Tax Competition and Employment—Empirical Analysis of Swiss Municipalities

Master Thesis

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- SPMAP: Pisati, 2008
- SPPACK: Drukker et al., 2013
- XSMLE: Belotti et al., 2016
- XTIVREG2: Schaffer, 2015

Executive Summary

Interjurisdictional tax rate competition and tax externalities can lead to distortions, which impact the location decisions of firms as well as of natural persons. The effects of these incentives on employment have not been subjected to (many) rigorous empirical studies yet. To ameliorate the situation, this thesis investigates the effect of tax competition on employment in Swiss municipalities. As a first step in the analysis, a theoretical model enable the derivation of a negative relationship between employment and corporate taxation. A unique dataset allows the examination of the effects of municipal taxes on hiring choices by using municipal tax burdens of different representative firms. The empirical results present evidence for a negative effect of municipal tax rates on firms' decisions with regards to employment, with the notable exception of the primary sector, and confirm the theoretical baseline model. The investigation of tax competition uses two methodologies to test the effect of neighboring tax choices on employment in a particular municipality. Firstly, the standard spatial econometric models indicate that neighbors decisions do not affect employment. However, these estimates are probably not reliable because of strong assumptions and an endogeneity concern. For these reasons, an innovative identification strategy exploits the state-level tax rate of the neighboring canton as an instrumental variable for the weighted (average) tax rate of neighboring jurisdictions. Therefore, the thesis profits from the exogenous variation of the state-level decisions. The results suggest a positive impact of the tax rates of neighboring firms on local employment depending on the sector of activity. Indeed, all sectors do not react similarly: the strongest response to a neighboring tax hike is found in the tertiary sector, whereas primary and secondary sectors do not appear to be affected. Hence, tax competition does influence the hiring decisions of firms, but principally in the sector with high mobility.

Résumé

La compétitivité fiscale interjuridictionnelle et les externalités fiscales peuvent aboutir à des distorsions qui influencent les décisions d'établissement des entreprises ainsi que des personnes physiques. Les effets de ces incitations sur l'emploi n'ont, pour le moment, pas été sujets à des études empiriques rigoureuses. Partant de ce constat, cette thèse investigue les effets de la compétitivité fiscale sur l'emploi dans les communes suisses. Une analyse préliminaire développe un modèle théorique qui dérive une relation négative entre emploi et taxation des sociétés. Une base de données unique permet d'examiner les effets des taxes communales sur les décisions d'embauche en utilisant les charges fiscales de différentes entreprises représentatives du paysage économique suisse. Les résultats prouvent l'existence d'une relation négative entre taux d'impôt communal et décision d'embauche, excepté dans le secteur primaire, ce qui confirme le modèle théorique de base. L'analyse de la compétitivité fiscale utilise deux méthodes pour tester les effets des choix fiscaux du voisinage sur l'emploi d'une commune. Tout d'abord, les modèles standards d'économétrie spatiale indiquent que l'emploi n'est pas affecté par le choix des communes voisines. Cependant, ces estimations ne sont probablement pas fiables pour deux raisons : d'une part, elles sont basées sur d'importantes hypothèses et, d'autre part, elles font face à un problème d'endogénéité. Pour ces raisons, une stratégie innovante d'identification exploite le niveau de taxation du canton voisin comme variable instrumentale pondérée du taux d'impôt des juridictions locales voisines. Avec cette méthodologie, les décisions cantonales sont considérées comme des variations exogènes pour les communes. En fonction du secteur d'activité, les résultats indiquent une hausse de l'emploi dans la commune, si les quotités d'impôt, pour les personnes morales, des communes alentour augmentent. En effet, tous les secteurs ne réagissent pas de manière similaire : la plus forte réponse à une augmentation du taux d'impôt vient du secteur tertiaire, tandis que les secteurs primaires et secondaires ne semblent pas affectés. Ainsi, la compétitivité fiscale influence les décisions d'engagement des entreprises, mais principalement dans le secteur à forte mobilité.

Table of Contents

Index of Figures

Index of Tables

1 Introduction

1.1 Background

Switzerland—with its federalist system—is a particularly suitable environment to study interactions of same-level jurisdictions. In international comparison, the local governments benefit from a strong degree of autonomy (Ladner et al., 2016, pp. 342–347).

This is a result of the federal constitution, which guarantees the delegation of competencies to the cantons, which, themselves, devolve some public services to municipalities. In all likelihood, the major delegation concerns taxes. Each level (Confederation, cantons, and municipalities) is authorized to levy taxes with, however, some reserved domains for the upper level (for instance, in indirect taxation) and a harmonization between cantons. Thus, the two local jurisdictions can adjust their tax rates to increase their tax bases. By setting these attractively, they can influence the location choices of firms or the development of business activities, and, therefore, increase the jurisdiction's employment. Hence, the choices of local jurisdictions exert an indirect effect on employment.

Even with autonomy, any jurisdiction can take decisions on the basis of the influence of other authorities. Under such circumstances, if a municipality chooses to set its tax rate strategically with the aim to attract firms or citizens, it is likely that neighboring municipalities would also reduce their tax burdens to preclude a flight of firms or citizens. These interactions have been intensively analyzed in the field of tax competition. Many studies have recently observed this phenomenon at the cantonal level (see, for example, Feld and Kirchgässner (2003)) and at the municipal level (see, for example, Parchet (2014)). The competition of same-level governments is in line with the Tiebout hypothesis of "voting with one's feet." Furthermore, research has identified three sources of strategic fiscal interactions: benefit spillovers, distorting taxes on the mobile tax base, and yardstick competition resulting from political economic considerations and information asymmetries[1] (Brueckner, 2006, pp. 333–335; Lyytikäinen, 2012, pp. 585–586). In contrast to the early works that identified tax competition as wastage of resources, it can also improve welfare on the condition that it restricts the scope for public-sector revenue maximization (Brülhart & Jametti, 2007, p. 29).

1 Voters use tax rates in their jurisdiction relative to other jurisdictions as a yard-stick to evaluate how well their government is performing. Yardstick competition arises because the citizens do not have all information on the true cost of providing public services and only observe tax rates.

The next section explains why it is valuable to enlarge interactions in tax settings between same-level jurisdictions to a field other than taxation.

1.2 Research Question

As tax competition between municipalities is usually easily identifiable, only a few studies have examined its effect on employment, probably because the causality is complex. Feld and Kirchgässner (2003) explored this relationship at the cantonal level and found that taxation does not appear to have a dramatic impact on cantonal employment. Nevertheless, fiscal policies appear to play a crucial role in the explanation of the regional distribution of firms. A more intensive analysis of the tax system at the municipal level could reveal incentives for jurisdictions to maintain employment level with the help of tax rate cuts. Indeed, the local government takes firms' decisions on employment as exogenous, and can only influence this indirectly through tax adjustments. This basic reasoning assumes that firms hire their workforces from the residential municipality, which is not necessarily always the case.

Previous research has concentrated on the reactions of municipalities' taxes to changes in neighbors' tax rates. This thesis is a first-of-its-kind contribution to enlarging the impact of tax competition to a branch of study other than taxation. Here I propose to apply methodologies used to identify strategic interactions on employment in municipalities. Hence, the main goal of the thesis is to investigate the effect of tax competition on employment in Swiss municipalities.

As a first step in the analysis, a negative effect of taxation on the number of employees in a firm is derived from a simple theoretical model. Thereupon, by using this basis, I expect a negative effect of municipal taxes on employment, as presented by Jofre-Monseny and Solé-Ollé (2008) or by Siegloch (2013). Hence, the first hypothesis is stated as follows:

H1: *The employment in a municipality depends (negatively) on the tax burden in this specific municipality.*

However, previous research that examines the employment reaction to taxation neglected to consider the effect of neighboring jurisdictions' taxes on firms' hiring decisions. Even though there is a negative effect of municipal taxation on employment, it is unclear if taxes of neighbor municipalities also negatively impact employment in the municipality under consideration. Indeed, a positive sign indicates that tax hikes of neighboring municipalities favor the development of firms in the municipality considered. In this case, firms shift to municipalities with lower taxes. In contrast, a negative effect of neighbors' tax decisions implies that neigh-

boring tax hikes decrease the employment in the municipality considered. This could occur when firms are highly interconnected in a region. For instance, if a business partner located in the neighboring municipality moves away because of tax reforms, it is possible that other linked companies—situated in other municipalities—will follow this first move. However, this situation probably arises only when the transport costs between enterprises are high. Thus, the second hypothesis is formulated hereunder:

H2: *The employment in a municipality depends on a weighted average tax burden of neighboring municipalities.*

The following section presents the methodology used to explore these two hypotheses.

1.3 Method

This thesis investigates the impact of taxation and tax competition (independent variables) on employment (dependent variable) between same-level jurisdictions. The quantitative method is chosen, since it is the predominant approach in the analysis of strategic interactions between same-level governments. With the aim to generate baseline results, non-spatial models are tested. However, these models do not account for spatial interactions. For this reason, spatial econometrics appears to be a more accurate methodology for the identification of tax competition (in line with Allers & Elhorst, 2005, pp. 7–8; Gérard et al., 2010, pp. 337–338). Three models (*Spatial Durbin Model*, *Spatial Autoregressive Model*, and *Spatial Error Model*) will be discussed. Nevertheless, these models rely on strong assumptions (Gibbons & Overman, 2012, pp. 177–180) and may have a tendency to overestimate the degree of interdependence in taxes (Lyytikäinen, 2012, pp. 592–593). For these reasons, a better strategy of identification is applied. This procedure is derived from Parchet (2014) and uses an exogenous variation at the cantonal level to identify tax competition.

The literature research is conducted in two main empirical fields: firstly, about tax competition between jurisdictions and, secondly, about the impact of firms' taxation on employment. Furthermore, the early theory about tax competition is also recalled.

The methodology relies on a unique database combining information about employment, firms, taxation and a set of control variables. The data cover 2,198 Swiss municipalities for the years from 2011 to 2014. The dependent variable—employment in terms of full-time equivalents—allows a separation between sector of activity (primary, secondary and tertiary). Two indexes have been created for the independent variables. The first one averages a large set of income tax rates for different categories of taxpayers. The second one is the average of

firms' tax rates for diverse classes of benefits. Even though the Swiss context is adapted because of its fiscal particularities, the generalization of the findings is, consequently, reduced. However, the study tries to enlarge the impact of tax competition to employment, and not to generate internationally valid results.

The main results show that neighboring tax choices partially influence the level of employment in a municipality. In particular, it does not appear to be the case in all sectors: only a rise in neighboring taxes increases the employment in the tertiary sector. Additionally, the first hypothesis is verified: the municipal tax rate has, indeed, a negative effect on the overall employment in a municipality.

The structure of this thesis is organized as follows. The next chapter presents the studies that have influenced this research. In Chapter 3, a simple microeconomic model demonstrates the negative relationship between taxation and employment for a firm. Chapter 4 justifies the choice to perform the analysis in Switzerland by explaining the particularities of the Swiss tax system. In Chapter 5, the sources of data are presented in detail. Chapter 6 considers the different empirical models without spatial interactions and confirms the negative effects of the taxes of municipal firms on employment. In Chapter 7, the spatial econometrics includes the neighbors' tax choices in the models. The standard models do not provide any convincing results and face a problem of endogeneity, whereas the instrumental variable strategy correctly captures the effect of neighboring decisions. Chapter 8 develops the three kinds of limitations that this analysis suffers from: theoretical, statistical and methodological. In Chapter 9, a discussion enlarges the findings to policy and future research recommendations. Before concluding, Chapter 10 proposes two extensions. The first one examines the effect of neighboring taxation on the number of firms in a municipality and the second one questions worker mobility between jurisdictions.

2 Literature Review

The classical and early theory claimed that tax competition wastes resources and results in inefficiency for the provision of public goods. Tax competition is a source of inefficiency if (1) mobile factors locate or reside in jurisdictions with (2) lower tax rates that are actually set strategically in order to attract mobile production factors (Feld & Reulier, 2005, p. 1). In contrast, more recent contributions have linked tax competition among governments with an efficiency-enhancing role. This chapter presents, firstly, the early theoretical analysis of tax competition. Secondly, there is a focus on contributions that identify empirical strategic inter-

actions. Finally, attention will be paid to empirical studies that argue that a link exists between taxation, location of firms, and employment.

2.1 Theory of Tax Competition

In the context of analysis of local fiscal policy, Tiebout (1956) argues that local governments offer different tax and expenditure bundles. Consequently, citizens sort themselves across jurisdictions in accordance with their preferences (Tiebout, 1956, p. 424). Even if the model of "voting with one's feet" is a major contribution to public finance literature, the source of tax competition relies more on the idea that jurisdictions try to attract tax bases from one another by providing lighter taxes, even if the production of public goods is suboptimal (Oates Decentralization Theorem, reformulated in Oates, 2005, p. 353; Oates & Schwab, 1988, pp. 350–351). In contrast, the reduction in the size of the public sector can also have a positive effect. From a public-choice perspective, Brennan and Buchanan (1980) argue that governments are "Leviathans" with the aim to maximize tax revenues instead of citizens' welfare (Brennan & Buchanan, 1980, pp. 13–33). In this context, fiscal decentralization can act as a mechanism to constrain the expansionary tendencies of governments. A strong support for the assumption that tax competition improves welfare is presented by Brühlart and Jametti (2007). They identified fragmentation resulting from tax competition as an instrument to reduce revenue maximization (Leviathan government) (Brülhart & Jametti, 2007, p. 29). However, and as noted in Wilson (1999), the prevailing view in literature remains that tax competition is damaging and results in sub-optimally low tax rates.

A formal analysis by Wilson (1986) and Zodrow and Mieszkowski (1986) highlights the fundamental trade-off implicated in the choice of the tax rate. High tax rates on mobile factors lead to higher revenues for a given tax base. Nevertheless, high tax rates also drive away a part of the tax base into other jurisdictions. Consequently, these models advocated a shift in taxes from mobile capital to immobile factors of production (Baskaran & Lopes da Fonseca, 2013, p. 4). Under those circumstances, a race to the bottom in the field of taxation can occur.

Another perspective for identifying inefficiency is the analysis of vertical and horizontal tax externalities (Blöchliger, 2013, pp. 69–71; Brülhart & Jametti, 2006, pp. 2032–2037). Horizontal externalities occur when uncoordinated (same-level) governments set tax rates (and consequently public expenditure) at an inappropriately low level in terms of efficiency and equity. Vertical externalities exist when the lower-level jurisdiction overtaxes relative to the social optimum. The main empirical result claims that municipal tax rates increase with the

relative smallness of municipalities. Vertical externalities appear to dominate in the Swiss federalist system (Brülhart & Jametti, 2006, pp. 2054–2056). In contrast, Leprince et al. (2007) claim that vertical tax interactions between departments and regions in France do not exist. Thus, the institutional setting appears to play an important role.

Even if tax competition provides a strong argument in the political debate about cutting tax burdens, this does not necessarily impact the migration of population or firms. Brülhart and Parchet (2014) find little discernible impact on migration patterns of elderly taxpayers in a context of bequest tax competition at the cantonal level. The two authors highlight the difficulty for estimating tax base elasticities in the case of interjurisdictional competition, leading to an erroneous estimate of the mobility of tax bases (Brülhart & Parchet, 2014, p. 63). The next section presents empirical studies that identify the interactions between neighbors' jurisdictions as tax competition.

2.2 Strategic Interactions through Neighbors' Jurisdictions

Decades of political and social science research have revealed the existence of government strategic interactions (for examples in the Swiss context, see Feld & Kirchgässner, 2001). Such interactions could occur at any level of jurisdiction. If tax competition exists, we could observe a systematic relationship between tax choices of a given jurisdiction and those of its neighbors. These interactions could be either strategic complements or substitutes. A selection of the most influencing elements for this Master's thesis is reviewed in this section.[2]

An overview of the early empirical literature that uses neighbors' reactions is presented by Brueckner (2006). In addition, the author classifies the models with strategic interaction into two categories: the "spillover" model and the "resource flow" model. In the spillover model, each jurisdiction chooses the level of a decision variable. However, the jurisdiction is also directly affected by the choices made elsewhere, indicating the presence of spillovers. In the "resource flow" model, a jurisdiction is not directly affected by the levels of a decision variable in other jurisdictions. But the jurisdiction cares about the amount of a particular "resource" that resides within its borders. Because the distribution of this resource among jurisdictions depends on the choices of all, each jurisdiction is then indirectly affected by choices made elsewhere (Brueckner, 2006, pp. 333–339).

The majority of studies observes that tax rates are strategic complements: a decrease in the tax rate by other jurisdictions leads to a decrease in one's own. In Switzerland, Feld and Reulier

2 As the thesis focuses on municipalities, the entire international tax competition literature will not be presented.

(2005) were two of the first to integrate the taxes of neighboring cantons to analyze a strategic tax setting. Their results argue that as the income tax rates in cantons get lower, the tax rates of their neighbors get lower, too (Feld & Reulier, 2005, p. 19). Using a meta-regression analysis, Costa-Font et al. (2015) insist that strategic interactions are stronger among municipalities than among intermediate levels of government. Their second result claims that decentralization reduces welfare and spending competition (Costa-Font et al., 2015, p. 22). Delgado et al. (2015) show with Spanish data the relevance of political variables such as the ideology of the incumbents and political fragmentation. They argue that incumbents mimic neighboring municipalities ruled by the same political party (Delgado et al., 2015, pp. 365–366). In the same fashion, socialization among policy makers appears to attenuate competitive dynamics by setting limits to the extent of competition considered acceptable (Gilardi & Wasserfallen, 2016, pp. 18–23).

Some authors use more advanced definitions of neighbors in spatial econometrics analysis. Gérard et al. (2010) specify different weight matrices to capture interregional differences. They find that Belgian municipalities are sensitive to the local income tax rates set by only their closest neighbors (Gérard et al., 2010, p. 339). The definition of the competitor is crucial for studies in spatial econometrics. Distance or population competitors are the most common approaches in literature. In reality, they may not be true competitors in the sense that potential movers care more about the actual policies of a potential new community rather than contiguity, proximity and/or population size when they make a decision to move (Dubois & Paty, 2010, pp. 443–444; Skidmore et al., 2012, p. 355).

Gibbons and Overman (2012) criticize empirical literature on local tax competition. They claim that the estimates rely on strong identifying assumptions (Gibbons & Overman, 2012, pp. 187–188). In particular, the effect of the neighbor's tax policy is identified through functional form assumptions by using neighbors' characteristics as instruments to induce quasi-exogenous variation in neighboring tax rates (Baskaran & Lopes da Fonseca, 2013, p. 8).

Some authors overcome this issue by using more elaborate identification strategies. Lyytikäinen (2012) takes recourse to a Finnish policy intervention that increased statutory lower limits to the property tax rates. His results contrast with earlier empirical literature and the standard spatial econometrics approach. He did not find evidence of interdependence in property tax rates. In addition, the comparison with standard spatial lag and spatial instrumental variable estimates suggest that these methods may have a tendency to overestimate the degree of interdependence in tax rates (Lyytikäinen, 2012, pp. 589–593). Parchet (2014)

compares Swiss municipalities using cantonal reforms as exogenous variations in the tax rate of local jurisdictions situated on the state border. The author argues that tax competition can either result in inefficiency when tax rates are strategic complements or efficiency when tax rates are considered strategic substitutes. When he uses the standard methodology, the results suggest that tax rates are strategic complements, while the cantonal border strategy advocates strategic substitutes (Parchet, 2014, pp. 15–19). Moreover, with the presence of cultural difference (mainly language) in preferences for public goods, the level of taxation will be established as equivalent to the neighboring municipalities' level. In other words, "[language] border municipalities are found to have the same differences in preferences as non-border municipalities, but the tax differential at the language border is zero" (Eugster & Parchet, 2013, p. 30). This fact advocates a tax rate which is not chosen with the aim to finance public goods, but is, rather, a strategic reaction. Agrawal (2013) uses local option sales taxes in the United States with a border strategy to show that state tax differences create horizontal inequities in consumption (individuals with the same ability to actually pay different taxes). In addition, firms distort the location characteristics of the good to the favorable tax side of the border (Agrawal, 2013, p. 21). The next section reviews a selection of studies that link taxes with firms' location and hiring choices.

2.3 Firms' Taxation, Location Choices, and Employment

Business taxation could depress business activity through several channels. For example, firms that may otherwise have hired or invested simply may not do so due to the difference between pre-tax and after-tax profits. As already mentioned, the location of activities could also be affected. Although this might be true, business taxation can give the incentive to use more tax-favored production strategies, organizational forms or benefit from public goods externalities (Giroud & Rauh, 2015, p. 2). A sample of studies that analyzes the relationship between firms' taxation, location choices and/or employment is presented in this section.

Even if the early work by Carlton (1983) claims that taxes and state incentive programs do not have any major effect on the location and employment choices, Feld and Kirchgässner (2003) presented some evidence that Swiss corporate and personal income taxes influence the regional distribution of firms at the cantonal level and, consequently, the employment. The corporate tax rate appears to have a negative impact on the number of highly profitable firms. Personal income taxation presents an even stronger negative impact on the regional distribution of firms (Feld & Kirchgässner, 2003, pp. 137–153).

Giroud and Rauh (2015) estimate the impact of state taxes on the activities of multi-state firms in the United States. They argue that corporate entities reduce the number of establishments per state when state tax increases. The number of employees and capital per plant also decrease (Giroud & Rauh, 2015, p. 40). If we concentrate on small business taxation instead of multiple state corporations, lighter taxation leads to increases in the turnover of firms, indicating more effort on part of the owner (Harju & Kosonen, 2012, pp. 25–34). A similar strong negative correlation between tax burden and the share of self-employed in Swedish total employment supports the hypothesis that lower taxes lead to increases in employment (Fölster, 2002, pp. 143–144). Identically, Siegloch (2013) argues that taxes reduce investments and, consequently, have a negative impact on employment.

From a welfare point of view, firm owners bear a substantial portion of the incidence of corporate taxes as non-tax considerations limit the mobility of business (Zidar, 2014, pp. 42–47). As a consequence, this fact suggests that highly productive firms will not change location after small tax increases, and may even hire employees. From a city's perspective, Haughwout et al. (2004) insist that for jurisdictions, revenues lost from tax cuts are private incomes gained. Consequently, there is no economic cost of creating jobs for the average resident using tax cuts (Haughwout et al., 2004, p. 580).

By enlarging the research to the local context and neighboring effects, Levratto (2014) shows that firm creation highly depends on local factors. Firm creation in a given employment area may exert a strong influence on the entrepreneurial spirit in the surrounding areas. Two externalities can arise: an imitation effect (positive) or the market could become unavailable for other potential entrepreneurs in the neighborhood (negative) (Levratto, 2014, p. 15). Thus, local factors could result in partial tax coordination or (with a similar result) yardstick competition. An explanation for yardstick competition, developed by Buettner and von Schwerin (2016), is that local jurisdictions mimic each other's taxation policies because investors compare policies to form expectations about future policies to avoid facing adjustment costs. Partial coordination occurs through bunching from small jurisdictions and jurisdictions sharing the same upper-level government, whereas yardstick competition prevents governments from extracting rents because of comparative performance information (Buettner & von Schwerin, 2016, pp. 192–193).

Borck and Pflüger (2006) argue that tax competition is different with new economic geography settings. The agglomeration rent that accrues to the mobile factor in the core region can be taxed. Moreover, a tax differential between the core and the periphery can be main-

tained (Borck & Pflüger, 2006, pp. 655–663). Following this theoretical postulate, Jofre-Monseny and Solé-Ollé (2008) use new economic geography models with Spanish data to analyze the combined effect of local business taxes and agglomeration economies on the intraregional location employment. They find that an increase in the strength of agglomeration economies in a municipality implies an increase (decrease) in the effects of taxes if the jurisdiction is similar (dissimilar) in size to their neighbors (Jofre-Monseny & Solé-Ollé, 2008, p. 28). Hence, stronger agglomeration economies imply a more marked effect of taxes. This agglomeration effect acts as a determinant in the firms' location choices. In more spatially concentrated sectors, location choices are less sensitive to tax differentials. In other words, agglomeration economies can diminish the importance of tax differentials for firms' location choices and reduce the intensity of corporate tax competition (Brülhart et al., 2012, p. 1090). As a consequence, the mobility of tax bases is difficult to forecast for jurisdictions when agglomeration forces arise. Even if the recent research underlines the importance of new economic geography in tax competition, this thesis concentrates on spatial models, accounting only for neighboring choices and ignoring agglomeration forces. The following chapter derives a theoretical model that advocates a negative effect of taxation on employment.

3 Theoretical Framework

This chapter presents a simple microeconomic model of labor demand to reveal the circumstances under which profit taxation affects a firm's employment decision. This framework is derived from profit basis theory in perfect competition (Varian, 2007, pp. 395–409) and the empirical study from Siegloch (2013, pp. 6–9).

A representative firm uses input factors capital K and labor L in its production function F, which is a standard neoclassical production function with positive and decreasing returns to scale. Additionally, a strict concavity assumption is needed on *F(K,L)* to ensure strictly positive profits. A profit tax τ is applied to the firm and a share $\alpha \in [0,1]$ of the capital costs can be deducted from the tax base. The enterprise's after-tax profits Π are:

$$\Pi = (1-\tau)[pF(K,L) - wL] - (1-\alpha\tau)rK \tag{1}$$

where r is the interest rate, w the wage and p the output price. The following first-order conditions can be derived to maximize profits:

$$F_L = \frac{w}{p} \tag{2}$$

$$F_K = \frac{(1-\alpha\tau)r}{(1-\tau)p} \tag{3}$$

Equation (2) shows that labor demand is not directly affected by the profit tax. If all capital costs are deductible from the profit tax base (i.e. $\alpha = 0$), the capital demand is also not affected by profit tax. Therefore, for the following analysis, it is assumed that $\alpha < 1$.

Totally differentiating equations (2) and (3) yields (assuming $d\alpha = 0$):

$$F_{LL}\,dL + F_{LK}\,dK = \frac{1}{p}\,dw - \frac{1}{p^2}\,dp \tag{4}$$

$$F_{KK}\,dK + F_{LK}\,dL = \frac{1-\alpha\tau}{(1-\tau)p}\left[dr - \frac{1}{p}\,dp\right] + \frac{(1-\alpha)r}{(1-\tau)^2 p}\,d\tau \tag{5}$$

The condition of perfect competition implies that firms are price takers. Two additional assumptions need to be made: firstly, the non-tax costs of capital are not affected by changes in the tax rate, i.e. $dp = dr = 0$. Secondly, labor is perfectly mobile across jurisdictional borders and a change in local tax rate leaves wages in the competitive sector unchanged, i.e. $dw = 0$. These assumptions reduce equation (4) to $dL = -\frac{F_{LK}}{F_{LL}}\,dK$. Plugging into equation (5) and rearranging shows that capital decreases as the profit tax increases

$$\frac{dK}{d\tau} = \frac{(1-\alpha)\,r\,F_{LL}}{(1-\tau)^2 p\left[F_{KK}F_{LL} - F_{LK}^2\right]} < 0 \tag{6}$$

since $F_{LL} < 0$ and, by the strict concavity assumption $F_{KK}F_{LL} - F_{LK}^2 > 0$. The negative effect on employment is:

$$\frac{dL}{d\tau} = \underbrace{-\frac{F_{LK}}{F_{LL}}}_{>0}\frac{dK}{d\tau} < 0 \tag{7}$$

Equation (7) presents a negative employment effect of corporate taxation which goes through capital: higher corporate taxes reduce capital. The complementarity between capital and labor ($F_{LK} > 0$) implies that the marginal product of labor has to decrease. Recall condition (2): the marginal product of labor equals the real wage. If w and p are given, F_L cannot decrease. Then, the marginal product of labor has to remain at its pre-tax reform level and this can only be the case by reducing L given $F_{LL} < 0$. Thus, this simple theoretical model implies that employment decreases if corporate taxes rise.

The strict assumption of perfect labor mobility in the model can be questioned, but it seems reasonable that workers do not restrict their job searches to the municipal area, but accept

offers within the canton or within the labor market region. The hypothesis of the cantonal mobility will be tested empirically in further analysis (see Section 10.2).

It is important to note that wages and capital costs will only remain approximately constant given decreasing returns to scale. The mechanism is straightforward: the prices within a regional labor market will not be affected by an increasing tax rate in one small municipality. Nevertheless, production factors move out of the high-tax municipality. Consequently, labor and capital will be spread equally over the other (lower-tax) municipalities in the region. This development will slightly impact the marginal products of labor and capital in other regions. The aggregate welfare loss induced by these small price reductions is substantial and exceeds tax revenues and dead weight output losses in the high-tax municipality (Siegloch, 2013, p. 9). Following this reasoning, small wages decreases result from a tax increase. The data availability in Switzerland limits the analysis of wage reactions after tax variations. This thesis will not test this effect since there is no data about the average municipal wage. As an approximation for this missing variable, the average regional wage will be used. However, Siegloch (2013) finds that wages are not very responsive to corporate tax changes in German municipalities. Hence, it is reasonable to assume that similar conclusions can be drawn in the Swiss context. The next chapter reveals why Switzerland is an accurate exemplar for capturing the effect of taxation on employment.

4 Switzerland's Institutional Setting

This chapter explains the extent to which Switzerland is appropriated to empirically explore the theoretical framework. The Swiss fiscal system provides a well-known and suitable laboratory to examine local tax competition. The Swiss constitution designates three layers of autonomous jurisdiction (national, cantonal and municipal), with strong fiscal competencies for the two local government units. Switzerland is divided into 26 cantons formed by 2,352 municipalities (in 2014) with 90 municipalities on an average by canton, ranging from 362 (Bern) to 3 (Basel-Stadt and Glarus). Moreover, the population varies strongly between municipalities, with 13 (Corippo – TI) to 391,359 (Zürich – ZH) inhabitants in 2014. Other important variations between municipalities (such as purchasing power, livability, topography, portion of young and elderly people, etc.) justify the strong autonomy for cantons and municipalities to determine their tax rates. Because of this federalist structure, the variations between tax burdens appear to be very large.

The main progressive taxes on personal and corporate income are state and local taxes. The cantons have the basic power to tax income (55% of their revenues in 2014), wealth (8.8% in 2014), corporate income (14.4% in 2014) and capital (2.1% in 2014). An important part of their revenues (12.9% in 2014) comes also from various indirect taxes (bequest, land tax, etc.) and from taxes on expense and possession (dog taxes, boat taxes, etc.). The municipalities can levy a surcharge on cantonal direct taxes and raise own property and wealth taxes. Direct tax income (62.9% in 2014) and direct profit tax (12.5% in 2014) are their main sources of revenues. The central government relies mainly on indirect (proportional) taxes (57.5% of its revenues in 2014), the value added tax (VAT) and specific consumption taxes, but also on direct tax on gain and income (29.6% in 2014) as well as a source tax on interest income (9% in 2014) (Feld & Kirchgässner, 2003, pp. 131–132; percentages calculated from Swiss Federal Finance Administration, 2016, pp. 37–67).

Even if cantonal and local jurisdictions can raise taxes to better answer the local demand for public goods, the corporate income taxation appears to be complicated. Feld and Kirchgässner (2003) identify seven taxes on capital: the corporate tax on profits, the capital tax, the federal source tax on interest and dividend income, an emission charge, the property tax, and—in some cantons—the Church tax and a minimum tax. It is important to note that private capital gains are not taxed in Switzerland. All these taxes are not negotiated with individual firms or sectors, but rely on legally binding statutory rates that depend on the firm's observed profitability and capital (Brülhart et al., 2012, p. 1076). Nevertheless, special tax regimes can be applied to firms (tax rebates, holding, and domicile privileges). For this reason, this thesis based its analysis on the two most common type of firms: the public limited company (AG) and the limited liability company (GmbH), without considering special tax rebates or profit shares between cantons.[3] In addition, these two entities face the same taxation scheme.

3 The strong variations in tax burdens imply that double taxation agreements play an important role in cantons and profits allocation rules for firms with plants in different cantons. However, for reasons of simplicity, the thesis only considers firms with activities in a single canton.

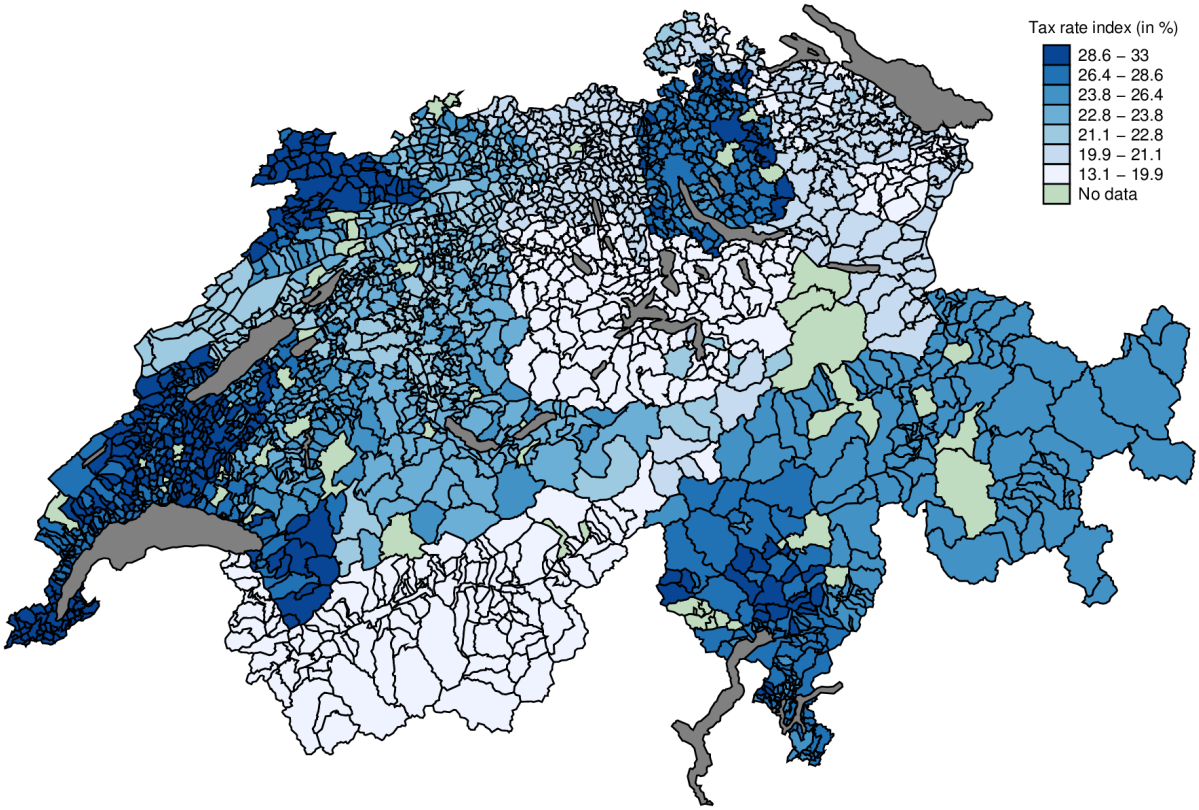

Figure 1: Firms' Tax Rate Index in Swiss Municipalities for year 2014

Notes: The tax rate index corresponds to the average of all tax rates (federal, cantonal, municipal and—if obligatory—Church) for a sample of representative standard firms with profits between 4,000 CHF and 50,000 CHF, with a capital of 100,000 CHF and firms with profits between 80,000 CHF and 1,000,000 CHF, with a capital of 2,000,000 CHF (see table B 3). Because of specific tax redistributions, municipalities in canton Basel-Stadt are excluded from the analysis. Similarly, the three municipalities in canton Glarus are excluded due to the complexity of taxation. The others municipalities without data are mainly municipalities that merged between 2011 and 2014.

To calculate the tax burden, the rate of the federal tax is expressly mentioned in the law, and enables immediate determination of the federal tax burden, given the profits. In most cantons, the tax burden is determined in two sections: the basis rate, fixed in the law, and a multiple of it, which is periodically fixed. To obtain the cantonal tax burden or municipal tax burden, it is necessary to multiply the basis of the calculation (profit or capital) by the basis rate, expressed in cantonal laws, and multiply the result (simple tax) by the annual multiple. This multiple is expressed as a percentage of the simple tax or, in some cantons, as a multiple in absolute numbers. In addition, a Church tax has to be paid based (usually) on a percentage of the cantonal simple tax. However, the Church tax for firms does not exist or is not obligatory in some cantons. There are various specificities to determine the municipal tax burden in each canton: for example, in Zürich, Solothurn, Vaud and Genève, the multiple is expressed as a percentage of the simple tax, whereas in Obwald and Basel-Stadt, municipalities do not levy

taxes for firms but benefit from a redistribution, while in Neuchâtel or Valais, the same rate as the canton are applied to municipalities (Federal Tax Administration, 2014, pp. 57–62). Under such circumstances, the variance of municipal tax burdens is very large. Figure 1 illustrates this fact with the firms' average tax rate index, which contains municipal, cantonal, federal and—if obligatory—Church taxations on profits and capital for a sample of representative firms. The highest rate of 33% (Avully – GE) is more than 2.5 times higher than the lowest rate at 13.07% (Wollerau – SZ).

Briefly, concerning the taxes for physical persons, it is important to note that the variance is also large between each municipality (see Figure A 1 in Appendix). Two reasons explain this situation: income taxation follows a similar scheme as profit taxation (i.e. cantonal, municipal and Church multiples are applied to the simple tax) and a range of different deductions exists between cantons. Given this institutional setting and the strong variation between municipalities, the following chapter showcases the data that are chosen to conduct the analysis.

5 Data

The strong decentralization of the levels of the Swiss government implies that comparable data on municipalities are difficult to acquire. The panel data set of municipal establishments, employments and taxation cover the years 2011, 2012, 2013 and 2014. Thus, I rely on data from three main sources: data about the structure of firms, municipal and regional data, both from the Swiss Federal Statistical Office, and a combination of all cantonal laws to aggregate data for firms' taxation in municipalities. This chapter presents, firstly, the three data sources summarized in table B 1 in Appendix. Secondly, a section details the descriptive statistics for the dependent variable. Finally, the summary statistics for the explanatory variables are discussed in a tertiary section.

5.1 Data Sources

The first data source comes from the Swiss Federal Statistical Office, which provides information about the structure of firms in Switzerland (STATENT). Every firm that pays Old Age Insurance contributions for its personnel is included. The variables that proceed from this dataset are the number of establishments, number of employed persons and full-time equivalents (FTE) per municipalities. The data are definitive for the years 2011, 2012 and 2013, while they are provisional for 2014. The term "establishment" refers to the fact that each observation corresponds to an individual plant and not necessarily to a firm. The data enables a

differentiation between sectors (primary, secondary and tertiary). These variables are the only missing data for 2015. With the aim to increase the number of years available, a possibility would be to impute them, through the common approach of multiple imputations. However, it is very likely that these imputations would lead to biased coefficients and standard errors if they are used as complete observations (Mittag, 2013, pp. 13–15). For this reason, I decided to concentrate on the years 2011 to 2014.

The second source for the municipal and regional data is provided by the Swiss Federal Statistical Office. Therefore, all the municipal control variables (population, Left parties' strength, regional wages, cinemas, metropolitan area, language and cantonal unemployment) are derived from this source. However, in the fiscal domain, the federal administration supplies only total tax rates for physical persons by municipality. These encompass cantonal, municipal and Catholic Church taxes. The data contain rates for four categories of taxpayers: single, married without kids, married with two kids, and retired, with annual income between 12,000 CHF and 1,000,000 CHF. The income tax burden is then calculated from these total tax rates. The third source provides data on firms' taxation to cover the dearth of fiscal information in municipalities.

Thirdly, a unique dataset, providing information on corporate municipal taxes, has been created for this thesis. I calculated the municipal tax burden for a sample of representative standard firms for a large panel of municipalities in Switzerland. For this purpose, I used the cantonal law and reproduced the taxation scheme for 24 of the 26 cantons. The two cantons that were dropped are Basel-Stadt, which uses a very particular tax system with redistribution for the municipalities, and Glarus, which has a complex Church taxation scheme. For this particular canton, it is a result of the administrative union in 2006, which drastically reduced the number of municipalities from 25 to 3. The data contain tax burden for representative firms with profits between 4,000 CHF and 50,000 CHF, with a capital of 100,000 CHF, as well as firms with profits between 80,000 CHF and 1,000,000 CHF, with 2,000,000 CHF of capital. The tax burden incorporates federal, cantonal, municipal and—if obligatory—Catholic Church taxes. The total tax rates are the ratio between tax burden and profits. The following section presents the descriptive statistics for the two dependent variables.

5.2 Dependent Variables

The objective of this thesis is to empirically analyze the effect of tax competition on employment. Hence, the regressions are run on employment in each municipality. Using the first

data source, *employment* is measured in *full-time equivalent* (FTE) to ensure a focus on the employment effect of corporate taxation (Siegloch, 2013, p. 12). Consequently, changes in the number of employees because of firm adjustments are not captured if there is no change in FTE. The data availability allows the use—as an alternative dependent variable—of the number of *establishments*. Indeed, if municipal corporate taxes are set strategically to attract firms, the number of establishments will increase. Both variables are categorized by sectors. Table 1 presents the summary statistics for the dependent variable employment in FTE and for the alternative variable (establishment). For reasons of clarity, the analysis with establishment alternative is not conducted in parallel of employment, but separately presented in Section 10.1.

Table 1: *Descriptive Statistics for Dependent Variables and their Alternative*

VARIABLES	Obs.	Mean	S.D.	Min	Muni. min	Max	Muni. max
Main variable							
FTE total	8,792	1,658	9,507	0.7	Corippo	358,459	Zurich
FTE in primary sector	8,792	45.94	50.86	0	*several*	471.8	Fully
FTE in secondary sector	8,792	423.0	1,107	0	*several*	28,214	Zurich
FTE in tertiary sector	8,792	1,189	8,598	0.1	*several*	330,613	Zurich
Establishment alternative							
Total firms	8,792	278.0	1,164	2	Corippo	43,401	Zurich
Firms in primary sector	8,792	24.07	27.31	0	*several*	213	Frutigen
Firms in secondary sector	8,792	40.78	93.10	0	*several*	2,678	Zurich
Firms in tertiary sector	8,792	213.2	1,075	1	*several*	40,672	Zurich

5.3 Explanatory Variables

From the second and third data sources, I derived the main independent variables. More precisely, two tax indexes were computed: one for physical persons and the other for firms. These averaged the total tax rates for all categories of taxpayers. A similar approach has been used by Brülhart and Jametti (2006), who computed a tax index from nine tax variables combining personal and corporate taxes.

Summary statistics for the independent variables are shown in Table 2. The personal *income tax rate index* is the average of 24 different tax rates for annual incomes from 12,000 CHF to

1,000,000 CHF by family status (single, married without kids, married with kids, and retired[4]). The taxes encompass cantonal, municipal and Catholic Church taxes. Various deductions for social insurance (11.25% of the gross wage) and professional fees (3% of net wages) are applied. Table B 2 in Appendix presents the descriptive statistics for the tax rates used in the creation of this index.

The *firms' tax rate index* is the average of 16 different tax rates for representative firms profits between 4,000 CHF and 50,000 CHF with a capital of 100,000 CHF and firms' profits between 80,000 CHF and 1,000,000 CHF with a capital of 2,000,000 CHF. These burdens cover federal, cantonal, municipal and—if obligatory—Catholic Church taxes. No deductions are applied here: thus, the taxes are calculated directly on after-tax profits. The descriptive statistics for variables used in this index is available in table B 3 in Appendix. Figure 2 plots the firms' tax rate index against the employment measured in FTE. The relationship between these two variables appears to be negative. Consequently—and in accordance with theory—I expect municipal taxes to have a negative effect on employment.

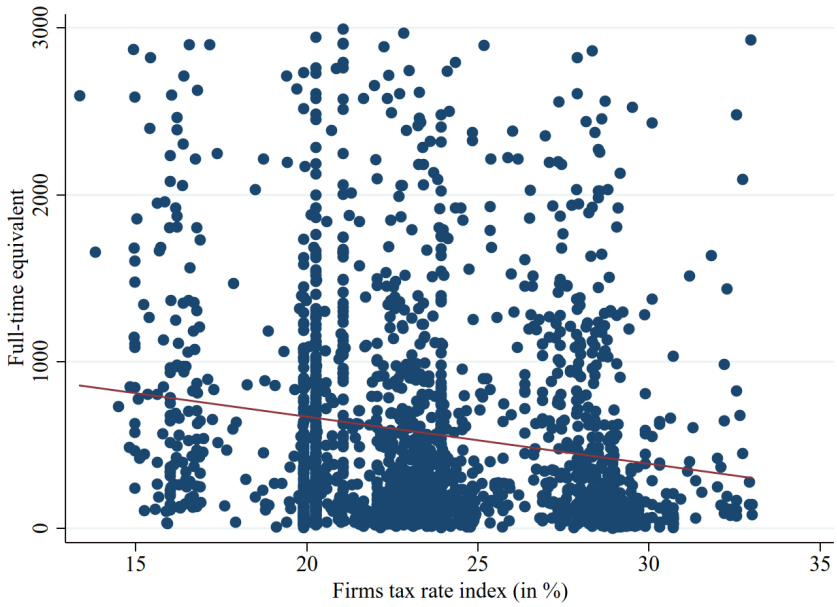

Figure 2: Scatter Plot of Firms' Tax Rate Index vs. Employment measured in Full-time Equivalent for year 2014

Note: For a better layout, 213 observations with more than 3,000 FTE are excluded from this plot. Each point represents a municipality.

4 For retired persons, there are only 21 categories of tax payers. Categories with annual income under 20,000 CHF are not available.

In order to allow for cantonal and regional employment characteristics, the price of labor and the cantonal annual *unemployment rate* will be controlled (in line with Siegloch, 2013, p. 10, who controls for local labor market conditions). However, it is important to note that *wages* are calculated for the large regions of Switzerland (Geneva Lake, Mittelland, Zurich, Ticino, East, Central and North-West Switzerland) for the years 2010, 2012 and 2014. Despite its lack of detail, these data are a good approximation. Indeed, competitive wages appear to be determined within the regional or even the national labor market, and should hardly respond to the tax changes in a small jurisdiction (Fuest et al., 2013, p. 34; Siegloch, 2013, pp. 30–31). With the aim to apply a border strategy in the empirical analysis, the *cantonal firms' tax rate index* calculates tax burdens for the same representative firms as the firms' tax rate index, but without the municipal burden. This variable will be later used as an instrument.

Table 2: *Descriptive Statistics for Independent Variables*

VARIABLES	Obs.	Mean	S.D.	Min.	Muni. Min.	Max.	Muni. Max.
Income tax rate index	8,792	9.653	1.443	3.326	Wollerau	13.31	Montalchez
Firms' tax rate index	8,792	23.83	4.080	13.07	Wollerau	33.05	Avully
Cant. unemployment rate[†]	8,792	3.083	1.125	0.900	*several*	6	GE
Cant. firms' tax rate index[†]	8,696	17.261	3.395	11.2	SZ	27.35	GE
Wages in big areas[‡]	8,792	6,297	331.2	5,377	*several*	6,900	*several*
Share of population < 20	8,792	0.228	0.0363	0	Corippo	0.412	Schelten
Share of population > 65	8,792	0.174	0.0419	0.036	Villarsel-sur-Marly	0.75	Corippo
Share of foreigners	8,792	0.153	0.0974	0	*several*	0.617	Leysin
Population	8,792	3,454	11,324	12	Corippo	391,359	Zurich
Strength of Left parties[¶]	8,792	23.05	9.582	0	*several*	67.44	Fontenais
Cinemas	8,792	0.118	0.700	0	*several*	18	Bern
University dummy[§]	8,792	0.00409	0.0639	0	*several*	1	*several*
Language dummy	8,792	0.364	0.481	0	*several*	1	*several*
Metropolitan dummy	8,792	0.392	0.488	0	*several*	1	*several*
Agricultural area[Δ]	8,792	45.81	19.56	0	*several*	92	Lohnstorf
Forest area[Δ]	8,792	32.69	16.46	0	*several*	89	*several*
Settlement area[Δ]	8,792	14.87	14.68	0	*several*	100	Massagno

Notes: [†]Canton instead of municipality. [‡]In CHF. [¶]In % of total vote. [§]Ten universities: Genève, Lausanne, Fribourg, Neuchâtel, Bern, Basel, Luzern, Zurich, St. Gallen, USI (Lugano). [Δ]In % of total municipal area.

To control for population characteristics, *share of young people* (under 20), *share of elderly people* (above 65) and *share of foreigners* in the municipality at the end of each year are used. The political orientation of each municipality is captured by the sum of votes obtained by the Socialist and ecologist parties (in percentages) at the last National Council elections (*Left parties*). Cultural particularities are represented by the number of *cinemas* in each municipality. Three additional dummy variables capture specific municipal attributes: *university* (Value 1 if there is a university in the municipality), *language* (Value 1 if the language is [mostly] non-German) and *metropolitan* (Value 1 if considered a part of a metropolitan area in 2005[5]). Finally, three topographical variables (*agricultural area*, *forest area*, and *settlement area*)—used in the selection analysis—capture the specificities of the territory. The next chapter exploits these data to produce the empirical baseline evidence for the first research hypothesis.

6 Empirical Non-Spatial Models

This chapter describes the models used to empirically investigate the first theoretical hypothesis—namely, the negative employment effect of corporate taxation. However, these do not account for spatial relationships. In consequence, the context of neighbors' influences and, hence, tax competition, is not analyzed in this chapter. Firstly, a standard quantitative approach using a linear model is presented. Secondly, the panel structure of the data enables the generation of more accurate results. Thirdly, the question of sample selection bias is investigated. Finally, a simultaneous equations model permits one to conduct a mediation analysis. The four sections briefly explains the specificities of each approach before to reveal the results. The aim of this chapter is to generate baseline results that can justify a more rigorous spatial methodology. Presenting linear models before moving on to more complex or non-linear models is a common approach (Brülhart & Jametti, 2006, p. 2050; Jofre-Monseny & Solé-Ollé, 2008, pp. 19–20; Brülhart et al., 2012, p. 1084).

6.1 Ordinary Least Squares (OLS) Approach

6.1.1 OLS Model

The first method is the well-known Ordinary Least Squares (OLS) approach, which does not exploit the panel structure of the data. This first model is inconsistent because it does not

5 Latest year available.

account for within-panel correlation, but it is the standard first step in the analysis. The formalization for this model is specified hereunder:

$$ln(E_i) = \alpha + \beta T_i + \gamma \boldsymbol{X}_i + \mu_i \quad (8)$$

where $ln(E_i)$ is the log of *employment* measured in FTE, T_i is the two *tax rate indexes* in municipality i, $\boldsymbol{X}$ is a vector of municipal and regional controls. Because of its inconsistency, this model showcases the importance of using better tools for the analysis.

6.1.2 OLS Results

Table 3 shows the estimates for the employment measured in FTE (equation (8)). The first column does not distinguish between sectors, while Columns (2) to (4) separate between activity sectors. With this basic model, the taxation's coefficient has a positive sign on employment, with a positive effect in some specifications (except for Column (4), but not significant), whereas it was expected to be negative. This divergence between the theoretical model and the results argues in favor of a more accurate analysis. The next section accounts for the panel structure of the data and is, thus, a first step in this direction.

Table 3: *OLS for log of Employment by Municipality measured in FTE*

VARIABLES	(1) Log FTE Total	(2) Log FTE Primary sector	(3) Log FTE Secondary sector	(4) Log FTE Tertiary sector
Firms' tax rate index	0.00526***	0.0119***	0.000188	-0.00327
	(0.00197)	(0.00304)	(0.00347)	(0.00247)
Income tax rate index	0.00969**	0.0311***	0.0232***	-0.0172***
	(0.00423)	(0.00693)	(0.00742)	(0.00528)
Log. of wages in big areas	-1.002***	0.610***	-2.268***	-0.675***
	(0.131)	(0.216)	(0.205)	(0.142)
Cant. unemployment rate	-0.0584***	-0.122***	-0.0786***	-0.0236**
	(0.00893)	(0.0122)	(0.0160)	(0.0114)
Cinemas	0.118***	0.0524***	-0.0127	0.101***
	(0.0136)	(0.0159)	(0.0111)	(0.0131)
Elderly people	0.0569	-1.146***	-2.638***	0.178
	(0.227)	(0.283)	(0.410)	(0.334)
Young people	-1.336***	4.925***	-3.257***	-3.209***
	(0.270)	(0.318)	(0.466)	(0.375)
Log. of population	1.154***	0.656***	1.373***	1.270***
	(0.00745)	(0.0100)	(0.0135)	(0.00970)
Foreigners	1.702***	-4.023***	0.840***	2.233***
	(0.0879)	(0.138)	(0.155)	(0.105)
Left parties	-0.00766***	-0.0182***	-0.00436***	-0.00709***
	(0.000764)	(0.00103)	(0.00136)	(0.000894)
University (Dummy)	-0.552***	-0.475***	-1.235***	-0.580***
	(0.0937)	(0.171)	(0.116)	(0.0997)
Language (Dummy)	0.0385**	0.137***	0.0769**	0.0822***
	(0.0192)	(0.0274)	(0.0336)	(0.0236)
Metropolitan (Dummy)	-0.169***	-0.719***	-0.339***	-0.0294
	(0.0155)	(0.0202)	(0.0254)	(0.0184)
Constant	6.515***	-6.645***	15.73***	2.665**
	(1.144)	(1.895)	(1.802)	(1.240)
Observations	8,792	8,719	8,656	8,792
R-squared	0.898	0.501	0.770	0.888

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6.2 Fixed Effects Approach

6.2.1 Fixed Effects Model

In contrast to the first model, the second model profits from the panel structure of the data and applies the standard Fixed Effects[6] approach to estimate the log of employment $ln(E_{it})$ measured in FTE in municipality i at time t. Hence, the following equation can be formalized:

$$ln(E_{i,t}) = \alpha + \beta T_{i,t} + \gamma \boldsymbol{X}_{i,t} + \delta_i + \mu_{i,t} \quad (9)$$

where $T_{i,t}$ is the two *tax rate indexes* in municipality i at time t, $\boldsymbol{X}$ is a vector of municipal and regional controls, δ_i is the municipal fixed effect.

6.2.2 Fixed Effects Results

Table 4 shows the results for equation (9) with a distinction by sectors, as before. In this model, the coefficient for taxation has a significant negative effect on the total of FTE in the municipality, but only for the firms' tax rate index. Hence, for an increase of 1% in the municipal firms' tax rate, the overall employment diminishes by 0.437%. The distinction per sector confirms that the firms' taxation exerts a negative effect on employment (except in primary sector). Nevertheless, a low R-Squared appears in multiple specifications, indicating the necessity to use a better approach. The next section examines the problematic of a bias, which can affect the data.

6 A Hausman test has been performed to make sure using fixed effects did not entail an unnecessary loss of efficiency.

Table 4: *Fixed Effects for log of Employment by Municipality measured in FTE*

VARIABLES	(1) Log FTE Total	(2) Log FTE Primary sector	(3) Log FTE Secondary sector	(4) Log FTE Tertiary sector
Firms' tax rate index	-0.00437***	0.00128	-0.00699**	-0.00422**
	(0.00127)	(0.00251)	(0.00285)	(0.00199)
Income tax rate index	-0.00248	0.000388	-0.00338	0.00379
	(0.00446)	(0.00898)	(0.0118)	(0.00858)
Log. of wages in big areas	-0.208	-0.128	0.0518	-0.445*
	(0.142)	(0.314)	(0.335)	(0.242)
Cant. unemployment rate	-0.0338***	-0.0474**	-0.00320	-0.0681***
	(0.00830)	(0.0235)	(0.0174)	(0.0141)
Cinemas	-0.00786	-0.0746	0.000719	-0.00758
	(0.00502)	(0.111)	(0.0113)	(0.00904)
Elderly people	-0.414	-0.656*	-0.903	-0.00930
	(0.265)	(0.390)	(0.571)	(0.442)
Young people	-0.387	-0.227	-0.744	0.187
	(0.236)	(0.287)	(0.542)	(0.521)
Log. of population	0.191***	0.0623	0.116	0.324***
	(0.0488)	(0.0649)	(0.0979)	(0.0954)
Foreigners	0.475***	0.143	0.508	0.556*
	(0.163)	(0.211)	(0.404)	(0.317)
Constant	6.667***	4.276	3.789	6.854***
	(1.345)	(2.787)	(3.092)	(2.305)
Observations	8,792	8,719	8,656	8,792
R-squared	0.043	0.009	0.005	0.049
Number of municipalities	2,198	2,185	2,170	2,198
Municipal FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: The variables university, language, metropolitan and Left parties are omitted because of collinearity.

6.3 Sample Selection Correction Approach

6.3.1 Heckman Model

The third non-spatial model considers the question of the sample selection bias. As an example, if we take a municipality, it is possible that there is no employment in the primary sector. Nevertheless, it does not obligatorily imply that it is impossible for firms in the primary sector to come and implement in this particular municipality. As a consequence, the data reflects only active firms in municipalities where they choose to locate. This fact biases

the analysis because the sample (municipalities with firms in the primary sector) is unrepresentative of the population one is interested in (municipalities where firms could implement in the primary sector) (Puhani, 2000, p. 53). In other words, the estimates would be biased downward, because the observations reveal only municipalities with established firms in the primary sector, but are not emblematic of the municipalities where firms in the primary sector could also have implemented. Hence, I propose to test this bias with the Heckman correction (Wooldridge, 2010, pp. 805–806).

In brief, this method works in two stages. In the first stage (selection equation), a model calculates the probability of a firm to be implemented in the municipality. The municipality's characteristics determine this probability. The second stage examines the effect of the independent variables on the outcome (in our example, log of employment in primary sector). For each municipality, the model can be formalized as follow:

- Selection equation: Firms $F_{i,s}$ in sector s choose to locate in the municipality i:

$$F^*_{i,s} = \alpha + \gamma w_i + \mu_i \tag{10}$$

Note: Equation (10) is only observable if firms are located in municipality *i.*

- Substantial equation: Estimation of the number of employees $E_{i,s}$ (in FTE) active in sector s:

$$E_{i,s} = \alpha + \beta x_i + \epsilon_i \tag{11}$$

Note: Equation (11) is only observable if $F^*_{i,s} > 0$.

where w_i and x_i are economic, geographical and demographical variables. Two more points have to be stated in addition: the error terms are jointly normal and, in the tables of results, ρ will represent the correlation between these.

The variables used to predict the firm's establishment in the first step (selection equation (10)) are tax indexes (firm and income), wages, share of elderly people, share of young people, population, share of foreigners, strength of Left parties, metropolitan area, arable land, forest and settlement in percent of total municipal area. The second step (equation (11)) estimates the number of employees active in sector s if the probability (equation (10)) is not equal to zero. The analysis concentrates on two sectors—primary and secondary—because these are the sectors where there is no employment in some municipalities. Indeed, at least one firm is active in the tertiary sector by jurisdiction. This correction is conducted with the logarithms of the dependent variables.

6.3.2 Heckman Results

Table B 4 in Appendix presents the results for the standard Heckman correction. The highly significant ρ indicates that a correction is desirable. In this model, the estimation of the coefficient for the firms' taxation appears to have a negative effect on employment, as expected in the theoretical model.

The standard Heckman correction does not exploit the panel structure of the data. However, some techniques exist to correct the selection bias for panel structure. Hence, I will follow the procedure of Wooldridge (2010, pp. 832–837), who extended the standard Heckit procedure to panel data (see, for an empirical application, Fiorito & Zanella, 2012). The same previous approach with two steps is applied here.[7] The variables used in the previous Heckman correction are also valid to predict the firm's establishment in municipality *i*. Table 5 displays the estimates for the sample selection correction in case of panel data. The highly significant coefficients for the yearly inverse Mills ratios justify the use of a correction. Similar to the standard Heckman procedure, the coefficients for the firms' taxation have a negative effect on employment in both sectors. In addition, accounting for the panel structure changes only slightly the point estimates for the firms' tax rate index (for example, in the primary sector, -0.0561 with panel data and -0.0610 without panel). In conclusion, these two models show that neither OLS model nor FE model was consistent: indeed, a selection correction was needed.

7 The obvious notational changes to include *time* in equations (10) and (11) are required.

Table 5: *Sample Selection Correction for Panel (extension of Heckit)*

	(1)	(2)
VARIABLES	Log FTE in primary sector	Log FTE in secondary sector
Independent variables		
Firms' tax rate index	-0.0561***	-0.111***
	(0.00333)	(0.00471)
Income tax rate index	0.00697	-0.0659***
	(0.00814)	(0.0104)
Wages in big areas	-5.29e-06	-0.000169***
	(3.62e-05)	(4.58e-05)
Elderly people	1.049**	3.204***
	(0.435)	(0.494)
Young people	7.308***	1.134*
	(0.435)	(0.607)
Population	2.03e-05***	3.79e-05***
	(5.34e-06)	(7.76e-06)
Foreigners	-0.608***	6.006***
	(0.197)	(0.242)
Left parties	-0.0131***	0.00464**
	(0.00133)	(0.00216)
Metropolitan area (Dummy)	-0.162***	0.453***
	(0.0267)	(0.0347)
Constant	3.227***	6.974***
	(0.295)	(0.344)
Observations	8,719	8,656
R-squared	0.258	0.475
Inverse Mills ratios		
Inv. Mills 2011	-4.393***	-6.990***
	(0.522)	(0.616)
Rho 2011	-3.885	-3.786
Sigma 2011	1.278	3.408
Inv. Mills 2012	-4.363***	-6.704***
	(0.635)	(0.585)
Rho 2012	-3.803	-3.669
Sigma 2012	1.316	3.337
Inv. Mills 2013	-3.786***	-8.938***
	(0.713)	(0.651)
Rho 2013	-3.555	-4.018
Sigma 2013	1.133	4.947
Inv. Mills 2014	-4.195***	-8.039***
	(0.845)	(0.688)
Rho 2014	-3.837	-3.893
Sigma 2014	1.195	4.263

Standard errors in parentheses (bootstrapped). *** p<0.01, ** p<0.05, * p<0.1

Despite its advantageous contribution, two criticisms of the Heckman correction should be underlined. Firstly, collinearity is likely to appear if identical variables are common to selection equation and to substantial equation. For instance, this would imply that the determining variables in selection equation have to be good predictors for the firm's implementation, but should not be associated with the log of employment in the primary sector (Puhani, 2000, pp. 57–58). Hence, in practice, it is difficult to find different variables for both equations. Secondly, from a more technical point of view, the Heckman correction assumes normality and linearity. Using Heckman on situations where these assumptions do not hold could result in strong bias (for detailed arguments, see Winship & Mare, 1992, pp. 341–342). Even though these two criticisms reduce the confidence in Heckman correction, the number of corrected observations is relatively low in comparison with the number of "uncensored" observations. Indeed, the sample correction is respectively applied to 73 and 136 observations in the primary and secondary sector. Therefore, a prediction will be used for these observations in the following analysis.

6.4 Simultaneous Equations Approach

6.4.1 Simultaneous Equations Model

The fourth non-spatial model concentrates on the relationship between taxation and employment. Indeed, the previous models assume that the number of firms directly influences the level of employment by jurisdiction. The mediation analysis hereunder evaluates the role of the number of firms as a mediator between employment and taxation. Hence, employment E_i (measured in FTE) in municipality i depends on taxation T_i and on the number of firms F_i that also depends on taxation T_i. This linear simultaneous equations model can be formalized as follows (Wooldridge, 2010, pp. 242–243):

$$E_i = \alpha_1 + \beta_1 T_i + \theta_1 F_i + \gamma_1 \boldsymbol{X_i} + \epsilon_i \tag{12}$$

$$F_i = \alpha_2 + \beta_2 T_i + \gamma_2 \boldsymbol{X_i} + \epsilon_i \tag{13}$$

Note: In equation (12) and (13) taxation T_i corresponds to the two tax indexes (firms and income tax rate indexes)

The notation implies that taxation is the exogenous variable determined by the municipal government, whereas the number of firms and employment are both endogenous. Figure A 2 in Appendix displays a path diagram for the equations (12) and (13) to help the visualization of

the links between variables. Taking the theoretical model as the basis, taxes are expected to have a negative effect on both employment and firms.

Based on the economic intuition, a positive effect of the number of firms on employment is awaited. It is, however, important to note that these relationships are analyzed without using the panel structure of the data. In consequence, the same problem of inconsistency as mentioned for the OLS model is also valid here.

6.4.2 Simultaneous Equations Results

The simultaneous equation model presented in equations (12) and (13) is estimated in table 6. As expected, the taxes' coefficients have a significant and negative effect on the number of firms by municipality, which itself has a positive effect on employment. However, and in contrast to the theory, the coefficients for taxes show a positive effect on employment, as was the case in OLS. The categorization by sector in table B 5 in Appendix shows that the coefficient for the number of firms has a positive effect on employment. Nevertheless, with this categorization, taxes' coefficients have diverse effects on employment and on the number of firms. It must be remembered that this simultaneous model does not exploit the panel structure of the data and various similar reactions were observed in OLS.

Table 6: *Simultaneous Equations Model*

	(1)	(2)
VARIABLES	F_i	E_i
Firms		6.657***
		(0.641)
Firms' tax rate index	-2.918***	34.19***
	(1.004)	(6.090)
Income tax rate index	-18.62***	92.29***
	(3.213)	(15.73)
Constant	756.9***	257.7
	(54.59)	(423.8)
Observations	8,792	8,792
Control variables	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Table B 5 provides the results with a categorization by sectors. Control variables are: wages in big areas, cantonal unemployment rate, cinema, share of elderly people, share of young people, population, share of foreigners, Left parties, university (dummy), language (dummy) and metropolitan (dummy).

This chapter confirms—through various models—the first hypothesis and the theoretical model. Indeed, the models, that account for the panel structure of the data, show that firms' taxation exerts a negative effect on employment. The categorization by sector supports this statement except for the primary sector. Until this point, spatial interactions between municipalities are not considered. Nevertheless, research has shown that governments set taxes under the influence of tax level in surrounding jurisdictions (for a survey of empirical evidence, see Baskaran & Lopes da Fonseca, 2013, pp. 7–12). The next chapter explores the effect of taxation on employment by also considering the tax choices of neighboring jurisdictions.

7 Empirical Spatial Models

The previous chapter concentrates on the effects of taxation on employment in a non-spatial environment without considering the choices of other similar jurisdictions. The models that were introduced claim for a better strategy to identify this relationship. This chapter overcomes this limitation and accounts for spatial interactions. More precisely, it identifies tax competition between municipalities. The first section develops prior evidence for spatial dependence. Secondly, different spatial econometric models are presented in detail. Finally, a section highlights the importance of using an alternative identification strategy and proposes exploiting cantonal borders as an instrument. Each section briefly explains the specificities of each approach before to reveal the results.

7.1 Moran's *I* Approach

7.1.1 Moran's *I* Measure of Spatial Correlation

As preliminary evidence for spatial dependence, it is pertinent to use a measure of spatial correlation in order to examine whether spatial patterns do exist in data. Despite the various alternatives, I choose to use the Moran's *I* because of its simplicity of interpretation. Indeed, the values of the Moran's *I* range between -1 and 1, with values close to 1 indicating positive spatial correlation, whereas values near -1 signal that places close to each other tend to have different values (Levratto, 2014, p. 6). Formally, the Moran's *I* is given by the expression (Fischer & Wang, 2011, p. 23):

$$I = \frac{n}{W_0} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}(z_i - \bar{z})(z_j - \bar{z})}{\sum_{i=1}^{n}(z - \bar{z})^2} \tag{14}$$

with the normalizing factor (sum of elements in the weight matrix):

$$W_0 = \sum_{i=1}^{n} \sum_{j \neq i}^{n} W_{ij} \tag{15}$$

with n number of observations, i, j the municipalities, z variable to be tested and W_{ij} element in the spatial weight matrix. The choice of spatial weight matrix takes on particular importance in Moran's I, as it is presented in equation (14) and (15). The use of weight is also justified by the theoretical framework: the municipalities are dependent on each other due to labor mobility and the supposed tax competition.

Some details have to be added regarding the weights. When the model required it (for instance, in standard spatial models), the spatial weights used in the rest of the thesis are minmax-normalized; otherwise, the raw matrices are used (for example, in the Moran's I analysis). Even if a row-normalized matrix would simplify the interpretation as an average of neighboring values, it equalizes the impact on each unit by all other units. Hence, the central and remote regions end up having the same effect, independent of their relative locations. Another concern with row-normalized matrix is the possibility of the spatial weights matrix to become asymmetric. This occurs when the impact of municipality i on municipality j is not the same as that of municipality j on municipality i (Elhorst, 2014, pp. 12–13). For these reasons and when a normalization is necessary, I chose to use a minmax-normalization that preserves symmetry and the basic model specification (for a detailed formalization, see Elhorst, 2014, p. 13).

7.1.2 Moran's *I* Results

The results for the Moran's I in year 2014 are shown in table 7.[8] Six inverse-distance weights with different thresholds and a Queen contiguity matrix[9] are selected: 5 kilometers, 10 kilometers, 15 kilometers, 20 kilometers, 30 kilometers and 100 kilometers. These different weights are calculated using the polygon centroid of each municipality as reference.

These measures of spatial autocorrelation are highly significant and present positive spatial autocorrelation for the two tax variables. This implies that municipalities close to each other tend to have similar rates of taxation. However, the values for the employment variable in FTE without sector categorization and its alternative—firms—are slightly superior to zero,

8 The Moran's I does not exploit the time variance. However, it is expected that the tendencies presented in this sub-section are also valid for other years.

9 The Queen contiguity matrix implies that neighboring municipalities have to share a common side or a vertex.

suggesting no spatial dependence. By sector, the secondary and tertiary sectors show similar low autocorrelation, while the primary sector shows higher positive spatial dependence. This can possibly be explained by the fact that firms in the agricultural field generally depend on regional specificities and are less mobile than firms in other sectors. Nevertheless, for all variables, the strength of spatial autocorrelation declines as the distance threshold increases. This means that as the set of municipalities considered to be neighbors expands, the correlation of employment and taxation between these neighbors lessens. More generally, it must be noticed that both employment and firms have similar Moran's *I* values.

Table 7: *Moran's I measures of global spatial autocorrelation in 2014*

	Contiguity	5 km	10 km	15 km	20 km	30 km	100 km
Income tax rate index	0.839	0.842	0.814	0.782	0.758	0.713	0.454
Firms' tax rate index	0.885	0.906	0.842	0.798	0.760	0.688	0.401
FTE total	0.071	0.036	0.033	0.022	0.017	0.014	0.007
Firms total	0.070	0.044	0.036	0.026	0.022	0.019	0.009
FTE in primary sector	0.414	0.313	0.341	0.303	0.272	0.224	0.099
Firms in primary sector	0.507	0.391	0.416	0.368	0.328	0.269	0.118
FTE in secondary sector	0.135	0.099	0.071	0.057	0.047	0.040	0.021
Firms in secondary sector	0.144	0.106	0.082	0.066	0.058	0.049	0.025
FTE in tertiary sector	0.064	0.030	0.029	0.019	0.014	0.011	0.005
Firms in tertiary sector	0.066	0.039	0.032	0.023	0.020	0.016	0.007

Note: All measures are significant at the 0.1% level.

This section presented the initial evidence for spatial autocorrelations and justified the use of spatial models. The next section outlines the three most common models of spatial econometrics, which will be used to investigate the two research hypotheses.

7.2 Standard Spatial Approach

In contrast to the previous chapter, spatial models incorporate strategic interactions from neighboring municipalities. A consequent literature field underlines this interdependence in taxation. However, only a few studies have used tax competition as an explanatory variable for another dependent variable as taxation (for example: Levratto, 2014, and, to a lesser extent, Feld & Kirchgässner, 2003; Brülhart & Parchet, 2014). This section fits the definition of spatial interaction into a model with employment as a dependent variable earlier to discuss

different methodologies to estimate it. The preliminary evidence for spatial interactions in the dataset presented in the previous section provides a first justification for spatial models.

7.2.1 Standard Spatial Models

The spatial models in tax and yardstick competition stipulate that jurisdiction i's fiscal decisions in year t, $T_{i,t}$ depend on i's neighbors' fiscal decisions, $T_{-i,t}$ and on i's socio-demographic characteristics $\boldsymbol{X_{i,t}}$ (Gérard et al., 2010, p. 337). The application of this definition with employment $E_{i,t}$ in municipality i at time t as dependent variable gives the following formulation:

$$\begin{aligned} ln(E_{i,t}) = \alpha + \rho\, W\, ln(E_{-i,t}) + \beta\, T_{i,t} + \theta\, W\, T_{-i,t} + \gamma\, \boldsymbol{X_{i,t}} \\ + \sigma\, W\, \boldsymbol{X}_{-i,t} + \delta_i + \mu_t + \epsilon_{i,t} + \lambda\, W\, \upsilon_t \end{aligned} \tag{16}$$

where $ln(E_{i,t})$ is the log of *employment* in municipality i, W is the *spatially weighted matrix*, $ln(E_{-i,t})$ is the *log of employment* in other municipalities, $T_{i,t}$ is the *municipal consolidated tax rate*, $T_{-i,t}$ is the *other municipalities' consolidated tax rate*, $\boldsymbol{X}$ is a *vector of municipal controls*, δ_i is the *municipal fixed effects*, μ_t is the *time fixed effects*, $\varepsilon_{i,t}$ is the *error term* and υ_t is the *spatially correlated error component*.

LeSage and Pace (2009) identified various motivations for using spatial models, such as time-dependence, omitted variables, spatial heterogeneity, externalities and uncertainty. Even though there exist various models to estimate spatial interactions depending on the motivation, I chose to concentrate on the three main types.

The first model—the Spatial Durbin Model (SDM)—includes spatially lagged independent variables and a spatial lag representing a linear combination of values of the dependent variable vector from neighboring observations (LeSage, 2014, pp. 16–19). A spatial lag of a variable can be defined as a vector of a weighted average of the neighboring values (Fischer & Wang, 2011, p. 20). In equation (16), it corresponds to the multiplication of the weighted matrix with each variable.

The theoretical framework suggests that the SDM might be the most appropriate approach since it includes spatially lagged dependent and explanatory variables. Indeed, employment in a municipality may be affected by employment in other municipalities (agglomeration forces or clusters), justifying the inclusion of a spatially lagged dependent variable. Moreover, other factors in these different municipalities, such as taxes and demographics, are also influenced by the situation in neighboring municipalities, confirming the use of spatially independent

variables. More formally, the SDM implies in equation (16), that: $\rho \neq 0$, $\theta \neq 0$, $\sigma \neq 0$ and $\lambda = 0$. In addition, the SDM is usually considered as the starting point because it subsumes the two other models presented below (LeSage & Pace, 2009, p. 46; Elhorst, 2014, p. 9).

The second model—the Spatial Autoregressive Model (SAR)—also includes a spatially lagged variable. Nevertheless, and unlike the SDM, it only includes a spatially lagged dependent variable. In other words, it is a specification of the SDM (Fischer & Wang, 2011, p. 37). Formally, the SAR involves in equation (16) that: $\rho \neq 0$, $\theta = 0$, $\sigma = 0$ and $\lambda = 0$. Consequently, in this model, the tax settings of neighboring municipalities will not have any effect on employment. In this case, the spatial specification accounts only for employment. Hence, regarding the low Moran's *I* values for the various employment variables, it is unlikely that this model is accurate for the analysis.

The third model—the Standard Error Model (SEM)—posits that the dependent variable depends on a set of observable local characteristics (Elhorst, 2010b, p. 379). Hence, it does not include any spatially lagged variable, at all. Instead, it incorporates a spatially correlated error component. In equation (16), the SEM implies that: $\rho = 0$, $\theta = 0$, $\sigma = 0$ and $\lambda \neq 0$. By construction, this model eliminates spillovers (LeSage & Pace, 2009, p. 22), but includes unobserved shocks that follow a spatial pattern (Elhorst, 2010b, p. 379). Similar to the SAR, the neighbors' taxes have been removed by construction.

For all these standard spatial econometric models, the results are estimated with the method of Quasi-Maximum Likelihood (QML).

7.2.2 Standard Spatial Results

As prior evidence, the different values of Moran's *I* suggest a certain spatial dependence, justifying the use of the spatial model. My approach is, then, to use the SDM as the first spatial model estimated and test it to ensure it is the most appropriate, as the theory proposes.

7.2.2.1 Selection of Spatial Model

The SAR is more suitable than the SDM if a test establishes that the coefficient for the spatially lagged dependent variable (ρ in equation (16)) is significant, but the estimates for the spatially lagged independent variables (θ and σ in equation (16)) are jointly insignificant. The results of this test with a 10-kilometer threshold are presented at the bottom of table 8. These demonstrate that the estimate for spatially lagged dependent as well as the one of the spatially lagged independent variables are only significant (at a 5% level) when considered jointly without sector categorization (Column (1)) or in the tertiary sector (Column (4)). Even if

Columns (2) (primary sector) and (3) (secondary sector) reject this test, I will favor the SDM over the SAR as first analysis. Indeed, by construction, the SAR removes the neighbors' taxation as an independent variable and, hence, tax competition.

A second test aims to assess if $\theta = -\rho\beta$ and $\sigma = -\rho\gamma$ in equation (16), as is the case when SDM becomes SEM (LeSage & Pace, 2009, p. 160; Elhorst, 2014, pp. 30–31). The results with the 10-kilometer matrix reject this specification at a 10% significant level but not at a 5% level in Column (1) (without sector categorization) of table 8. With sector categorization (Columns (2) to (4)), only the tertiary sector rejects the use of SEM. This test suggests that the SDM could be reduced to SEM. However, the SEM also loses the neighbors' tax choices as an independent variable, and, for this reason, it will be discussed after the SDM results.

Additionally, a Hausman test is performed to see if the same conclusion as non-spatial models appears—namely, that the fixed effects model is the most accurate. Even if this test is only realized without specification of the sector, a random effects model would yield inconsistent estimates, supporting the use of the fixed effects variant.

Table 8: *Spatial Durbin Model — Independent Variables Coefficient Estimates and Tests Results with a 10-kilometer Threshold*

VARIABLES	(1) Log FTE Total	(2) Log FTE Primary Sector†	(3) Log FTE Secondary Sector†	(4) Log FTE Tertiary Sector
Independent variables				
Firms' tax rate index	-0.00285	1.10e-05	-0.00846	-0.00192
	(0.00227)	(0.00429)	(0.00586)	(0.00376)
Income tax rate index	0.00112	0.0148	0.000357	-0.00141
	(0.00599)	(0.0121)	(0.0227)	(0.0128)
Log. of wages in big areas	0.225	-0.667	0.398	-0.0541
	(0.251)	(0.594)	(0.678)	(0.447)
Cant. unemployment rate	-0.0341**	0.0346	0.00619	-0.0960***
	(0.0160)	(0.0451)	(0.0362)	(0.0277)
Cinemas	-0.00623	-0.0984	0.00153	-0.00678
	(0.00500)	(0.104)	(0.0127)	(0.00969)
Elderly people	-0.372	-0.309	1.052	0.148
	(0.268)	(0.584)	(1.092)	(0.445)
Young people	-0.363	0.441	0.106	0.227
	(0.239)	(0.440)	(0.825)	(0.527)
Log. of population	0.182***	0.00101	0.201	0.270***
	(0.0494)	(0.0838)	(0.145)	(0.0951)
Foreigners	0.456***	0.173	0.804	0.518*
	(0.165)	(0.268)	(0.609)	(0.312)
Observations	8,792	8,792	8,792	8,792
R-squared	0.124	0.088	0.100	0.172
Number of municipalities	2,198	2,198	2,198	2,198
Municipal FE	YES	YES	YES	YES
Spatial FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Tests				
SAR test chi2	17.31	12	8.515	32.05
Prob > chi2 SAR	0.0441	0.213	0.483	0.000195
SEM test chi2	16.71	11.84	8.317	30.80
Prob > chi2 SEM	0.0535	0.222	0.503	0.000321
Hausman test chi2	1082.25			
Prob > chi2 Hausman	0.000			

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: The variables Left parties, university, language and metropolitan are omitted because of multicollinearity.
†Selection bias correction (Heckman) for predicting observations with a zero in log specification.

7.2.2.2 Spatial Durbin Model Results

In addition to the tests for the model's selection, table 8 provides the estimation of the coefficients for the independent variables (referred to in equation 16 as β and γ). Only the coefficients for cantonal unemployment rate, population, share of foreigners are significant. The main independent variables of interest—municipal taxes for firms and incomes—do not have an effect on employment in municipalities, as their coefficients are not significant. These results contrast with the previous non-spatial fixed effect where firms' taxation at least had a negative effect on employment.

Table 9 includes the estimates for the spatially lagged independent variables (referred to in equation 16 as θ and σ) with a 10-kilometer threshold. The share of elderly people is the only spatially independent variable's coefficient that is significant at the conventional 5% level in Column (4) (the tertiary sector's specification). The lack of significance for taxation's coefficients argues that neighbors' tax choices do not affect the employment in municipality *i*. As there is no specification where the coefficients for the spatially lagged taxes appear to be significant, it causes the rejection of the second hypothesis of this thesis—namely, that employment depends on the neighboring municipalities' tax burden. To put it another way, even if tax competition strongly affects tax decisions, it does not seem to have any repercussion on employment in this model.

At the bottom of table 9, the coefficient for the spatially lagged dependent variable (referred to in equation 16 as ρ) is only significant in the tertiary sector specification with a negative magnitude of -0.28. This fact indicates that employment in municipality *i* is not influenced by the employment in neighboring municipalities, barring the tertiary sector. It was already underlined by the Moran's *I* measures that were near zero for employment variables.

Table 9: *Spatial Durbin Model — Spatially Lagged Independent and Dependent Variable Coefficient Estimates*

VARIABLES	(1) Wx Log FTE Total	(2) Wx Log FTE Primary Sector†	(3) Wx Log FTE Secondary Sector†	(4) Wx Log FTE Tertiary Sector
Spatially Lagged Independent Variables				
Firms' tax rate index	-0.00511	0.0139	-0.00279	-0.00445
	(0.00910)	(0.0203)	(0.0238)	(0.0156)
Income tax rate index	-0.0106	-0.0590	-0.0118	0.0256
	(0.0244)	(0.0480)	(0.0827)	(0.0391)
Log. of wages in big areas	-1.105*	1.060	-0.642	-0.620
	(0.583)	(2.129)	(1.683)	(1.175)
Cant. unemployment rate	-0.00613	-0.269	0.00165	0.0772
	(0.0407)	(0.205)	(0.0984)	(0.0637)
Cinemas	0.155	0.692	0.726	-0.00954
	(0.211)	(0.734)	(0.572)	(0.390)
Elderly people	-0.306	1.201	-0.449	-8.748***
	(1.811)	(3.737)	(5.833)	(3.372)
Young people	1.407	-7.173*	-2.039	0.503
	(1.692)	(3.884)	(5.169)	(3.099)
Log. of population	0.515	0.894	1.473	1.713**
	(0.410)	(0.951)	(1.576)	(0.808)
Foreigners	1.376	-6.107*	3.836	0.471
	(1.362)	(3.308)	(4.344)	(2.384)
Spatially Lagged Dependent Variables				
Rho	-0.111	-0.0547	-0.0894	-0.286**
	(0.104)	(0.137)	(0.0707)	(0.139)
Municipal FE	YES	YES	YES	YES
Spatial FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: The variables Left parties, university, language and metropolitan are omitted because of multicollinearity.
†Selection bias correction (Heckman) for predicting observations with a zero in log specification.

7.2.2.3 Spatial Error Model Results

The tests, presented at the end of table 8, fail to totally reject the SEM as a plausible model. As already mentioned, this model loses the neighbors' taxation as explanatory variables. Indeed, it is here only the error term that is spatially auto-correlated (LeSage & Pace, 2009, p. 32) and not the independent variables anymore. Nevertheless, the lack of significance in SDM for the coefficients of the two variables measuring taxation, as well as their spatial lag, also

supports the use of SEM. Table 10 displays the results for the different categorizations and for the estimates of the spatially lagged error term (referred to in equation 16 as λ). The SEM is consistent with a situation where determinants of the employment omitted from the model are spatially auto-correlated, and with a situation where unobserved shock follow a spatial pattern (Allers & Elhorst, 2005, p. 6).

In this model, the firms' tax rate index has a negative impact on employment, as it is only in the primary sector that the coefficient for firms' taxation does not significantly affect employment. Other criteria than taxation are probably more decisive for the number of employees in the primary sector (for example, arable land, topography or meteorology). Furthermore, the low R-Squared of this model argues in favor of this sense. Without sector categorization (Column (1)), the coefficient for the firms' taxation has—as envisaged—a negative effect on employment. Indeed, an increase of 1% in municipal firms' tax rate reduces the overall number of FTE in the municipality by 0.437%.[10] A similar magnitude is found in the tertiary sector, where employment diminishes by 0.432% for the same increase in firms' tax rate. The employment in the secondary sector appears to react strongly to a rise of 1% in firms' taxation, with a decrease of 0.912%. Hence with this model, the first hypothesis and the theoretical model developed, which specified that firms' taxes have a negative effect on employment, are verified.

In contrast, the estimation of the coefficients for the income tax rate index are not significant. Despite the negative effect of firms' taxation, income taxation does not influence the number of employees in a municipality. Note that in Columns (1) and (4), the coefficient of the cantonal unemployment rate affects—negatively and significantly—the number of FTEs in a municipality. Similarly, the coefficients for the population and (only for Column (1)) the share of foreigners have a significant positive effect on employment.

10 A comparative estimate was found with the fixed effects model.

Table 10: *Spatial Error Model — Independent Variables Coefficient Estimates with a 10-kilometer Threshold*

VARIABLES	(1) Log FTE Total	(2) Log FTE Primary Sector†	(3) Log FTE Secondary Sector†	(4) Log FTE Tertiary Sector
Independent variables				
Firms' tax rate index	-0.00437***	0.00128	-0.00912***	-0.00432**
	(0.00127)	(0.00255)	(0.00320)	(0.00196)
Income tax rate index	-0.00249	0.00519	-0.00524	0.00382
	(0.00447)	(0.00998)	(0.0165)	(0.00836)
Log. of wages in big areas	-0.208	-0.447	-0.177	-0.463**
	(0.144)	(0.396)	(0.386)	(0.234)
Cant. unemployment rate	-0.0337***	-0.0375	0.00603	-0.0669***
	(0.00829)	(0.0313)	(0.0203)	(0.0137)
Cinemas	-0.00787	-0.102	-0.00127	-0.00796
	(0.00502)	(0.104)	(0.0117)	(0.00914)
Elderly people	-0.413	-0.247	0.973	-0.0369
	(0.265)	(0.573)	(1.099)	(0.452)
Young people	-0.387	0.405	0.0369	0.183
	(0.235)	(0.434)	(0.803)	(0.519)
Log. of population	0.191***	-0.0178	0.250*	0.331***
	(0.0489)	(0.0827)	(0.145)	(0.0965)
Foreigners	0.475***	0.189	0.890	0.561*
	(0.163)	(0.261)	(0.597)	(0.316)
Spatially Lagged Error Term				
Lambda	-0.00221	0.0143	-0.0581	-0.104
	(0.0994)	(0.130)	(0.0701)	(0.140)
Observations	8,792	8,792	8,792	8,792
R-squared	0.870	0.003	0.695	0.855
Number of municipalities	2,198	2,198	2,198	2,198
Municipal FE	YES	YES	YES	YES
Spatial FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: The variables Left parties, university, language and metropolitan are omitted because of multicollinearity.
†Selection bias correction (Heckman) for predicting observations with a zero in log specification.

It is important to realize that an endogeneity concern could arise if firms influence the governments in setting the tax rate. This simultaneity could be ruled out by iteratively adding the tax indexes for many periods and creating a time-lag model (Siegloch, 2013, p. 16). However, the small number of available years limits the accuracy of this strategy. The second case of si-

multaneity emerges if governments set tax rates procyclically in order to compensate for reductions in tax base during a recession by increasing tax rates (Feld & Kirchgässner, 2003, pp. 147–148). In such a situation, the tax rate may depend upon employment. These two reasons justify a better identification strategy. The following section (7.3) develops an instrumental strategy that overcomes these concerns.

To summarize, the standard spatial models have presented findings relative to the effect of municipal firms' taxes and neighboring taxes on employment with a sector categorization in a 10-kilometer threshold. The SDM allows an analysis of neighbors' tax choices on the number of employees in municipality *i*. The absence of significance in the coefficients for the spatially lagged tax variables indicates that tax competition does not affect employment in this model. The SEM is more suitable to analyze the effect of municipal taxation on the number of FTEs. In this model, municipal firms' tax rate appears to have a negative effect on employment, whereas the income tax rate does not affect it. To impart more confidence to the findings, a robustness check with various distance weight matrices is presented in the next point.

7.2.3 Robustness of Standard Spatial Model

7.2.3.1 Robustness Check for the Spatial Durbin Model

The previous estimates with the 10-kilometer threshold have shown that tax competition does not appear to have a significant effect on employment. It is a common approach using different distance thresholds to check the robustness of this results (Delgado et al., 2015, p. 361; Gérard et al., 2010, p. 339). For this reason, various spatial weighted matrices will be used. The same weight matrices (except the 100-kilometer threshold) and the Queen contiguity matrix chosen for the Moran's *I* analysis will be exploited. Table 11 displays the coefficients for the two tax variables and their spatial lag with different distance thresholds.

These estimates concentrate on employment without sector categorization (Column (1) in tables 8 and 9). In this model, only the coefficient for the firms' tax rate has a negative significant effect on employment with the contiguity and the 30-kilometer thresholds. As was previously the case with the 10-kilometer threshold, the coefficients for the neighbors' taxation do not have any significant effect on the number of FTE in a municipality. These results confirm the previous findings that neighboring tax choices do not influence employment in any given municipality.

Tables B 6, B 7, and B 8 in Appendix respectively present the estimates in the primary, secondary and tertiary sector (Columns (2) to (4) in tables 8 and 9). Even with the specification

of sectors, neighboring firms' tax choices do not affect employment as there are no significant spatial lag coefficients. According to this robustness check and in accordance with the previous findings, the standard spatial model analysis rejects the second hypothesis that tax competition has an effect on employment in municipality.

Table 11: *Spatial Durbin Model — Coefficient Estimates for Various Spatial Weight Matrices without Sector Categorization*

VARIABLES	Log of FTE without sector categorization					
	Contiguity	5 km	*10 km*	15 km	20 km	30 km
Independent Variables						
Firms' tax rate index	-0.00685**	-0.00246	-0.00285	-0.00277	-0.00370*	-0.00470**
	(0.00318)	(0.00193)	(0.00227)	(0.00228)	(0.00225)	(0.00210)
Income tax rate index	0.00305	0.00233	0.00112	0.000300	0.000831	0.00175
	(0.00648)	(0.00592)	(0.00599)	(0.00596)	(0.00590)	(0.00578)
Spatially Lagged Independent Variables						
Firms' tax rate index	0.0118	-0.0124	-0.00511	-0.00445	-0.000400	0.00455
	(0.0104)	(0.0109)	(0.00910)	(0.00835)	(0.00870)	(0.0088)
Income tax rate index	-0.0324	-0.0302	-0.0106	-0.00329	-0.00159	-0.00185
	(0.0258)	(0.0352)	(0.0244)	(0.0220)	(0.0222)	(0.0226)
Observations	8,792	8,792	8,792	8,792	8,792	8,792
R-squared	0.002	0.480	0.124	0.091	0.061	0.045
Number of municipalities	2,198	2,198	2,198	2,198	2,198	2,198
Municipal FE	YES	YES	YES	YES	YES	YES
Spatial FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: Control variables are: wages in big areas, cantonal unemployment rate, cinema, share of elderly people, share of young people, population, share of foreigners, Left parties, university (dummy), language (dummy) and metropolitan (dummy).

Surprisingly, in the primary sector, income tax choices of direct neighbors seem to negatively affect employment. However, the coefficient only appears to be significant with the Queen contiguity matrix, indicating that it is not a verifiable tendency.

7.2.3.2 Robustness Check for Spatial Error Model

With the 10-kilometer threshold, the SEM indicates that taxes exert a negative effect on employment. As a robustness check, the same different spatial matrices are used to confirm this tendency. Table 12 displays the results for employment without sector categorization (Column (1) in table 10).

As in the SEM earlier, the coefficient for the firms' taxation has a negative effect on employment. This fact is valid with all the thresholds. Furthermore, the magnitude of the coefficients is very similar in all specifications. Indeed, it is a consequence of the model's specifications that do not lag spatially variables, but exclusively the error term. For this reason, only the coefficient for the overall employment is estimated. Thus, the sector categorization provides estimates similar to the ones found in table 10.[11] Hence, an increase of 1% in municipal firms' tax rate reduces the overall number of FTE in a municipality by around 0.435%. Moreover, the municipal income taxation does not significantly affect the employment in the jurisdiction as the coefficients are never significant.

Table 12: *Spatial Error Model — Estimates of Coefficients for Various Spatial Weight Matrices without Sector Categorization*

VARIABLES	Log of FTE without sector categorization					
	Contiguity	5 km	*10 km*	15 km	20 km	30 km
Firms' tax rate index	-0.00435***	-0.00442***	-0.00437***	-0.00434***	-0.00433***	-0.00436***
	(0.00125)	(0.00125)	(0.00127)	(0.00128)	(0.00129)	(0.00130)
Income tax rate index	-0.00255	-0.00274	-0.00249	-0.00239	-0.00229	-0.00215
	(0.00441)	(0.00442)	(0.00447)	(0.00451)	(0.00456)	(0.00461)
Observations	8,792	8,792	8,792	8,792	8,792	8,792
R-squared	0.870	0.870	0.870	0.870	0.870	0.869
Number of municipalities	2,198	2,198	2,198	2,198	2,198	2,198
Municipal FE	YES	YES	YES	YES	YES	YES
Spatial FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: Control variables are: wages in big areas, cantonal unemployment rate, cinema, share of elderly people, share of young people, population, share of foreigners, Left parties, university (dummy), language (dummy) and metropolitan (dummy).

The next section highlights some concerns, that face the standard spatial models, and develops an innovative approach with the aim to produce more reliable estimates.

11 To prevent the Appendix from being overloaded, these tables are not displayed, but they are available upon request.

7.3 Instrumental Variable Strategy

This section explains, firstly, that spatial models rely on strong identifying assumptions, as noted by Gibbons and Overman (2012). Moreover, as already emphasized, these can suffer from an endogeneity problem. For these reasons, an alternative instrumental approach is chosen. After the consideration of the instrument's validity, the results for this strategy are presented and discussed. Finally, the robustness of this methodology is examined.

7.3.1 Instrumental Variable Model

The model used till here defined a variable with the average tax characteristics of the neighboring municipalities. The variable $T_{-i,t}$ in equation (16) is probably invalid because the tax rate of a neighboring municipality itself depends on the tax rate of municipality *i.* Moreover, many time-varying determinants of one jurisdiction's tax rate are likely to be unobservable and spatially correlated, implying a correlation of the explanatory variable with the error term (Parchet, 2014, p. 5). For this reason, I suggest employing a more elaborate identification strategy with exogenous variation in tax explanatory variables to produce more reliable estimates. I will combine here a usual instrumental variable strategy in a context of spatial interactions.

This thesis follows an approach similar to the recent contributions of Lyytikäinen (2012), Agrawal (2013), Eugster and Parchet (2013), Brülhart and Schmidheiny (2013), and Baskaran (2014), who use cultural, state borders or upper-level policy intervention to identify strategic interactions among jurisdictions. More precisely, I exploit the differences in tax rates between neighboring cantons as a source of exogenous variation in the taxation of the neighboring municipalities. This method was developed in the Swiss context by Parchet (2014). It is implied that it can be used only with data from municipalities at cantonal borders.

Hence, the *employment* $E_{ic,t}$ in municipality *i* and in canton *c* is estimated with this equation:

$$E_{ic,t} = \alpha + \rho E_{-i,t} + \beta T_{ic,t} + \theta t_{-c,t} + \gamma \boldsymbol{X}_{\boldsymbol{ic,t}} + \delta_i + \mu_{c,t} + \epsilon_{ic,t} \qquad (17)$$

where $E_{-i,t}$ is the *employment* in other municipalities, $T_{ic,t}$ is the *municipal taxes*, $t_{-c,t}$ is the *weighted consolidated cantonal, federal and—if obligatory—the Church tax rate of the neighboring canton* and $\mu_{c,t}$ is a *cantonal-year fixed effect*. It is important to note that the data availability limits the analysis to firms' taxation. The Swiss Federal Fiscal Administration publishes only consolidated rates, including municipal, cantonal, federal and Church tax rates, for income taxation. Therefore, it is not possible to disentangle the tax effect of each govern-

mental level. Hence, income taxation will not be spatially lagged, but only used as an independent variable.

In equation (17), it is assumed that the employment does not suffer from a similar problem as taxation—namely, that the level of FTE in a municipality does not itself depend directly on employment in neighboring municipalities. The basic intuition is that employment is not a political decision and, by consequence, is not directly influenced by governments. Under these circumstances, a similar instrument with cantonal employment instead of employment in neighbors municipalities $E_{-i,t}$ is not necessary.

The reasoning behind the instrument uses the federalist specificities of Switzerland and consider that firms are mobile and municipalities set their taxes strategically. If there is a change in a cantonal tax rate, firms located on the other side of the border will not be directly affected in their tax bills. Thus, the tax reaction of the municipality situated at the border but in cantons where the rate did not change demonstrates the presence of horizontal strategic interactions (Brülhart & Schmidheiny, 2013, p. 27). Furthermore, two conditions have to be fulfilled if t_{-ct} is to be considered a valid instrument.

First, it has to be exogenous to tax decisions of individual municipalities. In the Swiss setting, it is reasonable to assume that there is no reverse causality between municipalities and cantons. For instance, an individual municipality does not affect cantonal tax policies. In addition, cantonal tax decisions affect similarly all municipalities in the canton, reducing the probability of a cantonal decision driven by a subset of municipalities. Parchet (2014) adds that there is no reverse causality in cantons with a sufficiently high number of municipalities and a population not too concentrated in municipalities close to a particular cantonal border (this statement is tested as a robustness check in Sub-section 7.3.3).

Secondly, the instrument has to be relevant. This means, according to Parchet (2014), that the cantonal tax reform should not result in some unobserved factors that will also affect taxation decisions of municipalities. One needs to control, with the canton-year fixed effects $\mu_{c,t}$, for the existence of strategic interactions among cantons and shocks affecting all municipalities in one or several states. These fixed effects imply that the within-canton differential response of municipality i to changes in $t_{-c,t}$, compared to other municipalities in the same canton, is not affected by $t_{-c,t}$ (municipalities located at another cantonal border) (Parchet, 2014, pp. 7–8).

Another concern is the reaction of the i's neighbor municipalities situated on the same side of the border. I chose to exclude them to rule out the possibility that their reactions affect the

choices of municipality *i*. Hence, the reaction of municipality *i* stems only from reforms in the neighboring canton.

The same distance threshold of 10 kilometers that was chosen for the standard spatial model is also used in this approach. It must be remembered that the distances between municipalities are calculated from the centroid of the municipal polygon and not from road distances. This strategy considerably reduces the number of municipalities in the dataset. With a cutoff at 10 kilometers around the cantonal border (as the crow flies), there are 1,308 eligible municipalities (figure A 3 in Appendix presents their geographical location). Figure 3 plots the distribution of neighboring municipalities located in another canton than that of the reference municipality. Despite the reduction in the number of observations, the strong variation in the number of neighbors reinforces the relevance of the instrument. The majority of municipalities has between 1 and 20 neighbors located in another canton. The maximum (Vuissens – FR) even has till 45 neighbors in another canton within a radius of 10 kilometers.

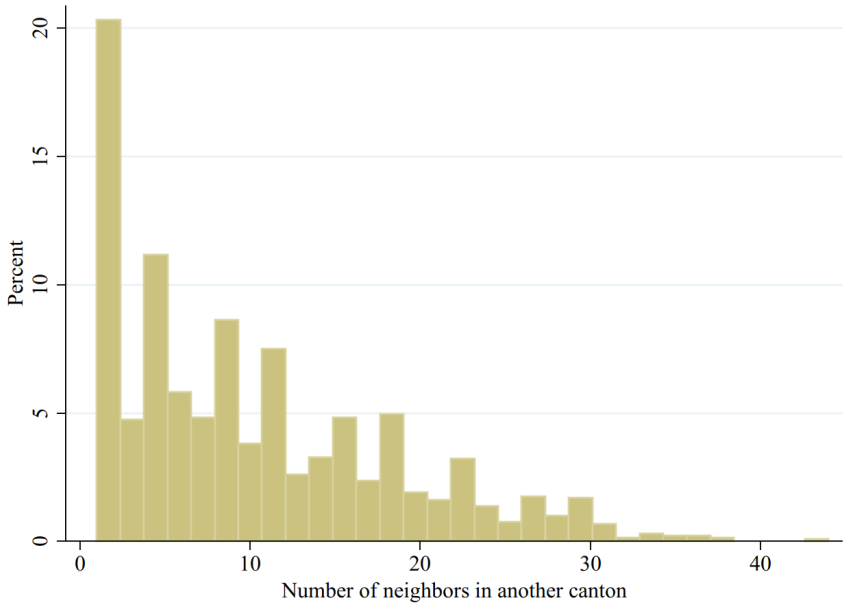

Figure 3: Distribution of Neighboring Municipalities Located in Another Canton

Note: A 10 kilometers-distance cutoff is used for this figure.

As for the SDM, the dependent variable is also spatially lagged. Given the previous results, this lag is not expected to affect employment. The spatial lag of firms' taxation is then instrumented with the spatial lag of the consolidated cantonal firms' tax rate. If municipalities have various neighbors in more than one canton, the spatial lag creates, by definition, a weighted

average of the variable being lagged. The following point considers results for this instrumental variable strategy.

7.3.2 Instrumental Variable Results

The model used to generate the results is the equation (17). They are estimated with a straightforward standard method of the two-step efficient generalized method of moments (GMM) estimator (Elhorst, 2014, pp. 18–19). Table 13 presents the results of the instrumental variable approach with employment measured in FTE without sector categorization (Column (1)) and in the three sectors (Columns (2) to (4)). The first variable of interest is the municipal tax rate index that has a significant coefficient in all specifications except in the secondary sector. Hence, an increase of 1% in municipal firms' tax rate reduces, on average, the overall number of FTE in a municipality by 12.

The primary sector surprisingly reacts positively to such an increase. However, the magnitude of the coefficient is quite small in comparison to the other sectors. The employment in the secondary sector seems not to be affected by municipal taxation. In tertiary sector, an increase of 1% in taxation implies a reduction of 15 FTE in the municipality. These estimates partially verify the first hypothesis. In other words, the overall employment or the employees in tertiary sector in a municipality are negatively affected by firms' taxation. As can be seen, the coefficient for income taxation does not impact the employment in any specification.

The second variable of interest is the spatially lagged firms' tax rate index, which is instrumented with the corresponding spatial lag of cantonal firms' tax rate. Without sector categorization (Column (1)), the instrument's coefficient has a positive but not significant effect on employment. In primary sector (Column (2)), the neighboring decisions appear to not affect employment. In secondary sector (Column (3)), the coefficient for the neighboring taxes has a negative effect on employment in a municipality. This negative sign could indicate that an increase in neighbors' taxes results in a decrease in the number of FTE in a municipality. It could signal that in this sector, the firms are strongly and regionally interconnected. This fact could point out the presence of clusters. However, with other distance thresholds, this result is not significant anymore (see robustness check in Sub-section 7.3.3 and in table B 10 in Appendix).

Table 13: *Instrumental Variable — Estimates and Tests for Employment in Municipalities at Cantonal Borders*

VARIABLES	(1) FTE Total	(2) FTE Primary Sector†	(3) FTE Secondary Sector†	(4) FTE Tertiary Sector
Firms' tax rate index	-12.06**	0.389**	3.128	-15.40**
	(5.624)	(0.190)	(2.176)	(6.452)
Income tax rate index	-5.936	0.713	-0.935	-5.124
	(17.43)	(0.532)	(3.405)	(18.20)
Wages in big areas	0.0440	0.00132	0.0105	0.0301
	(0.0677)	(0.00234)	(0.0161)	(0.0712)
Cant. unempl. rate	-13.94	-0.593	-6.468	-9.050
	(16.91)	(0.797)	(5.873)	(16.67)
Cinemas	374.9	1.383	11.86	362.1
	(737.8)	(3.618)	(46.83)	(773.2)
Elderly people	-1,276**	16.05	-2.224	-1,281**
	(547.0)	(16.31)	(75.07)	(573.3)
Young people	497.7**	10.10	-149.4***	555.6**
	(242.1)	(10.02)	(51.25)	(250.1)
Foreigners	-219.8	4.340	115.7**	-277.1
	(186.5)	(8.232)	(55.01)	(188.1)
Spatially Lagged Variables				
Firms' tax rate index‡	3.388*	-0.107	-1.741**	4.847***
	(1.799)	(0.0681)	(0.741)	(1.667)
FTE Total	0.0663***			
	(0.0210)			
FTE Primary Sector		-0.0191		
		(0.0141)		
FTE Secondary Sector			-0.0356*	
			(0.0199)	
FTE Tertiary Sector				0.0679***
				(0.0198)
Tests				
Underidentification test (LM stat.)	215.5	211.2	221.4	213.2
Chi-Sq. P-Val.	0	0	0	0
Weak identification test (F stat.)	1883	1795	1834	1860
Observations	5,232	5,232	5,232	5,232
R-squared	0.039	0.015	0.006	0.038
Number of municipalities	1,308	1,308	1,308	1,308
Municipal FE	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: †Selection bias correction (Heckman) for predicting observations with a zero in specification. ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. The variables university, language, metropolitan and Left parties are omitted because of collinearity.

Similar to the specification without sector categorization, the coefficient for employment in the tertiary sector (Column (4)) reacts positively and significantly to an increase in taxes of neighboring jurisdictions. Hence, if the neighbors' municipalities raise their tax rate by 1%, there is an increase of 4.84 FTE in tertiary sector in municipality *i*. Generally, the firms in tertiary sector are more mobile than in other sectors, and as a consequence, employment in primary and secondary sectors are less affected by neighbors' taxes. This point will be further discussed in Chapter 9. According to these results, the second hypothesis—which stipulates that the employment in a municipality depends on the tax burden of neighbors—is partially verified. Indeed, each sector reacts differently.

The last variables of interest are the spatial lags of the different dependent variables. Except for the primary and secondary sectors, all the coefficients are significant. Even if the Moran's *I* values indicate low spatial autocorrelation—and by opposition to the expected values, these estimates indicate that the employment in neighbors municipalities influences the level of FTE in a particular municipality. The coefficient's sign is positive without sector categorization and in the tertiary sector, whereas it is negative but not significant at the conventional levels in the secondary sector.

The following point provides two convincing robustness tests to confirm the accuracy of this instrumental variable strategy.

7.3.3 Robustness Checks for Instrumental Variable Strategy

With the 10-kilometer threshold, the instrumental variable approach reveals that neighbors' tax choices affect the employment in municipality *i*. Even if each sector reacts specifically, I propose a robustness analysis to support these findings and to control the validity of the instrument.

In table 14, the first robustness check uses five other inverse-distance weights—2 kilometers, 5 kilometers, 15 kilometers, 20 kilometers and 30 kilometers. These results are for employment without sector categorization. The first hypothesis is easily verified. Indeed, the coefficient for the municipal tax rate is significant with a negative sign in all thresholds except the 2 kilometers.[12] However, the second hypothesis is rejected, because the coefficient for the spatially lagged firms' rate index is not significant at conventional levels. By opposition, the one for the spatially lagged dependent variable (FTE Total) is significant with various

12 Nevertheless, with the 2-kilometer threshold, the low number of eligible municipalities reduces the confidence of the estimates.

distance thresholds. It appears that the employment numbers in a municipality are positively influenced by the employment situation in the neighborhood. Similar to the Moran's *I* findings, the spatial autocorrelation lessens as the distance between municipalities and cantonal border increases.

Table B 9 in Appendix presents the estimates with the distance variation for the primary sector. The firms' taxes apparently do not affect employment in this sector. The lack of significance for the coefficients of the municipal firms' tax rate index as well as its corresponding spatially lagged variables argue in favor of this sense. As already mentioned, criteria other than taxation could play a role in the hiring decisions in this sector.

Table 14: *Instrumental Variable — Estimates of Coefficients for Employment in FTE without Sector Categorization with Various Spatial Weights*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	*10km*	15km	20km	30km
Firms' tax rate index	14.42	-6.996**	-12.06**	-8.504**	-9.485**	-9.540**
	(15.89)	(3.496)	(5.624)	(3.867)	(4.026)	(3.988)
Income tax rate index	-12.64	13.71	-5.936	1.590	0.274	0.747
	(24.74)	(8.976)	(17.43)	(16.73)	(14.46)	(13.63)
Spatially Lagged Variables						
Firms' tax rate index‡	-4.433	3.170	3.388*	1.585	1.466	1.293*
	(15.48)	(2.706)	(1.799)	(0.980)	(0.922)	(0.722)
FTE Total	0.136*	0.0135	0.0663***	0.0658***	0.0454**	0.0396***
	(0.0797)	(0.0278)	(0.0210)	(0.0130)	(0.0183)	(0.0143)
Observations	340	2,884	5,232	6,600	7,428	8,316
R-squared	0.089	0.069	0.039	0.035	0.033	0.031
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area.

Table B 10 in Appendix shows that the neighboring tax rates do not influence the employment decision in the secondary sector. Indeed, the coefficient estimates are not significant. The first hypothesis is additionally not verified, as the coefficient for the municipal firms' tax rate variable is not significant.

Table B 11 in Appendix shows the results for the tertiary sector. The various distance weights confirm that the coefficient for the municipal firms' tax rate has a negative effect on employment. Additionally, the neighboring firms' tax choices positively affect the hiring decisions in this sector, as is emphasized by the highly significant coefficients of the dependent variable spatial lag. In this sector, the two hypotheses are confirmed.

The second robustness test controls if the selected instrument is effectively exogenous to municipal choices. Concerns could arise if cantons substitute for fiscal decisions of border municipalities or if cantons and border react to a common shock. Formally, the model concentrates on the effect of the instrument ($t_{-c,t}$) on the municipal firms' tax choices ($T_{ic,t}$):

$$T_{ic,t} = \alpha + \theta t_{-c,t} + \gamma \boldsymbol{X}_{\boldsymbol{ic,t}} + \delta_i + \mu_{c,t} + \epsilon_{ic,t} \tag{18}$$

To conduct this analysis, I select the "big" cantons by dropping those in which a large share of the population lives at the border (Parchet, 2014, pp. 20–21). Hence, the share of the cantonal population living in border municipalities is computed for each canton.

Table 15: *Instrumental Variable — Coefficient Estimates for Municipal Firms' Tax Rate in Big Cantons*

VARIABLES	(1) All cantons†	(2) 75%	(3) 50%	(4) 25%	(5) no capital city at border
Tax rate of neighboring municipalities‡	0.247***	0.126***	0.0918***	0.643***	0.0594***
	(0.00833)	(0.00748)	(0.00830)	(0.0486)	(0.00849)
Municipal income tax rate	0.304***	0.502***	0.809***	0.637***	0.654***
	(0.0386)	(0.0259)	(0.0452)	(0.191)	(0.0413)
Observations	5,232	2,948	1,600	288	1,976
R-squared	0.604	0.633	0.821	0.855	0.740
Number of municipalities	1,308	737	400	72	494
Municipal FE	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: †Except for the two cantons of Basel-Stadt and Glarus already excluded (see Section 5.1). ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, municipal employment, employment in neighboring municipalities, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language, and metropolitan area.

Table 15 presents results with municipal firms' tax rate as a dependent variable for a subset of "big" cantons. This strategy considerably decreases the number of cantons and the number of eligible municipalities. The first column estimates the effect of the instrument on the firms' tax rate in municipalities at 10 kilometers of the cantonal border without dropping the small cantons. In Column (2), cantons in which 75% or more of the cantonal population reside in municipalities located at one particular cantonal border are dropped.[13] In Columns (3) and (4), the maximum population share is lowered to 50%[14] and 25%[15] respectively. In Column (5), all cantons in which the capital city is located within 10 kilometers from the cantonal border are dropped.[16]

The highly significant coefficients in all specifications indicate that the instrument has been correctly chosen. The exclusion of small cantons with a consequent number of municipalities at the border confirms the exogeneity of the instrument. The positive sign argues that taxation acts as strategic complements instead of strategic substitutes, meaning that municipalities react to a rise in the neighboring firms' tax rates with an increase in their own municipal firm tax rates.

These robustness results and the previous findings can be summarized in three key points. Firstly, municipal firms' taxes negatively influence the overall number of employees (FTE total) and the employment in the tertiary sector. Secondly, neighboring tax choices do not automatically affect employment decisions. Indeed, only the number of employees in tertiary sector reacts positively to an increase in neighbors' taxes. Thirdly, the tax rates for firms should be considered as strategic complements. An extension of this instrumental strategy reformulates the employment model and considers the impact of municipal and neighboring firms' taxation on the number of firms located in a municipality (see Section 10.1). The next chapter presents the limitations of this thesis.

8 Limitations

In order to understand how much faith should be reposed in the answers to the research hypotheses, this chapter clarifies a selection of limitations. Some suggestions are also provided

13 Ten cantons are then ignored—namely, Luzern, Schwytz, Zug, Solothurn, Basel-Landschaft, Schaffausen, Appenzell Ausserhoden, St. Gallen, Aargau and Neuchâtel

14 These cantons are additionally dropped: Zurich, Uri, Fribourg, Thurgau and Jura

15 The analysis is performed only on four cantons: Graubünden, Ticino, Valais and Genève

16 That is, 15 cantons are removed: Zurich, Luzern, Uri, Schwytz, Zug, Solothurn, Basel-Landschaft, Schaffausen, Aargau, St. Gallen, Appenzell Ausserhoden, Thurgau, Ticino, Neuchâtel and Jura.

to improve the quality of further analysis. The key limitations can be grouped into three categories: theoretical, statistical and methodological limitations.

The theoretical framework assumes a perfect mobility of workers between municipalities. Even though it is conceivable in a restricted area, perfect mobility is generally a strong assumption in econometric models. For this reason, the question of intra-cantonal mobility will be tested in an extension of the model (see Section 10.2). Nevertheless, if restricted mobility increases unemployment in a municipality (more workers are available than jobs), it can give incentives for governments to reduce their taxes. Hence, it would be captured in the empirical models.

The theoretical model presents how firms react to taxes by reducing employment. However, it does not account for the neighbors' taxes. Indeed, it is assumed that the tax rate is exogenously settled by the government. A more complex model that includes the influence of neighboring decisions on taxes would better capture the influence of tax competition on hiring choices. Nevertheless, the focus of this thesis was the empirical research, and, for this reason, I decided not to develop too consequently the theoretical framework.

About the statistical limitations, it is important to note a lack of detail in the data. Indeed, the number of firms or the number of employees by profit categories in each municipality would have facilitated a more accurate analysis. However, due to tax secrecy, these data are not available. More precisely, with such information, it would have been possible to identify a firm in a municipality by deducting its profit category and the number of employees. Moreover, an important number of firms does not have taxable profits (due to previous years' loss reports, for example) and would not appear in such data. For these reasons, this thesis uses taxes for representative firms.

The study was constrained in the choice of the time periods and geographical units used as a result of non-availability of data. Indeed, employment and firms' data are not available in municipalities before 2011. This short time period (2011 to 2014) does not allow a large variation over time. Indeed, some municipalities did not change their tax rates during these four years. Hence, more years would better capture the variance, particularly with the instrumental variable strategy. Furthermore, with more years available, a lag model could be constructed to rule out the possibility for local firms to influence the governments in their tax choices (Siegloch, 2013, p. 16). By the same token, the analysis is limited to the Swiss context: it has the particularity to be a good laboratory for tax competition analysis, but does not allow a generalization of the findings.

Another limitation arises from the aggregation of the data. The two indexes are averages of taxes for a sample of taxpayers. Roller and Schmidheiny (2016) argue for a better strategy. With a combination of federal, cantonal and municipal taxes to create an average index, the tax rates increase as incomes (profits) rise. However, a phenomenon of income (profit) sorting could appear—namely, that high income households (highly profitable firms) live systematically in a municipality with low taxes. Indeed, following this argument, the taxes for some category of taxpayers with high incomes are even regressive (Roller & Schmidheiny, 2016, pp. 17–22). As a result, the effective tax burden is not adequately measured with the average indexes. Despite this drawback, the two tax indexes account for a large set of taxpayers with the aim to capture the variance and the progressivity in tax schedules across jurisdictions.

Two more minor limitations result from the data (non-)availability. Firstly, wages are not available at the municipal level and were approximated at the regional level. Secondly, the tax base equalization scheme is not used in the analysis, whereas it does exert an influence on the tax settings and should be controlled.

All the proposed methodologies have limitations. In this chapter, I choose not to discuss the non-spatial models (Chapter 6), but to concentrate on the limitations of the models of spatial econometrics (Chapter 7).

Firstly, the matrices used in the analysis are only distance-based ones. Other criteria should be used: for example, population matrices are also commonly adopted. Hence, the definition of competitor can be based on various indicators. For example, Allers and Elhorst (2005) used a set of the largest municipalities in the Netherlands to create alternative weights. In comparison, Skidmore et al. (2012) defined competitor communities with the migration flows. Also, in comparison, the definition of connectivity between jurisdictions should in addition be considered (Beck et al., 2006, pp. 32–33). However, the choice of distance matrices was motivated by the literature on tax competition in Switzerland, which provided evidence for a reaction of municipalities to spatially located neighbors (for example, Feld & Kirchgässner, 2001; Eugster & Parchet, 2013).

Secondly, the spatial weights are specified rather than estimated in advance. As a result, there is a lack of economic theory based on the chosen specifications (Elhorst, 2010a, pp. 17–18). Even if some techniques exist to select weight matrices, the large number of municipalities used in this study creates large matrices with a consequent number of elements (even though many of these are zeros) that would be difficult to estimate. The implication of this criticism is that the weight could be chosen to fit the results that are “wanted.” Nevertheless, the

various specifications of distance weights in the robustness analysis minimize concerns of this characters.

Two additional limitations have to be added with regard to the instrumental variable strategy. Firstly, the instrument is limited to the spatial lag of firms' taxation. Even though the municipal income tax rate is included as independent variable in the regression, the corresponding spatially lagged variable is not used. Compared to firms' taxation and as demonstrated by Parchet (2014), income taxation also suffers from the fact that the tax rate of a neighboring municipality depends on the tax rate of this municipality. Consequently, it also needs to be instrumented for a correct measure of the neighboring reactions. It must be remembered here that the only way to use cantonal income tax rate as an instrument was to recalculate the tax rates for each municipality, as the data do not disentangle rates between each government level. However, the confidence in the estimates should not be drastically diminished. Indeed, the municipal income tax rate rarely affects the employment decision of firms, as the estimates were seldom significant in the variously estimated models.

Secondly, I decided to use the spatial inverse-distance weights in the instrumental variable strategy to generate the spatial lags. Consequently, it is supposed that the tax reforms in neighboring cantons affect each municipality independently. However, to improve its quality, the instrument should recognize that cantonal tax reforms affect municipalities on the other side of the state border only if they affect the tax rate of a sufficient number of competing municipalities (Parchet, 2014, p. 9). For this reason, the multiplication of the cantonal tax rate by the share of neighboring municipalities located in the neighboring canton could also be an alternative instrument that accounts for this concern.

My findings are used alongside my knowledge of this paper's limitations to propose recommendations for policy and for future research in the following chapter.

9 Discussion

The various models point to a number of recommendations for policy and for further research. Though they can not be generalized, the results are still informative for policymakers, since they underscore the importance of neighbors' choices and the mobility of production factors when debating the effect of taxes on the labor market.

With or without spatial interactions, the municipal decision in taxation affects the level of employment in the same municipality. Under such circumstances, the municipal government

could face a trade-off between the wish to preserve employment and the need to raise taxes. Moreover, public authorities could use fiscal choices as a tool to increase employment. However, it is probably not the most appropriate measure to mitigate unemployment. Indeed, taxes are a sensitive subject in public opinion and, in the Swiss context, the referendum (obligatory or not) reduces the possibility for the municipal government to freely adjust tax rates (see Brülhart & Jametti, 2007, for more details).

The methodologies of spatial econometrics enlarge the analysis to the impact of neighbors' government tax choices on employment. The standard models advance the point that tax competition does not affect the employment in a municipality. This could give incentives for policymakers to adjust taxes residually after the setting of public expenses, without considering the neighbors' situation. Even if this thesis is one of the first to consider the influence of tax competition on variables other than taxation, the accuracy of these models can be questioned. Indeed, a problem of endogeneity appears because tax adjustments of a municipality due to tax decrease(s) in its neighborhood will itself influence the choices of neighbors' municipalities. For this reason, the estimates produced with this model should not be used to derive policy. In my opinion, the instrumental variable strategy generates better estimates.

The findings with instrumental variable strategy reveal that only the employment in tertiary sector reacts to the tax choices of neighboring municipalities. A reason that can explain this situation is the obstacle of mobility for firms in the primary and secondary sector. For example, a firm active in services (tertiary sector) that only requires computers will probably be more sensitive to taxes than an industrial firm (secondary sector) with various machines and raw materials. This example shows that mobility costs could play a crucial role in the firms' location choices and, hence, employment in a municipality. However, this statement should be empirically investigated alongside tax competition.

The specificities of the regional employment market influence the location choices of firms (Brülhart et al., 2012, pp. 1082–1088) and probably their tax sensitivity as well. Hence, even if neighbors' tax cuts reduce the employment in a municipality, its effect could be mitigated by the specific knowledge of the employees in a region, which prevents a firm from relocating outside the regional market. Additionally, once a firm is implemented, the moving cost could be high (loss of knowledge, loss of clients, etc.). Unfortunately, it is not possible to determine from this data if such a retention effect applies. Hence, more investigations with fine-grained data about firms' sensitivity and wage costs would make the importance of municipal and neighboring tax choices precise relatively to other criteria.

The aim of this thesis was to enlarge the impact of tax competition to a field other than taxation. Hence, the results show that it influences not only the taxation (strategic complements) but also the employment, even if each sector does not react to the neighbors' tax decisions. For this reason, local jurisdictions should be concerned by the tax level of competitors if they want to stay attractive and maintain their tax base. However, this situation could incite governments to repeatedly decrease their tax rates with the goal to attract new taxpayers, leading to a race to the bottom or to a reallocation of the tax burden on immobile tax bases (Brülhart & Jametti, 2006, p. 2028). My results also show that a municipality could lose employment if its government does not join the neighboring movement of tax cuts.

However, the effect of such tax competition on municipal finances should also be considered. Indeed, a municipality that follows its neighbors by dropping its tax rates, is not certain to be able to finance its expenditures. Hence, the municipal governments can face a similar trade-off as before—between staying attractive or ensuring that their expenditures are financed—with the risk to see a reduction of employment, and, consequently, their tax base.

The following chapter examines two extensions: firstly, the impact of taxation on the number of firms in a municipality and, secondly, the assumption of mobility across the borders of jurisdictions.

10 Extensions

10.1 Impact of Taxation on Firms

The availability of data allows us to enlarge the investigation into the impact of taxes on the number of firms. As a preliminary remark and to be accurate, this section should use the term "establishment" instead of "firm". The term "establishment" refers to the fact that each observation corresponds to an individual plant and not necessarily to a firm. Consequently, there can be several plants per firm in various municipalities.[17] Nevertheless—and following the same definition as Siegloch (2013)—I will use the term firm and plant synonymously while discussing the results.

17 The rule of allocation of profits regulates the taxation for multiple establishments in different cantons.

Similar to the previous analysis with employment, a non-spatial model is presented as a baseline analysis. The following equation formalized a fixed effects model for firms $F_{i,t}$ in municipality *i* at time *t:*

$$F_{i,t} = \alpha + \beta T_{i,t} + \gamma \boldsymbol{X}_{i,t} + \delta_i + \mu_{i,t} \tag{19}$$

where $T_{i,t}$ is the two tax rate indexes in municipality *i*, $\boldsymbol{X}$ is a vector of municipal and regional controls, δ_i is the municipal fixed effect. The coefficients estimates for equation (19) are displayed in table 16. Surprisingly, the firms' taxes exert a positive effect on the number of firms in a municipality, whereas the previous analysis with employment argues for a negative effect.

Table 16: *Fixed Effects for Number of Firms per Municipality*

	(1)	(2)	(3)	(4)
VARIABLES	Total	Primary sector	Secondary sector	Tertiary sector
Firms' tax rate index	1.076**	0.159***	0.242***	0.674
	(0.457)	(0.0378)	(0.0776)	(0.438)
Income tax rate index	-2.169	-0.547***	0.0289	-1.651
	(1.618)	(0.127)	(0.226)	(1.669)
Wages in big area	-0.00411	-0.000985*	-0.00271***	-0.000413
	(0.0107)	(0.000559)	(0.000871)	(0.0108)
Cant. unemployment rate	-11.45***	-0.819***	-1.832***	-8.795***
	(2.695)	(0.263)	(0.447)	(2.583)
Cinemas	36.66	0.771	4.911*	30.98
	(23.30)	(0.480)	(2.794)	(22.51)
Elderly people	255.5***	-7.639**	-0.980	264.1***
	(96.89)	(3.519)	(7.156)	(100.3)
Young people	-85.46	-0.916	-1.808	-82.73
	(55.24)	(4.721)	(4.360)	(57.69)
Population	0.182***	6.66e-05	0.00502	0.177***
	(0.0448)	(0.000446)	(0.00315)	(0.0464)
Foreigners	95.48	-1.405	-1.933	98.82
	(90.58)	(6.126)	(4.212)	(92.98)
Constant	-329.8	36.17***	39.95***	-405.9*
	(219.1)	(3.864)	(12.82)	(226.1)
Observations	8,792	8,792	8,792	8,792
R-squared	0.696	0.088	0.133	0.688
Number of municipalities	2,198	2,198	2,198	2,198
Municipal FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: The variables university, language, metropolitan and Left parties are omitted because of collinearity. Table B 12 in Appendix displays the estimates for the OLS model.

However, this positive relationship is not verified with the OLS methodology (see table B 12 in Appendix). It appears that the inclusion of a time fixed effect changes the sign of the coefficients. This inconsistency with previous analysis and theoretical model encourages us to investigate further by also accounting for neighbors' choices.

I choose to include neighboring jurisdictions only with the instrumental variable strategy for two reasons. Firstly, conducting this analysis with a standard spatial model would overload the thesis. Secondly, the instrumental variable strategy is more reliable in capturing the effects of neighboring taxation. As in the analysis of employment, I exploit the differences in tax rates between neighboring cantons as a source of exogenous variation in the taxation of the neighboring municipalities.

The following equation formalizes the instrumental strategy applied to firms $F_{i,c,t}$ in municipality i and in canton c:

$$F_{ic,t} = \alpha + \rho F_{-i,t} + \beta T_{ic,t} + \theta t_{-c,t} + \gamma \boldsymbol{X}_{\boldsymbol{ic,t}} + \delta_i + \mu_{c,t} + \epsilon_{ic,t} \tag{20}$$

where $F_{-i,t}$ is the *spatial lag of dependent variable*, $T_{ic,t}$ is the *municipal tax rate*, $t_{-c,t}$ is the *weighted consolidated cantonal, federal and—if obligatory—Church tax rate of the neighboring canton*, $\boldsymbol{X}_{ic,t}$ is a *vector of controls* and $\mu_{c,t}$ is a *cantonal-year fixed effect*.

The same cutoff distances as the robustness analysis with employment are used for this analysis: 2 kilometers, 5 kilometers, 10 kilometers, 15 kilometers, 20 kilometers and 30 kilometers. Table 17 presents the estimates of coefficients for equation (20) without sector categorization. The coefficients for the municipal tax rate show a negative effect on the number of firms in municipality. With the 5-kilometer threshold, an increase of 1% in firms' tax rate produces a loss of slightly more than one firm in the municipality.

The coefficients for the instrument are highly significant and with the expected sign: for example, with a 5-kilometer threshold, if the neighboring municipalities increase of 1% their tax rates, the considered municipality will gain around 1.5 firms. Moreover, the magnitude of this coefficient diminishes as the distance from the cantonal border increases. Even if the 2-kilometer cutoff presents some opposite or non-significant results, these are probably not suitable for the analysis due to the low number of eligible municipalities. These findings contrast with the results previously obtained with employment in Section 7.3. Indeed, the coefficient for the neighboring taxation (instrument) was not significant without sector categorization, indicating, that the overall employment does not react from tax changes in the neighborhood. This difference between the two dependent variables suggests that firms do not nec-

essarily hire their workforces from the established municipality. Indeed, the labor market is not exclusively limited to the municipal borders, but many workers are regionally mobile (see Section 10.2). Moreover, the coefficient for the spatially lagged dependent variable is positive and significant. This indicates that the number of firms in neighboring municipalities positively influence the number of firms in a municipality. This fact could be explained by the presence of externalities (for instance, agglomeration economies or clusters) that attract firms to a specific region (see Brülhart et al., 2012, pp. 1082–1087 for an empirical analysis in a context of agglomeration economies).

Table 17: *Instrumental Variable — Coefficient Estimates for Firms in Municipalities at Cantonal Borders (various thresholds)*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	10km	15km	20km	30km
Firms' tax rate index	8.826***	-1.110**	-2.279	-1.965**	-2.075**	-1.583
	(1.988)	(0.546)	(1.469)	(0.916)	(0.879)	(0.978)
Income tax rate index	-6.727***	1.372	-5.437	-4.414	-1.963	-1.225
	(2.394)	(1.587)	(6.617)	(5.320)	(4.174)	(4.048)
Spatially Lagged Variables						
Firms' tax rate index‡	1.249	1.475***	1.243***	0.726***	0.549***	0.458***
	(2.579)	(0.358)	(0.463)	(0.229)	(0.176)	(0.155)
Firms Total	0.473**	0.226***	0.0622***	0.0589***	0.0638***	0.0511***
	(0.186)	(0.0308)	(0.0110)	(0.00789)	(0.0103)	(0.00833)
Observations	340	2,884	5,232	6,600	7,428	8,316
R-squared	0.258	0.161	0.041	0.029	0.035	0.035
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area.

Tables B 13, B 14 and B 15 in Appendix respectively present the estimates for the primary, secondary and tertiary sectors. Surprisingly, firms in the primary sector react positively to firms' taxation, whereas it was not the case with employment specification (see table B 9). Furthermore, it is the only sector where the income taxation's coefficient has a significant negative effect on the number of firms. A potential explanation could be that the firms in primary sector are mainly small private companies where self-employment is high and where

income taxation is a more crucial criterion than firms' taxation. Additionally, the estimates show that the neighbors' tax rates negatively affect the number of firms in the primary sector in a municipality.

The firms in the secondary sector appear to not react strongly to taxes. Indeed, in this model, only the coefficient for the neighboring taxation has a positive effect on the number of firms in a municipality, but only with high distance thresholds. The magnitude is also relatively low: for an increase of 1% in neighbors' taxes, the number of firms in municipality rises with 0.06 (with a 15-kilometer cutoff). These results contrast to the ones obtain with employment as the dependent variable, where the neighbors' tax decisions do not exert an impact on employment. Hence, the lack of verifiability and the insignificant coefficients in the employment specification do not reduce my confidence in the estimates with the number of firms as the dependent variable.

The firms active in the tertiary sector react negatively to an increase in firms' taxes in the municipality, but positively to a rise in neighboring taxes. These results are similar to the ones found in the employment model. Hence, with a 5-kilometer cutoff, an increase of 1% in firms' tax rate in a municipality sees a decrease of 1.365 firms in this particular municipality. However, if there is an increase of 1% in the neighboring jurisdictions, the number of firms in the municipality rises by 1.559.

These findings with the firms' alternatives are similar to the main results with employment specifications. They thereby confirm the fact that in the tertiary sector, a rise in neighbors' taxes increases the employment in a municipality. Nevertheless, it is important to notice that in the two other sectors, the impact of neighbors' tax rates on the number of firms is not so clear. However, even if the overall number of firms in a municipality reacts positively to neighbors' tax choices, the employment without sector categorization does not necessarily increase (see tables 14 for the employment model and 17 for the firms model). This fact indicates that employees do not restrict their job searches to the municipal borders. The next extension considers this crucial question of labor mobility between municipalities.

10.2 Testing the Assumption of Intra-Cantonal Worker Mobility

The previous analysis and the theoretical model assume that labor was mobile across jurisdictions. This section addresses this assumption and test for intra-cantonal worker mobility. The reasoning is derived from the investigation of Siegloch (2013).

A fixed effects model exploits the employment in canton c and year t net of the employment in municipality i, measured in FTE as dependent variable $E_{-i,c,t}$. The main independent variable $E_{i,c,t}$ is the employment in municipality i in canton c at time t. Additionally, I specify two timely lagged employment variables with the aim to test the presence of long-term mobility.

The control variables are at the cantonal level and summarized in vector $\boldsymbol{K}_{c,t}$. More precisely, I add cantonal-specific variables that are not available at the municipal level. These are cantonal gross domestic product (GDP),[18] cantonal expenses,[18] cantonal revenues,[18] cantonal investments,[18] and the cantonal population. The previously used cantonal or regional control variables—viz. regional wages, cantonal unemployment rate and cantonal firms' tax rate—are also included in this vector. Similar to the instrumental variable strategy, a cantonal-year fixed effects $\mu_{c,t}$ is required to deal with endogeneity considerations between employment in municipality i and cantonal employment c. Hence, the model can be formulated as follows:

$$E_{-i,c,t} = \alpha + \beta E_{i,c,t} + \gamma \boldsymbol{K}_{c,t} + \mu_{c,t} + \delta_i + \epsilon_{i,c,t} \tag{21}$$

Table 18 displays the estimates for equation (21) which confirm the assumption of intra-cantonal mobility. Without sector categorization (Column (1)), a decrease in employment of the municipality i of 1 FTE increases the cantonal regional employment (net of municipality i's contribution) of 0.743 FTE. The primary sector is the only specification where the coefficient for the intra-cantonal mobility is not significant. In the secondary sector (Column (3)), for the same decrease of 1 FTE, an increase of 0.393 FTE is estimated. The tertiary sector (Column (4)) presents the highest coefficient estimate of 0.795 for a decrease of 1 FTE in municipality i.

Another key point is the lack of significance of the two timely lagged employment variables. This fact indicates that most workers react to changed labor market conditions in their municipality within one year.

To summarize this extension, the mobility assumption is verified, at least within cantonal borders, and the workers react within a small period of time.

18 Measured in thousand Swiss francs.

Table 18: *Intra-cantonal mobility — Effects on Net Cantonal Employment*

	(1)	(2)	(3)	(4)
VARIABLES	Total	Primary sector	Secondary sector	Tertiary sector
$Employment_{it}$	-0.743***	-0.143	-0.393***	-0.795***
	(0.0723)	(0.275)	(0.120)	(0.0545)
$Employment_{it-1}$	-0.000114	0.0157	-4.83e-05	-5.35e-05
	(0.00150)	(0.0298)	(0.00386)	(0.00179)
$Employment_{it-2}$	-2.62e-05	0.0162	0.000446	-6.61e-06
	(0.00176)	(0.0289)	(0.00372)	(0.00200)
Wages in the big areas	-12.33***	-1.043***	-1.866***	-9.424***
	(0.404)	(0.0356)	(0.168)	(0.325)
Cant. unemployment rate	-2,860***	-222.2***	-1,061***	-1,576***
	(93.61)	(8.362)	(46.67)	(75.51)
Cant. firms' tax index	-0.357***	-0.00163	-0.131***	-0.224***
	(0.0126)	(0.00122)	(0.00399)	(0.0117)
Cant. population	0.105***	-0.00504***	-0.00553***	0.115***
	(0.00432)	(0.000382)	(0.00185)	(0.00404)
Cant. GDP	2.808***	-0.000948	-0.0980***	2.908***
	(0.0490)	(0.00317)	(0.0143)	(0.0477)
Cant. expenses	-0.000831***	-2.23e-05***	-0.000167***	-0.000642***
	(5.62e-05)	(3.80e-06)	(1.69e-05)	(5.75e-05)
Cant. revenues	0.00168***	-0.000290***	0.000533***	0.00143***
	(0.000130)	(1.02e-05)	(4.82e-05)	(0.000111)
Cant. investment	0.00516***	0.000256***	0.00221***	0.00269***
	(0.000158)	(6.40e-06)	(4.22e-05)	(0.000190)
Constant	177,957***	19,405***	88,014***	70,389***
	(4,007)	(354.4)	(1,585)	(2,825)
Observations	8,694	8,694	8,694	8,694
R-squared	0.944	0.643	0.347	0.956
Number of municipalities	2,174	2,174	2,174	2,174
Municipal FE	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: Dependent variables: net cantonal employment, without sector categorization (Column (1)), in primary sector (Column (2)), in secondary sector (Column (3)) and in tertiary sector (Column (4)).

11 Conclusion

This thesis analyzes how corporate taxation affects employment in Swiss municipalities. It includes the local tax rates and the tax choices of the neighboring municipalities, an effect on employment that has so far been neglected. The basic theoretical model shows a negative effect of firms' taxes under the assumptions that wages are unaffected by municipal decisions

and the labor is mobile across jurisdictions. The various empirical models exploit the Swiss institutional setting of the local firms' taxation with a database that contains the rates for 2,198 municipalities between 2011 and 2014.

The first step in the empirical analysis was to estimate non-spatial models that show a reduction in employment on an average if municipal firms' tax rates increase. This negative relationship was then confirmed in the Spatial Error Model and with instrumental variable strategy. Each sector does not appear to react similarly: the primary sector is not impacted by a rise of municipal taxes, whereas the tertiary sector responds the most strongly. This fact could be explained by the ability for firms to move, which differs by sectors.

The second step enlarges the analysis to spatial interaction, accounting for the neighbors' choices with two approaches. Firstly, the standard spatial econometric models advance the viewpoint that neighboring taxation does not influence the employment in a municipality. However, these models rely on strong assumptions and suffer from an endogeneity problem. Hence, these do not provide reliable estimates. For this reason, the second approach produced instrumental variable estimates by exploiting the cantonal variations. In this model, the competitors have been defined as the neighboring municipalities at the cantonal border. With this innovative strategy, the neighboring choices positively impact the level of employment and the number of firms in a municipality. Here again, the tertiary sector appears to react strongly to the neighboring choices, although the other sectors are obviously not affected. Additionally, the robustness check of this strategy indicates that firms' taxes are strategic complements. As the municipal fiscal share differs strongly between federalist countries, it should be empirically verified whether these findings can be further generalized to other federations.

The various models also indicate the impact of income taxation on employment. Despite the strong influence of firms' taxes, the estimates demonstrate that income tax rates do not robustly affect hiring decisions.

The data allow two more extensions to be conducted. The first one supports the results with an alternative dependent variable—namely, the number of firms. Furthermore, even if new firms choose to locate in a municipality because of tax hikes in the neighborhood, this extension shows that this fact does not necessarily increase employment. The second one confirms the intra-cantonal labor mobility assumption, which was crucial for the theoretical framework.

In a sense, this research is a first step in the full evaluation of the prediction that taxes influences employment. These findings expand the effect of firms' taxes on employment by ac-

counting not only for the municipal choices, but also for the neighboring decisions. The analysis is performed with sector variations and underlines characteristics that influence the direction of the strategic interactions. Further studies that follow the same pattern could report additional effects of tax competition on other economic variables. Such an analysis may reveal different forms of spillover effects that could take place between different jurisdictions beyond strategic interactions. Moreover, the tax sensibility of firms should also be considered in further evaluations in order to account for forces (agglomeration, externalities, etc.) that could mitigate the impact of taxes.

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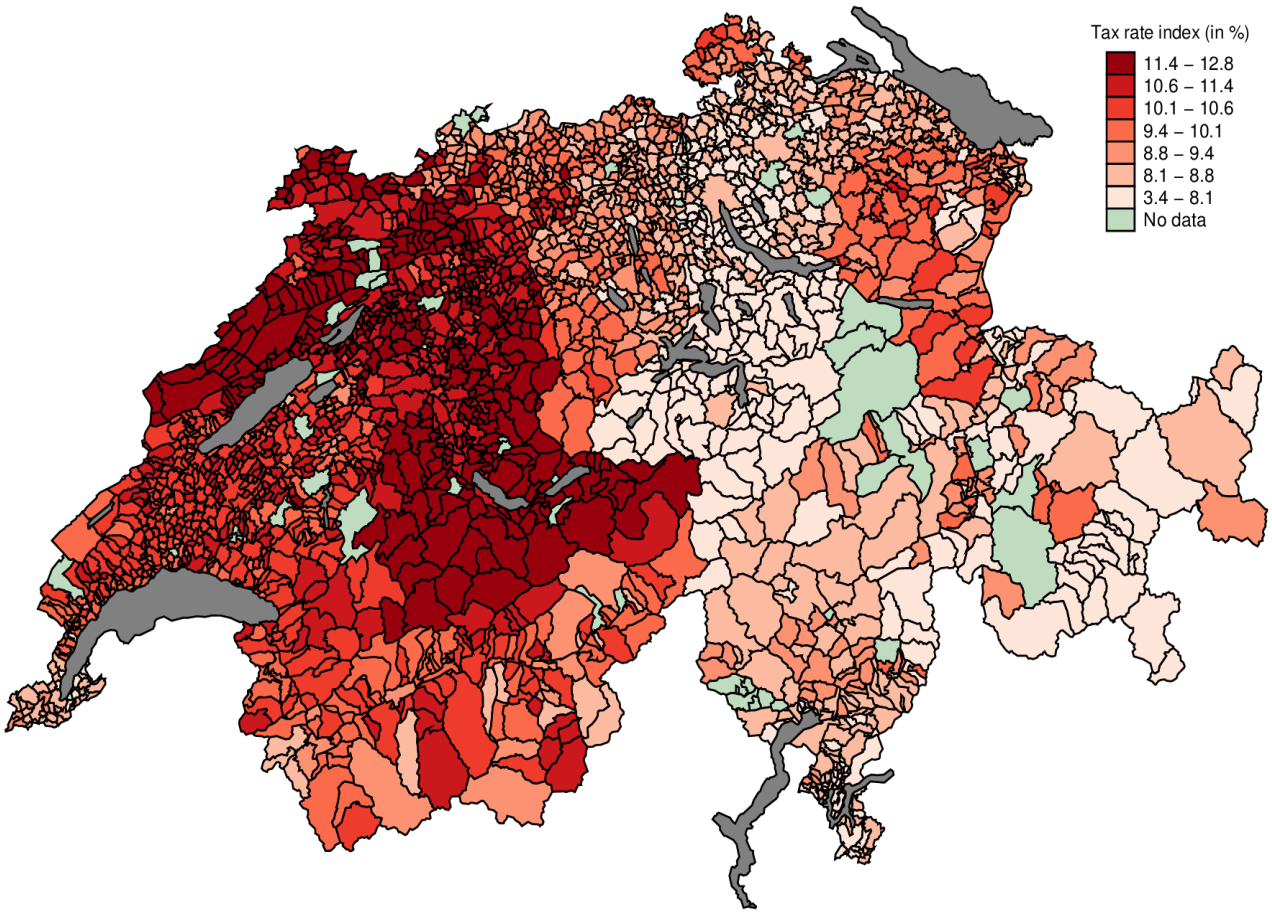
Index of Appendix

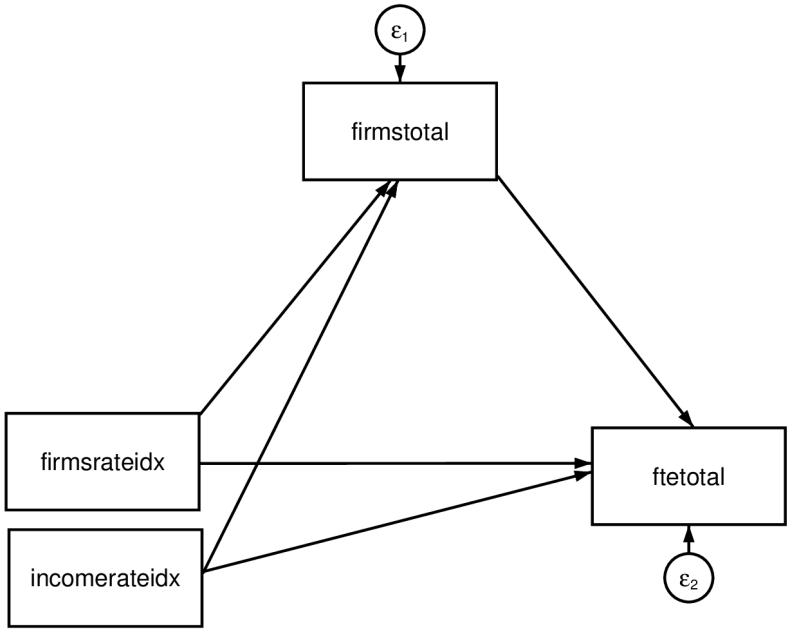
Appendix A: Figures

Figure A 1: Income Tax Rate Index across Swiss Municipalities for year 2014



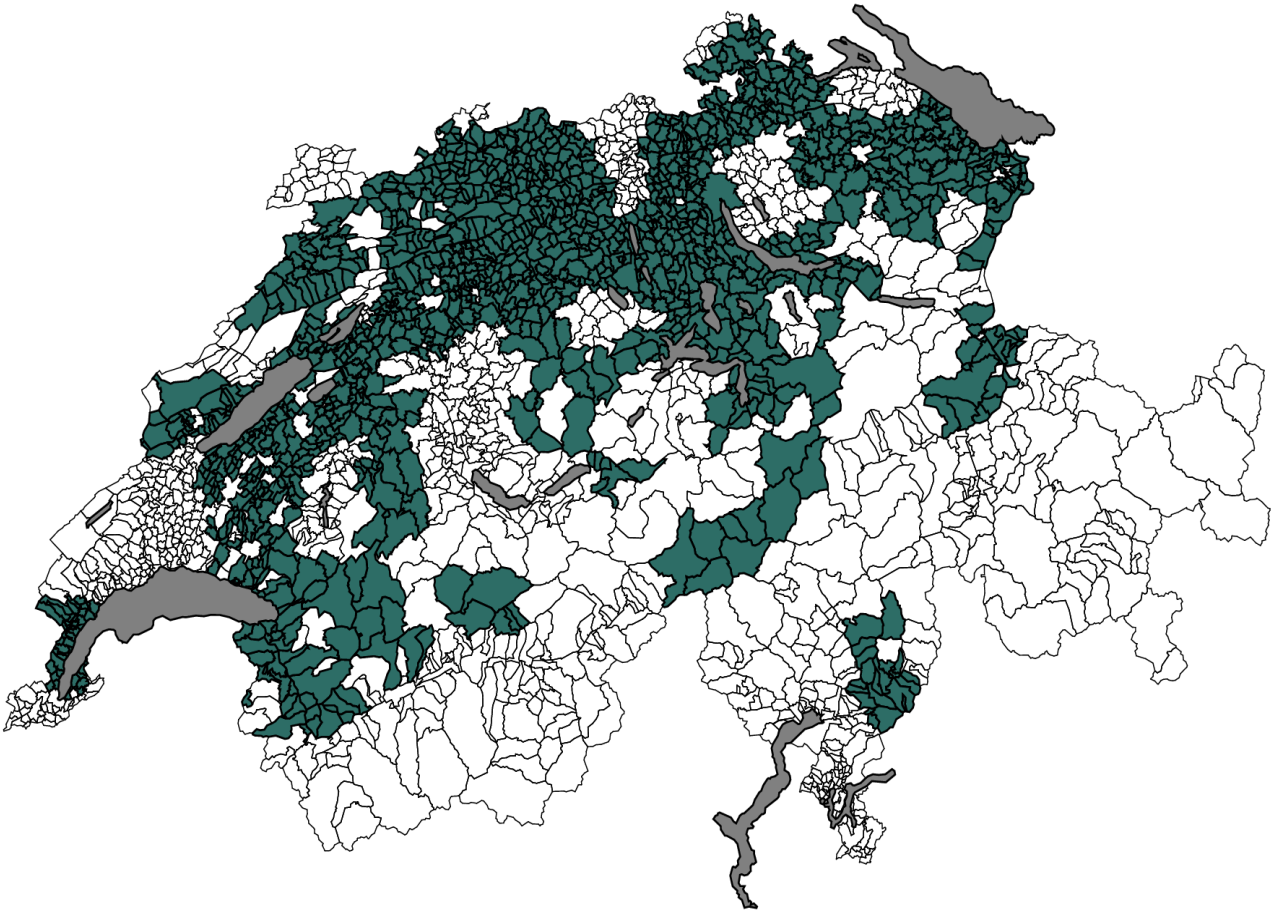
Notes: The tax rate index corresponds to the average of tax rates (canton, municipality and Church) for a sample of income groups (single, married without kids, married with two kids, and retired) with annual income between 12,000 CHF and 1,000,000 CHF (see table B 2). The same excluding reasons for missing data as those noted below figure 1 also apply here.

Figure A 2: Simultaneous Equations Model



Note: For reasons of clarity, this illustration does not account for control variables.

Figure A 3: Municipalities within 10 kilometers of a Cantonal Border



Notes: Colored municipalities have at least one municipal neighbor within a distance of 10 kilometers (as the crow flies) located in another canton. The centroids of each municipality is used to calculate the distance. The municipalities in cantons Basel-Stadt (3 municipalities) and Glarus (3 municipalities) are not used in the analysis (see Section 5.1).

Appendix B: Tables

Table B 1: *Sources of Data*

Data	Sources
Dependent variables:	
Firms and employment by municipalities, sector and size	Federal Statistical Office (2016), "STATENT, Structure of the economy", Neuchâtel. Available at: https://www.bfs.admin.ch/bfs/fr/home/statistiques/industrie-services/entreprises-emplois/structure-economie-entreprises.html
Independent variable:	
Municipal tax burdens for physical persons	Federal Tax Administration (2016), "Tax burdens", Bern. Available at: https://www.estv.admin.ch/estv/fr/home/allgemein/steuer-statistiken/fachinformationen/steuerbelastungen/steuerbelastung.html
Municipal tax burdens for firms	Own calculation from various sources: Tax Administration of each canton
Controls:	
Cantonal unemployment rate	State Secretariat for Economic Affairs (2016), "Unemployment Numbers", Bern. Available at: https://www.seco.admin.ch/seco/fr/home/wirtschaftslage---wirtschaftspolitik/Wirtschaftslage/Arbeitslosenzahlen.html
Wages in big areas	Federal Statistical Office, Section Labor Force (2016), "Major Regions: Wage Levels", Neuchâtel. Available at: https://www.bfs.admin.ch/bfs/en/home/statistics/work-income/wages-income-employment-labour-costs/wage-levels-major-regions.html

Data	Sources
Inhabitants Share of young people Share of elderly people Share of foreigners	Federal Statistical Office, Section Demography and Migration (2016), "STATPOP, Population Statistics" Neuchâtel. Available at: https://www.bfs.admin.ch/bfs/fr/home/statistiques/population/effectif-evolution/population.html
Strength of Left parties by municipalities in federal election (National council)	Federal Statistical Office, Section Politics, Culture and Medias (2016), "Parties Strength", Neuchâtel. Available at: https://www.bfs.admin.ch/bfs/fr/home/statistiques/politique/elections/conseil-national/force-partis.html
Number of movie theater in the municipality	Federal Statistical Office, Section Politics, Culture and Medias (2016), "Cinemas", Neuchâtel. Available at: https://www.atlas.bfs.admin.ch/maps/13/fr/11615_7307_4882_7265/19237.html
Municipal area statistics (agricultural, forest and settlement)	Federal Statistical Office, Section Geoinformation (2017), "Use and cover of the ground", Neuchâtel, Available at: http://www.landuse-stat.admin.ch
Cantonal controls (expenses, revenues, investment)	Federal Finance Administration, Financial statistic (2017), "Swiss public finances", Bern, Available at: https://www.efv.admin.ch/efv/en/home/themen/finanzstatistik/berichterstattung.html
Cantonal GDP	Federal Statistical Office, Section National Accounts (2017), "National Economy", Neuchâtel, Available at: https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy.html
Metropolitan	Dummy variable: 1 in case the municipality is in a metropolitan area in 2005, and zero otherwise. Own calculation based on data from Federal Statistical Office (2016), "Geographical Levels", Neuchâtel. Available at: https://www.bfs.admin.ch/bfs/fr/home/statistiques/themes-transversaux/analyses-spatiales/niveaux-geographiques.html

Data	Sources
University	Dummy variable: 1 in case the municipality with university, and zero otherwise. Own calculation.
Language	Dummy variable: 1 in case the main language of the municipality is non-German. Own calculation based on data from Federal Statistical Office (2016), "Geographical Levels", Neuchâtel. Available at: https://www.bfs.admin.ch/bfs/fr/home/statistiques/themes-transversaux/analyses-spatiales/niveaux-geographiques.html

Table B 2: *Descriptive Statistics for Tax Rates included in Income Tax Rate Index*

VARIABLES	N	Mean	S.D.	Min	Max
Income tax rate index	8,792	9.653	1.443	3.326	13.31
Single - income of 12,000 CHF	8,792	0.211	0.311	0	1.840
Single - income of 15,000 CHF	8,792	0.420	0.580	0	2.450
Single - income of 17,000 CHF	8,792	0.843	0.905	0	3.470
Single - income of 20,000 CHF	8,792	1.353	1.218	0	4.590
Single - income of 25,000 CHF	8,792	2.798	1.755	0	6.710
Single - income of 30,000 CHF	8,792	4.217	2.015	0.380	8.410
Single - income of 35,000 CHF	8,792	5.473	1.866	2.030	9.690
Single - income of 40,000 CHF	8,792	6.750	1.651	2.560	11.04
Single - income of 45,000 CHF	8,792	7.940	1.572	2.830	12.19
Single - income of 50,000 CHF	8,792	8.936	1.605	3.060	13.02
Single - income of 60,000 CHF	8,792	10.67	1.843	3.590	15.29
Single - income of 70,000 CHF	8,792	11.83	1.912	3.970	16.87
Single - income of 80,000 CHF	8,792	12.76	1.974	4.280	18.14
Single - income of 90,000 CHF	8,792	13.56	2.036	4.550	19.09
Single - income of 100,000 CHF	8,792	14.26	2.091	4.800	20.03
Single - income of 125,000 CHF	8,792	15.71	2.284	5.250	21.75
Single - income of 150,000 CHF	8,792	16.88	2.472	5.550	23.12
Single - income of 175,000 CHF	8,792	17.85	2.627	5.770	24.32
Single - income of 200,000 CHF	8,792	18.61	2.739	5.930	25.43
Single - income of 250,000 CHF	8,792	19.73	2.883	6.160	25.96
Single - income of 300,000 CHF	8,792	20.51	2.995	6.260	26.20
Single - income of 400,000 CHF	8,792	21.59	3.241	6.360	27.44
Single - income of 500,000 CHF	8,792	22.22	3.378	6.420	28.20
Single - income of 1,000,000 CHF	8,792	23.37	3.643	6.540	30.19
Married no kid – income of 12,000 CHF	8,792	0.124	0.185	0	0.880
Married no kid – income of 15,000 CHF	8,792	0.107	0.159	0	0.820
Married no kid – income of 17,000 CHF	8,792	0.139	0.199	0	1.160
Married no kid – income of 20,000 CHF	8,792	0.166	0.257	0	1.500
Married no kid – income of 25,000 CHF	8,792	0.433	0.497	0	3.490
Married no kid – income of 30,000 CHF	8,792	1.074	0.825	0	4.720
Married no kid – income of 35,000 CHF	8,792	1.803	1.230	0	5.470

VARIABLES	N	Mean	S.D.	Min	Max
Married no kid – income of 40,000 CHF	8,792	2.577	1.503	0.0600	6.430
Married no kid – income of 45,000 CHF	8,792	3.481	1.581	0.0600	7.380
Married no kid – income of 50,000 CHF	8,792	4.326	1.569	0.0500	8.320
Married no kid – income of 60,000 CHF	8,792	5.905	1.629	1.200	10.24
Married no kid – income of 70,000 CHF	8,792	7.257	1.828	2.310	11.43
Married no kid – income of 80,000 CHF	8,792	8.319	1.937	2.580	12.27
Married no kid – income of 90,000 CHF	8,792	9.155	1.878	2.760	13.34
Married no kid – income of 100,000 CHF	8,792	9.930	1.864	2.950	14.49
Married no kid – income of 125,000 CHF	8,792	11.56	1.848	3.640	16.65
Married no kid – income of 150,000 CHF	8,792	12.88	1.927	4.190	18.35
Married no kid – income of 175,000 CHF	8,792	14.11	2.041	4.880	19.82
Married no kid – income of 200,000 CHF	8,792	15.10	2.159	5.150	21.04
Married no kid – income of 250,000 CHF	8,792	16.63	2.331	5.540	22.86
Married no kid – income of 300,000 CHF	8,792	17.78	2.483	5.790	24.29
Married no kid – income of 400,000 CHF	8,792	19.44	2.742	6.120	26.13
Married no kid – income of 500,000 CHF	8,792	20.52	2.922	6.320	26.30
Married no kid – income of 1,000,000 CHF	8,792	22.65	3.500	6.490	29.22
Married with 2 kids – income of 12,000 CHF	8,792	0.120	0.184	0	0.880
Married with 2 kids – income of 15,000 CHF	8,792	0.101	0.154	0	0.730
Married with 2 kids – income of 17,000 CHF	8,792	0.0860	0.132	0	0.630
Married with 2 kids – income of 20,000 CHF	8,792	0.0755	0.116	0	0.550
Married with 2 kids – income of 25,000 CHF	8,792	0.0607	0.0923	0	0.440
Married with 2 kids – income of 30,000 CHF	8,792	0.0523	0.0803	0	0.570
Married with 2 kids – income of 35,000 CHF	8,792	0.0733	0.119	0	1.910
Married with 2 kids – income of 40,000 CHF	8,792	0.185	0.282	0	2.920
Married with 2 kids – income of 45,000 CHF	8,792	0.391	0.558	0	3.700
Married with 2 kids – income of 50,000 CHF	8,792	0.750	0.825	0	4.420
Married with 2 kids – income of 60,000 CHF	8,792	1.960	1.154	0	5.560
Married with 2 kids – income of 70,000 CHF	8,792	3.325	1.360	0.0400	7.610
Married with 2 kids – income of 80,000 CHF	8,792	4.576	1.516	0.390	8.670
Married with 2 kids – income of 90,000 CHF	8,792	5.720	1.642	0.770	9.420
Married with 2 kids – income of 100,000 CHF	8,792	6.740	1.835	1.040	10.79
Married with 2 kids – income of 125,000 CHF	8,792	8.761	1.901	1.480	14.03
Married with 2 kids – income of 150,000 CHF	8,792	10.33	1.908	2.150	16.05

VARIABLES	N	Mean	S.D.	Min	Max
Married with 2 kids – income of 175,000 CHF	8,792	11.72	1.942	2.870	17.73
Married with 2 kids – income of 200,000 CHF	8,792	12.93	2.002	3.400	19.20
Married with 2 kids – income of 250,000 CHF	8,792	14.74	2.157	4.940	21.30
Married with 2 kids – income of 300,000 CHF	8,792	16.16	2.316	5.290	22.99
Married with 2 kids – income of 400,000 CHF	8,792	18.21	2.595	5.750	25.30
Married with 2 kids – income of 500,000 CHF	8,792	19.56	2.798	6.020	25.63
Married with 2 kids – income of 1,000,000 CHF	8,792	22.23	3.482	6.350	28.66
Retired – income of 20,000 CHF	8,792	0.294	0.394	0	4.440
Retired – income of 25,000 CHF	8,792	0.965	0.941	0	6.230
Retired – income of 30,000 CHF	8,792	1.919	1.559	0	7.270
Retired – income of 35,000 CHF	8,792	3.155	1.842	0	8.080
Retired – income of 40,000 CHF	8,792	4.390	2.099	0	9.090
Retired – income of 45,000 CHF	8,792	5.560	2.180	0.0600	9.670
Retired – income of 50,000 CHF	8,792	6.586	2.398	0.0500	11.12
Retired – income of 60,000 CHF	8,792	8.333	2.518	0.710	12.84
Retired – income of 70,000 CHF	8,792	9.741	2.541	2.980	14.06
Retired – income of 80,000 CHF	8,792	10.85	2.416	3.340	15.52
Retired – income of 90,000 CHF	8,792	11.82	2.345	3.610	17.01
Retired – income of 100,000 CHF	8,792	12.68	2.283	4.010	18.21
Retired – income of 125,000 CHF	8,792	14.50	2.299	4.720	20.67
Retired – income of 150,000 CHF	8,792	16.05	2.427	5.310	22.51
Retired – income of 175,000 CHF	8,792	17.26	2.567	5.630	24.02
Retired – income of 200,000 CHF	8,792	18.23	2.651	5.920	25.16
Retired – income of 250,000 CHF	8,792	19.80	2.833	6.320	27.12
Retired – income of 300,000 CHF	8,792	20.96	2.991	6.590	28.61
Retired – income of 400,000 CHF	8,792	22.62	3.246	6.920	29.56
Retired – income of 500,000 CHF	8,792	23.62	3.438	7.070	30.12
Retired – income of 1,000,000 CHF	8,792	25.59	3.982	7.240	33.16

Table B 3: *Descriptive Statistics for Tax Rates included in Firms' Tax Rate Index*

VARIABLES	N	Mean	S.D.	Min	Max
Firms' tax rate index	8,792	23.83	4.08	13.07	33.05
Firms with profits of 4,000 CHF†	8,792	24.84	6.055	13.07	38.23
Firms with profits of 8,000 CHF†	8,792	22.31	5.419	13.07	33.44
Firms with profits of 12,000 CHF†	8,792	21.98	5.121	13.07	33.07
Firms with profits of 16,000 CHF†	8,792	21.99	4.915	13.07	32.88
Firms with profits of 20,000 CHF†	8,792	22.00	4.844	13.07	32.77
Firms with profits of 30,000 CHF†	8,792	22.22	4.743	13.05	33.83
Firms with profits of 40,000 CHF†	8,792	22.44	4.709	12.94	33.50
Firms with profits of 50,000 CHF†	8,792	22.55	4.724	12.87	32.50
Firms with profits of 80,000 CHF‡	8,792	25.78	5.482	13.07	38.23
Firms with profits of 160,000 CHF‡	8,792	24.89	4.537	13.07	33.44
Firms with profits of 240,000 CHF‡	8,792	24.97	4.134	13.07	33.07
Firms with profits of 320,000 CHF‡	8,792	25.00	4.036	13.07	32.88
Firms with profits of 400,000 CHF‡	8,792	25.03	4.013	13.07	32.77
Firms with profits of 600,000 CHF‡	8,792	25.06	4.027	13.05	32.62
Firms with profits of 800,000 CHF‡	8,792	25.08	4.052	12.94	32.54
Firms with profits of 1,000,000 CHF‡	8,792	25.08	4.073	12.87	32.50

Notes: †Firms with 100,000 CHF of capital. ‡Firms with 2,000,000 CHF of capital.

Table B 4: *Heckman Correction for Employment in the Primary and Secondary Sector*

	Employment in primary sector		Employment in secondary sector	
	(1)	(2)	(3)	(4)
VARIABLES	Log FTE	select	Log FTE	select
Firms in the primary sector		11.72***		
		(3.266)		
Firms in the secondary sector				13.73***
				(0.495)
Firms' tax rate index	-0.0610***	-0.0910	-0.130***	-0.0566
	(0.00312)	(0.0794)	(0.00466)	(0.0507)
Income tax rate index	0.0181**	-2.574***	-0.0251**	-0.0893
	(0.00863)	(0.585)	(0.0125)	(0.0610)
Wages in the big area	0.000130***	0.00357**	-0.000108**	-0.000304
	(3.86e-05)	(0.00141)	(4.93e-05)	(0.000408)
Elderly people	0.434	-7.951*	2.004***	0.316
	(0.405)	(4.807)	(0.628)	(0.547)
Young people	7.755***	-11.41*	2.793***	-1.636***
	(0.439)	(6.702)	(0.722)	(0.619)
Population	2.27e-05***	0.000238***	3.96e-05***	0.00115**
	(4.20e-06)	(5.78e-05)	(7.65e-06)	(0.000491)
Foreigners	-1.131***	-11.23***	6.844***	-0.189
	(0.164)	(3.131)	(0.260)	(0.519)
Left parties	-0.0149***	0.201***	0.00150	0.00760
	(0.00128)	(0.0289)	(0.00220)	(0.00510)
Metropolitan area (Dummy)	-0.217***	-5.080*	0.679***	-0.683
	(0.0260)	(2.732)	(0.0414)	(0.620)
Agricultural land		0.247***		-0.00578**
		(0.0707)		(0.00279)
Forest		0.0398**		-0.00986***
		(0.0192)		(0.00301)
Settlement		0.0334		0.00359
		(0.0246)		(0.0197)
Constant	2.469***	-6.251	6.166***	-4.258
	(0.296)	(4.924)	(0.416)	(3.211)
Observations	8,792		8,792	
Athrho	-11.53***		-1.374***	
	(0.136)		(0.0290)	
Lnsigma	-0.0497***		0.375***	
	(0.00975)		(0.00975)	
Rho	-1		-0.880	
Sigma	0.952		1.454	
Lambda	-0.952		-1.279	
	(0.00927)		(0.0156)	
Wald test of indep. equations	7204***		2241***	

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table B 5: *Simultaneous Equations Models with Sector Categorization*

	(1)	(2)	(3)	(4)	(5)	(6)
	Primary sector		Secondary sector		Tertiary sector	
VARIABLES	F_i	E_i	F_i	E_i	F_i	E_i
Firms' tax rate index	-1.150***	0.614***	-0.676***	-6.885***	-1.092	40.25***
	(0.106)	(0.0733)	(0.117)	(1.719)	(1.027)	(5.988)
Income tax rate index	0.536**	0.210	-0.733***	11.41***	-18.42***	103.4***
	(0.243)	(0.169)	(0.282)	(3.794)	(3.170)	(15.40)
F_i Primary		1.721***				
		(0.0155)				
F_i Secondary				13.41***		
				(0.722)		
F_i Tertiary						7.480***
						(0.673)
Constant	37.99***	-7.260*	70.03***	30.86	648.9***	-585.7
	(5.279)	(4.316)	(6.756)	(104.4)	(56.38)	(358.6)
Observations	8,792	8,792	8,792	8,792	8,792	8,792
Control variables	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Control variables are: wages in big areas, cantonal unemployment rate, cinema, share of elderly people, share of young people, population, share of foreigners, Left parties, university (dummy), language (dummy) and metropolitan (dummy).

Table B 6: *SDM — Coefficient Estimates for Various Spatial Weight Matrices for Employment in Primary Sector*

VARIABLES	Log of FTE in primary sector†					
	Contiguity	5 km	*10 km*	15 km	20 km	30 km
Independent Variables						
Firms' tax rate index	0.00204	0.00231	1.10e-05	-0.00169	-0.00155	-0.00135
	(0.00560)	(0.00398)	(0.00429)	(0.00416)	(0.00405)	(0.00396)
Income tax rate index	0.0271*	0.0125	0.0148	0.0155	0.0140	0.0120
	(0.0146)	(0.0120)	(0.0121)	(0.0122)	(0.0124)	(0.0122)
Spatially Lagged Independent Variables						
Firms' tax rate index	-0.00615	0.000905	0.0139	0.0222	0.0217	0.0231
	(0.0182)	(0.0285)	(0.0203)	(0.0175)	(0.0175)	(0.0185)
Income tax rate index	-0.135**	-0.0490	-0.0590	-0.0675	-0.0677	-0.0794*
	(0.0544)	(0.0706)	(0.0480)	(0.0431)	(0.0451)	(0.0454)
Observations	8,792	8,792	8,792	8,792	8,792	8,792
R-squared	0.143	0.159	0.088	0.050	0.031	0.010
Number of municipalities	2,198	2,198	2,198	2,198	2,198	2,198
Municipal FE	YES	YES	YES	YES	YES	YES
Spatial FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: †Selection bias correction (Heckman) for predicting observations with a zero in log specification. Control variables are: wages in big areas, cantonal unemployment rate, cinema, share of elderly people, share of young people, population, share of foreigners, Left parties, university (dummy), language (dummy) and metropolitan (dummy).

Table B 7: *SDM — Coefficient Estimates for Various Spatial Weight Matrices for Employment in Secondary Sector*

VARIABLES	Log of FTE in secondary sector†					
	Contiguity	5 km	*10 km*	15 km	20 km	30 km
Independent variables						
Firms' tax rate index	-0.00544	-0.00394	-0.00846	-0.00749	-0.00866	-0.0104*
	(0.00735)	(0.00540)	(0.00586)	(0.00578)	(0.00566)	(0.00544)
Income tax rate index	0.00565	0.00880	0.000357	-0.00613	-0.00927	-0.0136
	(0.0264)	(0.0222)	(0.0227)	(0.0228)	(0.0227)	(0.0225)
Spatially Lagged Independent Variables						
Firms' tax rate index	-0.0143	-0.0393	-0.00279	-0.00814	-0.00425	0.00381
	(0.0240)	(0.0317)	(0.0238)	(0.0214)	(0.0216)	(0.0231)
Income tax rate index	-0.0665	-0.0918	-0.0118	0.0293	0.0582	0.0950
	(0.0934)	(0.117)	(0.0827)	(0.0762)	(0.0792)	(0.0857)
Observations	8,792	8,792	8,792	8,792	8,792	8,792
R-squared	0.023	0.001	0.100	0.113	0.062	0.033
Number of municipalities	2,198	2,198	2,198	2,198	2,198	2,198
Spatial FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: †Selection bias correction (Heckman) for predicting observations with a zero in log specification. Control variables are: wages in big areas, cantonal unemployment rate, cinema, share of elderly people, share of young people, population, share of foreigners, Left parties, university (dummy), language (dummy) and metropolitan (dummy).

Table B 8: *SDM — Coefficient Estimates for Various Spatial Weight Matrices for Employment in Tertiary Sector*

VARIABLES	Log of FTE in tertiary sector					
	Contiguity	5 km	*10 km*	15 km	20 km	30 km
Independent variables						
Firms' tax rate index	-0.00783*	-0.00264	-0.00192	-0.00140	-0.00293	-0.00451
	(0.00462)	(0.00303)	(0.00376)	(0.00385)	(0.00382)	(0.00352)
Income tax rate index	0.00189	0.00348	-0.00141	-0.000988	0.00155	0.00377
	(0.0137)	(0.0120)	(0.0128)	(0.0129)	(0.0128)	(0.0125)
Spatially Lagged Independent Variables						
Firms' tax rate index	0.0197	-0.00745	-0.00445	-0.00410	0.00586	0.0172
	(0.0152)	(0.0171)	(0.0156)	(0.0148)	(0.0157)	(0.0160)
Income tax rate index	0.00944	-0.00565	0.0256	0.0260	0.0173	0.0145
	(0.0447)	(0.0481)	(0.0391)	(0.0369)	(0.0376)	(0.0407)
Observations	8,792	8,792	8,792	8,792	8,792	8,792
R-squared	0.748	0.376	0.172	0.186	0.262	0.296
Number of municipalities	2,198	2,198	2,198	2,198	2,198	2,198
Spatial FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Control variables are: wages in big areas, cantonal unemployment rate, cinema, share of elderly people, share of young people, population, share of foreigners, Left parties, university (dummy), language (dummy) and metropolitan (dummy).

Table B 9: *Instrumental Variable — Estimates of Coefficients for Employment in Primary Sector with various Spatial Weights*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	*10km*	15km	20km	30km
Firms' tax rate index	-1.051	0.0989	0.389**	0.256	0.220	0.174
	(2.503)	(0.216)	(0.190)	(0.315)	(0.284)	(0.205)
Income tax rate index	2.671	0.615	0.713	0.0397	-0.340	-0.437
	(3.139)	(0.798)	(0.532)	(0.508)	(0.442)	(0.401)
Spatially Lagged Variables						
Firms' tax rate index‡	0.0876	-0.0231	-0.107	-0.0184	-0.0132	-0.00429
	(1.285)	(0.141)	(0.0681)	(0.0921)	(0.0666)	(0.0355)
FTE Primary Sector	-0.0259	-0.0707***	-0.0191	-0.0963*	-0.0580	-0.0375
	(0.0534)	(0.0238)	(0.0141)	(0.0562)	(0.0431)	(0.0324)
Observations	340	2,884	5,232	6,600	7,428	8,316
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area. Selection bias correction (Heckman) for predicting observations with a zero in specification.

Table B 10: *Instrumental Variable — Estimates of Coefficients for Employment in Secondary Sector with various Spatial Weights*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	*10km*	15km	20km	30km
Firms' tax rate index	12.95	0.627	3.128	0.250	0.173	-0.551
	(10.14)	(1.493)	(2.176)	(1.513)	(1.468)	(1.412)
Income tax rate index	2.112	0.538	-0.935	0.371	-0.0360	-1.104
	(19.06)	(3.843)	(3.405)	(3.306)	(3.091)	(3.019)
Spatially Lagged Variables						
Firms' tax rate index‡	-3.385	-2.052	-1.741**	-0.494	-0.361	-0.134
	(9.866)	(1.496)	(0.741)	(0.372)	(0.291)	(0.194)
FTE Secondary Sector	-0.152**	-0.00267	-0.0356*	-0.0261	-0.0373**	-0.0235*
	(0.0734)	(0.0275)	(0.0199)	(0.0161)	(0.0172)	(0.0139)
Observations	340	2,884	5,232	6,600	7,428	8,316
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area. Selection bias correction (Heckman) for predicting observations with a zero in specification.

Table B 11: *Instrumental Variable — Estimates of Coefficients for Employment in Tertiary Sector with various Spatial Weights*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	*10km*	15km	20km	30km
Firms' tax rate index	4.427	-7.950**	-15.40**	-9.329**	-10.07**	-9.227**
	(10.08)	(3.349)	(6.452)	(4.204)	(4.405)	(4.439)
Income tax rate index	-10.69	13.45*	-5.124	1.059	1.668	2.476
	(10.56)	(7.528)	(18.20)	(17.48)	(15.04)	(14.16)
Spatially Lagged Variables						
Firms' tax rate index‡	3.119	5.408***	4.847***	1.970**	1.715**	1.353*
	(8.732)	(1.942)	(1.667)	(0.897)	(0.867)	(0.693)
FTE Tertiary Sector	0.907***	0.0995***	0.0679***	0.0580***	0.0492***	0.0431***
	(0.206)	(0.0360)	(0.0198)	(0.0124)	(0.0150)	(0.0124)
Observations	340	2,884	5,232	6,600	7,428	8,316
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area.

Table B 12: *OLS — Coefficient Estimates for the Extension with the Number of Firms per Municipality*

	(1)	(2)	(3)	(4)
VARIABLES	Total	Primary sector	Secondary sector	Tertiary sector
Firms' tax rate index	-2.918***	-1.150***	-0.676***	-1.092
	(1.004)	(0.107)	(0.117)	(1.027)
Income tax rate index	-18.62***	0.536**	-0.733***	-18.42***
	(3.216)	(0.244)	(0.282)	(3.173)
Wages in big area	-0.0492***	-0.00304***	-0.00745***	-0.0387***
	(0.00660)	(0.000793)	(0.00100)	(0.00675)
Cant. unemployment rate	14.62***	-2.412***	-0.911**	17.95***
	(2.516)	(0.336)	(0.378)	(2.729)
Cinemas	70.74***	2.958***	15.74***	52.04**
	(19.75)	(1.018)	(2.584)	(20.38)
Elderly people	-433.5***	53.06***	10.08	-496.7***
	(64.72)	(7.663)	(7.729)	(69.26)
Young people	-430.3***	178.2***	23.77***	-632.2***
	(56.28)	(10.03)	(7.553)	(60.69)
Population	0.0961***	0.000563***	0.00690***	0.0886***
	(0.00353)	(0.000169)	(0.000327)	(0.00396)
Foreigners	-507.0***	-13.76***	65.69***	-558.9***
	(61.24)	(3.832)	(6.423)	(67.81)
Left parties	-2.265***	-0.533***	-0.00697	-1.724***
	(0.302)	(0.0344)	(0.0311)	(0.315)
University (Dummy)	857.6**	-54.31***	7.137	904.8***
	(350.1)	(11.38)	(39.96)	(348.0)
Language (Dummy)	71.23***	-1.242	-2.447***	74.92***
	(6.500)	(0.935)	(0.863)	(7.037)
Metropolitan (Dummy)	-81.10***	-5.444***	4.470***	-80.13***
	(7.416)	(0.620)	(0.805)	(8.333)
Constant	756.9***	37.99***	70.03***	648.9***
	(54.63)	(5.283)	(6.761)	(56.42)
Observations	8,792	8,792	8,792	8,792
R-squared	0.971	0.226	0.936	0.963

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table B 13: *Instrumental Variable — Coefficient Estimates for the Extension with Firms in Primary Sector with various Spatial Weights*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	10km	15km	20km	30km
Firms' tax rate index	0.707**	0.201***	0.386***	0.442***	0.434***	0.371***
	(0.281)	(0.0650)	(0.0740)	(0.0679)	(0.0616)	(0.0521)
Income tax rate index	-0.689*	-0.555***	-0.675***	-0.650***	-0.575***	-0.452***
	(0.373)	(0.213)	(0.162)	(0.153)	(0.146)	(0.136)
Spatially Lagged Variables						
Firms' tax rate index‡	0.0573	-0.0857**	-0.110***	-0.0846***	-0.0708***	-0.0458***
	(0.330)	(0.0394)	(0.0232)	(0.0148)	(0.0108)	(0.00688)
Firms in Primary Sector	0.139	0.0378	0.0336**	0.0415***	0.0610***	0.0542***
	(0.0974)	(0.0273)	(0.0135)	(0.0108)	(0.0121)	(0.0104)
Observations	340	2,884	5,232	6,600	7,428	8,316
R-squared	0.092	0.053	0.078	0.086	0.096	0.096
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area.

Table B 14: *Instrumental Variable — Coefficient Estimates for the Extension with Firms in Secondary Sector with various Spatial Weights*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	10km	15km	20km	30km
Firms' tax rate index	1.284*	0.0175	0.0174	-0.106	-0.0865	-0.0147
	(0.672)	(0.107)	(0.111)	(0.0886)	(0.0847)	(0.0907)
Income tax rate index	-0.650	0.173	0.219	0.162	0.139	0.250
	(0.701)	(0.292)	(0.215)	(0.204)	(0.190)	(0.212)
Spatially Lagged Variables						
Firms' tax rate index‡	0.361	0.0451	0.0627*	0.0665***	0.0480***	0.0354***
	(0.627)	(0.0681)	(0.0325)	(0.0203)	(0.0155)	(0.0129)
Firms in Secondary Sector	-0.238**	0.0458	0.0254	0.0358***	0.0393***	0.0472***
	(0.103)	(0.0309)	(0.0175)	(0.0129)	(0.0105)	(0.00819)
Observations	340	2,884	5,232	6,600	7,428	8,316
R-squared	0.091	0.020	0.035	0.042	0.040	0.036
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area.

Table B 15: *Instrumental Variable — Coefficient Estimates for the Extension with Firms in Tertiary Sector with various Spatial Weights*

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2km	5km	10km	15km	20km	30km
Firms' tax rate index	7.142***	-1.365**	-2.718*	-2.353***	-2.462***	-1.947**
	(1.726)	(0.534)	(1.460)	(0.912)	(0.881)	(0.965)
Income tax rate index	-5.236**	1.556	-5.184	-4.254	-1.911	-1.295
	(2.151)	(1.472)	(6.653)	(5.344)	(4.238)	(4.083)
Spatially Lagged Variables						
Firms' tax rate index‡	1.051	1.559***	1.321***	0.773***	0.595***	0.476***
	(2.638)	(0.343)	(0.452)	(0.227)	(0.177)	(0.151)
Firms in Tertiary Sector	0.611***	0.223***	0.0578***	0.0546***	0.0605***	0.0486***
	(0.208)	(0.0321)	(0.00995)	(0.00723)	(0.0100)	(0.00828)
Observations	340	2,884	5,232	6,600	7,428	8,316
R-squared	0.310	0.191	0.040	0.028	0.034	0.034
Number of municipalities	85	721	1,308	1,650	1,857	2,079
Municipal FE	YES	YES	YES	YES	YES	YES
Cantonal FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: ‡Instrumented by the neighbor's spatially lagged cantonal tax rate index. Control variables are: cantonal unemployment, wages in big areas, cinemas, share of elderly people, share of young people, share of foreigners, Left parties, universities, language and metropolitan area.

Declaration of Independence

"I hereby declare that I have written this thesis without any help from others and without the use of documents and aids other than those stated above. I have mentioned all used sources and cited them correctly according to established academic citation rules. I am aware that otherwise the Senat according to the law is entitled to revoke the degree awarded on the basis of this thesis."

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Declaration of Publication

"I hereby declare that I agree to publish the master thesis that I have written, if the grading is 5.0 or above, in the library catalog IDS Basel Bern, in the specialized library of the Center of Competence for Public Management (KPM) as well as on the homepage of the KPM. The thesis is publicly available."

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