Transaction costs of agri-environmental policy measures: the case of Swedish permanent grasslands.

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Abstract

It has been shown in previous studies that transaction costs (TC) of agri-environmental policy measures often are very large both in absolute terms and as share of payments. As agri-environmental policy measures make up an increasingly large share of agricultural policies, not least within the European Union, it is becoming ever more important to improve the knowledge about the factors determining the level of transaction costs. This paper investigates the TC determinants of one Swedish agri-environmental policy measure. More specifically, it aims to investigate if the level of TC is attributable to economic factors, such as pasture density and distances, or if political factors, such as lobby groups and political majorities at the county level, influence the costs. To evaluate if the results are robust with respect to alterations in model specifications a version of the extreme bounds analysis is applied. Although initial results indicate that political parties influence the level of transaction costs, the extreme bounds analysis reveals that those results are fragile. It shows that five of the economic variables are robust with respect to model specifications but that none of the political variables is.

Keywords: extreme bounds analysis, agri-environmental policy measures, pasture, transaction costs.

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1. Introduction

In the last couple of decades, there has been an increasing number of articles devoted to the study of transaction cost economics.[1] Although most of the articles have studied the issue analytically or discussing the sources and implications of transaction costs (TC) in general terms (e.g. Coase, 1960; Williamson, 1985; Griffin, 1991; Vatn and Bromley, 1994; Stavins, 1995; Challen, 2000, 2001; Vatn, 1998, 2001; Berzel, 1985), there has lately also been an increasing number of empirical studies related to agriculture and the environment (e.g. Rorstad *et al.*, 2007; McCann, 2000; McCann and Easter, 1999; Falconer *et al.*, 2001; Falconer and Saunders, 2002; Mann, 2000).[2]

The magnitudes of transaction costs may be important for the development and implementation of environmental policy measures. Although traditional price and income support programs generally carry relatively small administrative costs, often between 1% and 5% of the total costs (Falconer and Whitby, 1999, 2000; Vatn, 2002), the level of transaction costs has tended to increase as programs have become more focused on supporting positive externalities. Since results of previous studies indicate that transaction costs may be sizeable (e.g. Rorstad *et al.,* 2007; Falconer and Whitby, 1999, 2000; McCann, 2000), it is important to gain a further understanding of the size and determinants of transaction costs. As noted by other authors (e.g. McCann *et al.*, 2005), non-negligible transaction costs will affect the optimal design of policy instruments as well as the optimal level of payments. Interestingly, despite the importance of developing efficient policy measures, relatively little attention has been given to the cost-effectiveness of conservation policies (Wätzold and Schwerdtner, 2005).

The agri-environmental policy measures are of increasing importance, not least in the European Union with the ongoing transfer from commodity related support to area payments complemented by payments for non-commodity outputs. Consequently, transaction costs are becoming increasingly important to study if efficient policy measures are strived for. This paper aims to increase the understanding of what determines the level of transaction costs by analyzing how some economic and political factors influence the level of transaction costs. It investigates the transaction costs of the Swedish agri-environmental policy measure that aims

[1] For a reader presenting original papers and applications, see Williamson and Masten 1999. Shelanski and Klein (1995) is a relevant survey on the empirical transaction costs literature. The concept of transaction costs will be further in the literature survey, but a general definition of transaction costs due to Arrow (1969, p. 49) is "the costs of running the economic system".

to support the qualities of semi-natural pastures. More specifically, it investigates the determinants of the county authorities' costs for setting up maintenance plans for the permanent pastures that participate in the system. Although to some extent fulfilling an educational function, the costs of creating the maintenance plans could essentially be classified as pure transaction costs. The costs per plan vary substantially between the 21 Swedish counties. Since no apparent reason for the divergence in costs can be easily found, the purpose of this paper is to shed further light on the sources of the transaction costs: It aims to investigate if the cost divergences could be attributable to reasonably objective economic factors, such as pasture density or distance, or if other factors, such as political majorities at the county level, influence the costs. Although the farmers' transaction costs may be substantial and are important to consider when developing policy measures (e.g. Falconer, 2000; Colman, 1994; Morris and Potter, 1995; Ducos and Dupraz, 2006), those transaction costs are not investigated in this paper.

Since very little empirical research has been performed on the determinants of transaction costs for agri-environmental policy measures, this paper is exploratory by nature. Thus, solid foundations for which variables that should be included in the specifications have not always been possible to find. This implies that the foundation for the inclusion of the different variables vary. In some cases there are previous studies available, indicating that variables such as membership in conservation organizations could be expected to have an influence. In other cases there is more of an intuitive reasoning arguing why the variables are to be included. The exploratory nature of this paper is one reason for the inclusion of the Extreme Bounds Analysis (EBA). The essence of the EBA will be further discussed in section V.3 of the paper but it could be stated here that it is a suitable method to check if the independent variables are robustly related to the dependent variable, or if they are fragile and depend on certain specifications to be significant. The method has previously mainly been applied to growth studies.

This paper contributes to the literature by focusing on the determinants of transaction costs for the implementation of agri-environmental policy measures. It also applies the EBA methodology to a new area, investigating the robustness of political and economic influences on the transaction costs of a Swedish agri-environmental policy measure.

The structure of the paper is as follows. In the next section, the transaction cost literature is briefly reviewed with a focus on empirical agricultural and environmental

[2] An excellent review and introduction to the field of transaction costs of agri-environmental policy measures is OECD (2007).

economics. In section three, the part of the Swedish agri-environmental support system that is relevant for permanent pastures is described as well as this system's relation to transaction costs. In section four the data and the expected relations are presented alongside a set of hypotheses. This is followed by the econometric specifications and results in section five. The final section presents a summary and the conclusions leading to suggestions for future research.

2. Literature review

Although economists always have been aware of the presence and importance of transaction costs, transaction costs have only recently begun to be thoroughly studied. The seminal article by Coase (1937) showed that with zero transaction costs, the distribution of initial property rights does not matter. Interestingly, despite the knowledge that the Coase theorem rarely holds, economists have often acted as if there were no transaction costs. The reason for why this has been such a common practice is disputed, but the most common argument seems to be that transaction costs are difficult to estimate empirically and that it is difficult to develop a useful definition that works in most circumstances. Of course, most transactions are performed with positive transaction costs but if transaction costs are positive and people are utility maximizers, exchanges in the markets will take place when the expected resources that must be spent on transaction activities are lower than the expected gains from the actual transactions (Fahlbeck, 1995).

Coase (1960) also pioneered the works on transaction costs associated with public policies. He shows that evaluation of alternative options for addressing externality problems should incorporate not only pollution-abatement costs but also transaction costs. Following the logic of his argument, it is irrelevant if we are talking about positive or negative externalities, the transaction costs should be incorporated in any case.

Clearly, transaction costs exist and they may be substantial. The sources of transaction costs vary but they could in general terms be described as costs that are linked to activities that are associated with exchange. For example, costs are incurred when gathering information and establishing contact between agents, writing contracts and control that the contracts are fulfilled (Dahlman, 1979).

One of the problems of making studies of transaction costs operational is the fact that there are no commonly accepted, empirically usable definitions of transaction costs. There are however plenty of general definitions. For example, Arrow vaguely defined transaction costs as the “costs of running the economic system” (Arrow, 1969, p. 49), whereas Gordon (1994) defined it as the expenses of organizing and participating in a market or implementing a policy. Thus, as stressed by McCann *et al.* (2005), one important goal of current economists should be to improve transaction cost theory and measurement.

According to Williamson (1989) there are three principal dimensions through which transactions ought to be analyzed and described. These dimensions are: i) *frequency,* measuring the extent to which transactions are recurrent; ii) *uncertainty*, indicating the level of risk involved in the transaction; and iii) *asset specificity*, which if high implies that the good involved has few alternative uses or buyers. For example, frequently occurring transactions with low uncertainty and low asset specification generally have lower transaction costs than transactions where the dimensions are reversed. There may for example be high start up costs associated with a policy but once in place the average cost falls over time due to recurring transactions and less need for information. This latter point has been supported by Falconer & Whitby (1999, 2000) in their studies of the transaction costs incurred in the public sector due to the introduction and existence of agri-environmental policies. It could furthermore be argued that well functioning institutions may be able to lower transaction costs substantially (Bromley, 1989; Hodgson, 1988). Clearly, Williamson (1989) has had a profound effect on the literature and it is now very common to structure transaction costs studies on the basis of the concepts of frequency, uncertainty and asses specificity. Interlinked is the common practice to link the costs to four broad categories: the characteristics of the policy, the institutional environment, structural factors and information/coordination systems (OECD, 2006).

According to Tinbergen (1952), one needs one instrument per desired objective. However, the stronger the relations between the different goals, the likelier that transaction costs make it optimal to apply fewer instruments than one per objective (Vatn et al., 2002). Even if it was possible to develop one instrument per desired goal, it is obvious that the process would carry high costs. Consequently, policymakers have had a strong tendency to opt for administrative ease and attempted to capture several objectives in each policy in order to lower transaction costs. This may be unfortunate, since one of the more important issues when developing policies is to strike the right balance between transaction costs and precision (Romstad *et al.*, 2000). Just because transaction costs absolutely, or as share of expenditures, are higher for some policies than others does not mean that the more expensive ones are less efficient. Using specific instruments and policies are likely to involve higher transaction costs, but the better precision might lower total costs and create gains that far outweigh the transaction costs.

One part of Peerlings and Polman (2004), concerns transaction costs of policy measures for jointly produced milk and 'wildlife and landscape services'. In a simulation built on an empirical study, they examine the effects of reduced farmer variable and fixed transaction cost. Not surprisingly, they find that decreasing transaction costs increase production of 'wildlife'.

Eklund (1999) has analyzed the transaction costs of the Swedish agri-environmental program and presents five hypotheses regarding the foundations of the transaction costs. According to her, the following factors influence the transaction costs: i) the character of the good; ii) the design of the measures; iii) administrative institutions; iv) the type and degree of uncertainty; and v) the frequency of transactions. The factors that seem to have the most substantial impact in the case of the Swedish program are the complexity of the kind of goods the government intends to promote and the complexity of the design of the policy measures. The other factors may however also be important depending on circumstances. The transaction costs as share of farmer payments vary between 8% and 17%, depending on policy (see Table 1 for a summary of this and the other referenced transaction cost estimates).[3]

Rorstad *et al.* (2007), investigate the differences between the transaction costs of various Norwegian agricultural and agri-environmental policy measures. They attempt to measure the total transaction costs as well as the share borne by the farmers involved. Twelve policy measures, covering the spectrum from low asset specificity and high frequency to high asset specificity to low frequency, are studied. The policy measure that most resembles the one studied in this paper is 'support for special landscape ventures', which is characterized by high asset specificity and low frequency of transactions. The data used in the study was collected through interviews with representatives of public administrations, market actors and farmers. The main conclusions are that transaction costs, as share of payments, differ significantly depending on policy measure and that the point of policy application, asset specificity and transaction frequency determine the size of transaction costs. For policies at the farm level, TC increase as asset specificity increases. The TC as per cent of payments to farmers regarding support for special landscape ventures is 47%. 6% of that cost is borne by the farmer.

In a study by McCann and Easter (1999), the transaction costs of policies aiming to reduce agricultural non-point source pollution, more specifically phosphorus pollution in the Minnesota River, are investigated. The data was gathered through interviews with government officials in an attempt to estimate the costs. Out of the four measures investigated,[4] it is found that the fertilizer tax has the lowest transaction costs.

[3] A study that presents additional estimates including e.g. the share of TC borne by the farmers is OECD (2006).

[4] Fertilizer tax, educational programs, conservation tillage requirement, expansion of permanent conservation easement program.

McCann and Easter (2000) analyze the size of transaction costs of the US Natural Resource Conservation Service's conservation systems, which partially aim to support positive externalities in the agricultural landscape. The data was collected in a nationwide survey in 1995 where the costs pertain to technical assistance and cost sharing. They find that the transaction costs represent a significant portion of the total conservation costs, 38%.

Buchli and Flury (2006) investigate the transaction costs of the Swiss agricultural direct payment systems. Between the various measures applied in the canton Graubünden, the transaction costs as share of payments varies from 0.6% for basic area payments to 16.6% for support of extensive production of rapes. The transaction costs are similar in the canton Zürich, ranging from 1.0% to 14.2% of payments for the same policy measures.

In a highly relevant study for this paper, Falconer *et al.* (2001) explore the transaction costs of agri-environmental policy schemes based on management agreements. The results indicate that there are efficiencies of scale with respect to the number of agreements formed within an area as well as to scheme experience. The data also shows that the administration costs as a share of total costs decline over time. In 1992/93, administration costs equaled 102% of payments, i.e. TC are higher than actual transfers, but had declined to 18% in 1998/99,.

Falconer and Saunders (2002), investigate the public and private transaction costs of management agreements on the 'sites of special scientific interests', including those under the English Wildlife Enhancement Scheme (WES). More specifically, the study was confined to the direct costs related to concluding and operating the management agreements. The average share of negotiation costs for all types of contracts borne by the administrating agent was 70 %, the remainder being borne by the farmers. The total negotiation cost was £86 per hectare, and £493 per agreement, thus making negotiation costs significant. Transaction costs as share of compensation payments for all types of agreements was 21% over the lifespan of the contracts. For the WES agreements it was substantially higher though, 113%.

Mann (2005) investigates the transaction costs of the Swiss agricultural cross-compliance programs and finds that the transaction costs as share of payments vary widely between measures. The TC share for 'mixed fallow land' is only 3% whereas the share for 'arable field margins' is 113% although the author argues that the latter is mainly due to the small scale, so far, of the program. Also, the transaction costs share in payments for 'low-intensity grassland' was 11%.

Vatn *et al.* (2002), in their report on transaction costs and multifunctionality, thoroughly present many of the complexities involved with efficient policy measures in the presence of transaction costs. They also attempt to estimate the transaction costs of a selection of Norwegian agricultural policy measures by interviewing representatives from the different actors involved in the process. In their study, the policy defined as "support for special landscape ventures", which includes 'preservation and promotion of biodiversity', is the policy that most resembles the policy investigated in this study. They find that the total transaction costs equal about 54% of payments. The local agricultural authorities carry the heaviest burden and their share of transaction costs is 85% of the total transaction costs.

Table 1: Transaction cost estimates.

Source	Objective	Estimate	When	Where
Mann 2005	Low intensity grassland	11%	Not specified	Switzerland
OECD 2005	Ecological compensation (Grisons/Zürich)	6.8%/7.6%	2003	Switzerland
Rorstad *et al.* 2007	Special Landscape Ventures	47%	2001/03	Norway
Vatn *et al.* 2002	Special Landscape Ventures	54%	2000	Norway
Falconer & Saunders 2002	Wildlife Enhancement Schemes	113%	1996	UK
Falconer *et al.* 2001	Management agreements	102% 18.1%	1992/93 1998/99	UK
McCann & Easter 2000	Natural Resource Conservation Service programs	38%	1995	USA
Eklund 1999	Preservation of biodiversity	13.5%	1997	Sweden
- Ibid	Preservation of cultural heritage	16.5%	1997	Sweden
- Ibid	Preservation of open landscape	8.3%	1997	Sweden
Falconer & Whitby 1999b	Ecologically valuable area scheme	10.3%	1996/97(a)	Austria
- Ibid	Eco-point scheme	18.4%	1996/97(a)	Austria
- Ibid	E. Flanders willows scheme	66.4%	1996	Belgium
- Ibid	Conversion to extensive grassland	53.4%	1995/96(a)	France
- Ibid	Maintain local species	137.9%	1995/96(a)	France
- Ibid	Valuable nature and cultural environment	8.3%	1997	Sweden
- Ibid	Biodiversity in pastures	13.5%	1997	Sweden
- Ibid	Open landscape	8.3%	1997	Sweden
- Ibid	Environmentally sensitive areas	24.6%	1996	UK
- Ibid	Countryside stewardship	37.9%	1996	UK
- Ibid	Habitat scheme	50%	1996	UK

N.B. (a) denotes average of the two years. Otherwise multiple years denotes that the data is gathered in those years. The percentage number under "estimate" refers to share of payments made to the farmers except for McCann and Easter (2000) where it refers to share of total costs.

One study that covers several agri-environmental policies in a European context has been performed within the STEWPOL project and is reported in Falconer and Whitby (1999b). The transaction cost estimates of 37 schemes in 8 countries are investigated and the

11 ones that are the most relevant for the purposes of this paper are presented in Table 1. In the study, the focus was placed on the public sector and only the direct organizational costs of the schemes were estimated. Given the diversity of both scale and objectives, it is not surprising that the magnitude of transaction costs varies substantially between countries and between policies. Two general conclusions that are drawn in the study are that transaction costs seem to decline with time as administrators become accustomed with the programs and also that fixed initial costs may be very important and a large share of total transaction costs.

The general tendency seems to be that transaction costs are high when agricultural positive externalities are supported. This may be true in absolute terms, but is nearly always the case when costs are estimated as share of payments. Some studies indicate that transaction costs may decrease with time. These facts have some specific implications on the Swedish administrative costs. Firstly, since the agri-environmental policy measures have gone through a series of changes since they were introduced, it is quite likely the transaction costs are higher than they would have been, had the system not been altered. However, hopefully the more recent policy measures achieve the policy goals more efficiently, thus overcoming the cost disadvantages that are due to policy alterations. More important is the fact that transaction costs tend to be of substantial magnitudes. Since the agricultural policy measures are becoming more and more focused on the reimbursement of public good production, the share of payments as well as the absolute amounts devoted to the policies are likely to increase. Thus, it will become increasingly important not to ignore the transaction costs if efficiency is strived for.

3. The Swedish pasture support system and transaction costs.

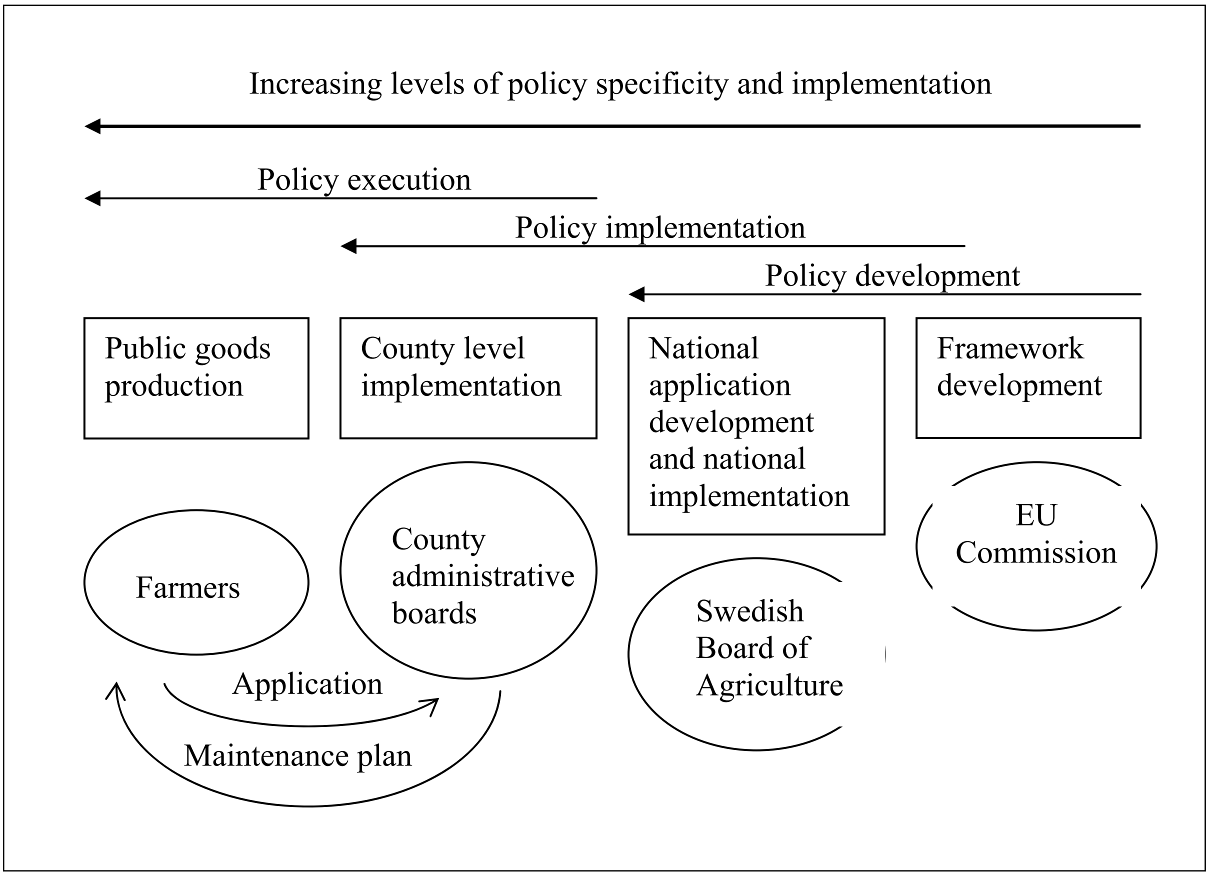
Internationally, and also within the European Union, there is a wide spectrum of agri-environmental policy measures in place, ranging from simple measures that are close to standard area payments with low TC to very sophisticated and detailed measures with very high TC. The Swedish pasture support system fits somewhere in the range of middle to high transaction costs, including many farmers and pastures but being fairly detailed and time consuming in the initial phase. Within the EU, there are some examples of measures that are similar to the Swedish measures (e.g. the British ESA and Higher Level Stewardship schemes) and it is quite likely that measures of this kind will become even more common as the EU common agricultural policy becomes increasingly focused on the production of environmental public goods. As such, it is a good example of a policy that is relevant to study and the results will give insights and knowledge about important aspects of future policy development, not only for EU members but also for other, third countries. Thus, this section discusses the Swedish pasture support system and the chain of transaction costs and institutions that affects the policy development and implementation process. Initially, the County administrative boards and the maintenance plans will be appropriately placed in the network of transaction costs. Thereafter, the maintenance plans and specification of transaction costs for the purposes of this study will be more thoroughly discussed.

A stylized framework identifying the most important actors and actions with respect to production, implementation and decision making is presented in Figure 1. As can be seen, there are many specific items in the chain ranging from decision to fulfilled production. What makes the maintenance plan section special, is that it directly affects the marginal cost of production. Thus, the creation of the maintenance plan does not necessarily have to be seen as the final step in the policy implementation process, but can rather, or also, be seen as the first step of the policy execution stage.

In Figure 1, the actions taking place are being shown in boxes and the most important actors are displayed in ellipses. The EU Commission develops the general framework for the policy and communicates it to the national level. The framework is being adapted to national demands and a national suggestion is presented to the commission that either rejects or accepts the suggestion. Once the national policy is in place, the policy is communicated to the county administrative boards and the farmers. The farmers have to devote time and resources to informing themselves and applying for payments. Finally, the county administrative boards have to create the maintenance plans and verify that the farmers fulfill the requirements.

In order not to crowd the figure with various graphics, additional links have not been included. All actors are for example monitored by other actors: the farmers are monitored by the county administrative boards, which are monitored by the Swedish Board of Agriculture, which is monitored by the EU Commission. The EU Commission is in turn not an independent entity but is being monitored by the EU Parliament, the national parliaments and governments, OLAF[5] etc.

Figure 1: Transaction costs chain.



Although not explicitly displayed, transaction costs occur between and within all the actors in the figure. Out of all these 'within' and 'between' transaction costs, only one is investigated in this paper, the creation of maintenance plans. As mentioned above, what makes this entity particularly interesting from a policy perspective is that it directly affects the marginal costs of policy implementation. Thus, if efficient policy measures are strived for, the

[5] The EU anti-fraud office.

policy makers' implementation costs at the farmer level are of the utmost importance. If these costs are ignored, too much resources will be devoted to the policy based on any utility maximization or efficiency criteria.

The Swedish county administrative boards essentially consist of administrators that are appointed by the central government.[6] Their main task is to function as the central government's administrator at the local level, handling the implementation of national policies in the counties. That includes e.g. handling applications for driving licenses and administration of agricultural support and agri-environmental policy measures. Since the county administrative boards are not elected but centrally appointed, they should not be influenced by local political majorities or preference formations at the county level. Neither should they be affected by the influence of interest groups since any implementation of policy that diverges from the norm decided by the central government would imply a breach with the boards' mandate. In essence, the boards should fulfill the tasks given to them by the central government efficiently and fairly.

In Sweden, the holders of semi-natural pastures can apply for compensation to maintain the pastures' specific qualities.[7] There is one basic payment of 1100 SEK/ha (about 120 €/ha) that all semi-natural pastures are granted, irrespectively of biological or aesthetical values, as long as some basic measures are fulfilled. If the pastures are deemed to be of special importance from a biological or cultural point of view, the holders may apply for an additional payment of 1400 SEK/ha (about 150 €/ha). However, in order to get the payment, the pasture has to be maintained in accordance with certain site-specific conditions. When a farmer has applied for the payment, an expert from the country administrative board visits the farmer, investigates the pastures and sets up, ideally together with the farmer, a maintenance plan for the pasture. The maintenance plan is thus a prerequisite for the implementation of the desired policy measure.

The maintenance plan contains certain stipulated conditions regarding the maintenance of the pasture that the farmer has to fulfill or he risks losing the payment. The plan can be quite detailed with respect not only to the types of objects that are included in the plan but also to how detailed the directives for each object is. A common example is directives stating that the area surrounding a specific solitary tree should be completely

[6] For a map of Sweden with the location of the counties presented, see Appendix 1.
[7] The system described here was in effect between the years 2000 and 2006. Betweem the years 1995 and 2000, a similar system was in place (see Swedish Board of Agriculture (2000) for a description of the rules governing that system) where farmers signed contracts covering five years. The high adaption rate in the first two years of

cleared from other vegetation, or exactly where in a field bushes of a certain specie are allowed. It is therefore possible that two experts that each visits a randomly chosen farmer could produce somewhat different plans. Consequently, it is also possible that some county administrative board experts generally produce more costly plans than others.

Two factors that are the cost bases that determine the costs of the maintenance plans are transportation and labor costs, where the former generally is a fraction of the latter and depends on the distance between the office and the farmer.[8] The major costs is the labor cost for the time the administrator spends at the farm investigating the pasture and talking to the farmer in addition to the time spent at the office typing the actual report.[9]

The costs of creating the maintenance plans could reasonably be considered a relatively pure transaction cost. Usefully for our purposes, between the years 2000 and 2003 the county administrative boards did not have to commit resources from their ordinary budgets for the creation of the maintenance plans. Rather, during these years the Boards could request funds from the project KULM[10] to cover their expenses. This procedure has two major implications. Firstly, it implies that explicit data is accessible regarding the costs for the creations of the maintenance plans. Secondly, it also implies that the local Boards did not necessarily have strong incentives to keep down the costs for the Plans as they were reimbursed for their expenses anyway. The Boards could thus to some extent follow agendas other than those decided by the government. The Boards could for example encourage the administrators to spend additional time on the plans and with the farmers in order to improve networks, increase farmer knowledge or simply make the plans more detailed in order to increase pasture performance. As has been shown in previous studies, bureaucrats sometimes influence the policy process (e.g. Miller, 2004; Wilson, 1989; Rourke, 1984). It has for example been suggested that local labour market conditions and unemployment levels influence regulators strategies (e.g. Dion et al., 1998; Gray & Deily, 1996) and that membership levels in conservation organizations affect enforcement decisions (Firestone, 2002). Likewise, it is commonly so that at higher income levels environmental quality tends to increase (e.g. Dinda, 2004). Then, if the administrative costs of a particular choice of the administrator does not influence the administrators' budgetary expenses, it would be even more reasonable that the bureaucrats utilize their potential powers.

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the new program (see Table 2) is reasonable since a high fraction of the farmers with pastures fulfilling the rules signed contracts in 1995 and 1996.

[8] It normally consists of some costs for car transportation and the labour time needed to travel the distance.

[9] Cost differences between counties may to some extent depend on the allocation of overhead costs.

As Table 2 clarifies, the transaction costs vary substantially between the counties and between years.[11,12] It may be the case that these cost divergences have valid foundations that could be empirically verified. It may for example be that case that high transaction costs reflect long distances between the central local government and the affected farmers. It could also be the case that some counties have a large share of relatively small pastures that increases costs whereas others have large pastures that decrease costs.

Table 2: descriptive statistics of transaction costs at county level, SEK/plan.

	2000	2001	2002	2003
Average	5237	4493	4962	5375
st dev	1117	1684	1869	2329
Max	7523	7398	8042	12126
Min	3410	570	759	565
No of plans	6680	11278	2526	1699

NB: SEK/plan, current prices. Conversion rate about 9.5SEK/€, July 2007.

On the other hand, given the substantial magnitude in differences, we can not *a priori* assume that the economic factors are the main foundations for the transaction cost divergences. Rather, a reasonable hypothesis is that other, political, factors influence the size of transaction costs.

[10] Swedish full policy name: ”Kompetensutveckling av lantbrukare inom miljöområdet”. English, own translation: ”*Farmer environmental competence development*”.

[11] Appendix 2 presents more thorough statistics for the transaction costs, specifying the transaction costs for each county and year.

[12] It should be noted that the in Table 2 reported Min values for 2001 through 2003 refer to *Z* county and diverge substantially from the min values of the other counties. The second lowest min value is 2377SEK for *U* county in 2003. Please see Appendix 2 for further details.

4. Expected relationships and data description

In the previous discussion, it has been argued that transaction costs *should* depend on factors that are unavoidable and *may* depend on factors that should not influence the level of transaction costs. An example of the latter is a common preference formation at the local level that induces administrators to spend resources on activities that the central administrators have not previously planned for. That may result in different levels of transaction costs spending between counties. In the following, the unavoidable factors that reasonably should affect transaction costs will be referred to as economic factors whereas the factors that should not affect the level of transaction costs will be referred to as political factors. For clarity, the expected relationships and stated hypotheses presented below have been grouped under these headings.

Economic variables

Naturally, total transaction costs should increase with the number of maintenance plans created by the Boards. However, it is also reasonable to expect some efficiencies of scale in the number of plans that are created. If many plans are created in a given county, it may be possible to use resources more efficiently as slack could be avoided. Likewise, it is probable that if many plans are created, the people creating the plans become more efficient. These assumptions would imply that an increasing number of maintenance plans created would increase total transaction costs but decrease transaction costs per plan. These effects are captured by data on the number of maintenance plans created (PLAN) and the same variable squared (PLAN2). These assumptions would imply that the variable PLAN would be positive as TC increase with increasing number of plans, but that PLAN2 would be negative because of efficiencies of scale.

The creation of maintenance plans necessarily imply some physical visits of the county boards' administrators to the farmers applying for the payments. Thus, some of the costs for the creation of the maintenance plans will be related to costs of transportation. Large distances contribute to transaction costs not only by the pure travel costs, but also through the cost increases incurred by time being spent on transportation rather then productive work. Since there are large differences in size between the Swedish counties (for some reference about the relative sizes, see the map of Sweden in Appendix 1), the effect of transportation costs could possibly explain some of the differences in TC, an effect that should be possible to capture through an indicator on the size of a county (CSIZE).

A variable that should work in the opposite direction of CSIZE is the variable PGNO that measures the number of pastures in a county. The argument is that the presence of many pastures in a county implies that they are closer to one another than they are if there are few pastures. Thus, many pastures in a specific county could decrease transaction costs be lowering the time spent on transportation between pastures.

An important aspect that should effect the magnitude of the transaction costs is the actual size of the pastures. Basically, the larger the pastures, the higher transaction costs could be expected to be. The argument is simply that larger pastures tend to consume more of the Boards' staffs' time as it will take longer time to accurately investigate the qualities of the pastures and set up the maintenance plans. Two alternative indicators are used as to capture the effect, the average size per pasture, aPGSIZE, and the total county pasture size, PGSIZE.

The share of total pasture area that is deemed to be of high quality[13], QUAL, is used as a proxy for the quality of the land.[14] The effect could work in two directions. One effect of high quality land could be that costs increase since the plans need to be more elaborate in order to account for the richness and complexities of the lands. On the other hand, the effect of poor quality lands could be an increase in costs since the previous degradation of the lands imply that the plans need to be more elaborate. The reason for this is that the plans have to be more detailed in order to specify the maintenance works that need to be fulfilled for the pastures the fulfill the requirements.

Finally, it should be expected that transaction costs are affected by a time factor. With time, efficiency should increase as the administrators get more accustomed to their tasks. Thus, it is reasonable to expect time to have a negative effect on the level of transaction costs. The time effect of organizational learning that is expected to occur in the Boards is captured by the three time dummies y2001, y2002 and y2003.

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[13] A pasture is included as a high quality pasture if it has been specified so in Swedish Board of Agriculture (2005a). To be included, the pasture should be used exclusively for grazing and not be suitable for ploughing. The general criterion for being regarded as a 'high quality' pasture is that the pasture is 'valuable', implying that the pasture has high nature- and/or culture-environmental values. Most of these pastures are semi-natural. See Swedish Board of Agriculture (2005b) for a detailed explanation of the inventory methodology.

[14] Le Goffe (2000) argues in a study on hedonic pricing of agricultural and forestry externalities that the share of permanent grassland to total surface area can be used as an indicator for the extensiveness of the agricultural system, where more extensive systems are supposed to be more respectful of hedgerows, soil and water quality. He finds the indicator to be significant, as do Bontemps *et al.* (2007) in their study on hedonic pricing and agricultural non-point source pollution when similarly using the share of permanent grassland that has been converted into cultivated pastures.

Political variables

A large population, POP, in a county could imply that there is a high demand for public goods. If that is the case, it may be the case that additional time is devoted to the maintenance plans in order to make the pastures more aesthetically attractive from a user perspective. Such efforts should then increase costs. It could however be the case that the population size per se has a minor affect, but that the population density POPDEN, is important.

Local politics could possibly influence the transaction costs because of unemployment levels. Since someone else pays for the staff, the Boards may have incentives to hire more people than necessary to fulfill the task in an attempt to improve the employment situation. The indicator used for employment is share of working age population that is unemployed, UNEMP.

Drawing on the environmental Kuznets curve literature, a test is performed to see if income, INC, has some kind of effect on the transaction costs. The link could then be that with increasing income beyond a certain level, increasing demand for public goods leads to more resources being devoted to the creation of maintenance plants in order to improve the performance of pastures. Two variables that sometimes capture the same effect, the average age of the population, AGE, and the education level (measured as the share of the population that has at least three years of university education) EDU are also included in the dataset.

The literature on lobby groups and their influence on policy outcome is now substantial and it is undeniably so that lobby groups sometimes manage to affect the policy process. In this study, the question of interest is whether lobby groups influence the implementation of policy. The argument in this context is that the stronger the lobby group in the county, the higher the expressed demand for public goods. The share of the population that is member of Swedish Society for Nature Conservation[15] (SSNC), LOBBY, is used as an indictor for lobby influence. If a high share of the population is member of SSNC, there may be high demands on the efforts of the Boards to create thorough plans. That would in turn increase the transaction costs.

Occasionally, the population expresses their preferences through the procedure of voting at the municipality level. Even though local politics should not affect the county administrative boards, it is still possible that there is some link and influence between the

[15] Swedish: "Svenska Naturskyddsföreningen".

composition of political parties in a county and the policy process. Local political configurations could affect the transaction costs by influencing the atmospheres in the counties and displaying implicit demands on the Boards' activities.[16] That could especially be expected to be the case for two types of parties. Firstly, there are the parties that claim to be more environmentally friendly than others. A higher influence of those parties could increase costs as the Boards devote more time to the maintenance plans. In Sweden, the liberal Center Party (CP) and the left wing Green Party (MP) are the two parties that traditionally are associated with environmental friendliness. Secondly, there are the parties that follow a fairly conservative agenda, in the case of Sweden the Christian Democrats (KD). A conservative agenda could in the framework of agriculture be a preference for traditional pastoral landscapes. As the semi-natural pastures that the maintenance plans aim to promote are important aspects of these landscapes, one hypothesis is that conservatives wish to promote resources to the maintenance plans. The above mentioned parties could be expected to have an effect on the policy implementation at the margin in a county. In addition to the above mentioned parties, the party configurations left wing block (LWB) and right wing block (RWB) are also tested for influence.[17] The variables for political influence are defined as the share of voters favoring a particular party or party configuration.

Data availability

The econometric estimates in this paper rely on the availability of panel data for all 21 Swedish counties. The transaction cost estimates are data from the Swedish Board of Agriculture, which is the institution wherefrom the County administrative boards retrieve the money used for the creation of the maintenance plans. The data on the area of high quality pastures that is used in the indicator QUAL is from Swedish Board of Agriculture (2005). The data on membership in the non-government organization Swedish Society for Nature Conservation has been received from its central office in Stockholm. All other data have been retrieved from Statistics Sweden. The data covers the four year period 2000-2003 and the data is balanced, implying that there is a total of 84 observations.

[16] Thus, the elections and political configurations should in the context of this paper primarily be seen as preference expressions (cp. Kahn, 2007).

[17] The RWB is defined as the combined votes on the Center Party, the Liberal Party, the Conservatives and the Christian Democrats; the LWB is defined as the combined votes on the Left Party and the Social Democrats.

Table 3: List of variables

	Var	Description	Unit	availability
	TC	Transaction costs	SEK	2000-2003
Economic variables	PLAN	Number of maintenance plans created	Number	2000-2003
	PLAN2	Number of maintenance plans created squared	Number	2000-2003
	CSIZE	County size	Km^2	Constant
	PSIZE	County pasture size of high quality	Ha	Constant
	aPSIZE	Average county pasture size of high quality	Ha	Constant
	PGNO	Number of high quality pastures	Number	Constant
	QUAL	Share of total pasture area that is of high quality	Percent	Constant
	Y2001	Time dummy for year 2001	dummy	- -
	Y2002	Time dummy for year 2002	dummy	- -
	Y2003	Time dummy for year 2003	dummy	- -
Political variables	POP	Size of population	Number	2000-2003
	POPDEN	Population density	Number	2000-2003
	UNEMP	Unemployment rate	Percent	2000-2003
	INC	Income per capita	1000 SEK	2000-2003
	AGE	Average age of the population	Year	2000-2003
	EDU	Share of population with at least three years of university education	Percent	Constant
	LOBBY	Share of pop that is member of SSNC	Percent	Constant
	KD	Share of voters voting on Christian Democrats	Percent	1998 & 2002 [α]
	MP	Share of voters voting on Green Party (leftist)	Percent	1998 & 2002 [α]
	CP	Share of voters voting on Center Party (liberal)	Percent	1998 & 2002 [α]
	RWB	Share of voters voting on Right Wing Block	Percent	1998 & 2002 [α]
	LWB	Share of voters voting on Left Wing Block	Percent	1998 & 2002 [α]

[α] Implying that the election result of 1998 covers the years 2000 - 2001, and that the election result of 2002 covers the years 2002 - 2003.

As indicated in Table 3, data is continuous for the dependent variable and seven of the independent variables. Seven of the variables are assumed constant over the period but in reality may the variables PSIZE, aPSIZE, PGNO and EDU have experienced some minor changes. Likewise, the variable LOBBY is not constant in reality as the number of members in SSNC is likely to have varied to some extent over the years. Data for this variable is however available only for 2002 and since changes over the period are likely to be relatively small, the variable is assumed constant in this paper. The indicator for landscape quality, QUAL, is also assumed constant event though some minor changes may have occurred over the period. The pastures were surveyed with respect to quality in the period 2002 – 2003. The period 2000 - 2003 covers two election periods as there was one election in 1998 and one in 2002. This implies that the result of the first election expresses preferences covering the period 2000 - 2001 and the second election the years 2002 - 2003. The election data is municipality votes that are aggregated to the county level.

5. Econometric specification and results

In order to give the analysis a good structure, this chapter is split into four sections. It begins with an initial discussion where the expected relationships from the previous chapter are summarized and possible econometric specifications discussed. Then, in section two, some initial estimations are performed by pooling the data and utilizing the standard OLS procedure. Although section two presents some interesting results, the analysis does not rest there. Due to the exploratory nature of this paper, an extreme bounds analysis is also performed in order to test whether the results are robust with respect to model specification. The EBA method is presented in section three along with some previous EBA applications where after the results of the EBA are presented in section four.

5.1. Initial discussion

If the administrators at the county administrative boards were indeed some kind of ideal bureaucrats in the Weberian sense, transaction costs would be expected to be a function of a set of economic factors. They would thus be a function of the number of maintenance plans, the size of the county, the size of the pastures and the quality of the pastures in addition to other economic factors:

$$TC_w = f_1(\underset{+}{PLAN}, \underset{-}{PLAN2}, \underset{+}{CSIZE}, \underset{+}{PSIZE}, \underset{+}{aPSIZE}, \underset{-}{PGNO}, \underset{+/-}{QUAL}, \underset{-}{time}, \underset{+/-}{other}) \tag{1}$$

A more realistic administrator may possibly be affected by political factors in addition to the economic factors. Examples of such factors may be lobby groups and local politics. An adjusted function for transaction costs could thus look as follows:

$$TC = TC_w + f_2(\underset{+}{POP}, \underset{+}{UNEMP}, \underset{+}{INC}, \underset{+}{LOBBY}, \underset{+}{CP}, \underset{+}{MP}, \underset{+}{KD}, \underset{+}{AGE}, \underset{+}{POPDEN}, \underset{+}{EDU}, \underset{+/-}{other}) \tag{2}$$

A complete econometric specification then takes the following form:

$$TC_{i,t} = \alpha_{i,t} + \beta_{i,t} \cdot \mathbf{x}_{i,t} + \eta_i \cdot \mathbf{z}_i + \varepsilon_{i,t} \qquad i=1,\ldots,21 \qquad t=2000,\ldots,2003 \tag{3}$$

where $\mathbf{x}_{i,t}$ is a vector of the independent variables that vary in both time and space, and $\mathbf{z}_i$ is a vector of independent variables that are constant over the years but vary between counties.

Since the data consists of a short panel (T=4) with relatively few observations in space (N=21), it is not possible to estimate all coefficients.

With a sufficient number of observations over time for each county it would be possible to estimate a separate regression for each county of the following form:

$$TC_{i,t} = \alpha_i + \beta_i \cdot \mathbf{x}_{i,t} + \varepsilon_{i,t} \qquad i=1,\ldots,21 \qquad t=2000,\ldots,2003 \qquad (4)$$

However, since there are only four time periods, that is not possible. What may be estimated is however a specification where the parameters are constant across individuals at a given time, but can vary over time. In that case, a separate regression can be postulated for each cross section:

$$TC_{i,t} = \alpha_t + \beta_t \cdot \mathbf{x}_{i,t} + \varepsilon_{i,t} \qquad i=1,\ldots,21 \qquad t=2000,\ldots,2003 \qquad (5)$$

Now, since all Swedish counties are investigated, a natural first suggestion for the empirical analysis would be to utilize the fixed effects model. The objection to that approach is however that it is necessary to incorporate the variables that are constant over time in the estimation, and thus the fixed effects model can not be utilized. A less obvious estimation procedure is to utilize the random effects model. Although it may seem unlikely that the random effects model would be an appropriate model since the investigated counties cover all Swedish counties, the model could still be appropriate due to omitted variables in the error component. Bresuch and Pagan (1980) present a Lagrange multiplier test for the random effects model based on the OLS residuals to find out if it is an appropriate model despite the presumptions that it is not. Regardless of which independent variables that are included in the analysis, the results of the tests indicate that the random effects model is not appropriate.

Another possible method that could be used to perform the estimation would be the between effects model. In that case though, the data for each county is averaged over the years and the estimation results can thus not describe any changes over time. Even if it is deemed suitable to ignore possible changes over time, the between effects model still produces relatively poor results and thus does not present a feasible estimation alternative.

5.2. Initial specifications

A remaining option is to pool the data and perform a simple OLS analysis.[18] In doing so, it is possible to test if time affects the transaction costs by implementing time dummies. The empirical specification then takes the form:

$$TC_{i,t} = \alpha + \beta \cdot \mathbf{x}_{i,t} + \eta \cdot \mathbf{z}_i + \gamma_1 \cdot D_{2001} + \gamma_2 \cdot D_{2002} + \gamma_3 \cdot D_{2003} + \varepsilon_{i,t} \quad \text{i=1,...,21 t=2000,...,2003} \quad (6)$$

Where, as previously, α is a constant, $\mathbf{x}_{i,t}$ is a vector of independent variables that vary with time and over space, $\mathbf{z}_i$ is a vector of independent variables that are constant over time but vary between countries and D_t are dummies capturing the learning process occurring over time. Initially, the Breusch-Pagan (Breusch and Pagan, 1979)[19] test is performed to test for heteroscedasticity in the sample and the test reveals that there is heteroscedasticity in the sample. Thus, the regressions need to be adjusted for heteroscedasticity, something that in the following is done by applying the weighted least squares procedure and using the variable PLAN as weight.[20,21]

Six regressions of this form are displayed in Table 4,[22] each of them containing seven economic variables in addition to the political variables. The fundamental economic variable is PLAN, joined by PLAN2 to capture the scale effect. The variable PLAN should reasonably have a substantial effect as it expected to drive the level of transaction costs. The variables PGSIZE and QUAL are likewise expected to be significant, the former because of the link between higher inventory needs and the latter due to previous empirical studies. The empirical literature also indicates that there may be significant learning effects that occur over time and therefore the time dummies are included in all regressions. The possible influence of preferences are captured through the inclusion of i) the voter preference variables for

[18] For a discussion on whether or not it is appropriate to pool the data, see Baltagi (2000).

[19] The test is also called the Breusch-Pagan/Cook-Weisberg and Cook-Weisberg. The test was originally derived, and published, independently by Breusch and Pagan (1979), Godfrey (1978) and Cook and Weisberg (1983).

[20] The variable PLAN has been used as analytical weight because preliminary test results indicate that the heteroscedasticity is proportional to that variable. When the regressions are heteroscedasticity adjusted through the weighting procedure, the coefficient of determination increases substantially and the B-P test comes out negative. It will be seen later in the EBA analysis that the use of PLAN as weight comes in very handy as it is the only independent variable that is present in all EBA regressions.

[21] Greene (2007) presents the logic behind the modification well: "The logic of the computation is that observations with smaller variances receive a larger weight in the computations of the sums and therefore have greater influence on the estimates obtained." (Ibid, p. 168).

[22] Several additional combinations of variables have been regressed but are omitted here due to space constraints.

individual parties (sKD, sMP, sCP); ii) the political block variables (LWB, RWB); and iii) the lobby group membership variable (LOBBY).[23]

Table 4: OLS tests for Model specifications.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
PLAN	2509.2 (3.23**)	2968.0 (3.88**)	2766.4 (3.71**)	2810.0 (3.71*)	3615.5 (4.60**)	2439.6 (3.27**)
PLAN2	0.190 (0.36)	-0.123 (0.24)	0.075 (0.15)	-0.046 (0.09)	-0.397 (0.78)	0.212 (0.43)
PSIZE	53.7 (9.64**)	56.0 (9.61**)	50.5 (8.45**)	57.3 (10.17**)	53.5 (9.69**)	55.6 (10.42**)
QUAL	-2 241 408 (6.55**)	-2 553 605 (7.87**)	-2 163 595 (6.14**)	-2 413 773 (7.51**)	-2 587 264 (8.45**)	-2 181 130 (6.72**)
Y2001	131 114 (0.92)	159 303 (1.09)	118 484 (0.83)	172 059 (1.19)	114 546 (0.81)	148 167 (1.07)
Y2002	-859 412 (4.24**)	-848 336 (4.07**)	-961 354 (4.61**)	-878 315 (4.27**)	-739 616 (3.60**)	-1 018 137 (4.95**)
Y2003	-818 237 (3.25**)	-765 477 (2.98**)	-867 576 (3.42**)	-799 490 (3.15**)	-625 881 (2.46*)	-957 878 (3.79**)
sCD	4 437 326 (2.02*)					
sLOBBY		-5 633 318 (0.22)				
sGP			-15 897 862 (2.18*)			
sCP				-2 011 153 (1.59)		
sLWB					2 800 243 (2.39*)	
sRWB						3 490 257 (2.92**)
Constant	829 411 (2.75**)	1 272 425 (2.28*)	1 851 118 (4.62**)	1 345 590 (4.86**)	-270 205 (0.42)	-1 211 549 (1.43)
Obs	84	84	84	84	84	84
Adj R^2	0.93	0.93	0.93	0.93	0.93	0.94

Absolute value of t-statistics in parentheses.
* denotes significant at 5% level; ** denotes significant at 1% level.

Five of the economic variables appear to be significant regardless of which other variables that are included in the regression. The two variables PGSIZE and PLAN have the expected signs: clearly, transaction costs increase with the number of plans that are created. Likewise, it appears that larger pastures imply higher transaction costs. Regarding the variable QUAL, it was previously argued that the standard of the landscape could drive costs in either

[23] In addition, the demographic characteristics variables (INC, AGE, EDU, POPDEN, UNEMP) have also been tested, jointly and individually. None is significant and are not presented here due to space constraints.

direction. It does appear though that transaction costs are lower where the share of semi-natural pastures is large in relation to the share of cultivated pastures, implying that a high quality of pastures decrease the costs. In addition to the three aforementioned variables, the time dummies for 2002 and 2003 are highly significant. The variables are large and negative, indicating that the county administrative boards do become more efficient over time, resulting in reduced transaction costs. The intercept is significant in four cases, all of which are positive.

Regarding the political variables, four of the variables are significant at the five or one percent level. It appears as if the Christian Democrats, the Left Wing Block and the Right Wing Block increase transaction costs, whereas the Green party decreases transaction costs. That a high presence of votes for the environmental party decreases transaction costs is rather surprising as the opposite would have been expected. It may further be of interest to note that even though the variables for the Center Party and Lobby are not significant (although the Center party is almost significant at the 10% level), the coefficients for those are highly negative as well. Thus, it may be the case that a high prevalence of environmental preferences in a county results in less resources being spent on transaction costs whereas a high preference for other political sympathies results in more resources being spent on transactions.

Although the results are interesting, not particularly inconclusive and the regressions evidently capturing a large share of the variability (the adjusted R^2 is 0.93 – 0.94 in all regressions) it would be appealing to strengthen the results further. Since this paper is exploratory, it is desirable to establish if the parameters are robust with respect to model specifications. Therefore, in order to improve the strength of the results and especially establish if the political variables indeed are robust, and extreme bounds analysis will be performed. The EBA methodology is discussed in section 5.3 and the results of the analysis are presented in section 5.4.

5.3. Testing for Robustness, Extreme Bounds Analysis

The methodology used above with the testing of several alternative specifications with various independent variables is a common practice in several scientific fields, particularly those where theory is not always perfectly guiding the choice of model specification or variable inclusion. Often authors suggest a more or less wide range of variables that are considered to (possibly) have an impact on the dependent variable. The procedure is then commonly one of two alternatives. The process either begins with the broadest possible specification, which then through a series of tests is limited by piecewise discarding of variables that fail to satisfy some (predetermined) criteria. Contrasting to this bottom-up method is the top-down method where the process begins with a limited set of variables where after variables are tested and added to the specification if they pass the test. Both procedures are clearly unsatisfactory as they essentially are *ad hoc* procedures that could lead to inclusion of different variables depending on e.g. the order of the tests. The results of studies attempting to investigate a specific phenomena sometimes differ substantially and many authors do not offer thorough analyses of the sensitivity of their conclusions with respect to model specifications. The problem becomes especially acute when theory does not guide the econometrics thoroughly. That is for example still a long-standing problem with econometric research in the field of growth theory. Likewise, the border area of transaction costs economics and political economics also leaves the field open to some *ad hoc* formulations regarding which variables that should be included in studies.

Over the years some alternative methods that could limit the above mentioned problems have evolved. In this paper, one version of the extreme bounds analysis originating with Leamer (1978), and subsequently discussed in Leamer and Leonard (1982) and Leamer (1983, 1985), will be utilized. Previous applications of the EBA have been related to growth theory, as in e.g. Levine and Renelt (1992), Temple (2000), Sturm and Haan (2005), Radulescu and Barlow (2002), Pitlik (2002) and Fölster and Henrekson (2001); but also to corruption studies (Serra 2006), determinants of intra industry trade (Torstensson, 1996) and foreign direct investment (Chakrabarti, 2001) as well as trade creation in the presence of regional trade arrangements (Ghosh and Yamarik, 2004). Leamer (1983) exemplified the methodology with an empirical application to the suggested deterrent effects of capital punishment. Common to all these studies is that there is a discussion in the research community whether or not various factors influence the dependent variable in a certain direction. In the growth literature, for example, a very wide range of factors have been suggested to contribute to, or damage, economic growth (see e.g. Durlauf and Quah (1999) for an overview of variables that have been suggested). In short, the central difficulty, which also applies to this study, is that many different models may seem reasonable given the data but yield different, or even opposite, conclusions about the parameters of interest.

The basic idea laying the foundation for the extreme bounds analysis is that the researcher has an idea on some variables that definitely should be included in an analysis. These variables are commonly called *free* variables. The reason why the researcher believes those variables should be included in the regressions could for example be due to prior empirical consensus in the research community or a solid theoretical foundation. In addition to the free variables there are also some variables that the researcher considers to be doubtful. One reason why the variables may be doubtful is that prior empirical investigations have shown inconclusive results. In our case, the EBA then uses an econometric specification of the following form:

$$TC = \alpha_j + \omega_j \cdot M + \beta_j \cdot F + \gamma_j \cdot Z_j + \mu \qquad (7)$$

Where the dependent variable *TC* is, as previously, transaction costs, *M* is the variable that always is included in the regressions, in our case the number of maintenance plans created (PLAN),[24] *F* is the variable of interest and $Z_j \in N$ is a vector of up to three doubtful variables taken from the pool *N* of doubtful variables that may be related to the dependent variable, and μ is the error term.[25] To apply the EBA, the specification is regressed for all possible combinations of $Z_j \in N$ resulting in a total number of 1140 combinations.[26] The extreme bounds test is applied on the variable *F* and for each model *j* one finds an estimate β_j and a standard deviation σ_j. The EBA criteria are as follows: If the *lower extreme bound* for β, which is equal to the lowest value for β_j achieved in any of the regressions *minus* two standard deviations ($\min\beta_j - 2\sigma_j$), is negative, whereas the *upper extreme bound* for β, which is equal to the highest value for β_j achieved in any of the regressions *plus* two standard deviations ($\max\beta_j + 2\sigma_j$), is positive, then the variable *F* is considered to be fragile, i.e. not robustly related to *TC*. If, on the other hand, the lower extreme bound and the upper extreme bound share the same sign, then the variable *F* is considered to be robust. Henceforth, this criterion will be referred to as the *strong* EBA criterion.

The criterion above is indeed very stringent as it implies that if there is *one* regression where the sign of the coefficient β changes, then the variable *F* is not considered to be robust. The criterion has been the focus of e.g. Sala-i-Martin (1994, 1997a,b) and Granger

[24] In most previous studies utilizing the EBA method more than one *M* variable is included. This study diverges from those in that respect but for good reasons since it is reasonable to argue *ex ante* that only the variable PLAN must be included.

[25] The decision to use three doubtful variables is of course arbitrary but the main rationale for choosing three *Z* variables and not more is to limit multicolinearity problems (e.g. Leamer and Leonard (1982)). Furthermore, with time it has become the standard practice to use three variables. I have experimented with the two and four Z variables as well, but that does not particularly change the results.

and Uhlig (1990) who both criticize the criterion on the grounds that it is too stringent. The main criticism by Granger and Uhlig is that the extreme values may come from combinations of variables that most economists would find unreasonable. They consider this problem by defining R^2-max as the R^2-value that is achieved by running a regression using all the free and doubtful variables at the same time. Then, it might be the case that the extreme bounds arise from variable combinations that achieve R^2-values very much lower than R^2-max and that those combination may be considered irrelevant because of the poor goodness-of-fit. Their suggestion is to rank the R^2-values achieved and include the rank in the presented statistics, thereby allowing a continuum of choices between Leamer's extreme bounds (any R^2) and classical econometrics (R^2-max). Sala-i-Martin's (1997a,b) suggestion is similar insofar as he also suggests that it may be unreasonable to discard variables just because a single regression (out of possibly hundreds) fails to be significant with the right sign. Instead, he suggests that the variables of interest *F* should be ranked according to the share of variable combinations of *Z* that display significant regression results. Then one could set a weaker criterion allowing less than 100% of the regressions being significant with the right sign. This suggestion will be taken into account by following e.g. Fölster and Henrekson (2001) and Serra (2006) and presenting the fraction of regressions that are significant at the 5% level. Henceforth, this criterion will be referred to as the *weak* EBA criterion.

Another objection to the EBA procedure is that the initial structuring of variables into the *M* and *Z* vectors are somewhat arbitrary. It could thus be questioned if it is not so that one *ad hoc* procedure has been exchanged for another. However, most researchers would probably agree that often we can be rather sure that some variables do influence the dependent variable substantially while we with good reason can be more uncertain of the effect of others. There is furthermore no apparent reason why standard model selection procedures, as stated by Temple (2000), should not be allowed to be applied in advance to identify the most relevant variables. Furthermore, in the case of this paper, there is indeed one variable that most certainly has an effect on transaction costs, namely the number of plans created (PLAN). With good reason, all other variables may be considered doubtful.

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[26] $\binom{n}{k} = \frac{n!}{k! \cdot (n-k)!} = \binom{20}{3} = 1140$

5.4. Extreme Bounds Analysis, Results

Although there are strong reasons to believe that the *M* variable is robust and always should be included in the regressions, it may still be reasonable to perform an EBA on that variable as presented in Table 5 in order to verify that the *M* variable indeed is robust.

Table 5: EBA, M variable

```
Table EBA HW=PLAN on var PLAN
```

F var	Coef	t-val	P-val	Z-var		Sign (%)	ROB
Min	3065	12.56	0.00	PGSIZE, y2002, y2003	-	0	
PLAN			0.00		Σ	100	R
Max	7108	7.59	0.00	PLAN2, INC, sLWB	+	100	

For each F variable there are three rows. The upper/lower rows labeled Min and Max display the lower/upper extreme bound for the variable F. The upper and lower extreme bound coefficients are displayed with (absolute) t-values and p-values. For each F variable there are three values in the column Sign. The upper(lower) value denotes the share of regressions that is negative(positive) and significant at the 5% level. The center value is the total share of regressions that is significant, irrespective of sign. Note that the numbers in the "Sign" column may not add up due to rounding. The column labeled Z denotes the variables that result in the lower/upper extreme bounds. R/F denotes if the variable F is Robust (R) or Fragile (F).

Evidently, since 100% of the 1330 regressions performed are robust, the variable PLAN clearly fulfills the EBA criteria and is robustly related to transaction costs.

The results of the EBA analysis of all doubtful variables is presented in Appendix 3. Very few of the regressions could be classified as robust and as a matter of fact, none of the variables fulfills the strong EBA criterion whereas only 2 of the 21 variables satisfy the weak EBA criterion. The first of these variables, aPGSIZE, is positive and significant in 96.9% of the 1140 regressions run. The implication is that if the average pasture size in a county is large, then the transaction costs increase, essentially implying that cost per plan increases when average pasture size increases. The other variable that passes the weak EBA criterion is PGNO with 96.8% of the regressions being negative and significant. It thus does appear that if there are many pastures in a county, transaction costs decrease. The reason for this should be that if pastures are close to one another, staff transportation costs will decrease. None of the political variables is significant.[27]

In the preceding section, one important aspect has not been taken into account. As can be seen in the correlation matrix in Appendix 5 there is a high degree of correlation between some particular variables. For example, the correlation between QUAL and PGSIZE is 0.65.

[27] It should be mentioned though that two of the political variables are fairly close. The coefficient for MP is negative and significant in 85% of the regressions and the coefficient for KD is significant and positive in 86.7%. Since the variables do not pass neither the weak nor the strong EBA criterion, the results are not further commented upon here, but the variables may be interesting to keep in mind for further research.

Often, a high level of correlation tends to decrease the robustness of the relationship between the independent and dependent variables when additional independent variables that are (highly) correlated with the dependent variable are included. In order to decrease the multicollinearity problem, I follow the suggestion by Beugelsdijk *et al*. (2004) and condition the *F* variables by a 0.5 correlation criterion and rerun the EBA. Thus, for each *F* variable, the *Z* variables that have an (absolute) correlation higher than 0.5 with the *F* variable are discarded.

The results of the multicollinearity adjusted EBA are presented in Appendix 4, which follows the structure of Appendix 3 however with an additional column indicating which variables that are excluded because of the correlation criterion. Now, the *M* variable PLAN still passes the strong EBA criterion[28], and the variables aPGSIZE and PGNO still pass the weak EBA criterion.[29] In addition, two new variables pass the strong EBA criterion. These are PLAN2 and PGSIZE, which are both positive. The variable PGSIZE essentially captures the same effect as aPGSIZE, i.e. the larger the pastures the higher the transaction costs per plan. The finding that PLAN2 is positive is somewhat surprising though. On the other hand, the coefficient is very low (the upper extreme bound has a value of only 3.4).

To summarize the EBA results, the extreme bounds analysis does not verify the robustness of all the variables that came out as significant in the initial analysis. Indeed, all the political variables are fragile according to both the strong and weak EBA criterion. In addition to that, the variable measuring the general quality of pastures, QUAL, is not robust. Likewise, it appears as if the organizational learning process captured by the time dummies was only apparent. When the EBA analysis is performed, the time dummies become fragile.

[28] And the regressions resulting in the extreme bounds display substantially lower p-values.

[29] For the latter two, the robustness increases as a larger share of the regressions are significant with the right sign.

6. Discussion and concluding remarks

This paper has investigated the determinants of the transaction cost related to the Swedish agri-environmental policy measure for maintenance of pastures. The originating hypothesis was that two different set of factors influence transaction costs, *economic* factors and *political* factors. It was argued that the economic factors should influence transaction costs as these are factors that the administrators can not really affect. It was also argued that, given the large variation in costs between countries, there may be other, political, factors that influence the transaction costs although they should not. In order to test the hypotheses, heteroscedasticity adjusted OLS regressions of various specifications were initially performed. These preliminary results indicated *inter alia* that political configurations at the local level might influence the level of transaction costs. It appeared for example that counties where a relatively large fraction of voters voted on the Green party had lower transaction costs than those where a large fraction voted on either Christian Democrats, the left wing block or the right wing block.

In order to test if these results were robust or not, a modified extreme bounds analysis was performed. In the EBA, all the political variables came out fragile, leaving only a set of five economic variables robust. The results showed that the free variable, i.e. the number of maintenance plans created, clearly influenced the level of transaction costs. In addition to that, the size of the pastures had the expected influence; the larger the pastures, the higher the level of transaction costs. One of the economic variables, the number of existing pastures in a county, contributed to decreases in transaction costs. An explanation for this could be that if there are many pastures in a county, the pastures tend to be closer to one another, thus reducing transaction costs.

To conclude, it appears as if level of the transaction costs investigated in this paper are not related to political factors but only to economic factors and that administrators at the county levels are not unduly affected by local politics and public preferences. As far as is possible to tell from this study, the county administrators seem to behave as Weber's ideal bureaucrats. The reader should finally be reminded that it is a very specific share of the total transaction costs of the agri-environmental policy measures related to pasture maintenance that has been investigated in this paper. Although being highly important for implementation purposes and cost-efficiency, the entire chain of transaction costs should preferably be investigated. That task is however left to later research.

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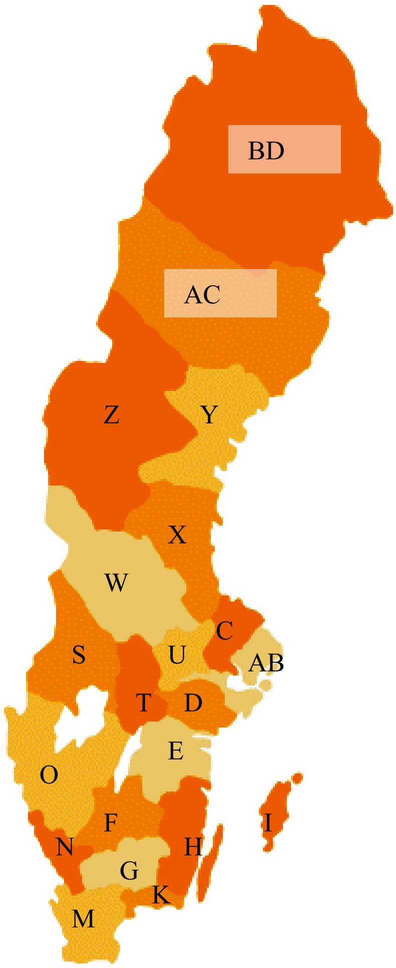
Appendixes:

Appendix 1: Map of Sweden with county locations.



Appendix 2: TC statistics.

County		2000	2001	2002	2003
Stockholms, AB	Tot / Avr TC	443448 / 4183	1468986 / 4913	423588 / 5648	366280 / 7793
	No plans	106	299	75	47
Uppsala, C	Tot / Avr TC	1087793 / 3442	1700751 / 3848	351232 / 3193	332602 / 3823
	No plans	316	442	110	87
Södermanlands, D	Tot / Avr TC	1874979 / 5403	1897205 / 4791	498621 / 4841	391671 / 4663
	No plans	347	396	103	84
Östergötland, E	Tot / Avr TC	2520208 / 4453	5180012 / 4600	729720 / 3475	929471 / 3659
	No plans	566	1126	210	254
Jönköping, F	Tot / Avr TC	1862967 / 6900	4074820 / 4307	1025754 / 6978	549887 / 5728
	No plans	270	946	147	96
Kronoberg, G	Tot / Avr TC	2772279 / 4659	1710660 / 5002	341682 / 5891	252488 / 4856
	No plans	595	342	58	52
Kalmar, H	Tot / Avr TC	4706659 / 6412	6369621 / 5728	1266127 / 4292	793832 / 4642
	No plans	734	1112	295	171
Gotland, I	Tot / Avr TC	1161044 / 4161	3167565 / 2575	507081 / 5122	449756 / 5766
	No plans	279	1230	99	78
Blekinge, K	Tot / Avr TC	1636353 / 6417	1938487 / 2951	629125 / 2255	319272 / 4434
	No plans	255	657	279	72
Skåne, M	Tot / Avr TC	3647484 / 5744	4965794 / 3929	1475154 / 3242	820523 / 6312
	No plans	635	1264	455	130
Halland, N	Tot / Avr TC	1573587 / 5142	2505233 / 3983	618412 / 6310	455518 / 6327
	No plans	306	629	98	72
Västra Götaland, O	Tot / Avr TC	4018838 / 4051	5202114 / 4353	1070004 / 5095	1236552 / 5888
	No plans	992	1195	210	210
Värmland, S	Tot / Avr TC	554535 / 6524	873501 / 6878	152793 / 8042	119120 / 7941
	No plans	85	127	19	15
Örebro, T	Tot / Avr TC	967464 / 5560	1618856 / 5582	389890 / 5734	297096 / 4792
	No plans	174	290	68	62
Västmanland, U	Tot / Avr TC	740000 / 3410	672091 / 3537	130700 / 2420	109352 / 2377
	No plans	217	190	54	46
Dalarna, W	Tot / Avr TC	638254 / 4872	1114645 / 6797	397782 / 6314	77004 / 2962
	No plans	131	164	63	26
Gävleborg, X	Tot / Avr TC	306815 / 5114	2530154 / 7398	413078 / 7944	318736 / 6782
	No plans	60	342	52	47
Västernorrland, Y	Tot / Avr TC	789486 / 5981	319010 / 1697	219748 / 6104	339534 / 12126
	No plans	132	188	36	28
Jämtland, Z	Tot / Avr TC	1158566 / 5266	77567 / 570	24284 / 759	28804 / 565
	No plans	220	136	32	51
Västerbotten, AC	Tot / Avr TC	717461 / 4751	726441 / 4779	267523 / 5460	283545 / 5907
	No plans	151	152	49	48
Norrbotten, BD	Tot / Avr TC	820000 / 7523	312900 / 6135	71265 / 5090	127155 / 5528
	No plans	109	51	14	23

Source: Swedish Board of Agriculture.

Appendix 3: Results of extreme bounds analysis.

F var	Coef	t	p	Z		Sign	R/F
Min	-2.40	3.65	0.00	UNEMP INC BEFTAT	-	66.8	
PLAN2					Σ	66.8	F
Max	-0.29	0.55	0.58	aPGSIZE KD y2002	+	0	
Min	3.78	0.55	0.58	aPGSIZE LOBBY EDU	-	0	
PGSIZE					Σ	88.4	F
Max	54.51	7.22	0.00	aPGSIZE PGNO y2003	+	88.4	
Min	-1.53e+05	3.18	0.00	PGNO UNEMP PGSIZE	-	1.5	
aPGSIZE					Σ	98.4	R
Max	2.24e+05	6.40	0.00	LWB Alder EDU	+	96.9	
Min	-129.40	6.76	0.00	QUAL POP C	-	96.8	
PGNO					Σ	96.8	R
Max	-8.58	0.70	0.48	KD CSIZE aPGSIZE	+	0	
Min	-2.94e+06	7.29	0.00	POP BEFTAT PGSIZE	-	36.5	
QUAL					Σ	48.2	F
Max	2.02e+06	3.72	0.00	POP KD PGNO	+	11.8	
Min	-9.22	1.79	0.08	LWB PGSIZE QUAL	-	0	
CSIZE					Σ	11.0	F
Max	19.68	3.20	0.00	C RWB PLAN2	+	11.0	
Min	-4.49E+05	2.48	0.02	EDU LWB aPGSIZE	-	0.4	
AGE					Σ	45.6	F
Max	7.41E+05	5.22	0.00	LOBBY EDU KD	+	45.3	
Min	-3.36E+05	1.63	0.11	LWB Y2002 aPGSIZE	-	0	
UNEMP					Σ	31.4	F
Max	9.74E+05	5.37	0.00	LOBBY KD Y2003	+	31.4	
Min	-1.29E+05	3.90	0.00	LOBBY C BEFTAT	-	34.5	
EDU					Σ	35.9	F
Max	1.61E+05	4.00	0.00	KD Y2002 AGE	+	1.4	
Min	-9.79E+03	2.37	0.02	POP LOBBY MP	-	0.7	
INC					Σ	3.7	F
Max	2.01E+04	2.69	0.01	BEFTAT PLAN2 UNEMP	+	3.0	
Min	-1.14E+04	3.34	0.00	POP aPGSIZE INC	-	6.8	
BEFTAT					Σ	7.2	F
Max	5518.9	2.04	0.04	KD C LWB	+	0.4	
Min	-0.60	3.67	0.00	C PGSIZE QUAL	-	1	
POP					Σ	7.8	F
Max	0.58	2.26	0.03	EDU PLAN2 BEFTAT	+	6.8	
Min	-1.02E+7	0.38	0.71	PGSIZE aPGSIZE PGNO	-	0	
sLOBBY					Σ	68.5	F
Max	2.15E+08	6.29	0.00	MP UNEMP EDU	+	68.5	
Min	-9.86E+04	0.03	0.97	MP y2002 LOBBY	-	0	
sKD					Σ	86.7	F
Max	1.81E+07	6.11	0.00	AGE UNEMP EDU	+	86.7	
Min	-5.64E+07	4.68	0.00	C RWB LOBBY	-	85.0	
sMP					Σ	85.0	F
Max	1.29E+0	1.27	0.21	aPGSIZE Alder KD	+	0	
Min	-8.38E+06	4.21	0.00	PGSIZE EDU LOBBY	-	9.9	
sC					Σ	24.6	F
Max	1.32E+07	3.72	0.00	RWB LWB POP	+	14.6	
Min	-5.64E+06	1.69	0.10	aPGSIZE KD C	-	0.1	
sRWB					Σ	52.2	F
Max	1.42E+07	4.91	0.00	CSIZE UNEMP C	+	52.1	
Min	-2.43E+06	1.20	0.23	PGNO QUAL AGE	-	0	
sLWB					Σ	34.0	F
Max	6.81E+06	3.27	0.00	BEFTAT KD C	+	34.0	
Min	-4.74E+05	2.03	0.05	Y2002 INC BEFTAT	-	5.4	
Y2001					Σ	5.6	F
Max	3.30E+05	2.04	0.04	PGSIZE QUAL INC	+	0.2	
Min	-1.07E+06	4.58	0.00	Y2003 PGSIZE RWB	-	39.5	
Y2002					Σ	39.5	F
Max	-2.13E+04	0.09	0.93	KD UNEMP LOBBY	+	0	
Min	-9.77E+05	3.57	0.00	PGSIZE RWB Y2002	-	3.2	
Y2003					Σ	3.2	F
Max	2.90E+05	0.88	0.38	PLAN2 QUAL LWB	+	0	

For each F variable there are three rows. The upper/lower rows labeled Min and Max display the lower/upper extreme bound for the variable F. The upper and lower extreme bound coefficients are displayed with (absolute) t-values and p-values. For each F variable there are three values in the column Sign. The upper(lower) value denotes the share of regressions that is negative(positive) and significant at the 5% level. The center value is the total share of regressions that is significant, irrespective of sign. Note that the numbers in the "Sign" column may not add up due to rounding. The column labeled Z denotes the variables that result in the lower/upper extreme bounds. R/F notes if the variable F is Robust (R) or Fragile (F).

Appendix 4: Results of extreme bounds analysis, multicollinearity adjusted.

F var	Coef	t	p	Z	Excluded		Sign	R/F
Min	3547.6	18.55	0.00	aPGSIZE Y2002 Y2003		-	0	
PLAN					PLAN2, PGSIZE, y2001	Σ	100	R
Max	4509.2	22.97	0.00	PGNO C LWB		+	100	
Min	1.92	10.68	0.00	PGSIZE Y2002 Y2003		-	0	
PLAN2					PLAN,	Σ	100	R
Max	3.37	13.75	0.00	PGNO POP Y2001		+	100	
Min	17.84	2.84	0.01	PLAN2 LOBBY MP		-	0	
PGSIZE					PLAN, aPGSIZE PGNO	Σ	100	R
Max	85.42	9.13	0.00	C KD RWB	QUAL	+	100	
Min	4.78E+04	1.27	0.21	UNEMP LOBBY MP		-	0	
aPGSIZE					PGSIZE	Σ	99.9	R
Max	2.24E+05	6.40	0.00	LWB AGE EDU		+	99.9	
Min	-80.13	5.78	0.00	CSIZE C 2001		-	97.5	
PGNO					PGSIZE QUAL	Σ	97.5	R
Max	-8.58	0.70	0.48	aPGSIZE KD CSIZE		+	0	
Min	-1.26E+06	3.64	0.00	aPGSIZE C LWB		-	31.9	
QUAL					PGSIZE PGNO	Σ	31.9	F
Max	2.56E+05	0.56	0.58	CSIZE KD RWB		+	0	
Min	-4.13	0.59	0.56	PGNO BEFTAT POP		-	0	
CSIZE					LWB	Σ	12.9	F
Max	19.68	3.20	0.00	PLAN2 C RWB		+	12.5	
Min	-1.02E+05	1.12	0.27	PGSIZE UNEMP MP		-	0	
AGE					EDU BEFTAT POP LWB	Σ	48.8	F
Max	4.94E+05	5.00	0.00	LOBBY C 2001		+	48.2	
Min	-2.52E+05	1.33	0.19	AGE aPGSIZE Y2002		-	0	
UNEMP					LWB	Σ	34.7	F
Max	9.74E+05	5.37	0.00	LOBBY KD Y2003		+	34.7	
Min	-1.26E+05	4.09	0.00	CSIZE LOBBY C		-	37.9	
EDU					AGE INC BEFTAT POP	Σ	37.9	F
Max	3.86E+04	1.79	0.08	PGSIZE KD LWB		+	0	
Min	-9.10E+03	2.18	0.03	QUAL LOBBY RWB		-	1	
INC					EDU BEFTAT POP	Σ	2.5	F
Max	8451.49	2.05	0.04	AGE Y2001 Y2002		+	1.5	
Min	-4.30E+03	2.87	0.01	QUAL APGISZE LOBBY		-	4.9	
BEFTAT					AGE EDU INC POP C	Σ	5.2	F
Max	4021.5	2.49	0.01	PGSIZE KD LWB	RWB	+	0.3	
Min	-0.43	2.97	0.00	QUAL PGSIZE RWB		-	1.8	
POP					AGE EDU INC BEFTAT	Σ	3.5	F
Max	0.33	2.15	0.03	PGSIZE PLAN2 LWB	C	+	1.8	
Min	-1.02E+07	0.38	0.71	PGSIZE PGNO aPGSIZE		-	0	
sLOBBY					LWB	Σ	63.7	F
Max	2.15E+08	6.29	0.00	EDU UNEMP MP		+	63.7	
Min	-9.86E+04	0.03	0.97	MP y2002 LOBBY		-	0	
sKD						Σ	86.7	F
Max	1.81E+07	6.11	0.00	AGE UNEMP EDU		+	86.7	
Min	-5.64E+07	4.68	0.00	C RWB LOBBY		-	85.0	
sMP						Σ	85.0	F
Max	1.29E+06	1.27	0.21	aPGSIZE Alder KD		+	0	
Min	-8.38E+06	4.21	0.00	LOBBY EDU PGSIZE		-	13.2	
sC					BEFTAT POP RWB	Σ	22.1	F
Max	5.05E+06	2.70	0.01	UNEMP PGNO CSIZE		+	8.8	
Min	-5.64E+06	1.49	0.10	APGSIZE C KD		-	0.1	
sRWB					BEFTAT	Σ	49.2	F
Max	1.42E+07	4.91	0.00	C UNEMP CISZE		+	49.1	
Min	-1.78E+06	1.00	0.32	EDU QUAL PGNO		-	0	
sLWB					CSIZE AGE UNEMP	Σ	41.2	F
Max	6.81E+06	3.27	0.00	C KD BEFTAT	LOBBY	+	41.2	
Min	-4.74E+05	2.03	0.05	Y2002 INC BEFTAt		-	5.4	
Y2001						Σ	5.6	F
Max	3.30E+05	2.04	0.04	PGSIZE QUAL INC		+	0.2	
Min	-1.07E+06	4.58	0.00	Y2003 PGSIZE RWB		-	39.5	
Y2002						Σ	39.5	F
Max	-2.13E+04	0.09	0.93	KD UNEMP LOBBY		+	0	
Min	-9.77E+05	3.57	0.00	PGSIZE RWB Y2002		-	3.2	
Y2003						Σ	3.2	F
Max	2.90E+05	0.88	0.38	PLAN2 QUAL LWB		+	O	

For each F variable there are three rows. The upper/lower rows labeled Min and Max display the lower/upper extreme bound for the variable F. The upper and lower extreme bound coefficients are displayed with (absolute) t-values and p-values. For each F variable there are three values in the column Sign. The upper(lower) value denotes the share of regressions that is negative(positive) and significant at the 5% level. The center value is the total share of regressions that is significant, irrespective of sign. Note that the numbers in the "Sign"

column may not add up due to rounding. The column labeled Z denotes the variables that result in the lower/upper extreme bounds. R/F notes if the variable F is Robust (R) or Fragile (F).
* Despite high correlation, PLAN has not been excluded in this regression since it is an essential variable.

Appendix 5: Correlation Matrix.

	TC	PLAN	PLAN2	PGSIZE	aPGSIZE	PGNO	QUAL	CSIZE	Alder	UNEMP	EDU	INC	BEFTAT	POP	sLOBBY
TC	1.0000														
PLAN	0.9474	1.0000													
PLAN2	0.8861	0.9571	1.0000												
PGSIZE	0.5447	0.5077	0.4558	1.0000											
aPGSIZE	0.2913	0.2374	0.1857	0.5241	1.0000										
PGNO	0.2051	0.2834	0.2905	0.5581	-0.2156	1.0000									
QUAL	0.2032	0.2563	0.2263	0.6475	0.2496	0.7451	1.0000								
CSIZE	-0.2209	0.2358	-0.1530	-0.2975	-0.1229	-0.2613	-0.3208	1.0000							
Alder	-0.1419	-0.1793	-0.1239	-0.0034	-0.0553	-0.0553	-0.0872	0.1667	1.0000						
UNEMP	-0.1491	-0.1933	-0.1299	-0.1775	0.0630	-0.2089	-0.1056	0.3740	0.4703	1.0000					
EDU	0.0139	0.0598	0.0448	-0.0464	0.1880	-0.1190	-0.0218	0.0132	-0.8475	-0.2787	1.0000				
INC	-0.1329	-0.1362	-0.1102	-0.1603	0.0754	-0.2297	-0.2613	-0.2046	-0.4773	-0.2319	0.5913	1.0000			
BEFTAT	0.0678	0.0725	0.0523	0.0131	0.2230	-0.0745	-0.0516	-0.3164	-0.5791	-0.2135	0.6524	0.8782	1.0000		
POP	0.2124	0.2035	0.2044	0.1126	0.2172	-0.0877	-0.1810	-0.1102	-0.5364	-0.1196	0.6377	0.7260	0.8335	1.0000	
sLOBBY	0.1290	0.1230	0.0657	0.1851	0.1343	0.0020	-0.0126	-0.4188	-0.4796	-0.4363	0.4160	0.3649	0.3573	0.2970	1.0000
sKD	0.3045	0.2349	0.1599	0.1281	-0.0204	-0.1234	-0.1281	-0.3289	-0.1904	-0.4433	-0.1388	0.0076	-0.0238	0.0261	0.1278
sMP	-0.0574	0.0263	0.0294	-0.0824	-0.2466	0.2674	0.1907	0.0145	-0.2246	0.0193	0.2430	-0.0181	0.0465	0.0735	0.3041
sC	-0.0161	-0.0053	0.0211	0.2045	-0.1942	0.3977	0.1216	0.0340	0.4158	-0.1170	-0.4713	-0.4675	-0.5104	-0.5163	0.1395
sRWB	0.0963	0.0588	0.0116	-0.0080	0.2496	-0.3381	-0.0585	-0.4400	-0.3961	-0.1608	0.3696	0.4678	0.5194	0.4589	0.0961
sLWB	-0.3207	-0.3483	-0.2859	-0.3185	-0.0835	-0.3153	-0.0779	0.5326	0.6120	0.6059	-0.3928	-0.3815	-0.4969	-0.4350	-0.5728
y2001	0.4626	0.5126	0.4785	0.0000	-0.0000	0.0000	0.0000	0.0000	-0.0300	-0.1488	0.0000	0.0123	-0.0009	-0.0010	0.0045
y2002	-0.2927	-0.2700	-0.2224	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0414	-0.2690	0.0000	0.0587	0.0009	0.0007	0.0004
2003	-0.3412	-0.3440	-0.2482	0.0000	0.0000	0.0000	0.0000	0.0000	0.1078	0.2323	0.0000	0.1888	0.0028	0.0027	-0.0083

	sKD	sMP	sC	sRWB	sLWB	y2001	y2002	y2003
sKD	1.0000							
sMP	-0.3976	1.0000						
sC	-0.1184	0.0220	1.0000					
sRWB	0.4792	-0.2967	-0.7375	1.0000				
sLWB	-0.3002	-0.0324	-0.1040	-0.1591	1.0000			
y2001	0.0406	0.0914	-0.0303	-0.0540	0.0003	1.0000		
y2002	0.0406	0.0914	-0.0303	-0.0540	0.0003	-0.3333	1.0000	
y2003	-0.1217	-0.2742	0.0909	0.1619	-0.0008	-0.3333	-0.3333	1.0000

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