to one of the off-diagonal square in Figure 2.1, can be determined. Lemma 2.4.2 gives the sufficient conditions for an individual i to be the only lobbyist in the equilibrium.

Lemma 2.4.2. *The sub-game case with only one lobbyist, either (L,N) or (N,L), is an equilibrium outcome when the following conditions are satisfied:*

$$u^i_l - u^i_{NN} = \tfrac{1}{1-\lambda}\big[(\eta^i + \lambda\eta^{-i})v(G_l) - \tfrac{c(1+\lambda)}{2}G_l - \big((\eta^i + \lambda\eta^{-i})v(G^\circ) - \tfrac{c(1+\lambda)}{2}G^\circ\big)\big] - \gamma^i \geqslant 0 \tag{2.24}$$

$$u^{-i}_{LL} - u^{-i}_l = \tfrac{1}{1-\lambda}\big[(1+\eta)v(G^\circ) - cG^\circ - \big((1+\eta)v(G_l) - cG_l\big)\big] - \gamma^{-i} \leqslant 0, \tag{2.25}$$

for player $i = 1, 2$ and the sub-game case $l = LN, NL$, respectively.

Proof. These conditions follow directly from Figure 2.1 and I omit the details. □

The first condition indicates that player i in the sub-game l is no worse by lobbying and the second one that $-i$ does not benefit from becoming a lobbyist when i is already

lobbying.[31] Observe that the eqs. (2.24) and (2.25), i.e., to enter and to stay out of the lobbying game respectively, depend on the values of four parameters: η, γ, λ c. For a certain combination of those four parameters, we can expect player 1 or player 2 to be the only active lobbyist. The fixed entry cost γ^i plays a clear role; it acts as an entry barrier. For example, in policy terms it could signify a fixed registration fee and/or the cost of compliance with the lobbying disclosure laws, required by national lobbying regulations.[32] Specifically, in eq. (2.25) a high entry cost can reduce individual $-i$'s final payoff from lobbying competition and make it not lucrative to join. Alternatively, we can say that for a sufficiently low γ^i lobbying is a best-response for player i when $-i$ is not lobbying.

To determine when it pays to enter the lobbying competition and when it is better to remain inactive, compare player i's net-payoff when he competes with the other lobbyist, u^i_{LL}, with his net-payoff when he remains inactive while the other player is the only lobbyist, represented by the off-diagonal payoff in Figure 2.1. Lemma 2.4.3 gives the necessary conditions for both individuals to simultaneously lobby in the equilibrium.

Lemma 2.4.3. *(L,L) is an equilibrium outcome if the following conditions are satisfied:*

$$u^1_{LL} - u^1_{NL} = \tfrac{1}{1-\lambda}\big[(1+\eta)v(G^\circ) - cG^\circ - \big((1+\eta)v(G_{NL}) - cG_{NL}\big)\big] - \gamma^1 \geqslant 0, \quad (2.26)$$

$$u^2_{LL} - u^2_{LN} = \tfrac{1}{1-\lambda}\big[(1+\eta)v(G^\circ) - cG^\circ - \big((1+\eta)v(G_{LN}) - cG_{LN}\big)\big] - \gamma^2 \geqslant 0. \quad (2.27)$$

Proof. Although these conditions follow directly from Figure 2.1 it is instructive to show how they are derived. The equilibrium net-payoff u^i_{LL} comes from Lemma 2.3.4, while the equilibrium net-payoff u^i_l is from eq. (2.13). Using the relation $G_{-i} = G_l$

[31] In eq. (2.25) the parameter η does not have the superscripts i or $-i$. It is always the same η regardless of the identity of the non-lobbyist.

[32] In the United States registration of lobbying activity is governed by various laws, such as the *Lobbying Disclosure Act*. In Canada, *The Commissioner of Lobbying* requires registration of lobbyists and enforces compliance with the *Lobbying Act* and the *Lobbyists' Code of Conduct*.

indicated above[33] we have

$$u^i_{LL} - u^i_l = b^\circ_i - u^i(G_l) - \gamma^i = \tfrac{1}{1-\lambda}\left[\mathcal{W}(G^\circ) - \mathcal{W}(G_l)\right] - \gamma^i.$$

□

Given that $\mathcal{W}(G^\circ) > \mathcal{W}(G)$ for any $G \in \mathcal{R}^+$, this difference is positive for a certain γ^i. It follows that when one principal is already lobbying it pays for the other principal to enter the lobbying competition if the entry cost is low enough, resulting in an SPNE with two lobbyists.

We want to know when the equilibrium conditions derived in eqs. (2.22) to (2.27) are satisfied and a specific outcome is realized as a unique equilibrium of the game. In all three lemmas, the preference parameter η^i, the lobbying cost γ^i, and the policymaker's weight on the gross aggregate welfare λ play an essential role in determining which outcome is realized in the equilibrium. The intuition behind how γ^i affects the equilibrium outcome is straightforward; for any given degree of heterogeneity, a low enough fixed cost implies the all-lobbyists equilibrium, while a high enough entry cost can fully eliminate lobbying. The results are more interesting if the two individuals face a different lobbying cost. The expectation then is that only the player facing a relatively lower cost will become a lobbyist. I explore this possibility with a numerical exercise.

Although the initial cost of lobbying plays a necessary role in determining which equilibrium is realized, we are not necessarily looking for γ^i, a "primitive" factor in the model, to be the sole or most significant determining factor of the equilibrium outcome. Rather, given the necessity of preference heterogeneity for the existence of a lobbying equilibrium, it is more interesting to evaluate how the degree of heterogeneity η^i affects the realization of a particular equilibrium and how the *combination* of η^i and

[33] Specifically, see the discussion below Definition 3 in section 2.3.3.

γ^i affects the possibility of one of the four sub-game cases to be the unique equilibrium outcome.

2.5 Numerical Analysis

Given the intractable nature of comparative statics, in order to determine the circumstances under which each of the four possible SPNE is realized as the equilibrium outcome I perform a numerical exercise. To facilitate that, assume the sub-utility in eq. (2.1) takes a logarithmic functional form, $v(G) = \ln(G)$. Also, in accordance with the assumption in the theoretical part, I specify that both individuals have the same fixed endowment of the private good, i.e., $y^1 = y^2 = 100$.

The model has four structural parameters and the values assigned to them are summarized in Table 2.1. The value of λ, the weight the policymaker assigns to gross aggregate welfare, is fixed at 0.5 throughout. Similarly, the value of c, the marginal rate of transformation for the public good, is fixed at 1. Since the primary interest is

Table 2.1: Parameter Values

λ	0.5
c	1
γ	[0,1] by 0.001
η	[0,1] by 0.001

the effect of the lobbying cost and degree of preference heterogeneity on the occurrence of four sub-game equilibra, I vary the γ and η values between $[0, 1]$.

In general, each pair (γ, η) will satisfy one or possibly more of the four SPNE described above. On the one hand, when the cost of lobbying is very low for the two individuals, it pays to become a lobbyist in the presence of heterogeneous public good preferences. Therefore, (L,L) should be the unique equilibrium outcome for small γ and values of $\eta < 1$. On the other hand, for a very high lobbying cost the expectation

is for (N,N) to be the unique equilibrium since engaging in lobbying would be very expensive, regardless of the degree of heterogeneity. Furthermore, if the lobbying cost differs between the two individuals, there is a possibility that only one engages in lobbying, resulting in either (N,L) or (L,N) as the equilibrium outcome.

In order to numerically explore which equilibrium is realized for symmetric or asymmetric lobbying cost, I perform the following exercise. Specify $\gamma^2 = k\gamma^1$, where $k = [0.5, 1, 1.5]$ and evaluate the possible equilibrium outcomes for the three different values of k. When k takes the value of 0.5 or 1.5 we have the situation of asymmetric lobbying cost, while for $k = 1$ the two individuals face a symmetric cost of lobbying.

2.5.1 Symmetric Lobbying Cost ($k = 1$)

Figure 2.2 depicts the equilibrium outcome in this situation. The vertical axis represents preference heterogeneity $\eta = [0, 1]$. At $\eta = 1$, in the top left corner, the two individuals have identical preferences. A decrease in η represents an increase in preference heterogeneity, which is interpreted as an increase in the conflict over the level of public good provided. The horizontal axis represents the initial cost of lobbying $\gamma = [0, 1]$. The shaded regions in the figure represent all the combinations of parameters (γ, η) for which cases (N,N) and (L,L) are realized as the equilibrium of lobbying game. There are five interesting results to observe.

First, with a symmetric lobbying cost, cases (L,L) and (N,N), are the only possible equilibrium outcomes for some values of γ and η. Cases in which only one lobbyist is present, (L,N) and (N,L), are realized only in the situation of identical preferences (top left corner where $\eta = 1$ and $\gamma = 0$). Besides that, they are never realized as an equilibrium outcome with a symmetric lobbying cost. In general, the equilibrium outcome with identical preferences is not of a particular interest in the analysis and I do not elaborate separately on it. Suffice it to say that it is a special case in which any of the four SPNE are a possible realization.

Second, the downward slopping border of the two shaded regions indicates a *positive* relationship between the degree of heterogeneity and the cost of lobbying. The greater the preference heterogeneity, the higher the maximum lobbying cost individuals are willing to pay to become lobbyists. High lobbying cost reflects the high-stakes of joining the lobbying competition if heterogeneity in public good preferences is also high. The intuition is the following. If at high levels of heterogeneity (low η) either individual chooses not to lobby and has no influence on policy, the level of public good provided will be considerably different from his own most preferred level; either at the optimal level provided by the policymaker or at the level induced by the other individual as a single lobbyist. Accordingly, the cost of lobbying that both individuals are willing to incur in order to exert influence is also high and in equilibrium both individuals will choose to lobby. The reverse is true when heterogeneity is low (high η).

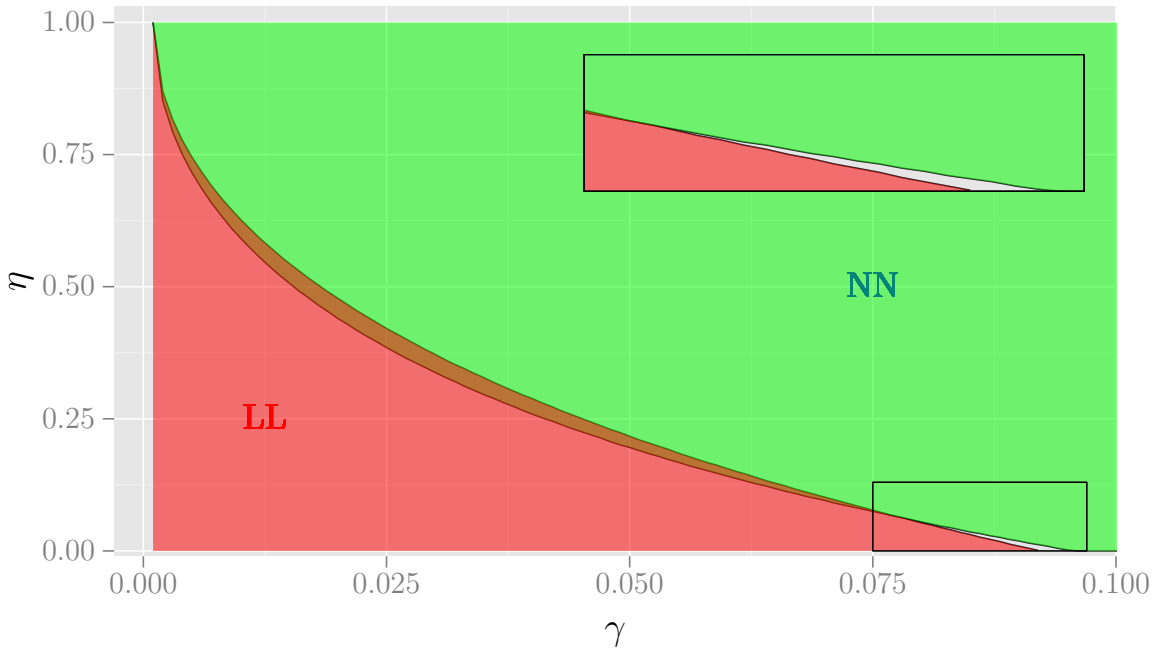

Figure 2.2: The vertical axis indicates the degree of preference heterogeneity η and the horizontal axis the symmetric lobbying cost γ. The two large shaded regions represent all the combinations of γ and η for which cases (L,L) and (N,N) are satisfied. The narrow overlapping area in the middle depicts the possibility of multiple equilibria: some combinations of γ and η satisfy Lemmas 2.4.1 and 2.4.3 conditions simultaneously. Also, the magnified bottom right area depicts that for some combinations of γ and η no pure-strategy equilibria exist.

Since lobbying by either individual does not change the public good considerably away from their most preferred level, the lobbying cost the individuals are willing to pay does not reflect the high-stakes of lobbying. Even a very low γ, the two individuals would opt out of lobbying and (N,N) would be the equilibrium outcome.

Third, observe that there is some overlap between the two areas, indicating the presence of multiple equilibra. The same values of (γ, η) allow for (L,L) and (N,N) cases to be simultaneously realized as the equilibrium outcome. The line indicating the highest combination of γ and η values for which case (L,L) is realized lies above the line indicating the lowest combination for which case (N,N) is realized.

Fourth, this overlap of the (L,L) and (N,N) areas indicates the possibility of coordination failure in the lobbying game. The argument is the following. With a symmetric lobbying cost the result could be a multiple equilibria for some values of γ and η. The two equilibrium outcomes can be Pareto ranked: the (N,N) outcome is always superior to the (L,L) one. When nobody lobbies the level of public good provided is socially efficient. When both individuals lobby, the public good provided is also socially efficient. In order to support (L,L) as the equilibrium, however, lobbyists have to expend resources, which makes them individually worse off. Failure to coordinate to not lobby can lead to a Pareto inferior equilibrium.

Finally, observe that a small section in Figure 2.2, the magnified part in the lower right corner, is left unshaded, indicating that for some pairs of (γ, η) none of the four SPNE is realized. In other words, for some 'elevated' values of the symmetric fixed cost and high degree of heterogeneity no pure-strategy equilibrium exists, although a mixed-strategy equilibrium may exist. I do not explore that possibility here.

2.5.2 Asymmetric Lobbying Cost

With an asymmetric lobbying costs the numerical analysis' results are more straightforward. Figure 2.3 depicts the equilibrium outcomes when $k = 0.5$, indicating that

for any given level of heterogeneity individual 2 faces only half the lobbying cost that individual 1 faces. The shaded regions labeled NN, NL, LL represent the combination of (γ, η) values which satisfy Lemmas 2.4.1 to 2.4.3, respectively.

In a clear contrast to the situation with a symmetric lobbying cost, case (N,L) from Lemma 2.4.2 is now realized as an equilibrium outcome. Case (L,N) is never realized as the equilibrium outcome in this situation.[34] The intuition behind this diagram is the following. First, for any fixed level of preference heterogeneity and a low enough lobbying cost, both individuals act as lobbyists. As the lobbying cost increases, however, individual 1 will be the first to exit the lobbying competition (L,L) since he is facing a higher relative cost and individual 2 remains as the only active lobbyist, resulting in (N,L) to be the unique equilibrium outcome. Eventually, at a high lobbying cost both individuals stop lobbying. As in the case with symmetric costs, the maximum willingness to pay the initial lobbying expense is declining as the degree of preference heterogeneity decreases (as η increases to 1), which is captured by the downward sloping border of the shaded regions in Figure 2.3.

Second, for any fixed but low[35] lobbying cost, as the degree of preference heterogeneity decreases, individual 1 facing a higher initial cost exits the lobbying competition first, even though he has a relatively higher public good valuation compared to individual 2. Therefore, individual 2 remains as the only lobbyist in the (N,L) equilibrium. Eventually, as the preference heterogeneity decreases further he too exits lobbying.

Similarly, Figure 2.4 depicts equilibrium outcomes when $k = 1.5$, indicating that for any given level of heterogeneity individual 2 pays a higher cost of lobbying than individual 1. With such lobbying cost asymmetry, case (L,N) is realized as one of the equilibrium outcomes for some (γ, η) values. Case (N,L) on the other hand is never an equilibrium outcome in this situation. The intuition here is the same as in

[34] Again, the exception is the special-case when $\eta = 1$, meaning both players have identical preferences, and there is no lobbying cost.

[35] Low because notice that γ^1 on the horizontal axis in Figure 2.3 extends only to 0.25, even though in the numerical analysis it was specified $\gamma = [0, 1]$.

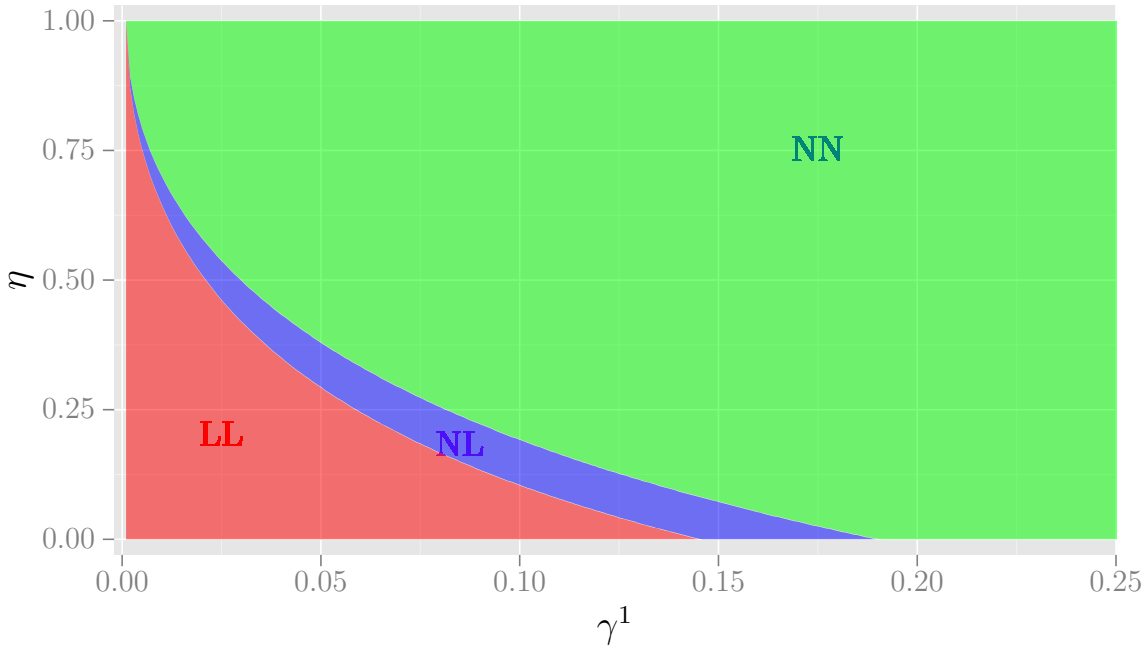

Figure 2.3: The vertical axis indicates the degree of preference heterogeneity η and the horizontal axis the lobbying cost faced by individual 1, γ^1. When $k = 0.5$ individual 2 pays half the cost of lobbying that individual 1 pays. The three large shaded regions represent all the combinations of γ and η for which Lemmas 2.4.1 to 2.4.3 are satisfied and cases (N,N), (N,L) and (L,L) are the equilibrium outcomes.

Figure 2.3; for a fixed η (γ), individual 2 is the first to exit the lobbying competition as the lobbying cost (degree of heterogeneity) increases (decreases). Notice that γ that allows for lobbying to occur in equilibrium is even smaller in Figure 2.4 than Figure 2.3. In other words, in both figures there are big regions of no lobbying for some relatively low and moderate absolute levels of the fixed lobbying cost.

In general, the numerical exercise shows that when $\eta < 1$ and the lobbying cost is asymmetric there exists a range of γ values for which at least one individual will engage in lobbying, so that either (L,N) or (N,L) will be an equilibrium outcome. Public policy is Pareto inefficient when there is only one active lobbyist. With identical preferences ($\eta = 1$) and a lobbying cost ($\gamma > 0$), lobbying is a strictly dominated strategy and the no lobbying case (N,N) is the unique equilibrium outcome.

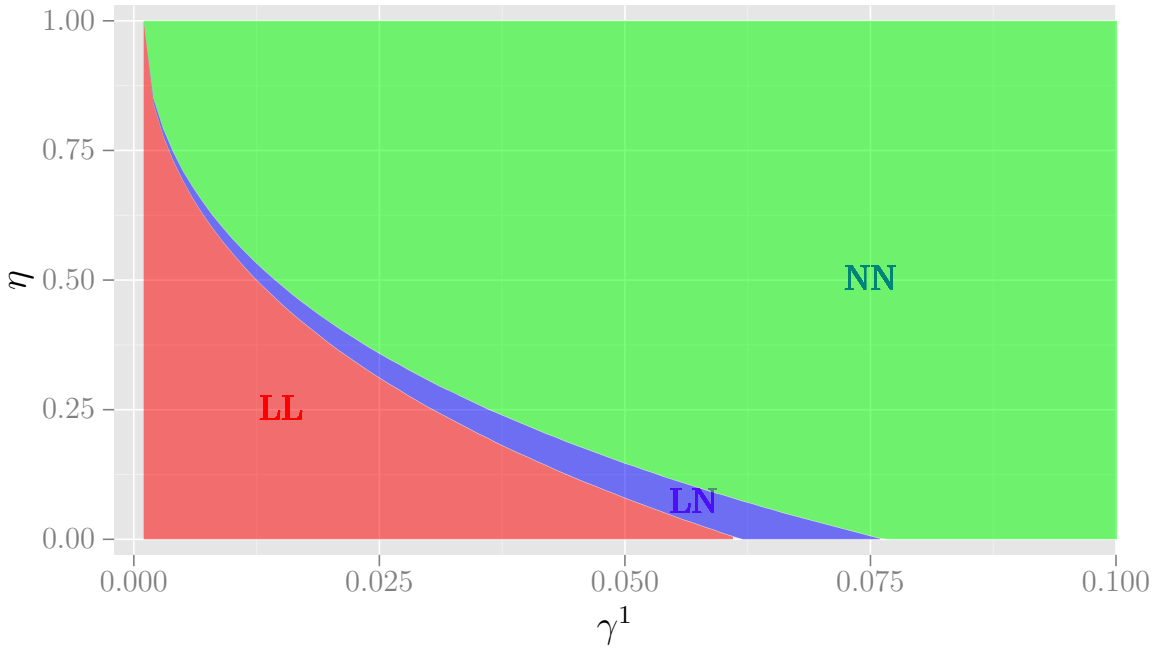

Figure 2.4: The vertical axis indicates the degree of preference heterogeneity η and the horizontal axis the lobbying cost faced by individual 1, γ^1. When $k = 1.5$ individual 2 pays a higher lobbying cost that individual 1. The three large shaded regions represent all the combinations of γ and η for which Lemmas 2.4.1 to 2.4.3 are satisfied and cases (N,N), (L,N) and (L,L) are the equilibrium outcomes.

2.6 Summary and Conclusion

In contrasts to the current literature on lobbying games where the costly decision to become a lobbyist is usually not explicitly considered, I this chapter I ask: Under what circumstances is it justified and necessary to incur the initial cost of lobbying in order to compete with other lobbyists? I provide some insight about this questions by analyzing a three-stage common agency model of lobbying. In the first stage, individuals with heterogeneous preferences for the public good have to decide whether to pay the fixed cost of engaging in lobbying. In the second, each lobbyist designs and offers a binding political contribution schedule to the policymaker. In the last stage, after observing all the contribution schedules offered the policymaker decides on the level of public good that maximizes her payoff - the weighted sum of aggregate welfare and political contributions.

The insights provided through this simple policymaking model and the numerical exercise address the question of when it is justified and necessary to participate in the lobbying competition to influence public policy, given the high upfront cost and unclear positive payoff.

Obviously, a prohibitively high initial lobbying cost can be a reason enough not to engage in lobbying. However, as with most economics considerations, the true cost of lobbying involves the opportunity cost, in addition to the direct organizational cost and the political contributions made. Willingness to pay the potentially high lobbying cost reflects the high-stakes of the lobbying competition; engaging in lobbying is costly, but withdrawing from the lobbying competition is potentially even costlier. In other words, if policy preference heterogeneity is high, paying the high initial cost is necessary in order to check the influence of the other lobbyists and balance the public policy toward the the middle ground. To avoid losing out, the lobbying interests' competitors could be drawn into the lobbying competition to either try and obtain similar protection and favorable consideration from the government (e.g. tax breaks) or to dismantle policies that favor the already established companies or interests, , i.e., preserve the status quo. As observed by *The Economist*: "Lobbying creates its own momentum. A company that sees its competitors doing it will follow suit to avoid losing out."[36]

The realized equilibrium depends on the degree of policy preference heterogeneity, which is an indicator of conflict, and a measure of stakes involved in terms of policy outcomes. With identical preferences, not lobbying is a strictly dominant strategy if there is even a slight initial lobbying cost. The theoretical part demonstrates that preference heterogeneity is necessary for the existence of an equilibrium with at least one individual lobbying. If the upfront lobbying cost is low, it pays to lobby for all. provided.

[36]See *The Economist* 'Special Report: Companies and the State' from Feb. 22, 2014.

Generally, for each pair of lobbying cost and preference heterogeneity values, one or potentially more SPNE will be realized. To provide a more precise exposition of the equilibrium outcomes and investigate possible results with a symmetric and asymmetric lobbying cost under various degrees of heterogeneity, I perform a numerical exercise of the model. The numerical exercise confirms theoretical predictions.

Throughout the numerical exercise I assign equal weight to the policymaker's concern for gross aggregate welfare and political contributions, in order to avoid having an obvious preference for one over the other, but still satisfy the condition that she cares about both. With a symmetric and low lobbying cost, and a sufficiently high level of heterogeneity, it always pays to become a lobbyist and compete for policy influence. At a low level of heterogeneity and a higher lobbying cost, lobbying is not advantageous and the sub-game equilibrium with no lobbyists is realized. Interestingly, for some range of the symmetric, although low, lobbying cost and preference heterogeneity values, multiple equilibria in which all or nobody is lobbying can occur. These equilibria can be Pareto ranked: no lobbying is always a superior outcome and individuals would be better off if they could preemptively commit to not lobby. Given the high-stakes the lobbying decision involves, however, this seems unlikely. Then, for some levels of the lobbying cost, a lower Pareto ranked equilibrium in the form of coordination failure can be realized.

With an asymmetric lobbying cost, the most important result of the numerical exercise is that an SPNE with a single lobbyist is now a possible outcome. Initially, for a low enough lobbying cost both individuals are engaged in lobbying. As the cost increases, however, the individual facing a higher cost will be the first to exit the lobbying competition, leaving the other one as the sole lobbyist. Similarly, when the degree of preference heterogeneity is low, the individual with a lower cost first engages in lobbying, but eventually, as heterogeneity falls further he exits as well. Therefore, the individual facing a higher fixed lobbying cost will have a higher intolerance for

incurring it as heterogeneity decreases. Finally, as Figures 2.3 and 2.4 show, the positive relationship between an individual's maximum willingness to pay for becoming a lobbyist and preference heterogeneity holds with both symmetric and asymmetric costs.

Chapter 3

Lobbying for Minimum Wages

3.1 Introduction

Despite affecting a relatively small proportion of the workforce, minimum wages are found in many countries and their adjustments are always politically contentious. Yet the determinants of minimum wages have received very little attention from economists, with most minimum wage research focused on analyzing its (dis)employment and welfare effects. In theory, these effects vary with the type of labour market in which the minimum wage is introduced. On the one hand, in a simple model of a perfectly competitive labour market and some search models, the minimum wage has negative effects on employment. On the other hand, in a monopsony model, which can also arise in a search framework, a rise in the minimum wage has the potential to increase employment.[1]

In fact, it might not be an exaggeration to point out that no other modern economic policy issue has generated so much research by so many for the benefit of so few, as the minimum wage policy controversy did. As Cahuc and Zylberberg [2004, p.715] point out, the minimum wage is "a constraint of varying strength" across countries,

[1]The cacophony of theoretical results and the potential for such diametrically opposite policy advice is likely the hallmark of policymakers' frustration with "two-handed economists".

but even when the *proportion* of workers paid the minimum wage differs considerably from country to country, the characteristics of those workers are similar. These are mainly workers in low skill industries, with lower educational attainment and youths. Cahuc and Zylberberg [2004] report that 31% of workers under 25 years of age in France are minimum wage employees.

Although minimum wage laws are not a purely economic but a political economy question, in the empirical analysis of these effects, economists take the minimum wage as an *exogenously* determined policy. This is likely because they generally do not advocate introducing price-floors in a market in the first place, and it is not a policy that arises as an economic equilibrium from the workings of a competitive labour market.[2] Rather, as a form of a labour market price-floor, minimum wage is determined in a *political equilibrium* with various normative policy goals.[3] For example, enabling single parent families to lift their households out of poverty, preventing 'unfair' wages, or guaranteeing a nominal income floor in order to compress earnings inequality and alter the distribution of income. Also, to maximize the minimum wage workers' earnings, the minimum wage should be set at the point where labour demand elasticity is unitary.

Consider the following example. Suppose the stated goal of the minimum wage policy is to achieve a certain base level of nominal income. Then, for a minimum wage increase, the earnings of minimum wage workers' will rise only if the labour demand is inelastic. Increasing it any further reduces their total income. Being a political issue, however, the process of setting the minimum wage could be influenced by special interest groups (SIGs) and policymaker's political preferences, with the rate potentially set above or below the optimal one with respect to labour demand

[2]For a good overview of the history of the minimum-wage controversy see Leonard [2000].

[3]This is in the spirit of Besley and Case [2000]'s view that "There is little doubt that policy choice is purposeful action and can rarely be treated as experimental data." See also Zavodny [1998] for an examination of political endogeneity reason why an increase in minimum wage might not lead to adverse employment effects.

elasticity, relative to the influence these groups have in the political process. Sobel [1999] points out that the enactment of the minimum wage legislation in the U.S. was subject to many political pressures. Besides the initial legislative act, "many other endogenous features of the minimum-wage legislation, such as the level of the minimum wage, the effective date of the change, and the number and the timing of the series of steps" are under the pressure of various special interest groups. [Sobel, 1999, p.768]

In this paper I illustrate how minimum wage is determined in a political equilibrium by SIGs directly lobbying the policymaker. I adapt the general common agency lobbying framework from Grossman and Helpman [2001], where principals are interpreted as SIGs - a union representing skilled workers and an association of industry firm owners - who are lobbying the policymaker, their common agent, responsible for setting the minimum wage. In that framework, I introduce the political ideology which distinguishes a more labour friendly policymaker from a business friendly one. I also develop a tractable way of formulating the level of unionization in the labour market. Furthermore, I specify functional forms for the production function and workers' skill distribution. These innovations allow me to derive a closed form solution for the equilibrium minimum wage and novel, testable predictions of minimum wage determination in the presence of lobbying and political ideology.

In the model the policymaker's objective function is a weighted sum of workers' income, business profits and political contributions, which take the form of a payment commitment conditional on the minimum wage imposed. Initially, I show that if the policymaker only cares about the welfare of both workers and business owners she will not introduce a binding minimum wage. Specifically, if the impact of the minimum wage on the weighted sum of workers' income and business profits is always negative, a policymaker has no incentive to introduce a wage floor in the economy,

regardless of her political ideology.[4] However, I also show that lobbying can change this incentive. When the policymaker cares about political contributions, the presence of lobbying can induce her to introduce the minimum wage in spite of the negative effect on aggregate income.

Several past papers analyzed the influence SIGs have on the the minimum wage and labour policies that increase the cost of production. I review most relevant ones for this paper in the next subsection. Even though these papers emphasize the role of SIGs and provide some support for their importance in determining minimum wages, they do not explicitly model the political mechanism by which SIGs exert political influence.[5] This paper's innovation over past literature is the explicit mechanism by which SIGs influence the policymaker's setting of minimum wage setting. Minimum wage derived in the political equilibrium (Section 3.2.3), shows how policymaker's political ideology interacts with economic factors (labour demand elasticity, union density, production technology) in determining the minimum wage in the presence of lobbying by SIGs. This makes it possible to answer questions such as when would a conservative,[6] business-friendly policymaker increase the minimum wage or a labour-friendly refrain from doing so.

First, the model naturally predicts that the policymaker will follow her ideology when setting the minimum wage. This is the case, however, only when labour demand elasticity is large enough. With labour demand elasticity being large, the benefit of lobbying against (for) the minimum wage by firm owners (the union) is greater since a given minimum wage increase has a larger negative (positive) effect on industry profits (unionized workers' income). With stronger negative effect on profits the stakes for lobbying are higher. Lobbying is then successful in inducing the policymaker to set the minimum wage in accordance with her ideological preference for profit relative to

[4] Labor market distortions from a binding minimum wage are independent of the policymaker's ideology, i.e., how labour vs. business friendly she is.

[5] Besides Aidt and Hwang [2008] who take the common agency approach to (international) lobbying.

[6] A "conservative" in the parlance of North American politics.

labour income. Accordingly, a more business (labour) friendly policymaker reduces (increases) the minimum wage in the presence of lobbying because that increases profits (income of unionized labour).

However, I show that lobbying can also *reverse* the ideological preference of the policymaker and induce a business (labour) friendly government to increase (reduce) the minimum wage. When labour demand elasticity is small, firms' lobbying effort against a minimum wage increase will be lower because lobbying is costly while the stakes are not high given that minimum wage has a small 'bite'. Union, on the other hand, always benefits from an increase in minimum wage and even with a business-friendly policymaker, union lobbying effort is relatively more effective. Then, a business-friendly policymaker is less resistant to increasing the minimum wage.

Second, minimum wage increases with the average skill level of unionized workers, i.e., the more representative the union is of high skilled workers. The intuition is that higher skilled union workers' income rises when minimum wage increases because their marginal product rises as low skilled non-union workers become unemployed. This result contrasts with past literature intuition that the minimum wage increases monotonically with union membership and/or union density. Under this hypothesis, a larger union means a politically stronger union which is then able to put more pressure on the government to increase the minimum wage. In this paper, however, a smaller union composed of more high skilled workers induces the government to increase the minimum wage through lobbying and benefits from such a policy by making the unskilled labour more expensive to hire, reducing their employment and in turn raising the marginal product of its members.

Third, minimum wage also increases when industries, possibly the labour intensive ones which are more likely to lobby against a minimum wage, become more productive. When the marginal productivity of labour rises, workers at all skill levels become more

productive and firms can afford to keep lower skilled workers for which the minimum wage was previously binding employed.

3.1.1 Literature Review

Several past studies on the political economy of the minimum wage analyzed the relationship between interest groups and the minimum wage policy.[7]

Cox and Oaxaca [1982, p.533] examine the "common knowledge" that "labour unions promote minimum wage legislation and that some organizations of capitalists and corporate executives impede it." They examine this conjecture closer since higher earning unionized workers are in no need of a higher minimum wage, while (unionized) corporations might not necessarily impede an introduction or increase in the minimum wage if it raises the labour cost of their (non-unionized) competitors. Also, if the intended goal of minimum wage laws is to curb unionization, then unions would clearly be against it while the industry owners might support the legislation as a relatively less costly labour option than organized labour. They try to answer two questions. First, what is the economic interest behind the involvement of high earning union workers and industry organizations in trying to affect the minimum wage? Second, do these interest groups actually have a "significant" effect on the minimum wage policy?

To answer the first question, they develop a model with two production sectors. One is unionized and employs skilled labour and capital, the second is non-unionized and employs both unskilled and skilled labour and capital as inputs. Unionized skilled workers enjoy a premium on their wage rate, w_u, over the wage rate of the non-unionized skilled labour, w_1^o.

[7] There are other papers on the political economy of minimum wage legislation that focus on legislators' voting behavior and election concerns, centered on the US. See Bloch [1993], Cox and Oaxaca [1982], Waltman and Pittman [2002] and references therein for some of these papers. Also, Epstein and Nitzan [1999] is another type of political-economic theory approach to minimum wage determination.

Suppose that the minimum wage increases the wage rate of unskilled labour relative to the rental rate of capital.[8] They prove that the minimum wage increases the wage of the unionized skilled workers, w_u, as well [9] and in turn it also increases the wage of the non-unionized skilled workers, w_1^o. By imposing a minimum wage on the non-unionized industry, which employs low earning unskilled and high earning skilled workers and produces a gross substitute product to the one from the high wage unionized industry, the labour costs of the low wage non-union firms are higher and subsequently the price of their product is higher. Also, if the unionized industry is more intensive in skilled labour than capital relative to the non-unionized industry, imposing the minimum wage will decrease the rental rate of capital r and "the union wage rate will increase relative to the rental rate of capital and the price of the product of union labour." [Cox and Oaxaca, 1982, p.552] The minimum wage decreases the rental rate of capital in all situation. Therefore, a minimum wage imposed on the non-unionized industry, which increases the wage rate of unskilled labour, can increase the wage rate of both union and non-union skilled workers. This will induce a substitution of the union product for the non-union product, increasing the demand for skilled union labour and thereby union employment. These are the channels though which the minimum wage legislation will be promoted by the unions and opposed by corporate executives.

To answer the second question, they postulate that the only way unions and corporations can affect the level of the minimum wage is by influencing the legislator. Cox and Oaxaca do not model the process of influencing the legislator, but simply assume that the legislator in a U.S. state is a self-interested individual who selects among alternative nominal minimum wage rates based on the impact this choice will have on his utility from holding public office. They estimate a "median legislator" utility maximization model of the relationship between the legislator's state minimum

[8] In their setup this means that $\frac{w_m}{r} > \frac{w_2^o}{r}$ where w_2^o is the equilibrium wage of the unskilled labour in the absence of the minimum wage.

[9] Precisely, it increases the $\frac{w_u}{r}$ ratio.

wage, measures of the relative strengths of organized labour and capital, and average hourly earnings in legislator's state.

Estimating the differential in minimum wages attributed to the presence of unions and organized 'capitalists' they show that the minimum wage enacted in a given U.S. state in 1975 would be 62% higher than in the absence of unions and 25% lower than in the absence of capital income earners. Also, evaluating whether a state would have enacted a minimum wage in the first place, they show that for a state in 1974, there was a 30% higher (5% lower) probability to establish a minimum wage in 1975 than would have been without unions (capital earners).

Adam and Moutos [2006] construct a model in which they relate the level of minimum wage and income inequality. Instead of evaluating the minimum wage as the outcome of special interest politics, however, their politically determined value of the minimum wage depends on the median voter's preferences for redistribution. With an increase in inequality the median voter wants more redistribution in the form of a higher minimum wage. Their equilibrium result, however, shows that an increase (fall) in inequality can actually lead to a lower (higher) minimum wage.[10]

Adam and Moutos [2011] examine a political economy mechanism of policymakers' unwillingness to implement a system of employment or wage subsidies in the place of minimum wage. Initially, minimum wages are *endogenously* determined through majority voting, so as to provide the highest utility possible to the median voter while increasing the income of workers who remain employed. Voters then have a policy choice to implement a wage subsidy instead of the minimum wage "such that even though the wage rate that producers pay drops to its full employment level the workers gross take-home wage remains at the level of the minimum wage." [ibid, p.172]. This

[10] These results are based on "extensive experimentation with empirically relevant parameter values," since the comparative statics results of a change in income inequality are ambiguous. [Adam and Moutos, 2006, p.174] The take away point is that these effects could be important for interpreting empirical research since they indicate that, even if a higher minimum wage can reduce employment, the data may show a positive relationship between minimum wage and employment if the minimum wage is changed as a result of political economy considerations.

switch from the minimum wage to a subsidy scheme, however, is not always politically viable. The results depend on the presence of a profit tax and the size of the labour demand elasticity. If the costs of the wage subsidy are borne only by the workers through the income tax, the median voter will not be in favor of the switch. If the costs of the switch are borne by the firms that benefit from scrapping the minimum wage, the policy will be supported in a political equilibrium. Similar to these two papers, in the political-economic equilibrium of Bacache-Beauvallet and Lehmann [2008] high skilled workers may favor second-best, inefficient income redistribution through minimum wage that results in unemployment over a preferred way through a negative income tax that results in no unemployment.

Saint-Paul [2000] shows how the minimum wage can be a tool for the employed insiders of one group in the society to exclude the low skilled workers in the same group from the labour market and employment. By lowering their job prospects, an increase in the minimum wage reduces the supply of substitute lower skilled workers and increases the demand and wages of the politically powerful higher skilled insiders. However, he does not explicitly model the political mechanism by which different groups of workers in the economy interact or from what they derive their political influence. Members of the more powerful group are simply able to impose the minimum wage to increase their rent in the labour market without lowering their employability.

Similarly, Saint-Paul [1998], although not dealing with the minimum wage directly, develops a framework to assess the political support for active labour market policies. In a democracy, labour market policies are designed according to the preferences of the majority, but they are also under the influence of powerful interest groups.[11] He frames the theory in terms of interest groups' influence on policymaking; employed "insiders" who have policy decision power and the long-term unemployed "outsiders".

[11] I believe Saint-Paul [1998] avoids an explicit discussion of minimum wage as a labour market policy in order to avoid some ambiguous implications of its effects on the search intensity and unemployment levels of the long-term unemployed.

To the extent that minimum wage legislation is a policy directed toward the most disadvantaged groups, who are not politically powerful, Saint-Paul [1998] asks under what circumstances will insiders politically support such policies? Clearly, employed insiders who determine labour market policies will be politically opposed to them if they negatively impact their welfare. For example, through the *insider effect*, the unemployed can negatively affect wage formation by underbidding the employed during the job search. If the minimum wage is introduced and set at a higher level, however, it might lower the possibility for the unemployed to underbid the employed. In addition, in the case that the minimum wage exacerbates unemployment of outsiders, it lowers the exposure of the employed to the increased competition from outsiders.[12] In this case, even though the employed lend support to a labour market policy, the minimum wage policy is a type of a suboptimal program that insiders support only to prevent the outsiders from underbidding them, shelter themselves from the increased competition and "keep the outsiders 'quiet'." [Saint-Paul, 1998, p.153] In general, employed insiders are more likely to support active labour market policies when the labour demand elasticity is higher and they are more exposed to the possibility of unemployment. When these conditions do not hold (say, relative to some other country's labour market) political support for socially inefficient labour market policies is more likely. Even here we can see the possibility of explaining the cross-country variation in minimum wage policies.

In probably the most prominent study of the political economy of minimum wages, Sobel [1999] examines whether the U.S. Congress has been setting the minimum wage according to a normative policy goal - 'poverty threshold' or a 'nominal income' target - or whether its level was determined by SIGs' pressure. Accordingly, he estimates the minimum wage levels that would, with purely economic considerations, have to be

[12] A higher minimum wage, however, might also increase the search intensity of the long-term employed. This can potentially have a favorable effect on their employment level by *increasing* the competition for jobs in the labour market, which is an important mechanism for lowering unemployment.

implemented to achieve either the poverty threshold level or maximize the nominal income of minimum wage workers. Estimating the minimum wage level to achieve a "poverty threshold target" for various different family sizes and working hours is fairly straightforward. Sobel obtains two minimum wage rates: a high \$6.03 and a low \$5.17, for the high and low 'poverty threshold targets' respectively.[13]

Furthermore, he points out that in the short run, increasing the minimum wage can increase workers earnings *beyond* the equilibrium point based on the long-run labour demand elasticity.[14] Politicians thus have an incentive to exploit the short-run earnings curve and time minimum wage changes to pre-election periods, irrespective of their ideology.[15]

To estimate the minimum wage needed to achieve a 'nominal income target' Sobel estimates the relationship between the minimum wage and total income. Insight about the politics of minimum wage legislation emerges from this model. Namely, in order to maximize workers' nominal income in the long run, policymakers should increase the minimum wage up to the point where the long run labour demand has unitary elasticity. However, the short-run 'political effects' of the minimum wage on total income can be different from the ultimately more important long-run effects. This reveals the policymakers' incentives for setting the minimum wage in a shortsighted political process. As Sobel puts it even, "if Congress were pursuing the nominal income target, a shortsightedness effect could lead it to adopt a minimum wage at the [short-run] level rather than at the level best from the long-run perspective." [Sobel, 1999, p.766]

[13]Unlike the minimum wage rate, poverty level in the U.S. is adjusted for inflation and therefore since 1959 the real poverty threshold has been constant.

[14]However, when the labour market adjusts and the short-run relationship between the minimum wage and total earnings shifts back to its long-run equilibrium, the resulting workers' total income will be lower than the initial long-run equilibrium.

[15]Sobel [1999] notes that even the Fair Labor Standards Act became effective only 8 days before the 1938 U.S. election.

The minimum wage that maximizes long-run nominal income target is around $5.36, while the minimum wage set in a shortsighted political equilibrium is estimated at $8.49. [16] This suggests that wages set above $5.36 would reduce the long-run earnings of minimum wage workers. The estimate of $5.36 is between the low and high poverty threshold estimates reported above.

Have the actual minimum wages been consistent with these three estimated minimum wage targets? Sobel rejects the "hypothesis that the minimum wage has been entirely determined by the stated goals of policy." [Sobel, 1999, p.779] In fact, based on these estimates of minimum wage targets, he indicates that for more than half of its history the actual minimum wage in the U.S. has been below the $5.17 lower poverty threshold and about a quarter of the time above the higher $6.03 level.

Can the historical path of the minimum wage in the U.S. be explained by interest group pressures and historic variation in their political strengths? In concordance with previous studies, Sobel considers organized labour unions and business interests as the two groups with an immediate interest in the minimum wage issue. He approximates their political strength by union membership and the corporate income tax, respectively. By simply plotting measures together with the real minimum wage the positive relation between them is clearly visible. When the minimum wage was introduced union membership was rising and so was the corporate income tax. Real minimum wage achieved its peak in the U.S. in late 1960s and its decline since then is associated with the decline in union membership and the corporate income tax rate in the 1980s. Sobel concludes that "a relative measure of the political power of interest groups on the minimum wage issue appears to be highly correlated with the overall trends in the minimum wage, whereas the stated goal levels are not." [Sobel, 1999, p.781]

[16] See Tables 1 and 2 in [Sobel, 1999, p.771-772] for these results and estimated confidence intervals. Sobel checks the robustness of these nominal income target minimum wage estimates using different data and also confirms that his estimates of short and long-run labour demand elasticities are consistent with those from other studies.

3.1.2 Three Canadian Studies

Unlike the United States where the minimum wage is legislated at the federal level, in Canada the minimum wage is under the provincial jurisdiction. This allows for a panel data analysis, relaying on more minimum wage heterogeneity across time and jurisdictions, usually unavailable for other countries. This makes the Canadian policy environment better suited for studying the determinants of minimum wages and the level and timing of their changes across jurisdictions since Canadian Three studies examining minimum wage determination across Canadian provinces are relevant to this paper.

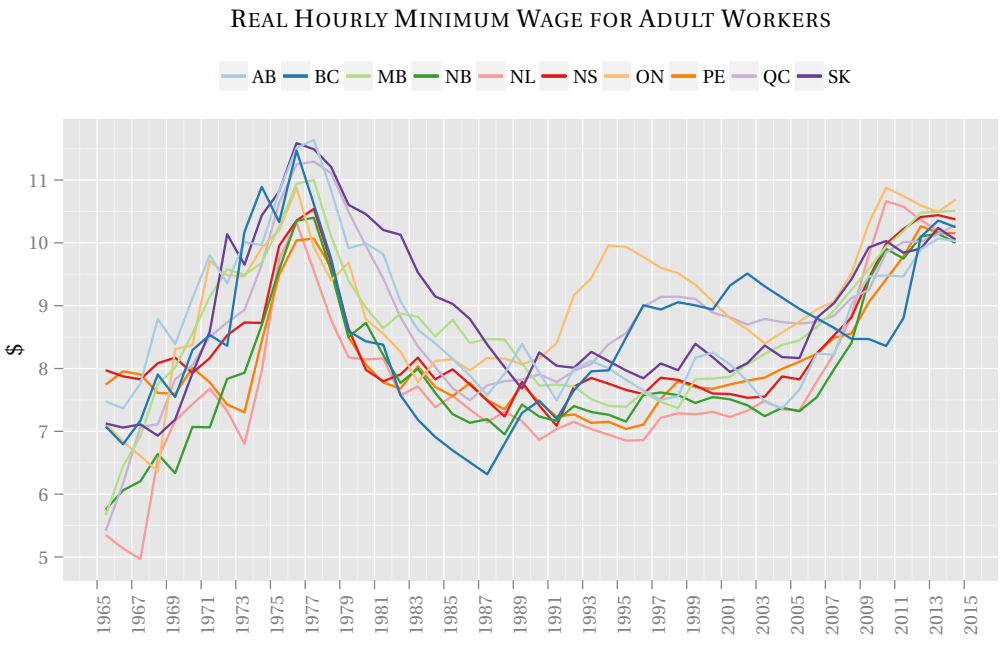

Figure 3.1: Real minimum wages across Canadian provinces, 1965-2013. Real minimum wages are expressed in 2013 constant dollars. Data: Labour Program Canada, Minimum Wage Database.

In an empirical study Blais et al. [1989] estimated the responsiveness of provincial governments to political pressure groups in raising the minimum wage during the 1975-1982 period. They focus on the political market explanation - the winners are more numerous than the losers - and consider the relative importance of unions, small

businesses, youths and women as SIGs. Under the conjecture that low wage workers are a substitute for high wage ones, high earning union members will benefit from a higher minimum wage. Without a formal theoretical model, they hypothesize that if union members benefit from a higher minimum wage, and assuming they are politically more powerful than the groups who are negatively affected by it (small businesses, women and youths), minimum wage will be increased.

The unionization effect, however, should be adjusted for the skill level; the average skill level of unions changed over time, which Blais et al. [1989] do not consider. Their conclusion is that "two weakly organized groups, women and the youth, seem to have a greater impact on the level of the minimum wage than the strongly organized ones, unions and small businesses." [ibid, p.19]

Dickson and Myatt [2002] study Canadian minimum wages variation over the 1977-1996 period. They too consider the relative strength of interest groups (unions, youths, big and small businesses), but they also examine the influence of political ideology, controling for unemployment rate, unemployment insurance, election timing and inflation. I also employ thee variables in my empirical analysis. Their results differ somewhat from Blais et al. [1989]. The unionization rate has a positive coefficient, although not very significant, while the strongest result comes from provincial political ideology variables; as expected minimum wages are higher under left-wing governments. Other interest groups' effects are significant, but in the "wrong" direction: youths and women have a negative coefficient. Both unemployment rate and insurance have a negative influence on the minimum wage determination. Overall, however, these results are difficult to interpret. In influencing an economic policy it is the relative power of SIGs rather than absolute that matters. Neither of the two papers, however, make that distinction clear.

Finally, Green and Harrison [2010], and more recently Green [2014], contend that the political economy of minimum wages in Canada can best be explained in

terms of voters' ideas of fairness. Unlike the previous studies which examined the models of competing interests groups, or a type of constrained altruism model where the minimum wage is used as redistributive tool to lift low earners out of poverty, Green and Harrison [2010] propose a model in which "minimum wages are set to outlaw labour market transactions with wages that are deemed to be unfairly low." [p.3] Voters are guided by the income distribution to determine the fair value of the minimum wage.[17] Specific to their study is that the interest group model emerges as a special case, allowing for an empirical test and comparison between three models: competing SIGs, constrained altruism, and fairness. Models are evaluated on ten Canadian provinces over the 1969-2005 period.

The data does not confirm either interest group or altruism model on their own, and seems to fit the best with the fairness model. Their empirical investigation results do not reject the 'fairness model' in which the voters try to ban unfairly low wages; minimum wage is a function of both the median unskilled wage, used as a proxy for the comparison market wage, and minimum wages in other provinces. A notable addition to their paper is the *qualitative* evidence they present about minimum wage setting, gathered thought interviews with provincial Ministers. A conclusion reached from these interviews is that labour mobility is not an important decision factor. As one Minster put it: "Minimum wage jobs are not mobile." [Green and Harrison, 2010, p.8] However, inter-provincial comparisons are important in minimum wage setting. I check for this in my own estimation.

Unlike the U.S. studies which analyzed cross-sectional data, Canadian focused studies exploit provincial minimum wage variation and estimate the determinants with panel data regressions. However, besides Green and Harrison [2010] who try to account

[17] Their basic goal is to explain the forces that lie behind four main patterns of Canadian minimum wages, some of which can be observed from Figure 3.1: (1) general rise in the minimum wage; (2) regional co-movement of minimum wages; (3) the highest minimum wages are correlated with the rule of left-wing parties; (4) the convergence of minimum wages between highest and lowest minimum wage provinces.

for SIGs in their theory, there is a lack of theoretical foundation in Canadian literature for SIGs influence on minimum wages. In this paper I provide both a theoretical basis for SIGs and ideological influence on minimum wages and empirically evaluate the predictions on a panel data of Canadian provinces.

Lobbying over minimum wage is very prominent across Canadian provinces. Although direct monetary contributions cannot be observed,[18] student and labour unions frequently expend a significant amount of time and resources to lobby provincial governments for minimum wage increases. Likewise, employers' associations such as food, restaurant and independent businesses lobby to try to stop the minimum wage from increasing whenever the prospect was introduced.

Furthermore, as indicated by Baker et al. [1999], the Canadian setting has unique advantages for studying minimum wages. Being determined provincially, minimum wages in Canada exhibit substantial heterogeneity in the level and frequency of changes over the 1965-2013 period, shown in Figure 3.1, for which I test the theoretical predictions of the model. Panel regressions of the most preferred specification accounting for province and time fixed effects give considerable support to these predictions. The significance and the sign on variables of interest are in line with the theory.

The rest of the chaper proceeds in the following way. Section 3.2 presents the theoretical model and derives its predictions. Section 3.3 empirically evaluates these predictions and section 3.4 summarizes and concludes.

[18]For example, unions in Canada, as SIGs with considerable lobbying resources, are not required to track and disclose their spending on political activities, social causes and various other transactions, such as salaries over $100,000 or contracts with private companies, to the Canada Revenue Agency which would make it publicly available. This is in contrast to United States and United Kingdom rules.

3.2 Theory of Lobbying Influence on Minimum Wage Determination

In a general common agency lobbying model, principals as SIGs compete for influence over a single policymaker, their common agent, who sets the level of the minimum wage. Principals have an incentive to design and offer political contribution schedules (e.g., campaign contributions) to induce the agent to take their interest into account and thereby influence her policy choice.[19]

3.2.1 The Economy

Following the basic setup of Grossman and Helpman [2001], a small open economy consists of two competitive industries, for example textiles and pharmaceuticals, denoted by T and P, respectively. We can think of one industry, say T, as being more labour intensive.[20] N workers in the labour force have different skill levels. Their ability determines the amount of 'effective labour' supplied; a worker with the skill level a supplies a times 'effective labour'. I assume that workers' skills are distributed according to the Pareto distribution over a support interval $a \in [1, \infty]$. The lowest skill level 1 is associated with the unskilled or 'raw' labour. Let $\Phi(a)$ be the fraction of workers with ability less than or equal to a and $N\Phi'(a)$ the total number of workers

[19] Formal models of common agency were initially developed by Bernheim and Whinston [1986a,b] and most notably applied by Grossman and Helpman [1994] and Dixit et al. [1997]. Other applications of common agency to endogenous policy formation include: commodity taxation (Dixit [1996]), environmental policy (Aidt [1998]), local public goods (Persson [1998]), fiscal federalism (Bordignon et al. [2008], Esteller-Moré et al. [2012]), and capital levy problem (Marceau and Smart [2003]). Previously, Rama and Tabellini [1998] used the common agency approach in the minimum wage context, although they analyzed different issues of jointly determining trade and labour market policies. See Martimort [2006] for a more extensive overview of theory and literature on common agency as a form of multi-contracting mechanism design.

[20] Names play no real role. What matters is distinguishing politically organized industry that is actively lobbying as a SIG from the one that is not. In that sense, the number of industries does not matter either. Having 'only' 2 industries in the economy serves a purpose of simplifying the analytical part and clearly distinguishing members of organized interests.

with the skill level a. The Pareto skill CDF and PDF are,

$$\Phi(a) = 1 - \left(\frac{1}{a}\right)^z \quad \text{and} \quad \Phi'(a) = \frac{z}{a^{1+z}}, \quad \text{for } a \geqslant 1,$$

respectively, where $z > 1$ is the shape parameter governing the skill level distribution. Dispersion increases monotonically as z decreases. Higher z means less fat upper tail and the proportion of workers with high skills is lower. The lower (higher) the z the heavier (less heavy) the upper tail of the distribution and the proportion of high-skilled workers is greater (lower).

Workers are perfectly substitutable after adjusting for their skill level. If $e_i(a)$ is the number of employed workers of ability a by industry i, then amount of effective labour employed by i is[21]

$$E_i = \int_1^\infty a e_i(a) \mathrm{d}a, \quad \text{for } i = T, P.$$

Each industry cares about effective labour employed and uses capital and sector-specific technologies, A_T and A_P, in production. Accordingly, I set up industries' constant returns to scale production functions as follows:

$$F(E_i) = A_i^{1-\alpha} E_i^\alpha, \quad \alpha < 1, \quad \text{for } i = T, P. \tag{3.1}$$

Capital used in production is in fixed supply, normalized to 1 and it is assumed that industry P is more capital intensive, so $A_P > A_T$.[22] Each produced good is traded on a world market and its price is taken as given. [23] For future reference, given the

[21] We can imagine that instead of employment, the 'raw' labour input of firms is hours of work. Multiplying by the ability a would still give the aggregate efficiency units of labour hired E_i.

[22] We can always reparametrize a Cobb-Douglas production function to redefine technological parameter as Hicks neutral by defining $\tilde{A}_i = A_i^{1-\alpha}$, so that $F(E_i) = \tilde{A}_i E_i^\alpha = A_i^{1-\alpha} E_i^\alpha$.

[23] In the Canadian context, a small open economy is a province whose two industries trade on the national and international markets, taking the price as given.

production function, the absolute value of wage elasticity of effective labour demand is

$$\varepsilon = \left| \frac{\partial E}{\partial w_E} \frac{w_E}{E} \right| = \frac{1}{1-\alpha}. \tag{3.2}$$

I formulate unionization as governed by the skill distribution. There is one union in the economy which represents workers at the higher end of the skill distribution. Suppose there is a cutoff skill level, denoted a_U, above which all workers are members of the union.[24] Figure 3.2 depicts the PDF of Pareto distributed skills with the cutoff value for union workers. Then, total units of effective labour among unionized

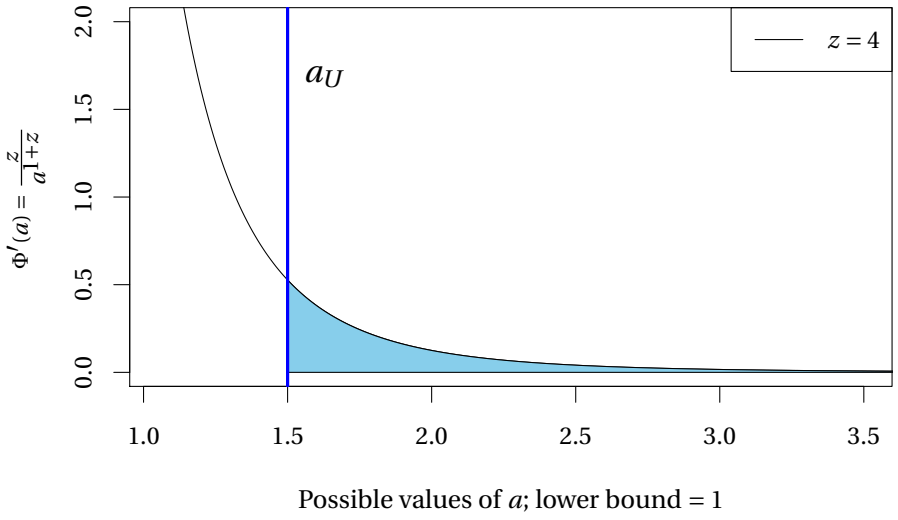

Figure 3.2: Skills are Pareto distributed and above the cutoff level a_U (represented by the shaded area) all workers are members of the union. In that way union represents higher skilled workers.

employed workers are

$$E_U = N \int_{a_U}^{\infty} a\Phi'(a)\mathrm{d}a = \frac{Nz}{z-1} a_U^{1-z}. \tag{3.3}$$

[24] This is done for simplicity and to facilitate a connection between theoretical implications and empirical analysis. I discuss this more in sections 3.2.3 and 3.3. Same intuition can be obtained following Grossman and Helpman [2001] general approach, defining a continuous function $\phi(a) = \frac{\theta \Phi_U(a)}{\Phi(a)}$, where θ is the fraction of workers represented by the union and making sure $\phi'(a) > 0$.

This formulation might appear somewhat counterintuitive but, given that the union is a politically organized SIG, the point is that political representation of labour is skewed toward higher skilled workers. Besides, even though unionization rates[25] vary across occupations and job characteristics, it is an empirical regularity that workers with higher educational attainment and those employed in higher skilled industries are associated with higher unionization rates.[26]

3.2.2 Political Equilibrium

Suppose that two SIGs compete for influence: (1) the association of capital owners in industry T and (2) the union of workers with abilities skewed toward the high end.[27] The lobbying game has three stages. In the first stage, each SIG offers the policymaker an optimal, non-negative political contribution schedule. In the second stage, the policymaker observes all contributions received and sets the minimum wage level that maximizes her objective function. In the third stage, equilibrium in the labour market arises and production takes place. I solve for the equilibrium by backward induction.

Labor Market Equilibrium With a Minimum Wage

Imposing a wage floor affects SIGs' incentives to lobby for or against minimum wage. From the labour market equilibrium we can examine political forces that determine

[25] Technically, a distinction should be made between workers who are *members* of a union and those who are *covered* by a union negotiated contract (collective agreement), but are not members. This distinction might matter empirically based on the type of data available. Sometimes, workers who are covered by a collective agreement, but are not actually members of a union are still considered as unionized.

[26] Although unionization rate differs between industries, it tends to rise with the skill level. As indicated by Pencavel [2014], compared to a private sector one, public sector union will be more representative of higher skilled employees. Higher public sector unionization indicates a growing influence of higher skilled unionized workers. In the private sector, low and unskilled workers are almost never unionized. See Galarneau and Sohn [2013] for the Canadian context.

[27] These are exogenously established organizations and I abstract from the 'collective action problem'. The presence of both types of organizations and their lobbying activities are present in many countries around the world. Although it is assumed that the owners in the other industry and the rest of the workers are unorganized, it is straightforward to introduce them as additional SIGs that also compete for influence over the minimum wage.

the minimum wage w_M, and the incentives to lobby for or against its increase. More detailed derivation and expressions of the labour market equilibrium are provided in Appendix A.1. Here I only show the equilibrium wage for a unit of effective labour is a function of the minimum wage $\hat{w}_E(w_M)$. From the full-employment condition we can obtain

$$\hat{w}_E(w_M) = \alpha^{\frac{1}{z+\alpha-z\alpha}} \left[\frac{Nz}{(z-1)\mathcal{A}}\right]^{\frac{\alpha-1}{z+\alpha-z\alpha}} w_M^{\frac{(1-z)(\alpha-1)}{z+\alpha-z\alpha}}, \tag{3.4}$$

where the shorthand $\mathcal{A} = \left[A_T + A_P\right]$ is used for simplicity throughout the paper. Observe that $\hat{w}_E(w_M)$ is increasing in w_M. Together with the function for the lowest employable skill level $a_M(w_M)$, we have two functions that determine the income levels of all groups in the economy as a function of w_M and thus give a stake to various interest groups to compete for the influence over the minimum wage policy.

Another relevant point is that a binding w_M can be set such that the least employable worker has the skill level greater than the lowest unionized skill, that is $a_M(w_M) > a_U$, illustrated in Figure A.1 in Appendix A.1. Inevitably some unionized workers will loose their employment in that case. Thus, a very high minimum wage can potentially reduce the union's membership as well. Since this would conflict with the union's goal of maximizing its members' income, it is more sensible to look for an interior solution when $a_M(w_M) < a_U$.

Lobbying Contributions and First Order Condition

The government's objective when setting the minimum wage is to maximize the sum of aggregate welfare, $W(w_M)$, and SIGs' political contributions, c_T and c_U for textile association and the union respectively. Thus, the government's objective function takes the linear form $G(w_M) = W(w_M) + \lambda_C(c_T + c_U)$, with λ_C as a fixed positive weight put on total contributions received from the lobbyists. With the minimum

wage in place, I formulate the aggregate welfare in the economy in the following way:

$$W(w_M) = \lambda_L \underbrace{w_E(w_M)E[w_E(w_M)]}_{labour\ income} + \lambda_S \underbrace{\Big[\Pi_T[w_E(w_M)] + \Pi_P[w_E(w_M)]\Big]}_{profits}. \tag{3.5}$$

λ_L (λ_S) is the weight the policymaker assigns to labour income (profits) and assume $\lambda_L + \lambda_S = 1$.[28]

These different weights capture the possibility that policymakers of different political orientations have stronger preference for labour income relative to profit income. A left-wing policymaker could be expected to favor labour income over profits, and opposite for the right-wing one. The weights can be used to control for the type of government in power for a given period of time. The preference for the political contributions, λ_C, does not a priori have to be different between the more labour or business friendly policymakers and it is held constant.[29]

In order to influence the policymaker's decision, both SIGs are simultaneously and independently offering the policymaker a contribution c, a binding payment conditional on the minimum wage level set. Thus, the union and firm association design their contributions as schedules, denoted as $c_U = C_U(w_M)$ and $c_T = C_T(w_M)$,[30] to maximize their members' net-of-contribution labour income and industry profits, respectively. These contribution schedules are non-negative and differentiable when positive. Following the common-agency literature, a schedule that satisfies those properties is a *truthful contribution schedule*, formally defined as

$$C_l(w_M, b_l) = \max[0, W_l(w_M) - b_l], \quad \text{for } l = T, U, \tag{3.6}$$

[28] If all individuals have identical and homothetic preferences, aggregate welfare is proportional to aggregate income in the economy, which is equal to the sum of total labour income and industries' profits.

[29] Although there are no explicit re-election concerns here, we can think of policymaker's ideology (λs) as reflecting her constituents' ideology, as in a principal-agent relationship. Then, the presence of λ_C can be interpreted as coming from the lack of perfect monitoring, reflecting the policymaker's own want or need for re-election campaign funding.

[30] c is the contribution level and $C_i(w)$ is a non-negative, differentiable function.

where b_l is a given welfare anchor, chosen optimally by each lobbying group l.[31] Reducing the contribution by b_l makes sense, since by doing so a SIG retains some of the gains from lobbying, without breaking the truthfulness condition.[32] Also, Bernheim and Whinston [1986b] and Dixit et al. [1999] prove that a truthful contribution schedule is part of each principal's best-response set and therefore does not involve any cost in playing that strategy.[33] The shape of the truthful contribution function matches the shape of the SIG's welfare function and so it exactly reflects the marginal impact of a change in the minimum wage. The change in contribution compensates for the change in the minimum wage so that the welfare of SIG members stays constant. It is basically a costless requirement for the contribution schedule to remain truthful.[34]

Suppose that a binding minimum wage $w_M > \hat{w}_E$ is set, such that $a_M(w_M) < a_U$ as discussed above. Then, the equilibrium minimum wage policy satisfies the necessary first-order condition for maximizing the policymaker's objective function G,[35]

$$W'(w_M) + \lambda_C \big[C'_T(w_M) + C'_U(w_M)\big] = 0. \tag{3.7}$$

First, using the Envelope theorem properties of the profit function

$$W'(w_M) = \big((1-\varepsilon)\lambda_L - \lambda_S\big) w'_E(w_M) E(w_M) \tag{3.8}$$

[31] Although it is implicitly present, for notational simplicity I suppress b_l in the remained of the paper.

[32] A technical assumption is that political contributions are bounded from above by some maximum amount, since it is reasonable to assume that each SIG has a finite total income to contribute.

[33] See also Dixit et al., 1997, p. 759 for a discussion and justification for using truthful contribution schedules.

[34] The 'locally compensating' condition means that near a political equilibrium the SIG's marginal cost of contribution is equal to the marginal benefit it receives; therefore $C'_T(w_M) = W'_T(w_M)$ and $C'_U(w_M) = W'_U(w_M)$, where $C'_l(w_M) = \frac{\partial C_l(w_M)}{\partial w_M}$, for lobbies $l = T, U$.

[35] Throughout the paper, the prime notation $'$ denotes partial, first derivative of $f(x)$, i.e., $f'(x) = \frac{\partial f(x)}{\partial x}$.

where ε is the absolute value of the wage elasticity of effective labour demand, derived in eq. (3.2).[36] Since the labour share parameter $\alpha < 1$ in the production function, we have $\varepsilon \geqslant 1$. Then, from eq. (3.8), when the minimum wage increases, some loss in employment occurs and the value of output declines. Then, at the very least, if the policymaker equally favors wage income and profits in the economy, meaning $\lambda_L = \lambda_S = 0.5$, from eq. (3.8) raising w_M will have a negative effect on aggregate welfare. Regardless of the values λ_L and λ_S, an increase in minimum wage reduces total aggregate income. For larger values of ε the reduction in aggregate income is greater.

This illustrates the importance of active lobbying and preference for political contributions $\lambda_C > 0$. Because the minimum wage reduces aggregate income, the policymaker would never choose to introduce or increase it in the simple equilibrium with no lobbying. This negative aggregate income effect of the minimum wage increase can be offset only with political contributions.

Second, because the contribution schedules are truthful, we can substitute $C'_T(w_M) = W'_T(w_M)$ and $C'_U(w_M) = W'_U(w_M)$ in the policymaker's FOC. For the textile industry, a higher minimum wage increases the cost of effective labour and reduces profits. Then, given that $W_T(w_M) = \Pi_T[w_E(w_M)]$ the marginal contribution is

$$C'_T(w_M) = W'_T(w_M) = \Pi'_T[w_E(w_M)]w'_E(w_M) = -E_T[w_E(w_M)]w'_E(w_M). \tag{3.9}$$

Union members' labour income as a function of the minimum wage is given by $W_U(w_M) = w_E(w_M)E_U$, with E_U as total effective labour of all employed unionized workers. It is worth pointing out that this is an *aggregate* supply of effective unionized labour in the economy, not just in comparison with a particular industry, such as textiles whose owners are acting as a second lobbying SIG. Some of the unionized

[36] A more detailed derivation of this expression is in Appendix A.2.

labour is employed in the pharmaceutical industry, and these may as well be the most skilled workers. For a binding minimum wage such that $a_M(w_M) < a_U$, the supply of effective unionized labour E_U is not a function of w_M and the union's marginal contribution is

$$C'_U(w_M) = W'_U(w_M) = w'_E(w_M)E_U. \tag{3.10}$$

As long as $a_M(w_M) < a_U$, if a minimum wage is increased union members' aggregate income will rise because the decline in total employment increases their marginal product.

Substituting eqs. (3.8) to (3.10) into the policymaker's first-order condition eq. (3.7) that any binding minimum wage has to satisfy and further simplifying, we obtain:

$$\lambda_C\Big[E_U - E_T(w_M)\Big] = \big(\lambda_S - \lambda_L(1-\varepsilon)\big)E(w_M) \tag{3.11}$$

Notice that the incomes of lobbying SIGs, the union's earnings and textile firms' profits, receive a higher weight than the incomes of politically unorganized workers firm owners.[37] Therefore, lobbying SIGs are given more consideration when setting the minimum wage. The left-hand side of eq. (3.11) represents the marginal increase in the joint welfare (income) of the two lobbying SIGs. The first term in the brackets captures the increase in income for unionized workers while the second indicates by how much income drops for capital owners in industry T. The right-hand side shows how much total income declines when w_M is increased. To evaluate political and economic variables that determine w_M I derive an explicit closed-form solution from eq. (3.11). Under what circumstances would w_M be enacted or increased? Equation (3.11) determines the equilibrium minimum wage and allows us to evaluate

[37] Namely, if $G = \lambda_L W_N + \lambda_L W_U + \lambda_S W_T + \lambda_S W_P + \lambda_C[C_T(w_M) + C_U(w_M)]$, where W_N is simply the welfare (income) of the non-unionized workers, the first-order condition is $G' = \lambda_L W'_N + \lambda_S W'_P + (\lambda_S + \lambda_C)W'_T + (\lambda_L + \lambda_C)W'_U = 0$, where I simply suppressed (w_M) for notational simplicity. The lobbying industry T owners and unionized workers receive a higher weight than the non-lobbying workers and industry P owners.

if the policymaker will impose or increase a binding minimum wage, and how its level reflects political and economic variables in the model.

Before doing so, however, notice that when industry T's demand for effective labour is greater than the aggregate supply of effective labour among unionized higher skilled workers, i.e., $E_T > E_U$, a binding minimum wage cannot emerge in the political equilibrium. Proof by contradiction is straightforward. Suppose that a binding minimum wage $w_M > w_E$ is an equilibrium policy choice. However, since $(E_U - E_T) < 0$ in this case and the LHS of eq. (3.11) is negative, while the RHS is positive, the first-order condition is not satisfied. This contradicts the claim that a binding w_M is imposed in the political equilibrium. The intuition is that if the LHS of eq. (3.11) is negative, *reducing* the minimum wage would reduce the LHS thereby increasing the SIGs' joint welfare. The policymaker benefits from such a policy move since it induces a larger contribution from both SIGs and also increases the RHS, the aggregate income in the economy.[38] Therefore, a binding w_M cannot be the policymaker's equilibrium policy choice here.

An example of an economy where $E_T > E_U$, is a developing country where an industry such as textiles is large and unionized labour small, such as in Bangladesh. The garment and textile industry in Bangladesh is the engine of the national economy, accounting for 80% of manufacturing exports and employing over 4 million workers, mostly women. Around 2.3 million people in the country's workforce belong to a trade union. Workers in Bangladesh's textile and garment industry, however, were until very recently forbidden to unionize and are still actively discouraged by the industry owners

[38] See also Grossman and Helpman [2001, Ch. 8] for a discussion of a first order condition similar to eq. (3.11).

and the government.[39] As a result, only around 5 percent of all garment workers in Bangladesh are unionized.

In Bangladesh total employment by the textile industry is greater than aggregate unionized labour, with the composition of existing union members skewed toward the high skilled male workers in other industries. A minimum wage covering the garment industry was introduced as a part of the 2006 Labour Act and was increased only twice since,[40] after being substantially eroded by high inflation and each time after considerable delay under the influence of textile factory owners.

In contrast, in a country such as Canada it is not unreasonable that (1) the demand for effective labour by any one industry that mainly employs low skilled workers (e.g. textile, retail, food, etc.) will not exceed the aggregate supply of effective unionized labour in the economy and (2) that precisely these industries' owners would be politically organized to lobby against minimum wage increases.

Consequently, the focus here is on the case when $E_U > E_T$ and a binding minimum wage can exist in a political equilibrium. Intuitively, the union members are a clear winner from a higher minimum wage because its members' earnings increase; minimum wage induced unemployment increases the unionized workers' marginal product while no ensuing job loss falls on their members. Only non-unionized low skilled workers experience loss in employment. The textile firms are clear losers in terms of lost profits. Given that $E_U > E_T$, the benefit to the union from pushing w_M higher is greater than firms' lost profits and the net effect on the SIGs' joint income is positive. This effect

[39] The political influence of the textile industry owners is well documented and widely recognized. For example, 60% of members of Bangladesh's Parliament are involved in the business while about 10% directly own garment factories. Restrictions on forming trade unions in the garment industry were lifted only in 2013. Prior to that workers were required to obtain permission from owners before they could unionize. Factory owners also sit on regulatory agencies' councils and boards, including the minimum wage one. See [Yardley, 2013].

[40] Prior to 2006 legislation there was an across the board minimum wage in place since 1994. However it was not increased until the 2006 law change. Since 2006, the minimum wage structure applying to the garment industry was increased in 2010 and 2013. It is however questionable whether this minimum wage structure is binding, with some reports indicating that nearly 40% of garment factories are paying below the minimum wage.

is reinforced by the policymaker's preference for political contributions. With a high λ_C the preference for contributions overrides the negative effect of lower aggregate income and increased unemployment.

Even with lobbying and political contributions, politics would never set w_M above a certain maximum value. In Grossman and Helpman [2001, Ch. 8]'s original argument this value is the one above which the RHS is greater than the LHS in eq. (3.11). When the minimum wage is so high, both lobbying SIGs and the rest of the economy benefit from a reduction in the minimum wage. In my version of the model, this occurs in the Case 2 situation when the minimum wage is set such that $a_M(w_M) > a_U$. Figure A.1 illustrates this situation. We know that workers at all skill levels above a_U belong to a union. Since only union workers satisfy the total demand for labour when $a_M(w_M) > a_U$, only union workers stand to to lose the job with a higher minimum wage. Those union members with the skill level $a_U \leqslant a \leqslant a_M$ would become unemployed. This goes against the union's goal to maximize the net-of-contribution earnings of its members. Therefore, the union would oppose an increase in the minimum wage such that $a_M(w_M) > a_U$.

3.2.3 Solution and Comparative Statics

The equilibrium solution for the minimum wage when $a_M(w_M) < a_U$ is given in Proposition 3.2.1.

Proposition 3.2.1. *The equilibrium minimum wage in the political equilibrium of the lobbying game is*

$$\hat{w}_M^{\frac{z-1}{z+\alpha-z\alpha}} = \frac{a_U^{z-1}\left[\left[2\lambda_S - \varepsilon\lambda_S - 1 + \varepsilon\right]\mathcal{A}^{\frac{(z-1)(1-\alpha)}{z+\alpha-z\alpha}} + \lambda_C \frac{A_T}{\mathcal{A}^{\frac{1}{z+\alpha-z\alpha}}}\right]}{\lambda_C \left[\frac{Nz}{z-1}\right]^{\frac{(1-\alpha)(z-1)}{z+\alpha-z\alpha}} \alpha^{\frac{1-z}{z+\alpha-z\alpha}}}. \tag{3.12}$$

Proof. To obtain the closed form solution for the equilibrium minimum wage simply insert eq. (A.5) for $E_T(w_M)$, eq. (A.6) for $E(w_M)$ and eq. (A.7) for E_U into the FOC eq. (3.11). This gives

$$a_U^{1-z}\left[\tfrac{Nz}{z-1}\right]^{\frac{(1-\alpha)(z-1)}{z+\alpha-z\alpha}}\mathcal{A}^{\frac{(z-1)(\alpha-1)}{z+\alpha-z\alpha}}\alpha^{\frac{1-z}{z+\alpha-z\alpha}}\hat{w}_M^{\frac{z-1}{z+\alpha-z\alpha}}=\frac{\lambda_S-\lambda_L+\varepsilon\lambda_L}{\lambda_C}+\frac{A_T}{\mathcal{A}}$$

After simplifying and rearranging, the equilibrium minimum wage is as given in eq. (3.12). To obtain eq. (3.12) recall that $\lambda_S+\lambda_L=1$. Then, $\hat{w}_M$ can easily be expressed in terms of λ_S or λ_L only. □

Equation (3.12) can tell us how the underlying political and economic (labour market) conditions of a particular jurisdiction matter for a minimum wage determined in a political equilibrium. To facilitate the derivation of comparative statics and empirical estimation in the next section, I take the logarithm of eq. (3.12). Thus

$$\ln\hat{w}_M=(z+\alpha-z\alpha)\ln a_U+\left[\tfrac{z+\alpha-z\alpha}{z-1}\right]\ln\left[\left[2\lambda_S-\varepsilon\lambda_S-1+\varepsilon\right]\mathcal{A}^{\frac{(z-1)(1-\alpha)}{z+\alpha-z\alpha}}+\lambda_C A_T\mathcal{A}^{\frac{-1}{z+\alpha-z\alpha}}\right]$$
$$-\left[\tfrac{z+\alpha-z\alpha}{z-1}\right]\ln\lambda_C+(\alpha-1)\ln\left[\tfrac{Nz}{z-1}\right]+\ln\alpha. \quad (3.13)$$

Comparative statics with respect to variables of interest are presented in the following corollaries.

Corollary 3.2.1. *Conditional on the level of labour demand elasticity, the minimum wage will decrease or even increase when the policymaker becomes more business friendly.*

$$\frac{\partial\ln\hat{w}_M}{\partial\lambda_S}=\frac{z+\alpha-z\alpha}{z-1}\times\frac{2-\varepsilon}{2\lambda_S-\varepsilon\lambda_S-1+\varepsilon+\lambda_C A_T\mathcal{A}^{-1}}\lessgtr 0 \quad \textit{when} \quad \varepsilon\gtrless 2. \quad (3.14)$$

Proof. This follows directly from the partial derivate of eq. (3.13) w.r.t. λ_S. Notice that the first term and the denominator of the second term are always positive and

the sign depends only on ε. First, recall that the Pareto distribution parameter $z > 1$, but for the distribution to have a second and third moment it should be $z > 3$. For political ideology it is the case that $\lambda_S = (1 - \lambda_L) < 1$ always. To convince oneself of the second claim recall that $\varepsilon = \frac{1}{1-\alpha}$, where $\alpha \in (0, 1]$ implies $\varepsilon \geqslant 1$. Then, for any given λ_S let $f(\varepsilon, \lambda_S) \coloneqq 2\lambda_S + \varepsilon(1 - \lambda_S) - 1$. Since $f(\varepsilon, \lambda_S)$ is increasing in ε, we have that $f(\varepsilon, \lambda_S) > 0, \ \forall \varepsilon > 1$. □

Parameter λ_S captures the policymaker's preference for profits relative to labour income, i.e., how business-friendly she is. If the value of ε is large (small), in this case greater (lower) than 2, the minimum wage will decrease (increase) when λ_S increases.

From eq. (3.9) we know that a higher minimum wage decreases profits as it raises the cost of effective labour. When labour demand elasticity is large, a given increase in w_M has a more negative effect on profits. There are two effects on labour income: low skilled workers' income drops as a result of the disemployment effect, while the income of remaining employed workers, including unionized higher skilled ones, increases as they do not experience any unemployment and the marginal product of their effective labour is higher. The profit income always decreases. When the policymaker cares more about the loss in profits, lobbying against minimum wage by the industry association is more advantageous. Then, the more business friendly the policymaker is, the more successful the lobbying effort by firm owners is and the more likely she is to reduce the minimum wage or at least refrain from increasing it.[41] For a given large ε, lobbying is able to induce the policymaker to set the minimum wage in accordance with her ideological preference for profits relative to labour income.

Corollary 3.2.1, however, also delivers a counterintuitive prediction. When the elasticity of labour demand is small, lobbying can overturn the ideological effect and even a business friendly policymaker would be willing to increase the minimum wage.

[41] Although there were no cases of minimum wage being lowered in Canada, regarding the real minimum wage there were extended periods during which the nominal rate was not changed and its value was simply eroded by inflation.

For smaller ε, an increase in w_M has a smaller disemployment effect and the decline of aggregate income is also lower. The policymaker might be more business friendly, but she still receives a lobbying contribution from the union to increase the minimum wage while the 'return' on the lobbying effort against an increase is now lower.

Analogously, given that $\lambda_S = 1 - \lambda_L$ it is straightforward to show that

$$\frac{\partial \ln \hat{w}_M}{\partial \lambda_L} = \frac{z + \alpha - z\alpha}{z - 1} \times \frac{\varepsilon - 2}{1 - 2\lambda_L + \varepsilon\lambda_L + \lambda_C A_T \mathcal{A}^{-1}} \gtrless 0 \quad \text{when} \quad \varepsilon \gtrless 2.$$

Parameter λ_L captures the policymaker's preference for workers' income. Equation (3.10) shows that a marginal increase in w_M increases unionized workers' income. When ε is large an increase in minimum wage has a stronger 'bite'; disemployment effect falling on the low skilled workers is greater, causing a larger increase in unionized workers' marginal product. Therefore, when the policymaker is more labour-friendly and ε is relatively large, the union has a stronger incentive to lobby *for* a higher minimum wage.

Lobbying is costly too. Because a minimum wage increase has a negative effect on aggregate income and with large ε the disemployment effect on the low skilled workers is greater, political contribution offered by the union to offset these negative effects has to be higher. The more labour friendly the policymaker is, the more she cares about lobbying union's income and more successful the union is in its lobbying effort. (See the discussion below the FOC eq. (3.11) and footnote 37.) Observe again that when labour demand elasticity is large, the policymaker sets the minimum wage in accordance with her ideological preference for labour income over profits, even though this will decrease the employment and earning of lower skilled, non-unionized workers.

What is most clear from Corollary 3.2.1 is that ε determines how high the lobbying game stakes are.

Corollary 3.2.2. *The effect of political ideology on the minimum wage is influenced by* ε.

$$\frac{\partial}{\partial \varepsilon}\left(\frac{\partial \ln \hat{w}_M}{\partial \lambda_S}\right) = -\frac{1}{\varepsilon^2} \times \frac{2-\varepsilon}{\lambda_S(2-\varepsilon)-1+\varepsilon+\lambda_C A_T \mathcal{A}^{-1}} - \frac{z+\alpha-z\alpha}{z-1} \times \frac{1+\lambda_C A_T \mathcal{A}^{-1}}{\left(\lambda_S(2-\varepsilon)-1+\varepsilon+\lambda_C A_T \mathcal{A}^{-1}\right)^2}. \tag{3.15}$$

Proof. This result follows directly from the partial derivate of Corollary 3.2.1 w.r.t. ε and the fact that $\varepsilon = \frac{1}{1-\alpha}$. □

Corollary 3.2.2 describes the effect of labour demand elasticity on the influence of policymaker's ideology when changing the minimum wage. It is not immediately clear in which direction this effect goes. Given that the second term is always negative, if $\varepsilon \leqslant 2$ the derivative is negative, but for $\varepsilon > 2$ the direction of the derivative is not immediately obvious. A positive sign would indicate that elasticity reinforces the effect of ideology on the minimum wage in the presence of lobbying; as elasticity increases, the ideology effect on the minimum wage is stronger. A clearer understanding about the direction of this sign may come from the empirical estimation.

Corollary 3.2.3. *Minimum wage increases with the unionization cutoff skill level, given that the shape parameter of the Pareto distribution* $z > 1$.

$$\frac{\partial \ln \hat{w}_M}{\partial a_U} = \frac{z+\alpha-z\alpha}{a_U} > 0 \tag{3.16}$$

Proof. This result follows directly from the partial derivative of $\ln \hat{w}_M$ w.r.t. cut-off skill a_U and the fact that $z > 1$. □

The equilibrium minimum wage will rise when the lowest skill level necessary to be a union member increases. Intuitively, an increase in the necessary cut-off unionization skill level a_U increases the average skill level of unionized workers. Since the higher skilled unionized workers' income rises following an increase in the minimum wage, as

long as $a_M(w_M) < a_U$ the more representative the union is of higher skilled workers, the more 'room' there is to push the minimum wage higher before it reaches the level for which $a_M(w_M) = a_U$. This can be seen from Figure A.1.

Following an increase in a_U the skill composition of union's membership is more representative of higher skilled workers, but given the fixed number of workers in the economy N, the remaining *number* of unionized workers is lower. If we define union density by the number of unionized workers as a proportion of all workers, we can interpret an increase in a_U as a decrease in union density. Therefore, minimum wage increases when union density decreases, i.e., a smaller union is more effective at increasing the minimum wage.

This prediction contrasts with some previous hypothesis about the effect of unionization on the minimum wage. A standard prediction is that greater union membership and/or union density should have a positive effect on the w_M level; a larger union means a politically stronger union, which can then exert more pressure on the government to increase the minimum wage. In the current model, this effect is captured by the first term in the LHS bracket of eq. (3.11).

The theory here, however, also interprets unionization adjusted for the skill level. It highlights that a smaller union with higher average skill level can also induce the w_M to increase. Only the non-unionized low skilled workers are at the risk of becoming unemployed following an increase in the minimum wage. As the average skill level of unionized workers increases, the union composed of high skilled workers benefits from a higher minimum wage because it makes unskilled labour more expensive to hire, reduces their employment and raises the marginal product of its members.

Corollary 3.2.4. *The minimum wage increases when the lobbying industry T becomes more productive.*

$$\frac{\partial \ln \hat{w}_M}{\partial A_T} > 0. \tag{3.17}$$

Proof. This result follows directly from the partial derivate of $\hat{w}_M$ w.r.t. technology A_T. □

The interpretation is that when the lobbying industry T becomes more productive the marginal productivity of industry labour is higher. With a minimum wage in place then, firms can afford to keep some lower skilled workers, for which the minimum wage was binding, employed. Then, industry T will not necessarily oppose a hike in the minimum wage, because it does not immediately result in the loss of employment for the lower skilled workers; a decline in total employment would raise the marginal product, i.e., the cost of other workers. In what follows these comparative static results will be empirically evaluated.

3.3 Empirical Analysis and Results

The theoretical predictions are evaluated with panel data regressions. The dataset for ten Canadian provinces contains relevant economic and political variables over the 1965-2013 period. This is the longest, consistent time series available for minimum wages across Canadian provinces and the longest one used compared to past studies of minimum wage determinants. I also consider regressions starting with 1976, when the Canadian Labor Force Survey (LFS) in its current modern form started, allowing for more precise labour force control variables. As will be show, the main results for the most preferred specification do not differ considerably for these two periods.

Being determined at the provincial level, we observe considerable variation across ten independent jurisdictions setting their own minimum wage, within the same broad political, institutional and legal framework.[42] The resulting provincial variation in the timing, levels and frequency of minimum wage changes over the last 49 years, enumerated in Figure 3.3, provides a good foundation for a panel data analysis of

[42]Besides Québec, and to some extent Alberta, the rest of the provinces share the same cultural attitudes as well.

minimum wage determinants. During that time, all but one year (1983) saw minimum wages increase in Canada, (Figure 3.3b). In total, Canadian provinces increased the nominal minimum wage 359 times over the 1965-2013 period, some more often than others (Figure 3.3a). In the next four subsections I briefly describe the main variables of interest: real minimum wage, political ideology, union density, technological progress and labour demand elasticity. Details on various control variables are presented in the Appendix. Section 3.3.5 discusses regression specification and presents results.

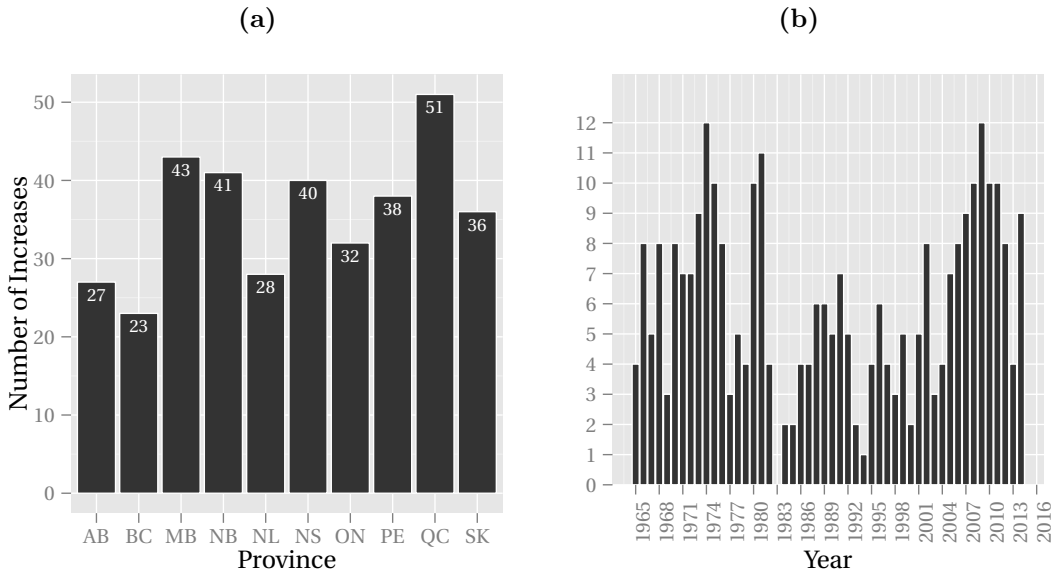

Figure 3.3: The diagram on the left shows the number of nominal minimum wage increases for each Canadian province in the 1965-2013 period. It shows provincial heterogeneity in the frequency of minimum wage changes. The right diagram shows the distribution of nominal minimum wage increases for all ten provinces over the same period i.e., the number of times all provinces increased the minimum wage in a given year. Note that these aggregates are calculated for the monthly observation of nominal minimum wage changes. Data: Labour Program Canada, Minimum Wage Database.

3.3.1 Real Minimum Wage (w_M)

The dependent variable of interest is the (logarithm of) provincial real hourly minimum wage (RMW). Although RMW is available on a monthly frequency, in order to match the observations on explanatory and control variables I calculate the RMW at a yearly frequency as the weighted average of monthly minimum wages in a given year, with

weights being the number of months in a year that a particular minimum wage was in effect. All nominal dollar variables are deflated by the provincial CPI.[43] Table 3.1 provides summary statistics for the RMW at yearly frequency for each province, where heterogeneity across provinces is visible.

From Figure 3.1 observe that RMWs were rising in all provinces until the late 1970s, when they reached an overall peak, measured in constant 2013 dollars. It means that nominal minimum wages (NMW), as the actual policy under provincial governments' control, were being raised faster than inflation. Furthermore, Figure 3.3b shows NMW raised frequently until the late '70s. The 1980s saw RMWs decline across all provinces, a result of NMWs not being changed very often, remaining (almost) flat for several years which allowed the inflation to erode their value.

Table 3.1: Summary statistics for the hourly real minimum wages, 1965-2013. Real values expresssed in 2013 dollars using the CPI for the respective province and year.

Statistic	N	Mean	St. Dev.	Min	Median	Max
Newfoundland and Labrador (NL)	49	7.745	1.300	4.966	7.348	10.664
Prince Edward Island (PE)	49	8.107	0.884	7.038	7.781	10.263
New Brunswick (NB)	49	8.319	0.944	7.089	7.905	10.542
Nova Scotia (NS)	49	7.871	1.147	5.757	7.543	10.400
Quebec (QC)	49	8.756	1.196	5.417	8.741	11.293
Ontario (ON)	49	8.987	1.077	6.362	9.068	10.878
Manitoba (MB)	49	8.594	1.147	5.668	8.471	11.001
Saskatchewan (SK)	49	8.905	1.234	6.931	8.393	11.587
Alberta (AB)	49	8.721	1.139	7.365	8.254	11.638
British Columbia (BC)	49	8.480	1.213	6.317	8.470	11.469

Note: Yearly Frequency. For the source see Figure 3.3

As noted by Baker et al. [1999], the 1990s is the beginning of substantial provincial heterogeneity in minimum wage policies, with increased frequency and magnitude of changes compared to the '80s. In some provinces NMW started to rise substantially and frequently while in others it did not increase for several years. On the one hand, in British Columbia after an extended period of no increases during 1980s, NMW

[43] Although some provinces legislate special, lower rates for some classes of workers, such as students or liquor servers, the focus here is on the minimum wage for adult workers. Shannon and Beach [1995] shows that very few workers are covered by these rates.

started rising such substantially and frequently that by 2001 B.C. had the highest hourly real and nominal minimum wage in Canada. Today, British Columbia has one of the lowest RMW. Ontario, on the other hand, having the highest RMW in Canada in 1995, did not increase its NMW for the subsequent nine years. By 2004 its real value was eroded below that of British Columbia. Since the late 2000s, RMWs have been converging across provinces, although they are still slightly lower than their peak in the mid 1970s.

3.3.2 Political Ideology (PI)

A crucial variable in the theoretical model is the policymaker's ideological position with respect to economic issues, i.e., her preference for profits over labour income. Either she is more business friendly (λ_S) or more labour friendly (λ_L). The expectation is that minimum wages will be increasing under more labour friendly governments. The theory, however, does not preclude that a business friendly policymaker also increases the minimum wage, under the condition that the labour demand elasticity is not large and in the presence of lobbying.

In constructing the measure of policymaker's ideology I follow the methodology of Bjørnskov and Potrafke [2012], who measure political ideology based on the idea that the ideological position of parties, and in turn provincial parliaments and governments, changes over time as different factions of a given provincial party are in power. An ideological score i_{rt} on a right-left scale, with 1 being right-wing and -1 left-wing, is assigned to party r based on its leader in year t. The party leader signals the faction in power and is the Premier of the province if that party is in power. This enables parties "to take up more than a singular point on the left-to-right line" over time. [ibid, p.147] For each province, the time series of the parliament's political ideology is then constructed as

$$[\text{Political Ideology}]_{pt} = \frac{\sum_r i_{rt} S_{rpt}}{\sum_r S_{rpt}},$$

where S_{rpt} is the number of seats party r has in province p in year t. With a change in party leadership (faction) and/or election, there is a change in the provincial parliament's political ideology.

This measure of political ideology follows entirely standard features of a left-right political divide on economic issues in Canadian provinces. (See Cross and Young [2002] and Dyck [1991].) I calculate this measure over the 1965-2013 period and illustrate it in Figure C.3.

Previous papers on minimum wage determination across Canadian provinces have identified the evidence of political ideology effect based on dummy variables corresponding to right or left wing governments being in power, with identification coming from the underlying assumption that parties on the right are less supportive of minimum wage increases and converse for those on the right. In Canadian provincial politics, however, a Liberal party government does not necessarily imply a labour friendly government,[44] and a more nuanced coding of political ideology is required. The more flexible measure of political ideology employed in this paper, which permits provincial parties' and parliaments' ideological position to change over time, allows for stronger identification of the ideology effect on minimum wage changes, coming from greater province specific ideology variation over time. See Appendix B.2 for more details and discussion of these issues.

3.3.3 Labor Demand Elasticity (ε)

The production function in eq. (3.1) gives the wage elasticity of effective labour demand as $\frac{1}{1-\alpha}$, where α is the labour share of income. I compute this elasticity measure for each province by calculating the share of labour compensation in the provincial GDP

[44]For example, the Liberal Party of British Columbia is more business friendly and opposed minimum wage increases for years, compared to Ontario Liberal Party that is a classic left leaning, consistently more labour friendly. Liberal and conservative parties are not directly comparable across provinces and cannot all be put under the same 'wing' throughout the whole period under study here.

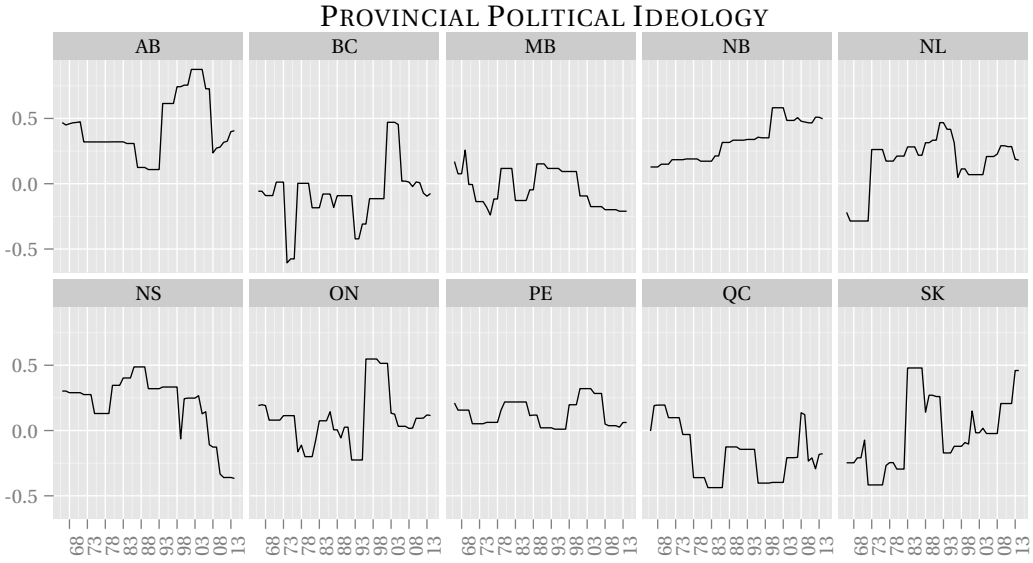

Figure 3.4: Political ideology depicts the ideological position of provincial parliaments. With a focus on economic issues, the ideological scale is bounded by -1 for left-wing socialists, and 1 for right-wing conservatives. The ideological score of each party in a given year is based on its leader indicating which party faction is in power. For example, the Conservative Party can have the score 1/3 denoting Red Tory leaders in Canadian politics, the standard right-of-center score 2/3 or a far right position 1, for example during Mike Harris (ON) or Ralph Klein (AB) rule. The Liberal Party's standard score is 0, the business-friendly faction is at 1/3, while the social faction is at $-1/3$. NDP is the most ideologically homogeneous of the major parties, but it is possible it shifts from its standard social-democratic, labour-friendly $-2/3$ to a far left, socialist position -1.

(at factor cost), following the preferred estimation and adjustments for α discussed in Gollin [2002] and Morel [2006]. In the estimation, the elasticity measure is interacted with the political ideology to evaluate the cross-partial derivative in Corollary 3.2.3. See Appendix B.3 for more details on ε calculation.

3.3.4 Union Density and Technology (UD and A)

The effects of skill adjusted union density and technological change on minimum wage are also empirically tested. The expectation is that after adjusting for the union's skill composition, union density will have a negative relationship with the minimum wage. (See the discussion following Corollary 3.2.3.) Provincial unionization rates have been declining in some provinces since 1965, especially in the most populous ones,

Ontario, Québec and British Columbia. This is mostly due to growing employment, while union membership has been stagnating.

To make a skill adjustment, for every year I separate unionized workers in each province by sex and weight male and female workers by a measure of their relative productivity, i.e., the respective sex's average hourly earnings (AHE) normalized with respect to AHE over all employees in Canada. This is the ratio $\frac{AHE_{st}}{AHE_t}$, for $s = M, F$ and year t. Using Canada wide AHE, each male and female union worker carries the same respective weight in each province. By not using province specific AHE I avoid the likely positive effect of provincial unionization on provincial wages. Appendix B.4 contains details on this adjustment.[45]

Unfortunately, a readily available measure of skill adjusted union density does not exist for Canadian provinces nor is a more specific type of adjustment easily possible. For example, although the composition of provincial union membership changed across industries since 1965, the possibility of capturing this change is limited since the available data is often incomplete, with many breaks in the series. The same argument applies to the age composition of union members, or their hours worked, which could also potentially be adjusted by a productivity measure, but the data does not allow union membership to be separated by age or hours. Nevertheless, the sex based adjustment captures the variation in the number of male and female union members since 1965 while the AHE weights capture the productivity-related characteristics for the male-female wage differential.[46] This adjustment tends to reinforce the downward trend in union density given that union membership in the

[45] A possible concern is that union density and political ideology are correlated and that one is endogenous to the other. I explore and discuss this in Appendix B.4 and report provincial correlation coefficients in Figure B.7. In general, three provinces have a distinct positive and three have a negatively correlation, while some have a weak or no correlation, which indicates considerable provincial heterogeneity in the relationship between union density and political ideology.

[46] Male AHE weights are always > 1, while female are < 1. Albeit, this is an imperfect measure since some of the male-female wage gap can be explained by productivity-related factors, while the unexplained part can be due to different labour market decisions, unobserved skill measures or discrimination. See Gunderson [2006] for a review of male-female wage gap explanation in Canada.

1960s and '70s was composed of mostly male workers who were earning higher relative wages compared to female workers. By the 2000s the number of female union members caught up with male and the male-female wage gap had shrunk considerably.

The technology component A in the production function is interpreted and calculated as the province specific Solow residual. Specifically, for each province I calculate A as the residual of the Cobb-Douglas production function $Y_p = A_p E_p^{\bar{\alpha}_p} K_p^{1-\bar{\alpha}_p}$, where Y_p represents provincial real GDP, K_p is provincial capital stock, E_p is total provincial employment and $\bar{\alpha}_p$ is the provincial mean labour share over the 1961-2013 period.[47] Because we want to capture the effect of technological progress on minimum wage determination, when computing the Solow residual I do not hold K fixed, but make use of all the available data on provincial capital stock. Otherwise, the estimated parameter A would reflect all sources of growth other than the contributions of employment. See Appendix B.5 for more calculation details.

3.3.5 Regression Specification and Results

Guided by the theoretical results in the section 3.2.3 and the nature of data, estimation is based on the following specification:

$$\ln w_{M,pt} = \alpha + \beta_1 UD_{pt} + \beta_2 A_{pt} + \beta_3 PI_{pt} + \beta_4 (PI \times \varepsilon)_{pt} + \beta_5 \varepsilon_{pt} + \boldsymbol{X}'_{pt}\boldsymbol{\gamma} + \theta_p + \mu_t + \nu_{pt} \tag{3.18}$$

The dependent variable is the log of real minimum wage. The main explanatory variables of interest, with coefficients β_1 to β_4, are respectively: skill adjusted union density UD, technology A, political ideology PI, and the interaction of ideology and labour demand elasticity $(PI \times \varepsilon)$. Linear approximation of minimum wage eq. (3.13) contains ε so I included it in the estimation, even though the parameter β_5 is not of primary interest.

[47] I make use of the longest possible time-series when computing the Solow residual, but in regressions I only use values starting with 1965 or later.

To identify parameters on key theoretical variables I employ the method of fixed effects regression as an identification strategy to eliminate unobserved heterogeneity across provinces and years. The identification is obtained from within province-time variation. Preferred estimates include province fixed effects (θ_p) and year fixed effects (μ_t). The vector $\boldsymbol{X}$ includes various time-varying, province-specific economic and political variables that may also affect the w_M and should be accounted for. I discuss these controls and the reasons for their inclusion them with all the other regression results. Most of the right-hand-side variables are in logs[48] and all regressions report cluster robust standard errors, appropriate for panel-data. In Appendix B.8 I also evaluate the same regressions with bootstrap based clustered standard errors.

[48]It is not possible to log the ideology and HHI variables, for example, because of negative and zero values.

Table 3.2: Determinants of Real Minimum Wage for 10 Canadian provinces.

	Dependent Variable: Log(Real Minimum Wage)				
	Pooled OLS	Year FE	Province FE	Prov+Year FE	Prov+Year FE
	(1)	(2)	(3)	(4)	(5)
Log(Union Density)	−.097***	−.0003	−.189***	−.077**	−.105***
	(.023)	(.023)	(.033)	(.039)	(.039)
Log(Technology)	.113***	.056***	.073	.136*	.219***
	(.020)	(.018)	(.078)	(.070)	(.075)
Political Ideology	−.386***	−.235***	−.263***	−.168**	−.178**
	(.084)	(.066)	(.078)	(.069)	(.081)
Political Ideology×ε	.283***	.187**	.224**	.165**	.170*
	(.093)	(.075)	(.090)	(.078)	(.091)
Log(ε)	.007	−.077**	.071	−.005	.013
	(.039)	(.030)	(.057)	(.061)	(.065)
Log(Real Wage)	.697***	.129**	1.120***	.268***	.309***
	(.052)	(.063)	(.068)	(.089)	(.081)
Log(Real Weekly E.I.)	.144***	.287***	.009	.215**	.252**
	(.035)	(.086)	(.037)	(.091)	(.111)
Log(lag Unempl. Rate)	−.080***	−.076***	−.068***	.003	−.086***
	(.014)	(.016)	(.013)	(.016)	(.026)
Log(lag Teen Pop. Share)	.343***	−.112**	.374***	−.023	
	(.029)	(.056)	(.027)	(.066)	
Log(lag Teen Part. Rate)					.430**
					(.190)
Log(lag Teen Empl. Rate)					−.448***
					(.158)
Election Dummy	−.004	−.002	−.005	−.003	−.003
	(.009)	(.008)	(.008)	(.007)	(.008)
HHI	−.355***	−.189***	−.602***	−.406***	−.288***
	(.077)	(.072)	(.094)	(.094)	(.107)
Constant	.041				
	(.167)				
Year dummies?	No	Yes	No	Yes	Yes
Province dummies?	No	No	Yes	Yes	Yes
Period	1965-2013	1965-2013	1965-2013	1965-2013	1976-2013
Observations	470	470	470	470	370
Adjusted R^2	.586	.999	.999	.999	.999

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust Standard Errors

Table 3.2 presents main regression results. Column (1) reports coefficient estimates for a simple pooled OLS specification. These results provide initial patterns in the data and give simple relationships between minimum wages and their theoretically derived determinants. The negative coefficient on union density, indicates that a falling skill-adjusted unionization rate will have a positive effect on minimum wages. Technological improvement, proxied by the Solow residual, will increase provincial minimum wages. Political ideology has a strongly negative coefficient, indicating that as the provincial government becomes more business friendly, real minimum wage would decrease. The coefficient on the interaction of ideology and labour demand elasticity is interpreted as the sign of the cross-partial derivative in Corollary 3.2.2. A positive relationship with the minimum wage reveals that larger elasticity reinforces the effect of ideology on the minimum wage.

Columns (2) and (3) of Table 3.2 include year and province fixed effects, respectively. *Year* fixed effects control for additional time varying factors that might have common influence on minimum wages across all provinces. These would include federal government's labour market and taxation policies or global economic shocks (recessions) that impact whole of Canada. The provincial unemployment rate and the teen share of working age population capture general labour market conditions affecting minimum wage workers and the possibility of adjusting the minimum wage.[49]

However, provinces could also differ in social values toward remuneration of low skilled labour, the proportion of workers earning a minimum wage, poverty rate or income inequality and redistribution preferences. Cross-provincial differences in labour market or business policies could also influence the possibility or frequency of minimum wage adjustment. *Province* fixed effects capture such province-unique

[49]It is well documented that teenagers (age 15-19) are the group most likely to be working at minimum wage and be affected by its change. According to Galarneau and Fecteau [2014] 50% (31%) of teen employees in Canada were paid minimum wage in 2013 (1997). Gunderson [2014] indicates that "60% of minimum wage workers are teens or youths".

influences, provided they do not change over time. Although fixed effects reduce the variability in explanatory variables, including them helps avoid omitted variable bias.

The first four rows of columns (2) and (3) show that adding either of these two fixed effects does not change coefficients' estimated signs, while the only variables that change significance between the two regressions are the union density and technology. Given that standard tests for individual and time effects reject removing them from the specification, in column (4) I include both year and province fixed effects in the regression.[50] These are the preferred specification estimates.

Coefficients on the first four variables of interest, union density, technology, ideology and its interaction with labour demand elasticity, have the expected sign. More so, compared to columns (2) and (3), they are all significant. Compared to column (1) they lose some significance, but unlike the pooled OLS regression these estimates are unaffected by the omitted variable bias coming from time and province constant variables.

The set of variables included in rest of Table 3.2 control for other, potentially important, determinants of w_M. These are province specific and time varying variables, so by accounting for them I further reduce omitted variable bias. From the bottom, the Herfindahl-Hirschman Index (HHI) and the election dummy variable control for provincial political influences other than ideology. HHI assesses party competition in a provincial parliament, capturing how concentrated is the distribution of party seat shares while also accounting for each party's ideological deviation from the overall parliament's ideological score. Given that construction[51], a value of $HHI = 0$ indicates that one party holds all the seats in the parliament and has ideological monopoly

[50] The Lagrange Multiplier test for individual and/or time effects in panel model and the F test comparing the fixed effects and pooled OLS fits, strongly rejecting the null that OLS is a better fit and that no fixed effects are needed. Both indicate the presence of inter-provincial and time variation.

[51] See Appendix B.2 for details on this calculation. Data sources for the rest of these variables are provided in Appendix B.7.

on the government's policymaking.[52] HHI can also be indicative of a government having a majority or a minority of seats in the parliament. In terms of setting the minimum wage, the more legislative power is concentrated with one party the easier it is to change the minimum wage as the party in power faces no opposition and does not have to compromise with other parties in the legislature. A negative coefficient indicates that as HHI drops and party competition is lower, minimum wage increases.

The election dummy captures the potential effect of election years on the minimum wage increase; an incumbent provincial government would be inclined to raise the minimum wage during elections to take advantage of the short-run labour demand curve (as argued by Sobel [1999]) and to increase the reelection probability. While it is important to control for that possibility, in no specification did this election variable play a significant role in determining the minimum wage.[53]

The teen share of the working age population (ages 15-64) controls for the effect of supply of individuals most directly affected by minimum wage changes, i.e., the 'at risk' group. In the category of low-skilled workers, minimum wages have a significant 'bite' and affect a considerable proportion of Canadian teenagers. Yuen [2003] finds that "the minimum wage has a significant negative effect on the employment probability" of teens and youth. Brochu and Green [2013] shows strongest negative impact of the minimum wage on teenagers separation rate. Either positive or negative effect could have an intuitive interpretation. On the one hand, increasing the minimum wage could increase the employed teens' income, as well as that of other groups for which the minimum wage is relevant. On the other hand, a policymaker who cares about teens working would not want to negatively affect their job prospects by raising

[52] It happened in New Brunswick during 1988-91 period, when the Liberal Party under Frank McKenna won all 58 seats in the legislature. Given that, the parliament's ideology was equivalent to the Liberal party's and HHI=0 in those years.

[53] Lagging the election dummy, designating the next calendar year as the election year, also did not show significance nor did it change other coefficient estimates. It has proven difficult to time minimum wage changes to election cycles in Canada, and these results are no exception. See Dickson and Myatt [2002].

the minimum wage. It is lagged with the intuition that the policymaker can only observe teen workforce level for the past year and make a decision based on that information. Furthermore, it avoids the possible reverse causality effect on the labour market segment which a minimum wage increase affects the most. The same intuition applies to the lagged provincial unemployment rate, which captures overall provincial labour market conditions. In the preferred specification, column (4) with two-way fixed effects, neither teen share nor unemployment are significant for the minimum wage level.

Column (5) specification is based on the shorter time frame, 1976-2013, but uses more precise indicators of teen labour market, their labour force participation and employment rates, in addition to overall provincial unemployment rate. All three are now significant, indicating that higher unemployment and teen employment in a province negatively affects minimum wages, while more teenagers participating in the labour market has a positive effect.[54]

Including average weekly employment insurance (known as 'unemployment benefits' outside Canada) in the regression captures the effect of an institutional feature of provincial labour markets; it is an alternative minimum 'earnings' floor in a province, below which workers will not supply any labour. As discussed by Boeri [2012], it can be expected that as workers' outside option in the form of unemployment benefits increases, it will push the minimum wage higher.[55] The coefficient on this variable is indeed always positive and significant in most preferred estimations.[56] Real wage,

[54]Reverse causality is a possibility here, with higher minimum wages negatively affecting teen employment rate, while encouraging higher teen participation rate in the labour force. These variables are in general slow to change on a yearly frequency and I also check regressions without lagged variables and the results remain in line with Table 3.2. See Appendix B.8.

[55]Dickson and Myatt [2002] speculate that more generous unemployment benefits would negatively affect a minimum wage increase since higher minimum wage would reduce employment, making it harder to qualify for benefits. An argument can be made for reverse causality as well, whereby higher minimum wage decreases the generosity of the unemployment insurance system if the minimum wage compresses the wage distribution.

[56]Although the Employment Insurance program in Canada is federally managed, parameters and characteristics of the system are based on sub-provincially established economic regions. Eligibility, benefit amount and duration are calculated based on the number of hours worked, unemployment

measured as average hourly earnings, controls for the general level of wages in a province. It is expected that it will be positively associated with the price of low skilled labour in the province.

3.3.6 Robustness Checks

In Tables B.6 to B.8 (shown in Appendix B.8) I check for additional factors that could be influential when determining the minimum wage. Table B.6 introduces measures of youth (ages 15-24) share of working age population in place of teen, labour demand shocks and a measure of provincial business cycle. See Appendices B.6 and B.7 for details on these variables. The first three columns are for the period starting in 1965, and last three starting with 1976. Youth workers are also affected by minimum wage changes, although maybe not to the same extent since they also includes university graduates. The result on the first four effects are robust to this change of the control group and the sign on youth share of working age population is the same as teen share.

Column (2) reverts to teen share, but introduces a measure of province specific labour demand shocks to control for employment shocks. Details on calculation of this variable are provided in Appendix B.7. The estimates of primary interest are not sensitive to this addition, while the negative sign on labour demand shock, although insignificant, indicates that real minimum wage is less likely to change when labour demand shocks are stronger. In column (3) instead of labour demand shocks I use a measure of the provincial business cycle, captured by the cyclical component of provincial real GDP. [57] This controls for the possibility that provincial governments increase minimum wages (only) during good economic times. The cyclical component of GDP can also capture the effects of fiscal stress on government's policies, especially

rate and number of weeks with highest earnings in a particular economic region. The variation of parameters across regions creates variation in eligibility rates and benefit payments across provinces, which has been fruitfully used in other research, such as Lemieux and MacLeod [2000].

[57] Although, there could be some level of correlation across provinces through Canada wide recessions and federal governments and central bank's responses.

those that affect the distribution of income, which minimum wage does. There is again no change in the first four effects of interest and the effect of business cycle measure is statistically insignificant. Columns (4)-(6) make the same three checks starting with 1976, with estimates comparable to column (5) in Table 3.2. The results are not significantly altered, and only the significance of interaction variables is weakened.

Table B.7 shows the results from additional robustness checks of the primary Table 3.2 results, columns (4) and (5), using the control variables that other Canadian papers employed in their study of minimum wages. I evaluate the impact of adding three different control variables successively; average regional minimum wage, provincial corporate income tax for small businesses and a dummy indicating if the nominal minimum wage increased from the year before.[58]

By including the (log of) average regional minimum wage, in column (1), and respectively column (4) for the shorter period, I control for the effect of minimum wage levels in other provinces. This is in line with Green and Harrison [2010] who argue that inter-provincial comparisons are important to provincial policymakers when setting their own minimum wage. They use three regions: Atlantic (NL, PEI, NS, NB), Central (ON, QC) and West (MB, SK, AB, BC). For each province, regional minimum wage in year t is computed as the average of all other provincial minimum wages in that region excluding that province. Inclusion of regional averages has no effect on other variables, especially those of main interest in the first four rows. Also, as in Green and Harrison [2010] the regional minimum wage has a positive sign, but unlike their estimates it has no significance here.[59]

The second variable I include in the preferred specification is the provincial corporate income tax rate on small business.[60] Green and Harrison [2010] consider

[58] I compute the actual nominal minimum wage increase as $w_{M,t} - w_{M,t-1}$ and assign 1 if the difference is positive.

[59] Since their dependent variables is the log of nominal minimum wage I check that regression in my context, as in Table B.8, and find the same results as for real minimum wage: positive coefficient, not significant and no change in first four variables of interest.

[60] The data on corporate tax rates for provinces was generously provided by Cahill [2007].

this as "a measure of the political strength of minimum wage opponents" (see footnote 16 in their paper) and it's in line with Sobel [1999] investigation of business interest groups opposing minimum wage. In columns (2) and (5) the small business tax has a strong and positive association, although a weak effect. Somewhat surprising, but more important is that the main results are not substantially altered. Technology variable in column (2) looses significance, while the other estimates are in line with previous results. This would be more indicative of the importance of the time period being evaluated.

In the last row I check the results for the presence of a dummy indicating whether there was an increase in the *nominal* minimum wage last year. Brochu and Green [2013] use this control to capture equilibrium effects in their estimation of minimum wage impact on transition in and out of employment. Here the focus is on minimum wage adjustments and the presence of dummy avoids an immediate type of effect of other variables on minimum wage. It could also be the case that a nominal minimum wage increase in the past year reduces the possibility of a policymaker increasing it in the current year. The inclusion of this dummy seems to improve the overall fit of the primary specification. In columns (3) and (6), despite the nominal minimum wage dummy being highly significant, the cluster robust standard errors for the first four variables are in fact smaller. I also included all three of these controls in the primary specification simultaneously and the results are not substantially different from Table 3.2. In fact, the significance of union density, ideology and interaction variables all increase, while the only one that is weakened is the technology variable measured by the Solow residual. All keep the same theoretically predicted signs.

Table B.8 replicates two-way fixed effects specifications from Table 3.2 with the dependent variable being the *nominal minimum wage*.[61] Columns (1) and (3) in Table B.8 are directly comparable to (4) and (5) in Table 3.2. The results do not

[61]For consistency, I also use the nominal wage, nominal employment insurance and the Solow residual calculated using nominal values of capital and GDP.

substantively change. In columns (2) and (4) I use labour market indicators for youths instead of teens and although those variables reverse the sign, the key effects of interest in the first four rows are comparable to previous estimates. The only variable that loses significance is the column (4) interaction of political ideology and elasticity in the shorter time period when controlling for youth labour market indicators.

Finally, although clustering standard errors on provinces allows for both autocorrelation within clusters and potential heteroskedasticity, due to the small number of provinces the cluster-robust standard errors could be biased downwards. Because of this I use the bootstrap procedure to check more accurately the cluster-robust inference. Appendix Table B.5 replicates Table 3.2 columns (4) and (5) regressions with a wild cluster bootstrap proposed by Cameron et al. [2008]. Besides union density, other key determinants of interest, especially the political ideology effects, are still significant at the 5% level, especially for analysis starting in 1976. The importance of the time period for inference could warrant further investigation.

3.4 Summary and Conclusion

In this chapter I analyzed the political origins of minimum wage determination, taking into account the political influence of special interest groups, political ideology and various labour market factors. Taken together, the theoretical results show that when the policymaker cares about lobbying contributions, the equilibrium minimum wage set will not be the one which maximizes aggregate welfare, but rather the one preferred by politically organized members of society.

A particularly interesting insight that the model delivers is an explanation of when a more business-friendly policymaker would not necessarily oppose an increase in the minimum wage, despite always having a negative effect on profits, provided she receives lobbying contributions from the union. In addition, a novel insight that

emerges is that a smaller union, composed of higher skilled workers, can be more effective at increasing the minimum wage. This prediction is contrary to a more usual expectation that a larger union is a politically stronger union, having more influence on the government to increase the minimum wage. In the current model setup, capital used in firms' production is assumed to be fixed. Relaxing this assumption, given that firms can substitute labour for capital in the long run, would likely have an effect on the elasticity of labour demand in the long run. I leave this extension for future research.

Theoretical predictions are verified empirically with evidence from Canadian provinces, taking advantage of the rich heterogeneity in their historical minimum wage evolutions. According to robust panel data regression estimates, presented in Table 3.2 and Appendix B.8 Tables, after controlling for unobserved province and year effects, real minimum wage is shown to decrease in skill-adjusted union density and a measure of political ideology. The latter means that as the provincial government becomes more labour-friendly the minimum wage will be higher.

Furthermore, data shows that this political ideology effect is reinforced by a large labour demand elasticity, which is compatible with the theoretical insight that lobbying is successful in inducing the policymaker to set the minimum wage in the direction of her political ideology preference when labour demand elasticity is larger. Finally, the minimum wage will also increase as a result of technological advancement, measured by province specific Solow residuals. Making workers more productive allows firms to employ the lower skilled workers for which the minimum wage was previously binding. These results do not prove very sensitive to a variety of different political and economic time varying factors across provinces, that could also influence minimum wages.

The minimum wage as the policy outcome does not rely on the somewhat vague notions of society's fairness or bargaining between SIGs and the government. Although it is important to properly account for control variables that might influence minimum

wage determination besides those in the theory, it always possible that some other important determinants have not identified or cannot be properly measured even if they are know. Every effort has been made to ensure that all relevant and possible controls that might also influence the minimum wage are accounted for.

Chapter 4

Income Inequality, Small Business Taxation and Lobbying

4.1 Introduction

On September 8^{th} 2015, mere weeks before the Canadian federal election, the Liberal Party leader and current Prime Minister of Canada, Justin Trudeau, said: "We have to know that a large percentage of small businesses are actually just ways for wealthier Canadians to save on their taxes…".[1] Following the controversial statement, in the subsequent weeks Canadian media featured numerous discussions by journalists, policy analysts and prominent economists on the preferential tax treatment toward small businesses, exploring the extent of what PM Trudeau was insinuating, and the potentially adverse effects this policy might have on income inequality in the country.[2]

[1] Trudeau said this in an interview with CBCs news-anchor Peter Mansbridge, CBC [2015]. The quote continues: "and we want to reward the people who are actually creating jobs, and contributing in concrete ways." The next day he defended the small business tax shelter claim: "…its high net worth individuals who incorporate…who actually use it to avoid paying as high taxes as they otherwise would." See Campion-Smith [2015].

[2] See for example Brownell [2015], Johnston [2015], Lanthier [2015], McGregor [2015], Milligan [2015, September 10], Press [2015]

For decades now in Canada, it has been possible for small businesses and the self-employed to take advantage of the differential between the lower small business income tax and the higher (top) personal marginal tax rate. A longstanding criticism of such a small business tax policy is that the wealthy take 'unfair' advantage of it by creating small corporations in order to shift their income from the individual to the small business base, reducing their personal tax obligations. In fact, Wolfson et al. [2016] have empirically documented this to be an important aspect of widening income inequality in Canada. Their calculations show that top income shares increase significantly (about 1/4) when the income earned and retained by small business owners is accounted for.

In this paper, I provide a theoretical mechanism consistent with Wolfson et al. [2016]'s calculations and which supports PM Trudeau's statement, showing how a lower small business tax rate encourages income shifting activity by small business entrepreneurs, increases the income share of the top small business earners, and thereby exacerbates overall income inequality. In the model I develop, part of the labor force consists of people who can be either workers or entrepreneurs. The government cares about the latter enough that it wants to encourage more of them to open small businesses. However, because the personal income tax is applied to all individuals in the economy, workers and small business entrepreneurs alike, and has economy wide effects, it is a less effective policy to affect the occupational choice decision and encourage small business creation. Therefore, the small business tax rate is the policy instrument that the government introduces and uses to encourage small business entrepreneurship. The focus is on a situation where the small business income tax rate (τ) is lower than the top personal rate (t), given that the divergence between those two rates has been observed in Canada since the 1960s (Figure 4.1).[3]

[3]Although in legal terminology a corporation is a person, I interchangeably use the terms "personal tax" and "individual tax" as meaning private income tax.

I supplement the model with the possibility of small businesses, organized as a special interest group, lobbying for a lower business tax rate. The possibility of 'buying' a lower tax through lobbying is consistent with empirical evidence that business taxation is the most prominent lobbying issue for corporations and companies that lobby pay lower average effective tax rates.[4] In fact, Kerr et al. [2014] show that in the U.S. taxation issues make the largest percentage of lobbying expenditures.[5] Given that all firms, whether large or small, care about taxes, the question then is: can lower tax rates be 'bought' by (small) businesses through lobbying? Chirinko and Wilson [2010] explored this question by empirically analyzing how campaign contributions affect states' tax rates. I theoretically validate their empirical findings by providing a mechanism by which a lower small business tax rate can be bought with lobbying.

Theoretical results are as follows. First, straightforward, small business owners have a clear tax incentive to shift income and the amount shifted is increasing in the difference between the personal and small business tax rates, $(t - \tau)$. Thus, small business owners always benefit from a lower business tax τ not only because this increases their after-tax income, but also because for a given t, it makes it more advantageous to retain income within their small business. A lower τ also encourages more individuals to become small business entrepreneurs in order to take advantage of the income shifting opportunity. However, the marginal entrepreneur will be the one with a lower skill. Given the systematic downward trend in small business tax rates relative to top personal rates in Canada, the possibility of income shifting likely became a more important tax avoidance mechanism through which small business entrepreneurs could retain more income within their small businesses.

[4]For example, Richter et al. [2009] show that a 1% increase in strategic lobbying expenditure by an average firm decreases the effective tax rate between .5 and 1.6 percentage points. Chirinko and Wilson [2010] find that every $1 of business campaign contributions lowers the state corporate tax by $6.65.

[5]The main small business interest group in Canada is the Canadian Federation of Independent Businesses (CFIB).

Second, following this result, small business owners, organized in a special interest group (SIG), always have an incentive to lobby the government for a lower business tax rate. I show that regardless of the government's political ideology, the small business SIG is always able to 'buy' a lower tax rate on business income through direct lobbying, i.e., by offering political contributions. Briefly, I empirically evaluate this proposition in case of Canada, providing evidence that the presence of lobbying across provinces has a significant negative influence on small business tax rates.

Third, I show that if the entrepreneurial skill is not bounded, a lower business income tax rate is income inequality neutral. However, if the skill distribution is truncated - which is a more appropriate assumption given that the lower tax rate applies only on business income up to a certain limit - this neutrality result breaks down. Then, income inequality among small business owners is negatively related to the small business tax rate. Basically, at a lower small business tax rate the top $p\%$ income share of all business incomes is first order stochastically dominated by the top income share at a higher small business tax rate. In other words, the income share of the top 1% of small business entrepreneurs unambiguously increases following a decrease in the small business tax, given that it is more lucrative to retain income within small businesses. Therefore, lobbying by the small business owners to lower their taxes exacerbates income inequality among small business entrepreneurs and contributes to an overall increase in the top income shares in the economy.

I empirically test this theoretical prediction on a panel data for ten Canadian provinces by estimating the relationship between top income shares, either top 1% or 0.1%, and the small business tax. The results show consistent evidence that the top income shares are negatively related to the small business tax for the period 1988-2013. These estimates are fairly robust across different income definitions and the period before and after the Great Recession. Also, special care is taken in panel data estimation given the low number of Canadian provinces. I employ a more robust

estimation and hypothesis testing procedure that takes into account and adjusts the possible bias in cluster robust standard errors because of small number of clusters.

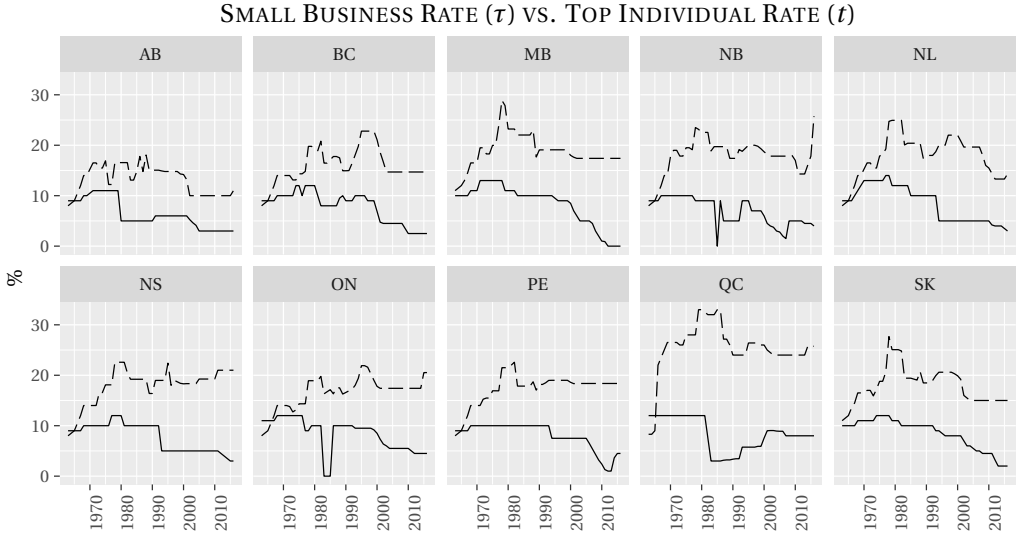

Figure 4.1: The gap between the small business income tax, τ (full line), and the top individual income tax rate, t (dashed line), has increased since the 1960s. Even in Québec, which is the only province that has recently increased it's small business tax rate, the gap remains large. Shown are only the provincial statutory tax rates.

4.1.1 Background on small business and income inequality in Canada

Various countries have a preferential corporate tax policy in place for small businesses. In Canada, a small business takes the legal form of a 'Canadian-controlled private corporation' (CCPC). A CCPC qualifies for a reduced corporate income tax rate on business income up to some threshold, currently on the first $500,000.[6] The trend across Canadian provinces and the federal government over the last several decades has been to reduce the small businesses tax rate (even faster than the general top corporate tax rate) and to provide a more generous income threshold. As pointed out

[6] A legal test for registering a business as a CCPC is that it is not controlled by a public corporation or non-Canadian residents and that its shares are not publicly traded. Investment income of CCPC does not qualify for a lower tax rate.

by Chen and Mintz [2011], this practice is in contrast to trends in most other OECD countries, which have lowered the threshold below that present in Canada. The policy rationale for a preferential, i.e., lower, corporate tax rate for small businesses rests on the 'entrepreneurship' and growth arguments: It incentivizes small business ownership which is seen as an important source of job creation and economic growth.[7]

However, in the Canadian setting, CCPCs also allow wealthier individuals to reduce their personal income taxes because the small business tax rate that applies to CCPCs is considerably lower than the top individual marginal rate. For example in Ontario in 2015, income of a small business CCPC was taxed at a combined federal and provincial rate of 15.5%, while the combined top marginal rate on individual income was 49.5%. As illustrated in Figure 4.1, this difference has widened over the years and across almost all of the provinces.

Therefore, having a lower tax rate available to small businesses provides a clear and relatively simple opportunity to reduce individual (owners') income taxes by retaining income within CCPCs and thereby shifting the tax burden from the higher personal to a lower business earnings base.[8] By combining income from CCPCs and individual tax returns, Wolfson et al. [2016] have looked at the use of CCPCs among the wealthy exactly for this purposes.[9] They find that income earned and retained by CCPC owners was highly skewed toward the rich during the 2001-2011 period. Specifically, for the top 1% income group, around 60% are CCPC owners and for the top 0.01% around 85% are CCPC owners.

[7]Further arguments in favor of a reduce tax point out that small businesses are at a financing disadvantage due to market failures - debt finance is usually unavailable and access to capital finance is limited - making the retained earnings the only reliable source of financing. See Mallett [2015] for a discussion. For an in-depth discussion of small business taxation issues see Crawford and Freedman [2010].

[8]On top of this, it is also possible to use CCPCs as income-splitting vehicles where 'dividend sprinkling' and salary compensation for family members are techniques employed. See Wolfson and Legree [2015] for a discussion of these tax avoidance activities.

[9]Their data links CCPCs' tax returns with their owners individual income tax returns, for the period 2001-2011. This creates a 20% sample of income tax returns supplemented with corporate ownership and CCPC income information.

The possibility of retaining and shifting income to a lower taxed base by the wealthiest individuals in the economy has important consequences for understanding income inequality levels and trends. By now it is well documented that income inequality has widened in North America in the last 30 years. See Atkinson et al. [2011], Saez and Veall [2005], Veall [2012] and references therein. But unlike in Canada, the U.S. top individual tax rates are lower than the corporate ones making small businesses a less advantageous vehicle for tax avoidance purposes.[10] The most important question that the Wolfson et al. [2016] study addresses is: to what degree does including income earned and retained within CCPCs affect income inequality measurements? They document that omitting income retained by CCPCs significantly underestimates the top income shares. When this income is included, the top 1% income share in Canada in 2011 increases from 10% to 13.3%, and the share of the top 0.01% almost doubles, from 1.3% to 2.1%. Furthermore, once the CCPC income is accounted for, the top income shares are shown to have grown at a faster rate over the 2001-11 decade, which is of empirical relevance for this paper.

4.1.2 Related Literature

Although income shifting via private corporations has been an important feature, or rather a byproduct, of the small business tax policy in Canada for decades, not a lot of research has gone into understanding the mechanisms and consequences of such a policy setup. The contribution of this paper is in presenting an intuitive mechanism of the impact that income shifting through small businesses has on income inequality.

When studying income shifting within corporations, the literature has generally focused on cross-border income shifting and the use of corporate debt policy as an

[10] Furthermore, besides having higher corporate tax rates than Canada, the U.S. has a 'repatriation tax' on foreign profits and does not integrate its corporate tax with shareholder taxes to avoid double-taxation. Canadian sales and property tax systems mostly exempt business inputs. The U.S. does not. See McBride [2014] for a brief overview of the extent and degree that Canada's business taxes are different i.e., lower.

instrument used to shift income between different subsidiaries in multiple jurisdictions. For example, in the Canadian context, Mintz and Smart [2004] study income shifting of corporations by way of lending and borrowing among their provincial affiliates. They find that firms that are able to do so avoid a substantial amount of provincial corporate taxes and reduce the provincial tax base. Firms that are able to shift income in such a way are strongly responsive to provincial corporate tax rates and tax distortions.

On an individual level, existing literature focuses mostly on income splitting and tax planning techniques around family and individual income taxation, but does not explicitly take into account the extent of income shifting within an existing corporation, between personal and business income tax bases. For instance, Bauer et al. [2015] consider the "kiddie tax", a policy effective in Canada since 2000 aimed at preventing the flow of dividends from CCPCs to minor children as an income splitting technique to reduce the parents' tax obligation. They find it to be an "effective method to deter income splitting." Also in the Canadian setting, Schuetze [2006] analyzes income splitting among self-employed couples. However, the focus in that study is on the *illegal* income splitting and he is able to provide evidence of serious income tax evasion among self-employed men and their wives.

Even less research has gone into measuring and understanding the extent and consequence of income splitting and shifting for income inequality. Similar in focus to this paper's topic is Gordon and Slemrod [1998], who investigated the extent of income shifting but in the opposite direction to that in Canada; from the corporate tax base to the personal one. This type of income shifting was observed as a result of declining personal tax rates relative to the corporate ones in the 1980's U.S.. The authors note the possible impact of this on personal income inequality. The discussion in the earlier work of Gordon and MacKie-Mason [1995] recognizes the importance of income shifting opportunities for an increasing trend of top income shares, particularly

within the U.S. context. More recently, Sivadasan and Slemrod [2008] empirically evaluate the extent of this type of income shifting in the context of a developing country, India. Their focus is on an incentive to shift income from profits to wages in partnership firms, induced by an Indian tax policy reform in 1992, and find a strong behavioral response to this tax incentive. They also show this tax policy change, which eliminated the penalty on wages paid to partners, had an impact on measured wage inequality; almost all of the increase in the skill premium and the white-collar share of the wage bill is a result of income shifting by partnership firms.[11]

In the most recent study similar to Wolfson et al. [2016], Alstadster et al. [2016] also link business' income to their owners' personal one in the case of Norway. They evaluate the effect of retained business earnings on the traditional measures of top income shares and find the same result as in Canada: The income share of the top 0.1% more than doubles.

The paper proceeds as follows. Section 4.2 presents the theoretical model of income shifting and lobbying for a lower business tax rate. Section 4.3 derives the effect of lowering the small business tax rate on income inequality, especially when the business tax rate is below the personal one. Section 4.4 empirically evaluates some of these predictions. Section 4.5 summarizes and concludes.

4.2 Theory of Income Shifting

The economy consists of risk-neutral individuals who possess an innate entrepreneurial skill $s > 0$, with a CDF $H(s)$ on an interval $[\underline{s}, \bar{s}]$. Each individual has to decide whether to become a small business entrepreneur, who earns an income in the form of profit π, or remain as a worker, earning an effective wage income w. In both cases, the individual pays a personal income tax (PIT) t. However, to capture the PM Trudeau's

[11] These, however, make a relatively small part of the Indian economy, making it difficult to quantify and generalize the contribution of this increase in inequality to overall income inequality in India.

view that small business owners can engage in income shifting, entrepreneurs also have the possibility of shifting their income between the personal and business tax base, but at a cost. On the part of the income declared (retained) as business income, each small business owner pays a business income tax (BIT) τ. Essentially, individuals with high enough s would want to become entrepreneurs to earn a higher income and pay a lower tax on it.

The effective wage w also implicitly applies to a group of workers that do not have an entrepreneurial skill s and are simply workers. These could be high paid managers and other professionals, for example, who benefit from the w increase, but do no change their occupational choice. Although, τ is essentially a corporate profit tax rate, the focus is only on the small businesses and therefore τ is taken to be the tax rate applying only on small business profits.[12]

It is assumed that $1 > t > \tau$ so that business income is shifted out of the personal and into business income tax base. This condition on the tax rates is what we observe in Canada and across Canadian provinces since 1965 and we want the theory to reflect that situation (Figure 4.1).[13] I start by deriving optimal profit shifting and occupational choice, respectively.

Small-business owners earn their income π by combining their entrepreneurial skill s with an overall production technology in the economy available to all entrepreneurs, denoted by A. This free parameter includes all the technological components necessary for production, such as capital and labor inputs, and it is assumed for simplicity of theoretical results. If an entrepreneur with skill s starts a small business, her before-tax 'profit' is simply $\pi(s) = sA$. Therefore, her optimization problem for profit

[12]Thus, I avoid the use of a more standard 'corporate income tax' terminology to distinguish small businesses from big corporations.

[13]It is also correct that the overall corporate profit tax rates are several percentage points above those applying to small business profits.

shifting is

$$\max_{\theta} \quad \underbrace{sA}_{=\pi} - t\left[sA - \theta\right] - \frac{\theta^2}{2\pi} - \tau\theta,$$

where θ is the amount of taxable income shifted to the business income base while $\frac{\theta^2}{2\pi}$ represents the convex cost of income shifting. This cost structure reflects the non-trivial tax and regulatory compliance expenses involved with aggressive tax planning and avoidance (e.g. paying tax accounting, legal and administrative fees) which could increase with the taxable income being "split" and increasing tax savings. Also, in Canada, some studies found these compliance costs to be non-linear and larger for small businesses relative to large corporations.[14] The presence of these costs also underlines that undertaking tax avoidance through income shifting should be justified and well worth in terms of a large tax rate differential.

Given the assumption $t > \tau$, the entrepreneur shifts income into the business income tax base and $\tau\theta$ is the business tax paid on the shifted income. The first-order condition gives:

$$\theta^*(s, t, \tau) = (t - \tau)sA. \tag{4.1}$$

This intuitive result means that optimal business income shifting is a function of the difference between PIT and BIT rates. It follows naturally that $\frac{\partial\theta^*}{\partial\tau} < 0$: lower τ increases the gap between t and τ and therefore the return on profit shifting. Also, the amount of profit shifting is positively related to the entrepreneurial skill as long as $t > \tau$.

Although the above result does not contain an explicit formulation for labor demand, the theoretical results presented below are still valid with a more traditional approach of specifying small business profit as $\pi(s, l) = sf(l) - wl$ where l is homogeneous labor, w is wage paid to workers, and $f(l)$ a concave production function, such as Al^{α}.

[14] Business compliance costs have been estimated approaching $20 billion and majority borne by small business with less than 20 employees. See Mallett [2015].

Functional expressions and algebra are more complex in this setup, but the intuition and comparative statics carry through.

4.2.1 Occupational Choice

Because individuals are risk-neutral in this economy, their occupational choice is a function of the difference between the two tax rates and not risk aversion. Each individual has two choices. She can become a small business entrepreneur earning an after-tax-and-shifting income

$$(1-t)sA + \theta(t,\tau)(t-\tau) - \frac{\theta^2(t,\tau)}{2\pi} = \left(1 - t + \frac{(t-\tau)^2}{2}\right) sA \tag{4.2}$$

using eq. (4.1). Otherwise, as a worker she can earn an after-tax labor income at a fixed wage, $(1-t)w$. The cutoff value s^*, denoting the marginal individual who is indifferent between becoming a small business entrepreneur or a worker, is derived by setting these two incomes equal to each other. The necessary condition is then simply

$$(1-T)\, s^* A = (1-t)w \tag{4.3}$$

where $T := t - \frac{(t-\tau)^2}{2}$ for notational simplicity. Equation (4.3) can naturally be interpreted as the equality between the net-of-tax-and-shifting profit income and net wage income.[15]

Additionally, eq. (4.3) can be interpreted as the zero rent condition. Specifically, given that small business owners derive their income from entrepreneurial skill s, and each small business owner can always abandon his firm and become a worker, the

[15]The left-hand side of eq. (4.3) is monotonically increasing in s, while w is assumed constant for all workers who choose not to become entrepreneurs. Then, it is assumed that the conditions $(1-T)\underline{s}A < (1-t)w$, and $(1-T)\bar{s}A > (1-t)w$ are satisfied, so that the lowest skilled individual never becomes a small business owner.

entrepreneurial skill (business) rent earned by a small business owner is defined as

$$r(s) = (1 - T)\pi(s) - (1 - t)w. \tag{4.4}$$

It is the difference between the small business income and what the individual can earn by becoming a worker. In equilibrium, the marginal small business owner s^* earns zero rent, $r(s^*) = 0$. Then, as in Kuhn [1988], all individuals above s^* are small business owners who earn positive rent, while all individuals below s^* are workers.

Notice that without the possibility for profit shifting, i.e., when $(t = \tau)$, the last term in the bracket of eq. (4.2) is zero and $\pi^* = w$. Intuitively, the opportunity to shift profit between the personal and business income base influences who engages in small business entrepreneurship. When income shifting is not available, the proportion of entrepreneurs and workers in the economy is fixed. Solving eq. (4.3) for s^* yields:

$$s^*(t, \tau) = \left(\frac{w}{A}\right)\left(\frac{2(1 - t)}{2(1 - t) + (t - \tau)^2}\right). \tag{4.5}$$

As indicated earlier, I assume that $1 > t > \tau$ throughout. Then, the comparative statics on eq. (4.5) show the following,

$$\frac{\partial s^*}{\partial \tau} = \frac{w}{A}\left[\frac{4(1 - t)(t - \tau)}{[2(1 - t) + (t - \tau)^2]^2}\right] > 0. \tag{4.6}$$

When τ increases. there are two mechanisms at work in this result: (1) the tax paid on entrepreneurs' profit income is higher and (2), for a given t, the $(t - \tau)$ difference is reduced, lowering the value of income shifting. With a higher tax on business income, less workers choose to become small business owners and only more skilled individuals engage in entrepreneurship. In other words, a higher skill is required to become an entrepreneur when the small business income tax (τ) increases and the benefit of

income shifting $(t-\tau)$ is lower. Furthermore,

$$\frac{\partial s^*}{\partial t} = -2\frac{w}{A}\left[\frac{(t-\tau)^2 + 2(1-t)(t-\tau)}{\left[2(1-t)+(t-\tau)^2\right]^2}\right] < 0. \tag{4.7}$$

As t rises. more workers choose to become entrepreneurs for two reasons: (1) as workers they pay a higher tax on labor income and (2) although the tax payment on profit income earned as entrepreneurs increases as well, the value of shifting income also increases, everything else remaining constant.

The difference $(t-\tau)$ indicates the value of (the 'return' on) income shifting and retaining income within the small business. Then,

$$\frac{\partial s^*}{\partial (t-\tau)} = -\frac{w}{A}\frac{4(1-t)(t-\tau)}{\left[2(1-t)+(t-\tau)\right]^2} < 0, \tag{4.8}$$

indicating that a higher return on profit shifting enables the marginal entrepreneur to be a less skilled individual. It is also straightforward to check that $\frac{\partial s^*}{\partial w} > 0$. The marginal small business owner will be a more skilled individual and less people will become small business entrepreneurs because at a higher wage the lower skilled ones will choose to remain as workers earning a higher labor income.[16]

Finally, aggregate small business income is defined as

$$\Pi(s^*) = \int_{s^*}^{\bar{s}} \pi(s)h(s)\mathrm{d}s = A\int_{s^*}^{\bar{s}} sh(s)\mathrm{d}s. \tag{4.9}$$

Comparative statics useful for later analysis indicates that $\frac{\partial \Pi}{\partial s^*} < 0$. Changes in τ change the set of small business owners. Clearly, when less people choose to become entrepreneurs, the aggregate business income shrinks. Notice that with w being exogenous in this setup, maximizing the aggregate after-tax-and-shifting small

[16] In the case where labor is an input in small business production, profit falls when w increases, meaning that only higher skilled entrepreneurs can earn a positive profit income. The rest remain as workers earning labor income and the supply of workers increases.

business income is equivalent to maximizing the aggregate rent income from eq. (4.4). We can then say that small business owners want to maximize their skill rent by obtaining a lower τ.

4.2.2 Setting the Small-Business Income Tax Rate

The working of the model so far can be summarized as follows. Individuals observe a set of tax rates (t, τ) and decide whether to become small business owners or workers. This determines the cutoff value $s^*(t, \tau)$. In turn, small business owners choose optimal income shifting θ to maximize their income given (t, τ).

Given these behaviors, what is the government's tax policy? The government observes the proportion of workers and small business owners in the economy and chooses tax rates to maximize its revenue. Although the government is aware of the income shifting opportunity for small businesses, it is considered too costly in terms of direct monitoring and compliance resources to directly reduce or prevent it.[17] It collects the revenue from:

- small business entrepreneurs: $t\left[\Pi(s^*(t,\tau)) - \Theta(s^*(t,\tau))\right] + \tau\Theta(s^*(t,\tau))$,
- workers: $twH(s^*)$,

where $\Theta(s^*)$ is the aggregate amount of small business income retained as profit, defined as:

$$\Theta\left(s^*(t,\tau)\right) = (t-\tau)\int_{s^*}^{\bar{s}} sAh(s)\mathrm{d}s = (t-\tau)\Pi(s^*(t,\tau)).$$

Government's objective function is a weighted sum of business and labor income tax revenue:

$$G(t,\tau) = \left(t - (t-\tau)^2\right)\Pi(s^*(t,\tau)) + \lambda twH(s^*), \tag{4.10}$$

[17] Note also that in the Canadian case, establishing a CCPC and taking advantage of the lower small business tax rate are all legal ways to reduce tax obligations, sanctioned by the government's tax policy.

where $\lambda > 0$ is the 'political' weight the policymaker attaches to revenue collected from workers. The weight put on the revenue from small business is always one. This captures in a simple way the political ideology of the government in power and thus the possibility that different governments are relatively more or less business friendly. Note that how much the government cares about small business owners is negatively related to λ.[18]

To analyze the government's simultaneous decision on t and τ requires a more precisely specified model. Therefore, in order to focus on the effects of the small business profit tax τ, I take the initial value of the personal income tax as given. The government chooses τ to maximize $G(t_\circ, \tau)$ in eq. (4.10) given the restriction that $t_\circ \geqslant \tau \geqslant 0$, which could simply reflect the political environment such that the values of two tax rates cannot be reversed. Also, observe from Figure 4.1 that this is empirically valid across Canadian provinces. By setting τ, the government influences the decision to become a small business owner according to eq. (4.5). Focusing on the interior solution for this problem, the first-order condition is

$$2(t_\circ - \tau_\circ)\Pi(s^*) + \left(t_\circ - (t_\circ - \tau_\circ)^2\right)\frac{\partial \Pi}{\partial s^*}\frac{\partial s^*}{\partial \tau} + \lambda t_\circ w h(s^*)\frac{\partial s^*}{\partial \tau} = 0, \tag{4.11}$$

which gives the initial, optimal small business tax rate $\tau_\circ$ without lobbying.

Notice that only the last term depends positively on λ. That means if there is a small decrease in λ, indicating the government is relatively more business friendly and less concerned about collecting tax revenue from workers' income, the F.O.C. with the initial $\tau_\circ$ solution becomes negative. Only a lower τ will now satisfy the F.O.C. for an interior solution. In other words, a lower λ government is a more business friendly

[18] Although there are no explicit re-election concerns here, we can also interpret λ as a given policymaker's constituents ideology, as in a standard principal-agent relationship.

government that will want to further reduce the business income tax from the initial $\tau_\circ$, conditional on $t > \tau$ remaining true.[19]

It is of some interest to highlight the mechanism through which this happens. On the one hand, reducing τ increases the value of income shifting for small business owners and the government loses $(t_\circ - \tau)\theta$ tax revenue. On the other hand, lower τ induces more individuals to open small businesses who collectively pay more in tax revenue. Then, a business friendly government naturally wants to encourage more people to become small business entrepreneurs and collects its revenue from their aggregate income.

A labor-friendly government, such as Trudeau's Liberal government in Canada, might be concerned about the extent of income shifting opportunities and would accordingly want to increase τ, reducing the return on income shifting and the proportion of individuals who decide to become small business owners motivated by this possibility. Recall that lower τ encourages individuals with lower entrepreneurial skill s to become small business owners (see eq. (4.6)).

4.2.3 Buying a Lower Tax Rate

The previous subsection has illustrated that when the government becomes more business friendly τ will be lowered and the proportion of business owners in the economy will increase. Regardless of the government's ideological preference, small businesses might try to obtain an even lower τ through lobbying. As was discussed in the introduction, Chirinko and Wilson [2010] evaluated empirically the question whether lower business tax rates can be bought. In this subsection, I show that they can indeed be bought and provide some theoretical context to this result.

[19] Technically, a corner solution, where the government does not allow for profit shifting, is possible if λ is sufficiently high. When two tax rates are the same, the first term on the left-hand side of eq. (4.11) is zero, the second term is still negative whereas the last term is positive. If λ is sufficiently high, it could make the whole left-hand side positive at $t = \tau$.

Small-business owners derive income from their entrepreneurial skill and in that sense s represents a kind of sector specific factor of production benefiting only the small business 'industry'. Suppose small businesses are organized in a special interest group (SIG) whose goal is to maximize the aggregate after-tax-and-shifting rent of their members, defined above as the difference between their 'profit' and labor earnings as workers.

As a SIG, they offer political contribution c to the policymaker to obtain a lower τ. Thus, the SIG's problem is

$$\max_{\tau} \left(1 - T(t,\tau)\right) \Pi(s^*(t,\tau)) - c \quad \text{subject to} \quad G(t_\circ,\tau) + c \geqslant G_\circ(t_\circ,\tau_\circ) \tag{4.12}$$

where $T(t,\tau) := t - \frac{(t-\tau)^2}{2}$ and $G_\circ(t_\circ,\tau_\circ)$ is the policymaker's revenue collected with the initial tax rates ($t_\circ$ and $\tau_\circ$) from eq. (4.11). As is standard in this type of principal-agent problem, the government policymaker can always refuse the contribution offered and set the tax rate τ to collect the initial tax revenue $G_\circ(t_\circ,\tau_\circ)$ without lobbying influence.

Although the lobbying structure is rather simple, with one party lobbying unopposed, it does not appear that the question of small business taxation in Canada is a highly prominent public issue, attracting various interests to the debate.[20] The public opinion consensus is that having a lower tax for small businesses is a desirable policy. This is in contrast to some other public policies such as sales taxes and minimum wage, which are very prominent topics and attract a wide variety of special interests in favor and in opposition.

Following the Grossman and Helpman [2001] argument, in the political equilibrium tax policy must be jointly efficient for the SIG and the policymaker.[21] Since there is

[20] Canadian Federation of Independent Business advocates and lobbies for lower taxes on behalf of small businesses.

[21] Note that this tax policy is not necessarily Pareto efficient for the whole economy, including the workers who are not lobbying, but simply jointly efficient policy such that there is no other policy and political contribution that can make either party better off, without harming the other.

only one lobbying SIG, offering political contributions can take the form of a take-it-or-leave-it offer; a tax rate and monetary contribution pair, τ and c respectively. Rewriting the policymaker's binding constraint, using eq. (4.10), we can obtain the optimal contribution that needs to be offered by the SIG:

$$c = G_\circ(t_\circ, \tau_\circ) - \left(t_\circ - (t_\circ - \tau)^2\right) \Pi(s^*(t_\circ, \tau)) - \lambda t_\circ w H(s^*(t_\circ, \tau)). \tag{4.13}$$

The unconstrained max problem for SIG is now

$$\begin{aligned}\max_\tau \left(1 - t_\circ + \frac{(t_\circ - \tau)^2}{2}\right) \Pi(s^*(t_\circ, \tau)) - G_\circ(t_\circ, \tau_\circ) \\ + \left(t_\circ - (t_\circ - \tau)^2\right) \Pi(s^*(t_\circ, \tau)) + + \lambda t_\circ w H(s^*(t_\circ, \tau)),\end{aligned} \tag{4.14}$$

and the first-order condition is

$$\begin{aligned}-(t_\circ - \tau)\,\Pi(s^*) + \left[1 - t_\circ + \frac{(t_\circ - \tau)^2}{2}\right] \frac{\partial \Pi}{\partial s^*} \frac{\partial s^*}{\partial \tau} + \\ + 2(t_\circ - \tau)\Pi(s^*) + \left(t_\circ - (t_\circ - \tau)^2\right) \frac{\partial \Pi}{\partial s^*} \frac{\partial s^*}{\partial \tau} + \lambda t_\circ w h(s^*) \frac{\partial s^*}{\partial \tau}.\end{aligned} \tag{4.15}$$

Focusing on the interior solution for eq. (4.15) we have the following proposition.

Proposition 4.2.1. *The τ rate set under the lobbying influence of the small business SIG is lower than the initially optimal solution $\tau_\circ$ set without lobbying regardless of political preference.*

Proof. Observe that the first and second terms in the first line are negative (because $\frac{\partial \Pi}{\partial s^*} < 0$) while the remaining terms in the second line are the same as in eq. (4.11). That means if we evaluate eq. (4.15) at $\tau = \tau_\circ$, the second line is equal to zero and the F.O.C. is negative. That is, the F.O.C. can now be satisfied only for a $\tau < \tau_\circ$. □

Through lobbying the SIG is able to buy a business income tax rate lower than the policymaker's initial revenue maximizing rate $\tau_\circ$. This corresponds to the empirical

result in Chirinko and Wilson [2010]. Denote the BIT set under the lobbying influence as $\tilde{\tau}$ and proposition 4.2.1 shows that $\tilde{\tau} < \tau_{\circ}$. As the government becomes relatively more business friendly λ decreases and the F.O.C. eq. (4.15) becomes negative at $\tilde{\tau}$, which means that the new BIT that will satisfy the F.O.C., denoted $\tilde{\tau}'$, must be lower than the original one. Conversely, when λ increases because the government is more labor friendly, $\tilde{\tau}' > \tilde{\tau}$. However, regardless of the ideological preference the government in power has, small business SIG can always buy a lower tax rate.

4.2.4 Small Business Tax Lobbying in Canada

Although it is not the main focus of the data analysis, I briefly empirically evaluate Proposition 4.2.1. Ideally, testing Proposition 4.2.1 in the Canadian case would proceed in a manner similar to Chirinko and Wilson [2010]'s analysis of the effect that political contributions by business groups have on determining state tax policy in the U.S., although their focus was on campaign contributions. However, no political contribution or direct lobbying expenditure data are publicly recorded in Canada for business groups, either on the federal or provincial level, which makes replicating their analysis difficult.

Instead, I proceed in the following way. I create an indicator variable across provinces for the years when the small business interest group was active in a given province and was believed to be actively lobbying. The Canadian Federation of Independent Businesses (CFIB) is the most prominent and vocal such organization in Canada. It was founded in 1971 as a reaction to the federal government's proposal to abolish the reduced small business tax rate.[22] CFIB very prominently indicates on its website that lobbying and advocating for "better taxes" is the key activity conducted

[22]This was part of the 1966 Royal Commission on Taxation, also know as the Carter Commission. Some recommendations were proposed for implementation in the federal government's White Paper on Taxation in 1969. This started a public debate and provoked the small business owners to rally against the proposed repeal of the reduced profit tax rate. CFIB was born out of this protest in 1971. See Hale [2002].

on behalf of its members. It currently has offices in all ten provinces and at the federal level in Ottawa. Therefore, the presence of CFIB in the province is taken as a signal of its lobbying activity.

I construct a dummy variable indicating the years when the CFIB is believed to have been lobbying the provincial government for the small business tax, starting with the year when it opened its office in a given province.[23] Of course, this variable only roughly captures the influence lobbying might have on the provinces' small business tax policy. We know that small business owners organized and were influential in 1971 tax reform, pushing for the small business deduction which reduces the federal corporate tax rate up to a certain business income limit.

Let $BIT_{r,s}$ represent the small business tax rate in province r in year s. I then estimate an equation of the form

$$BIT_{r,s} = \alpha_1 LD_{r,s} + \mathbf{\Gamma}_{r,s}\boldsymbol{\gamma} + \mathbf{\Sigma}_{r,s}\boldsymbol{\sigma} + \theta_r + \epsilon_{r,s}. \tag{4.16}$$

The dependent variables used is either the provincial statutory rate, which captures the actual provincial government's tax policy toward small businesses, or a combined federal and provincial rate prevailing in each province. The independent variables $LD_{r,s}$ is the lobby dummy, indicating the presence of CFIB in the province r after it opened its office in year s. A negative coefficient α would be indicative that the small business tax decreases in the presence of a lobbying SIG in the province. The vector $\mathbf{\Gamma}_{r,s}$ contains time-varying provincial political control variables, other than the lobbying dummy. These include the election year dummy (coded as "1" for the provincial election year), provincial governments' political ideology, and the Herfindahl-Hirschman Index (HHI) of political competition in the provincial parliament.

[23] Chronologically, after its founding in 1971 in Ontario, CFIB opened a provincial office in British Columbia (1980), Nova Scotia and Quebec (1981), Alberta (1983), Saskatchewan (1985), Manitoba (1986), New Brunswick (1995), Newfoundland and Labrador (2003), and Prince Edward Island (2007).

The political ideology variable is the one employed in Lesica [2016] for 1965-2014 period, constructed following the methodology in BjØrnskov and Potrafke [2012]. See Figure C.3 in appendix C for values across provinces. A given political party in each province is assigned an ideological score on a right-left scale, with 1 being right-wing and -1 left-wing, weighted by each party's parliamentary seat share.[24] When party leadership changes or an election happens, a given provincial government's political ideology also changes. The ideology index follows standard features of the left-right political spectrum on economic issues in Canada.

The HHI captures the concentration of party seats in each provincial parliament, while also accounting for each party's ideological deviation from the overall parliament's ideological score. This controls for the level of political competition, which can stimulate policy changes when there is more pressure on the incumbent party from its rivals. An HHI=0 means that one party holds all the seats in the parliament and has ideological monopoly on policymaking, facing no political pressure.[25] HHI is also an indicator for a provincial government being either a majority or a minority one. See Lesica [2016] for more details on these two political variables.

$\mathbf{\Sigma}_{r,s}$ is a vector of provincial economic variables, including provincial real GDP (deflated by provincial CPI, 2013 dollars) and the average regional small business tax. The first is self-explanatory. The second calculates average regional τ across three standard regions in Canada: Atlantic (NL, PEI, NS, NB), Central (ON, QC) and West (MB, SK, AB, BC). For each province, the yearly *regional* small business tax is calculated as the average of all other provinces' τ in the region excluding that province.

[24] Specifically,

$$[\text{Political Ideology}]_{rs} = \frac{\sum_p i_{ps} S_{prs}}{\sum_p S_{prs}},$$

where S_{prs} is the number of seats party p has in province r in year s. Depending on the province, scores across parties change, but fall within certain ranges: $NDP = \left[-1, -\frac{2}{3}\right]$, $Liberal = \left[-\frac{1}{3}, 0, \frac{1}{3}\right]$, $Conservative = \left[\frac{1}{3}, 1\right]$.

[25] This was the case in New Brunswick during 1988-91, when the Liberal Party under Frank McKenna won all 58 seats in the legislature. The parliament's ideology was equivalent to the Liberal's and HHI=0 in those years.

Table 4.1: DETERMINANTS OF PROVINCIAL SMALL BUSINESS TAX RATE, 1971-2013

	Dependent variable:			
	Provincial SBIT		Combined SBIT	
	(1)	(2)	(3)	(4)
Lobby Dummy	−4.710***	−2.300**	−6.530***	−3.310***
	(.165)	(.801)	(.347)	(.958)
	$p = 0.00000$	$p = .020$	$p = 0.00000$	$p = .008$
Political Ideology	.925	1.370	1.210	1.940
	(1.460)	(.743)	(1.910)	(1.120)
	$p = .552$	$p = .111$	$p = .548$	$p = .128$
Election Dummy		−.010		−.013
		(.174)		(.224)
		$p = .956$		$p = .954$
HerfindahlHirschman Index		3.650		8.290*
		(3.410)		(3.850)
		$p = .347$		$p = .100$
Provincial Real GDP		−.00001		−.00001
		(.00001)		(.00001)
		$p = .522$		$p = .325$
Regional SBIT		.529**		.684**
		(.178)		(.242)
		$p = .024$		$p = .029$
Observations	430	430	430	430
Adjusted R^2	.387	.561	.437	.640
F Statistic	138.000***	96.300***	171.000***	137.000***

Note: *p<0.1; **p<0.05; ***p<0.01
Reported are cluster-robust standard errors and p values.
See the empirical section 4.4 for details on these calculations.

This controls for the effect of inter-provincial tax competition and comparisons within the region. A positive sign would be indicative of the province adjusting its small business tax in the direction of its neighboring provinces.

In estimating the specification in eq. (4.16) I follow the strategy in Green and Harrison [2010] and Lesica [2016], who analyzed the political economy of minimum wage setting using a panel data for ten Canadian provinces since the 1960s. Given the panel data regression design, all specifications include province fixed effects, but not necessarily year fixed effects. As Green and Harrison [2010] indicate, long run patterns in the tax variable can be absorbed by year dummies, and those are the ones to be captured here. Identification comes from within-province over-time variation

and aggregate time variation. All estimation is for the period 1971-2013, following the 1971 tax reform in Canada and formation of CFIB.

Results in Table 4.1 indicate that lobbying might actually have a significant negative effect on provincial small business tax rates. Under columns (1) and (2), the dependent variable is the provincial statutory small business tax rate, while under (3) and (4) it is the combined rate. Reported p-values and cluster-robust standard errors, clustered by province, are computed with bias-reducing adjustments made for the fact that there are only a few independent clusters, i.e., ten provinces. The details on these corrections are discussed in the empirical section 4.4.

The coefficient on the lobbying dummy is negative and significant across all specifications. The political ideology is not significant, however, while the positive sign is interesting to interpret. Two points can be made. First, it is not necessarily surprising to see that, in the Canadian political context, a more left oriented government would decrease the small business tax. For example, in 2015 the social-democratic and very labor-friendly NDP was proposing to reduce the small business tax more than the Conservative party, traditionally very business friendly, already did. See Raj [2015]. Reducing the small business tax is seen as helping the hard working 'little guy' and middle class business owners. The NDP was also a strong critic of Justin Trudeau's comments regarding the small business owners taking advantage of the lower tax rate for tax acoidance purposes. Second, recall that Proposition 4.3.2 implies that the government's ideological preference does not matter for the small business lobby to obtain a lower tax rate. The only other variable that is showing significance across specifications, is the average regional small business tax. The positive coefficient is indicative of the effect small business tax rates in the region have: a decrease in the neighboring province's small business rate can induce other provinces to follow. This empirical analysis is exploratory and only presents suggestive evidence that the small business tax decreases in the presence of a lobbying SIG, such as the Canadian

Federation of Independent Businesses. For a more serious analysis with credible causal interpretation, a more precise measurement of the lobbying influence by the CFIB across provinces is needed.

4.3 Small Business Taxation and Income Inequality

Basic theoretical results from section 4.2 indicate that small business owners and their SIG benefit from a decrease in τ because (1) $s^*(t,\tau)$ decreases and more people open small businesses and (2) for a given t, the return on income shifting between two tax bases is larger, increasing the aggregate small business profit retained, $\Theta(s^*)$, and the after-tax income.

Define the ratio $R(p,\tau)$ as the share of the top $p\%$ income in total business income:

$$R(p,\tau;t) = \frac{(1-T)\int_{s_p}^{\bar{s}} \pi(s)h(s)\mathrm{d}s}{(1-T)\int_{s^*}^{\bar{s}} \pi(s)h(s)\mathrm{d}s}, \tag{4.17}$$

where p denotes any percentile income group. The personal income tax t is taken as fixed and I suppress it in the further notation for R. For example, $p = 0.01$ is the cutoff skill above which only the top 1% incomes are considered. In this setting $R(p,\tau)$ is taken as a measure of income inequality, among small business owners. The share of income going to the top earners may increase, increasing income inequality, for a variety of reasons, some of which may be entirely meritocratic and desirable.[26] However, we have also seen that small business owners always have an interest in lowering τ because it increases their aggregate after-tax-and-shifting profit income

[26]For example, entrepreneurial skill can increase because of more education or access to better technology. Entrepreneurial ability can also improve with experience, allowing some individuals to successfully undertake more risky business projects, which can be handsomely rewarded in the market.

$(1-T)\Pi(s(t,\tau))$. Then, one straightforward implication of this is that a lower τ can increase the share of income going to business owners.

Of primary interest is to evaluate how $R(p,\tau)$ changes when τ changes, and more precisely does $R(p,\tau)$ increase when τ decreases? To evaluate more clearly how lowering τ affects income inequality, measured by the top $p\%$ share of income, we need to specify the functional distribution of s. In turn, this enables us to derive the specific form of the aggregate profit function $\Pi(s^*(t,\tau))$. I consider two possibilities, unbounded and truncated Pareto skill distribution.

4.3.1 Unbounded Pareto Skill Distribution

The entrepreneurial skill s is distributed with a Pareto CDF (PDF) $H(s)$ $(h(s))$ over an interval $[1,\infty]$:

$$H(s) = 1 - \left(\frac{1}{s}\right)^z \quad \text{and} \quad h(s) = \frac{z}{s^{1+z}},$$

where $z > 1$ is the shape parameter governing the skill level distribution. The lower the z the heavier the upper tail of the distribution and the proportion of individuals with high entrepreneurial skill is greater. Then, aggregate after-tax business income takes the form

$$(1-T)\Pi(s^*) = (1-T)\int_{s^*}^{\infty} \pi(s)h(s)\mathrm{d}s = (1-T)\frac{Az}{z-1}s^{*1-z} \tag{4.18}$$

where T is defined as earlier. Equation (4.18) is similarly defined for a higher cutoff $s_p > s^*$, as in the numerator of eq. (4.17), denoting aggregate business income of a higher income percentile group, such as top 1% or 5%. It is easy to check that $\frac{\partial \Pi}{\partial s^*} < 0$.

To derive an expression for the income ratio in eq. (4.17) under an unbounded Pareto distribution, we have to find the value of s_p. This is found by solving

$$\frac{H(s_p) - H(s^*)}{1 - H(s^*)} = 1 - p$$

which, after some simplifying, gives the higher cutoff value

$$s_p(t, \tau) = \frac{s^*(t, \tau)}{p^{1/z}}. \tag{4.19}$$

The following neutrality proposition then follows immediately.

Proposition 4.3.1. *When the entrepreneurial skill distribution $H(s)$ takes the form of an unbounded Pareto distribution, the income inequality is independent of the business income tax τ.*

Proof. Combining eqs. (4.17) and (4.18) gives $R(p, \tau) = \frac{s_p^{1-z}}{s^{*1-z}}$. Now, even though both $s^*(t, \tau)$ and $s_p(t, \tau)$ are functions of the two tax rates, substituting in that expression eq. (4.19) results in a constant ratio $R(p, z) = p^{\frac{z-1}{z}}$. □

We have seen that when the government becomes more business-friendly it will decrease τ and when small business are organized into a special interest group and lobby the government, they will induce a further reduction in τ, regardless of government's political preference. In a sense, a SIG able to buy a lower tax rate. Proposition 4.3.1, however, indicates that with the unbounded skill distributions, this lower τ rate is income inequality neutral.

The lower τ applies only to business incomes earned up to a certain limit.[27] Considering this, with an unbounded skill distribution and given the small business

[27] Specifically, in Canada, private Canadian-controlled Corporations (CCPCs) earning up to $500,000 in a given tax year (the current maximum allowable business limit, but which varied over time) can claim the small business status and can qualify for a lower federal tax rate of 11%. This rate is scheduled to decrease to 9% by 2019. On top of the federal rate, each provincial government also levies its own, lower BIT rate.

'income function' π, earnings of the highest skilled small business entrepreneur may not be eligible for a lower small business tax, since his income level would be too high. It is therefore more appropriate to analyze the effect of lowering τ on $R(p,\tau)$ using the skill distribution with a finite upper bound. I derive these results next and show that the top p income share is a function of (t,τ).

4.3.2 Bounded Pareto Skill Distribution

Consider a Pareto distribution truncated from the right, with the support $[1,b]$, where b is a constant greater than s^*. Its CDF and PDF are then defined as

$$H_b(s) := \frac{H(s)}{H(b)} \quad \text{and} \quad h_b(s) = \frac{h(s)}{H(b)} = \frac{zs^{-(z+1)}}{H(b)},$$

where $H(b)$ is constant and the shape parameter $z > 1$ as before. Now the aggregate after-tax business income function is

$$(1-T)\Pi(s^*) = (1-T)\int_{s^*}^{b} \pi(s)h_b(s)\mathrm{d}s = (1-T)\frac{Az}{(z-1)H(b)}\left(s^{*1-z} - b^{1-z}\right) \quad (4.20)$$

It is similarly defined for the cutoff $s_p > s^*$. Deriving the skill cutoff for a higher income percentile, s_p, means solving the following equation

$$\frac{H_b(s_p) - H_b(s^*)}{1 - H_b(s^*)} = 1 - p,$$

which, after simplifying, gives

$$s_p = \frac{s^*(t,\tau)b}{\left[pb^z + (1-p)s^{*z}\right]^{1/z}}. \quad (4.21)$$

Combining eqs. (4.17) and (4.20) gives the top p income share with the truncated skill distribution:

$$R(p,\tau) = \frac{s_p^{1-z}(t,\tau) - b^{1-z}}{s^{*1-z}(t,\tau) - b^{1-z}}. \tag{4.22}$$

Notice, this not a constant as in the case with the unbounded skill distribution, but rather a function of (t,τ) rates. This allows us to evaluate how the top p income share responds to changes in τ. Proposition 4.3.2 describes that result.

Proposition 4.3.2. *When the entrepreneurial skill is Pareto distributed and truncated from the right, the income inequality is negatively related to the business income tax* τ.

$$\frac{\partial R(p,\tau)}{\partial \tau} = \underbrace{\frac{(1-z)}{s^{*z}}}_{-} \underbrace{\frac{\partial s^*}{\partial \tau} b^{1-z}}_{+} \underbrace{\left[1 - \frac{pb + (1-p)s^*}{[pb^z + (1-p)s^{*z}]^{1/z}}\right]}_{+} < 0 \tag{4.23}$$

where $z > 1$, $b > s^* > 0$, *and* $\frac{\partial s^*}{\partial \tau} > 0$ *(see eq. (4.6)).*

Proof. The overall sign of eq. (4.23) is determined by the sign of the ratio in the final bracketed term. The signs on the first two terms are unambiguous. The bracket is positive when

$$1 > \frac{pb + (1-p)s^*}{[pb^z + (1-p)s^{*z}]^{1/z}} \tag{4.24}$$

$$[pb^z + (1-p)s^{*z}]^{1/z} > pb + (1-p)s^* \tag{4.25}$$

$$pb^z + (1-p)s^{*z} > [pb + (1-p)s^*]^z. \tag{4.26}$$

Because $f(x) = x^z$ is a strictly convex function for any $z > 1$, then for any $p \in (0,1)$ and a pair (b, s^*) such that $b \neq s^*$, eq. (4.26) is true by the definition of a strictly convex function. This implies that the ratio in the bracket of eq. (4.23) is less than one, making $\frac{\partial R(p,\tau)}{\partial \tau} < 0$ for all $p \in (0,1)$. Thus, the sign of the bracket is also unambiguously positive. □

Given τ, $R(p,\tau)$ is a measure function with a total measure of one, where $R(0,\tau) = 0$, $R(1,\tau) = 1$, and also $\frac{\partial R(1,\tau)}{\partial \tau} = \frac{\partial R(0,\tau)}{\partial \tau} = 0$ for all τ. Then, for $\tau' < \tau$ we have $R(p,\tau') > R(p,\tau)$ for all p other than $p = 0$ and 1. This implies that $R(p,\tau')$ is first-order stochastically dominated (FOSD) by $R(p,\tau)$. This is illustrated in Figure 4.2. Any (top) income percentile p will capture a higher income share under $R(p,\tau')$. Analogously, if 10% of income, for example, accrues to the top 2% under the initial τ policy, it goes to the top 1% under the new $\tau' < \tau$ rate.

Basically, FOSD of $R(p,\tau)$ over $R(p,\tau')$ indicates that income which is responsive to tax policy changes will record higher shares of income in distribution $R(p,\tau')$ than in distribution $R(p,\tau)$. An intuitive conclusion is that preferential, meaning lower, taxation of small businesses has an adverse impact on vertical income inequality among business owners, contributing to an overall widening of income inequality in the economy.

Proposition 4.3.2 tells us that lower τ is not income inequality neutral when the skill distribution is bounded. In fact, we should expect that the top p% income share among businesses owners, increases as τ decreases. This follows the result from section 4.2.3: Small business SIG can increase its members' income by buying a lower tax rate. I explore these theoretical implications of changing τ empirically in the next section, using a panel data of income shares and small business taxes for ten Canadian provinces.

4.4 Empirical Analysis

The main motivation for this study comes from the empirical observation that, in Canada, because the corporate tax rate on small businesses is considerably lower than the top marginal individual rate, it is lucrative to retain income in a lower taxed small business base. Then, the theoretical result derived above could be interpreted as

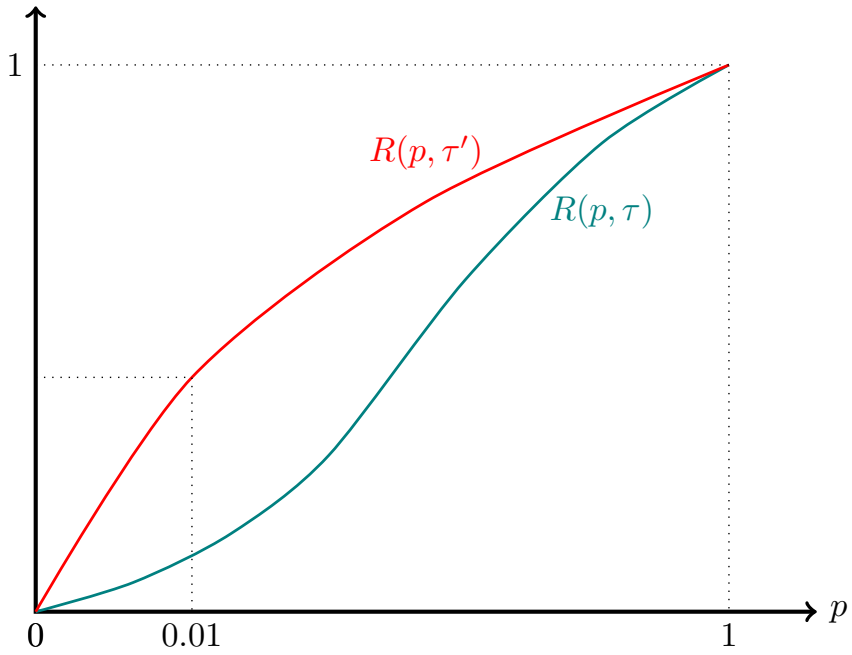

Figure 4.2: For $\tau' < \tau$, ratio $R(p, \tau')$ is first-order stochastically dominated by $R(p, \tau)$.

indicating that, with other things constant, retaining personal income within CCPCs increases the income share of the affluent, which unambiguously increases overall inequality in the economy. This possibility of retaining incomes within small businesses is simply another mechanism by which the top p% income shares can be larger and potentially grow at a higher rate than the lower shares.

Therefore, in the Canadian setting, due to available tax savings associated with owning a CCPC, it seems particularly appropriate to explore the relationship between the small business tax rate, which would apply to the top earning small businesses owners, and the top income shares. The empirical strategy for evaluating this relationship, and the theoretical prediction that lowering the small business tax rate unambiguously increases inequality among small business entrepreneurs, relies on a panel data for ten Canadian provinces. Being determined at the provincial level,

we observe considerable variation of small business tax rates across ten independent jurisdictions, within broadly the same institutional framework.[28]

At the outset, however, one problem with directly empirically testing the above theoretical prediction is the lack of a precise measures for top income shares among small business owners. Even though the Canadian context, with province-time variation of individual and corporate taxes and income shares, offers some unique benefits for an improved identification of the role tax policy plays in the evolution of top incomes and inequality, I have to rely on the aggregate top income share data. This publicly available income shares data, which I discuss below in more detail, does not allow for separation by the type of income or to splice together individual owners' incomes with those of their CCPCs at the provincial level. The lack of a more precise measure is not just a matter of relying on publicly available data sources. Even the data not publicly available, compiled for example from individual taxfiler information recored in the Longitudinal Administrative Databank in Canada, would not provide an exact measurement of what is required to directly test the theoretical prediction above - total and top income shares among small business and CCPC owners. This extremely time consuming, but unique calculation is essentially what Wolfson et al. [2016] performed. The panel data regression analysis cannot be done with their supplemented income shares measurements because they only perform calculations for national income shares and for a relatively 'short' time period, over the 2001-2011 decade. This facilitates a more precise comparison with top U.S. income shares, but it is not conducive to a panel regression analysis.

In trying to work around this issues, while still empirically exploring the theoretical prediction in a way that is consistent with other works, especially in the light of the results by Wolfson et al. [2016], I make the following arguments.

[28]The claim is that beside Québec, the rest of the provinces share broadly the same cultural attitudes and heritage.

In an expanded model, where small businesses profit maximization involves hiring workers and having an explicit labor demand function, entrepreneurs take the effective wage w as given; they are wage takers.[29] As noted in section 4.2, this does not change the key results of the model. Individuals correctly expect the w prevailing in equilibrium after the occupational choice is made; because of rational expectations they know what they can earn as workers.

A more subtle question is, how would a change in the small business tax τ affect w and labor incomes? There are two effects a decrease in τ has. On the one hand, we know the number of small business owners in the economy would increase, leading to more competition for hiring workers and a small increase in their wage. On the other hand, as more individuals choose to become small business entrepreneurs, there would also be less individuals who remain as workers in this economy. The two effects can offset each other, leaving the total labor income in the economy unchanged, even if the equilibrium ratio of workers to small business entrepreneurs changes following a reduction in τ.[30] If a small increase in w changes the distribution of labor incomes, there could be asymmetric effects on wage earners such that the top paid ones, who do not make or change their occupational decision, and are not explicitly modeled here, benefit more. Then, income inequality among labor incomes could be higher.

But, if this increase in w is coming from a reduction in τ, we know that income inequality increases because by Proposition 4.3.2 reducing τ unambiguously increases inequality among small business owners, and the wealthiest of them constitute part of the overall top 1%. Given the calculations in Wolfson et al. [2016], the implication is that increasing inequality among the small business owners simply contributes to the overall increase in the top 1% income share in the economy. Considering the presence and importance of the small business sector in the Canadian economy, (30% of GDP

[29] Given the high competition among small businesses for employment in the Canadian economy, this is a reasonable assumption.

[30] Of course, wages and so aggregate labor incomes can change for variety of other reasons affecting labor compensation, including minimum wage policy or the level of unionization.

and 98% of all employer businesses), higher inequality among small businesses likely has a considerable impact on the widening of overall income inequality.

The top 1% income share in Canada experienced a surge starting around 1985, and for almost all income definitions and top percentiles, the surge was in the numerator of the top shares. For example, as indicated by Osberg [2013], all of the increases in inequality were in absolute incomes of the top 1%, without any increase in the inequality in the bottom 99%. The gain of the top shares in absolute income terms dominated the magnitude of change at other parts of the income distribution. Veall [2012] indicates that the top share levels in Canada are understated relative to the U.S. ones and in general biased downward because of the 'hidden' profit income retained by individual taxfilers under the lower taxed CCPC base.[31] Once these hidden incomes received indirectly through a CCPC are taken into account, there is a general increase in the level of inequality.[32] In other words, including the income retained by CCPCs has an across-the-board augmenting impact on the top income percentiles, raising them proportionally while maintaining the pattern of fluctuation the same. Consequently, this makes the following estimation analysis with publicly available income shares consistent.

In fact, what may be the most interesting finding coming from Wolfson et al. [2016] splicing of individuals with their CCPCs' incomes, is that there is also an increase in the overall *trend* of the top 1% income share. This is quite vividly displayed in Figure 10 of their paper, and especially pronounced for the top 0.1% share. The implication is that income inequality is not only higher when publicly available top income shares are supplemented by CCPC incomes, but its trend is also increasing at a faster rate compared to individuals' income tax returns trends only.[33]

[31] While the opposite is true for the U.S. top shares, being somewhat overstated, because the top personal rate is lower than the corporate tax rate, not enabling the same tax avoidance opportunity.

[32] For example, in percentage points terms for 2011, Wolfson et al. [2016]'s calculations result in a 1.5pp higher share for the top 0.1%, 3.3pp for the top 1% and 3.9 percentage points for the top 5% incomes.

[33] This is also especially pronounced after the Great Recession.

With all that in mind, when estimating the relationship between the small business taxes and the aggregate top p% income shares across provinces, we should first observe a negative relation and second, realize that the relationship might actually be underestimated given that publicly available top income shares data does not fully capture the notably faster growth of top shares when CCPC incomes are included. In particular, while Wolfson et al. [2016] calculations are for Canada wide top shares, there might be significant differences across provinces, with some exhibiting even higher growth rates in top income trends. Next, I review the available data which has been previously used in studying the effect of taxation on the evolution of top income shares and inequality in Canada.

4.4.1 Data and Trends

There are two main data components employed in the empirical analysis: small business tax rates and top incomes shares, both at provincial level. The corporate income tax rates that apply to small business, i.e., below a certain business income threshold, come from various issues of *Finances of the Nation* and *National Finances* in the past, which are annual monographs published by the Canadian Tax Foundation.[34]

From those publications I record provincial and federal statutory tax rates levied on small business income for the period 1962-2015.[35] In most of the empirical analysis I use the combined federal and provincial tax rates that apply to small businesses. I also explore regressions with only the provincial small business rate for robustness. Figure 4.3 shows the combined small business tax rates for each province. Immediately noticeable is the wide variation of tax rates across provinces and a clear downward trend across almost all provinces. The only exception to this rule is Québec, which

[34]These are available as a hard copy and starting with 2002 on the Canadian Tax Foundation's website. Since 2014 CTF discontinued publishing annual monographs and included *Finances of the Nation* feature in its *Canadian Tax Journal* publication.

[35]The federal corporate income tax rate for small businesses is a basic rate with reduction available for income earned by CCPC on the first $500,000 of active business income.

Table 4.2: Summary statistics for main estimation variables, 1988-2013.

Statistic	N	Mean	St. Dev.	Min	Median	Max
Small Business Tax (provincial)	260	6.115	2.508	0.000	5.500	10.000
Small Business Tax (combined)	260	18.740	3.017	11.000	18.620	23.390
Top 1% Income Share	260	8.055	1.965	5.400	7.700	16.600
Top 0.1% Income Share	206	2.836	1.059	1.400	2.550	7.000
Provincial GDP/capita, $2013	260	42,700	12,405	24,641	40,479	87,282
U.S. Top 1% Income Share	260	15.460	2.035	12.170	15.330	18.880
Top 1% Income Share, men	260	6.580	1.619	4.600	6.200	14.200
Top 1% Income Share, women	228	1.534	0.487	0.700	1.500	2.900
Top 0.1% Income Share, men	187	2.480	0.957	1.200	2.200	6.400
Top 0.1% Income Share, women	72	0.517	0.191	0.200	0.500	1.000

Note: All data at yearly frequency. Income is defined as after-tax including capital gains. Income shares separated by sex are not available for all provinces.

actually increased its small business tax rate in recent years and now has the highest rate among all provinces.

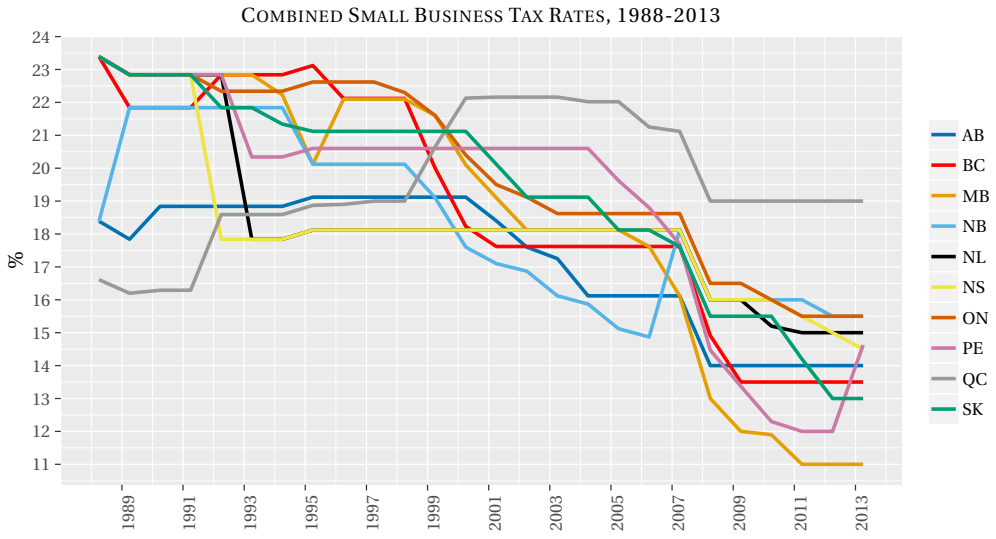

Figure 4.3: Small business tax, as combined federal and provincial rates. Source: *Finances of the Nation* published by Canadian Tax Foundation.

The main source of data on income shares for the top percentile groups across provinces is the Longitudinal Administrative Databank (LAD), a 20% annual sample of Canadian individual taxfilers, from which income shares can be calculated. These

are publicly available through Statistics Canada's CANSIM database.[36] The CANSIM data on provincial income shares are available for the 1982-2013 period, making it impossible to take advantage of the longer provincial time series on business income tax rates going back to 1960s, or even 1972 when the small business tax deduction became effective. Furthermore, the main sample I analyze starts with 1988, following a major tax reform in Canada after which the definition of the tax base remained fairly stable. This is consistent with the approach in Milligan and Smart [2015, 2016].

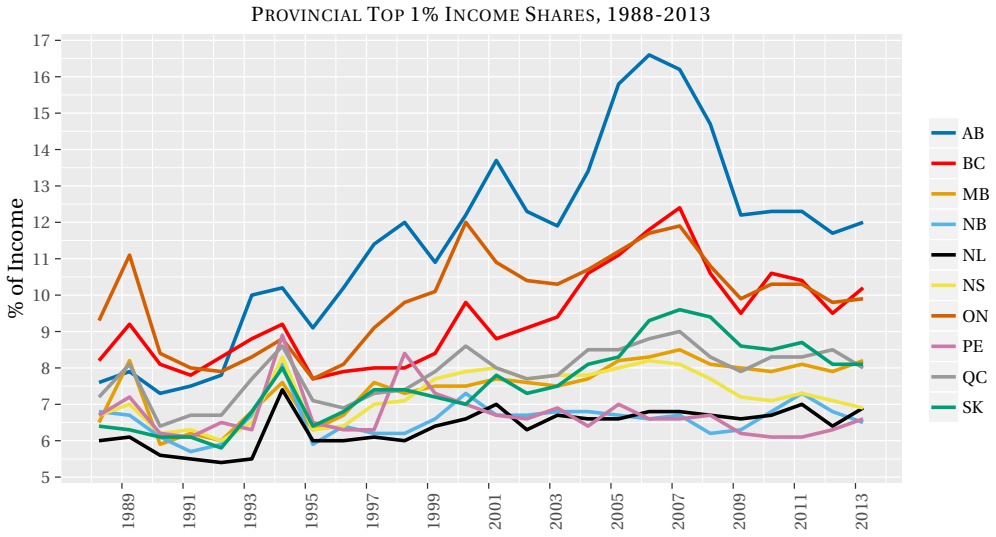

Figure 4.4: Top 1% income shares, based on total after-tax income including capital gains. Source: CANSIM table 204-0002.

Figure 4.4 illustrates the provincial time series for the top 1% income share for the 1988-2013 period. There is again a lot of variation across provinces over this period, but also clearly visible is an overall increasing trend across most provinces, especially for British Columbia, Alberta and Ontario, as the most populous ones, which display a surge. For others, the increase is somewhat subdued. Francophone Québec, as expected, displays a much less pronounced surge in top incomes. Also noticeable is the slowdown in the growth of top 1% shares following the Great Recession starting in 2007, which was relatively milder in Canada compared to other OECD countries.

[36] See Appendix C for specific data sources.

Table 4.2 reports the summary statistic for these two key variables and several others used in the subsequent regression analysis.

Figure 4.5 shows a preview of the main empirical relationship between the small business tax rate and the top 1% income share, explored with panel-data regressions over the period 1988-2013. It shows a strong negative relationship holds across provinces, being relatively stronger in some, like Alberta and Ontario. The exception is again Québec and also Prince Edward Island, which show a positive relationship, relatively stronger in Québec. The pooled scatter plot Figure C.1 in the appendix C indicates an overall negative relationship. To assess the extent of tax variation within-

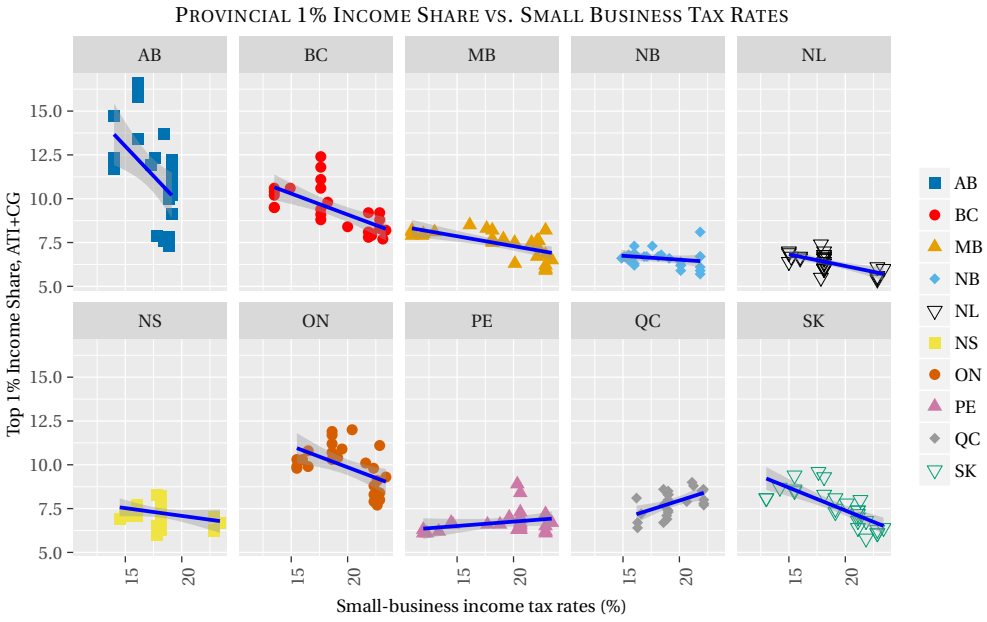

Figure 4.5: Top 1% income share is based on total After-Tax Income including capital gains. Canadian provinces, 1988-2013. Source: CANSIM table 204-0002.

province over time, I run an exploratory regression of the combined small business tax rate on province and year dummies for the period 1988-2013. The R^2 of 64.9% indicates a considerable within-province movement over time. There is even more within-province variation when the dependent variable is only the provincial component

of the small business tax rate; the R^2 is then 54.1%.[37] Because there could be province secular trends that induce small business tax change, I add the province specific trends to this regression. The R^2 is then 87.4% for the combined rate and 81.4% for the provincial statutory rate only.

4.4.2 Empirical Specification

Considering the nature and limitations of available data discussed above and the theoretical results in section 4.3.2, I make the empirical estimation as consistent as possible with the theoretical framework. Estimation is based on the following specification:

$$R(p)_{r,s} = \beta_1 \tau_{r,s} + \beta_2 y_{r,s} + \theta_r + \mu_s + \epsilon_{r,s}, \tag{4.27}$$

where r and s index province and year, respectively. $R(p)_{r,s}$ denotes the top p% income share.[38] The primary dependent variable used is the top 1% income share, where the definition of income is after-tax including capital gains (ATI+CG). I focus on this income measure for two reasons. First, when studying income inequality it is preferred to use as complete income definition as possible. Also, it is consistent with the income concept for the top shares estimated and focused on by Wolfson et al. [2016]. Second, from an economics perspective it could be that business income is capital income, especially for self-managed and self-employed small businesses. Furthermore, as pointed out by Veall [2012], when considering after-tax-and-transfer income, capital gains should be included because income tax data does not distinguish between taxes paid on capital gains and other forms of income.

I also explore regression results for the top 0.1% income share as the dependent variable, give than Wolfson et al. [2016] have established that among the top 0.1

[37] Also, R^2 for a regression over the longer period, before the tax reform, 1982-2013, is somewhat lower, at 60.9% with more within-province variation.

[38] Although empirically this $R(p)_{r,s}$ is not the same as the share of the top p% income among business owners in eq. (4.17), I keep notation the same for consistency.

percent more than 2/3 own a registered CCPC, thus qualifying them for a small business tax rate on personal income.[39] Therefore, it would appear that at this top level of income the extent of income shifting through a CCPC, which then adversely affects observed income inequality by increasing the top 0.1% share, is particularly strong.

The key explanatory variable of interest, $\tau_{r,s}$, is the small business tax rate. I mainly use the combined federal and provincial rate since tax avoidance activity might be most responsive to the total tax obligation faced. I separately explore regressions with only the provincial statutory rate. $y_{r,s}$ serves as a control variable, taking the values of either province specific income, in this case provincial GDP per capita, or the top 1% income share in the United States. The later controls for the global trend among the top incomes, faced by all Canadian provinces. This is motivated by the observation of Saez and Veall [2005] that the top shares in Canada follow U.S. trends closely and are more responsive to them than changes in Canadian marginal tax rates. All dollar values are deflated by the provincial CPI and converted to 2013 dollars, the last year for which income shares are available as of now. Provincial GDP controls for province specific income trends that would be positively related to the share of income going to the top p%, and accounts for different income growth across provinces. This was also employed in Atkinson and Leigh [2010] for their cross-country analysis of top income shares.

To identify parameters on the small business tax rate more precisely, the preferred regressions include province (θ_r) and year fixed effects (μ_s) to eliminate unobserved heterogeneity across provinces and years. The identification is obtained from within province-time variation. Further, I include province-specific time trends in some regressions as a stronger test of the specification. I also estimate the natural logarithm

[39] For example in 2011, 77.5% of the top 0.1% owned a CCPC. This ownership increases to 85.7% for the top 0.01%, but the data for such high income shares are unavailable for all provinces, except Ontario and in some years for Québec. See Appendix table A3 in Wolfson et al. [2016]

specification of eq. (4.27), where the estimated coefficients on the right-hand side, specifically on the business tax rate, can be interpreted as elasticities, highlighting the responsiveness of top income share to statutory small business tax changes. All regressions are weighted by provincial population given the advice in Solon et al. [2015] and in line with the estimation strategy followed by Milligan and Smart [2015].[40]

Finally, special attention is paid to estimation of cluster-robust standard errors, considering the small number of clusters in the Canadian panel data with only ten provinces. Applied microeconomics literature has recognized, for a long time now, the importance of using cluster-robust variance estimators (CRVE), allowing for heteroskedasticity and flexible within-cluster error correlation, but which are uncorrelated between clusters. CRVE has become the staple of fixed-effects panel data estimation literature. The necessity of clustering standard errors by entity was highlighted by Bertrand et al. [2004].

CRVE methods provide consistent estimates of standard errors and hypothesis tests in panel data models based on the assumption that the number of independent clusters is very large, i.e., goes to infinity. See Cameron and Trivedi [2005], Wooldridge [2002] for theoretical treatment when the number of clusters is large. Increasingly, however, growing econometrics literature has indicated that when the number of clusters is small or even moderate, CRVE methods can perform poorly and the subsequent inference has important shortcomings. See the discussion in Wooldridge [2003] for a brief overview and also Donald and Lang [2007] for a general discussion on panel data inference when the number of groups is small. This is clearly the case in the Canadian setting when clustering is only on ten provinces.

There are two important issues when doing cluster-robust inference in a panel data with only a few clusters. First, the estimated cluster-robust errors are downward biased and some bias corrections methods are needed. Second, even after bias corrections are

[40] As an alternative, I also use total number of provincial taxfilers as weights, but this does not change the results.

made, the usual (Wald) t-tests based on CRVE may over-reject in hypothesis testing. As Wooldridge [2003] indicates, with small number of clusters, the requirements for a significant t-test are more demanding.

As pointed out by Imbens and Kolesár [2016], in small samples and with only a few clusters, the behavior of the variance estimators and the accuracy of test statistics depends not only on the total number of clusters, but on the configuration of the regressors; if their distribution is skewed or the number of observations per cluster varies. Cameron and Miller [2015] provide a thorough discussion of these issues, and indicated that typical correction methods for t-test in the presence of only a few clusters are not always adequate enough and Wald tests generally over-reject. See also Cameron et al. [2008], MacKinnon and Webb [2016].

In my estimation and cluster-robust inference on the Canadian province-by-year panel data, with fixed effects in both dimensions and clustering by province, I rely on the approach proposed by Bell and McCaffrey [2002]. This modification involves two components. First, they propose a bias-reducing correction that improves the small-sample properties of standard CRVE. As indicated by Cameron and Miller [2015], this is an extension of the HC2 variance estimator of MacKinnon and White [1985] to a situation with clustering.[41] Second, Bell and McCaffrey [2002]'s method adjusts hypothesis tests statistics in the presence of few clusters with a degrees-of-freedom correction based on Satterthwaite approximation. Imbens and Kolesár [2016] argue the test statistics modifications and confidence intervals based on a degrees-of-freedom correction of Bell and McCaffrey [2002] should be used more widely in the empirical literature and I try to follow this advice as closely as possible. These methods have been recognized as providing a notable improvement over the standard CRVE properties

[41] In the abbreviation terminology of Cameron and Miller [2015], this correction is referred to as CR2VE, while the commonly used bias corrections for few clusters, in software such as *Stata* and *SAS*, would be denoted as CR1VE. These commonly used standard adjustments under-correct the bias compared to CR2VE.

with only a few clusters, and have received positive attention in the econometrics literature.

However, a problem with Bell and McCaffrey [2002] corrections is that they are not fully implementable in panel data settings with two way fixed effects. This problem has been addressed by Pustejovsky and Tipton [2016]. They develop a generalized solution for the bias-reducing methodology of Bell and McCaffrey [2002] and show how it can be computed efficiently in common econometric settings such as province-by-year panel models with fixed effects for both provinces and years. They also extend the above mentioned degrees-of-freedom correction to hypothesis testing with multiple parameters. Finally, Pustejovsky and Tipton [2016] modifications and extensions for the bias correcting CRVE with a small number of clusters can be applied in models estimated by weighted least squares, which I employ.[42]

4.4.3 Main Results

Panel regression results of eq. (4.27) are reported in Table 4.3.[43] The dependent variable in all columns is the income share for the top 1% over the 1988-2013 period. I report the p-values below the cluster-robust standard errors (in parenthesis) because these are based on the Satterthwaite-type correction from the Bell and McCaffrey [2002] method.[44]

Starting with a rather strong assumption that there were no other developments over this period influencing the trends in top incomes, the initial specification in column (1) includes only the province fixed effects. The coefficient on the small business tax is negative and significant at the 1% level. Of course, it is important to not attribute the changes in top income shares and income inequality entirely to tax rates, but rather estimate the extent of their influence controlling for the contribution from other

[42] In R this approach is implemented through the package *clubSandwich*, Pustejovsky [2016].
[43] Tables are produced using the *stargazer* package in R, see Hlavac [2015].
[44] When using the typical cluster-robust standard error estimates and adjustments for the presence of only a few clusters, the inference results are even better than those presented below.

factors. Therefore, following other approaches when estimating the influence of tax rates on income shares in Canada, in column (2) I include the top 1% income share for the United States. This has two expected effects on the provincial top shares. First, it has a positive and significant influence, and second it reduces the effect of small business tax by about 73% while keeping its effect strongly significant. This reduction is in line with the results of other Canadian studies that find Canadian top income shares are first strongly responsive to movements in the top U.S. shares and then domestics tax changes.[45]

[45]See primarily Milligan and Smart [2015], Saez and Veall [2005]. They, however, focus on personal income taxes.

Table 4.3: SMALL BUSINESS TAX RATE EFFECT ON CANADIAN TOP 1% INCOME SHARE

	Dependent variable: Income share of Top 1% (ATI + CG)					
	(1)	(2)	(3)	(4)	(5)	(6)
Small Bus. Tax (comb)	−.182***	−.049***	−.077***	−.068***	−.049**	−.115**
	(.004)	(.004)	(.007)	(.007)	(.015)	(.030)
	p = .00001	p = .0003	p = .002	p = .002	p = .042	p = .034
US Top 1%		.277***				
		(.008)				
		p = .00004				
Real GDP per capita				.0001	.0001*	.0001**
				(.00002)	(.00003)	(.00002)
				p = .112	p = .092	p = .041
Regional Small Bus. Tax					.047	
					(.022)	
					p = .121	
Year effect?	No	No	Yes	Yes	Yes	Yes
Province effect?	Yes	Yes	Yes	Yes	Yes	Yes
Province trend?	No	No	No	No	No	Yes
Adjusted R^2	0.596	0.755	0.84	0.88	0.882	0.996
Observations	260	260	260	260	260	260

Note: *p<0.1; **p<0.05; ***p<0.01
Reported in parentheses are robust standard errors, clusterd by province.
All regressions are weighted by the provincial population.

Middle columns (3) and (4) add a full set of time fixed effects to capture all the factors that are common across provinces but evolve over time, such as the federal government's taxation policies, global economic shocks that impact whole of Canada, top U.S. income shares or the U.S./Canadian dollar exchange rate, which might be important for small business operating across the border.[46] In column (3) the small business tax coefficient is negative, actually gaining some strength over column (2) and still significant at the 1% level.

Column (4) regression adds provincial real GDP per capita ($2013) to control for different income levels across provinces. Although overall income expanded in all provinces during this period, some experienced much larger expansion due to growth in natural resources sectors, especially Newfoundland and Labrador, Alberta and Saskatchewan. This resource sector boom has been identified as an important factor in "lifting all boats" and increasing mean wages. See Fortin and Lemieux [2015] for details. Further, because the importance of various economic sectors vary between provinces, some could very well experience internal economic downturns, which would negatively affect their top income shares, while others remained unaffected.[47] The real GDP then captures these developments across different provincial economies. As expected, it has a significantly positive effect on the top 1% share. The small business tax coefficient is reduced but still significant at the 1% level.

Column (5) adds to this specification a control for average small business tax rates in the neighboring provinces of a given region, with the idea that top p% might be responsive to regional changes in τ. These are the same regional average small business taxes as calculated and used in Table 4.1 in Section 4.2.4, classified across three standard regions in Canada, Atlantic (NL, PEI, NS, NB), Central (ON, QC) and

[46] I also run a separate regression controlling for the USD/CAD exchange rate and find that it has a positive but non-significant effect, while the coefficient on the small business tax rate remains negative, higher and significant at the 5%.

[47] For example, the recession of 2007, although overall relatively mild in Canada, affected the economies of Ontario and Québec more than Alberta, while the opposite is generally true for the negative oil price shocks.

West (MB, SK, AB, BC). Regional inter-provincial tax developments and competition might be important when provincial governments set their own tax rate. Although small businesses might not be very mobile across provinces, a province that sets a lower small business tax rate can 'invite' inter-provincial business income shifting from small businesses conducting a lot of business or having a subsidiary in the region, and trying to take advantage of a lower tax rate. Mintz and Smart [2004] study how and to what extent such corporate taxable income shifting among provinces affects provincial tax bases and revenue. See also Hayashi and Boadway [2001] for evidence of significant horizontal business tax interactions in Canada.

Although the coefficient on the regional small business tax rate has a positive sign, indicating that a given province's share of top 1% increases as its neighbors increase the small business tax, the effect is not statistically significant. Inclusion of regional averages reduces the magnitude of the relationship between small business tax and top income share, although it is still significant at the 5% level.

Finally, in column (6) I include linear province-specific trends as an extra control and specification test of column (4). Given that the regression is already 'saturated' with fixed controls, I avoid adding additional variables besides the real GDP, since there is no easy way to know which other controls might be the right ones. Note that the R^2 in the last column is at its uppermost value already. The small business tax effect is now stronger, but looses some of its significance, while real GDP becomes a significant positive factor.

Table 4.4: SMALL BUSINESS TAX EFFECT ON CANADIAN TOP 1% INCOME SHARE

	Dependent variable: Log(Income share) of Top 1% (ATI + CG)					
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Small Bus. Tax (comb))	−.341***	−.085***	−.120***	−.118***	−.114**	−.156
	(.007)	(.007)	(.014)	(.014)	(.031)	(.066)
	p = .00001	p = .0004	p = .002	p = .003	p = .031	p = .127
Log(US Top 1%)		.533***				
		(.013)				
		p = .00002				
Log(Real GDP per capita)				.361	.374	.682*
				(.171)	(.269)	(.159)
				p = .266	p = .378	p = .090
Log(Regional Small Bus. Tax)					.014	
					(.087)	
					p = .890	
Year effect?	No	No	Yes	Yes	Yes	Yes
Province effect?	Yes	Yes	Yes	Yes	Yes	Yes
Province trend?	No	No	No	No	No	Yes
Adjusted R^2	0.62	0.785	0.88	0.895	0.895	0.999
Observations	260	260	260	260	260	260

Note: *p<0.1; **p<0.05; ***p<0.01
Reported in parentheses are robust standard errors, clusterd by province.
All regressions are weighted by the provincial population.

Table 4.4 columns display the results following table 4.3, but in a log-linear specification. This allows the estimated coefficients to be interpreted as elasticities, which is of particular interest for the coefficient on the small business tax rate. Except in the last column (6), the results are unchanged from table 4.3 with respect to the small business tax effect. The growth of the top 1% income share in the U.S. has a significant effect on the growth of its Canadian counterpart. On the other hand, the relationship between provincial GDP growth and the share of income growth is now less significant. Ignoring column (1) with only the province fixed effect, we can interpret that a 10% decrease in the small business tax τ leads to a 0.8-1.2% increase in the after-tax income share.

From these results, the preferred specification estimates are those in column (4) of both tables 4.3 and 4.4, controlling for real provincial per capita GDP and those in column (6) with province-specific trends included. Of more interest is to further test how sensitive these results are to a higher income share, top 0.1%, as a dependent variable, to a different time period, namely before the Great Recessions in 2007, to a change in the explanatory small business tax rate used, and also to different definitions of income. I explore all of these next.

4.4.4 Robustness

All the robustness checks and supplementary results are reported in Appendix D. In the first two columns of Table D.1, which are comparable to columns (3) and (4) in table 4.3, I change the dependent variable to the top 0.1% share in order to evaluate how responsive a higher income fractile is to changes in the small business tax. Wolfson et al. [2016] calculate that around 2/3's of the top 0.1% incomes own a registered CCPC, allowing them to take advantage of a lower small business rate for personal tax purposes. Consistent with their study, income definition still remains the same, as

after-tax including capital gains. Tax coefficients are expectedly negative, although of somewhat lower magnitude, while the GDP income effect is now significant.[48]

The next two columns resort back to the top 1% as the dependent variable and estimate the influence of the small business tax while limiting the period to before the 2007 Great Recession. Perhaps not surprisingly, by excluding the negative effect the recession had on income, the tax coefficients are now larger indicating a stronger effect on the top 1% share. This relationship holds at the 1% significance level even with provincial GDP included.

The last two columns in table D.1 switch back to the period 1988-2013, but use only the statutory provincial small business tax rate as the key explanatory variable. This is the tax rate over which provincial governments have direct control. The tax coefficients are almost the same as in columns (3) and (4) in table 4.3, both in magnitude and significance. I also estimated the last regression with province-specific trends included, not reported here, and the result show that real GDP becomes statistically significant in that case while the provincial small business tax rate is significant at the 10% level.

Next, to evaluate whether the most preferred specification estimates in table 4.3 change when the income definition of the top 1% changes, I use two alternative measures of income available in the Statistics Canada's CANSIM database: *total income*, with and without capital gains, and *market income*, with and without capital gains. The results are reported in Tables D.2 and D.3, respectively, in Appendix D.[49]

For each income definition I report three sets of results: (1), with the U.S. top 1% share or (2) the provincial real GDP as controls, and (3) with province-specific trends included as in column (6) of table 4.3. Evaluating total income before taxes and

[48]Notice that the number of observations is considerably lower here since two provinces (Newfoundland and Prince Edward Island) are missing data for the top 0.1% share over the entire period and New Brunswick for years 1988 and 1989. Thus, to maintain a balanced panel I estimate the sample starting with 1990.

[49]The results of the same specification using after-tax income *excluding* capital gains, not reported here, are virtually identical to the ATI+CG ones in table 4.3 with all the relevant coefficients significant at the 1% level. Therefore, I evaluate these other income definitions to see how sensitive the results are.

transfers shows that the effect of small business taxes is now weaker across-the-board, but still significant at conventional levels. The difference is noticeable between results with capital gains, included in first three columns, and when they are excluded in the last three columns, for both total and market incomes. We can conclude that the results are less sensitive to the definition of income, with mostly the magnitude of the effects changing, and somewhat more sensitive to the presence of capital gains. However, once the regression includes province-specific trends, the results are almost the same as in table 4.3's column (6).

It is worth keeping in mind that these empirical results probably underestimate the effect small business tax reduction has on the top income shares. These estimates, although consistent with the income share patterns in Wolfson et al. [2016] are based on the aggregate values, and it is currently not possible to disentangle the business income from individual incomes in the data.

Lastly, I do two more checks.[50] First, I estimate the specification from table 4.3 over the entire available period, 1982-2013, for both top 1% and 0.1% income shares. Appendix D table D.4 shows that the influence of the small business tax is now halved, although still significant at the 10% level. Of course, the actual 'surge' in income shares in Canada did not start until around 1985, so this could be indicative that the choice of period post tax reform might matter more for detecting the influence of taxes on income shares and inequality. The result is not particularly different with either the combined small business rate or the provincial statutory rate as the only explanatory variable, nor for the top 1% or 0.1% as the dependent variable.

Second, I evaluate specifications from table 4.3 for income shares separated by sex. Given that Schuetze [2006] finds considerable evidence of income splitting among self-employed men in Canada, who attribute income to their wives, but not the other

[50] I will also perform an endogenous policy check, to explore whether the change in the small business tax is influences by certain province specific factors over this time period, in the manner of Besley and Case [2000].

way around, it is also possible that men's top income shares are more responsive to small business tax changes. This hypothesis might also be reinforced by the fact that in 2014, majority ownership of small businesses is overwhelmingly in favor of men than women. Indeed, table D.5 shows that the effect of small business tax is seven time as strong for men than women's top 1% share. Similar comparison cannot be made for the top 0.1% due to small number of observations for womens' income share.

4.5 Summary and Conclusion

Given that the small business sector comprises a large part of the total economic activity in Canada, small business owners shifting and retaining income within their businesses is an important contributor to overall income inequality measurement in Canada. Having a small business income tax rate significantly below the top individual rate, a situation observed in Canada since the 1960s, creates a tax avoidance mechanism through which individuals can retain income within their small businesses, thereby shielding it from higher taxes. Ownership and use of small businesses in Canada (CCPCs) as vehicles for tax reduction is widespread among the wealthiest individuals.

In this paper, I provide a theoretical foundation for widening income inequality as a direct consequence of small business tax reduction. For a given (top) individual income tax, a lower small business tax rate is income inequality neutral when the entrepreneurial skill takes the form of an unbounded Pareto distribution. However, this neutrality result breaks down when Pareto skill distribution is bounded and in Proposition 4.3.2 I show that a lower small business tax rate unambiguously increases the share of income going to the top small business owners. In other words, top p% income share under the lower small business tax is first-order stochastically dominated by a top income share when the small business tax is higher, implying that the top percentiles capture a higher share of income when small business tax is lower.

Moreover, I am able to derive the reduction in the small business rate as a consequence of the small business interest group lobbying the government, regardless of the political preference the policymaker has toward businesses.

Canada is uniquely positioned to empirically evaluate this proposition because the small business tax rates across its ten provinces have declined considerably over the last several decade, and are now well below the top individual tax. This is unlike the United States, where it is the top individual tax rate that is lower than the corporate one, so small businesses are not as useful of a vehicle to lower ones tax bill.

Using a panel data of provincial aggregate top income shares and small business tax rates for the period 1988-2013, I confirm that lowering the small business tax increases the top income share. This result is robust across different income definitions, although I focus the main estimation on the same income concept as in Wolfson et al. [2016]. Because the publicly available top income share measures do not include an explicit measure of the profit incomes retained by the top earning individuals within their CCPCs, this negative relationship is likely understated. By including these CCPC incomes, the measure of top income share is significantly higher and steeper, showing a significant trend increase, according to Wolfson et al. [2016] calculations.

Nevertheless, the estimates based on the publicly available top income shares are consistent with their general insight - that substantial income is retained within small businesses and these accrue to individuals at the top of the income scale, increasing income inequality - since the inclusion of retained business income simply raises income shares proportionally across-the-board.

A questions for future research to address is: Would there be, and to what extent, deviations from these findings once more precise measurements of income shares are available? Such measure would include income retained by individual owners within their small businesses. This measure is currently unavailable by province, with Wolfson et al. [2016] calculations done for Canada wide only. However, given that the pattern

of their supplemented top share measurement and the publicly available one used in my estimation are almost the same, the results of this paper would likely remain unchanged.

It is also of considerable interest to understand how both small business and individual income tax rates are jointly determined and how lobbying and political preference of the government affect these. Developing a more comprehensive model, with endogenous wage and clearly defined labor income of workers employed by small businesses as well those in other sectors, such as large corporations, is also left for future research.

Chapter 5

Conclusion

In this work, I analyze lobbying influence on policymaking and, in particular, provide possible explanations of how lobbying can affect minimum wage and small business tax setting by the government. Both policies could, in turn, have consequences for income distribution and inequality, and I analyzed this possibility for the small business tax policy. This is because in the Canadian context, the small business tax policy has been shown to be an important aspect of widening income inequality by enabling the wealthier individuals to shift income away from the higher taxed personal income and declare it as lower tax business income.

Considering that government policies carry distributional and efficiency consequences, it is not surprising that lobbying is present at every level of government and almost every stage of policymaking. Lobbying, however, is a costly activity and in Chapter 2 I ask what influences the decision to engage in the lobbying competition given that the associated upfront cost can be high. A possible answer is provided by analyzing a three-stage common agency model of policymaking with an endogenous decision to engage in lobbying and a simple conflict structure. Without the initial cost, it is not clear what the equilibrium of such a model looks like. The multiplicity

of equilibria is often the feature outcome in the current literature on such lobbying games.

In Chapter 2, however, I was able to obtain the lobbyists' unique equilibrium payoffs profile, which allowed for the derivation of the necessary conditions for a single, multiple or no lobbyist sub-game perfect Nash equilibrium (SPNE) to be realized. In other words, it is possible to evaluate under what conditions will individuals decide to become lobbyists, join the lobbying competition with another lobbyist or stay out. Preference heterogeneity is necessary for an equilibrium in which both individuals are simultaneously and non-cooperatively lobbying the policymaker. Also, as could reasonably be expected, for any given asymmetric lobbying cost, the individual facing the higher cost will leave the lobbying competition first as preference heterogeneity decreases. This is because at low levels of preference heterogeneity the intolerance for paying the lobbying cost is high since the benefit of lobbying is very small. In addition, I have shown that in both SPNE with no lobbyist or all lobbyists the policy, which takes the form of a public good provision, is Pareto efficient. In the SPNE with only one active lobbyist, however, public good provision is inefficient. The lobbyist is able to skew the public policy in favor of his preference, resulting in a too high or too low public good level.

Lobbying competition was characterized as a high-stakes game, meaning, the opportunity cost of not lobbying and allowing the opponent to influence policymaking can outweigh the initial fixed cost, even a high one. Because refraining from lobbying means potentially losing in terms of policy implemented, special interest groups might be compelled to engage in lobbying as a necessity simply to counter the opponents' influence over the policymaker; in the pure rivalry sense, to not allow the opponent to gain ground in the policy outcome.

Therefore, the decision to engage in the lobbying competition is influenced not just by the direct upfront cost, but also by the opportunity cost of allowing the other special

interest group's influence on the public policy in the direction of their preference. Therefore, a possible first basic conclusion of this common agency *endogenous* lobbying model is the one recognized by Baumgartner et al. [2009]: "One reason why resources may not translate directly into outcomes is that lobbying is so competitive." In other words, special interest lobbying can be intended purely to preserve the status quo. Second intuitive conclusion is that this provides the rationale for defensive lobbying that has been recognized in the literature: the decision behind lobbying engagement is to preserve the status quo policy, rather than to design or induce a more favorable one.

In Chapter 3 I focus the lobbying framework on the minimum wage and SIGs who want to influence its movement by adapting a theoretical framework of minimum wage lobbying outlined in Grossman and Helpman [2001]. They set up certain *possibilities* of how minimum wage could be affected through lobbying and indicate the importance of labour demand elasticity as well as the extent of unionization. They do not, however, consider how labour demand elasticity affects the lobbying effort by SIGs, nor do they consider the political ideology of the government policymaker as a determinant of the minimum wage. Because of that, they do not address how political ideology also affects the lobbying effort by different SIGs.

I make the minimum wage policy a function of labour demand elasticity, extent of unionization, and also introduce political ideology as it pertains to economic issues. Social welfare maximized by the policymaker is a weighted sum of profit and labor income and I attach weights on each. These indicate if policymaker is more business or labor friendly. Then, by relating the political ideology and labour demand elasticity, I am able to derive predictions of how the lobbying effort by SIGs and its payoff changes, and in turn how the MW would change through lobbying. I also have a tractable way of formulating unionization in the economy.

In general, the theory effectively relates the economic factors prevailing in a specific jurisdiction - the skill (income) distribution, the labour demand elasticity, the skill composition of union members and the unionization rate - and the government's political ideology with the SIGs' competition for policy influence, whose income depends on the minimum wage set. The SIGs are able to induce the level of minimum wage which benefits them at the expense of unorganized members of society: low skilled workers who lose their jobs and firm owners whose profits are reduced.

The model has a natural prediction that the policymaker follows her ideology when setting the minimum wage; a more business (labour) friendly government decreases (increases) the minimum wage. This is, however, the case only when labour demand elasticity is sufficiently large. The intuition behind this result is that when labour demand elasticity is large, increasing the minimum wage has strong negative effect on profits, meaning the stakes for lobbying by business owner are higher. Furthermore, when a more business friendly government is in power, lobbying effort by firm owners is greater and more effective. I also show that LDE reinforces the effect of ideology.

However, not all theoretical predictions are as straightforward. I am also able to show when the policymaker will go against its ideological preference in the presence of lobbying. Namely, when labor demand elasticity is small, increasing the minimum wage does not have a strong negative effect on profits. Then, firms will not oppose this increase, because lobbying is costly and the stakes are not high. At the same time, the union always benefits from a minimum wage increase. Then, the union's lobbying effort is relatively more effective when labor demand elasticity is small, even with a business friendly government in power. Therefore, it is possible that a business friendly government will increase the minimum wage. These results illustrate the importance of relative and not absolute power of SIGs when lobbying.

Studying what drives policy choices is of independent concern and interest. Neumark and Wascher [2004] showed that cross-country differences in labour market

policies and institutions can affect the *impact* of minimum wages. It seems reasonable then that these differences would help us understand the variation in minimum wages themselves. More importantly, studying the determinants of policies that have a clear political dimension in their choice, like minimum wage, has practical merit. Boeri [2012] and Besley and Case [2000] have pointed out the relevance of assessing policy endogeneity for the empirical analysis of the disemployment and welfare effects of minimum wages. The next step could be to employ this model's estimates as a possible first stage in assessing the effect of the minimum wage on, for example, teen employment. Alternatively, if a political variable, such as ideology, is found to have an independent effect on policy determination and not on the outcome of that policy, it could prove useful as a candidate instrument to control for potential policy endogeneity. In general, accounting for important economic and political sources of minimum wage variation can improve the unbiased estimation of minimum wage effects. This would be a valuable extension of this research and I leave it for a future project.

Finally, in the last study in this thesis, Chapter 4, I apply the lobbying framework to the small business tax (SBT) policy and issue of income inequality. Specifically, I provide some theoretical answers to questions such as: Can a lower SB tax rate be "bought" through lobbying, and what is the effect of reducing SBT on income inequality?

The reason I investigate this second question in particular is because, in the Canadian context, it has been documented that the SBT policy is an important aspect of widening income inequality. This is because the small business tax rate in Canada is below the top personal marginal rate. In fact, the difference between the two has been widening over the last 3 decades. Having a small business income tax rate significantly below the top individual rate creates a tax avoidance mechanism through which individuals can retain income within their small businesses, thereby shielding it from higher taxes. Ownership and use of small businesses in Canada,

legally know as Canadian-controlled private corporations (CCPC), as vehicles for tax reduction is widespread among the wealthiest individuals, as was documented in Wolfson et al. [2016]. Given that the small business sector comprises a large part of the total economic activity in Canada, small business owners shifting and retaining income within their businesses is an important contributor to overall income inequality measurement in Canada.

The main goal of the study was to provide a theoretical foundation for widening income inequality as a direct consequence of small business tax reduction. I start by modeling a situation in which the small business tax rate is below the top personal income one. This is the situation that we have observed in Canada since 1960s and I wanted the theory to reflect that empirical fact. The model has an endogenous occupational choice; individuals in the economy choose to become either small business entrepreneurs or workers.

Importantly, because of the positive difference between the small business income and personal income tax rates, as small business owners, the individuals have the opportunity of shifting income away from the personal base, retaining it within their business and effectively paying a lower tax. Therefore, a reduction in the SBT benefits small business owner not only directly because of a higher after-tax income, but indirectly because for a given personal income tax, they have an incentive to shift more income and lower their tax obligation.

The *key result* is that the policy of reducing small business income tax is not income inequality neutral. It unambiguously increases the share of income going to the top 1% (or 0.1%) of business owners. This result corresponds to the empirical observations and, ceteris paribus, contributes to overall widening of income inequality in the economy. In fact, I show that the measure of top income share under the lower SBT is first-order stochastically dominated by a measure under the higher SBT.

(See Figure 4.2) Intuitively, this means that any top percentile of income distribution captures a higher share of income under a lower SBT.

Further, I introduce the lobbying mechanism. Given this income shifting mechanism, a small business interest group always has an incentive to lobby for a lower SBT. The standard argument is that this encourages more small business entrepreneurship, increases profits and investments. My model has this prediction; as the SBT is lowered more individuals choose to become small business owners. Lowering the SBT also widens the tax difference, however, providing a higher "return" on income shifting. Then, without the lobbying influence, the government sets the SBT to maximize its revenue and SBT rate is a function of the government's political preference; a more business (labor) friendly government decreases (increases) SBT. But, with lobbying present, the small business interest group is able to "buy" a SBT rate lower than the revenue maximizing one, regardless of the government's political preference.

Finally, I empirically analyze some of these predictions with a panel data on ten Canadian provinces and confirm a negative relationship between the small business tax and the top 1% as well as 0.1% income shares. I also explore and find indicative evidence that lobbying by the Canadian Federation of Independent Businesses is significantly related to the SBT downward movement since 1981 across Canadian provinces.

In the classical approach to policymaking, the government is omni-benevolent, un-corruptible, and its sole goal is to maximize social welfare. On the other hand, the research in this thesis analyzes the positive aspects of policymaking, in particular a situation when the government policymaker cares about monetary contributions received from lobbyists as well as social welfare. We know that policies such as the minimum wage and small business taxation attract a lot of attention, and SIGs want to influence their direction through lobbying, i.e., offering monetary contributions as a function of a particular policy choice.

Lobbying in general, but in Canada especially, is somewhat understudied in the scholarly way, despite increasing in the extensive and intensive scope on both the federal and provincial policymaking level. With this thesis I wanted to change that and expand our knowledge of lobbying mechanisms and policy effects in the Canadian context by providing insight into how policies are determined when multiple interest groups try to lobby the government who sets them.

Appendix A

Derivation Details for Chapter 3

A.1 Labor Market Equilibrium With a Minimum Wage

Firms care about the units of effective labor employed and profit maximization. With w_E the cost of a unit of effective labor, the maximum level of profits that firms in each industry can attain are given by $\Pi_T(w_E)$ and $\Pi_P(w_E)$. Then, respective industries' labor demands can be obtained thorough the Envelope result,

$$E_i(w_E) = -\Pi_i'(w_E), \quad \text{for } i = T, P.$$

The total demand for effective labor is simply $E(w_E) = E_T(w_E) + E_P(w_E)$.

Since all workers are perfectly substitutable, in the competitive equilibrium the least skilled worker earns $\hat{w}_E$, i.e., his marginal output.[1] When a minimum wage is imposed such that $w_M > \hat{w}_E$, firms will not hire the least skilled worker since his marginal product does not cover the wage he *must* be paid. Imposing such a binding minimum wage leads to labor demand falling short of supply. Therefore, the least

[1] Actually, the least skilled worker earns $\underline{a}\hat{w}_E$. The assumption made here is that the lowest skill level is $\underline{a} = 1$.

skilled hired worker will be the one with the skill level a_M such that

$$a_M w_E = w_M, \tag{A.1}$$

which implies that the a_M is a function of w_M. The full-employment condition is

$$E(w_E) = N \int_{a_M(w_M)}^{\infty} a\Phi'(a)\mathrm{d}a. \tag{A.2}$$

The right-hand side indicates that only workers with ability greater than a_M are employable. Equations (A.1) and (A.2) enable us to jointly solve for a_M and w_E as functions of w_M, with solutions denoted by $a_M(w_M)$ and $w_E(w_M)$, respectively. These two functions determine the income levels of all groups in the economy as a function of w_M and thus give a stake to various interest groups to compete for the influence over the minimum wage policy. Specifically, the unique solution to eq. (A.2) gives the equilibrium wage for a unit of effective labor

$$\hat{w}_E(w_M) = \alpha^{\frac{1}{z+\alpha-z\alpha}} \left[\frac{Nz}{(z-1)\mathcal{A}}\right]^{\frac{\alpha-1}{z+\alpha-z\alpha}} w_M^{\frac{(1-z)(\alpha-1)}{z+\alpha-z\alpha}}. \tag{A.3}$$

where the shorthand $\mathcal{A} = \left[A_T + A_P\right]$ is used for simplicity throughout the paper. Observe that $\hat{w}_E(w_M)$ is increasing in w_M. The minimum skill level of an employed worker is

$$a_M(w_M) = \left[\frac{Nz}{(z-1)\mathcal{A}}\right]^{\frac{1-\alpha}{z+\alpha-z\alpha}} \left[\frac{w_M}{\alpha}\right]^{\frac{1}{z+\alpha-z\alpha}}. \tag{A.4}$$

To facilitate deriving the minimum wage determined in the political equilibrium under the influence of lobbying SIGs, I express each industry's and the aggregate labor demands as well as union's labor supply in terms of minimum wage. I make use of eqs. (3.4) and (A.4) to do so. The demand for effective labor by industry $i = T, P$ as

a function of w_M is

$$E_i(w_M) = A_i\left[\hat{w}_E(w_M)\right]^{\frac{1}{\alpha-1}}\alpha^{\frac{1}{1-\alpha}} = A_i\left[\frac{Nz}{(z-1)\mathcal{A}}\right]^{\frac{1}{z+\alpha-z\alpha}}\left[\frac{w_M}{\alpha}\right]^{\frac{1-z}{z+\alpha-z\alpha}}. \tag{A.5}$$

The total demand for effective labor as a function of w_M is

$$E(w_M) = E_T(w_M) + E_P(w_M) = \left[\mathcal{A}\right]^{\frac{(1-\alpha)(z-1)}{z+\alpha-z\alpha}}\left[\frac{Nz}{z-1}\right]^{\frac{1}{z+\alpha-z\alpha}}\left[\frac{w_M}{\alpha}\right]^{\frac{1-z}{z+\alpha-z\alpha}}. \tag{A.6}$$

With the minimum wage imposed in the economy, the expression for the total units of effective labor supplied by unionized workers has to be evaluated for two possible cases. In the first case, if the minimum wage is such that $a_M(w_M) < a_U$, then the supply of effective unionized labor is

$$E_U = N\int_{a_U}^{\infty} a\Phi'(a)\mathrm{d}a = N\int_{a_U}^{\infty} a\frac{z}{a^{1+z}}\mathrm{d}a = \left[\frac{Nz}{z-1}\right]a_U^{1-z}. \tag{A.7}$$

The other possibility is that $a_M(w_M) > a_U$, in which case E_U is

$$E_U(w_M) = N\int_{a_M(w_M)}^{\infty} a\Phi'(a)\mathrm{d}a = \left[\frac{Nz}{z-1}\right]a_M(w_M)^{1-z}. \tag{A.8}$$

These two cases are illustrated in Figure A.1. Intuitively, in the first case, when the binding minimum wage is set low enough such that the lowest employed skill level (denoted a_M^1) is not greater than a_U, the supply of effective unionized labor remains as initially specified in eq. (3.3). In the second case describes the situation when w_M is set so high that unionized workers with the skill level in the range $[a_U, a_M^2)$ lose their employment. This goes against the union's interest since it reduces the earnings of its members and it is reasonable that those unionized workers who lose their jobs as a result of union's lobbying effort to increase the minimum wage, would have no

incentive to remain members of the union any longer. In other words, there is no reason to remain union member after losing the 'unionized job'.

Therefore, the focus of the analysis on the interior solution in the first case when the union lobbies to increase the minimum wage as long as $a_M(w_M) < a_U$ is more sensible. Equations (A.5) to (A.7) can be used to derive the political equilibrium in the economy, for a given pattern of lobbying.

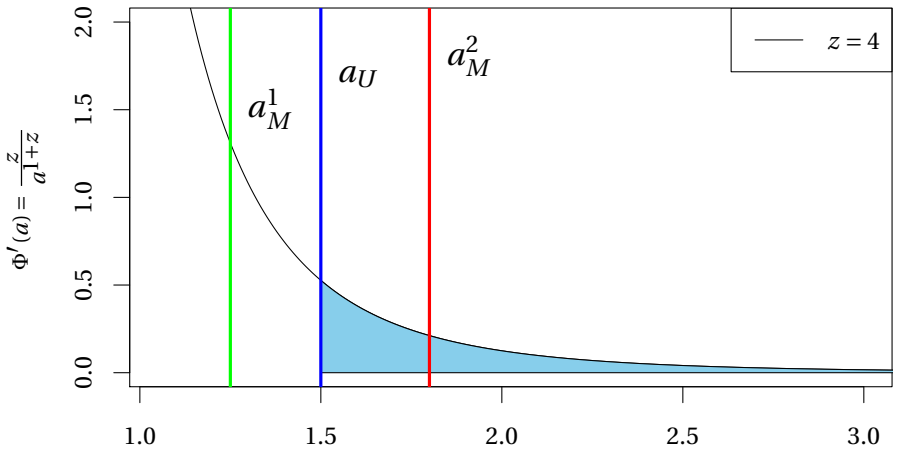

Figure A.1: Skills are Pareto distributed and above the cutoff level a_U all workers are union members. The vertical (green) line $a_M^1 < a_U$ depicts the first case situation, and the vertical (red) line $a_M^2 > a_U$ case.

A.2 Lobbying Contributions and First Order Condition

To derive the eq. (3.8) from the policymaker's FOC,

$$\begin{aligned} W'(w_M) &= \lambda_L w'_E(w_M) E[w_E(w_M)] + \lambda_L w_E(w_M) E'[w_E(w_M)] w'_E(w_M) \\ &\quad + \lambda_S \left[\Pi'_T[w_E(w_M)] w'_E(w_M) + \Pi'_P[w_E(w_M)] w'_E(w_M) \right] \\ &= (\lambda_L - \lambda_S) w'_E(w_M) E[w_E(w_M)] + \lambda_L w_E(w_M) E'[w_E(w_M)] w'_E(w_M) \end{aligned}$$

using the fact that $\Pi'_i[w_E(w_M)] = -E_i(w_E(w_M))$ for $i = T, P$.

Appendix B

Data Details and Sources for Chapter 3

B.1 Summary Statistics for the Main Explanatory Variables of Interest

Table B.1: Summary statistics for the adjusted provincial union density, 1965-2013. The observation for 1965 is missing because the provincial total employment is not available for that year

Statistic	N	Mean	St. Dev.	Min	Median	Max
Newfoundland and Labrador (NL)	48	35.600	7.637	20.250	33.490	47.340
Prince Edward Island (PE)	48	20.030	4.913	8.194	21.700	26.600
New Brunswick (NB)	48	25.860	2.354	21.970	26.490	30.010
Nova Scotia (NS)	48	27.400	3.888	21.860	28.900	34.150
Quebec (QC)	48	31.660	2.284	24.560	31.180	36.030
Ontario (ON)	48	25.660	3.088	20.970	27.180	29.070
Manitoba (MB)	48	27.500	1.999	23.110	27.790	30.610
Saskatchewan (SK)	48	22.440	3.375	15.520	23.700	26.590
Alberta (AB)	48	19.320	2.070	16.440	19.310	23.320
British Columbia (BC)	48	31.110	5.334	22.480	32.610	38.450

Note: Yearly Frequency. For the data source see Appendix B.4.

Table B.2: Summary statistics for the provincial Solow residual (technological progress), 1965-2013.

Statistic	N	Mean	St. Dev.	Min	Median	Max
Newfoundland and Labrador (NL)	49	11.950	3.086	8.384	11.440	19.770
Prince Edward Island (PE)	49	13.170	1.567	9.658	13.930	15.150
New Brunswick (NB)	49	16.370	2.092	12.370	17.540	18.650
Nova Scotia (NS)	49	14.120	1.962	10.750	15.010	16.400
Quebec (QC)	49	15.990	1.028	13.910	15.690	17.880
Ontario (ON)	49	17.550	1.603	14.510	17.230	20.390
Manitoba (MB)	49	12.450	1.169	10.090	13.080	13.870
Saskatchewan (SK)	49	6.001	0.610	4.862	5.966	7.673
Alberta (AB)	49	7.461	0.810	5.901	7.673	9.035
British Columbia (BC)	49	15.100	1.270	12.500	15.140	17.100

Note: Yearly Frequency. For the data source see Appendix B.5.

Table B.3: Summary statistics for the provincial political ideology index, 1965-2013.

Statistic	N	Mean	St. Dev.	Min	Median	Max
Newfoundland and Labrador (NL)	49	0.162	0.205	−0.286	0.212	0.468
Prince Edward Island (PE)	49	0.133	0.102	0.010	0.118	0.321
New Brunswick (NB)	49	0.198	0.237	−0.367	0.290	0.487
Nova Scotia (NS)	49	0.323	0.147	0.128	0.333	0.582
Quebec (QC)	49	−0.176	0.206	−0.437	−0.183	0.195
Ontario (ON)	49	0.092	0.217	−0.226	0.080	0.548
Manitoba (MB)	49	−0.034	0.141	−0.240	−0.094	0.257
Saskatchewan (SK)	49	−0.013	0.282	−0.417	−0.073	0.479
Alberta (AB)	49	0.429	0.229	0.108	0.321	0.876
British Columbia (BC)	49	−0.079	0.226	−0.606	−0.091	0.470

Note: Yearly Frequency. For the data source see Appendix B.2.

Table B.4: Summary statistics for the labor demand elasticity (ε), 1965-2013.

Statistic	N	Mean	St. Dev.	Min	Median	Max
Newfoundland and Labrador (NL)	49	2.771	0.788	1.482	2.718	4.224
Prince Edward Island (PE)	49	2.752	0.316	2.345	2.633	3.678
New Brunswick (NB)	49	3.156	0.636	2.500	2.870	4.466
Nova Scotia (NS)	49	2.925	0.529	2.372	2.659	4.252
Quebec (QC)	49	2.879	0.256	2.497	2.842	3.400
Ontario (ON)	49	2.893	0.179	2.615	2.852	3.276
Manitoba (MB)	49	2.585	0.160	2.341	2.543	2.939
Saskatchewan (SK)	49	1.875	0.115	1.591	1.893	2.097
Alberta (AB)	49	2.052	0.187	1.697	2.042	2.539
British Columbia (BC)	49	2.841	0.338	2.368	2.803	3.726

Note: Yearly Frequency. For the data source see Appendix B.3.

B.2 Political Ideology and HerfindahlHirschman Index Construction

B.2.1 Provincial Political Ideology

The political ideology variable is constructed following the approach of Bjørnskov and Potrafke [2012], who employ a variant of the following ideology scale across Canadian *provincial* parties, with minor differences. See their Figure 1 for comparison.

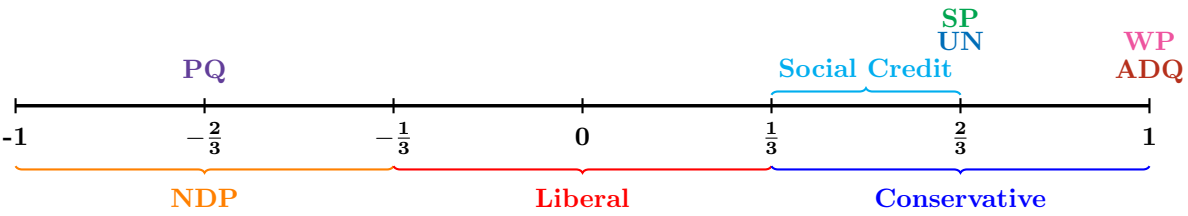

Figure B.1: Canadian Provincial Parties Ideology Scale. PQ is Parti Québécois, UN is Union Nationale, ADQ is Action Démocratique du Québéc and SP is the Saskatchewan Party. The score of $-\frac{1}{3}$ is coded for NDP only in Saskatchewan during the Romanow years as the party leader.

Corollaries 3.2.1 and 3.2.2, in section 3.2.3, indicate that the political ideology will have a different effect on the minimum wage when elasticity is large (¿2) in the presence of lobbying. The real minimum wage would increase under a more labor friendly, left-of-center government such as the National Democratic Party and sometimes the Liberal Party, while Conservative governments would oppose an increase.

On the one hand, although the ideology score scale for Canadian provinces illustrates a standard ranking in the party space and ideological location regarding economic issues, there is always a question of a 'human element' in assigning the score. To keep a consistent scoring methodology, for each party the ideology score can change when the party leader changes, which indicates the possible change in the faction that leads a particular party. On the other hand, there are certain peculiarities of Canadian provincial politics that should be taken into account when expanding the measure of political ideology over this time period. In general, Canadian provincial parties

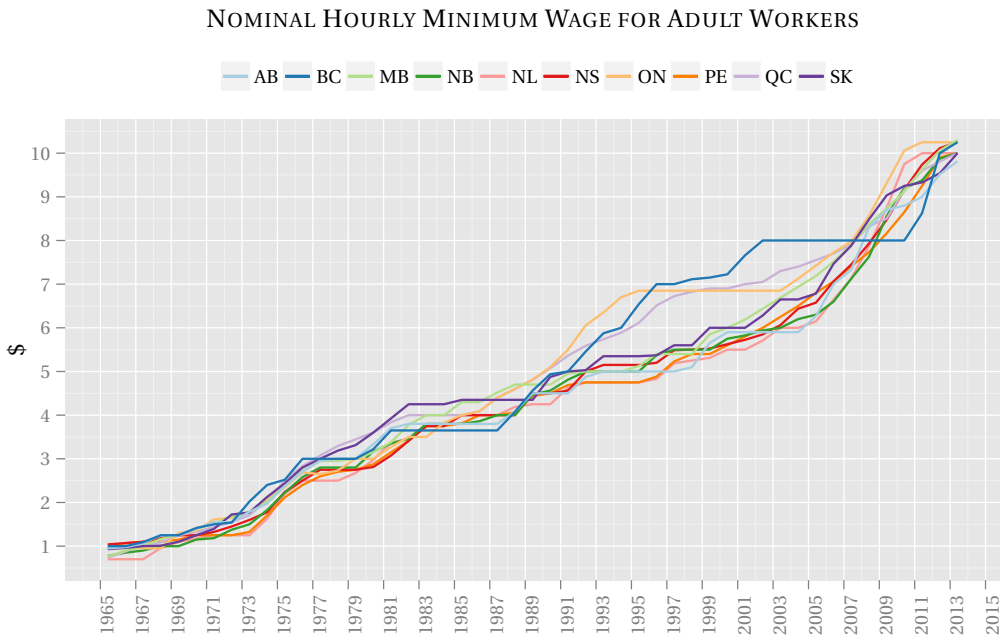

Figure B.2: Nominal minimum wages across Canadian provinces, 1965-2013. These are calculated as the weighted average of monthly nominal minimum wages, with weights the number of months in a year that a particular nominal minimum wage was in effect. Data: Labour Program Canada, Minimum Wage Database.

are self-contained organizations and not necessarily connected to the federal party with the same name. Thus, membership in the provincial political party, for example Liberal, does not imply membership in the federal Liberal Party. The exception to this rule is the New Democratic Party.

In light of this, Canadian politics requires careful consideration when applying standardized party labels, as they are understood in Canadian federal politics or North American politics in general. For example, the Liberal Party in British Columbia is a conservative, center-right party. Its opposition to the minimum wage increase is visible from the flat nominal rate during the 2001-2010 period in Figure B.2. Subsequent increases are, however, not entirely incompatible since the theory does not preclude that even a business friendly government increases the minimum wage, under the condition that the labor demand elasticity is not large and lobbying for the increase is strong. Also, it is possible that with the change in leadership the party changes its

ideological stance, as discussed above.[1] The conservative Social Credit party in B.C. also kept the nominal minimum wage unchanged for extended periods of time during late '70s and all of 1980s, allowing the real minimum wage to deteriorate sharply. Additionally, in the province of Québec the Liberal Party is often characterized as a free-market (center-right) party, in opposition to the social democratic Parti Québécois (center-left).

B.2.2 HerfindahlHirschman Index of Provincial Political Competition

HHI captures the concentration of party seat shares in each provincial parliament, i.e., political competition. I calculate HHI for a province p in year t in two ways: first, discussed in the main part of the paper, by taking into account the ideological difference of each party r from the parliament's ideological score,

$$[\text{Ideologically Adjusted HHI}]_{pt} = \frac{\sum_r ((i_{rt} - PI)S_{rpt})^2}{\left(\sum_r S_{rpt}\right)^2},$$

and second, by simply taking into account the number of seats each party has.

$$[\text{Simple HHI}]_{pt} = \frac{\sum_r (S_{rpt})^2}{\left(\sum_r S_{rpt}\right)^2}.$$

where S is the number of seats in the legislature. Both have the same interpretation, while simply inverting the direction in which party competition increases. When $HHI = 1$, one party holds all the seats and there is no party competition in the parliament. Using this measure of HHI in table 3.2 regressions, as opposed to the ideologically adjusted one, leads the coefficient on HHI to be positive, indicating that as the 'Plain HHI' increases to 1, political power is concentrated within one party,

[1] Note that even with the recent increases, the minimum wage in British Columbia is among the lowest in Canada and the governing Liberal party opposes further increases.

making it easier to increase the minimum wage. Figure B.3 illustrates these two

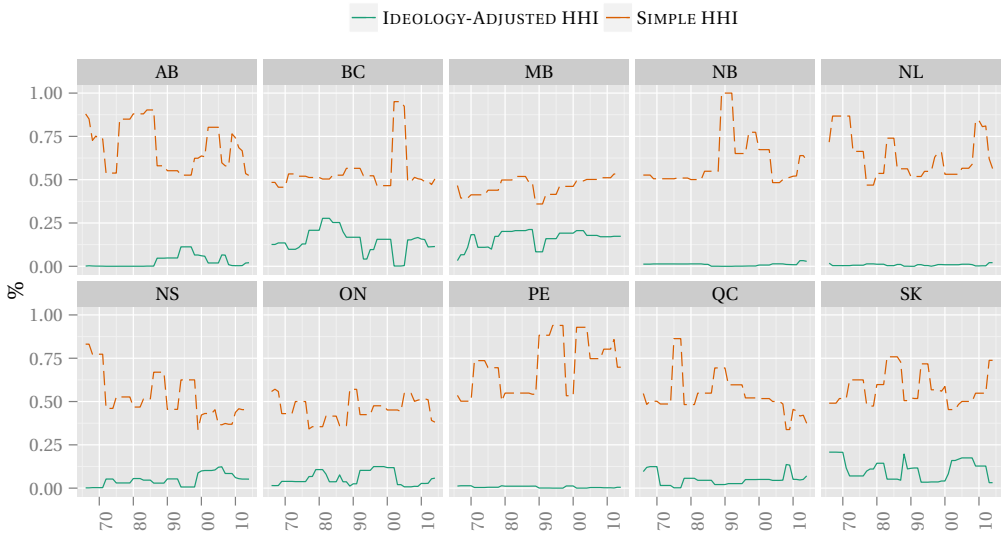

Figure B.3: Two Herfindahl-Hirschman Indices of Provincial Political Competition, 1965-2013.

measure of HHI. Notice that the value of 'Simple HHI' (dashed line) in New Brunswick during the period 1988-91 is equal to 1, as expected when one party holds 100% of the seats in the provincial legislature.

Furthermore, in regressions I also check for the *inverse of the HHI*, which measures the effective number of parties in the provincial parliament. The intuition here is that as the effective number of parties increases it is more challenging to increase the minimum wage, potentially requiring compromises with political opponents and concessions on other policies. Indeed, the coefficient on 'inverse HHI' in the regression has a negative sign, indicating that minimum wage increases with lower effective number of parties in the parliament.

B.3 Labor Demand Elasticity

Following the theory, the absolute value of labor demand elasticity for each province is derived in eq. (3.2) as $\varepsilon = \frac{1}{1-\alpha}$, where α denotes labor share in total income, also calculated for each province. Although there is no widely accepted approach, I estimate α following Gollin [2002], Morel [2006] recommendations. There are three ways of computing α, depending on how the small, self-employed unincorporated business income (UBI) is attributed to total labor income. Specifically,

$$\alpha_{Raw} = \frac{\text{Compensation of Employess}}{\text{GDP at Factor Cost}};$$

$$\alpha_{Adj1} = \frac{\text{Compensation of Employess} + \text{UBI}}{\text{GDP at Factor Cost}};$$

$$\alpha_{Adj2} = \frac{\text{Compensation of Employess}}{\text{GDP at Factor Cost} - \text{UBI}}$$

The "Raw" measure of labor share simply does not include the UBI and this

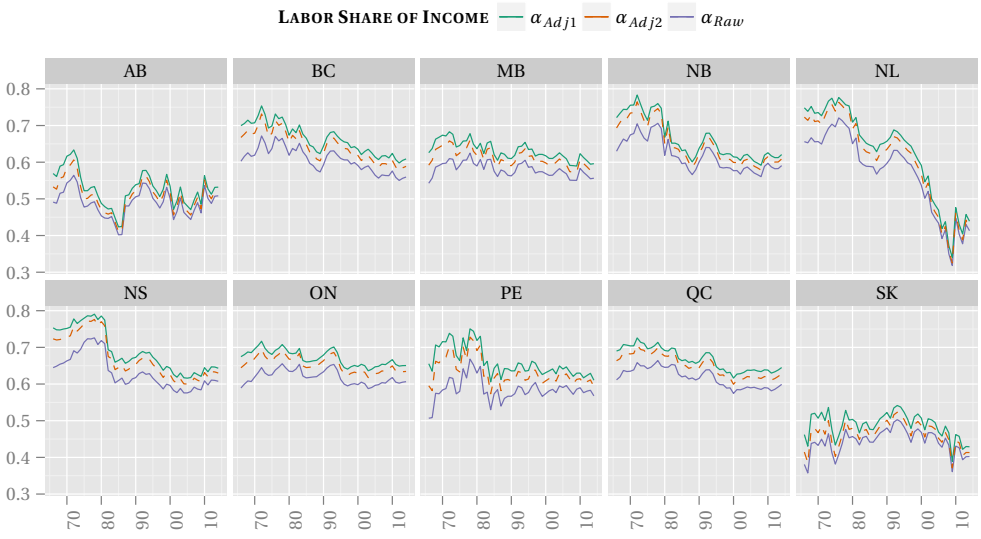

Figure B.4: Labor Share of Income across Canadian provinces, 1965-2013.

underestimates the labor share measure, as show in Figure B.4. Attributing entire UBI to labor income, as in "Adjustment 1", overestimates the labor share. A preferred adjustment is to somehow allocate UBI between these two extremes, where the gap is the measure of UBI. "Adjustment 2" subtracts the UBI from GDP, meaning the α_p is calculated for the incorporated part of the economy. According to Gollin [2002, p.468] this treats UBI "as comprising the same mix of labor and capital income as the rest of the economy." In Figure B.4 we can see that this second adjustment measure lies between the other two extremes, denoted by a dashed line. The second adjustment is the most preferred measure of α, used in this paper. The preferred measure of total income is GDP at factor cost (GDP at market prices - Indirect taxes less subsidies).

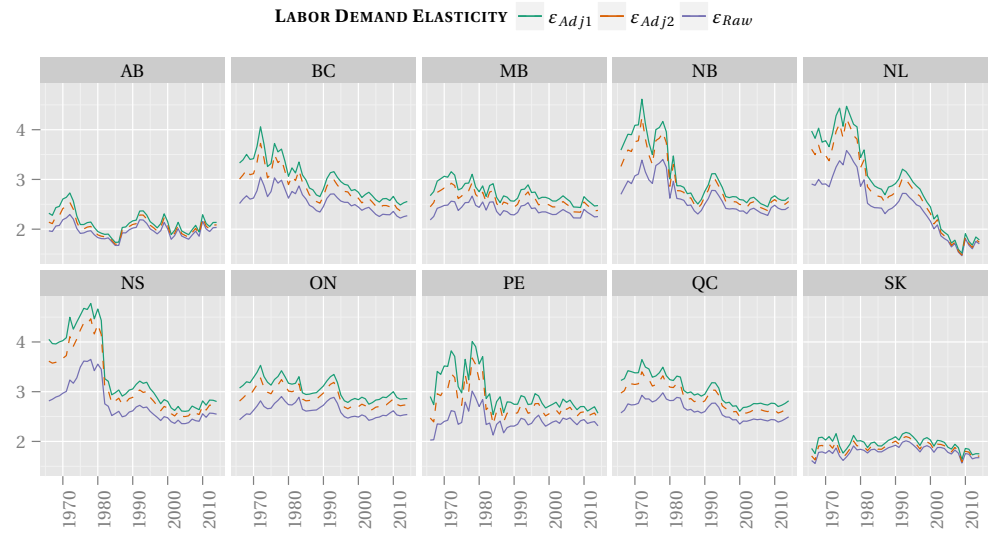

Figure B.5: Labor Demand Elasticity across Canadian Provinces for period 1965-2013.

DATA SOURCES

- Compensation of Employees: CANSIM 384-5000 (1926-2013). Same values as 384-0037 compensation series (1981-2013).

- GDP at factor cost and indirect taxes less subsidies: CANSIM 384-0014 (1965-1980) and 384-0037 (1981-2013).
- Unincorporated Business Income: CANSIM 384-0014 (1965-1980) and 384-0040 (1981-2013).

After calculating α for each province, computing labor demand elasticity ε is straightforward. Figure B.5 shows the three measure of ε corresponding to three adjustments. The preferred measure is again ε_{Adj2}.

B.4 Provincial Union Density Adjusted for the skill level

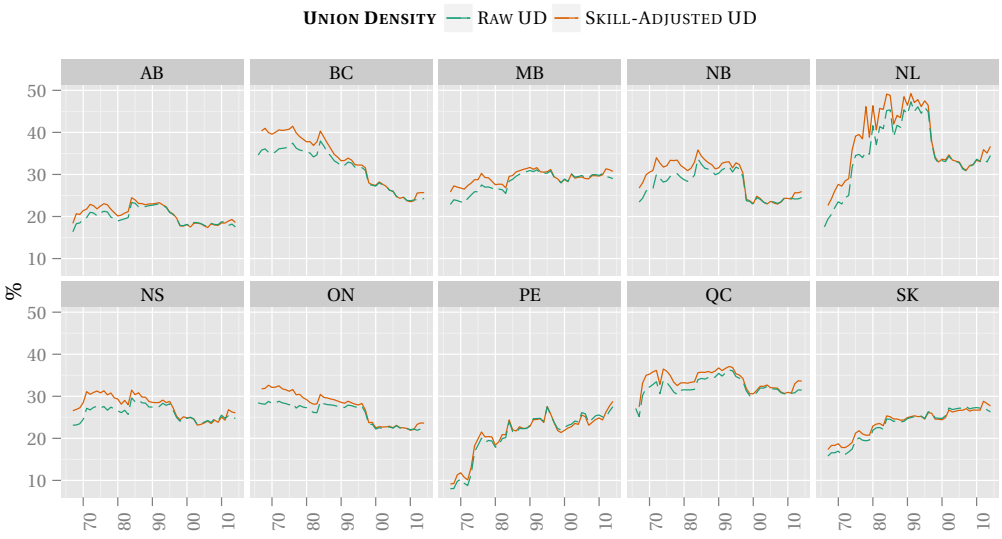

Figure B.6: Union Density across Canadian Provinces, 1965-2013.

Provincial union density is defined as the ratio of unionized workers to total employment. Provincial time-series data on unionized workers are obtained from the Corporations and Labour Unions Returns Act (CALURA) until 1995 and starting

with 1997 from the Labor Force Survey (LFS). CALURa is an administrative data on union membership and combining it with the survey based LFS has certain drawbacks. Since CALURA only counts workers who are members of the union, when combining the two series I only use LFS's measure of employees who are union members, and exclude those workers who are also covered by a union contract despite not being members. See Legree et al. [2014] for more discussion on these two series.

Despite some limitations, these are the longest consistent measures of unionization in Canadian data. Further, the benefit is that membership series from both CALURA and LFS can consistently be separated by sex and province, over the entire period 1965-2013. The skill adjusted measure of union density is constructed by first weighing male and female unionized workers in each province by the respective ratios of average hourly earnings (AHE) to overall AHE, and then dividing the sum of the two measure by total provincial employment. In other words, I first compute a weighted sum of male (M) and female (F) unionized workers and then divide by total employment in the province. Specifically,

$$[\text{Skill Adjusted } UD]_{pt} = \frac{\frac{AHE_M}{AHE}\text{Unionized Workers}_{Mpt} + \frac{AHE_F}{AHE}\text{Unionized Workers}_{Fpt}}{\text{Total Employment}}$$

The weight for male union members is always > 1 while the one for women is < 1, although approaching 1 overt time. The average hourly earning are calculated from hours worked and labor compensation data used by the Canadian Productivity Accounts. Figure B.6 illustrates two measure of union density, the Raw unadjusted and the Adjusted one from the above equation.

Figure B.7 explores the correlation between (log) provincial union density and political ideology. Even if the workers' unionization decision is exogenous, the relation between provincial's political ideology and union density could affect the regression estimates of the unionization effect on minimum wage determination.

Overall, the correlation coefficients' strength and direction give an inconclusive picture of this relationship. Three provinces (AB, BC, NB) show a relatively higher *negative* correlation between union density and ideology, indicating an intuitive relationship that as the provincial parliament becomes more labor friendly, union density would be higher. However, two largest provinces (ON, QC) show a relatively low negative relationship between these two variables while the smallest province (PEI) and MB exhibit no correlation. Further, three provinces (NL, NS, SK) show a relatively higher *positive* correlation, indicating that union density is higher during periods when provincial parliament was more business friendly.

In conclusion, provinces exhibit considerable heterogeneity in union density and political ideology relationship and it is possible that the two are positively or negatively correlated across provinces. In other words, a union could help bring a labor friendly government to power, but it could also be that a labor friendly government elected to office introduces union friendly legislation and props up the level of unionization in the province. Correlation coefficients computed for raw, untransformed union density values and political ideology are virtually the same as the ones reported in Figure B.7 below.

DATA SOURCES

- Union Membership: CALURA CANSIM 279-0025 series for 1965-1995 and the LFS series CANSIM 282-0220 for 1997-2013. Printed CALURA reports were also used. Union data for 1996, when CALURA stopped, are obtained from Galarneau [2003].
- Total employment, persons: CANSIM 384-0035 and CANSIM 384-0002.
- Average Hourly Earnings, for the weight ratios: CANSIM 383-0024.

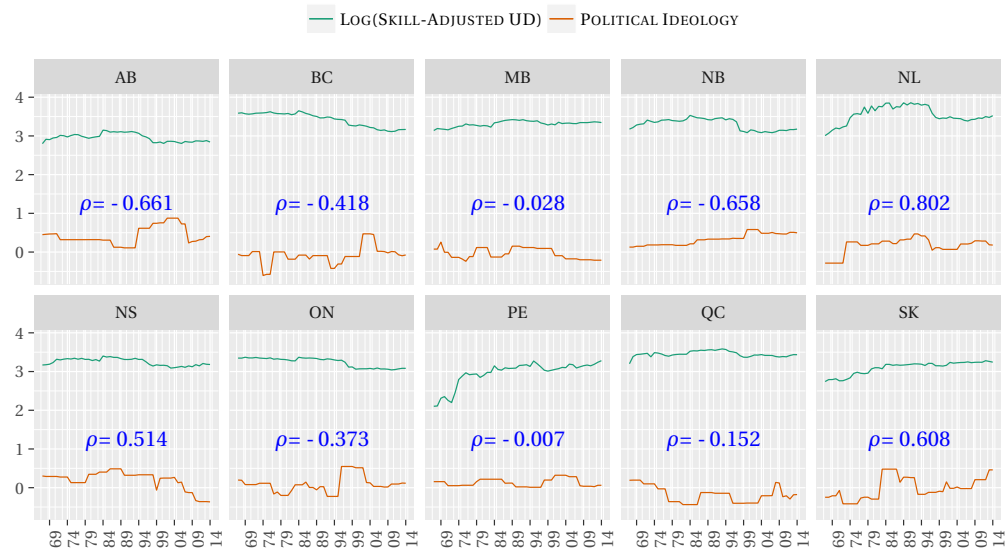

Figure B.7: Union Density and Political Ideology across Canadian Provinces, 1966-2013. The ρ value is the correlation coefficient between the two measure. Union density is logged, as it was in the main regression analysis.

B.5 Solow Residual

Province specific Solow residual is used to measure the technological progress and the time series for each province is calculated as the residual of the Cobb-Douglas production function:

$$A_{pt} = \frac{Y_{pt}}{E_{pt}^{\bar{\alpha}_p} K_{pt}^{1-\bar{\alpha}_p}}$$

where Y_{pt} is real GDP in province p, in year t, while E and K are provincial employment and capital stock, respectively. $\bar{\alpha}_p$ is the average value of labor share in each province for 1961-2013. All dollar values are deflated by the provincial or federal CPI. For capital stock measures I used the geometric end-year net stock.

DATA SOURCES

- Income based GDP: CANSIM 384-0014 (1961-1980) and CANSIM 384-0037 (1981-2013)

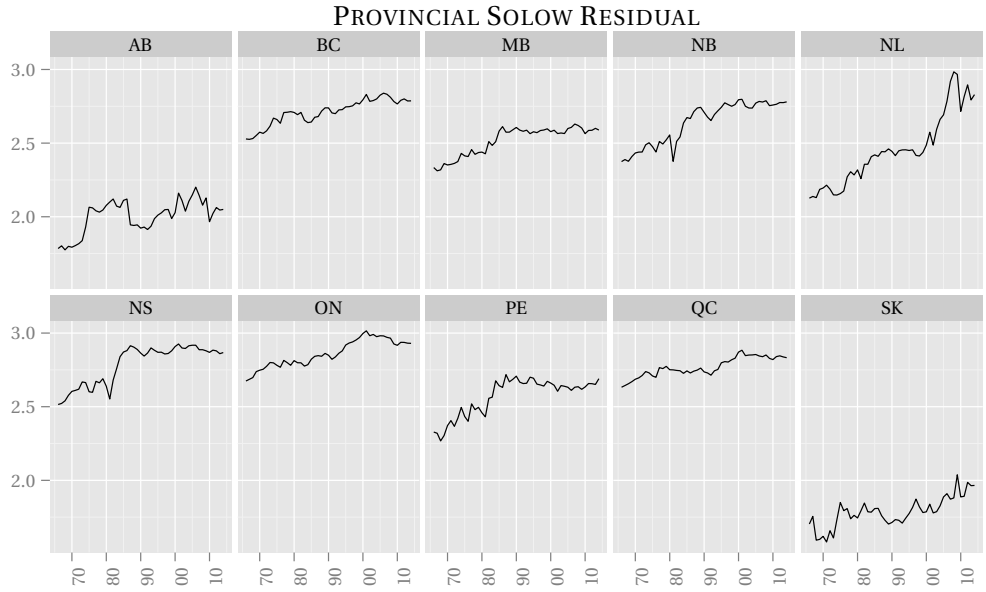

Figure B.8: Logarithm of the Solow residual across Canadian Provinces, 1965-2013.

- Employment: CANSIM 281-0015 (1961-1982) CANSIM 281-0005 (1983-2000) CANSIM 281-0024 (2001-2013)
- Capital Stock: Fixed residential CANSIM 031-0008 (1961-2013) and fixed non-residential CANSIM 031-0005 (1961-2013)

B.6 Cyclical Component of Provincial Real GDP

Provincial business cycle is defined as fluctuations about trend of real GDP and a provincial recession is then simply a negative deviation from this trend. The provincial real GDP trend and cyclical component are calculated in two alternative ways, both of which give almost identical results. First, based on the well known Hodrick-Prescott detrending procedure, and second based on a nonparametric, kernel regression estimate of log provincial real GDP on its time trend. The nonparametric cyclical component

of real GDP is then extracted as

$$\text{NPCC of RealGDP} = \log(\text{Real GDP}) - \text{NP Trend Real GDP}$$

where the NP Trend are the fitted values of the nonparametric provincial regression. Figure B.9 superimposes both NP and HP calculated cyclical components. The nonparametric cyclical component is the preferred measure used in regressions to control for the effect of the business cycle.

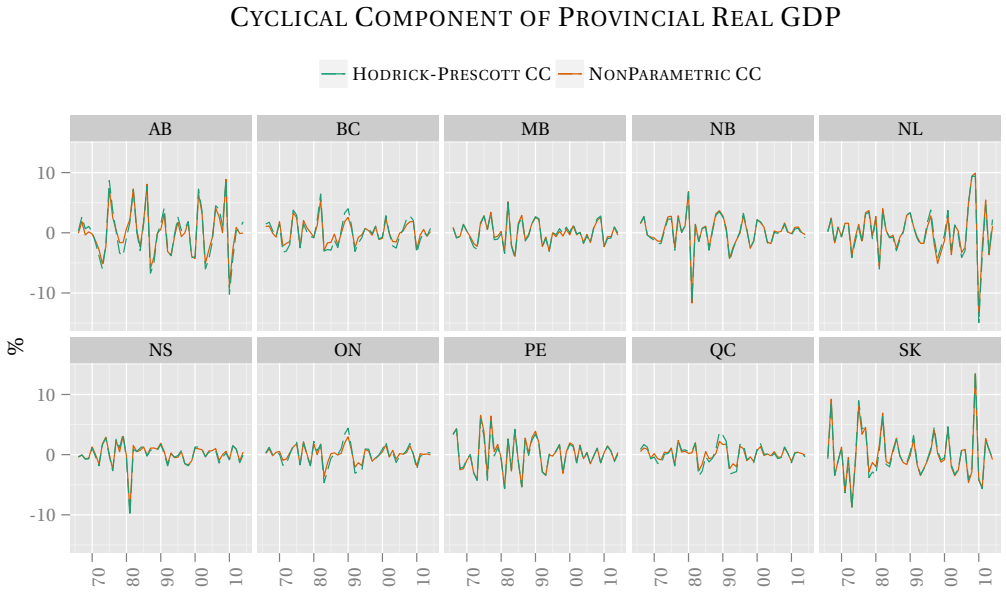

Figure B.9: Percentage Deviations from Provincial Trend Real GDP, 1965-2013.

B.7 Data Sources for Control Variables

- Unemployment Rate: CANSIM 384-0035 (1966-1975) and CANSIM 282-0002 (1976-2013)
- Teen and Working Age Population: CANSIM 051-0026 (1965-1971) and CANSIM 051-0001 (1971-2013)

- Teen and Youth Employment and Participation Rates: CANSIM 282-0002 (1976-2013)
- Average Hourly Earnings: Survey of Employment, Payrolls and Hours data on industrial composite of provincial average weekly earnings and hours. CANSIM 281-0021 and 281-0022 (1965-1982). CANSIM 281-0006 and 281-0007 (1983-2000). CANSIM 281-0027 and 281-0038 (2001-2013). Alternatively average weekly hours from the same source.
- Average Weekly Employment Insurance: CANSIM 276-0015 and CANSIM 276-0005 for (1965-2010) and CANSIM 276-0017 for (1997-2013)
- Election Dummy: Obtained from provincial parliaments' historical records available on their official websites.
- Provincial Small-Business Corporate Tax Rates: Cahill [2007] for the period 1965-2005 and updated to 2013 through Canadian Tax Foundation's *Finances of the Nation* reports.

Labor demand shocks are defined as the residuals from the following regression, run for each province separately:

$$\ln(E_{p,t}) = \alpha + \beta_1 \ln(E_{p,t-1}) + \beta_2 \ln(E_{p,t-2}) + \beta_3 \ln(E_{p,t-3}) + \beta_4 \ln(RGDP_{pt}) + \beta_5 \ln(RLC_{pt}) + \epsilon_{pt},$$

where E is provincial employment, $RGDP$ is real GDP and RLC is real employee labor cost. Residuals capture all sources of employment demand change other than change in real GDP, labor cost and past demand. As pointed out by Nickell et al. [2005], these residuals control for short-run employment shocks.

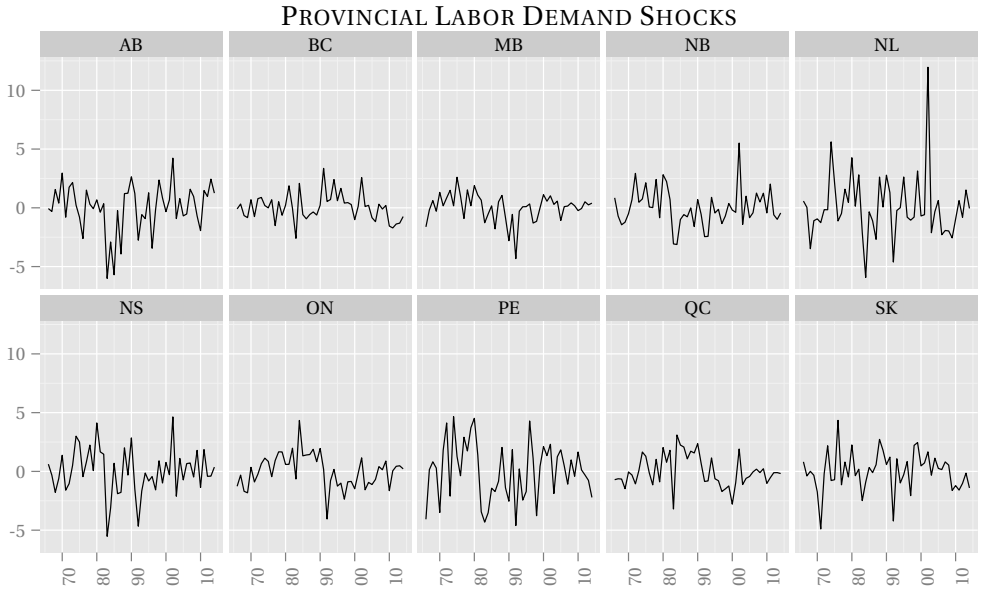

Figure B.10: Labor demand shocks across Canadian Provinces, 1965-2013.

B.8 Robustness Checks and Additional Regression Tables

The standard errors in these regressions, which are directly comparable to Table 3.2, are estimated by cluster bootstrapping (or block bootstrap) following Cameron et al. [2008]. The estimation is based on the wild cluster bootstrap, with province clusters, using the Rademacher distribution with 999 replications. This is a generalization of the wild bootstrap for models with heteroskedasticity. According to Henderson and Parmeter [2015] a wild bootstrap is consistent under both homoskedastic and heteroskedastic data.

Table B.5: Estimates of Real Minimum Wages Determinants in Canadian provinces using Bootstraped Standard Errors with Clustering. The wild bootstrap was used in computation. These two columns are comparable to Table 3.2 columns (4) and (5).

	Dependent Variable: Log(Real Minimum Wage)	
	Prov+Year FE	Prov+Year FE
	(1)	(2)
Log(Union Density)	−.077	−.105
	(.063)	(.068)
Log(Technology)	.136	.219*
	(.097)	(.122)
Political Ideology	−.168**	−.178**
	(.078)	(.075)
Political Ideology×ε	.165**	.170*
	(.082)	(.091)
Log(ε)	−.005	.013
	(.084)	(.091)
Log(Real Wage)	.268**	.309
	(.127)	(.194)
Log(Real Weekly E.I.)	.215	.252
	(.186)	(.245)
Log(lag Unemployment Rate)	.003	−.086***
	(.019)	(.025)
Log(lag Teen Pop. Share)	−.023	
	(.054)	
Log(lag Teen Part. Rate)		.430***
		(.158)
Log(lag Teen Empl. Rate)		−.448***
		(.123)
Election Dummy	−.003	−.003*
	(.002)	(.002)
HHI	−.406*	−.288
	(.229)	(.274)
Constant	−.006	−.342
	(1.030)	(1.200)
Year dummies?	Yes	Yes
Province dummies?	Yes	Yes
Period	1965-2013	1976-2013
Observations	470	370
Adjusted R^2	.999	.999
F Statistic	8,626.000***	9,459.000***
Note:		*p<0.1; **p<0.05; ***p<0.01
		Bootstrapped Standard Errors with Clustering

Table B.6: Robustness of Real Minimum Wage Determinants across Canadian provinces for Youth (15-24) Labour variables, Labor Demand Shocks and Provincial Business Cycle.

	Dependent Variable: Log(Real Minimum Wage)					
	Prov+Year FE	Prov+Year FE	Prov+Year FE	Prov+Year FE	Prov+Year FE	Prov+Year FE
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Union Density)	−.067* (.039)	−.076* (.039)	−.077** (.039)	−.066* (.038)	−.107*** (.039)	−.101** (.040)
Log(Technology)	.162** (.071)	.125* (.071)	.152** (.075)	.221*** (.076)	.203*** (.078)	.242*** (.079)
Political Ideology	−.167** (.068)	−.165** (.070)	−.167** (.070)	−.147* (.083)	−.168** (.083)	−.176** (.082)
Political Ideology×ε	.163** (.077)	.163** (.079)	.163** (.078)	.135 (.093)	.159* (.093)	.167* (.092)
Log(ε)	.036 (.062)	−.003 (.062)	−.001 (.061)	.048 (.066)	.020 (.065)	.019 (.065)
Log(Real Wage)	.220*** (.083)	.270*** (.090)	.268*** (.089)	.347*** (.087)	.318*** (.082)	.309*** (.082)
Log(Real Weekly E.I.)	.239*** (.092)	.209** (.092)	.211** (.091)	.196* (.113)	.246** (.112)	.246** (.112)
Log(lag Unempl. Rate)	−.001 (.017)	.002 (.016)	.003 (.016)	.004 (.030)	−.083*** (.026)	−.087*** (.026)
Log(lag Youth Pop. Share)	−.142* (.076)					
Log(lag Teen Pop. Share)		−.031 (.066)	−.020 (.066)			
Log(lag Youth Part. Rate)				−.833** (.339)		
Log(lag Youth Empl. Rate)				.501** (.254)		
Log(lag Teen Part. Rate)					.403** (.190)	.432** (.189)
Log(lag Teen Empl. Rate)					−.420*** (.157)	−.453*** (.157)
Election Dummy	−.003 (.007)	−.002 (.007)	−.002 (.007)	−.003 (.008)	−.003 (.008)	−.003 (.008)
HHI	−.413*** (.095)	−.411*** (.094)	−.408*** (.094)	−.263** (.103)	−.293*** (.106)	−.291*** (.107)
Labor Demand Shock		−.162 (.237)			−.202 (.215)	
Business Cycle			−.082 (.133)			−.102 (.152)
Year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Period	1965-2013	1965-2013	1965-2013	1976-2013	1976-2013	1976-2013
Observations	470	470	470	370	370	370
Adjusted R^2	.999	.999	.999	.999	.999	.999
F Statistic	8,687.000***	8,490.000***	8,484.000***	9,458.000***	9,291.000***	9,281.000***

Note: *p<0.1; **p<0.05; ***p<0.01

Cluster Robust Standard Errors

Table B.7: Robustness of Real Minimum Wage Determinants across Canadian provinces to inclusion of Average Regional minimum wages, small business income tax and nominal minimum wage increase in the previous year.

	Dependent Variable: Log(Real Minimum Wage)					
	Prov+Year FE	Prov+Year FE	Prov+Year FE	Prov+Year FE	Prov+Year FE	Prov+Year FE
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Union Density)	$-.077^{**}$ (.039)	$-.075^{*}$ (.039)	$-.089^{**}$ (.036)	$-.106^{***}$ (.038)	$-.090^{**}$ (.036)	$-.106^{***}$ (.038)
Log(Technology)	$.137^{*}$ (.070)	.095 (.069)	$.146^{**}$ (.070)	$.221^{***}$ (.075)	$.160^{**}$ (.073)	$.247^{***}$ (.077)
Political Ideology	$-.167^{**}$ (.070)	$-.163^{**}$ (.066)	$-.162^{**}$ (.068)	$-.176^{**}$ (.082)	$-.164^{**}$ (.076)	$-.183^{**}$ (.082)
Political Ideology$\times\varepsilon$	$.165^{**}$ (.079)	$.155^{**}$ (.074)	$.173^{**}$ (.075)	$.168^{*}$ (.091)	$.148^{*}$ (.086)	$.188^{**}$ (.092)
Log(ε)	$-.002$ (.063)	$-.031$ (.060)	.006 (.059)	.018 (.065)	$-.029$ (.063)	.033 (.064)
Log(Real Wage)	$.264^{***}$ (.088)	$.286^{***}$ (.089)	$.260^{***}$ (.086)	$.306^{***}$ (.081)	$.376^{***}$ (.083)	$.306^{***}$ (.079)
Log(Real Weekly E.I.)	$.213^{**}$ (.090)	$.199^{**}$ (.088)	$.222^{**}$ (.091)	$.255^{**}$ (.111)	$.214^{**}$ (.107)	$.271^{**}$ (.114)
Log(lag Unempl. Rate)	.003 (.016)	.0004 (.016)	.006 (.016)	$-.084^{***}$ (.027)	$-.076^{***}$ (.026)	$-.073^{***}$ (.025)
Log(lag Teen Pop. Share)	$-.021$ (.068)	$-.025$ (.066)	$-.011$ (.065)			
Log(lag Teen Part. Rate)				$.417^{**}$ (.189)	.276 (.188)	$.413^{**}$ (.187)
Log(lag Teen Empl. Rate)				$-.438^{***}$ (.157)	$-.347^{**}$ (.155)	$-.442^{***}$ (.155)
Election Dummy	$-.003$ (.007)	$-.002$ (.007)	$-.004$ (.007)	$-.003$ (.008)	$-.003$ (.008)	$-.004$ (.007)
HHI	$-.412^{***}$ (.093)	$-.438^{***}$ (.094)	$-.375^{***}$ (.092)	$-.295^{***}$ (.109)	$-.335^{***}$ (.105)	$-.259^{**}$ (.103)
Regional Average MW	.042 (.081)			.033 (.078)		
Small Business Tax		$.006^{***}$ (.001)			$.006^{***}$ (.001)	
MW Change Dummy			$.038^{***}$ (.009)			$.030^{***}$ (.008)
Year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Period	1965-2013	1965-2013	1965-2013	1976-2013	1976-2013	1976-2013
Observations	470	470	470	370	370	370
Adjusted R^2	.999	.999	.999	.999	.999	.999
F Statistic	$8{,}486.000^{***}$	$8{,}782.000^{***}$	$9{,}034.000^{***}$	$9{,}274.000^{***}$	$9{,}700.000^{***}$	$9{,}763.000^{***}$

Note: *p<0.1; **p<0.05; ***p<0.01

Cluster Robust Standard Errors

Table B.8: Determinants of Nominal Minimum Wages in Canadian provinces

	Dependent Variable: Log(Nominal Minimum Wage)			
	Prov+Year FE	Prov+Year FE	Prov+Year FE	Prov+Year FE
	(1)	(2)	(3)	(4)
Log(Union Density)	−.080**	−.068*	−.096**	−.065*
	(.041)	(.041)	(.038)	(.038)
Log(Technology)	.182***	.213***	.241***	.258***
	(.069)	(.069)	(.072)	(.074)
Political Ideology	−.192***	−.193***	−.173**	−.151*
	(.068)	(.067)	(.079)	(.082)
Political Ideology×ε	.186**	.186**	.163*	.134
	(.077)	(.076)	(.090)	(.092)
Log(ε)	.028	.076	.033	.087
	(.058)	(.059)	(.060)	(.061)
Log(Nominal Wage)	.321***	.261***	.315***	.375***
	(.087)	(.082)	(.079)	(.087)
Log(Nominal Weekly E.I.)	.236**	.261***	.250**	.223*
	(.099)	(.100)	(.117)	(.121)
Log(lag Unempl. Rate)	−.005	−.010	−.100***	−.007
	(.016)	(.016)	(.026)	(.032)
Log(lag Teen Pop. Share)	−.003			
	(.067)			
Log(lag Youth Pop. Share)		−.139*		
		(.077)		
Log(lag Teen Part. Rate)			.464**	
			(.188)	
Log(lag Teen Empl. Rate)			−.486***	
			(.156)	
Log(lag Youth Part. Rate)				−.795**
				(.347)
Log(lag Youth Empl. Rate)				.450*
				(.262)
Election Dummy	−.003	−.003	−.004	−.003
	(.007)	(.007)	(.008)	(.008)
HHI	−.422***	−.430***	−.291***	−.269***
	(.093)	(.093)	(.106)	(.103)
Year dummies?	Yes	Yes	Yes	Yes
Province dummies?	Yes	Yes	Yes	Yes
Period	1965-2013	1965-2013	1976-2013	1976-2013
Observations	470	470	370	370
Adjusted R^2	.998	.998	.999	.999
F Statistic	4,491.000***	4,522.000***	6,206.000***	6,170.000***

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust Standard Errors

Appendix C

Data Details and Sources for Chapter 4

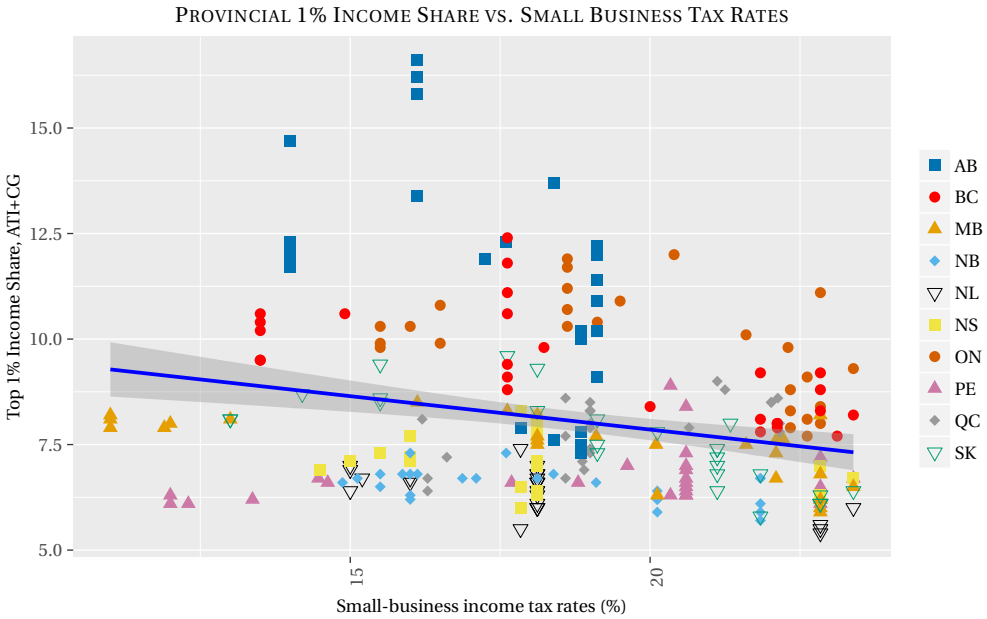

Figure C.1: Provincial top 1% income share vs. combined federal and provincial small business tax rates, 1988-2013. The straight line is a pooled linear fit. Sources: CANSIM table 204-0002 by Statistics Canada and *Finances of the Nation* published by Canadian Tax Foundation.

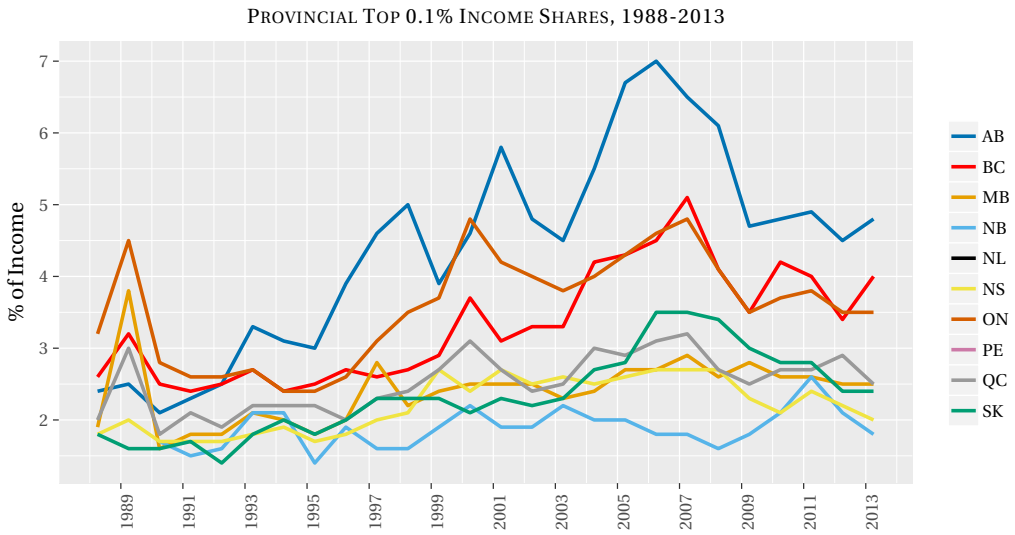

Figure C.2: Top 0.1% income shares, based on total after-tax income including capital gains. Data for NL and PEI are not available. Source: CANSIM table 204-0002.

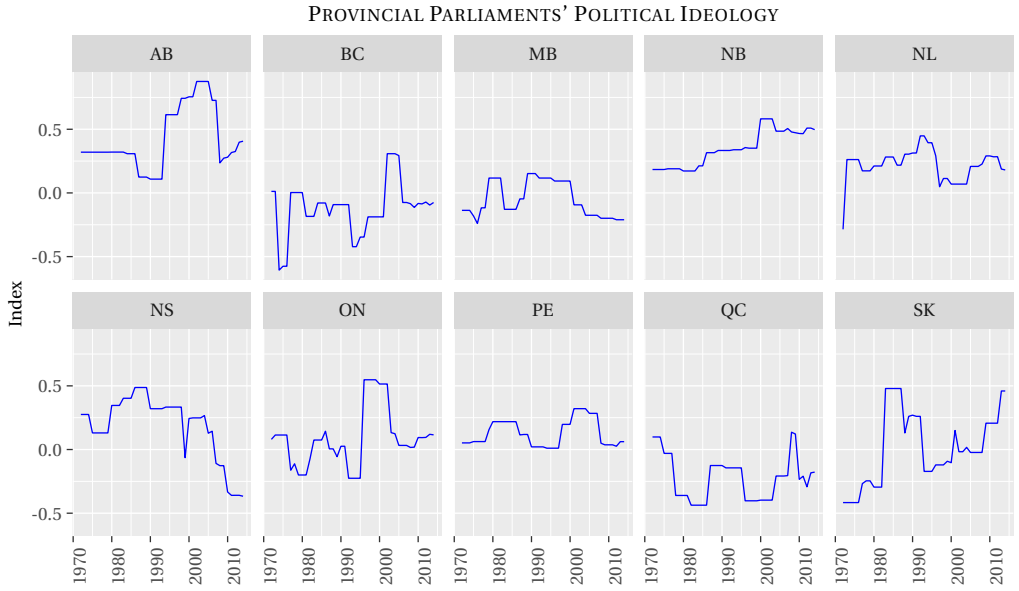

Figure C.3: Focused on economic issues, the ideological scale is bounded by -1 left-wing socialists and 1 for right-wing conservatives. The ideological score of each party in a given year is based on its leader indicating which party faction was in power. For example, the Conservative Party can have the score 1/3 denoting traditional Red Tory leaders in Canadian politics, the right-of-center score 2/3 or a far right position 1, for example during Mike Harris (ON) or Ralph Klein (AB) rule. The Liberal Party's standard score is 0, the business-friendly faction is at 1/3, while the labor-friendly faction is at $-1/3$. NDP is the most ideologically homogeneous of the major parties, but it is possible it shifts from its standard social-democratic, labor-friendly $-2/3$ to a far left, socialist position -1. See Lesica [2016] for further calculation details and a complete scale.

Table C.1: Sources of variables used in the empirical analysis. Unless otherwise noted all variables are at the provincial level.

Variable	Description	Source
Small Business Tax Rates	Provincial statutory and combined with federal)	*Finances of the Nation* and *National Finances* by CTF.
Top Individual Marginal Tax Rates	Provincial and combined top income bracket tax rate	*Finances of the Nation* and *National Finances* by CTF.
Top Income Shares	Provincial Top 1% and 0.1% income share trends of tax filers. Various income definitions used.	CANSIM Table 204-0002
GDP	Nominal provincial GDP, income based	CANSIM Table 384-0014 and 384-0037
Population	Total provincial population	CANSIM Table 051-0001
CPI	Province specific CPI. Series starts in 1979.	CANSIM Table 326-0021
U.S. Top Income Share	The top 1% income share	The World Wealth and Income Database, available at http://www.wid.world; accessed on 10/10/2016
Political Ideology	Based on parties ideology score and share of seats in the parliament	See Bjørnskov and Potrafke [2012], Lesica [2016] for details.
Election Dates	Provincial election years	Canadian Elections Database

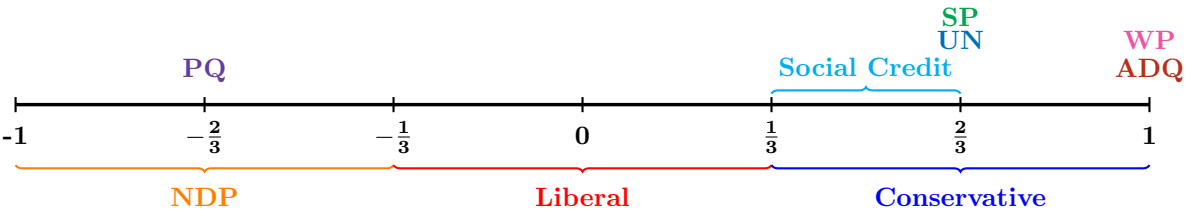

Figure C.4: Provincial Parties' Ideological Score

Appendix D

Robustness Checks and Additional Regression Results

Table D.1: SENSITIVITY TO TOP 0.1% INCOME SHARE, TIME PERIOD, AND PROVINCIAL SMALL BUSINESS TAX RATE ONLY

	Dependent variable:					
	Top 0.1% (ATI + CG)			Top 1% (ATI + CG)		
	(1)	(2)	(3)	(4)	(5)	(6)
Small Bus. Tax (combined)	$-.064^{**}$	$-.056^{**}$	$-.092^{***}$	$-.090^{***}$		
	(.007)	(.006)	(.012)	(.011)		
	p = .011	p = .013	p = .005	p = .004		
Real GDP per capita		$.0001^{***}$		$.0002^{*}$		.0001
		(0.00000)		(.00003)		(.00002)
		p = .001		p = .093		p = .112
Small Bus. Tax (province)					$-.078^{***}$	$-.070^{***}$
					(.005)	(.005)
					p = .0005	p = .0004
Year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Period	1990-13	1990-13	1988-07	1988-07	1988-13	1988-13
Adjusted R^2	0.86	0.894	0.819	0.894	0.84	0.881
Observations	192	192	200	200	260	260

Note: *p<0.1; **p<0.05; ***p<0.01
Reported in parentheses are robust standard errors, clusterd by province.
All regressions are weighted by the provincial population.

Table D.2: SENSITIVITY TO DIFFERENT TOP 1% INCOME DEFINITIONS, (1988-2013)

	Dependent variable:					
	Top 1% (Total Income + CG)			Top 1% (Total Income)		
	(1)	(2)	(3)	(4)	(5)	(6)
Small Bus. Tax (combined)	−.014**	−.039**	−.104*	−.018***	−.013	−.084*
	(.004)	(.007)	(.034)	(.003)	(.006)	(.029)
	p = .025	p = .012	p = .054	p = .005	p = .127	p = .062
U.S. Top 1%	.371***			.353***		
	(.010)			(.009)		
	p = .00003			p = .00003		
Real GDP per capita		.0001	.0002**		.0001	.0001**
		(.00002)	(.00002)		(.00002)	(.00001)
		p = .136	p = .042		p = .153	p = .036
Year effect?	No	Yes	Yes	No	Yes	Yes
Province effect?	Yes	Yes	Yes	Yes	Yes	Yes
Province trend?	No	No	Yes	No	No	Yes
Adjusted R^2	0.808	0.896	0.924	0.82	0.911	0.941
Observations	260	260	260	260	260	260

Note: *p<0.1; **p<0.05; ***p<0.01
Reported in parentheses are robust standard errors, clusterd by province.
All regressions are weighted by the provincial population.

Table D.3: SENSITIVITY TO DIFFERENT TOP 1% INCOME DEFINITIONS, (1988-2013)

	Dependent variable:					
	Top 1% (Market Income + CG)			Top 1% (Market Income)		
	(1)	(2)	(3)	(4)	(5)	(6)
Small Bus. Tax (combined)	−.012*	−.032**	−.117**	−.016***	−.002	−.090*
	(.004)	(.008)	(.036)	(.003)	(.007)	(.030)
	p = .051	p = .027	p = .047	p = .010	p = .757	p = .060
U.S. Top 1%	.411***			.390***		
	(.011)			(.011)		
	p = .00003			p = .00003		
Real GDP per capita		.0001	.0001**		.0001	.0001**
		(.00002)	(.00002)		(.00002)	(.00001)
		p = .169	p = .042		p = .199	p = .038
Year dummies?	No	Yes	Yes	No	Yes	Yes
Province dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Province trend?	No	No	Yes	No	No	Yes
Adjusted R^2	0.801	0.887	0.92	0.81	0.905	0.94
Observations	260	260	260	260	260	260

Note: *p<0.1; **p<0.05; ***p<0.01
Reported in parentheses are robust standard errors, clusterd by province.
All regressions are weighted by the provincial population.

Table D.4: SENSITIVITY TO THE PRE TAX REFORM PERIOD, 1982-2013

	Dependent variable:			
	Top 1% (ATI + CG)		Top 0.1% (ATI + CG)	
	(1)	(2)	(3)	(4)
Small Bus. Tax (combined)	−.038*		−.037*	
	(.014)		(.004)	
	p =.075		p =.071	
Small Bus. Tax (province)		−.038*		−.036*
		(.014)		(.004)
		p =.069		p =.071
Real GDP per capita	.0001	.0001	.0001***	.0001***
	(.00002)	(.00002)	(0.00000)	(0.00000)
	p =.144	p =.144	p =.006	p =.006
Year dummies?	Yes	Yes	Yes	Yes
Province dummies?	Yes	Yes	Yes	Yes
Adjusted R^2	0.869	0.869	0.882	0.881
Observations	320	320	223	223

Note: *p<0.1; **p<0.05; ***p<0.01
In the last two columns income shares data for NL, PEI, NB are missing.
Reported in parentheses are robust standard errors, clusterd by province.
All regressions are weighted by the provincial population.

Table D.5: TOP INCOME SHARE RESPONSES TO τ ACROSS SEXES, 1988-2013

	Dependent variable:		
	Top 1% (ATI + CG)		Top 0.1% (ATI + CG)
	(1)	(2)	(3)
Small Bus. Tax (combined)	−.063***	−.009***	−.033***
	(.006)	(.001)	(.001)
	p =.002	p =.004	p =.006
Real GDP per capita	.0001	.00001	.0001***
	(.00002)	(0.00000)	(0.00000)
	p =.110	p =.114	p =.005
Year dummies?	Yes	Yes	Yes
Province dummies?	Yes	Yes	Yes
Adjusted R^2	0.859	0.929	0.857
Observations	260	228	187

Note: *p<0.1; **p<0.05; ***p<0.01
Top income shares data for both sexes are not available for all provinces.
Top 0.1% share in column (3) is for men only.
Reported in parentheses are robust standard errors, clusterd by province.
All regressions are weighted by the provincial population.

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