

Shifting of red tape?

The impact of authority behavior on tax compliance costs

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Abstract - The compliance costs of private taxpayers are not only affected by the tax law itself but also by its implementation through the tax authorities. In the following paper we analyze the effect of administrative actions on the compliance costs of private businesses. We demonstrate in a theoretical model that compliance costs may partially be interpreted as externalities of authority behavior. As a result we expect a "shifting" of administrative cost burdens from the tax administration to private taxpayers, what implies an economically inefficient outcome. Based on Belgian survey data, we find empirical evidence for the elucidated relationship. We give an quantitative estimate for the accordant effects and demonstrate, which activities of the administration are the most important cost drivers. Furthermore, we find empirical support that the effect of administrative issues is independent from the impact of the tax law itself.

Jel Classification – K29, L51, M20.

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1. Introduction

In addition to an optimal tax law, the optimal enforcement of tax regulations is an important economic issue. There is a comprehensive literature on this aspect regarding questions on the efficient budget of a tax collection agency (Slemrod and Yitzhaki 1987, McCubbin 2003, Liang and Yang 2007) or on the optimization of auditing rules (Yitzhaki and Vakneen 1989, Cremer and Gahvari 1996, Nigrini 1996, Kastlunger et al. 2009). However, the effects of authority behavior on tax complexity and the compliance costs of private businesses have not been taken into account within the theoretical and empirical literature.

As has been stated by Gale and Holtzblatt (2002), administrative issues affect substantially the burden of red tape. On the one hand, the revenue service specifies the necessary compliance actions and information requirements that have to be taken into account by private taxpayers. On the other hand, the tax administration may support private taxpayers by information material, a short processing time or advisory services. As documented by empirical evidence, the lion's share of the overall cost burden resulting from tax complexity consists of the compliance costs of private businesses (for a review see Evans 2003, and Vaillancourt and Clemens 2008). For example, Vaillancourt and Clemens (2008) estimate the compliance costs of Canadian businesses at a range from 1.2% to 1.8% of the GDP, while the administrative costs of the Canadian authorities lie in a range from 0.2% to 0.5%.

The literature identifies also considerable economies of scale regarding compliance activities that result from organisational specialisation, the cost degression and technological improvements (Sandford et al. 1989, Allers 1994, Evans 2003). From this perspective, the support especially of small businesses by administrative bodies could result in a decrease of the cost burden for the economy as a whole. Hence, a "customer-oriented" approach of tax administration could have a share in improving the productivity of the overall tax system (Barton 2001).

In our paper, we analyze the relationship of the tax collection agency and private taxpayers from a compliance cost perspective. As the payment of taxes reduces the economic resources of private households and businesses, there is a need to control for the compliance with the tax law. Typical instruments of the tax authorities are tax audits and information requirements that reduce the information asymmetry between both parties of the tax evasion "game".

However, the use of these instruments affects not only the resources of the authorities but also cost burden of private taxpayers. Tax audits are time-consuming and information requirements increase the cost burden resulting from record-keeping. If the administrative authorities do not take into account this taxpayer part of overall cost burden, we expect a "shifting" of red tape from the tax administration to private taxpayers. We demonstrate in a simple theoretical framework that these externalities of tax authority behavior could yield to an economically inefficient outcome.

Using survey data of private businesses in Belgium, we find empirical support for the expected correlation of authority behavior and compliance costs. Based on information about administrative quality, we also give a quantitative estimate of the effects on the compliance cost burden. Furthermore, we find empirical support for the hypothesis that the impact of these administrative issues is independent from the effect of the tax law itself. Our research implies that an enhancement of taxpayer services could have a share in reducing the transaction costs of the overall tax system. As well, an internalization of tax compliance costs in the decision-making of administrative bodies should promote economic efficiency.

The paper is organized as follows. In section 2 we analyze the relationship between the tax administration and the taxpayer in a simple microeconomic framework. We demonstrate that tax compliance costs can be partially interpreted as externalities of administrative decision-making. Section 3 investigates the correlation of authority behavior and compliance costs in an empirical setting. The analysis is based on data raised by the Federal Planning Bureau. Section 4 concludes the paper.

2. Authority behavior and tax compliance costs

2.1. Taxpayer

Since the analysis of Allingham and Sandmo (1972) the compliance decision of a taxpayer is typically analyzed as a maximization of the expected utility resulting from post-tax income (for a review see Andreoni et al. 1998, Slemrod and Yitzhaki 2002, and Sandmo 2005). The taxpayer has the opportunity to decide which amount E of his gross income Y is evaded.¹ For simplicity we assume a linear tax function T .

In addition to the tax payment, the taxpayer is also burdened by compliance costs C_i . Due to economies of scale, this additional part of the tax burden increases on a diminishing scale in the turnover or employee number of a business (Sandford et al. 1989, Hudson and Godwin 2000, Evans 2003). Hence, we expect a regressive effect of income Y on the compliance costs C_i ($\partial C_i / \partial Y > 0$, $\partial^2 C_i / \partial Y^2 < 0$). The literature implies further that the bigger part of the cost burden results from bookkeeping and documentation activities (Blumenthal and Slemrod 1992, Slemrod and Venkatesh 2002, DeLuca et al. 2005). Therefore, we assume the compliance burden increasing in the amount of information requirements I that are defined by the tax administration.

By contrast, the effect of tax evasion on the compliance cost burden is not straightforward (Slemrod 1989, Hasseldine 2001). On the one hand, tax evasion may be connected with hiding costs increasing the cost burden C_i . On the other hand, noncompliance and especially non-filing could result in a reduction of red tape as the information requirements are not taken into account. In accordance to that argument, Erard and Ho (2003) find a negative correlation of estimated compliance costs and tax evasion. By assumption, tax compliance costs are fully deductible from the tax base.² If there is no audit, the disposable income X_n of a representative taxpayer is characterised as

$$X_n = Y - T(Y - C_i - E) - C_i(Y, I, E). \quad (1)$$

The taxpayer is audited with a detection probability p .³

¹ In a broader sense, our setting could also include tax planning actions. It has to be taken into account that not each planning activity will be accepted in case of a tax audit. A correction of tax returns in the past results generally in interest payments and administrative cost burdens that can be interpreted as a penalty for the taxpayer. Therefore, it would be also possible to consider in our model the sum of evasion and avoidance activities that are not accepted by the authorities. Seldon (1979) denominates this sum as tax avoision.

² That holds at least for business expenses like payments for tax advisers or wages for the accounting personnel. Even in case of the time burden of a self-employed entrepreneur, one may argue that the opportunity cost is the net income for additional working effort (Tran-Nam et al. 2000). This implies an implicit deductibility of these cost elements.

³ For simplicity, we expect that the taxpayers' subjective audit probability p^* is equal to the true detection probability. This is not a necessary condition. The inclusion of a subjective probability p would not yield to different implications of the model regarding our question of research.

In case of an audit a noncompliant taxpayer has to pay a penalty θ depending on the amount of evaded income E and the tax rate T' . Hence, the taxpayer receives the net income X_a

$$X_a = Y - T(Y - C_t + \theta(E)) - C_t(Y, I, E). \quad (2)$$

The taxpayer optimizes its expected utility EU

$$EU = p \cdot U(X_a) + (1-p) \cdot U(X_n). \quad (3)$$

The first order condition for the evasion decision is described by

$$\frac{\partial EU}{\partial E} = p \cdot U'_a \cdot \left(-\theta' \cdot T' - \frac{\partial C_t}{\partial E} \cdot (1-T') \right) + (1-p) \cdot U'_n \cdot \left(T' - \frac{\partial C_t}{\partial E} \cdot (1-T') \right) = 0. \quad (4)$$

According to condition 4, the choice of E depends on the degree of risk aversion, the tax rate T' , the detection probability p , the marginal effect on compliance costs C_t and the marginal penalty for evaded income. In case of an audit, there is a negative marginal income $-\theta' \cdot T' - \frac{\partial C_t}{\partial E} \cdot (1-T')$. Hence, $T' - \frac{\partial C_t}{\partial E} \cdot (1-T')$ must be positive. The second order condition has the following form:

$$\begin{aligned} \frac{\partial^2 EU}{\partial E^2} &= p \cdot U''_a \cdot \left(-\theta' \cdot T' - \frac{\partial C_t}{\partial E} \cdot (1-T') \right)^2 + (1-p) \cdot U''_n \cdot \left(T' - \frac{\partial C_t}{\partial E} \cdot (1-T') \right)^2 \\ &\quad - p \cdot U'_a \cdot \left(\theta'' \cdot T' + \frac{\partial^2 C_t}{\partial E^2} \cdot (1-T') \right) - (1-p) \cdot U'_n \cdot \frac{\partial^2 C_t}{\partial E^2} \cdot (1-T') < 0 \end{aligned} \quad (5)$$

2.2. Tax administration

The tax administration controls private taxpayers to reduce the expected level of tax evasion. We assume a fixed budget B of the revenue service for this target (for the optimal budget see Slemrod and Yitzhaki 1987, McCubbin 2003, and Liang and Yang 2007). In our setting the tax collection agency has two opportunities to spend its resources. It may enhance its audit strategy A (Yitzhaki and Vakneen 1989, and Cremer and Gahvari 1996) to improve the chance of detecting a tax evader. As an alternative, it could increase the information requirements I to reduce the information asymmetry in relation to private taxpayers. Evidently, the collection of taxpayer data is a necessary precondition for audit selection processes that have been analyzed by Alm et al. (1993) and Nigrini (1996).

Both actions result in administrative costs for the revenue service C_a . We expect that the effectiveness of tax audits and information requirements decreases in the amount of resources allocated to these instruments $\left(\frac{\partial C_a}{\partial A} > 0, \frac{\partial C_a}{\partial I} > 0, \frac{\partial^2 C_a}{\partial A^2} > 0, \frac{\partial^2 C_a}{\partial I^2} > 0 \right)$. We assume further a posi-

tive effect of the information requirements on the taxpayers' compliance costs.⁴ As the effectiveness of both instruments is taken into account by the cost function C_a , we assume for simplicity that the detection probability is a linear function of $A + I$.

According to the public administration literature (Khademian 1995, Waterman and Meier 1998), public authorities typically concentrate on their mission that is defined by the legislator. Therefore, it is appropriate to anticipate that the tax authorities' target lies in the minimization of non-compliance as well as in the maximization of the tax payment. The expected value of an average payment (including penalties for tax evasion) can be described by

$$EV = p \cdot T(Y - C_t^* + \theta^*) + (1 - p) \cdot T(Y - C_t^* - E^*) \quad (6)$$

E^* , C_t^* and θ^* denote the optimal level of evasion, compliance costs and penalties from a taxpayers' perspective. Including the administrative costs of the tax authorities with the shadow price λ , we obtain the Langrangian function

$$L = EV - \lambda \cdot (C_a(I, A) - B). \quad (7)$$

The following first order conditions can be derived for information requirements I and audit strategies A

$$\frac{\partial L}{\partial A} = p' \cdot (T_a - T_n) - \lambda \cdot \frac{\partial C_a}{\partial A} = 0, \quad (8)$$

$$\frac{\partial L}{\partial I} = p' \cdot (T_a - T_n) - T' \cdot \frac{\partial C_t^*}{\partial I} - \lambda \cdot \frac{\partial C_a}{\partial I} = 0. \quad (9)$$

T_a denotes the tax payment for the detection case, while T_n describes the tax payment in case of no audit. In the optimum the marginal expected revenue from controlling actions $p' \cdot (T_a - T_n)$ corresponds to the marginal administrative costs plus the expected decrease in tax revenue due to an increase in tax compliance costs $T' \cdot \frac{\partial C_t^*}{\partial I}$. Equalling 8 and 9, we can derive a decision rule

R for the choice between A and I

$$R = \left(\frac{\partial C_a}{\partial A} - \frac{\partial C_a}{\partial I} \right) \cdot \lambda - T' \cdot \frac{\partial C_t^*}{\partial I} = \frac{\partial C_a}{\partial A} - \frac{\partial C_a}{\partial I} - \frac{T' \cdot \frac{\partial C_t^*}{\partial I}}{\lambda} = 0. \quad (10)$$

⁴ Increasing information requirements imply a more sophisticated documentation. By contrast, the effect of an enhanced audit strategy on compliance costs is not straightforward. Taking into account that audits are costly, the compliance costs should increase in the number of tax audits. However, an enhancement of the audit strategy not necessarily implies a higher audit number. Furthermore and in contrast to documentation costs, auditing costs represent only a minor part of the overall compliance cost burden (Slemrod and Venkatesh 2002, DeLuca et al. 2005). Therefore, we neglect a potential correlation of compliance costs and audit strategy for simplicity.

In the optimum, the marginal costs of an enhancement of the audit strategy $\frac{\partial C_a}{\partial A}$ are equal to the marginal administrative costs for information requirements $\frac{\partial C_a}{\partial I}$ plus the reduction of taxes due to an increase in taxpayers' compliance costs C_t^* weighted with the Lagrange multiplier λ . According to this criterion, tax authorities only partially account compliance costs resulting from their actions. From this perspective, the residual compliance costs $\frac{\partial C_t^*}{\partial I} \cdot (1 - T')$ can be interpreted as externalities of tax authority behavior.

Due to the neglect of a considerable part of the cost burden resulting from authority behavior, an economically inefficient outcome can be expected. This argument is reinforced by the fact that the tax administration has a limited ability in observing cost burdens of private taxpayers. According to empirical evidence (Hudson and Godwin 2000, Slemrod and Venkatesh 2002, Klun and Blažić 2005) the lion's share of the costs of red tape consists of personnel costs and material expenses that are not itemized within the tax statements and are therefore "invincible" for the revenue service.

2.3. Economic inefficiency

The economic inefficiency of the externalities exemplified in 2.2. can be demonstrated if we compare this outcome with a tax agency maximizing a social welfare function instead of minimizing tax evasion (Slemrod and Yitzhaki 1987, and McCubbin 2003). Except from the public good G , the expected utility of the representative household can be described by

$$EU = p \cdot U(Y - T(Y - C_t^* + \theta^*) - C_t^*(Y, I, E^*)) + (1 - p) \cdot U(Y - T(Y - C_t^* - E^*) - C_t^*(Y, I, E^*)) \quad (11)$$

The expected tax revenue has to be sufficient to finance the public good G plus the administrative costs C_a . Taking into account this budget constraint ($G + C_a = EV$), we obtain a Lagrangian function with the shadow price ω

$$L = EU + \omega \cdot (p \cdot T_a + (1 - p) \cdot T_n - G - C_a) \quad (12)$$

The first order conditions for A and I are defined as

$$\frac{\partial L}{\partial A} = p' \cdot (U_a - U_n) + \omega \cdot \left(p' \cdot (T_a - T_n) - \frac{\partial C_a}{\partial A} \right) = 0 \quad (13)$$

and

$$\begin{aligned} \frac{\partial L}{\partial I} = & p' \cdot (U_a - U_n) - p \cdot U_a' \cdot \frac{\partial C_t^*}{\partial I} \cdot (1 - T') - (1 - p) \cdot U_n' \cdot \frac{\partial C_t^*}{\partial I} \cdot (1 - T') \\ & + \omega \cdot \left(p' \cdot (T_a - T_n) - T' \cdot \frac{\partial C_t^*}{\partial I} - \frac{\partial C_a}{\partial I} \right) = 0. \end{aligned} \quad (14)$$

Equalling both conditions results in

$$\frac{\partial C_a}{\partial A} = \frac{\partial C_a}{\partial I} + T' \cdot \frac{\partial C_t^*}{\partial I} + \frac{p \cdot U_a' \cdot \frac{\partial C_t^*}{\partial I} \cdot (1-T') + (1-p) \cdot U_n' \cdot \frac{\partial C_t^*}{\partial I} \cdot (1-T')}{\omega}. \quad (15)$$

The main difference to condition 10 lies in the acknowledgment of the full amount of compliance costs that is weighted by the shadow price ω and the marginal effects on the utility function. Furthermore, the marginal effect of information requirements on compliance costs $T' \cdot \frac{\partial C_t^*}{\partial I}$ is not weighted with a Lagrange multiplier. Therefore, a tax agency optimizing social welfare gives an identical weight to administrative costs and the loss of tax revenue. Furthermore, it also accounts for compliance costs burdening private taxpayers.

A tax collection agency neglecting the overall cost burden has an incentive to “shift” administrative activities to the private sector. As documented by 10 and 15, this implies an inefficiently high amount of resources allocated to information requirements and record-keeping activities, while the investments in audit strategies are comparatively low. This conclusion is in line with the high proportion of documentation costs to total compliance costs.

It is an important question what factors have a significant influence on the exemplified inefficiency of authority behavior. The effect of a change of one of the model variables on the relative attractiveness of A compared to I can be demonstrated by the partial derivatives of the decision rule R representing the choice between A and I .⁵ A positive derivative of R implies that there is an increase in the marginal costs of A compared to I . In this case, we would expect a relative decrease of resources allocated to A . A negative derivative of R has an opposite effect.

Taking into account that the shadow price λ represents the scarcity of the administrative resources, we interpret it as a negative function of the budget B . A higher budget of an agency generally implies a lower opportunity cost of the administrative resources. Therefore, we expect a negative effect of B on the shadow price $\left(\frac{\partial \lambda}{\partial B} < 0\right)$. With regards to the authorities' budget B

we obtain in this case

$$\frac{\partial R}{\partial B} = \frac{\partial \lambda}{\partial B} \cdot \left(\frac{\partial C_a}{\partial A} - \frac{\partial C_a}{\partial I} \right). \quad (16)$$

From 10 follows that $\frac{\partial C_a}{\partial A}$ in the optimum exceeds $\frac{\partial C_a}{\partial I}$. Under these conditions, a higher budget B results in a negative derivative of R , thus increasing the relative attractiveness of A . By contrast, a low budget implies a higher “shifting of red tape” from the authorities to private

⁵ However, these derivatives do not allow for a conclusion on the absolute effect of an exogenous shock on A and I . The absolute effect depends not only on the relative attractiveness of both instruments but also on the overall effectiveness of auditing and information requirements as well as on the question if A and I are substitutes or complements. A more detailed analysis including the comparative statics results is included within the appendix. Due to the interdependency of A and I , we find ambiguous results in this setting.

taxpayers. The motivation for this behavior lies in the limitation of administrative resources. If the budget of the revenue service is not sufficient to facilitate an effective audit strategy, the agency “shifts” administrative obligations to private taxpayers to ensure at least a minimum compliance level with the tax law. From this perspective, an insufficient budget of fiscal authorities could result in economic inefficiency.

The following derivative documents the effect of the expected evasion E^* on R

$$\frac{\partial R}{\partial E^*} = -T' \cdot \frac{\partial^2 C_t^*}{\partial I \cdot \partial E^*}. \quad (17)$$

The impact of E^* depends on its effect on $\frac{\partial C_t^*}{\partial I}$. If the combination of I and E^* increases compliance costs, this results in a higher attractiveness of A that has in our setting no significant effect on the compliance cost burden. Otherwise, we find an opposite effect. However, due to the ambiguity of $\frac{\partial^2 C_t^*}{\partial I \cdot \partial E^*}$ it remains unclear if the degree of evasion increases or reduces the expected “shifting of red tape” to private businesses even if we ignore the possible interdependencies between the choice of A and I .

By contrast, there is no direct effect of an exogenous shock of audit probability on the choice between A and I . This result of condition 18 is especially driven by our assumption that p is a linear function of $A + I$.

$$\frac{\partial R}{\partial p} = 0. \quad (18)$$

An exogenous increase in compliance costs (documented by a cost parameter γ with $C_t^* = \gamma \cdot \bar{C}_t^*$) as well as higher tax rates ceteris paribus raise the attractiveness of A in relation to I and, therefore, reduce the incentive for a “shifting of red tape”. This is documented by

$$\frac{\partial R}{\partial \gamma} = -T' \cdot \frac{\partial \bar{C}_t^*}{\partial I} \quad (19)$$

and

$$\frac{\partial R}{\partial T'} = -\frac{\partial C_t^*}{\partial I}. \quad (20)$$

Due to the fact that higher tax payments or compliance costs increase the negative effect of information requirements on the tax revenue, they reduce the incentive for the administrative authorities to “shift” tax obligations to the private sector. As has been outlined above, the relative effects on the choice between A and I do not allow for a conclusion regarding the absolute effects on these instruments.⁶ For example, a higher tax rate could generally increase the incen-

⁶ See the comparative statics results within the appendix.

tive to control private taxpayers resulting in higher absolute values for A and I . Nevertheless, a higher tax rate would also increase the attractiveness of A in relation to I .

3. Empirical analysis

In the following section, we present an empirical analysis of tax compliance cost data. We document and quantify the expected effects of authority behavior on tax compliance costs. Furthermore, we demonstrate that the impact of administrative issues is not identical to the effect of the tax legislation on the compliance cost burden.

3.1. Data base

We use survey data of Belgian businesses raised by the Federal Planning Bureau. Our data source contains information on the personnel costs and the external costs resulting from bureaucratic obligations of taxation.⁷ The cost measurement is similar to OECD (2001). The data consists of four cross-sections regarding the years 2000, 2002, 2004 and 2006. Due to the fact that our data source is not a panel, most of the records are one-shot observations. Each survey contains two separated samples for enterprises in the legal form of a corporation and independent businesses (for further information see De Vil and Kegels 2002, Joos and Kegels 2004, Janssen et al. 2006, and Kegels 2008).

In addition to the cost burden the data includes "demographic" information on business size (turnover, number of employees), industry and region, ratings on the Belgian tax policy and ratings on the quality and customer care of the Belgian revenue service. For specific years, there is also information regarding business age, the number of establishments in Belgium, the legal form, the use of different information technology tools for tax purposes and proposals to simplify the overall tax system.

The following table documents the mean and the median (in parentheses) compliance cost burdens of sampled Belgian businesses in euro. The table contains separate values for independent businesses (IND) as well as for small (SE), medium (ME) and big enterprises (BE). According to the size criteria of the European Union,⁸ we define enterprises with less than 50 (between 50 and 249) employees as small (medium). The case number is also considered [in parentheses].

⁷ Employment taxes and social insurance contributions are not included. They are part of additional statistical material of the Federal Planning Bureau about the compliance costs of labour legislation.

⁸ See the recommendation of the European Communities K (2003) 1422 from the 6th of May 2003.

Table 1: Absolute cost burdens

Survey	IND	SE	ME	BE
2000	4,550 (2,975) [117]	40,110 (10,055) [87]	66,738 (17,105) [12]	201,506 (87,382) [32]
2002	11,044 (2,856) [174]	171,232 (14,310) [106]	85,681 (39,000) [23]	145,108 (62,250) [40]
2004	8,054 (3,240) [142]	74,490 (12,060) [77]	36,004 (25,020) [32]	304,529 (62,400) [61]
2006	2,400 (1,250) [113]	30,801 (10,000) [72]	39,024 (14,563) [20]	74,009 (30,750) [47]

According to table 1, the cost burden increases in business size. Like documented by the case numbers, the lion's share of our data base consists of small businesses. The differences between median and mean values are remarkable. This results from the variance in business size as well as from considerable economies of scale that are documented by the relative cost burdens in table 2 (in % of the turnover).

Table 2: Relative cost burdens

Survey	IND	SE	ME	BE
2000	14.29 (5.83) [109]	10.19 (0.96) [80]	0.65 (0.17) [12]	9.98 (0.04) [32]
2002	221.03 (4.77) [158]	4.15 (0.80) [99]	0.33 (0.13) [23]	0.11 (0.04) [37]
2004	301.12 (4.64) [130]	17.90 (0.80) [74]	4.54 (0.22) [31]	2.99 (0.09) [60]
2006	11.03 (3.04) [100]	77.05 (0.66) [67]	0.13 (0.10) [20]	0.10 (0.03) [47]

According to literature, we find evidence for economies of scale. The cost ratios are significantly higher for independents and small businesses compared to the bigger size classes. Nevertheless, we also find high differences of cost ratios between mean and median values. That holds especially for independents in 2002 and 2004, small enterprises in 2006, medium enterprises in 2004 and big enterprises in 2000. The main reason for this outcome lies in the fact that a very low turnover results in a proportion of compliance costs to turnover converging to infinity. For example, the independents survey 2002 contains cases with a turnover of less than 10 euro and very high cost ratios. Nevertheless, the differences between mean and median values suggest also that an analysis for outliers is an appropriate measure.

3.2. Hypotheses and estimation strategy

Our data base contains ratings on a number of administrative actions. We interpret these ratings as a proxy for authority behavior. Therefore, we expect that a positive rating is connected with a reduction of compliance costs, while a negative rating indicates a customer-unfriendly behavior like "shifting of red tape" from the administrative authorities to private businesses.

The data set includes seven questions on administrative quality. Question 1 (Q1A) asks for the simplicity of finding the right agency (AGENCY). Q2A is about the difficulty in contacting competent service personnel (PERSONNEL). Q3A issues precise answers of the authorities (ANSWER). Q4A addresses the aspect if administrative decisions are clearly motivated (MOTIVATION). Q5A asks for the time delay for a requested answer (DELAY). Q6A relates to

contradictions between the answers of different administrative staff members (CONTRADICTION), while Q7A broaches the subject if businesses obtain the required information (INFORMATION). The answers are given on a 5-point Likert scale. The following table contains the absolute (the relative in %) frequencies of the corresponding answers. 1 is a positive and 5 is a negative rating. Businesses without a specific opinion are considered by a value of 3.⁹

Table 3: Ratings for tax administration

Survey	1	2	3	4	5	Total
AGENCY	108 (6.99)	581 (37.58)	95 (6.14)	487 (31.50)	275 (17.79)	1,546
PERSONNEL	89 (5.79)	535 (34.81)	109 (7.09)	517 (33.64)	287 (18.67)	1,537
ANSWER	72 (4.67)	629 (40.79)	144 (9.34)	487 (31.58)	210 (13.62)	1,542
MOTIVATION	61 (3.96)	514 (33.40)	192 (12.48)	563 (36.58)	209 (13.58)	1,539
DELAY	96 (6.25)	709 (46.13)	173 (11.26)	356 (23.16)	203 (13.21)	1,537
CONTRADICTION	49 (3.20)	416 (27.17)	351 (22.93)	491 (32.07)	224 (14.63)	1,531
INFORMATION	59 (3.84)	725 (47.20)	194 (12.63)	426 (27.73)	132 (8.59)	1,536

We find a considerable variance in the distribution of ratings. For example only about 30 % of the requested businesses did give a positive rating regarding possible contradictions in the statements of administrative staff members (CONTRADICTION). By contrast, most of the requested businesses were altogether convinced to receive the required information (INFORMATION).

A problem in estimating the effect of authority behavior on administrative cost burdens lies in a potential endogeneity of the rating variable. A correlation could not only result from the authority behavior itself but also from the dissatisfaction of the taxpayer with the tax legislation or the compliance burden or the tax system. According to this argument, taxpayers with high compliance costs could "punish" the tax administration by negative ratings. On the other hand, it has to be expected that negative and positive are significantly affected by the experiences of taxpayers with the administrative authorities. Therefore, if the ratings are reliable they should be a good proxy for authority behavior from a taxpayers' perspective.

The data source contains not only ratings on administrative issues but also on tax law quality. This information can be used as a control parameter for the reliability of the ratings regarding authority behavior. If the ratings of private businesses result mainly from a single factor like the compliance cost burden (endogeneity of the value judgment), we would expect a high degree of collinearity of all rating variables. Hence, the taxpayer would punish or reward the authorities as well as the legislator with a generally positive or negative rating that results especially from the compliance cost burden and not vice versa. In this case, we would expect that taxpayers with high compliance costs give a negative rating for legislative as well as for administrative issues. Regarding taxpayers with low compliance costs we should find an opposite effect.

⁹ In the original questionnaire a rating of 5 was allocated to businesses without a specific opinion. In our paper we allocated a rating of 3 for readability reasons.

The data set contains seven questions regarding tax legislation. Q1L broaches the subject if businesses are informed in advance about new tax regulations (ADVANCE). Q2L asks for the understandability of the tax law (UNDERSTANDABLE) and Q3L for clear objectives of tax legislation (OBJECTIVE). Q4L addresses the issue if tax regulations are sufficiently adapted to business situations (ADAPTION). Q5L asks for information in sufficient time to comply with the tax law (TIME). Q6L issues the coherency of the tax legislation (COHERENCY), while Q7L addresses the corresponding information material of the legislator (MATERIAL). The following table contains the absolute (the relative in %) frequencies for these questions:

Table 4: Ratings for tax legislation

Survey	1	2	3	4	5	Total
ADVANCE	133 (8.74)	447 (29.37)	191 (12.55)	422 (27.73)	329 (21.62)	1,522
UNDERSTANDABLE	39 (2.54)	328 (21.33)	87 (5.66)	639 (41.55)	445 (28.93)	1,538
OBJECTIVE	73 (4.79)	428 (28.07)	130 (8.52)	597 (37.97)	315 (20.66)	1,525
ADAPTION	35 (2.30)	299 (19.61)	184 (12.07)	612 (40.13)	395 (25.90)	1,525
TIME	112 (7.28)	604 (39.25)	115 (7.47)	432 (28.07)	276 (17.93)	1,539
COHERENCY	42 (2.74)	307 (20.03)	244 (15.92)	587 (38.29)	353 (23.03)	1,533
MATERIAL	45 (2.93)	417 (27.18)	153 (9.97)	589 (38.40)	330 (21.51)	1,534

The frequencies do not seem to support the hypothesis of a strong correlation between administrative and legislative ratings. On average, the requested businesses have a lower rating for tax legislation compared to the tax administration. Furthermore, there are also remarkable differences regarding the distribution of the legislative ratings (for example TIME and UNDERSTANDABLE). The following table documents the correlations of the legislative and administrative rating variables.

Table 5: Rating correlations

Survey	Q1L	Q2L	Q3L	Q4L	Q5L	Q6L	Q7L	Q1A	Q2A	Q3A	Q4A	Q5A	Q6A	Q7A
Q1L	1.000	0.434	0.356	0.372	0.396	0.349	0.394	0.295	0.252	0.291	0.329	0.257	0.301	0.308
Q2L		1.000	0.610	0.540	0.467	0.472	0.566	0.417	0.353	0.376	0.339	0.304	0.231	0.336
Q3L			1.000	0.555	0.425	0.504	0.503	0.333	0.305	0.345	0.347	0.299	0.258	0.358
Q4L				1.000	0.452	0.604	0.556	0.310	0.282	0.359	0.375	0.326	0.316	0.393
Q5L					1.000	0.424	0.550	0.317	0.287	0.374	0.351	0.328	0.200	0.345
Q6L						1.000	0.592	0.288	0.280	0.365	0.405	0.334	0.344	0.386
Q7L							1.000	0.358	0.328	0.366	0.413	0.330	0.302	0.391
Q1A								1.000	0.692	0.532	0.426	0.446	0.322	0.489
Q2A									1.000	0.566	0.447	0.476	0.301	0.490
Q3A										1.000	0.573	0.546	0.398	0.624
Q4A											1.000	0.546	0.414	0.554
Q5A												1.000	0.451	0.596
Q6A													1.000	0.470
Q7A														1.000

Evidently, the coefficients are considerably higher for correlations within administrative or legislative ratings. For example, the coefficients of Q1L for correlations with other legislative rat-

ings lie in a range from 0.349 to 0.434, while the range for correlations with administrative ratings is about 10 percentage points lower (from 0.257 to 0.329). Furthermore, we find also a considerable variance of the correlation coefficients. While there is a very strong correlation between Q1A and Q2A (AGENCY and PERSONNEL), the coefficient for the connection between Q1A and Q1L (ADVANCE) is relatively low.

The observed diversity and interdependency of rating behavior does not support the hypothesis that the ratings are mainly driven by a single factor. Hence, the empirical support for a strong effect of tax compliance costs on the overall rating behavior is relatively weak. Furthermore, we find also that ratings for similar issues (like AGENCY and PERSONNEL) are strongly correlated to each other compared to ratings for separate aspects (like ADVANCE and AGENCY). As an exogenous event should affect ratings for related aspects in a similar direction, this can be interpreted as an empirical support for a rating behavior that is mainly driven by exogenous factors like the experiences of the taxpayer.

Corresponding to the literature (Hudson and Godwin 2000), we use an OLS model for our econometric analysis. Taking into account that most cases are one-shot observations, we would lose the greater part of the overall information if we choose a panel estimation method. Including the control parameters that are available for each year we receive:

$$CCOST = \alpha_0 + \alpha_1 \cdot SIZE + \alpha_2 \cdot SURVEY + \alpha_3 \cdot INDUSTRY + \alpha_4 \cdot YEAR + \alpha_5 \cdot ADVICE + \alpha_6 \cdot ADMINISTRATION + \alpha_7 \cdot LEGISLATION + \varepsilon \quad (21)$$

The variables are defined as follows:

CCOST	Logarithm of compliance costs: the compliance costs are defined as sum of personnel costs and external costs. Amounts in Belgian francs are converted into euro. Inflation effects are controlled by the year dummies.
SIZE	Businesses in the independent survey do not have employees. For that reason, we deploy the logarithm of turnover as size measure.
SURVEY	The dummy variable controls for the requested group of the survey. It takes a value of 1 (0) for an independent (enterprise) survey.
INDUSTRY	Set of dummy variables: within the enterprises survey, we control only for industrial businesses (EINDUSTRIAL). Regarding independents, we control in addition to IINDUSTRIAL for the primary sector (IPRIMARY) and construction (ICONSTRUCT). The other independents are active in the services sector.
YEAR	Set of dummy variables: we consider dummies for 2002, 2004 and 2006 to control for time series effects.

ADVICE Variables measuring the use of external advice: we utilize the logarithm of the fraction of external costs to total compliance costs increased by 1%¹⁰ (OUTSOURCING) as well as a dummy variable for businesses without external advice (INHOUSE).

ADMINISTRATION Set of rating variables for administrative issues.

LEGISLATION Set of rating variables for legislative issues.

As our data set contains Likert scale values, it is appropriate to consider the rating behavior by dummy variables. However, taking into account all questions on administrative and legislative issues would result in 56 dummy variables within one equation. Hence, the regression would be biased by multicollinearity. Therefore, we initially analyze the effect of the dummy variables in a "stepwise" approach taking into account only one rating question in each specification. For each question, we analyze the effects of a very positive, a positive, a negative and a very negative rating on the compliance cost burden.

As documented by table 1 and table 2, the data set contains a number of outliers that could bias our regression results. Therefore, we initially exclude these cases from the data set. We use two standard deviations of a simplified regression including only business size, survey and survey year as outlier criterion. Hence, we exclude all cases with considerably high or low compliance cost values compared to business size, year and survey effects. According to this criterion, 60 cases were identified as outliers.

$$CCOST = \alpha_0 + \alpha_1 \cdot SIZE + \alpha_2 \cdot SURVEY + \alpha_3 \cdot YEAR + \varepsilon \quad (22)$$

As documented by Hudson and Godwin (2000) and Eichfelder and Schorn (2009), heteroscedasticity is a problem regarding the estimation of tax compliance costs. For that reason, we use robust standard errors for our econometric analysis.

3.3. Results

Excluding all rating variables, we obtain the following regression results ($R^2 = 0.6554$, 1,013 cases), where ***, ** and * indicate a significant result on a 1%, 5% and 10% level:

¹⁰ We add 0.01 to prevent undefined logarithmic values.

Table 6: Basic model excluding rating behavior

Variable	Coefficient	STD DEV
Constant	5.163***	0.277
SIZE	0.286***	0.018
SURVEY	-0.293**	0.115
2002	0.076	0.083
2004	0.095	0.088
2006	-0.439***	0.104
EINDUSTRIAL	0.116	0.095
IINDUSTRIAL	0.267	0.211
IPRIMARY	-0.888***	0.101
ICONSTRUCTION	-0.044	0.099
WALLONIA	-0.141*	0.075
BRUSSELS	0.078	0.097
OUTSOURCING	-0.288***	0.050
INHOUSE	-1.795***	0.220

In accordance to the literature (Hudson and Godwin 2000), we find a regressive impact of tax compliance costs. The high constant implies fixed cost elements. The correlation coefficient of SIZE being smaller than one indicates that a growth of turnover by 1% results in an increase in compliance costs by only 0.286%. We also find evidence for higher compliance costs of the enterprises survey. This should be due to the legal form, as respondents in the enterprises survey are corporations.

In terms of the survey years, we find no clear evidence for a positive or a negative cost trend. In spite of that the compliance cost burden in 2006 seems to be significantly smaller than in 2000, 2002 and 2004. The main reason for this result should be a different phrasing of the questionnaire in 2006. Regarding the industry, we find evidence for lower compliance costs in the primary sector (regularly farmers). Furthermore, there is empirical support for lower costs in the Wallonian part of Belgium as well as a connection of tax-related cost burdens and the use of external resources (for a more detailed analysis of that aspect see Eichfelder and Schorn 2009).

Integrating dummy variables for each question on administrative quality in a "stepwise" approach yields to the following correlation coefficients (robust standard errors in parentheses):

Table 7: Results on administrative ratings

Variable	Very positive		Positive		Negative		Very negative	
AGENCY	0.137	(0.179)	0.133	(0.142)	0.156	(0.146)	0.263*	(0.152)
PERSONNEL	0.185	(0.178)	0.220*	(0.129)	0.185	(0.130)	0.409***	(0.141)
ANSWER	-0.115	(0.162)	0.131	(0.109)	0.232**	(0.113)	0.367***	(0.129)
MOTIVATION	-0.205	(0.187)	0.158	(0.110)	0.202*	(0.110)	0.381***	(0.124)
DELAY	0.001	(0.145)	0.060	(0.114)	0.282**	(0.121)	0.257*	(0.133)
CONTRADICTION	0.082	(0.200)	0.093	(0.087)	0.101	(0.087)	0.237**	(0.100)
INFORMATION	0.094	(0.176)	0.115	(0.100)	0.359***	(0.107)	0.584***	(0.136)

First of all, we can state a positive impact of negative ratings on the compliance cost burden, while there is in general no significant effect of positive ratings. Hence, taxpayers with a positive rating on average do not have a significantly lower cost burden as respondents who did not give a rating of authority behavior. From this perspective, authority behavior is especially an issue if it results in problems for private taxpayers (negative ratings). Corresponding problems could result from mistakes of the administration or from "shifting" of administrative cost burdens to private taxpayers.

In contrast, a high degree of contentment (for example due to a very friendly administration) does not necessarily reduce the costs of red tape. Furthermore, the effect of authority behavior depends on the considered aspect. While we find only a barely significant effect of problems to find the right agency (AGENCY), there is a strong and positive correlation of compliance costs and businesses who did not obtain the required information (INFORMATION).

Taking into account the results above, it seems appropriate to exclude positive ratings for further analysis. To restrict the number of variables, we also use only one rating variable for each question. Therefore, negative and very negative ratings are consolidated in one dummy. Including also negative rating variables on legislative issues, we receive as our final estimate ($R^2 = 0.6674$, 937 cases):

Table 8: Results of the extended model

Variable	Coefficient	STD DEV	VIF
AGENCY	-0.062	0.076	1.49
PERSONNEL	-0.086	0.078	1.63
ANSWER	-0.032	0.079	1.66
MOTIVATION	-0.023	0.078	1.46
DELAY	0.144*	0.074	1.32
CONTRADICTION	-0.060	0.073	1.31
INFORMATION	0.229***	0.086	1.71
ADVANCE	0.013	0.069	1.25
UNDERSTANDABLE	0.143*	0.081	1.56
OBJECTIVE	-0.043	0.077	1.40
ADAPTION	0.001	0.081	1.47
TIME	0.137*	0.074	1.33
COHERENCY	0.154*	0.083	1.55
MATERIAL	0.067	0.075	1.57
SIZE	0.279***	0.019	2.63
SURVEY	-0.340***	0.120	3.42
2002	0.130	0.084	1.67
2004	0.153*	0.093	1.65
2006	-0.321***	0.108	2.08
EINDUSTRIAL	0.161	0.099	1.51
IINDUSTRIAL	0.316	0.238	1.09
IPRIMARY	-0.834***	0.103	1.56
ICONSTRUCTION	0.036	0.101	1.42
OUTSOURCING	-0.270***	0.052	3.42
INHOUSE	-1.710***	0.228	3.47
WALLONIE	-0.149**	0.080	1.14
BRUSSELS	0.060**	0.098	1.57
Constant	4.920***	0.295	-

Also in the extended model, we find a significant and positive effect of negative ratings of authority behavior. Interestingly, the variable INFORMATION seems to be a good proxy for this issue. The only other administrative rating variable contributing significantly to the compliance cost burden is DELAY. Therefore, it seems to be essential that private businesses are supported with the necessary information by the administrative authorities in a reasonable time.

The model exemplifies that the effect of administrative issues is separate from the effect of the tax law itself. Taking into account legislative aspects, the most important subjects seem to be the understandability and consistency of the tax law. Furthermore, a new legislation should be introduced in a way that leaves enough time for businesses to take the new regulations into account (TIME). The rather low significance of these variables results from the fact that they are a measure for similar aspects. According to our estimate, the cost burden of a business which is not content with the obtained information would increase by about 26 percentage points. A severe time delay adds further 15% to the compliance cost burden.¹¹

¹¹ The additional cost burdens are slightly higher than the coefficients in table 8. This is due to the fact that these coefficients document exclusively the marginal but not the absolute effects of our logarithmic regression model. Regarding dummy-variables, there is no meaningful interpretation of a marginal effect.

It is an important question of research, to what extent the cost burden could be reduced in case of a more "customer-friendly" administration taking into account not only administrative but also compliance costs. The available data does not allow for an analysis of fundamental reform measures like a reduction of information requirement or a creation of new customer services for private businesses.

Nevertheless, we may use our regression results to calculate the compliance cost burden in a world without negative experiences with the tax administration. On this account, we simulated the cost burden by using the regression coefficients of table 8. To identify the effect of administrative actions, we simulated a model including and a model excluding the significant and negative rating variables for DELAY and INFORMATION. We find on average that the neglect of negative ratings results in a reduction of the simulated cost burden of 10 % to 14 %. Therefore, we would expect that an enhancement of tax administration in a form of best practice should result in a reduction of the cost burden by at least 10 %. This value can be taken as a lower bound of a potential compliance cost reduction due to a more fundamental reform of tax administration.

4. Conclusion

In our paper, we investigated the link between tax authority behavior and the compliance cost burdens of private businesses. In a simple microeconomic framework, the compliance costs of taxpayers may partially be interpreted as externalities of the control and audit strategy of the tax administration. From this perspective, there is an incentive for the tax authorities to “shift” administrative cost burdens to the taxpayer. Corresponding administrative actions imply an inefficient outcome reducing the productivity of the overall tax system. As the shadow price of administrative actions decreases in the amount of administrative resources, a low budget of a tax collection agency could be an incentive to “shift” a bigger part of the overall cost burden to the private sector.

Empirical results based on a survey of Belgian businesses confirm the results of our analytical model. According to our estimate businesses who did not obtain the requested information bear an additional cost burden of about 26%. A severe delay in answering a request adds further 15% to the cost burden. Altogether these two rating variables explain between 10% and 14% of the average cost burden. To control for possible endogeneity, we used comparable rating variables on tax legislation. We demonstrated that there is a significant and separate effect of tax administration and tax legislation on the costs of red tape.

Our results imply that the simplification of a tax system is not only a legislative but also an administrative issue. To reduce the costs of red tape, it seems appropriate to incorporate the externalities of administrative control and audit strategies in the decision making of the revenue service. Due to the very high cost burdens especially of small businesses, we would also expect that an extension of taxpayer services could have a share in reducing the administrative cost burden of the tax system as a whole.

5. Appendix: Comparative statics results

The first order conditions of a tax authority minimizing tax evasion are described by

$$\frac{\partial L}{\partial A} = p' \cdot (T_a - T_n) - \lambda \cdot \frac{\partial C_a}{\partial A} = 0, \quad (23)$$

$$\frac{\partial L}{\partial I} = p' \cdot (T_a - T_n) - T' \cdot \frac{\partial C_t^*}{\partial I} - \lambda \cdot \frac{\partial C_a}{\partial I} = 0. \quad (24)$$

For an optimum, also the following second order conditions have to be fulfilled

$$\frac{\partial^2 L}{\partial A^2} = -\lambda \cdot \frac{\partial^2 C_a}{\partial A^2} < 0, \quad (25)$$

$$\frac{\partial^2 L}{\partial I^2} = -\lambda \cdot \frac{\partial^2 C_a}{\partial I^2} - T' \cdot \frac{\partial^2 C_t^*}{\partial I^2} < 0 \quad (26)$$

and

$$\frac{\partial^2 L}{\partial A^2} \cdot \frac{\partial^2 L}{\partial I^2} - \left(\frac{\partial^2 L}{\partial I \partial A} \right)^2 > 0. \quad (27)$$

The derivative $\frac{\partial^2 L}{\partial I \partial A} = L_{IA}$ is defined as

$$L_{IA} = -\lambda \cdot \frac{\partial^2 C_a}{\partial I \partial A}. \quad (28)$$

This condition can be positive or negative depending on the question if A and I are substitutes or complements. The effect of an exogenous shock of a variable X on the optima can be described by

$$dL_A = L_{A^2} \cdot dA + L_{AI} \cdot dI + L_{AX} \cdot dX = 0 \quad (29)$$

and

$$dL_I = L_{I^2} \cdot dI + L_{IA} \cdot dA + L_{IX} \cdot dX = 0. \quad (30)$$

Rewriting yields to the following conditions for $\frac{dA}{dX}$ and $\frac{dI}{dX}$

$$\frac{dA}{dX} = \frac{L_{IA} \cdot L_{IX} - L_{AX} \cdot L_{I^2}}{L_{I^2} \cdot L_{A^2} - (L_{IA})^2}, \quad (31)$$

$$\frac{dI}{dX} = \frac{L_{IA} \cdot L_{AX} - L_{IX} \cdot L_{A^2}}{L_{I^2} \cdot L_{A^2} - (L_{IA})^2}. \quad (32)$$

Taking into account $L_{I^2} < 0$, $L_{A^2} < 0$ and $L_{A^2} \cdot L_{I^2} - (L_{IA})^2 > 0$, the overall effect of an exogenous variable depends on L_{IX} , L_{AX} and L_{IA} . Regarding the budget of the revenue service B , we obtain the following partial derivatives:

$$L_{IB} = -\frac{\partial C_a}{\partial I} \cdot \frac{\partial \lambda}{\partial B} \quad (33)$$

$$L_{AB} = -\frac{\partial C_a}{\partial A} \cdot \frac{\partial \lambda}{\partial B} \quad (34)$$

Under the assumption of $\frac{\partial \lambda}{\partial B} < 0$, we find a positive effect of both instruments. However, as the budget affects exclusively the shadow price of the administrative costs C_a and not the tax compliance costs C_t^* , it seems probable that the effect is stronger in case of an audit strategy A compared to information requirements I . From this perspective, the effect of the budget on the stated "shifting" of administrative cost burdens does not seem to be straightforward. If I and A are substitutes, a low budget could reduce the resources allocated to A in favour of I . In the alternative case a higher budget should increase the resources allocated to both control instruments.

For an increase in the level of optimal tax evasion E^* , we obtain:

$$L_{IE^*} = T' \cdot \left(p' \cdot (\theta^* + 1) - \frac{\partial^2 C_t^*}{\partial I \partial E^*} \right), \quad (35)$$

$$L_{AE^*} = p' \cdot T' \cdot (\theta^* + 1) \quad (36)$$

For the instrument A , we find a positive effect of E^* if we ignore the effect on I . Due to the higher amount of additional tax revenue in case of a successful audit, tax evasion ceteris paribus promotes audit strategies. By contrast, the effect of evasion on information requirements is not straightforward. On the one hand, there is a positive effect of the expected tax value in case of an audit $p' \cdot T' \cdot (\theta^* + 1)$. On the other hand, the effect of tax evasion on compliance costs C_t^* is unclear. According to Erard and Ho (2003), high tax compliance costs may be correlated to a high value of tax evasion implying a positive sign of $\frac{\partial^2 C_t^*}{\partial I \partial E^*}$. In this case, high tax evasion could also decrease the incentive of the tax administration for information requirements I .

Regarding an exogenous increase in compliance costs C_t^* , we integrate a multiplier with $C_t^* = \gamma \cdot \overline{C_t^*}$. The partial derivatives according to γ yield to:

$$L_{I\gamma} = -T' \cdot \frac{\partial \overline{C}_t^*}{\partial I} \quad (37)$$

$$L_{A\gamma} = 0 \quad (38)$$

We do not find an isolated effect of C_t^* on A but only a negative impact on I . This is due to the fact that in our setting an audit strategy does not significantly affect the compliance burden. If both variables are substitutes, an exogenous increase of C_t^* should reduce the resources allocated in I in favour of A . A similar argumentation holds for an increase in the linear tax rate. In this case we obtain:

$$L_{IT'} = p' \cdot (\theta^* + E) - \frac{\partial C_t^*}{\partial I} \quad (39)$$

$$L_{AT'} = p' \cdot (\theta^* + E) \quad (40)$$

Evidently, there is a stronger isolated effect on A compared to I as a higher tax rate does not only imply an expected gain from detected tax evasion but also a stronger effect of tax compliance costs on the tax payment. However, the overall effect depends also on the interdependency of both administrative instruments symbolized by the derivative L_{AI} .

By contrast, an exogenous increase in the detection probability has no divergent effect on both instruments. This can be documented for $p = \pi \cdot \bar{p}$. Therefore, we would in general not expect that an exogenous increase or decrease of the probability has a significant effect on the choice between I and A . Nevertheless, as mentioned also for the other exogenous factors, the overall effect of p depends on the criteria considered in 31 and 32. Therefore, a general solution depends especially on the sign of L_{AI} .

$$L_{I\pi} = \bar{p}' \cdot (T_a - T_n) \quad (41)$$

$$L_{A\pi} = \bar{p}' \cdot (T_a - T_n) \quad (42)$$

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