Regulation and Taxation:

Analyzing Policy Interdependence

by

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Abstract

The paper draws attention to the interdependence of regulation and taxation. We analyze the nature of policy equilibrium, as well as the implications of three 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. Regulation is represented by barriers to entry created by the government for a favored industry. 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 elasticity of supply in the regulated industry playing a crucial role. Growth in the labor force participation of women, on the other hand, lowers business tax rates, while resulting in more regulation and higher contributions of political resources. The paper concludes with a consideration of the efficiency of policy equilibrium and the analytical problems that arise in evaluating efficiency in such a context.

An interest group enters the political process to advance the common interest of its members. It can accomplish this by providing candidates information...by delivering votes...and most 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)

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

Knut Wicksell (1896)

1. Introduction

Most observers of politics are familiar with the balancing of different public policies. Few Americans were surprised, for example, when former President Clinton took credit in 1996 for passing an increase in the minimum wage jointly with a package of tax measures designed to alleviate the impact of higher wages on small business. 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.[1]

Once we focus on the possibility of substitution, a new set of analytical questions arises. If

[1] Other significant exceptions include the work of Hamilton (1975), Aronson and Ordeshook (1981), Trebilcock et al

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 paper, we propose a model that provides specific links between regulation and taxation. The analysis is part of a larger framework that views policy choices as the endogenous outcome of a well-specified political process. Both types of instruments are used by parties in their struggle to stay in power or to become the government. 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.[2]

The paper 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 so as to maximize expected support in the next election. The process results in a Nash equilibrium, associated with an equilibrium combination of tax and regulatory

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(1982), Hahn (1990), Kelman (1999) and Brennan (2002).

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 investigate the effects of three historically important, exogenous shocks. We include shocks of two types to make the analysis more broadly representative: those that originate in the operation of the political process and those that represent a change in economic forces.

The examination of comparative statics yields several conclusions concerning the nature of policy interdependence, as well as questions for further applied research. In addition, the model allows us to raise normative questions concerning the efficiency of various outcomes. In section five, 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 paper 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

[2] 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.

model does not include a detailed characterization of information transmission and of the bargaining between the government and special interests.

Consider a 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 Anthony Downs (1957), Mancur Olson (1965), David Austen-Smith (1987), David Baron (1994) and Gene Grossman and Elhanan Helpman (2001), and are an important aspect of special interest politics.[3]

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 expected utility (v) 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

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

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) and analogously for the opposition party (o), we thus have $\pi = \pi (v_i - v_o)$ 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.[4] Note that the functional form of both the voting density function and the indirect utility function 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 values for p and 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 1987, 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.[5] We shall return to the issue of how advertising affects voting behavior in the

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

[5] For further discussion see the recent review of related literature by Polk (2002).

discussion of normative issues in section five.

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.[6] 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.[7] We assume that if successful, each party will deliver to members of the (well-informed) interest group whatever was promised.[8] This is a model of regulation of the 'capture type' (regulation is demanded by the regulated) analyzed by Stigler (1971) 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 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 in order 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

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[6] Baron (1994) considers 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 policies to attract campaign funds from special interests and choosing policies to attract the informed vote.

[7] 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.

[8] 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).

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:

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

subject to

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

where

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

(3b) $$B_1 = B_1(t_{1i}, x);\ \frac{\partial B_1}{\partial t_{1i}} < 0$$

(3c) $$F = f \bullet B_2$$

(3d) $$f = f(t_{2i}, r_i, y);\ \frac{\partial f}{\partial t_{2i}} < 0,\ \frac{\partial f}{\partial r_i} \gtreqless 0$$

(3e) $$B_2 = B_2(p,\, t_{2i},\, f,\, r_i,\, y);\ \frac{\partial B_2}{\partial p} \gtreqless 0,\ \frac{\partial B_2}{\partial t_{2i}} < 0,\ \frac{\partial B_2}{\partial f} < 0,\ \frac{\partial B_2}{\partial r_i} > 0$$

(3f) $$p = p(t_{2i},\, r_i,\, f,\, z);\ \frac{\partial p}{\partial t_{2i}} > 0,\ \frac{\partial p}{\partial r_i} > 0,\ \frac{\partial p}{\partial f} > 0.$$

Additional assumptions about the nature of first partial derivatives stated in equations (3) are introduced below. Assumptions about second partial derivatives sufficient for existence of a solution to the optimization problem are also discussed below, and are implicitly imposed in the graphical analysis of the model.

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 (3a) and (3b) 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 F is given by (3c) and (3d), with F expressed as a contribution rate f per dollar of income multiplied by the taxable income of producers B_2, with the latter governed by (3e).[9] In (3d), 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 r_i rises and that the party in power will benefit from any such increase by receiving more resources for advertising. We should expect, however, that increases in r_i beyond some point may not be politically desirable, since entry barriers cause 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.[10]

As shown in (3f), 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 (3f), 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.

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

[10] Grossman and Helpman (2001) suggest one method of modeling the bargaining between interest group members and the government. The form of f in (3d) 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 taxes that can be used to single out individual firms.

Differentiating the Lagrangian function

(4) $$L = H \bullet \pi(v_i - v_o) - \lambda(G_i - t_{1i}B_1 - t_{2i}B_2)$$

with v_o given and making use of equations (2c)-(3f) yields the following first order conditions for the optimization of the incumbent's total expected vote (subscripts denoting the party are omitted here and in what follows for convenience):

(5a) $$H\frac{\partial \pi}{\partial v}\frac{\partial v}{\partial t_1} + \lambda B_1(1+\alpha_1) = 0 \quad \text{where} \quad \alpha_1 = \frac{\partial B_1}{\partial t_1}\frac{t_1}{B_1}$$

(5b) $$H\frac{\partial \pi}{\partial v}\left(\frac{\partial v}{\partial p}\frac{\partial p}{\partial t_2} + \frac{\partial v}{\partial F}\frac{\partial F}{\partial t_2}\right) + \lambda B_2(1+\alpha_2) = 0 \quad \text{where} \quad \alpha_2 = \left(\frac{\partial B_2}{\partial t_2} + \frac{\partial B_2}{\partial f}\frac{\partial f}{\partial t_2}\right)\left(\frac{t_2}{B_2}\right)$$

(5c) $$H\frac{\partial \pi}{\partial v}\frac{\partial v}{\partial G} - \lambda = 0$$

(5d) $$H\frac{\partial \pi}{\partial v}\left(\frac{\partial v}{\partial p}\frac{\partial p}{\partial r} + \frac{\partial v}{\partial F}\frac{\partial F}{\partial r}\right) + \lambda t_2\left(\frac{\partial B_2}{\partial p}\frac{\partial p}{\partial r} + \frac{\partial B_2}{\partial r} + \frac{\partial B_2}{\partial f}\frac{\partial f}{\partial r}\right) = 0.$$

In equations (5a) and (5b), α_1 and α_2 are the elasticities of tax bases B_1 and B_2 with regard to tax rates t_1 and t_2 respectively. In both cases, we assume $\alpha > -1$ to insure that 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.[11]

The opposition's expected vote is $EV_o = H - EV_i$. Since π depends only on the difference in utility levels under opposing platforms, the first order conditions defining an optimal platform for the opposition are the same as those for the incumbent. The Nash equilibrium, if it exists, will be the

[11] Points on the backward-bending portion of the Laffer curve are excluded in the case of t_1 since they would imply higher opposition from the unorganized for two reasons: a higher tax rate and lower services resulting from reduced revenues going along with the higher rate. Values of t_2 on the backward-bending portion would be undesirable from the government's point of view since they would result in a loss of F as well as in a loss of tax revenues.

simultaneous solution to the first order conditions for both parties.

The signs of first partial derivatives that have been specified are not sufficient to insure the existence of a Nash equilibrium for the electoral game. Assuming that the feasible set of policy platforms is identical for both parties and is convex and compact, a Nash equilibrium in pure strategies exists if the 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 (Fuderberg and Tirole, Theorem 1.2).[12] In this paper we shall assume that the expected vote functions of each party are strictly concave and proceed to investigate the nature of substitution of policy instruments in equilibrium.

Before turning to the method that we shall use to characterize equilibrium in various situations and to conduct several experiments in comparative statics with the model, we note that party platforms will converge in equilibrium. 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 proof of this result is provided by Enelow and Hinich 1989, 107). This is also evident from the fact that first order conditions defining optimal platforms are essentially the same for both parties. No party can do better in equilibrium by adopting a policy platform that differs from that proposed by the other party.

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

Following Coughlin and Nitzan (1981), we may state the following theorem showing how the Nash equilibrium in the model outlined above can be conveniently characterized or represented by

[12] Enelow and Hinich (1989) provide extensive discussion of the conditions for existence of Nash equilibria in spatial probabilistic voting models.

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* $S = H \bullet \theta \bullet v$ *where* θ *is the value of* $\partial\pi/\partial v$ *at the Nash equilibrium, subject to equations (2)-(3f), 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.[13] A formal proof of the theorem in this particular form is provided in Hettich and Winer (1999, chapter 4), and other forms of the theorem are presented in Coughlin (1992). Here we discuss the theorem only briefly.

The proof proceeds by noting that the first order conditions for the problem of choosing s^* to maximize political support S subject to equations (2) to (3f) are identical to the first order conditions for the choice of policies by *either* party that must be satisfied at the Nash equilibrium, namely equations (5a) to (5d) with $\partial\pi/\partial v$ set equal to its Nash equilibrium value. Thus s* solves the first order conditions for expected vote maximization by both parties at the Nash equilibrium. Second order conditions for maximization of the expected vote functions at the Nash equilibrium are also satisfied by s* since these functions are assumed to be concave over the set of all feasible policy choices.

The intuition is straightforward: political competition for support from voters who care about their economic welfare forces each party to adopt policies consistent with movements towards the Pareto frontier. Otherwise, the opposition will be able to increase its support at the polls by improving the welfare of some voters. In a competitive political equilibrium of the kind described

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[13] 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 probability of voting density, and in part because they were concerned with establishing that a policy platform is a Nash equilibrium if and only if it optimizes an appropriately chosen function of individual utilities (their analogue to the function S). See also Coughlin (1992).

above, no such economic or political gains remain to be captured. (In subsequent versions of the model discussed in section five, 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 π, while (implicitly) members of the special interest group are given a weight of 0. 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 regulation 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. 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 graphical 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. Such a change

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 comprised of the incomes of unorganized voters. An example of such a shock is provided by the shift in the labor force participation of women whose previous activities in the home could not be captured in the tax base.[14] 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 analysis, we use the Representation Theorem to characterize the equilibrium use of policy instruments. We proceed by solving the following optimization problem.

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

The Langrangean is

(7) $$L = H \bullet \theta \bullet v - \lambda (G - t_1 B_1 - t_2 B_2),$$

[14] Kau and Rubin (2002) provide evidence that this shock is a major determinant of the growth of government in the United States since 1930.

and the first order conditions for an interior solution to problem (6) are:[15]

For t_1 :

(8a) $$H \bullet \theta \frac{\partial v}{\partial t_1} + \lambda B_1(1+\alpha_1) = 0 ,$$

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

For t_2 :

(8b) $$H \bullet \theta(\frac{\partial v}{\partial p}\frac{\partial p}{\partial t_2} + \frac{\partial v}{\partial F}\frac{\partial F}{\partial t_2}) + \lambda B_2(1+\alpha_2) = 0 ,$$

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

For r :

(8c) $$H \bullet \theta(\frac{\partial v}{\partial p}\frac{\partial p}{\partial r} + \frac{\partial v}{\partial F}\frac{\partial F}{\partial r}) + \lambda t_2(\frac{\partial B_2}{\partial p}\frac{\partial p}{\partial r} + \frac{\partial B_2}{\partial r} + \frac{\partial B_2}{\partial f}\frac{\partial f}{\partial r}) = 0$$

And for G :

(8d) $$H \bullet \theta \frac{\partial v}{\partial G} - \lambda = 0 .$$

These first-order conditions can be conveniently rearranged to yield the basis for a graphical analysis of the model showing the equilibrium use of policy instruments. Equation (8d) indicates that the Lagrange multiplier λ represents the marginal gain in expected votes from increasing government expenditures by \$1. This marginal political benefit is shown in the first panel of Figure 1 as the downward sloping curve MPB_G.[16]

Equations (8a) and (8b), when solved for λ , yield the following expressions (9a) and (9b) 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 so as to equalize the marginal political costs per dollar (MPC/\$)

[15] In what follows, all cross-partial derivatives are assumed to be zero.

[16] The MPB_G curve drawn is downward sloping on the assumption that marginal utility of public services is

of revenue raised from each source:

(9a) $$(H \bullet \theta \frac{\partial v}{\partial t_1}) \Big/ B_1(1+\alpha_1) = -\lambda$$

(9b) $$H \bullet \theta(\frac{\partial v}{\partial p}\frac{\partial p}{\partial t_2} + \frac{\partial v}{\partial F}\frac{\partial F}{\partial t_2}) \Big/ B_2(1+\alpha_2) = -\lambda \ .$$

Figure 1 shows marginal political costs per dollar, MPC_1 and MPC_2 (the left side of 9a and 9b respectively), for each of the two tax bases in panels two and three.

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 MPC_T shown on the first panel.

The equilibrium use of regulation r is shown in the fourth panel of Figure 1, employing condition (8c) which is solved for λ to yield (9c):

(9c) $$H \bullet \theta(\frac{\partial v}{\partial p}\frac{\partial p}{\partial r} + \frac{\partial v}{\partial F}\frac{\partial F}{\partial r}) \Big/ t_2(\frac{\partial B_2}{\partial p}\frac{\partial p}{\partial r} + \frac{\partial B_2}{\partial r} + \frac{\partial B_2}{\partial f}\frac{\partial f}{\partial r}) = -\lambda \ .$$

The left side of this relationship is graphed in the top part of panel four as the negatively sloped, concave curve labeled MPB_r. As the numerator on the left side of equation (9c) indicates, an ncrease 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 ($H \bullet \theta \ (\partial v / \partial F \bullet \partial F / \partial r)$) will decline at an increasing rate, and partly because the resulting increase in consumer prices leads to a loss of support from consumers

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declining.

($H \bullet \theta \ (\partial v / \partial p \bullet \partial p / \partial r)$) that is increasing at the margin.

Integrating the relationship between *r,* t_2 and *F* in equations (8) 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 (3c), (3d), (3e) and (3f) can be combined to yield $F = F(t_2,r,y,z)$:

$$F = F\,(t_2, r, y, z);\ \frac{\partial F}{\partial t_2} < 0, \frac{\partial F}{\partial r} > 0 \quad . \tag{10}$$

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*.

Equilibrium for all policy instruments is shown in Figure 1 by the 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 assured 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.

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_1^*.

4.3 The impact of exogenous shocks

One of the most significant shocks to politics in advanced democracies in the second half of the last 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 enters the model through its effect on $\partial v/\partial F$ in (9c) shifting the MPB_r curve in panel four of Figure 2 to the right. The shift reflects the increased vote productivity of F obtained by an increase in regulation. The shock also shifts MPC_2 in panel three upwards (see equation (9b)). The MPC_2 curve moves upwards because a given increase in t_2, which reduces F to some extent, now leads to a greater marginal loss in expected votes.

As illustrated in the figure, the new equilibrium involves a smaller size of government, higher taxation of the unorganized voters, lower taxation of the special interest group, and more regulation. 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 the special interest and higher taxation for the average voter.

It is also possible that r may be lower in the new equilibrium. Figure 2 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)[17]. On the other hand, if entry into the industry is initially difficult, then the industry would primarily be interested in '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

[17] In a seminal paper, Migué (1977) explains how the political choice by a 'captured' government between entry barriers and other controls, on the 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 a political equilibrium, when both instruments are always in

decline.

Important shocks may also emanate from a change in economic structure. A major development in all Western economies over the last fifty years has been the increase in the participation of women in the labor force. This shock can be illustrated by shifting the Laffer curve in panel two of Figure 3 outward to reflect the larger tax base available to the government. As a result of the growth in the tax base, 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 panel two.[18]

As shown in Figure 3, the result is growth in *G*, and an increase in revenue T_1 which is accompanied by a lower t_1 (but which could just as well lead to an increase in t_1 depending on the exact nature of the shift in the Laffer curve). In addition, we have an increase in T_2 and t_2, and an increase in *r* (as well as in F) so that the equality of net marginal political payoffs across instruments in equilibrium is maintained.

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. The implications of such a shock can be analyzed in Figure 1 by introducing three shifts: (i) an inward shift of the Laffer curve in panel three to reflect the loss of the business tax base; (ii) a corresponding upward shift in MPC_2 reflecting the now more negative repercussions of taxing mobile domestic producers that are the result of a smaller and more elastic tax base; and (iii) a downward shift of MPB_r in panel four to reflect the fact that regulation of domestic markets will not be rewarded as before, since domestic protection is now

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use.

[18] A larger base allows the same revenue to be collected at a lower rate, thus the excess burden associated with any level of revenue is reduced. Since the burden per dollar of activity is reduced, the larger base also allows the government to lower the size of the burden on any taxpayer relative to the costs of organizing more political

not as valuable. 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.[19] Since the support function S in (6) 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.[20] 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

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opposition, thus reducing the incentive for political opposition.

[19] See Winer and Hettich (2003) for further discussion of this point.

[20] 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 of money 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.

use a somewhat different framework for assessing democratic policy outcomes.

The analogy to the first theorem of welfare economics suggests that normative analysis of political equilibria should focus on the circumstances under which competition fails to yield an outcome on the Pareto frontier.[21] In the context our framework, such political market failure may occur for several reasons. For example, there may 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 $\pi_i = \pi(v(s,F)_i - v_o(s,F))$, where s is the policy vector.[22] 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.[23] We proceed in the same fashion as we did in our discussion of the Representation Theorem is section three. In a Nash equilibrium, policy proposals converge and can be characterized by the solution to the choice of a policy vector $s = (s_1, s_2, .., s_K)$ that maximizes expected votes EV subject to the government budget restraint and the structure of the private

[21] 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.

[22] Introducing the social role of money in a model by placing the stock of money in the utility function is a similar construction.

economy, written generally here as *B(s,F)=0.* The maximization problem is:

(11) $$\underset{\{s\}}{Max}\ EV = H \bullet \pi\,(v(s,F)_i - v_o(s,F)) \quad \text{subject to} \quad B(s,F(s)) = 0.$$

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

(12) $$H\ (\frac{\partial \pi}{\partial v}\frac{\partial v}{\partial s_k} + \frac{\partial \pi}{\partial v}\frac{\partial v}{\partial F}\frac{\partial F}{\partial s_k}) + \lambda\,(\frac{\partial B}{\partial s_k} + \frac{\partial B}{\partial F}\frac{\partial F}{\partial s_k}) = 0,\ \ k = 1,2,...K,$$

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:

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

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

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

Assuming again that second order conditions are satisfied, it is evident that the policies that solve

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[23] For a complementary discussion, see Hettich and Winer (1999, chapter 6).

(13) and those solving equation (11) evaluated at an equilibrium are identical.[24] Thus, expected vote maximizing policies in the Nash equilibrium are Pareto efficient because they maximize the particular weighted sum of voter utilities S in (13).

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.[25] 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 2003). 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:

$$(15) \qquad \underset{\{s\}}{Max}\ S = H \bullet \theta \bullet v + H \bullet \theta_F \bullet F \qquad \text{subject to } B(s,F)=0$$

where, $\theta = \partial\pi / \partial v$ and $\theta_F = \partial\pi / \partial F$ at the Nash equilibrium.[26] The problem summarized in (15) 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

[24] The Lagrange multipliers λ in (13) and δ in (15) are also identical since the constraints in both problems are the same.

[25] One may note here 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).

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.[27] 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 paper 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

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[26] 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.

[27] 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 value of resources wasted in seeking power and 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 at first glance appear to impose a social cost by forcing parties to adopt inefficient policies, it is possible that welfare is increased in equilibrium as a result of
their existence.

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 paper 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 paper suggests several dangers in such an approach. In political equilibrium, changes in any policy field may spill over into other areas, as suggested by the tax breaks mentioned in the introduction, which had been designed to offset the effects of a higher minimum wage. 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.

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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)	• MPC_r shifts upward • $MPCt_2$ 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)	• $MPCt_1$ shifts downward	• G, r, F increase • t_2 decreases • change in t_1 ambiguous
Shift in profitability of off-shore production	• $MPCt_2$ shifts upward • MPC_r shifts downward	• G, r decrease • t_1 increases • change in t_2, F ambiguous

* All cross-partial derivatives are assumed to be zero.

Figure 1. Taxation and Regulation in a Political Equilibrium

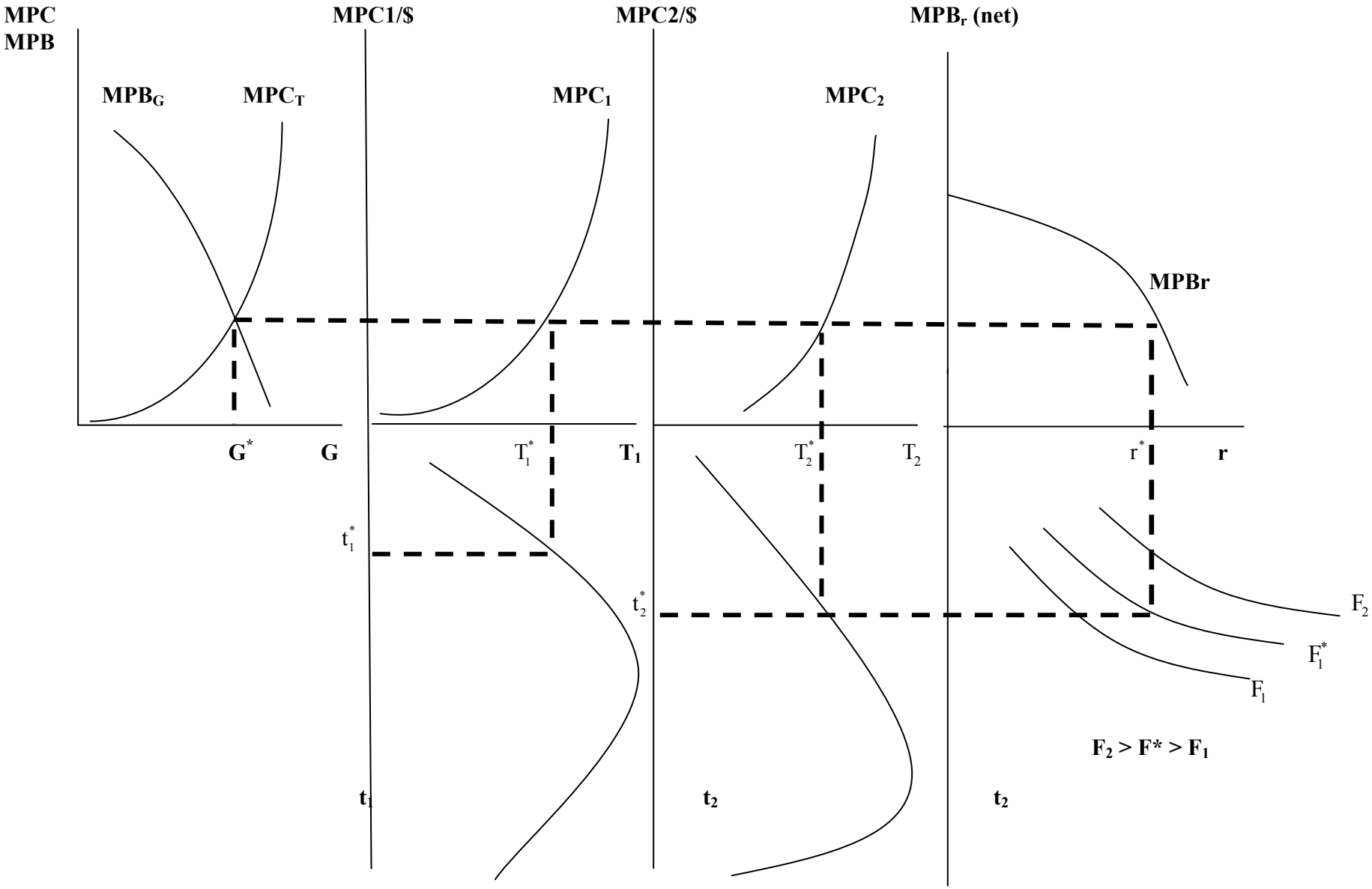

Figure 2. The Introduction of Television (An Increase in the Vote-Productivity of Political Resources F)

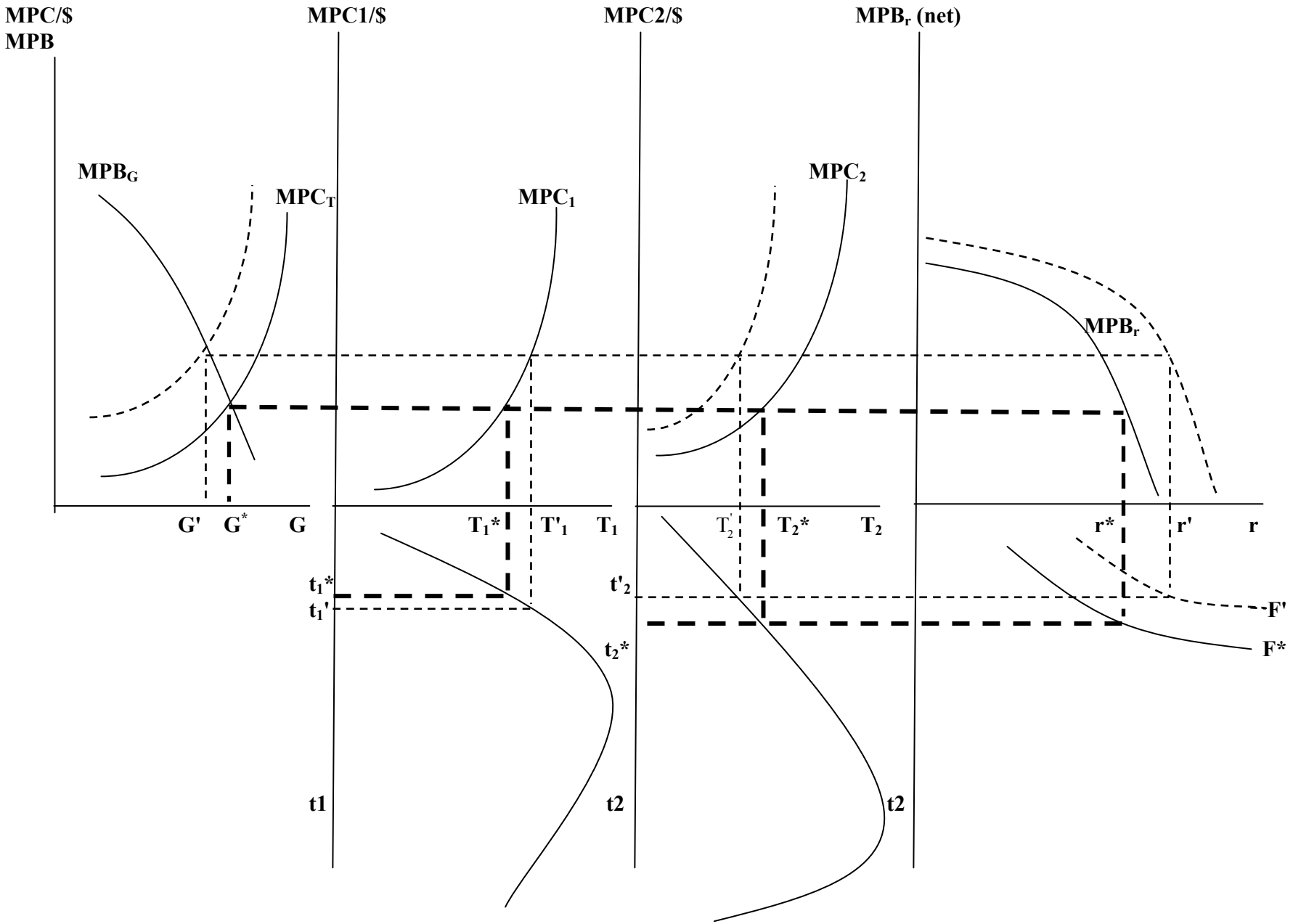

Figure 3. A Shift in the Labor Force Participation of Women