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Determinants of Agricultural Protection from an International Perspective

The Role of Political Institutions

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ABSTRACT

This paper explores the role of political institutions in determining the ability of agriculture to avoid taxation in developing countries or attract government transfers in industrialized countries. The utilized model is based on a probabilistic voting environment, wherein rural districts are less ideologically committed than urban districts in industrialized countries, and the reverse is true in developing countries. As a consequence, in industrialized (developing) countries rural (urban) districts are pivotal in determining the coalition that obtains a majority, whereas urban (rural) districts are pivotal within the majority itself. In bargaining at the level of the legislature, this generates a conflict between a government that tends to favor rural (urban) districts, and a parliamentary majority that is dominated by urban (rural) concerns. As district size grows and the electoral system converges to a purely proportional system, both of these biases are attenuated. Overall, we see opposing nonlinear relationships between district size and agricultural subsidies on the one hand and district size and taxation on the other. In developing countries, taxation of agriculture first increases and then decreases with district magnitude; in industrialized countries, agricultural subsidization first increases and then decreases with district magnitude. Moreover, the impact of district magnitude on the level of agricultural subsidization is attenuated in presidential versus parliamentary systems, while the level of agricultural taxation is amplified in presidential systems. In the present paper, these findings are first theorized and then empirically confirmed by a cross-country analysis of data from 37 countries over a 20-year period.

Keywords: political economy of agricultural protectionism, political institutions

JEL-classification: D 780, H 730, Q 180

1. INTRODUCTION

It has long been a well-established policy pattern that industrialized countries subsidize their agricultural sector, while developing countries tax this sector (Bale and Lutz, 1981; Anderson, 1995; Krueger et al., 1988). Reducing the taxation of agriculture in developing countries has been a main goal of many structural adjustment policies. However, a recent multi-country study led by Anderson (2008) found that although the anti-agricultural bias has indeed been reduced on average in most regions, it still exists. Moreover, the anti-trade bias of agricultural policies has remained. The study also found that, as economic development proceeds, some countries have switched from agricultural taxation to protection, rather than stopping at neutral policies (Anderson, 2008). This pattern of taxation-protection switching has been characterized as a development paradox. Most existing studies on political economy have used classical public choice approaches to examine why inefficient (biased) agricultural polices persist in developing (industrialized) countries (Peltzman, 1976; Zusman, 1976; Becker, 1983; Gardner, 1987; Krueger et al., 1988; Miller, 1991; Tyers and Anderson, 1992; Swinnen, 1994). These studies propose that agricultural policies are the result of political bargaining (competition) among various social groups for income/welfare redistribution. The final policy outcome is determined by both the relative political bargaining power of the agrarian and non-agrarian groups and the economically-determined transformation of welfare among these groups. As both the political bargaining power of a particular social group and its political welfare transformation increases, ceteris .paribus so does the income politically redistributed towards this group in the political economy equilibrium.

Although the various political economy approaches differ in the details of their modeling strategies, they basically highlight three components as being key to determining agricultural protection levels in the political economy equilibrium, namely: (1) farmers' cost of organization to overcome the free-rider problem inherent in collective political action; (2) the cost of income redistribution, i.e. deadweight costs; and (3) the relative income of the rural and urban populations. Accordingly, the empirical studies have mainly focused on various demographic and economic variables influencing the deadweight and organizational costs (Gardner, 1987; Tyers and Anderson, 1992; Anderson, 1995).

The existing political economy models certainly contribute to our understanding of biased agricultural policies, but some puzzles remain yet unsolved. In particular, the prior studies fail to explain the variation of agricultural protection levels across nations with relatively similar economic and demographic structures (e.g. in industrialized versus developing countries that are otherwise similar).

At the theoretical level, the classical public choice models lack a micro political foundation of political behavior, i.e. these approaches take political decision-making as a black box by assuming that a unitary political actor maximizes a given political preference, voter support, or influence function. In contrast, more recent approaches open up this a black box by explicitly modeling the political decision-making process as an interaction between a set of individually rational political actors. Within these new political economy approaches, biased policies result from specific incentive problems, where political institutions are considered as key factors influencing the individual incentives of the political actors. These new approaches suggest that, beyond general economic factors determining deadweight costs and demographic factors determining the cost of organization, political institutions are the main factors explaining the observed variances of economic policies across countries (Persson and Tabellini, 2002). For example, Persson and Tabellini (2002) and Milesi- Ferretti et al. (2002) nicely demonstrate how the electoral system and the organization of the legislature determine general macroeconomic policies. Nowadays it is commonly accepted that political institutions have a significant impact on policy outcome (Weingast et al., 1981; Miller, 1997; Binswanger and Deininger, 1997). Even international organizations such as the World Bank and the International Monetary Fund take governance criteria increasingly into account when granting financial aid.

However, there is still a relative lack of theoretical and empirical analyses of the political economy of agricultural policy, especially with regard to specific political institutions (Beghin and Fafchamps, 1995). Some recent analyses have attempted to cover this gap (for example, see Beghin and

Kherallah, 1994; Beghin et al., 1996; Olper, 2001; Swinnen et al., 2001; Henning, 2004), but most of these studies analyze the general impact of democracy on agricultural protectionism by comparing agricultural protection levels in democratic and autocratic countries. Moreover, all of these studies apply a heuristic approach based on quasi-reduced form estimation, and do not provide an explicit theory explaining how political institutions influence agricultural protection. The one exception to this is Henning and Struve (2007), who, within a probabilistic voting environment, derived a theory explaining the role of electoral rules on agricultural protection in parliamentary systems in industrialized countries[1]. Within this framework, the present paper further attempts to systematically analyze the impact of political institutions on agricultural policies at both the theoretical and empirical levels. In particular, the model of Henning and Struve (2007) explaining the role of electoral rules in agricultural protection in parliamentary systems of industrialized countries is extended in two directions.

First, the model is applied to the demographic and economic framework conditions of developing countries. This is done because although industrialized countries are characterized by largely urban populations, developing countries are characterized by largely rural populations.

In detail, the voting model suggested by Henning and Struve (2007) is based on a probabilistic environment wherein rural districts are less ideologically committed than urban districts in industrialized countries. As a consequence, in the parliamentary systems of industrialized countries, rural districts are pivotal in determining which coalition obtains a majority, whereas urban districts are pivotal within the majority itself. In bargaining at the legislature level, this generates a conflict between the prime minister (PM), who will tend to favor rural districts, and the parliamentary majority, which will be dominated by urban concerns.

At the election stage, both biases are attenuated when district size grows and the electoral system converges to a purely proportional representation, since district populations become more homogenous. Overall, a nonlinear relationship between district size and agricultural protection follows: when the system is close to purely proportional, a decrease in district size increases agricultural subsidies as the PM becomes more biased towards rural districts. As the district size continues to decrease, urban legislators become less and less willing to support agricultural subsidies; this implies that despite party discipline, they would eventually be willing to break the coalition, meaning that agricultural subsidies must decrease in order to preserve unity.

Using this model to explain agricultural taxation in the parliamentary systems of developing countries, we herein find that exactly the same logic yields an inverse u-shaped relationship between district magnitude and the level of taxation. Unlike the case in industrialized countries, developing countries have a relative minority of urban districts, and these are less ideologically committed than the rural districts. Hence, in the parliamentary systems of developing countries, urban districts are pivotal in determining which coalition obtains a majority, whereas rural districts are pivotal within the majority itself. Accordingly, in bargaining at the legislature level, this generates conflicts between the pro-urban prime minister and the pro-rural parliamentary majority. Following the same logic derived above for industrialized countries, a non-linear relationship between district size and level of agricultural taxation is seen for the parliamentary systems of developing countries.

These theoretical results have major implications for cross-country analysis, as we herein use different regimes to explain the influence of political institutions on agricultural protection for countries that tax agriculture versus those that subsidize agriculture. Notably, when using the usual concepts to measure agricultural protection (e.g. PSE or NPC), our theory predicts an inverse u-shaped relationship between district magnitude and the PSE- or NPC-measured results for countries subsidizing agriculture (i.e. industrialized countries), but a u-shaped relationship between district magnitude and the PSE or NPC measures for countries taxing agriculture (i.e. developing countries). Therefore, estimating a single equation for both regimes (agricultural taxation and subsidization together) will lead to biased results

[1] Another exception is Henning (2004), who explained different protection levels observed for the U.S. and E.U. by taking into account the different legislative organizations of agricultural policy decision-making under the regimes of the U.S. and EU.

regarding the influence of political institutions on agricultural protection. Accordingly, we use a switching regression model to differentiate between developing and industrialized countries.

The second extension of the prior work is that we herein analyze the impact of the governmental system on patterns of agricultural protection in developing and industrialized countries. In particular, we extend the model of Henning and Struve (2007) to incorporate presidential systems in addition to parliamentary systems. In contrast to parliamentary systems, which are characterized by stable ex ante majorities and strong legislative cohesion granting the PM strong legislative power, legislative cohesion is rather small in presidential systems, where the parliamentary committees are characterized by agenda-setting power. We find that legislative bargaining in a presidential system is characterized by a conflict between the median of the agricultural committee, who will tend to favor rural (urban) districts, versus the floor median, who will tend to favor urban (rural) districts in industrialized (developing) countries.

Again, both biases are attenuated at the election stage, when district size grows and the electoral system converges to a purely proportional representation as the district populations become more homogenous. Overall, for presidential and parliamentary systems we see the same nonlinear relationships between district size and agricultural protection (taxation) for industrialized (developing) countries. However, as the agenda-setting power of the agricultural committee in a presidential system is lower than party discipline in a parliamentary system, agricultural subsidization in industrialized countries should be lower for presidential systems. By the same argument, the level of agricultural taxation in developing countries should also ceteris paribus be lower for presidential versus parliamentary systems. Moreover, our theory implies that the cut points of the nonlinear relationship will ceteris paribus occur at a lower district magnitude.

Notably our model also extents the standard models of pre-election politics by implying that majoritarian election systems lead to higher target redistribution when compared to systems of proportional representation (Persson and Tabellini, 2002), because in contrast to our model these models focuse solely on the policy preferences of the party or government leader, neglecting post-election bargaining.

In the empirical part of this paper, we test our theory using cross-country data from 37 countries (13 OECD countries, 4 CEEC, and 20 developing countries), covering the period from 1982 to 2003. We apply a switching regression model to account for the two different protection regimes, namely agricultural taxation and subsidization. Following Beghin et al. (1996) we use a two-stage-least-square regression to account for possible simultaneous equation bias when regressing agricultural protection on the specific economic framework variables. Additionally, since we use cross-country time series data, we apply a cluster-specific random effect model (Hosmer and Lemeshow, 2000) to account for possible correlations of error terms over time for the same country.

The estimation results mainly support our theory. In particular, we find a significant inverse u-shaped relationship between district magnitude and PSE measures for the subsidy regime, as well as a significant u-shaped relationship between district magnitude and PSE measures for the tax regime.

Regarding the impact of governmental system, we obtain mixed results. First, for both the tax and subsidy regimes, we see a significant impact of the governmental system on agricultural protection. However, we see opposing direct and indirect effects resulting from the interaction with district magnitude. Thus, the overall impact of the governmental system depends on the district magnitude. For small district sizes (electoral systems that are closer to a majority rule), a presidential regime leads to a higher subsidization and higher taxation than parliamentary systems, while we see the opposite effect when we move towards proportional representation (i.e. higher district magnitude).

One explanation for this might be found in unobserved characteristics of governmental regimes. Parliamentary systems vary from country to country regarding the rules that determine their legislative cohesion (e.g. detailed rules of government breakup and formation), while presidential systems vary regarding the rules used to determine the agenda-setting power of the parliamentary committees (e.g. open and closed rules). Moreover, presidential regimes might vary in terms of the formal and (in particular) informal rules granting legislative power to the president. Thus, further research will be

necessary for us to more clearly understand the role of governmental institutions and their interaction with electoral rules regarding the pattern of agricultural protection in developing and industrialized countries.

The rest of the paper is structured as follows. The theoretical model is introduced and the hypotheses regarding the impact of political institutions on agricultural protection in developing and industrialized countries are derived in Section 2. Section 3 presents the empirical analyses, and Section 4 summarizes the main results.

2. THEORETICAL MODEL

The Population and Economy

Consider a society comprised of two groups: $I = A,M$. A represents the rural population and M represents the urban population. Each group has unit mass, and the share of each group in the total population is denoted by α_I.

Society's economy is subdivided into two sectors, agriculture and manufacturing. Agricultural policy is considered to consist of redistribution between the agricultural and non-agricultural sectors. For simplicity, we assume that income redistribution occurs via subsidization and taxation, where two different policy regimes are considered. In particular, let s_A and s_M denote the per capita subsidy paid to the rural and urban populations, respectively, while t_A and t_M denote the corresponding per capita taxes. Accordingly, $s_A - t_A$ is the net subsidization of the rural population; a positive net subsidy (i.e. $s_A - t_A > 0$) indicates a *subsidy regime*, while a negative net subsidy ($s_A - t_A < 0$) indicates a *tax regime*.

Any feasible agricultural policy (s_A, t_A) must satisfy the following budget constraints:

$$\tilde{\Gamma}^{Tm}(t_M) = \frac{\alpha_A}{\alpha_M}\tilde{\Gamma}^{Sa}(s_A) \Leftrightarrow t_m = \Gamma^S(s_A) \tag{1}$$

$$\tilde{\Gamma}^{Sm}(s_M) = \frac{\alpha_A}{\alpha_M}\tilde{\Gamma}^{Ta}(t_A) \Leftrightarrow s_m = \Gamma^T(t_A) \tag{2}$$

The functions Γ^S and Γ^T include deadweight costs (Becker, 1983). In particular, $\Gamma^S(s_A) > s_A$, $S_A > 0$ and $\Gamma^T(t_A) < t_A$, $t_A > 0$. Moreover, we assume increasing deadweight costs, i.e. Γ^S is strictly convex and increasing in the level of subsidization, while Γ^T is strictly concave and increasing in the level of taxation. Deadweight costs significantly vary across various agricultural policy instruments. We do not herein focus on the choice of redistribution instrument, although this makes up a large part of the discussion on agricultural policy (Swinnen and DeGroter, 2002; Lohmann, 1998).

Assuming identical individuals for both groups implies the following welfare function for each member given agricultural policy (s_A, t_A):

$$W^A = Y_A^o + s_A - t_A; \quad W^M = Y_M^0 + \Gamma^T(t_A) - \Gamma^S(s_A)$$

where Y_A^0 and Y_A^0 denote the equilibrium incomes of the rural and urban populations, respectively, without any agricultural policy intervention.

Notably, due to deadweight costs, efficient agricultural policy implies that $t_A * s_A = 0$. That is, efficient net subsidization of agriculture implies that agricultural taxation is zero, while efficient net taxation of agriculture implies that agricultural subsidization is zero.

Political System

Legislative Decision-Making

To systematically analyze legislative decision-making, we first formally define a legislative system as a finite set of political agents, N, where $i = 1, \ldots, n$ denotes a generic element of the legislative system. Within the political system, specific institutions (i.e. the government, Go, the parliament, P, and parliamentary committees, C_A and C_M) are defined as specific subsets of N. C_A is the agricultural committee dealing with agricultural policy, while C_M is a general economic committee dealing with policies targeting the manufacturing sector.

Parliamentary Systems. Huber (1996) and Diermeier and Feddersen (1998) nicely demonstrated that parliamentary systems are characterized by a stable ex ante majority coalition built among legislators, where legislative decision-making occurs solely within this majority coalition. The rationale of ex ante majority coalition building corresponds to the fact that this coalition at least weakly increases the utility of all majority members when compared to their utilities derived under a default outcome ($\bar{s}_I, I = A, M$) resulting under non-cooperative behavior of legislators. In particular, ex ante fixed parliamentary majorities are able to guarantee higher utilities for their members, due to the additional rent legislators realize from being part of a stable majority (Huber, 1996).

Following Henning and Struve (2007), we suggest a rather simple legislative majority bargaining game that captures the essential characteristics of legislative bargaining in parliamentary systems, namely the existence of a stable ex ante majority coalition and government-held proposal power (Diermeier and Feddersen, 1998). To this end, we can concentrate on the PM and his/her majority (M) in the parliament. M is a finite subset of legislators, $g \in N$, and g is a generic element of M. Following Huber (1996) we assume that the PM's majority is ex ante identifiable. In general, M could correspond to a multi-party coalition or a single majority party. However, to simplify the following analyses at the election stage, we assume a two-party set-up, where M corresponds to all parliamentary members of the majority party, P_M, and P_O denotes the members of the opposition party (O). Moreover, we assume that the PM is also the party leader of the majority party.

In general, we assume that the level of subsidies to the agricultural and manufacturing sectors (s_A and s_M, respectively) are decided separately. However, in parliamentary systems, the net redistribution between rural and urban populations can be modeled as one unidimensional decision. For simplicity, we assume that agricultural policy corresponds to an efficient net subsidization of agriculture, i.e. ($s_A - t_A \geq 0$) and $t_A = 0$, where tax regime analyses are analogous[2].

Formally, we denote the unidimensional policy space by $A = (0, 1)$. The model of legislative bargaining in parliamentary systems has two stages. At the first stage, we model the default policy outcome, $\bar{s}_A$. Further, we assume that agents' policy preferences can be represented by a single-peak function, $U_i(s_A)$. Let Y_i^A denote the ideal point of legislator i, i.e. Y_i^A is the maximum of $U_i(s_A)$. According to their single-peaked policy preferences, each political agent desires to achieve policy outcomes that are as close as possible to his/her ideal position, Y_i^A. Obviously, under this assumption the well-known median voter theorem applies, i.e. the ideal point of the floor median is the unique equilibrium outcome of the non-cooperative legislative decision-making game neglecting any ex ante coalition building (Black, 1958).

At the second stage the bargaining between the majority legislators' occur. Here, we assume two steps. First, the PM proposes a policy, υ_G, to his/her parliamentary majority and announces side payments, γ, that will be paid to the majority if it approves the governmental proposal υ_G,. Regarding content, we interpret these side payments as rent the PM can pay to the majority due to specific formal legislative procedures (e.g. issuing a confidence vote) or informal procedures (e.g. generating favor by granting political careers for party members). In this paper, we are not specifically interested in modeling exactly how the PM can generate rent valuable to the majority. Instead we subsume this under an assumed party or coalition discipline mechanism. In fact, the specific procedures for exerting party or coalition discipline vary across political systems. Our major point is that these procedures allow the PM to extract political

[2] Please note that assuming a unidimensional decision excludes inefficient redistribution resulting from simultaneous taxation and subsidization of agriculture. However, efficiency is not the focus of this paper. Otherwise we would also need to model agricultural policy instruments in much greater detail. Assuming unidimensional policy space facilitates our analysis regarding the role of political institutions in determining the pattern of agricultural protection, but by no means allows any further conclusions regarding the efficiency of agricultural policy-making in parliamentary systems.

favors from the majority; in capturing this, we introduce some party discipline into our simple modeling strategy[3].

At the second stage, each individual majority member can decide whether or not to accept the governmental proposal. If all majority members accept the governmental proposal, the proposed policy, v_G, is the final legislative decision, and all majority members receive the announced rent. Otherwise, the legislative decision is the default policy, $\bar{s}_A$, and no rent is paid.

We assume that legislators value the rent (γ) offered by the PM, and therefore assume that legislators maximize the sum of actual rent, γ, and the utility derived from the policy, as captured by the utility function, $U_g(s_A)$:

$$u_g = U_g(s_A) + \gamma$$

Under these assumptions, the legislative majority bargaining game has a unique subgame perfect Nash equilibrium, where s_A^{par*} denotes the equilibrium outcome that is characterized in *Proposition 1*.

Proposition 1: Assuming a one-dimensional agricultural policy choice, s_A, a unique subgame perfect Nash equilibrium exists for the legislative majority bargaining game defined above. The equilibrium outcome, s_A^{par*}, depends on the rent, γ, the default policy outcome, $\bar{s}_A$, and the policy preferences of the PM and the majority members. In particular, the following holds:

(i) In equilibrium agricultural policy choice, s_A^{par*}, results from the following maximization[4]:

$$s_A^{par*} = \underset{s}{Max} \quad U^{PM}(s_A) \quad s.t.\ s \in \underset{g}{U} A^g$$
$$with \quad A^g = \{s \in A \mid U^g(s_A) + \gamma \geq U^g(\bar{s}_A)\} \tag{3}$$

Interestingly, if the rent, γ, is sufficiently large or the legislators' preferences are sufficiently homogeneous, the final agricultural policy outcome corresponds to the ideal point of the PM. Hence, under this condition our model corresponds to pre-election politics models, which generally assume that governmental policy simply corresponds to the political preferences of the party leader (who becomes the omnipotent head of government after the elections). However, if party discipline (i.e. the rent, γ) is not sufficiently high or the policy preferences of the PM and the parliamentary majority are sufficiently heterogeneous, then the agricultural policy outcome is not determined by the PM's policy preferences, but rather by the intersection set of subsets, A^g, i.e. the policy preferences of the majority member, the majority rent, γ, and the default policy, $\bar{s}_A$.

The policy preferences of legislators are generally assumed to reflect the agents' interest in political support by politically-responsive interests located in their constituencies (see for example Weingast and Marshall, 1988; Persson and Tabellini, 2002). Electoral competition induces political agents, at least in part, to represent the interests of their constituents. Since the economic importance of the farm sector is not uniformly distributed across constituencies, farm interests are also not uniformly distributed over constituencies. We will explicitly derive legislators' policy preferences from electoral competition in Subsection 2.3. In particular, we will demonstrate that the electoral system has a significant impact on legislators' preferences and thus on the final policy outcome of our legislative decision-making game.

[3] We assume that at this stage the PM can commit to paying the rent. However, this assumption is not necessarily true; in a richer modeling set-up including specific procedures, it is possible to obtain essentially the same results without assuming this kind of commitment.

[4] Note that the maximization problem always has a unique solution, as long as the utility functions of legislators are strictly concave. Note that all sets of A^g are compact and convex subsets of A.

However, before we analyze the election stage, we first derive a model of legislative decision-making for presidential systems.

Presidential Systems. In contrast to parliamentary systems, presidential systems are not characterized by stable ex ante coalitions or legislative cohesion. Rather, presidential systems are characterized by more dispersed proposal powers, where proposal power over specific policy domains resides with corresponding parliamentary committees (Persson and Tabellini, 2002). In particular, we assume that the agricultural committee exerts agenda-setting power for agricultural subsidies, s_A, while the economic committee, C_M, has agenda-setting power for subsidies paid to the manufacturing sector, s_M.

Accordingly, to model legislative bargaining on agricultural subsidies in presidential systems, we focus on the floor median, *F*, and the median of the agricultural committee, C_A (Weingast et al., 1981; Krehbiel, 1991; Henning, 2004). To model legislative bargaining on manufacturing subsidies, we focus on the floor median, *F*, and the median of the economic committee, C_M. In the following, we characterize legislative bargaining for agricultural subsidies; legislative bargaining for manufacturing subsidies yields analogous results.

The legislative procedure consists, in essence, of a committee submitting a policy proposal, $\upsilon_I, I = A,M$, to the floor, and the floor choosing the final policy based on the committee's proposal. The floor's policy choice can be regulated by different rules granting the committee different agenda-setting powers with regard to the floor. For example, in the U.S.-based system the floor can operate under closed or open rule. Under closed rule, the floor can only choose between the committee proposal and the status quo, whereas under open rule, the floor can amend the committee proposal and select among amended proposals (Weingast et al., 1981; Krehbiel, 1991). We assume in the following that the floor operates under the closed role, granting maximal agenda-setting power to the floor (i.e. the floor can approve the committee proposal or not; in the latter, case the status quo policy, SQ_I, $I = A,M$, remains). Let $U_F(s_I)$ denote the policy preferences of the floor median regarding subsidization of agriculture ($I = A$) and manufacturing ($I = M$). Accordingly, let U_{C_A} denote the policy preferences of the median of the agricultural committee regarding subsidization of agriculture, while U_{C_M} denotes the preferences of the median of the economic committee regarding subsidization of manufacturing. Under these assumptions, the decisions on subsidizing agriculture and manufacturing can be considered as two separate legislative bargaining games. As we show in *Proposition 2* (below), each game has a unique subgame perfect Nash equilibrium, where $s_I^{pre*}, I = A,M$ denotes the equilibrium outcome that is characterized in *Proposition 2*.

Proposition 2: Assuming a one-dimensional policy choice s_I, I = A,M, there exists a unique subgame perfect Nash equilibrium for our legislative bargaining game in a presidential system as defined above. The equilibrium outcome, s_I^{pre*}, depends on the default policy outcome, SQ_I, and the policy preferences of the committee and floor median. In particular, the following holds:

(ii) In equilibrium policy choice, s_I^{pre*}, results from the following maximization[5]:

$$s_I^{pre*} = \underset{s_I}{Max} \quad U^{C_I}(s_I) \quad s.t.\ s_I \in A^F$$
$$with \quad A^F = \{s_I \in A \,|\, U^F(s_I) \geq U^g(SQ_I)\} \tag{4}$$

[5] Note that the maximization problem always has a unique solution, as long as the utility functions of the floor and committee median are strictly concave. Note that all sets of A^F, A^{C_I} are compact and convex subsets of A.

Obviously given the equilibrium policy choices, s_A^{pre*} and s_M^{pre*}, in presidential systems net redistribution between rural and urban population results from the budget constraint:

$$s_A^{pre*} - t_A^{pre*}, \; with \quad s_M^{pre*} = \Gamma^T(t_A^{pre*}) \tag{5}$$

Election Stage

In this section, we derive the policy preferences of legislators using the theory of electoral competition. In general, the literature includes two different approaches: pre- and post-election politics models. The classical pre-election approach refers to Hotelling (1929) and Downs (1957). An extension of Downs' classical approach is probabilistic voting (Hinich, 1977). Probabilistic voting models have been successfully used to explain special interest politics. In essence, these approaches argue that small groups, such as farmers in industrialized countries, are less ideologically biased when compared to other groups and therefore become a natural target for politicians who vie for electoral support. Assuming ideological preferences is standard in the probability voting literature (see Perrson and Tabellini, 2002). In essence, it is assumed that beyond their economic policy positions, candidates differ in some other (policy-independent) dimension of interest to the voter. Generally, authors refer to this other dimension as "ideology," but it could involve other attributes such as personal characteristics. Notably, this other dimension is a permanent feature that cannot credibly be modified as part of the electoral platform. An ideological bias corresponds to the fact that voters prefer a specific party. This argument is formally elaborated below. Applying the same argument, these theories propose that in developing countries, urban industry is less ideologically biased compared to the large and often relatively uneducated rural population; therefore urban industry is often subsidized in developing countries, where subsidies are financed via taxation of agriculture.

In models of pre-election politics, agents' policy preferences can be directly derived from electoral competition by assuming that agents commit to their electoral promises. In contrast, post-election politics models do not make the strong assumption that electoral promises are binding. However, elections still have an impact on legislators' behavior via retrospective voting, i.e. voters can discipline political agents by voting against them if they have previously misbehaved. The advantage of post-election politics models is the lack of an assumption regarding binding electoral promises. Therefore, we derive legislators' preferences by applying a post-election politics model. The main argument corresponds to the basic logic used by Olson (1965) to explain the development paradox, i.e. the taxation-protection switch observed for developing versus developed countries. Although in industrialized countries, special interest politics implies the subsidization of agriculture, because farmers as a small group are less ideologically biased, the same argument implies that agriculture will be taxed in developing countries, where urban industry is a small and less ideologically biased group.

However, as will become clear in the following, our theory goes beyond this basic logic in explaining the role of political institutions in agricultural protection. In particular, we demonstrate that the impact of the electoral system on agricultural protection works in opposite directions for industrialized versus developing countries, and that this influence is significantly attenuated in presidential versus parliamentary systems.

To formally outline our argument, we offer the following abstract approach to more generally explain the impact of electoral rules and governmental systems on special interest politics. In a subsequent section, we then apply the general model to the specific case of agricultural policy in industrialized and developing countries.

To this end, we assume that legislators are rent-seeking, i.e. legislators' behavior can be derived from the maximization of actual and future rent. Future rent depends on the probability of being re-elected. Let P_{rg} denote the probability that a legislator, g, will be re-elected. Obviously, this probability depends on the voters' electoral response to observed policies. Therefore, we now turn to voter behavior in elections. To simplify notations, we denote the majority party by M and the opposition party by O.

Furthermore, we define a set of generic voting districts as a family of distinct subsets covering the total population, and note that any voting district, *d*, corresponds to a geographical subunit of the total nation. In general, the population composition of a district d might be different when compared to total society. Let α_d^J denote the share of a group, *J*, in district *d*. Assume an individual incumbent $g \in M$ is re-elected in generic voting district *d*. We generally assume that a voter votes for an incumbent if the utility he/she has derived under the implemented policy, *z**, is higher than his/her specific reservation utility. However, voters have ideological preferences for parties beyond their economic welfare derived under observed policies, $W^J(z^*)$. Ideological preferences are exogenous and might correspond to different characteristics of parties or candidates (e.g. competence or appearance). In this paper, we do not further analyze the ideological preferences of voters; we only assume that these correspond to a non-policy dimension that is a permanent feature, i.e. it cannot credibly be modified as part of the electoral platform. Furthermore, we assume that ideology can be subdivided into three components: a group-specific relative importance of the ideology compared to economic well-being, K^J; a regional component, μ^{id}; and a national component, δ. Thus, a voter, $i \in J$, votes for the incumbent, *g*, if the utility he/she observes under agricultural policy *z** is higher than a specific reservation utility, W_O^J, corrected by the ideological preferences in favor of the incumbent party, *M* as follows:

$$W^J(z^*) > W_O^J + K^J(\mu^{id} + \delta) \tag{6}$$

Parameters μ_{id} and δ can take negative and positive values, and measure the ideological bias of voter *i* toward party O. A positive value implies that voter *i* has a bias in favor of party O. The ideological preferences are uncertain at the time political agents have to make their policy decision. In detail, we assume that the parameter μ^{iJ} has region-specific uniform distributions on the interval:

$$\left[\overline{\mu}^d - \frac{1}{2\chi}, \overline{\mu}^d + \frac{1}{2\chi}\right]$$

Thus two parameters, $\overline{\mu}^d$ and χ, fully characterize the regional distribution of ideological preferences. However, we assume that the density, χ, is the same for all regions, and regions only differ in their average ideology, which is captured by the regional means, $\overline{\mu}^d$. Moreover, we assume that the relative importance of ideology K^J differs across groups. Note that assuming a different relative importance of ideological preferences implies that groups generally differ in their effective ideological homogeneity, i.e. they have different effective densities, $\phi^J = \frac{\chi}{K_J}$.

We make specific assumptions about the differences in these distributions. In particular, we distinguish two groups, say G and L, where group G has less relative interest in ideology, i.e. $K^G < K^L$. Thus, we assume that group G is more ideologically homogeneous than group L, i.e. $\phi^G > \phi^L$.

Regarding the regional average ideology, $\overline{\mu}_d$, we assume the existence of three clusters, D_1, D_2 and D_3. Cluster D_3 has an average ideological preferences in favor of party O, i.e. $\overline{\mu}^d > 0$ for $d \in D_3$; cluster D_1 has an average ideological preference for party M, i.e. $\overline{\mu}^d < 0$ for $d \in D_1$; and cluster D_2 is ideologically unbiased, i.e. $\overline{\mu}^d = 0$ for $d \in D_2$. Furthermore, we assume that the strength of the average ideological bias is negatively correlated with the share of group G. For simplicity, we assume that there are only two types of districts, G- and L-type districts. G-type districts are characterized by a higher share of group G compared to L-type districts, i.e. $\alpha_g^G < \alpha_l^G$. G-type districts are ideologically unbiased (i.e. they form cluster D_2), while L-type districts are ideological biased between the two parties (clusters D_1

and D_3). In addition, we define $\overline{\mu}^d = \overline{\mu}^O > 0$ for all $d \in D_3$ and $\overline{\mu}^d = \overline{\mu}^M < 0$ for all $d \in D_1$. Finally, we assume that $\overline{\mu}^O + \overline{\mu}^M = 0$ as well as $\sum_d \alpha_d \overline{\mu}_d = 0$, where α_d denotes the share of the total population of district d. We assume the same population shares, α_d, for all districts, meaning that none of the regional clusters (D_1, D_2 and D_3) includes the majority of the voter population, while any two clusters taken together include the majority of voters.

The idea behind these assumptions is that the voting decision of the G-type group is generally more sensitive to political redistribution than that of the L-type group. Moreover, individual districts might be ideologically biased towards a specific party, but the overall total population is unbiased[6].

We assume that political agents know the regional and group-specific distributions (μ^{id} and ϕ^J, respectively) when they decide on agricultural policy. Electoral uncertainty derives from the uncertainty of the national components, δ, which measures the average popularity of party M in comparison to party O. Here, we assume a uniform distribution on the interval:

$$\left[-\frac{1}{2\psi},+\frac{1}{2\psi}\right]$$

Thus, on average, the national ideological shock is unbiased.

Given the assumption above, it follows that the vote share incumbent g receives in group J running for election in generic district d, results, after the national ideological shocks δ have been realized, in:

$$\pi_d^J = \phi^J \left[W^J(s_I) - W_O^J\right] - (\overline{\mu}^d + \delta)\chi + \frac{1}{2} \tag{7}$$

Accordingly, the total vote share incumbent g receives in district d after the regional and national ideological shocks have been realized is:

$$\Pi_d = \sum_J \alpha_d^J \pi_d^J = \sum_J \alpha_d^J \phi^J \omega^J - \chi\left[\overline{\mu}_d + \delta\right] + \frac{1}{2}$$
$$, where \quad \omega^J = W^J(s) - W_O^J \tag{8}$$

Given the electoral support of incumbents in generic district d, the re-election probability of political agent g crucially depends on the concrete organization of the electoral system.

However, before we analyze the impact of electoral rules on the re-election probability, it might be instructive to analyze the impact of district characteristics on policy preferences with regard to political agents' maximizing their re-election probabilities in a generic district.

Obviously, to maximize their re-election probability, agents select a policy ($s = s_A$, t_A) that maximizes the probability that they will receive the majority of votes in generic district d, as follows:

$$P_d = \Pr ob\left[\Pi_d > \frac{1}{2}\right] = \psi\left[\sum_J \alpha_d^J \frac{\phi^J}{\chi}\omega^J - \overline{\mu}_d\right] + \frac{1}{2} \tag{9}$$

[6] For an example, see Henning and Struve (2007).

Thus, maximizing the probability of re-election (taking groups' reservation utilities as given) implies that each legislator *g* re-elected in district *d* has an additive social welfare function (SWF_d), where the absolute and relative weights of group *J*, g_d^J and $\overline{g}_d^J$, correspond to the following terms:

$$g_d^J = \alpha_d^J \phi^J \frac{\psi}{\chi}; \qquad \overline{g}_d^J = \frac{g_d^J}{\sum_J g_d^J} \tag{10}$$

Accordingly, an optimal agricultural policy (s_A^*, t_A^*) that maximizes the chance of re-election can be derived from the following first order conditions:

$$\begin{aligned} &\frac{\partial P_d}{\partial s_A} = \phi^A \alpha_d^A - \phi^M \alpha_d^M \frac{\partial \Gamma^S}{\partial s_A} = 0 \quad \perp s_A = 0 \\ &\frac{\partial P_d}{\partial t_A} = \phi^A \alpha_d^A - \phi^M \alpha_d^M \frac{\partial \Gamma^T}{\partial t_A} = 0 \quad \perp t_A = 0 \end{aligned} \tag{11}$$

Based on the first-order condition characterizing political equilibrium in a generic district, we can derive a set of hypotheses regarding the pattern of agricultural protection that partially replicates the well-known results of existing studies mentioned in our introduction above. We summarize these results in *Proposition 3.*

Proposition 3: Agricultural policy, (s_A^*, t_A^*)*, resulting from electoral competition in a generic districts d is characterized by the following properties:*

(i) Electoral competition implies efficient redistribution policies, i.e. it always holds that $s_A^* t_A^* = 0$*. Thus, competing candidates prefer subsidization of either agriculture or manufacturing, but never both.*

(ii) Subsidization of agriculture can only be observed in equilibrium if one of the following conditions holds:

$\theta^A > \theta^M$ *or* $\alpha_d^A > \alpha^A$

Analogously, taxation of agriculture can only be observed if one of the following conditions holds:

$\theta^A < \theta^M$ *or* $\alpha_d^A < \alpha^A$

Moreover, assuming that the generic district is perfectly representative of the total society, i.e. $\alpha_d^J = \alpha^J$*, it follows that the relative ideological bias of the rural and urban populations will determine the candidates' preferred policy regimes. In particular, in a perfectly representative district, candidates will only prefer subsidization (taxation) of agriculture if the rural population is less (more) ideologically biased than the urban population. However, assuming heterogeneous districts, subsidization (taxation) of agriculture might be preferred, even though the rural population is more (less) biased than the urban population, as long as the share of agricultural population is sufficiently higher (lower) in the generic district compared to the average national share. The latter replicates the well-known result of Weingast et al. (1981), indicating that the geographical distribution of costs and gains from political redistribution determines the politically-preferred level of redistribution. When the share of the rural population in a generic district is higher (lower) than the corresponding national share, the share in political gains is higher (lower), the share of political costs resulting from agricultural subsidization is lower (higher), and more (fewer) politicians preferring agricultural subsidization are re-elected.*

Assuming a subsidy regime, i.e. $s_A^* > 0$*, then subsidization of agriculture increases the higher urban population is ideologically biased compared to rural population (the higher* $\frac{\theta^A}{\theta^M}$ *) as well as the higher the rural population share in the generic district is compared to that in the total society (the higher* $\frac{\alpha_d^A}{\alpha^A}$ *). In contrast, subsidization of agriculture decreases with the relative national share of rural population (the higher* $\frac{\alpha^A}{\alpha^M}$ *).Note that the latter replicates the results of Becker (1983) nicely demonstrating that assuming increasing deadweight costs of taxation implies that subsidization resulting in the political economy equilibrium is the higher the smaller the subsidized group in relation to the taxed group is.*

Defining a family of redistribution schemes, r = 1, ...,n_r*, characterized by different deadweight costs, where the difference in deadweight costs can be expressed with factor* λ_r*, such that:*

$$\lambda_r \Gamma_r^S(s_A) = \Gamma_1^S(s_A), \quad \lambda_{r+1} \geq \lambda_r \geq 1 \quad \forall r = 1,..., n_r$$
$$\lambda_r \Gamma_r^T(t_A) = \Gamma_1^T(t_A), \quad 0 \leq \lambda_{r+1} \leq \lambda_r \leq 1 \quad \forall r = 1,..., n_r$$

It thus follows that in equilibrium, subsidization (taxation) of agriculture decreases with decreasing deadweight cost.

The proof of Proposition 3 is straightforward given the first-order condition found in eq. 11, and is therefore omitted here. Overall, Proposition 3 gets to the well-known development paradox, that higher costs of collective action by a large group of farmers compared to a relatively smaller and politically better-organized urban manufacturing sector tends to lead to taxation of agriculture in developing countries. As economic development continues, a declining farm population finds it easier to organize and thus votes less ideologically, but more in response to politically distributed welfare. Meanwhile, higher wages and smaller expenditure shares on food decrease urban resistance to higher agricultural prices. Therefore, the political costs of subsidizing agriculture are significantly lower in industrialized countries than in developing countries. Conversely, the political costs of taxing agriculture are significantly lower in developing versus industrialized countries. However, it also follows directly from Proposition 3 that beyond the relative political responses of urban and rural populations, the preferred direction and level of redistribution are also determined by deadweight costs.

Beyond these well-known results derived under the assumption that electoral competition takes place only in one generic district, we next demonstrate that given electoral support of incumbents in a generic district, the re-election probability of a political agent depends on the concrete organization of the electoral system.

The Impact of the Electoral System on Agents' Preferences

Scholars of comparative politics define an electoral system mainly via the following three variables: (1) electoral formula, i.e. the mechanism by which cast votes are transformed into parliamentary seats; (2) the district magnitude or district size, i.e. the number of candidates to be elected in a voting district; and (3) the electoral threshold, i.e. the minimum of votes a party has to receive to be represented in the parliament (Lijphart, 1984). In general, proportional representation (PR) and majoritarian systems (MS) are distinguished as ideal-typical election systems. In the context of district magnitude, PR systems are characterized by candidates that are elected in a single, multiple-member national electoral district. In contrast, pure MS are characterized by each candidate's election in a one-member electoral district. Thus, if we denote the total number of parliamentary seats as *N*, PR systems corresponds to a district size of *N*, while pure MS correspond to a district magnitude of 1.

Mixed electoral systems, which lie between pure PR systems and MS, are characterized by multiple multi-member districts (Lijphart, 1984). If we let *k* denote the number of parliamentary members

elected in an electoral district, a mixed electoral system is characterized by a district magnitude $1 < k < N$. Thus, normalization delivers an election system index corresponding to a normalized relative district size, $RDS = \frac{k-1}{N-1}$, which measures the extent to which a given system corresponds to a pure MS or PR system (for which the index would be 0 and 1, respectively). Thus, keeping the total number of parliamentary seats constant, the electoral system is perfectly defined by the district magnitude, *k*.

In the following, we derive the general logic of our argument. In particular, this logic depends on the distribution of rural and urban populations across districts. However, fundamental differences exist between developing and industrialized countries in this regard. While the share of rural population is relatively small in industrialized countries and the rural population is less ideologically biased compared to the urban population, the opposite structures are observed in developing countries, where the urban population is relatively small and less ideologically biased compared to the rural population. In industrialized countries, therefore, special interest politics correspond to agricultural subsidies, while in developing countries, special interest politics correspond to subsidization of the manufacturing sector.

To analyze how political institutions, the electoral system, and the governmental system all influence special interest politics in industrialized and developing countries, we develop a formal model denoting the special interest group as the G-type group and the other, larger group as the L-type group. In industrialized countries, the G- and L-type groups correspond to the rural and urban populations, respectively, while the opposite is true in developing countries.

Pure majoritarian system. Assuming a pure MS ($k = 1$ and $RDS = 0$) implies that any member of the parliament (MEP) is re-elected in a one-member electoral district, *d*. The MEP is re-elected if it holds that:

$$\Pi_d \geq \frac{1}{2} \tag{12}$$

Therefore, the probability of re-election of a legislator *g* running for election in district *d* under a pure MS, P_{rg}^1, is:

$$P_{rg}^1 = P_d = \Pr ob\left[\Pi_d > \frac{1}{2}\right] = \psi\left|\left[\sum_J \alpha_d^j \frac{\phi^J}{\chi}\omega^J - \bar{\mu}_d\right] + \frac{1}{2}\right. \tag{13}$$

Overall, maximizing the probability of re-election taking groups' reservation utilities as given implies that each legislator *g* re-elected in district *d* has an additive social welfare function (SWF_d), where the absolute and relative weights of group *J*, g_d^J and $\bar{g}_d^J$, simply correspond to the following terms:

$$g_d^J = \alpha_d^J \phi^J \frac{\psi}{\chi}; \qquad \bar{g}_d^J = \frac{g_d^J}{\sum_J g_d^J} \tag{14}$$

Thus, the relative and absolute weights of group *J* in the legislator's SWF_d are higher the higher the group's share in the district population and the higher the group's ideological density, ϕ_J.

Under a pure MS, each MEP is elected in a different district, and MEPs have heterogeneous policy preferences as long as districts are heterogeneous. In particular, it follows quite plainly that MEPs who are re-elected in G-type districts ($d \in D2$) have a higher relative political weight for the G-type population and therefore prefer a higher subsidization level compared to legislators re-elected in L-type districts ($d \in D1$ or $d \in D3$). Further note that under our simplified assumptions, all L-type districts have the

same relative G-type population share, thus, only two different types of legislators' policy preferences exist overall, namely L-type and G-type preferences.

So far, we have analyzed the re-election probability of members of parliament. Next we analyze the re-election probability of a PM in a parliamentary system or a president in a presidential system. In general, the same logic applies for a PM or president. However, since the president is not an essential part of legislative decision-making in our model, we herein focus on the case of a PM. In contrast to an MEP, a PM is only re-elected if party M wins the election by garnering the majority of votes in a majority of the generic districts. To formally derive the probability of re-election of party M as the governmental party, we define the following stochastic variable, K_d, for each election district:

$$K_d = \begin{array}{l} 1 \ \textit{with probability} \ P_d \\ 0 \ \textit{with probability} \ (1 - P_{d)} \end{array} \tag{15}$$

Given the definition of K_d as the probability that party M wins the election, the probability that the PM is re-elected, P^1_{rPM}, is:

$$P^1_{rPM} = \Pr ob\left[\sum_d \alpha_d K_d \geq \frac{1}{2}\right] \tag{16}$$

It is generally difficult to find an analytical expression for the probability, P^1_{rPM}, which allows derivation of the induced policy preferences of the PM. Therefore, we follow Perrson and Tabellini (2002) and introduce additional assumptions to guarantee that an equilibrium exists for our simple electoral competition set-up[7].

Essentially, we assume that the ideological biases toward party M in district type D1, $\overline{\mu}^M$, and toward party O in district type D3, $\overline{\mu}^O$, are sufficiently large that electoral competition only takes place in district type D2[8].

Under these additional assumptions, the relevant expression for the re-election probability of the PM is simply the probability that party M wins the election in the D2-districts . Thus, under majority voting, the PM has the same policy preferences as a legislator re-elected in a G-type district.

We have specified the policy preferences of all MEPs, the PM in a parliamentary system, and (by analogy) the president in a presidential system. Thus, we are now able to determine the overall

[7] We basically assume this simple model set-up to facilitate the analytical derivation of our central results. Please note that alternative approaches can be used to derive equilibria for electoral competition in a majoritarian system under less restrictive assumptions (for example, see Stroemberg 2005). However, since the essential results we derive here would not change under application of these less restrictive approaches (see Perrson and Tabellini 2002), we use this simpler, though certainly more restrictive, approach in order to increase the tractability of our analyses.

[8] Without going into detail at this stage, to intuitively understand the condition under which a party leader competes only in district type 2, note that according to our assumptions above, the probability of winning a majority in the different districts depends on the common national shock, δ, meaning that these probabilities are related. In particular, for any given policy, z, there exists a specific threshold value for each of the three different district types, namely $\delta^1(z)$, $\delta^2(z)$ and $\delta^3(z)$. If the realization of the national shock is below this threshold value in a given district type, party M wins the majority in this district type and loses otherwise. Obviously, these threshold values depend on the ideological bias and on policy z. If the urban districts have sufficient ideological bias towards party M or party O, the threshold value of the G-type district is for any given policy $z \in [z^u, z^r]$ always lower than that of L-type districts biased towards party M (D1) and always higher than that of L-type districts biased towards party O (D3). Thus, for any national shock the G-type districts are decisive, i.e. whenever a party wins the majority in the G-type districts, it by definition wins the majority of districts; vice versa, if a party does not win the G-type districts, it does not win the national election.

equilibrium of our legislative bargaining game. However, we first analyze the impact of PR and MS on legislators' preferences.

Proportional representation. Assuming a purely proportional representation system ($k = N$ and $RDS = 1$) implies that all members of the majority are re-elected in a single national multi-member district. We assume that the total number of parliamentary seats a party wins is proportional to the party's vote share. On one hand, the probability that a specific member, $g \in M$, will be re-elected depends on the number of seats won by party M (i.e. on party M's vote share). On the other hand, as long as party M does not win all of the votes, not all N candidates of party M running for election will get a seat. Thus, the chances of an individual candidate being re-elected depend on the specific organization of the party's candidate list. For simplicity, we assume that no ex ante fixed list order exists, and all N candidates have the same probability of getting a parliamentary seat, $\frac{1}{N}$[9]. Under this assumption, the re-election probability, $\tilde{\pi}_{rg}^{N}$, of an MEP under proportional representation conditional on the national shock, δ, is given by:

$$\tilde{\pi}_{rg}^{N}(\delta) = \frac{1}{N}\Pi_N = \frac{1}{N}\sum_d \pi_d = \sum_J \alpha_N^J \phi^J \omega^J - \chi\left[\bar{\mu}_N + \delta\right] + \frac{1}{2} \tag{17}$$

where it holds that:

$$\alpha_N^J \sum_{d\in N} \alpha_d \alpha_d^J \quad and \quad \bar{\mu}_N = \sum_{d\in N} \alpha_d \bar{\mu}_d = 0$$

The expected re-election probability, π_g^N, depends on the national ideological shock, δ, and thus is uncertain ex ante. However, since the expected national shock is zero, it follows that:

$$\pi_{rg}^{N} = \int_{-\frac{1}{2\psi}}^{\frac{1}{2\psi}} \pi_{rg}^{N}(\delta)\psi d\delta = \frac{1}{N}\sum_J \alpha_N^J \phi^J \omega^J + \frac{1}{2} \tag{18}$$

Under PR, the re-election probability of the PM corresponds to the probability that party M wins the majority of all votes, i.e. it holds that:

$$P_{PM}^{PR} = \Pr ob\left[\Pi_N > \frac{1}{2}\right] = \psi\left[\sum_J \alpha_N^J \frac{\phi^J}{\chi}\omega^J\right] + \frac{1}{2} \tag{19}$$

Obviously, under PR, maximizing the re-election probability of the party leader corresponds to the same additive SWF as maximizing the re-election probability of an MEP[10]. Under PR, legislators' preferences are perfectly homogenous, i.e. all MEPs prefer the same subsidization level of the G-type group that is preferred by the PM or president. The situation under MS differs, as follows.

Mixed electoral system. According to our above definition, mixed electoral systems are characterized by multiple multi-member electoral districts. We denote k as the number of parliamentary members being elected, where it holds that $1 < k < N$. Thus, under a mixed system, Mk, each voting district comprises k generic districts, where the number of electoral districts reduces to $\frac{N}{k}$. A crucial factor determining the

[9] Assuming a fixed list would not change the essential parts of our analyses; although, legislators' individual re-election probabilities would differ under this assumption, in equilibrium, the legislators' policy preferences would correspond to the same SWF derived here.

[10] Note that the relative additive SWF weights corresponding to eqs. (18) and (19) are identical, although the absolute weights differ. However, the relative weights are relevant for determining the legislators' ideal points in equilibrium.

policy preferences of legislators being elected is the composition of the voting population. Here, we already assume that the regional distribution of the total population is characterized by the existence of specific groups and ideological clusters. Therefore, it follows that, analogously to our generic district in which $k = 1$, larger electoral districts in which $k > 1$ also vary systematically regarding the share of the G-type population and the average ideological bias. Obviously, the larger the district (i.e. the closer k is to N), the more equal the compositions of the district and national populations (i.e. larger districts are more homogenous then smaller districts). This fact has clear consequences regarding the heterogeneity of policy preferences across majority members. To formalize this point, we make the following simplifying assumption.

For a mixed system $N > k > 1$, we define the set of electoral districts as a family of subsets, d_k, which cover the total population. Moreover, every subset d_k contains a voter population of k generic districts[11]. We denote α_{d_k} as the share of agricultural population in district d_k.

Furthermore, to maintain the simplicity of these analyses, we assume that for any mixed system $N > k > 2$, electoral districts can still be subdivided into three ideological clusters, D_1^k, D_2^k and D_3^k[12]. Analogous to our assumptions above, we differentiate only G- and L-type districts. G-type districts are ideologically unbiased (i.e. belong to D_2^k), whereas L-type districts are ideologically biased, with the bias split between the two parties. More specifically, we define $\alpha_{G_k}^G \leq \alpha_{L_k}^G$ as the share of G-type population in L- and G-type districts, respectively, and $\overline{\mu}^{d_k} = \overline{\mu}^{O_k} > 0$ for all $d \in D_3^k$ and $\overline{\mu}^{d} = \overline{\mu}^{M_k} < 0$ for all $d \in D_1^k$. Finally we assume that $\overline{\mu}^{O_k} + \overline{\mu}^{M_k} = 0$ and $\sum_d \alpha_{d_k} \overline{\mu}_{d_k} = 0$, where α_{d_k} denotes the share in total population of district d_k. Again, for simplicity we assume the same population share, α_{d_k}, for all districts. Moreover, we assume that none of the regional clusters (D_1^k, D_2^k, or D_3^k) includes the majority of the voter population, while any two clusters together include the majority of voters.

Obviously, given these definitions, it follows from our above assumptions that the ideologically-neutral cluster includes all G-type districts with the highest share of G-type population, $\alpha_{G_k}^G$, while the ideologically-biased districts are the L-type districts.

The basic idea behind these assumptions is that both the G-type group and the ideologically-biased L-type populations are regionally clustered. Empirically, regional rural and urban clusters can be found in all countries, both industrialized and developing. In most industrialized countries, regional ideological L-type clusters correspond to ideological clusters of the urban population, such as a left-wing working-class areas and right-wing upper-class areas. In developing countries, regional ideological L-type clusters correspond to ideological clusters of the rural population, such as ethnic clusters wherein different ethnic groups tend to live in specific rural regions.

Thus, while simplifying our analysis our assumptions definitely smooth out the real world heterogeneity. However we argue that our model still provides a good representation of essential mechanism driving agricultural policy making in the real world.

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[11] Note that we do not necessarily assume that electoral districts *dk* include exactly *k* of the generic districts originally defined under a pure majoritarian system. We only assume that they comprise the same magnitude of voting population as *k* original generic districts

[12] We assume in the following that the number of electoral districts is greater than or equal to 3. However, to include also the case of only two voting districts we assume for simplicity, that if only two electoral districts exist and that these are perfectly homogenous. Thus, electoral competition in this case corresponds to the competition under PR.

Finally, to cover the increasing homogeneity seen in larger electoral districts, we assume the following:

$$\alpha_{G_k}^{G} \leq \alpha_{G_{k-1}}^{G} \quad and \quad \alpha_{L_k}^{G} \geq \alpha_{L_{k-1}}^{G} \quad \forall = 1,..., N \tag{20}$$

$$(\mu^{O_k} - \mu^{M_k}) \leq ((\mu^{O_{k-1}} - \mu^{M_{k-1}}) \quad \forall k = 1,..., N \tag{21}$$

Please note that a larger voting district includes a higher share of the total population. Accordingly, differences in population shares among voting districts decrease, ceteris paribus, with district size. This is exactly what we assume in eq. 20 and (21).

Given these assumptions, it is relatively simple to derive the policy preferences of the political agents. Assuming a mixed electoral, $1 < k < N$ implies that each member of the majority is re-elected in a multi-member district, d_k. Analogous to our expositions regarding re-election probabilities under PR, we assume that all k candidates of party M running for election in the k-member district, d_k, have the same chance, $\frac{1}{k}$, of getting a parliamentary seat won by party M in this district. Under this assumption, the re-election probability of a MEP under mixed system Mk ($\tilde{\pi}_{rg}^{k}$) conditional on the national shock, δ, is given by:

$$\tilde{\pi}_{rg}^{k}(\delta) = \frac{1}{k}\Pi_{d_k} = \frac{1}{k}\left[\sum_{J} \alpha_{d_k}^{J} \phi^{J} \omega^{J} - \chi\left[\overline{\mu}_{d_k} + \delta\right] + \frac{1}{2}\right] \tag{22}$$

Analogously, the expected re-election probability, π_{rg}^{k}, is:

$$\pi_{rg}^{k} = \int_{-\frac{1}{2\psi}}^{\frac{1}{2\psi}} \tilde{\pi}_{rg}^{k}(\delta)\psi d\delta = \frac{1}{k}\left[\sum_{J} \alpha_{d_k}^{J} \phi^{J} \omega^{J} - \chi\overline{\mu}_{d_k} + \frac{1}{2}\right] \tag{23}$$

Overall, maximizing the probability of re-election taking the groups' reservation utilities as a given corresponds again to maximizing an additive social welfare function (SWF_{d_k}); in this case, compared to the SWFs derived under PR or MS, the relative weight of group J, $\overline{g}_{d_k}^{J}$, simply differ due to the difference in G-type population share. Moreover, analogously to the situation under MS, it follows that under mixed system Mk, legislators have different policy preferences as long as the electoral districts are heterogeneous. In particular, we can again define G- and L-type policy preferences depending on legislators' re-election in G- type (D2) and L-type (D1 or D3) districts. Moreover, G-type preferences are characterized by a higher relative SWF weight for the G-type population, thus implying a higher preferred subsidization level compared to L-type preferences. However, as we will demonstrate in detail below, the difference of relative weights between G- and L-type preferences decreases with the district size, k.

Analogous to the situation for a pure MS, deriving the probability of re-election for the PM under mixed system Mk is tentative. Therefore, we again assume that the ideological biases toward party M in district type D1, $\overline{\mu}_k^{M}$, and toward party O in district type D3, $\overline{\mu}_k^{O}$, are sufficiently large that electoral competition only takes place in district type D2[13]. Thus, analogous to the case of pure MS, the re-election

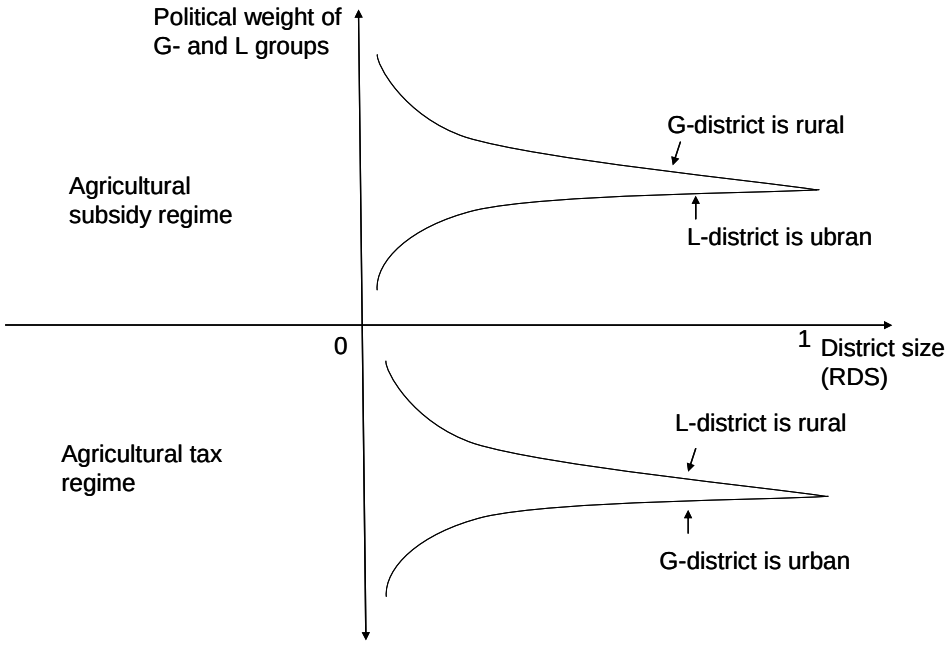
[13] Of course, this assumption becomes more restrictive as the district size increases. As noted above, we use this approach to simplify our analyses; however, we could derive essentially the same results using an approach with less restrictive assumptions (Stroemberg, 2005). Moreover, if districts are sufficiently large, they are ceteris paribus also homogeneous enough that assuming perfect homogeneity is a reasonable approximation. For a perfectly homogenous district, analysis of the PM's re-election probability is again straightforward, even for majoritarian systems.

probability of the PM under mixed system M*k* simply corresponds to the probability of a legislator being re-elected in a district of type D2, that is a G-type district.

Overall, it follows quite plainly from our analyses that electoral competition implies that the PM in a parliamentary system or the president in a presidential system will always have G-type policy preferences, while the majority of MEPs will have L-type policy preferences.

However, the difference between G- and L-type preferences crucially depends on the electoral system, i.e. the district size, *k*. This relationship is summarized in Figure 1 below. Under a pure majoritarian system (k = 1), policy preferences are the most heterogeneous, and legislators who are re-elected in G-type districts observe a higher relative SWF weight for the G-type population compared to legislators who are re-elected in L-type districts. However, in a larger district the heterogeneity is reduced, and the relative SWF weight of the G-type population is lower for G-type preferences, while it is higher for L-type preferences. In a purely proportional representation system, policy preferences are perfectly homogenous, i.e. all MEPs and the PM (or president) have the same relative SWF weights. Accordingly, the PM (or president) and all G-type legislators observe their lowest G-type SWF weights under PR and their highest SWF weights under pure MS. On the other hand, L-type legislators observe their highest G-type SWF weights under PR and their lowest G-type SWF weights under MS.

Figure 1. Impact of district size on the relative political weights of winners and losers of political redistribution in G- and L-type districts



Policy Outcomes under Different Electoral Systems and Governmental Regimes

Electoral rules in parliamentary systems. Given the impact of the electoral system on legislators' policy preferences, we can now summarize the impact of the electoral system on the equilibrium policy outcome of our legislative bargaining game in parliamentary systems (see Proposition 4 below). To this end, we let d_1 denote a generic one-member district of pure MS and let d_N denote the *N*-member national district under PR (proof of proposition 4 is given in Henning and Struve 2007).

Proposition 4: Let s_k^{par*} and $\bar{s}_k$ denote the level of subsidization of the G-type group resulting in equilibrium and the default policy outcome, respectively, of the majority bargaining game defined in Proposition 1, assuming electoral system k = 1, ..., N. Then the following hold true:

(i) The equilibrium policy outcome is defined by:

$$\begin{aligned} s_k^{par*} = \underset{t}{Max} \quad & g_{G_k}^G W^G(s) + g_{G_k}^L W^L(s) \\ s.t. \quad & g_{L_k}^G W^G(s) + g_{L_k}^L W^L(s) + \gamma \geq g_{L_k}^G W^G(\bar{s}) + g_{L_k}^L W^L(\bar{s}) \end{aligned} \tag{24}$$

where $g_{L_k}^J$ and $g_{G_k}^J$ denote the group weights of an additive SWF corresponding to the electoral competition equilibrium in L- and G-type districts, respectively, defined by electoral system k.

(ii) In particular, the equilibrium outcome can be derived from the maximization of an

aggregated SWF, where the relative weight of the G-type population, $\bar{g}_G^{par,k*}$, corresponds to the following linear combination:

$$\bar{g}_G^{par,k*} = \frac{1}{1+\sigma_k^{par}} \left(\bar{g}_{G_k}^G + \sigma_k^{par} \bar{g}_{L_k}^G \right) \tag{25}$$

where σ_k^{par} denotes the Lagrangian-multiplier of the maximization problem defined under point (i) above.

(iii) (iii) There always exists a k with $1 \leq k^* \leq N$, and it holds that:*

$$s_k^{par*} \leq s_{k+1}^{par*} \quad \forall k < k^* \quad and \quad s_k^{par*} \geq s_{k+1}^{par*} \quad \forall k \geq k^* \tag{26}$$

Two things are worth noting. First, in extreme cases of perfect party discipline, the restriction of the decisive (L-type district) majority member[14] is never binding, i.e. the equilibrium outcome is solely determined by the preferences of the PM. In this case, k* = 1. Second, if this restriction is binding, the equilibrium is solely determined by the preferences of the decisive majority member being re-elected in an L-type district, and the rent, γ. Notably, under this condition the equilibrium would not change with changed preferences of the PM, as long as the PM prefers a subsidization level higher than the maximum level the decisive (L-type) majority member is willing to accept in exchange for the rent, γ.

This last point is crucial regarding the impact of the election system on subsidization policy. This is especially true because pre-election politics models explaining special interest politics (see Perrson and Tabellini 2002) focus on the impact of the election system of the party leader's (i.e. the PM's) preferences; this assumes perfect party discipline and neglects post-election legislative bargaining.

In our more general approach, the impact of the electoral system on protection is ambiguous and depends on the heterogeneity of generic districts and on the level of party discipline (i.e. γ) that can be exerted by the PM. If this is sufficiently high, our model replicates the results of existing pre-election politics models by finding that protection is higher under pure MS compared to that under PR, and it decreases with district magnitude. However, if party discipline is extremely limited due to extremely heterogeneous policy preferences, as implied by electoral competition under a majoritarian system, the opposite results can be derived in the framework of our model, i.e. in parliamentary systems, the protection level is higher under PR versus MS, and increases with district magnitude.

Finally, please note that our model has different implications for industrialized and developing countries. The general demographic and economic framework conditions imply that the G-type group corresponds to the rural and urban populations in industrialized and developing countries, respectively.

[14] Note that as long as we assume a one-dimensional policy space, the intersection set $\cap A^g$ corresponds to the set $A^{g=DM}$ of a single majority member. We call this member the decisive majority member, *g = DM*.

Accordingly, our theory suggests an inverse u-shaped relationship between district magnitude and agricultural protection in industrialized countries with parliamentary systems, in that agricultural protection increases with district size up to a specific threshold value ($1 \leq k^* \leq N$), and decreases with further increases in district magnitude. Analogously, our theory suggests an inverse u-shaped relationship between district magnitude and agricultural taxation in developing countries with parliamentary systems.

Interestingly, if we express policies for redistribution between the rural and urban populations in terms of net subsidization of agriculture ($s_A - t_A$), we see the following relationship between the level of agricultural subsidization in industrialized countries (wherein the G-type group is the rural population) and the level of agricultural taxation in developing countries (wherein the G-group is the urban population).

Electoral Rules in Presidential Regimes

In contrast to parliamentary systems, legislative bargaining in presidential systems occurs between the floor median and the median of the relevant committee.

While the construction of our electoral equilibrium means that the policy preferences of the floor median always correspond to L-type preferences, the preferences of the median of the relevant committee have not yet been discussed. The relevant committees corresponds to the agricultural and economic committees when considering agricultural subsidies, s_A, and manufacturing subsidies, s_M, respectively. But who sits on the relevant committees?

Here we apply the exchange theory of Weingast and Marshall (1988) who nicely demonstrate that committee membership can be modeled via an auction mechanism, where legislators beat for committee seats according to their relative interest in the policy domain controlled by the committee. Thus, legislators being re-elected in rural districts have a relatively high interest in agricultural subsides, while legislators being re-elected in urban districts have a relatively high interest in manufacturing subsidies.

Furthermore, we assume for simplicity that the economic and demographic framework conditions in industrialized countries imply that all legislators prefer an agricultural subsidy regime, while those in developing countries prefer a tax regime. Under these assumptions, legislative decision-making in a presidential system focuses on agricultural subsidization in industrialized countries, but manufacturing subsidization in developing countries. Therefore, the final policy outcomes in industrialized countries result from legislative bargaining between the floor median and the median of the agricultural committee, whereas outcomes in developing countries result from legislative bargaining between the floor median and the median of the economic committee. Overall, this is summarized in *Proposition 5* (the proof of Proposition 5 is similar to the proof of proposition 4 and therefore is omitted here):

Proposition 5: Let s_k^{pre*} *denote the levels of G-type group subsidization resulting in equilibrium and the default policy outcome of the legislative bargaining game defined in Proposition 2, assuming a electoral system k = 1, ..., N. Furthermore, let* SQ_G *denote the corresponding status quo policy. Then the following holds:*

The equilibrium policy outcome is defined by:

$$\begin{aligned} s_k^{pre*} = \underset{t}{Max} \quad & g_{G_k}^{G} W^{G}(s) + g_{G_k}^{L} W^{L}(s) \\ s.t. \quad & g_{L_k}^{G} W^{G}(s) + g_{L_k}^{L} W^{L}(s) \geq g_{L_k}^{G} W^{G}(SQ_G) + g_{L_k}^{L} W^{L}(SQ_G) \end{aligned} \tag{27}$$

where $g_{L_k}^{J}$ *and* $g_{G_k}^{J}$ *denote the group weights of an additive SWF corresponding to the electoral competition equilibrium in L- and G-type districts, respectively, defined by the electoral system, k.*

In particular, the equilibrium outcome can be derived from the maximization of an aggregated SWF, wherein the relative weight of the G-type population, $\overline{g}_G^{par,k*}$*, corresponds to the following linear combination:*

$$\bar{g}_G^{par,k*} = \frac{1}{(1+\sigma_k^{pre})}\left(\bar{g}_{G_k}^G + \sigma_k^{pre}\bar{g}_{L_k}^G\right) \tag{28}$$

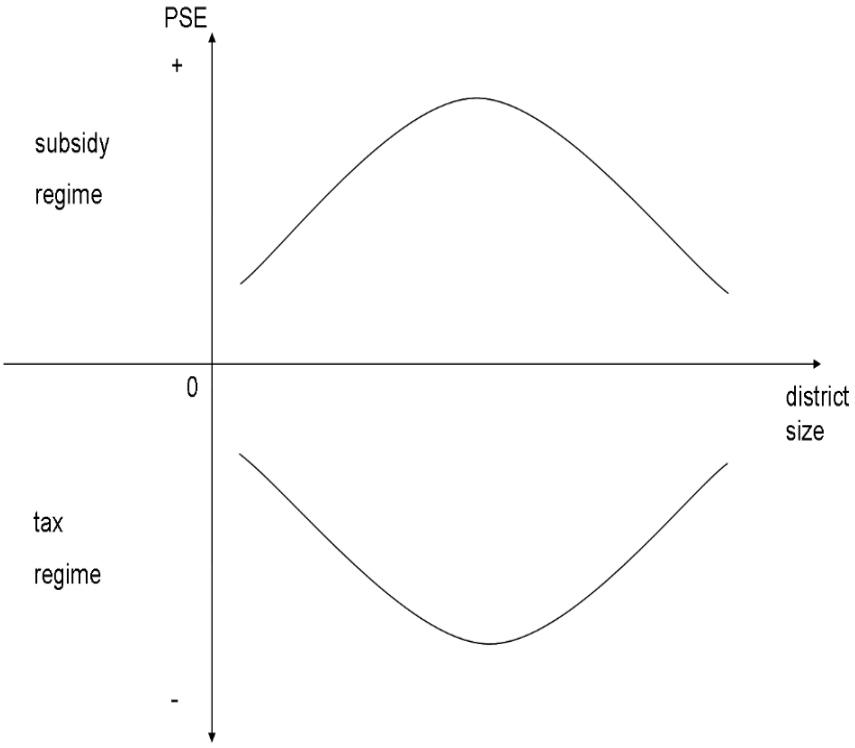
where σ_k^{pre} *denotes the Lagrangian-multiplier of the maximization problem defined under point (i) above.*

(iii) There is always a k^{pre*} *with* $1 \le k^{pre*} \le N$ *, and it holds that:*

$$s_k^{pre*} \le s_{k+1}^{pre*} \quad \forall k < k* \quad and \quad s_k^{pre*} \ge s_{k+1}^{pre*} \quad \forall k \ge k* \tag{29}$$

Thus, at least in qualitative terms, we see the same relationship between agricultural protection and district magnitude for both presidential and parliamentary regimes (see Figure 2 below).

Figure 2. District size and patterns of agricultural protection in parliamentary systems



Forms of Government and Patterns of Agricultural Protection

Although the same qualitative relationship between district magnitude and agricultural protection is derived from our theory for both parliamentary and presidential regimes, another interesting question is whether these forms of government have different impacts on the absolute level of agricultural protection (taxation). To assess this question, we compare the agenda-setting power of the committees in presidential systems versus the party discipline exerted by the PM in parliamentary systems.

Party discipline (corresponding to the rent γ) can be high or low in parliamentary systems. Analogously, assuming the floor operates under closed rule, the agenda-setting power of a parliamentary committee vis a vis the floor solely depends on the position of status quo policy in comparison to the preferred policy of the floor and the committee median.

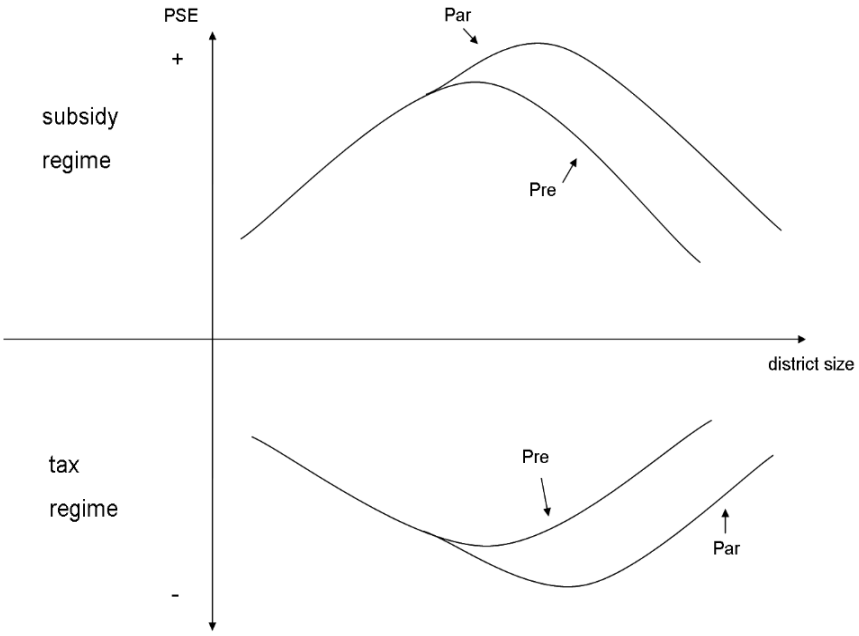
In general, one might tend to assume that party discipline is ceteris paribus stronger in parliamentary system when compared to the agenda-setting power of committees in presidential systems. Under this assumption, both agricultural protection levels in industrialized countries and agricultural taxation levels in developing countries should be ceteris paribus higher for parliamentary versus presidential systems. Moreover, under this assumption the turning point for a presidential system should be higher than that of the parliamentary system, $k^{pre*} > k^{par*}$.

However, our theory does not provide any information regarding the determinants of both party discipline and the committee's agenda-setting power. Therefore, we can not exclude the opposite assumption, that the agenda-setting power of committees in presidential systems is stronger than the average party discipline exerted by PMs in parliamentary systems. Obviously, this assumption would imply that the governmental form would have the opposite effects on agricultural protection compared to the above predictions.

However, assuming that the party discipline of the PM is stronger than the committee's agenda-setting power, agricultural protection will be ceteris paribus lower in presidential regimes for a given district magnitude, while the cut point will be higher. Moreover, since after the cut point the level of agricultural protection is solely determined by rural policy preferences, both curves should ceteris paribus coincide beyond their cut points. This is shown in Figure 3. Analogously, exactly the opposite result should be expected if we agenda-setting power of committees in presidential systems is stronger than the party discipline executed by the PM in parliamentary systems.

Finally, note that the corresponding implications of parliamentary and presidential systems can also be derived for the level of agricultural taxation in developing countries. This is also shown in Figure 3.

Figure 3. District size (measured by RDS), form of government and patterns of agricultural protection



3. EMPIRICAL EVIDENCE

Estimation Strategy and Data

Estimation Strategy

In this section, we test our theory by moving beyond economic and demographic variables to examine whether political institutions (electoral rules and form of government) have a significant impact on the level of agricultural protection. The basic multivariate model that has been applied in the literature to test these effects is the following regression equation, which is used to regress an agricultural protection measure on political variables as well as economic and demographic control variables, using cross-country panel data (Olper, 2001; Beghin and Kherallah, 1994):

$$P_{it} = \alpha + \beta x_{it} + \gamma y_{it} + \upsilon_{it}$$

where the subscripts refer to country i and time t; P denotes a measure of agricultural protection; x is the set of political variables capturing the impact of the electoral rules and government form on agricultural protection; y is a set of control variables that capture the relevant economic and demographic framework conditions determining agricultural protection; and υ_{it} is the error.

However, according to our theoretical considerations, estimating the impact of political institutions on the level of agricultural protection implies different regimes for protection and taxation of agriculture. Therefore, in contrast to the earlier studies of Beghin and Kherallah (1994) or Olper (2001)[15], we estimate different regression equations for agricultural protection and taxation:

$$\begin{aligned} P_{it} &= \alpha^S + \beta^S x_{it} + \gamma^S y_{it} + u_{it}^S \quad P_{it} \geq 0 \\ P_{it} &= \alpha^T + \beta^T x_{it} + \gamma^T y_{it} + u_{it}^T \quad P_{it} < 0 \end{aligned} \tag{30}$$

where $P > 0$ indicates agricultural subsidization and $P < 0$ indicates agricultural taxation. In general, the regression equations could be estimated separately using cross-country panel data from available subsamples of protecting and taxing countries, respectively. However, the simple econometric estimation of eq. 30 is plagued by several potential estimation problems.

First, a simple separate OLS estimation of eq. 30 with a subsample of protecting and taxing countries, respectively, would suffer from a selectivity problem (Heckman, 1976). In particular, our theory implies that the impact of political institutions on the level of agricultural protection is contingent on the political decision to tax or subsidize agriculture. As this decision is an endogenous choice, there may be unobservable variables that affect both the probability of taxing (subsidizing) agriculture and the level of taxation (subsidization). To account for the potential simultaneity bias arising from the existence of such variables, our empirical specification therefore employs a two-stage switching regression model with endogenous switching (Lee, 1983; Maddala, 1983). The model considers that observations are ordered into two regimes, a tax regime and a subsidy regime, which are represented by the following equations:

Policy regime selection equation (estimated as a bivariate probit model):

$$R_{it} = z_{it}' u_{it} \quad with\ R_{it} \geq 0\ if\ P_{it} \geq 0\ and\ R_{it} < 0\ if\ P_{it} < 0 \tag{31}$$

Agricultural protection and taxation level equations (second stage of the regression):

[15] Please note that Miller (1991) also estimated two different regimes to analyze determinants of agricultural protection and taxation. However, Miller (1991) neglected political institutions in his analysis. Moreover, based on his estimation results he concluded that as far as economic and demographic determinants of agricultural protection are concerned, the same regime can explain both subsidization and taxation of agriculture.

$$P_{it} = \alpha^S + \beta^S x_{it} + \gamma^S y_{it} + \sigma^S \lambda^S + \varepsilon_{it}^S \quad if \quad R_{it} \geq 0$$
$$P_{it} = \alpha^T + \beta^T x_{it} + \gamma^T y_{it} + \sigma^T \lambda^T + \varepsilon_{it}^T \quad if \quad R_{it} < 0 \tag{32}$$

where *z* are factors influencing agricultural policy regime selection, i.e. the subsidy and tax regimes; all ε and *u* denote the error terms; all γ, β, σ, and μ are parameters or parameter vectors to be estimated, and all λ are selectivity terms defined as:

$$\lambda_{it}^S = \frac{-\phi(z_{it}'\mu)}{\Phi(z_{it}'\mu)},$$
$$\lambda_{it}^T = \frac{-\phi(z_{it}'\mu)}{1-\Phi(z_{it}'\mu)} \tag{34}$$

where $\phi()$ and $\Phi()$ denote the probability density function (pdf) and cumulative distribution function (cdf), respectively, of a standard normal distribution.

The λ is also called the inverse Mill's ratio. When appended as an extra regressor in the second stage estimation, this ratio is a control for potential bias arising from sample selectivity. If the coefficient of the Mill's ratio is significant, it indicates that sample selectivity is present. Because the residuals are heteroskedastic, they are estimated by weighted least squares using the Huber/White estimates of variance.

Second, since we use cross-country panel data for the estimation, an autocorrelation problem might arise. The probit regression requires that observations be independent from each other; independence of single observations secures freedom from autocorrelation because the residuals of subsequent years are not correlated. However, the observations for a given country over subsequent years are probably not independent of one another, thus violating this assumption. To account for this problem we use a model that is referred to in the literature as "cluster-specific"(Hosmer and Lemeshow 2000).

Third, regressing the level of agricultural protection (taxation) on different economic and demographic control variables could introduce a possible simultaneous equation bias, since the agricultural protection and specific economic variables might be interdependent; for example the GDP share of agriculture as well as the share of agriculture in employment (see Beghin and Kherallah, 1994). Thus, to control for possible endogeneity problems, we estimate a two-stage least square regression (2SLS), where we instrument economic variables that might be interdependent with agricultural protection.

Data

Following Beghin and Kherallah (1994), we use the Producer Subsidy Equivalent (PSE) measure of agricultural protection as our central dependent variable. Although the PSE measure is not ideal, it can be considered an improvement over simple nominal protection measures. In particular, PSE seems particularly appropriate because it provides an indicator of the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers. Based on the work of Josling (FAO, 1975), this indicator (formerly called Producer Subsidy Equivalent) belongs to the current OECD classification and is measured at the farm-gate level (see OECD, 2000 and 2002). The PSE includes both implicit and explicit payments, such as price gaps on outputs or inputs (market price support), tax exemptions and budgetary payments. Unfortunately while the OECD has calculated PSE measures for member states and certain others from 1986 through the present, these measures are not available for most developing countries. For future work availability of PSE measures for additional countries would be quite desirable. In addition to the OECD dataset, the United States Department of Agriculture (USDA) offers 1980-1993 data for some countries, and a study funded by the World Bank offers 1984-1993 data for Latin America (Valdes, 1996). From these three sources, we compiled a dataset containing information from 37 countries. However, from this dataset we excluded the European Union (considered as a single country),

because agricultural policy is mainly decided at the European level and thus it is not straightforward to describe the relevant political institutions.

As determinants of agricultural protection we use the following political variables (x). For the electoral system we use a continuous measure, *DISTRMAGN*. Following Persson et al. (2003), we define *DISTRMAGN* as the ratio of the number of districts divided by the total number of parliamentary seats:

$$DISTRAMAGN = \frac{DISTRICTS}{SEATS}$$

The measure *DISTRMAGN* ranges between 0 and 1, taking a value of 1 for pure majority systems and a value close to 0 for pure PR systems.

As our theory implies a non-linear relationship between district magnitude and PSE, we also include squared *DISTRMAGN* as an additional variable, $DISTRMAGN^2$.

Further, we use FORMGOV as an indicator for the form of government, where $FORMGOV = 1$ indicates presidential systems and $FORMGOV = 0$ indicates parliamentary systems.

We also include an interaction term, $FORMGOVDISTRMAGN^2 = FORMGOV * DISTRMAGN^2$, to test for the theoretically predicted non-linear interaction between the form of government and the impact of the electoral rule on agricultural protection.

Furthermore, we include different economic and demographic variables, *y*, to check for other political economy factors, which already have been identified in the existing political economy literature.

Since our theory does not add to existing studies regarding the impact of demographic and economic framework conditions on agricultural protection, control variables will be mainly taken from the literature (Tyers and Anderson, 1992; Anderson, 1995; Beghin and Kherallah, 1994; Olper, 2001). These include: GDP per capita, *GDPPC*, to capture economic development; agricultural share in employment, *AGPOSHARE*, to account for differences in economic structure and industrialization[16]; the ratio of the agricultural share in value-added and the agricultural share in employment, *COMPAD*, to proxy comparative advantages in agriculture; and arable land per farm worker, FACTOREND, to take the relative incomes of agricultural farmers into account. Following Beghin and Kherallah (1994) we use the share of agricultural exports in total merchandise exports, *TAX*, to capture government tax collection constrains. Moreover, we define *BUDGET* as the net agricultural export per capita, in order to account for governmental budget constraints. In particular, budget costs due to agricultural trade policy crucially depend on the country's agricultural net trade position.

The explanatory variables explaining the policy regime selection in the probit estimation, *z*, include all economic and demographic variables, *y*. Additionally, we take into account the average life expectancy at birth measured in years, *LIFEEXP*, and the average literacy rate of adults measured in percent of literate people ages 15 and above, *LITERACY*, as additional indicators of economic development.

The demographic and economic variables are taken from the Food and Agriculture Organization of the United Nations (FAO, 2005) and the World Bank (WDI, 2005). The data on democratic governance go back to the surveys published annually since 1972 by Freedom House (Freedom House, 2005). In addition to these sources, the present study relies on the Database of Political Institutions (Beck et al., 2001).

Overall, our dataset included information on 37 countries for the years 1982-2003. The countries and years included in our dataset are given in the appendix (Table A.1). Moreover, Tables A.3 and A.4 in the appendix report the summary statistics of all variables used in the estimation.

It should be noted that the theoretical background discussed above is based on democratic institutions. Given the influence of political institutions on agricultural policy, we therefore focus on democratic countries. Given the scarcity of reliable PSE protection measures, we first use a fairly

[16] We also took the share of rural population, *RURALPOP*, as an explanatory variable into account. However, as rural population share and agricultural share in employment are highly correlated, we omitted rural population from our estimation. The estimation results did not fundamentally differ whether we used *RURALPOP*, *AGPOSHARE*, or both.

generous minimal requirement to classify a country as a democracy. Freedom House measures freedom according to two broad categories: political rights and civil liberties. The resulting Gastil Index takes values on a discrete scale from one to seven. Countries scoring one or two are "free," those scoring three to five are "partly-free," and countries scoring six or seven are "non-free."

For the following empirical analysis, we use two main datasets: the "broad" dataset contains countries that score an average Gastil Index of five or less over the study period, whereas the "narrow" dataset includes countries having an average Gastil Indices of two or less. Table A.1 in the appendix shows the countries used in the estimation and their classifications. Obviously the dataset is substantially reduced when we require that countries be free. Thus, the robustness of the estimation results for the different datasets and specifications becomes an interesting aspect of our empirical analysis. In particular, the subsample of countries taxing agriculture is dramatically reduced in the free country sample, to the point that specific estimations could only be undertaken for the broad dataset, not for the narrow dataset.

Based on the narrow and broad datasets, we estimate many specifications using different estimation strategies, including two-stage Heckman, 2SLS and ML-estimations. The reported estimation results are derived from two-stage Heckman estimations of eq. 30, where we used cluster-specific estimators to control for the panel structure of our data (Hosmer and Lemeshow, 2000).[17]

[17] We investigated numerous specifications including various combination of economic and demographic control variables as well as political variables. Moreover, we undertook 2SLS estimations instrumenting *AGPOPSHARE*, *TAX* and *BUDGET*. Furthermore, one reviewer pointed out that PSE measures depend on world commodity prices. To control for this dependency, we added dummies for each year. The preferred specification and estimation strategy reported in this paper is one that consistently yielded robust results. All estimation results are available from the author.

4. RESULTS

Tables 1-3 show the estimation results for the first and second stages of the two-stage Heckman estimation undertaken for the broad and narrow subsamples. In particular, both the subsidy and tax regime estimation results of the second stage are reported for four different specifications. The first specification corresponds to a basic specification including only the traditional economic and demographic variables used in previous studies, while the remaining specifications include political variables: specification 2 includes only district size (*DISTMAGN* and $DISTMAGN^2$); specification 3 additionally includes the impact of the form of government (*FORMGOV*); and specification 4 also includes the interaction effect ($FORMGOVDISTMAGN^2$).

Overall, the estimation results for the basic specification are consistent with the results of previous studies, in that most of the "classical" economic and demographic determinants of agricultural protection enter the equations with the expected signs and are, for the most part, statistically significant at a 10 percent level or higher.

As can be seen from Table 1, both the selection of subsidy (tax) regime and the level of subsidization (taxation) are crucially determined by traditional economic and demographic variables; in line with the so-called development paradox, they are consistent with the developmental stage of the country. In particular, GDP per head has a positive and highly significant impact on a country's probability to subsidize agriculture. Moreover, the level of subsidization significantly increases with a higher GDP per capita, while the level of taxation significantly decreases.

Table 1. Results of the first stage of the Heckman estimation (probit estimation) for the broad sample

	Sample	
	Broad	Narrow
Dependent variable	PSE-bin	
AGPOSHARE	2.7266 (1.76)	14.02 (2.89)***
GDPPC	0.3849 (6.33)***	0.90245 (2.8)***
COMPAD	-1.82 (-2.42)**	-1.216 (-0.73)
BUDGET	-0.0000996 (-0.13)	-0.00353 (1.32)
FACTOREND	-0.01628 (-0.096)	-0.0756 (-1.78)*
TAX	-0.037319 (-4.89)***	-0.07304 (-3.24)***
LIFEEXP	-0.1208 (-2.5)**	0.0765 (0.57)
LITERACY	0.0419 (3.2)***	0.0517 (1.12)
Cons	3.545 (1.1)	-14.719 (-1.64)
num. observ	319	252
Num. countries		
Pseudo R2	0.5315	0.6816

Note: Cluster robust standard errors in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%; PSE-bin = 1 indicates agricultural subsidization.

However, for the two other indicators of economic development, *LITERACY* and *LIFEEXP*, we observe inconsistent results. Although literacy has a positive impact on the probability to subsidize agriculture in both the broad and the narrow subsamples, significance is only observed for the latter. In contrast, life expectancy is not significant in either sample and has a slightly negative effect in the broad sample. Both variables are positively correlated with GDP per capita and thus do not add any explanatory

power to second stage estimation. Therefore these variables are omitted from the reported estimation results.

Table 2. Results of the second stage of the Heckman estimation for the subsidy regime: broad sample

	(1)	(2)	(3)	(4)
Dependent variable	PSE	PSE	PSE	PSE
Sample	broad			
AGPOSHARE	10.847 (0.87)	38.46 (3.04)***	38.197 (3.03)***	42.148 (2.31)***
GDPPC	1.289 (7.75)***	1.44 (8.28)***	1.36 (7.64)***	2.09 (12.20)***
COMPAD	5.889 (1.12)	1.29 (0.23)	0.496 (0.09)	8.835 (2.05)**
BUDGET	-0.03 (-10.5)***	-0.026 (-9.00)***	-0.027 (-9.22)***	-0.0259(-15.04)***
FACTOREND	-0.294 (-7.34)***	-0.09995 (-1.65)*	-0.105 (-1.74)*	-0.336 (-5.49)***
TAX	-0.039843 (-0.58)	0.0416 (0.6)	0.0332 (0.48)	-0.069 (-1.14)
FORMGOV			-3.711 (-1.73)*	10.07 (3.39)***
DISTMAGN		80.288 (3.87)***	79.127 (3.83)***	53.805 (3.48)***
DISTMAGN2		-84.455 (-4.21)***	-82.459 (-4.13)***	-39.64 (-2.52)***
FORMGOVDISTMAGN2				-39.64 (-8.21)***
cons	14.739 (3.19)***	2.199 (0.44)	5.416 (1.03)	-11.15 (-2.13)**
lambda	-3.326 (-0.84)	-7.148 (-1.83)*	-7.035 (-1.81)*	-3.95 (-1.1)
num. observ	240	240	240	240
num. countries				
adj. R2	0.6169	0.6939	0.6984	0.7606

Note: Cluster robust standard errors in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3. Results of the second stage of the Heckman estimation for the tax regime: broad sample

	(1)	(2)	(3)	(4)
Dependent variable	PSE	PSE	PSE	PSE
Sample	broad			
AGPOSHARE	9647696 (0.23)	77.0218 (1.31	76.9825 (1.31	69.12 (0.92)
GDPPC	3.832006 (0.74)	13.928 (1.84)*	13.9322 (1.83)*	13.57 (1.72)*
COMPAD	75.91165 (2.89)***	75.65312 (1.84)*	75.777 (1.64)	76.48 (1.65)*
BUDGET	0.0263998 (0.23)	0.011 (0.08)	0.01172 (0.08)	0.02368 (0.15)
FACTOREND	-2.495599 (-1.72)*	-4.837 (-2.23)**	-4.843 (-1.96)**	-5.0597 (-1.82)*
TAX	-0.0626918 (-0.18	-0.3763 (-0.77)	-0.3741 (-0.61)	-0.3191 (-0.46)
FORMGOV			-0.14186 (-0.01)	-9.079 (-0.16)
DISTMAGN		-167.84 (-1.72*	-168.9589 (1.78)	-188.86 (-1.12)
DISTMAGN2		150.7307 (2.01)**	150.9589 (1.78)*	161.73 (1.52)
FORMGOVDISTMAGN2				8.054 (0.17)
cons	-87.01336 (-2.56)***	-95.637 (-1.55)	-95.5983(-1.54)	-83.29 (-0.87)
lambda	8.755268 (0.62)	--17.61888 (-0.97)	-17.598 (-0.95)	-16.61 (-0.86)
num.observ	79	65	65	65
numbcountires				
adj. R2	0.0606	0.0811	0.0641	0.0468

Note: Cluster robust standard errors in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

The estimated coefficient of *TAX* is highly significant and in line with our theoretical expectations in the first-stage estimation. The higher the share of agricultural export in total exports, the higher the probability that agriculture is taxed, confirming the anti-trade hypothesis that the more administrative

capacities to collect income taxes, the more taxation of agricultural exports become a major source of taxation. However, *TAX* has no significant impact on the level of taxation (subsidization).

In contrast, the agricultural net trade position (*BUDGET*) has no significant impact on the agricultural regime selection, but a highly significant negative impact on the level of agricultural subsidization. This indicates that agricultural subsidization mainly occurs via trade policies and budgetary expenditures, which increase drastically with agricultural net exports (see for example Anderson, 1995).

FACTOREND has a negative impact on a country's probability of subsidizing agriculture; this is in line with the relative income hypotheses of Tyers and Anderson (1992) and DeGroter and Tsur (1991). However, this effect is significant for the narrow sample but not for the broad sample. *FACTOREND* also has a negative impact on the level of subsidization and a positive impact on the level of taxation, which is also in line with the relative income hypothesis. However, this effect is only significant for the broad, but not for the narrow sample.

Analogously, *COMPAD* has a significant negative impact on the probability of a country subsidizing agriculture, in line with theoretical implications indicating that decreasing comparative advantages in agriculture are associated with a higher demand for assistance (Beghin and Kherallah, 1994). However, this effect is only significant for the broad sample, not the narrow sample, and this variable is not significant at the second-stage estimation.

The share of agriculture in employment has a positive impact on both the selection of a subsidy regime and the level of agricultural subsidization, while for the tax regime we see a negative (though not significant) impact of *AGPOSHARE* on the level of taxation. Therefore, the estimation results cast some doubts on Olson's structural hypothesis of decreasing free-riding within smaller agriculture interest groups. However, other studies have found results similar to our results (e.g. Beghin and Kherallah, 1994; Olper, 2001).

The differences we see in the statistical significance of partial effects may be associated with the fact that a high Gastil Index (i.e. only restricted democratic freedom) is observed for the developing countries in our sample, whereas the subsample of free countries mainly contains industrialized countries. Thus, the significance of structural and developmental indicators decreases due to increased homogeneity of these indicators in our subsamples.

We herein mainly focus on the impact of political institutions on agricultural protection. As can be seen in Table 2, the estimation results for specifications 2-4 nicely support our theory.

In particular, for the subsidy regime we see a highly significant inverse u-shaped relationship between district size and agricultural protection measured by PSE. Moreover, agricultural subsidization is significantly lower for presidential versus parliamentary systems, and we find a significant interaction effect between presidential regimes and the impact of district size on agricultural protection (Table 2, specification 4). Please note that in Figure 4 (below), district size is measured by the variable, *DISTRMAGN*, whereas in the previous figures district size was measured by the variables RDS. Accordingly, in Figure 4 DISTMAGN = 1 corresponds to a pure majority system, while in Figure 2 and 3 RDS = 1 corresponds to a purely proportional representation.

For the subsidy regime these results are quite robust, holding for both the narrow and broad samples (see appendix, Table A.2).[18]

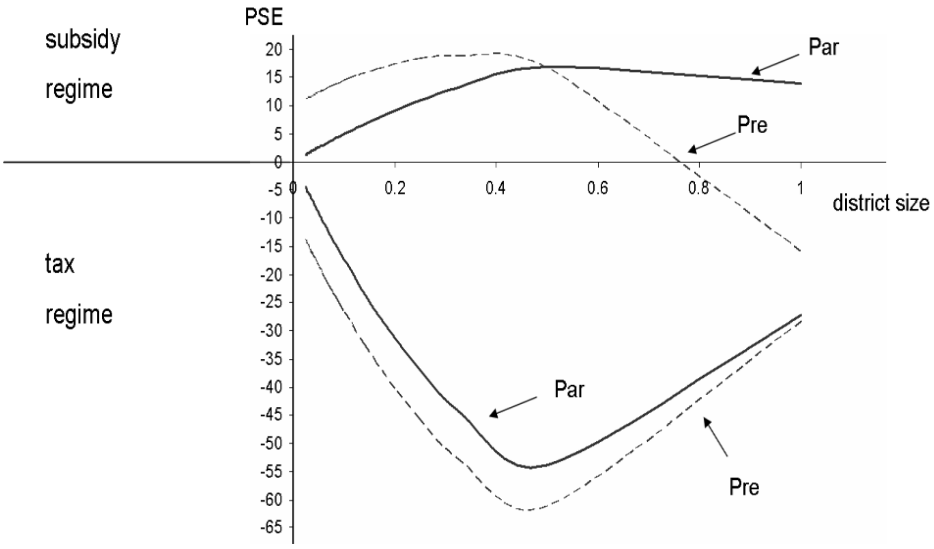
For the tax regime we also find support of our theory; for the broad sample the estimation results indicate a u-shaped relationship between district size and agricultural taxation measured by a negative PSE[18]. Moreover, the results do not change when we apply other estimation strategies, such as a Maximum-Likelihood estimator or a 2SLS estimation. However, we were unable to estimate results for this regime from the narrow dataset, due to the relative paucity of data. Indeed, estimation was problematic even for the broad sample due the small sample size (only 65 observations). Therefore, these estimation results should be interpreted with caution.

[18] Moreover, it does not change when we apply other estimation strategies, such as a Maximum-Likelihood estimator or a 2SLS estimation or add time dummies for each year.

Interestingly, our estimation results imply a positive impact of the presidential versus parliamentary regime on the level of taxation (see the negative parameter of -0.14186 for the dummy variable *FORMGOV* for specification 3 in Table 3). Analogously, including the interaction term between electoral rules and form of government yields an overall higher taxation level for presidential versus parliamentary systems.

These results indicate that, at least for countries taxing agriculture, presidential regimes lead to higher taxation compared to parliamentary systems. The main estimation results regarding the impact of political institutions on agricultural protection and taxation are illustrated in Figure 4 (below). One possible explanation for the unexpected finding that presidential systems are associated with higher agricultural taxation is that the agenda-setting power of the economic committee may be higher in these systems compared to the party discipline of the PM in parliamentary systems, meaning that the preferred policy position of the floor median also corresponds to a sufficiently high taxation of agriculture (i.e. one that is sufficiently distant from a hypothetical status quo policy of no agricultural intervention). However, especially in developing countries, the president (like the PM in parliamentary systems) exerts specific informal power over the parliamentary majority. Thus, another possible explanation for our result is that in developing countries, the informal power of a president is higher than the party discipline of a PM.

Figure 4. District size (measured by DISTRMAGN), form of government and estimated patterns of agricultural protection



Finally, it might be interesting to analyze the quantitative impact of political institutions on the level of agricultural protection, especially in comparison to the impact of traditional economic and demographic determinants.

For example, based on the estimated parameters for the broad sample, the maximal increase in agricultural protection induced by a shift of electoral rules is 18 percent of the PSE measure for parliamentary systems and 19 percent of the PSE measure for presidential systems. For comparison, in order to yield the same increase, the GDP per capita would need to increase by 9000 US$ per year. Analogously, assuming a majority system (*DISTRMAGN* = 1), a shift from a presidential to a parliamentary system would increase the PSE level by 29 percent. Thus, our estimation results indicate that political institutions do have an important impact on agricultural protection levels. However, political institutions, at least in terms of district size and parliamentary versus presidential regimes, have no impact on the selection of agricultural policy regime. The decision to tax or subsidize agriculture is solely determined by economic and demographic framework conditions.

5. CONCLUSION

We herein provide a systematic analysis of the impact of political institutions on agricultural policies at both the theoretical and empirical levels. In particular, the model of Henning and Struve (2007), explaining the role of electoral rules in the agricultural protection in parliamentary systems of industrialized countries, is extended in two directions:

First, the model is applied to the demographic and economic framework conditions of developing countries. While industrialized countries are characterized by primarily urban populations, developing countries are characterized by primarily rural populations. The voting model suggested by Henning and Struve (2007) is based on a probabilistic environment in which rural districts of industrialized countries are less ideologically committed than urban districts. As a consequence, in industrialized countries with parliamentary systems, the rural districts are pivotal in determining which coalition obtains a majority, whereas the urban districts are pivotal within the majority itself. In bargaining at the legislature level, this generates a conflict between the PM, who will tend to favor rural districts, and the parliamentary majority, which will tend to be dominated by urban concerns.

At the election stage, both the bias of the PM in favor of rural districts and the bias of the majority in favor of urban districts are attenuated because the district size grows, district populations become more homogeneous and the electoral system converges to a purely proportional representation. Overall, a nonlinear relationship between district size and agricultural protection follows: when the system is close to purely proportional, a decrease in district size increases agricultural subsidies, since it implies that the PM becomes more biased towards rural districts. As district size continues to decrease, urban legislators become less and less willing to support agricultural subsidies; this implies that at some point they would be willing to break the coalition despite party discipline, meaning that agricultural subsidies must decrease in order to preserve unity.

Using this model to explain agricultural taxation in the parliamentary systems of developing countries, a corresponding inverse u-shaped relationship between district magnitude and the level of taxation results by exactly the same logic. This follows because, in contrast to the case in industrialized countries, urban districts in developing countries are in the minority and are less ideologically committed than rural districts. Hence, in developing countries with parliamentary systems, urban districts are pivotal in determining which coalition obtains a majority, whereas rural districts are pivotal within the majority itself.

In bargaining at the legislature level, this generates conflicts between the pro-urban PM and the pro-rural parliamentary majority. Following the same logic derived for industrialized countries, in developing countries with parliamentary systems, we see a non-linear relationship between district size and level of agricultural taxation.

However, these seemingly compatible results have major implications for cross-country analysis. In particular, our theoretical results use a different regime to explain the influence of political institutions on agricultural protection for countries that tax agriculture versus those that subsidize agriculture. Notably, when measuring agricultural protection with the usual concepts (e.g. PSE or NPC), it follows directly from our theory that an inverse u-shaped relationship will be seen between district magnitude and the PSE- or NPC-measured results for (industrialized) countries subsidizing agriculture. In contrast, our theory implies that a u-shaped relationship will be seen between district magnitude and the PSE or NPC measures for (developing) countries taxing agriculture. Therefore, estimating one equation for both regimes (agricultural taxation and subsidization) will lead to biased results regarding the influence of political institutions on agricultural protection, suggesting that a switching regression model should be used when performing a cross-country analysis that includes both developing and industrialized countries.

The second extension we suggest corresponds to our analysis of the impact of the governmental system (parliamentary versus presidential) on patterns of agricultural protection in developing and industrialized countries. In particular, we extend the model of Henning and Struve (2007) to also incorporate presidential systems. In contrast to parliamentary systems, which are characterized by stable

ex ante majorities and strong legislative cohesion granting the PM strong legislative power, legislative cohesion is rather small in presidential systems, which are characterized by parliamentary committees with agenda-setting powers. Therefore, legislative bargaining in a presidential system is characterized by a conflict between the median of the agricultural committee, who will tend to favor rural (urban) districts and the floor median, who will tend to favor urban (rural) districts in industrialized (developing) countries. Again, at the election stage, both the bias of the committee median in favor of rural districts and the bias of the floor median in favor of urban districts are attenuated, when district size grows, district populations become more homogenous, and the electoral system converges to a pure proportional representation. Overall, as in parliamentary systems, for presidential systems we see the same nonlinear relationships between district size and agricultural protection (taxation) for industrialized (developing) countries, respectively. However, as long as the agenda-setting power of the agricultural committee is lower than that of the PM due to legislative cohesion in parliamentary systems, agricultural subsidization in industrialized countries should be lower for presidential versus parliamentary systems. By the same argument, the level of agricultural taxation in developing countries should also be lower for presidential than parliamentary systems. Moreover, our theory implies that the cut points of the nonlinear relationship will ceteris paribus occur at a lower district magnitude in the parliamentary system.

Our theory is supported by empirical estimations based on cross-country panel sample of 37 countries for the period 1982-2003.

In particular, for industrialized countries subsidizing agriculture, we see that, consistent with our theory, political institutions have a significant impact on agricultural protection . For developing countries, our estimation results confirm the theoretically-predicted u-shaped relationship between district size and agricultural taxation, as measured by PSE. Moreover, for countries taxing agriculture, presidential systems lead to higher taxation compared to parliamentary systems. However, estimation results for the tax regime are less reliable, since the utilized dataset is relatively small. Further research will be necessary to address this point.

APPENDIX

Table A.1. Countries included in the database

Country	Broad	Narrow	Ø Gastil	Ø PSE
Argentina *	1982-1992	1984-1992	2,0	-34,1
Australia	1986-2003	1986-2003	1,0	6,6
Brazil	1985-2003	1985-2003	2,6	6,0
Canada	1986-2003	1986-2003	1,0	24,8
Chile *	1987-1992	1990-1992	3,3	13,6
Colombia *	1982-1992	1982-1988	2,8	14,5
Czech Rep.	1993-2003	1993-2003	1,5	19,3
Dominican Rep. **	1984-1993	1984-1993	2,3	-22,7
Ecuador **	1986-1993	1986-1993	2,3	-54,3
Egypt *	1982-1992	-	4,6	-48,6
EU[#]	1986-2003	1986-2003	1,3	36,0
Hungary	1986-2003	1991-2003	2,5	23,6
Iceland	1986-2003	1986-2003	1,0	69,0
India *	1982-1990	1982-1990	2,5	-13,3
Jamaica *	1982-1989	1982-1989	2,4	-36
Japan	1986-2003	1986-2003	1,4	57,6
Kenya *	1982-1986	1982-1986	1,5	-15,4
Mexico	1986-2003	2000-2003	3,4	15,7
New Zealand	1986-2003	1986-2003	1,0	1,8
Nigeria *	1982-1989	1982-1983	3,7	6,3
Norway	1986-2003	1986-2003	1,0	69,6
Paraguay **	1984-1991	-	4,6	-19,0
Poland	1986-2003	1991-2003	2,4	15,8
Russia	1992-2003	-	4,5	-4,2
Senegal *	1982-1989	-	3,6	23,9
Slovak Rep.	1994-2003	1995-2003	2,1	19,7
South Africa *	1983-1989	-	5,5	8,7
South Korea	1986-2003	1988-2003	2,4	68,2
Switzerland	1986-2003	1986-2003	1,0	72,4
Turkey	1986-2003	-	3,9	19,8
Ukraine	1992-2003	-	3,7	-4,3
United States	1986-2003	1986-2003	1,0	18,5
Uruguay **	1987-1993	1987-1993	1,7	-15,3
Venezuela *	1982-1987	1982-1987	1,5	62,8
Yugoslavia *	1983-1988	-	5,4	49,3
Zambia *	1982-1991	-	5,1	-125,1
Zimbabwe *	1982-1989	-	4,9	-31,0

Note: Some PSE values for the studied time series are missing for Brazil, Nigeria, Paraguay and the Slovak Republic. The average Gastil Indices and PSE levels are calculated over the broad sample range. Countries marked * are taken from the USDA source, countries with ** from Valdes, and countries without mark are taken from OECD data. # E.U. not used in estimation

Table A.2. Results of the second stage of the Heckman estimation for the subsidy regime: narrow sample

	(1)	(2)	(3)	(4)
Dependent Variable	PSE	PSE	PSE	PSE
Sample	Narrow			
AGPOSHARE	-14.069 (-0.83)	32.502 (1.81)	32.622 (1.73)	53.43 (2.61)
GDPPC	0.091 (5.01)***	1.205 (5.94)***	1.084 (4.89)***	1.97 (7.09)***
COMPAD	4.247 (0.67)	-2.879 (-0.44)	4.735 (-0.68)	5.801 (0.76)
BUDGET	-0.032 (-10.93)***	-0.027 (-8.35)***	0.028 (-8.18)***	-0.027 (-7.5)***
FACTOREND	-0.289 (-6.88)***	-0.0999 (-1.3)	-0.11 (-1.36)	-0.377 (-3.95)***
TAX	-0.023 (-0.31)	0.065 (0.82)	0.062 (0.75)	-0.044 (-0.48)
FORMGOV			-5.694 (-2.08)	13.303 (3.09)***
DISTMAGN		93.965 (3.8)	98.137 (3.75)***	60.912 (2.15)
DISTMAGN2		94.89 (-3.88)***	-96.557 (-3.74)***	-39.94 (-1.39)
FORMGOVDISTMAGN2				-45.73 (-6.12)***
Cons	26.590 (5.03)***	8.745 (1.42	13.17 (1.92)	-9.886 (0.233)
Lambda	-8.038 (-1.74)*	7.148 (-3.37)***	-16.305 (-3.36)***	-17.295 (-3.36)***
num.observ	219	204	204	204
Numbcountires				
adj. R2	0.6687	0.7281	0.7354	0.8159

Note: Cluster robust standard errors in parentheses. * Significant at 10%; ** significant at 5%; ***significant at 1%.

Table A.3. Variables used in estimation: broad sample

Variable	Obs	Mean	Std. Dev.	Min	Max
PSE	452	14,864	45,581	-383	79,7
PSEBIN	452	0,763	0,426	0	1
AGPOSHARE	452	0,213	0,199	0,02	0,82
EMPLSHARE	452	0,215	0,207	0,02	0,82
RURALSHARE	452	0,333	0,170	0,07	0,82
LIFEEXP	416	69,730	8,144	46,3	81,6
LITERACY	416	88,700	17,098	22,4	99,6
GDPPC	442	13,368	9,763	0,7	35,8
COMPAD	433	0,532	0,259	0	1,3
BUDGET	452	30,728	331,698	-704,9	1656,1
FACTOREND	452	14,398	28,735	0,3	126,1
TAX	385	21,626	21,108	0,5	83,6
DISTMAGN	354	0,367	0,414	0,01	1
FORMGOV	451	0,432	0,496	0	1

Table A.4. Variables used in estimation: narrow sample

Variable	Obs	Mean	Std. Dev.	Min	Max
PSE	312	24,16923	36,52122	-147,7	79,7
PSEBIN	312	0,8333333	0,3732767	0	1
AGPOSHAREe	312	0,1453846	0,1482302	0,02	0,82
EMPLSHARE	312	0,1449679	0,154114	0,02	0,82
RURALSHARE	312	0,2852885	0,1559967	0,07	0,82
LIFEEXP	279	72,59785	6,607881	46,4	81,6
LITERACY	279	92,95771	12,42706	36,1	99
GDPPC	312	16,68622	9,689669	0,7	35,8
COMPAD	303	0,5534654	0,2509179	0	1,3
BUDGET	312	41,55769	397,4753	-704,9	1656,1
FACTOREND	312	18,95962	33,4895	0,4	126,1
TAX	290	22,50024	22,53472	0,5	83,6
DISTMAGN	275	0,398073	0,4260285	0,01	1
FORMGOV	311	0,3858521	0,4875804	0	1

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