

Analyzing the Interdependence of Regulation and Taxation

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This article draws attention to the interdependence of regulation and taxation. The authors analyze the nature of policy equilibrium, as well as the implications of historically important political and economic shocks, for the joint use of the two policy instruments in a framework that embodies relationships common in the literature. Regulation is represented by barriers to entry created by the government for favored industries. Among the results are the following: the introduction of new methods of communication in politics, such as television advertising, leads to increased taxation of the average voter, lower business tax rates, greater entry barriers in private markets, and greater resource use for campaign advertising, with the marginal cost of the new medium and the elasticity of supply in regulated industries playing crucial roles. Budgetary government size declines. The two additional shocks analyzed, namely, growth in the labor force participation of women and increased offshore production also have substantial consequences for tax rates as well as regulation. The article concludes with a consideration of the efficiency of policy equilibrium and the analytical problems that arise in evaluating efficiency in such a context.

Keywords: *regulation; taxation; policy interdependence; political advertising; efficiency of political equilibrium*

An interest group enters the political process to advance the common interest of its members. It can accomplish this by providing candidates

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information . . . by delivering votes . . . and most importantly and conspicuously in recent years by supplying a candidate with money. . . . By far the most controversial of these three activities of interest groups, from both a positive and a normative perspective, is their use of money to influence the outcomes of the political process.

—Dennis Mueller (2003, 74)

It would be strange if taxation by interested parties should not result in taxation according to interest.

—Knut Wicksell (1896/1958, 77)

1. Introduction

Most observers of politics are familiar with the balancing of different public policies. Few voters, for example, are surprised when changes in the regulation of labor markets are coupled with tax measures directed toward business interests.¹ Voters expect and accept compromises of this sort as a valid expression of the democratic process, regardless of whether they favor or oppose a particular policy.

Economic analysts have been less sanguine in dealing with choices involving the simultaneous use of policy instruments, particularly when the relevant policies are as different in nature as regulation and taxation. With some notable exceptions over the years (for example, Posner [1971] and more recently, Borcherding and Lee [2002]) economic researchers generally focus on one policy area, to the exclusion of other concerns, and thus often disregard the possible interdependence of important governmental choices.²

Once we focus on the possibility of substitution, a new set of analytical questions arise. If there are crucial linkages between regulation and taxation, for example, we must ask how major shocks to the economic and political system affect the use of both instruments and the balance between them. Will a shock that has a large impact on the tax system also lead to significant regulatory changes? Or alternatively, will deregulation (or an increase in regulation) entail major alterations in the tax system? Furthermore, such questions will be joined by normative concerns. Can we formulate conditions that characterize the best mix of policies, and is it feasible to determine under what conditions political markets may fail to generate equilibria reflecting an efficient policy mix?

In this article, we propose a model that provides specific links between regulation and taxation. We analyze the nature of policy equilibrium, as

well as the implications of several historically important political and economic shocks, for the joint use of the two policy instruments in a framework that embodies relationships common in the literature on political economy. The analysis is part of a larger framework that views policy choices as the endogenous outcome of a well-specified political process. For expositional purposes, we limit the treatment of regulation to the "capture type," a situation where decision makers exchange protective regulatory policies for economic resources, obtained from a favored industry that can be used in the pursuit of winning elections.³ The essential link between regulation and taxation that arises in this framework stems from the fact that all political parties can use both instruments to affect the behavior of the same special interests and that political competition forces them to do so. In this world, shocks that initially affect tax bases, for example, must carry implications for regulation, and vice versa, and these connections will not arise in a framework where only one of the two types of instruments is analyzed as part of an electoral strategy.

The article proceeds in several steps. We begin with a sketch of the political framework. It is assumed that voting is probabilistic from the perspective of political parties and that parties formulate policy platforms to maximize expected support in the next election. The process results in a Nash equilibrium, associated with an equilibrium combination of tax and regulatory policies. We next show that the investigation of policy choice can be pursued by optimizing a political support function, an interesting aspect of the probabilistic voting model that is finding increased application and that we refer to as the Representation Theorem.

Once the theoretical framework has been established, we turn to comparative statics. To gain a better understanding of policy interdependence, we use a graphical analysis of the model to investigate the effects of historically important, exogenous shocks of two types to make the analysis more broadly representative.⁴ One type originates in the operation of the political process, and the other one represents a change in economic forces. Among the results are the following: the introduction of new methods of communication in politics, such as television advertising, leads to increased taxation of the average voter, greater entry barriers in private markets, and greater resource use for campaign advertising, with the marginal cost of the new medium and the elasticity of supply in regulated industries playing crucial roles. Overall government size declines. Growth in the labor force participation of women, a shock of an economic nature, lowers business tax rates and results in more regulation and higher contributions of political resources while leading to larger government.

The examination of comparative statics also yields questions for further applied research. In addition, the model allows us to raise normative questions concerning the efficiency of various outcomes. In section 5, we use the Representation Theorem to comment on the normative properties of the framework and to point out several questions regarding efficiency that require further attention. The article ends with a brief concluding section.

2. The Political Economy Framework

Our purpose is to explore policy interdependence in competitive political equilibrium. Since the focus is on the policy mix, and on how this policy mix responds to exogenous shocks, we develop a model that is designed to capture the crucial elements underlying interdependent policy choice. The model does not include a detailed characterization of information transmission and of the bargaining between the government and special interests.

We also note that the spatial voting model of political equilibrium used in the article is a two-party framework that assumes effective political competition. It is not designed to investigate exogenous changes in the degree of competition (such as might follow the entry of wealthy individuals who spend large amounts of money) or situations of slack that allow individual politicians to pursue personal goals. It is interesting and worthwhile to consider how spatial voting models could be amended to include variations in the degree of political competition and the existence of slack. However, little theoretical work exists on how different definitions of political competition affect formal equilibrium results in models of this type, and we leave exploration of this issue for future research.⁵ Consider, then, a perfectly competitive two-party system where both the incumbent, i , and opposition, o , must appeal to two types of citizens as they continually attempt to maximize the size of their total expected vote in the next election: first, a large number (H) of unorganized, risk-averse voters who are imperfectly informed about party policies and candidates for office, and whose individual voting behavior is probabilistic from the perspective of the parties; and second, a small number of organized, well-informed producers belonging to a specific industry. The asymmetries in organization and information between the two groups reflect a difference in group behavior emphasized repeatedly by writers such as Downs (1957), Olson (1965), Baron (1994), Austen-Smith (1997), and Grossman and Helpman (2001), and are an important aspect of special interest politics.⁶

To keep the model as simple as possible, we shall assume that behavior is homogeneous within each of the two groups, although we are aware that

a large unorganized group may be heterogeneous and that not all special interests necessarily represent a single industry or have members that share the same goals.

Unorganized voters may express opposition to fiscal and regulatory policies by voting against the government in the next election. The probability that a representative member of the unorganized group will vote for one of the parties (π) depends exclusively on the difference in (indirect) utilities implied by the fiscal and regulatory platforms of each party, and by the level of expenditure on advertising and organization (F) that each makes. The fiscal program of each party consists of a proposed level of a pure public good (G), a proportional tax rate (t_1) to be imposed on the gross income of the unorganized (B_1), and a tax rate (t_2) to be imposed on the business income of the special interest B_2 . The regulatory program of each party, which we represent with an index or measure of government-created barriers to entry (r), affects the price of output in the regulated industry (p) and thereby the welfare of consumers.

For the incumbent (i), $\pi = \pi(v_i - v_o)$ with $v_i = v(t_{1i}, G_i, p, F)$, where v_i represents the indirect utility of a representative member of the unorganized group of voters given the platform of the incumbent, and v_o stands for the indirect utility of a typical unorganized voter under the platform of the opposition.⁷ Note that the functional form of both the voting density function and the indirect utility functions is the same for all unorganized voters. Increases in G_i and F are assumed to raise v_i , thereby increasing π , with both effects declining at the margin. Higher prices p and tax rates t_{1i} , on the other hand, will have the opposite consequences for political support by unorganized voters.

In the above formulation of the probability of voting, political advertising affects voting only because it improves the welfare of voters. This may be justified in two ways. Because unorganized voters are risk-averse, they will benefit from advertising that reduces the perceived variance in their beliefs about proposed policies (Austen-Smith 1997; Hinich and Munger 1994). Advertising may, for example, provide information about the nature of policies, or about the methods by which a campaign promise will be implemented after an election. Second, by reducing the cost of acquiring knowledge about political platforms, advertising leaves imperfectly informed voters with more resources for private consumption. We shall return to the issue of how advertising affects voting behavior in the discussion of normative issues in section 5.

Although members of the second, organized group can vote, the group's impact does not derive from the ballot box, but rather from a process of exchange with whatever party becomes the government. We assume for

analytical convenience that ballots cast by interest group members do not influence electoral results.⁸ Since they are dealing with a well-organized group, parties can obtain the resources required to provide political resources F from this group in return for promises of favorable tax and regulatory treatment.⁹ We assume that if successful, each party will deliver to members of the (well-informed) interest group whatever was promised.¹⁰ This is a model of regulation of the “capture type” (regulation is demanded by the regulated) analyzed by Stigler (1971), Peltzman (1976), and many others since.

Members of the special interest group are seeking, via their industry association or special interest lobby, to obtain a lower tax rate (t_2) on the observable or taxable income they derive from their industry activity (B_2), as well as higher barriers to entry (r) offered as part of political platforms. The parties, on the other hand, have a need for financial and other resources to engage in political activities, such as party organization and political communication. We assume that existing constitutional provisions prevent the incumbent party from obtaining such resources directly through taxation and that both participants are interested in the exchange of policies for political resources. Although both tax concessions to industry and more regulation result in lower utility of unorganized voters, there is room for a trade-off among policy variables and for the mutually beneficial exchange between political parties and the organized group.

We may write the incumbent party’s problem of maximizing expected votes as follows:

$$\underset{\{t_{1i}, t_{2i}, r_i, G_i\}}{\text{Max}} \quad EV_i = H \pi(v_i - v_o) \quad (1)$$

subject to

$$G_i = t_{1i}B_1 + t_{2i}B_2, \quad (2)$$

where

$$v_i = v(p, t_{1i}, G_i, F, x); \quad \frac{\partial v_i}{\partial p} < 0, \frac{\partial v_i}{\partial t_{1i}} < 0, \frac{\partial v_i}{\partial G_i} > 0, \frac{\partial v_i}{\partial F} > 0 \quad (3)$$

$$B_1 = B_1(t_{1i}, x); \quad \frac{\partial B_1}{\partial t_{1i}} < 0 \quad (4)$$

$$F = fB_2 \quad (5)$$

$$f = f(t_{2i}, r_i, y); \quad \frac{\partial f}{\partial t_{2i}} < 0, \quad \frac{\partial f}{\partial r_i} \geq 0 \quad (6)$$

$$B_2 = B_2(p, t_{2i}, f, r_i, y); \frac{\partial B_2}{\partial p} \leq 0, \frac{\partial B_2}{\partial t_{2i}} < 0, \frac{\partial B_2}{\partial f} < 0, \frac{\partial B_2}{\partial r_i} > 0 \quad (7)$$

$$p = p(t_{2i}, r_i, f, z); \frac{\partial p}{\partial t_{2i}} > 0, \frac{\partial p}{\partial r_i} > 0, \frac{\partial p}{\partial f} > 0. \quad (8)$$

Assuming that everyone votes, the expected vote maximized by the opposition is simply $EV_o = H - EV_i$.

Here x , y , and z are vectors of factors exogenous to the model. For given values of policy instruments and the state of the economy, equations (3) and (4) reflect optimizing behavior by unorganized voters. Note again that we assume the same indirect utility function for all members of the unorganized group.

As the budget restraint (2) indicates, provision of political resources falls outside of the regular budgetary process. Determination of the total amount of political resources F is given by (5) and (6), with F expressed as the product of a contribution rate f per dollar of taxable income and the taxable income of producers B_2 , with the latter governed by (7).¹¹ In (6), the contribution rate f depends negatively on t_{2i} and it depends positively on r_i , reflecting the underlying assumptions that producer profits will increase monotonically as t_{2i} falls and as r_i rises, and that the party in power will benefit from any such changes by receiving more resources for political advertising and organization.

We should expect, however, that increases in r_i beyond some point may not be politically desirable, since the resulting entry barriers cause consumer prices to rise, harming unorganized voters. We should also note that the model does not specify the full nature of the underlying bargain between the group representing producers and the governing party, leaving the exact "split" between them, as well as the degree of enforcement of the exchange, to be determined exogenously.¹²

As shown in (8), the price of the regulated industry depends as noted above on r_i , as well as on t_2 , increasing with both. Over some range, as indicated by (8), a rise in price may lead to larger taxable incomes for producers. Whether or not this is the case will depend on the nature of demand for the product being sold. However, it seems reasonable to expect that further price increases will reduce B_2 beyond some point.

A Nash equilibrium in the electoral game, if it exists, is a simultaneous solution to the first-order conditions for both parties required for maximization of their respective expected vote functions. The signs of first partial derivatives that have been specified so far are not sufficient to insure the existence of a Nash equilibrium. Assuming that the feasible set of policy

platforms is identical for both parties and is convex and compact, a Nash equilibrium in pure strategies will exist if both expected vote functions are continuous in the space of all platforms and quasi-concave in each party's platform for every given platform of the other party (Fudenberg and Tirole 1991, Theorem 1.2).¹³ In this article, we shall assume that the expected vote functions of each party are strictly concave and proceed to investigate the nature of the substitution of policy instruments in equilibrium.¹⁴ Assumptions about second derivatives sufficient for existence of a Nash equilibrium are implicitly imposed in the graphical analysis of the model.

3. Regulation, Taxation, and Political Support: A Representation Theorem

To develop a graphical analysis of the electoral equilibrium, it is useful to apply the following theorem due to Coughlin and Nitzan (1981). This theorem, which we state but do not prove here, shows how a Nash equilibrium in the model outlined above can be conveniently characterized or represented by solving a particular optimization problem:

Theorem: Assuming indirect utility functions are concave in policy instruments, if a policy platform $s^* = (t_1^*, t_2^*, G^*, r^*)$ solves the problem of maximizing the political support function $S = H\theta v$, where θ is the value of $\partial\pi/\partial v$ at the Nash equilibrium, subject to equations (2) through (8), then (s^*, s^*) is a Nash equilibrium.

We shall refer to the equivalence of the policy platform that optimizes S and the Nash equilibrium in the electoral game as the Representation Theorem.¹⁵ A formal proof of this particular theorem is provided in Hettich and Winer (1999, chap. 4), and other forms of the theorem are presented in Coughlin (1992). The formal proof proceeds by showing that the first order conditions for maximizing S are identical to those required for maximizing expected votes for either party, while second-order conditions are satisfied because of the assumed concavity of the indirect utility functions.

The intuition for the theorem is straightforward: political competition for support from voters who care about their economic welfare forces each party to adopt policies consistent with movements toward the Pareto frontier—this is what leads to the maximization of the support function S , which is a particular weighted sum of voter utilities. Otherwise, the opposition will be able to increase its electoral support by improving the welfare of some voters. In a competitive political equilibrium of the kind described above, no such economic or political gains remain to be captured. (In subsequent

versions of the model discussed in section 5, the equilibrium may not lie on the Pareto frontier.)

This does not mean that all voters are treated equally well however. In S , unorganized voters are given a weight of θ , while (implicitly) members of the special interest group are given a weight of 0 since they do not vote. One should also note that although the welfare of members of the special interest group are not represented directly in S , because their nominal votes are too few in number to matter, the government does take their welfare indirectly into account through the exchange of policies for political resources F . Finally, it must be pointed out that S is not a social welfare function. The weights in S as well as its linear form are determined within the model rather than on the basis of normative reasoning.

4. The Joint Use of Regulation and Taxation

4.1. Political and Economic Shocks

A major purpose for constructing a model of this nature is to conduct experiments in comparative statics that allow us to examine the influence of significant exogenous shocks on equilibrium values of the main variables. Using a graphical analysis, we shall examine the effects of three such shocks that we believe to be of particular interest for the joint use of regulation and taxation. The following analysis of these shocks relates to the medium term over which some entry and exit of firms occurs, rather than to quick, immediate changes or to the effect of shifts taking place over very long periods of time.

We shall consider one change related to the more political aspects of the model that has a close counterpart in the recent political experience of modern nations. Consider a breakthrough in the technology of communication, such as occurred with the introduction of television. This innovation will have a major impact on the political process described in our model by changing the vote productivity of funds spent on political advertising.

The model also allows us to consider shocks that are primarily economic in nature. Again, we shall choose examples having direct relevance to experience in the advanced democracies. In the first case, the change relates to the behavior of the unorganized. Imagine an exogenous increase in the tax base composed of the incomes of unorganized voters. An example of such a shock is provided by the substantial shift in the labor force participation of women whose previous activities in the home could not be captured

in the tax base.¹⁶ In the second case, we assume that there is a change in industrial organization making domestically imposed limits on entry less useful to the protected industry, such as occurs when it becomes more profitable to move domestic production abroad to locations where labor and other costs are lower. In both cases, major and analytically significant effects on the use of policy instruments can be expected.

4.2. The Equilibrium Mix of Policy Instruments

As a basis for the graphical analysis developed in the next section, we use the Representation Theorem to characterize the equilibrium use of policy instruments. We proceed by solving the following optimization problem:

$$\underset{\{t_1, t_2, r, G\}}{\text{Max}} \quad S = H\theta v \quad \text{subject to} \quad G = t_1 B_1 + t_2 B_2. \quad (9)$$

The Lagrangean is

$$L = H\theta v - \lambda(G - t_1 B_1 - t_2 B_2). \quad (10)$$

The first-order conditions for an interior solution to problem (9), which we shall interpret and solve graphically later on, are as follows:¹⁷

For t_1 ,

$$H\theta \frac{\partial v}{\partial t_1} + \lambda B_1(1 + \alpha_1) = 0, \quad (11)$$

where $\alpha_1 = \frac{\partial B_1}{\partial t_1} \frac{t_1}{B_1}$ is the elasticity of B_1 with respect of t_1 .

For t_2 ,

$$H\theta \left(\frac{\partial v}{\partial p} \frac{\partial p}{\partial t_2} + \frac{\partial v}{\partial F} \frac{\partial F}{\partial t_2} \right) + \lambda B_2(1 + \alpha_2) = 0, \quad (12)$$

where $\alpha_2 = (\frac{\partial B_2}{\partial f} \frac{\partial f}{\partial t_2} + \frac{\partial B_2}{\partial r})(\frac{t_2}{B_2})$ is the elasticity of B_2 with respect of t_2 .

For r ,

$$H\theta \left(\frac{\partial v}{\partial p} \frac{\partial p}{\partial r} + \frac{\partial v}{\partial F} \frac{\partial F}{\partial r} \right) + \lambda t_1 \left(\frac{\partial B_2}{\partial p} \frac{\partial p}{\partial r} + \frac{\partial B_2}{\partial r} + \frac{\partial B_2}{\partial f} \frac{\partial f}{\partial r} \right) = 0. \quad (13)$$

And for G ,

$$H\theta \frac{\partial v}{\partial G} - \lambda = 0. \quad (14)$$

In equations (11) and (12), we assume that the elasticities $\alpha_i > -1$ to ensure that in an equilibrium, an increase in either tax rate leads to an

increase in tax revenue, since positions on the backward-bending part of any Laffer curve are not politically rational.

These first-order conditions can be conveniently rearranged to yield the basis for the graphical analysis showing the equilibrium use of policy instruments. Equation (14) indicates that the Lagrange multiplier λ represents the marginal gain in expected votes from increasing government expenditures by \$1. This marginal political benefit (MPB) is shown in the first panel of Figure 1 as the curve MPB_G and is drawn as downward sloping on the assumption that marginal utility of public services is declining. Note that Figure 1 contains a set of dotted lines that apply to a subsequent comparative static experiment, and we shall ignore these dotted lines for the moment.

Equations (11) and (12), when solved for λ , yield the following expressions (15) and (16) that can be interpreted as marginal political cost of taxation functions. These indicate that tax rates t_1 and t_2 will be chosen in equilibrium to equalize the marginal political costs (MPC) per (marginal) dollar ($MPC_i/\$/$) of revenue raised from each source:

$$H\theta \frac{\partial v}{\partial t_1} / B_1(1 + a_1) = -\lambda, \quad (15)$$

$$H\theta \left(\frac{\partial v}{\partial p} \frac{\partial p}{\partial t_2} + \frac{\partial v}{\partial F} \frac{\partial F}{\partial t_2} \right) / B_2(1 + \alpha_2) = -\lambda. \quad (16)$$

The solid lines in the top part of panels 2 and 3 of Figure 1 show these marginal political costs per dollar—the left side of (15) and (16), respectively—labeled MPC_1 and MPC_2 . Note that each of these MPC curves is drawn with total revenue from each base T_1 and T_2 on the horizontal axis. The curves in the lower part of panels two and three are the Laffer curves for each revenue base and allow the determination of the tax rate associated with each total revenue. Finally, the two MPC curves are summed horizontally to yield the total marginal political cost per dollar of total revenue, the solid line labeled MPC_T in the first panel.

The equilibrium use of regulation r is shown in the fourth panel of Figure 1, employing condition (13), which is solved for λ to yield (17):

$$H\theta \left(\frac{\partial v}{\partial p} \frac{\partial p}{\partial r} + \frac{\partial v}{\partial F} \frac{\partial F}{\partial r} \right) / t_2 \left(\frac{\partial B_2}{\partial p} \frac{\partial p}{\partial r} + \frac{\partial B_2}{\partial r} + \frac{\partial B_2}{\partial f} \frac{\partial f}{\partial r} \right) = -\lambda. \quad (17)$$

The left side of this relationship is graphed in the top part of panel 4 as the negatively sloped, solid concave curve labeled MPB_r , representing the marginal political benefits of regulation per (marginal) dollar of tax

revenue raised from special interests. Note that these benefits are gross of (include the consequences of) the political effects of regulation on consumer prices as well as of the effects of additional political resources for advertising or other political activities.

As the numerator on the left side of equation (17) indicates, an increase in entry barriers r leads to more F , which can be used to generate more votes. We assume that, at the margin, the increase in votes from a given rise in r is declining at an increasing rate, partly because the marginal vote-productivity of F , represented by the term $H\theta(\partial v/\partial F \cdot \partial F/\partial r)$, will decline at an increasing rate, and partly because the resulting increase in consumer prices leads to a loss of support from consumers $H\theta(\partial v/\partial p \cdot \partial p/\partial r)$ that is increasingly negative at the margin.

Integrating the simultaneous relationship between r , t_2 , and F in equations (15) through (17) into the diagram is a more difficult task. We accomplish this by showing iso- F curves in the lower part of panel 4. Here we assume that equations (5) through (8) can be combined to yield $F = F(t_2, r, y, z)$:

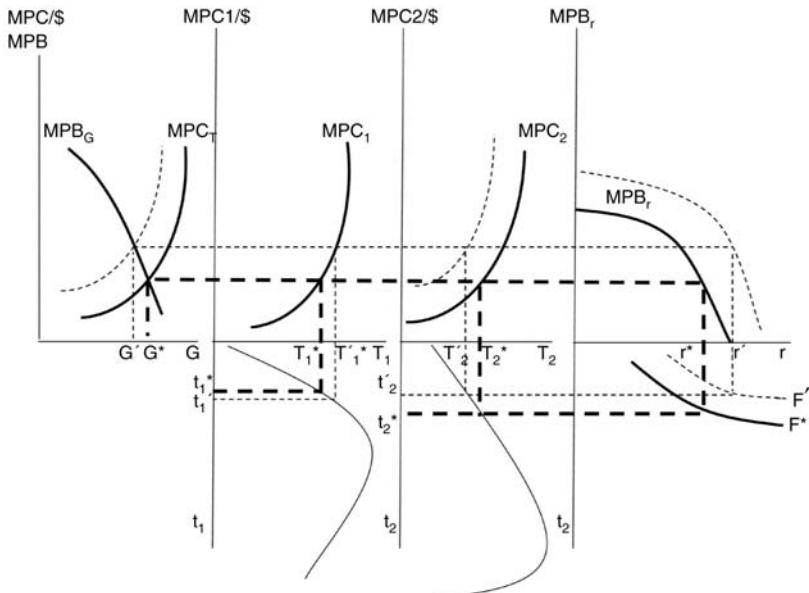
$$F = F(t_2, r, y, z); \frac{\partial F}{\partial t_2} < 0, \frac{\partial F}{\partial r} > 0. \quad (18)$$

For given exogenous shift factors y and z , the iso- F curves in the lower part of the panel will slope downwards to the right and represent various combinations of t_2 and r that yield equal levels of F . Iso- F curves that are higher up represent greater levels of political resources.

An initial equilibrium for all policy instruments is shown in Figure 1 by the heavy dotted line, where marginal political benefits of public expenditure, taxation, and regulation are equalized. Although regulation does not directly enter the government budget constraint, taxation and regulation are linked in equilibrium via political optimization. The existence of an equilibrium is ensured by the assumptions made concerning first partial derivatives and by the second partial derivatives implied by the slopes of the marginal political benefit and cost curves shown in the figure.

It is important at this point to understand the link in equilibrium between taxation and regulation. In equilibrium, marginal political payoffs are equalized across all instruments, as the marginal conditions above show. Marginal payoffs for t_2 and r are expressed per dollar of tax revenue raised from the same special interests. This implies that a shock that initially alters t_2 will affect the marginal benefit per dollar of revenue raised from taxing the business activity of special interests (recall the denominator of [17]), and political competition will then induce the governing party to adjust r to ensure that all instruments are politically equally productive per dollar of revenue. The

Figure 1
Taxation and Regulation in Political Equilibrium:
The Introduction of Television



Note: MPC = Marginal Political Cost; MPB = Marginal Political Benefit.

essential link between taxation and regulation thus arises from the fact that parties have two substitutable instruments to direct towards the same special interests in the pursuit of electoral success.

One may note that the size of government G^* is determined in panel 1 by the intersection of the MPB_G curve and the curve showing total marginal cost of taxation MPC_T . Finally, the lower part of panel 4 shows the equilibrium level of political contributions by the special interest F^* .

4.3. The Impact of Exogenous Shocks

One of the most significant shocks to politics in advanced democracies in the second half of the past century has been the introduction of television as a medium for political advertising. Even though it emanates from

politics, this shock has significant consequences for the choice of economic policies including regulation and taxation. The shock initially enters the model through its effect on $\partial v/\partial F$ in (17), which we assume has the effect of shifting the MPB_r curve in panel four of Figure 1 to the right.

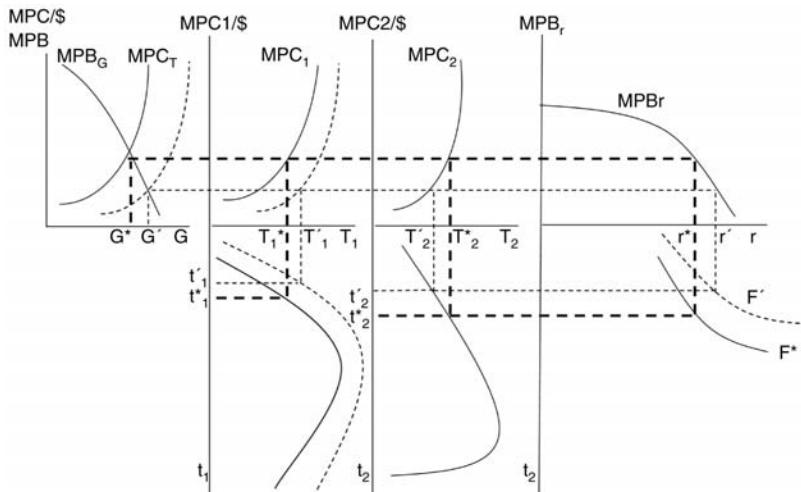
Advertising is more desirable after the introduction of TV because it is more effective in reaching a mass audience than traditional means of communication. It is also more expensive for the same reason: political parties are forced by competition to bid airtime away from private interests who also find the new medium more profitable. Of course, the parties will direct resources previously used in other ways (e.g., to finance whistle stop train tours or radio advertising) toward the new medium. By shifting the MPB_r curve upwards, we are implicitly assuming that such savings are not sufficient to purchase enough TV time to reduce the marginal vote-productivity of additional resources spent on the new medium far enough to remain politically competitive without raising additional funds.

The greater vote productivity of F also results in a higher MPC_2 curve in the third panel. An increase in the tax rate on the special interest lowers F , while a decrease in t_2 leads to more contributions from the industry. Since F now has a higher vote productivity per dollar received, small changes in t_2 represent a greater change in marginal political cost than before, implying a higher $MPC_2/\$/T_2$ for all T_2 . This is also shown in equation (16), which contains a term relating marginal changes in v , F , and t_2 .

As illustrated in the figure, the new equilibrium involves a smaller size of budgetary government, higher taxation of unorganized voters, lower taxation of the special interest group, and more regulation.¹⁸ Assuming that the slope of the F -function remains unaltered, the shock also results in a higher level of F . In short, the introduction of television leads to more campaign advertising expenditure, more regulation, tax concessions to special interests, and higher taxation for the average voter.¹⁹

It is also possible that r may be lower in the new equilibrium. Figure 1 is drawn on the assumption that the marginal productivity of regulation in generating F is sufficiently greater than that of tax reductions, so that the upward shift in MPB_r is large enough (relative to the upward shift in MPC_2) to lead to an equilibrium increase in entry barriers. Such would be the case if the elasticity of supply in the regulated industry is initially high and entry into the regulated industry is easy. In this case, the benefits of tax reductions would be competed away by new entrants, and the first order of business of such an industry would be to seek additional entry barriers, for which it would be prepared to pay handsomely (Migué 1977).²⁰ On the other hand, if entry into the industry is initially difficult, then the industry would primarily be interested in

Figure 2
A Shift in the Labor Force Participation of Women



Note: MPC = Marginal Political Cost; MPB = Marginal Political Benefit.

“buying” further tax reductions. In this case, the upward shift in MPC_2 might be sufficiently larger than that of MPB_r , so that r may actually decline.

Important shocks can also emanate from a change in economic structure. A major development in all Western economies over the past fifty years has been the increase in the participation of women in the labor force. One of the most significant effects of this shock is to enlarge the income tax base since homemaker services provided by women cannot be taxed effectively, while wages are readily captured by tax authorities. Our analysis focuses on this aspect, although there may be other consequences for public policies, such as an increased demand for child care services.

The impact on the tax base can be illustrated in Figure 2 by shifting the Laffer curve in the bottom part of panel two outward to reflect the larger tax base now available to the government. As a result of this growth, the marginal political cost of raising more revenue from unorganized voters declines at any tax rate, leading to a downward shift of the MPC_1 curve in the top part of panel 2. A larger base allows the same revenue to be collected at a lower rate, thus reducing the excess burden and the extent of

political opposition associated with any level of revenue. The result is a larger public budget G and an increase in revenue T_1 , which is accompanied by a fall in rate t_1 (but which could also involve an increase in t_1 , depending on the exact shift in the Laffer curve).

The figure also shows a decrease in t_2 and an increase in r . It should be recalled that in equilibrium, net marginal political payoffs must be equalized across all instruments. Given that the MPC_2 curve and the MPB_r curve do not shift, the changes in the first two panels imply a lower value of t_2 and a higher one of r . The relevant relationships between variables are reflected formally in equation (17). Intuitively, we may think about the adjustments in the following way: at the lower tax rate on the special interest, the marginal increase in F from lowering this rate further by a small amount will now be lower than before. This implies that entry barriers must also be adjusted to reach equilibrium. Thus, r must increase until the marginal return in votes (obtained by the resulting change in F) again equals the marginal loss in votes from a small change in t_2 . The overall level of F will increase in equilibrium, as shown in the lower part of the fourth panel.

It may be noted here that a model of taxation alone (such as in Hettich and Winer 1999) would not pick up the induced change in regulation that occurs because of the expansion of the tax base. This is because taxation is not seen there as a substitute for nontax methods (i.e., regulation) of dealing with the same part of the polity. For the same reason, a model of regulation like that of Peltzman (1976) would not show how shocks to the payoff from regulation or deregulation must affect tax structure.

The final shock relates to the location of production. Most developed countries have experienced movement of domestic production abroad in response to greater profitability in offshore production and the declining costs of international transactions. There are three main effects of these developments. Assuming the special interests move some of their production abroad, the government will face a reduced business tax base.²¹ Second, as a result of this, the marginal political cost or opposition to any rate of taxation t_2 will increase since any given rate is now levied on a smaller base. Finally, barriers to entry become a less valuable tool since special interests no longer find entry barriers as profitable as before the greater availability of offshore production. One may also note that in the context of increased international competition, entry barriers become more politically costly to enforce because domestic consumers demand access to cheaper goods from abroad.

The implications of these developments can be analyzed in a figure analogous to Figures 1 or 2 by introducing three shifts: (1) an inward shift of the Laffer curve in panel 3 to reflect the loss of the business tax base, (2) a

Table 1
Analysis of Equilibrium Outcomes

Nature of Shock	Shift in Curves	Change in Equilibrium Values
Increase in the vote productivity of F (introduction of television)	MPB_r shifts upward; MPC_{t_2} shifts upward	G, t_2 decrease; t_1, F increase; r increases if elasticity of supply is high so that the marginal F -productivity of r exceeds that of t_2
Increase in the tax base of unorganized (a shift in the labor force participation of women)	MPC_{t_1} shifts downward	G, r, F increase; t_2 decreases; change in t_1 ambiguous
Shift in profitability of offshore production	Laffer curve for T_2 shifts inward; MPC_{t_2} shifts upward; MPB_r shifts downward	G, r decrease; t_1 increases; change in t_2, F ambiguous

Note: All cross-partial derivatives are assumed to be zero. $\text{MPB} = \text{Marginal Political Benefit}; \text{MPC} = \text{Marginal Political Cost}.$

corresponding upward shift in MPC_2 in panel 3 reflecting the more negative repercussions of taxing mobile domestic producers who now have a smaller and more elastic tax base, and (3) a downward shift of MPB_r in panel 4 to reflect the fact that regulation of domestic markets will not be rewarded as before. The overall results of the shock are summarized in Table 1 and will not be illustrated with a new diagram. In equilibrium, G , and r decrease; t_1 increases; and the changes in t_2 and F remain ambiguous.

5. Normative Analysis

We have analyzed the interdependence of policy instruments in a competitive political system without regard to normative issues. The question arises whether an equilibrium with resources devoted to political advertising and organization F obtained from special interests can be efficient.

If we accept the framework underlying the previous analysis where governing parties cannot use tax revenues for partisan purposes and are forced to raise such resources from special interests, we can use the Representation Theorem to conduct a normative analysis. The theorem suggests an approach to normative inquiry that is similar in nature to the analysis

of efficiency used for private markets.²² Since the support function S in (9) is a weighted sum of individual utilities, the theorem provides a set of sufficient conditions under which the electoral equilibrium is efficient, just as the first theorem of welfare economics establishes conditions under which equilibria in competitive markets are efficient.²³ It implies that any policy that can make some voters better off without making others worse off will increase the likelihood of electoral success, with political competition insuring that in equilibrium, no such Pareto-superior policies remain for adoption. The reasoning is similar to that employed in work by Wittman (1995) and Becker (1983), even though these authors used a somewhat different framework for assessing democratic policy outcomes.

The analysis can be related directly to the policy cases discussed in section 4. We showed, for example, that the introduction of television leads to more expenditures on campaign advertising, more regulation, and higher taxes on the average voter. While this outcome may appear as undesirable at first glance, it cannot be judged to be inefficient unless we can show that the outcome is linked to factors that prevent equilibrium on the Pareto frontier.

The analogy to the first theorem of welfare economics is instructive in this context and suggests that normative analysis of political equilibria should focus on the circumstances under which competition fails to yield an outcome on the Pareto frontier.²⁴ In our framework, such political market failure may occur for several reasons. For example, there may be barriers to free entry of parties into the political arena, leading to a failure on the part of decision makers to take the welfare of all voters fully into account. A normative analysis in such circumstances would require investigation of the reasons for such barriers to entry and of their effects on the efficiency of the political equilibrium.

As in private markets, lack of information may be another cause of inefficiency in electoral equilibria. This source of market failure is of particular interest because of the role of political advertising in our model. If such advertising provides information that is useful to voters in evaluating alternative policy proposals, then it is appropriate to allow F to enter the probability of voting only through voters' indirect utility functions, as when $\pi = \pi(v_i[s_i, F] - v_o[s_o, F])$ where s_i is a policy vector.²⁵ In this case, equilibrium will be Pareto-efficient.

To see this, it is sufficient to show that in a Nash equilibrium, public policy maximizes a weighted sum of voter utilities.²⁶ We proceed in the same fashion as we did in our discussion of the Representation Theorem in section 3. In a Nash equilibrium, policy proposals converge and can be characterized by the solution to the choice of a policy vector $s = (s_1, s_2, \dots, s_K)$

that maximizes expected votes EV subject to the government budget restraint and the structure of the private economy, written generally here as $B(s, F) = 0$. The maximization problem for party i is

$$\underset{\{s_i\}}{\text{Max}} EV = H\pi(v_i(s_i, F) - v_o(s_o, F)) \text{ subject to } B(s_i, F(s_i)) = 0. \quad (19)$$

Here the indirect utility function of the representative voter depends on the policies s and on political advertising $F(s)$. The dependence of F on s captures the idea in the previous analysis that the level of political resources depends on how parties tailor their policies to the demands of special interest groups.

The first-order conditions for the optimal policy choice in the Nash equilibrium are

$$H\left(\frac{\partial\pi}{\partial v}\frac{\partial v}{\partial s_k} + \frac{\partial\pi}{\partial v}\frac{\partial v}{\partial F}\frac{\partial F}{\partial s_k}\right) + \lambda\left(\frac{\partial B}{\partial s_k} + \frac{\partial B}{\partial F}\frac{\partial F}{\partial s_k}\right) = 0, \quad k = 1, 2, \dots, K, \quad (20)$$

where $\theta = \partial\pi/\partial v$ and λ is the Lagrange multiplier associated with the constraint. We assume that the second-order conditions relevant for a maximum are satisfied.

Now consider the following maximization problem:

$$\underset{\{s\}}{\text{Max}} S = H\theta v(s, F(s)) \text{ subject to } B(s, F(s)) = 0, \quad (21)$$

where $\theta = \partial\pi/\partial v$ is evaluated in the Nash equilibrium. The first-order conditions for this problem are

$$H\theta\left(\frac{\partial v}{\partial s_k} + \frac{\partial v}{\partial F}\frac{\partial F}{\partial s_k}\right) + \delta\left(\frac{\partial B}{\partial s_k} + \frac{\partial B}{\partial F}\frac{\partial F}{\partial s_k}\right) = 0, \quad k = 1, 2, \dots, K. \quad (22)$$

Assuming again that second order conditions are satisfied, it is evident that the policies that solve (21) and those solving (19), evaluated at an equilibrium, are identical.²⁷ Thus, expected vote maximizing policies in the Nash equilibrium are Pareto efficient because they maximize the particular weighted sum of voter utilities S in (21).

The preceding proof depends crucially on how F affects voter behavior. Some people may argue that advertising can be used to sway voters to support policies that are not in their best or true interest, even though voters make voluntary and rational choices.²⁸ It may also be argued that too much advertising may make voters suspicious of the party doing the advertising, thus reducing the social usefulness of such resources in distinguishing between good and bad platforms and candidates (Coate 2004). In either case, policy choices may be inefficient. If we write $\pi = \pi(v[s],$

$F[s]$) rather than $\pi = \pi(v[s, F])$ as a representation of these situations, expected vote-maximizing policies in a Nash equilibrium can be replicated by the following problem:

$$\max_{\{s\}} S = H\theta v + H\theta_F F \text{ subject to } B(s, F(s)) = 0, \quad (23)$$

where $\theta = \partial\pi/\partial v$ and $\theta_F = \partial\pi/\partial F$ at the Nash equilibrium.²⁹ The problem summarized in (23) shows that the governing party will adjust policies so as to sacrifice voter welfare in order to generate additional resources F that can be used to obtain votes.

As pointed out earlier, the analysis so far assumes a prohibition on using tax revenues for partisan purposes. As in any type of welfare analysis, we must start with a definition of rights and of limitations on the exercise of such rights. Otherwise, we cannot define a Pareto frontier meaningful for the examination of public policy. It is possible that a broader or more general approach would endogenize the definition of rights, including the prohibition on the use of tax revenues by politicians for political purposes.³⁰ One should note that a similar problem of generality arises in welfare analysis of the private economy, which can be carried out for different definitions of initial rights to resources.

6. Conclusions

Regulation and taxation are two of the most important policy tools available to modern governments. While there has been much analysis in the economic literature of how each instrument affects economic activity, little effort has been devoted so far to explaining their joint use in a policy equilibrium. The analysis presented in this article demonstrates that they can be closely linked and that a connection between them may occur for both political and economic reasons. This implies that policy choice in equilibrium depends on both types of factors and that exogenous shocks leading to substitution between the instruments may be either political or economic in nature. The model used for this analysis embodies relationships common in the political economy literature.

The consequences of policy interdependence may be quite unexpected. We construct a model in which the introduction of television advertising for political purposes leads to higher taxation for the average voter, higher entry barriers in private markets, and more campaign advertising. The analysis also shows that a shift in the labor force participation of women leads

to greater tax burdens for unorganized voters and to more regulation. Assumptions about the elasticity of supply in industries that are seeking political favors are a key factor in the derivation of these results.

Our focus is on the nature of interdependence. The analysis does not identify the empirical magnitude of the effects we have identified, or their relative size. Not all of the shocks will be of equal empirical significance. The challenge for applied research is to identify and measure the effects of shocks on the policy mix when significant interdependence exists between taxation and regulation.

The article also presents a normative analysis of policy equilibria. A key issue that arises in the evaluation of the equilibrium policy mix relates to whether political advertising provides useful or misleading information to voters in equilibrium.

As a final point, we note that many public policy analysts prefer to take a somewhat different approach than the one suggested here, evaluating the implications for efficiency of policy outcomes without reference to the interdependence of policies or to the possibility of political market failure. The general equilibrium framework explored in this article suggests several dangers in such an approach. In political equilibrium, changes in any policy field may spill over into other areas. Any complete examination of regulation and taxation should take account of the equilibrium consequences when these policy instruments are used together. The fact that relevant substitutions may take several years to reveal themselves does not make them a less important subject for analysis.

Notes

1. Policies passed by the U. S. Congress provide two recent examples. In 1996, President Clinton took credit for passage of a bill that increased the minimum wage jointly with a package of tax measures designed to alleviate the impact of higher wages on small business. A second example occurred in legislation in 2004 designed to respond to the EU-initiated WTO challenge to U. S. tax law granting favored treatment to foreign profits of U. S. companies. The extensive tax changes designed to offset the adverse consequences of removing this tax loophole were passed partly on the basis of a compromise that protects labor legislation on overtime pay (see Simon 2004).

2. Exceptions also include Hamilton (1975), Trebilcock et al. (1982), Hahn (1990), Kelman (1999), and Brennan (2002).

3. In our framework, taxation and regulation are substitutes in the governing party's attempt to obtain resources for use in the competitive political process. The framework can be adapted to any situation where political parties exchange policies for political resources and may well have relevance to regulation of business with respect to the environment, consumer protection, and worker safety. For a different approach to the modeling of the joint use

of taxation and regulation in a probabilistic voting model, see Borcherding and Lee (2002), where the two policies are treated as complementary instruments.

4. An interesting but quite different graphical analysis of regulation is provided by Beard, Kaserman, and Mayo (2003). This article does not deal with the substitution of governing instruments.

5. For recent unpublished papers that might be of help in moving in this direction, see Besley, Perrson, and Sturm (2005) and Ferris, Park, and Winer (2005).

6. See Austen-Smith (1997), Grossman and Helpman (2001), and Polk (2002) for review of the related literature on interest groups and the role of information in competitive political systems.

7. Here and below, with the exception of utility v , we attach subscripts only to policy instruments *directly* under the control of a party.

8. Baron (1994) considered the role of informed but unorganized voters in a similar model, where voting by the informed group matters. In his model, the presence of informed voters leads to a trade-off for the government between choosing to attract campaign funds from special interests and choosing policies to attract the informed vote.

9. It should be noted that adding to the model a capacity for organized interests to influence the voting behavior of unorganized voters directly through advertising or other means would not alter the essential determinants of policy platforms in the present model and therefore has for convenience been omitted.

10. For a discussion of the agency problem that arises in the context of the exchange of policies for political resources, see Grossman and Helpman (2001, 1994) and Dixit, Grossman, and Helpman (1997).

11. The income, B_2 , referred to here is taxable income before the payment of political contributions.

12. Grossman and Helpman (2001) suggested one method of modeling the bargaining between interest group members and the government. The form of f in (6) could result from this type of bargaining provided that the government *cannot* costlessly tax individual members of the special interest group. In this case, the extra profits that result from regulation will be split between the government and firms in the regulated industry. In the present model, the government's ability to enjoy the rents from regulation is limited by the absence of instruments that can be used to single out individual firms.

13. Enelow and Hinich (1989) and Lin, Enelow, and Dorussen (1999) provided extensive discussion of the conditions for existence of Nash equilibria in spatial probabilistic voting models.

14. We may note that party platforms will converge in equilibrium if it exists. This follows regardless of the form of v or π since the expected vote functions are assumed to be strictly concave and voting depends only on the difference in utilities under policies of the opposing parties. A general proof is provided by Enelow and Hinich (1989, 107). This is also evident from the fact that first order conditions defining expected vote-maximizing platforms will be essentially the same for both parties since π depends only on the difference in utility levels.

15. We have given the theorem a name for convenience. The original theorem by Coughlin and Nitzan (1981) differs from that stated here in part because they used a specific voting density and in part because they were concerned with establishing both necessary and sufficient conditions. See also Coughlin (1992) and Rutherford and Winer (2002).

16. Kau and Rubin (2002) provided evidence that this shock is a major determinant of government growth in the United States since 1930.
17. In what follows, all cross-partial derivatives are assumed to be zero.
18. In our model, G refers to budgetary government. Measurement of the full impact of government on welfare, including the economic effects of regulation, is a more complex task. For interesting work using a more inclusive definition of government, see Borcherding, Ferris, and Garzoni (2004).
19. A related shock that works in an opposite direction is the advent of the Internet. The Internet has already had a significant effect on fund-raising in U. S. elections by candidates such as Howard Dean, who apparently raised almost all of his money in this way in the Democratic primaries. The Internet makes it cheaper to reach small contributors and to galvanize the committed voting base (the left wing of the Democratic Party in Dean's case), thus reducing the need to appeal to contributors by delivering rents via regulation or by offering tax reductions. In the model, this can be represented by an inward shift in the MPB_r curve and a downward shift of the MPC_2 curve. The net effect will be a decrease in r and an increase in t_2 . Intuitively, the reason is that the increase in the vote productivity of F reduces the need for financing of campaign advertising via regulation or via tax reductions, thus uncoupling the ability to advertise from the need for traditional sources of financing. (Public financing of campaigns would have a similar effect.) One should also note that unlike TV, the Internet will affect selected groups of voters in a way that TV cannot replicate without huge expense.
20. In a seminal paper, Migué (1977) explained how the political choice by a "captured" government between entry barriers and other controls, on one hand, and subsidies including tax reductions, on the other, depends on the elasticity of supply. Here we extend his analysis to show the role played by the elasticity of supply in determining the substitutability of the two types of instruments in equilibrium, when both instruments are always in use.
21. Here we are assuming that foreign source income cannot be taxed as easily as domestic profits, so that outsourcing of production involves a loss of domestic tax revenue.
22. See Winer and Hettich (2003, forthcoming) for further discussion of this point.
23. The utility functions of those who belong to organized interests do not appear in S , but this was a matter of convenience based on the idea that the number of people who donate significant sums to political parties is small relative to the electorate as a whole. The model can be extended to encompass direct voting by members of the special interest.
24. Defining the Pareto frontier in the presence of political institutions is not a simple matter. In particular, it is necessary to decide if the transactions costs associated with majority rule should be allowed for in defining the set of feasible allocations and if constraints imposed by democratic institutions on the set of feasible allocations should be accommodated in judging efficiency. We consider the second of these issues briefly below.
25. Introducing a social role for money by placing the stock of money in the utility function is a similar construction.
26. For a complementary discussion, see Hettich and Winer (1999, chap. 6).
27. The Lagrange multipliers in (21) and in (23) are also identical since constraints in both problems are the same.
28. Recent innovations, such as the Iowa Electronic Vote Market, may have the effect of making elections more efficient by reducing the possibility of bias through advertising. As a result, outcomes may be more likely to lie (or be close to) the Pareto frontier. In relation to the discussion in the text, it is interesting to note the existence of a parallel and longstanding

debate concerning the welfare consequences of advertising in private markets. See, for example, Staaf (1978) and Nelson (1976).

29. Grossman and Helpman (2001) have also used a similar function as a representation of the government's objective. The argument here provides a different and perhaps more general justification for its use.

30. Reasons for creating such restrictions at the constitutional stage may include an attempt to restrict the government's ability to acquire resources for propaganda or an intention to reduce the incumbent party's advantage in political contests. In addition, Tullock (1990) and Wilson (1990) have suggested that restrictions of this nature may limit the total resources wasted in creating and redistributing rents by raising costs and forcing participants to incur large excess burdens when delivering special privileges and generating campaign contributions. While restrictions on exchange between political and private agents may thus appear to impose a social cost by forcing the adoption of inefficient policies, it is possible that welfare is increased in equilibrium as a result of their existence.

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