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The political economy of health care finance

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**Abstract**

We present a model of political competition, in a multi-dimensional policy space and with policy-oriented candidates, to analyze the problem of health care finance. In our model, health care is either financed publicly (by means of general taxation) or privately (by means of a copayment). The extent of these two components (as well as the overall tax schedule) is the outcome of the process of political competition. Our results highlight, from a political-economy perspective, the key role of technological change in explaining the widely observed phenomenon, in advanced democracies, of a rising share of total economic resources spent on health.

**Keywords:** political competition, health care finance, ideological equilibrium, technology

**JEL Classification:** D72, H51, I18

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# 1 Introduction

Financing health care is a priority on the political agenda of advanced democracies. Over the past half century, these democracies have usually spent a rising share of total economic resources on health. For instance, in 1960 aggregate health expenditures in the United States were 5.1 percent of GDP, 9.4 percent in 1975, and 15.4 percent in 2000 (e.g., Hall and Jones, 2007). Most of the OECD countries share a similar trend. In 2004, the health expenditure represented an average of 8.9 percent of GDP in the OECD, up from 7.7 percent in 1990, 7.1 percent in 1980 and 5.4 percent in 1970 (e.g., OECD Health Data 2006). Several conventional explanations for this phenomenon (such as aging of the population, the spread of health insurance, the growth of income, differential productivity growth, and supplier-induced demand for medical care) have been proposed. Newhouse (1992), however, argues that, even taken together, these explanations account for only a minority of the increase in health expenditures and that the bulk of the residual increase is attributable to *technological change*. This hypothesis has received growing attention throughout the last decade (e.g., Fuchs, 1996; Okunade and Murthy, 2002; Cutler, 2004; Hall, 2004). Our aim in this paper is to explore this hypothesis from a political-economy perspective.

Countries typically finance the bulk of their health care expenditures with mixed systems: some emphasize taxes, others emphasize social insurance, others still emphasize private sources –private insurance and out-of-pocket payments– and, in general, there is substantial variation across countries in both the way revenue is raised within each source and the relative importance of each source (e.g., Wagstaff and van Doorslaer, 1992). We propose that the particular system of health care finance of a given democratic country can be seen as an outcome of political competition therein.

In all advanced democracies, citizens organize their political competition through parties that compete in general elections. Recently, there has been a growing interest in providing formal models of political competition in general elections.<sup>1</sup> The most commonly used model is due to Downs (1957), who elaborated an early contribution of Hotelling (1929) in the field of industrial organization. The principal result of the Downs-Hotelling model, which posits a unidimensional policy space, is the so-called median voter theorem. Unidimensionality of the policy space is a severe limitation; in addition, the Downs-Hotelling model is unrealistic in supposing that competition takes place between two candidates who do not care about policies:

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<sup>1</sup>See, for instance, Roemer (2004) and the literature cited therein.

their sole motivation for running is to enjoy the power and privileges of holding office.

In this paper, we present a theory of political competition, on a multi-dimensional policy space and with policy-oriented candidates, to analyze the problem of health care finance. We restrict our attention to countries that mainly finance their health care expenditures from two sources: general taxation and out-of-pocket payments. The extent of these two components of health care finance (as well as the overall tax schedule in the country) will be the outcome of the process of political competition. More precisely, our model of the process of political competition assumes there are two political parties (Left and Right) proposing each a policy consisting of (i) a tax rate, (ii) the fraction of taxes going to fund the public medical care budget, (iii) the fraction to be spent on other state-provided goods, and (iv) the copayment, i.e., the private contribution to health care. All citizens (who have utility functions over policies) vote sincerely (for the party whose policy leads to a higher individual utility). We assume a perfectly representative democracy in which each citizen belongs to one party. The Left (Right) party represents the citizens with income levels below (above) a certain income level, called the *pivot income*.<sup>2</sup> This income level is endogenous in the model: it will be the income level of the citizen for whom the policies proposed by the two parties yield the same utility level. Both parties have derived preferences on policies. We assume that each party member receives equal weight in the determination of these preferences. An equilibrium of this model is a triple consisting of the policies that maximize the utility function of each party, and the corresponding pivot income, separating the constituency of both parties, for those policies. We shall use this partisan equilibrium concept as a way of obtaining an idea of the range over which the implemented policy in a country can be expected to lie.

The results of our model provide support for the hypothesis that technological change accounts for the bulk of medical care cost increases over time. We show first that there exists an equilibrium of our model in which parties propose to use the most technologically advanced health interventions that exist, even though they are the most expensive. Then, making use of this equilibrium, and performing some comparative statics, we show that, in a dynamic framework, health expenditures would increase as a consequence of the evolution of technology. This result is due to the party platforms in equilibrium, which are a reflection of voters preferences them-

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<sup>2</sup>Each citizen is identified by her (pre-tax) income level. Once her income level is determined, so is her utility function.

selves in our model of a perfectly representative democracy. Consumers are willing to pay for the new advances in health care available to them (albeit to a different extent) and hence the parties representing them propose increasing health expenditures. The Left party, representing citizens with low income, recommends increasing public health expenditures, whereas the Right party, representing citizens with high income, recommends increasing private health expenditures. As a result, both private and public health expenditures increase.

Our paper can be considered as part of an emerging literature dealing with the political economy of publicly provided private goods. This literature mostly comprises public-choice models examining the interaction between voter demand and the supply of publicly provided private goods (e.g., Epple and Romano, 1996; Gouveia, 1997) and normative models focussing on the efficiency enhancing role of publicly provided private goods (e.g., Guesnerie and Roberts, 1984; Boadway et al., 1998). Blomquist and Christiansen (1999) synthesize the two strands by constructing a political-economy framework which, in general, yields an efficient choice of distributional policy, under plausible information constraints. Ours is a more specific model but, as we shall see later in the text, shares with Blomquist and Christiansen (1999) the relevance of the redistributive element in the political economy of health care. We do so, nonetheless, as a result of studying political competition, for the specific problem of health care finance, in a more sophisticated model on the political side but less sophisticated on the economic side.

The rest of the paper is organized as follows. In Section 2, we present the preliminaries of the model and describe the process of political competition. In Section 3, we compute the equilibrium of the model in which parties propose policies that are at the technological frontier. We also show that this equilibrium provides reasonably accurate static predictions for a list of countries whose health care systems fit the premises of our model. In Section 4, we perform comparative statics to show that health expenditures (both private and public) increase when technology advances. We also provide reasonably accurate dynamic predictions for the same list of countries considered in Section 4. Section 5 concludes. Some technical proofs, as well as some tables, have been relegated to an Appendix.

## 2 The model

### 2.1 Preliminaries

We assume a society that consists of a continuum of citizens. A citizen is characterized by her (pre-tax) income level  $y$ . Income is distributed according to the probability distribution function  $F(y)$ . We assume that  $F$  is differentiable and strictly increasing. Denote its support by  $[y, \bar{y}]$  and its mean by  $\mu$ . All individuals have identical preferences over disposable income, a public good and health status.<sup>3</sup> More precisely, the utility that an individual enjoys is given by

$$U(x, G, H) = \log x + \alpha \log G + (1 - \alpha) \log H,$$

where  $\alpha \in (0, 1)$  is a parameter reflecting the relative salience of the public good and  $H$  is the health status of the individual. If the individual is healthy, then  $H = H^*$ , some constant; if the individual becomes ill then his (expected) health will be a function of the quality of the treatment. We write the health outcome of the treatment as a function of its cost,  $z$ . Thus,  $H^{ill} = \varphi(z)$ .

A similar, but more sophisticated, modelling is provided by Hall and Jones (2007) who also assume that health status (which is also produced by spending on health) and consumption are additively separable in individual utility.<sup>4</sup> In their model, however, besides a baseline level of utility, each individual utility comprises a standard constant-elastic specification for consumption and health status.

Let  $t$  denote the tax rate,  $q$  the fraction of taxes that fund the public medical care budget and  $(1 - q)$  the fraction of tax revenues that fund the public good  $G$ .<sup>5</sup> Then, the utility that a healthy individual enjoys at a tax rate  $t$  is given by

$$U^h = \log(1 - t)y + \alpha \log t(1 - q)\mu + (1 - \alpha) \log H^*,$$

while, the utility that a sick individual enjoys is given by

$$U^s = \log((1 - t)y - c) + \alpha \log t(1 - q)\mu + (1 - \alpha) \log \varphi\left(c + \frac{t \cdot q}{p}\mu\right),$$

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<sup>3</sup>It is worth noting that the public good here stands for non-health government expenditures.

<sup>4</sup>In our case, consumption is decomposed between disposable income and a public good.

<sup>5</sup>Note that we assume that the government budget is always balanced. Setting the price of the public good equal to one, the amount of public good is  $G = t(1 - q) \int_y^{\bar{y}} y dF(y) = t(1 - q)\mu$ .

where  $c$  is the private contribution to the treatment of the illness (the *copayment*),  $p$  is the average probability of illness in the society and  $z = c + \frac{t \cdot q}{p} \mu$  is the total expenditure (private plus public) on an episode of illness, assumed to be the same for all individuals. It is important to note that sick citizens do not choose the quality of health care individually: this is a public decision.

Of the essence is the fact that medical technology is improving rapidly with time. Rather than modeling this by letting the function  $\varphi$  itself depend on time, we say that the state-of-the-art treatment cost depends on time. Thus, let the state-of-the-art treatment cost at time  $\tau$  be  $z_\tau$ . Then we say, at time  $\tau$ , the citizenry can choose any method of medical care used in the past, up to the present state-of-the-art method. Assuming that these costs are rising with time, the expected health outcome for the patient can be any value  $\varphi(z)$ , for  $z \leq z_\tau$ .<sup>6</sup> The idea is that, as time passes, more medical interventions and techniques are discovered; these cost more money, but they also bring about increasing utility for the sick at the rate that  $\varphi$  yields.<sup>7</sup> We impose from the outset that  $\varphi$  is an increasing, differentiable function.<sup>8</sup>

To conclude, assume that the probability of getting sick is given by a function  $p(y)$  of individual income.<sup>9</sup> Then, the (expected) utility function of an agent with income  $y$ , is given by  $U = p(y) \cdot U^s + (1 - p(y)) \cdot U^h$ . Upon rearranging and eliminating constant terms, we have the following:

$$U(t, q, c; y) = p(y) \left( \log((1-t)y - c) + (1-\alpha) \log \varphi \left( c + \frac{t \cdot q}{p} \mu \right) \right) + (1 - p(y)) \log(1-t) + \alpha \log t(1-q).$$

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<sup>6</sup>There is substantial evidence that the state-of-the-art treatment cost is increasing over time. For instance, from the mid 80's to the late 90's (a period in which the development of angioplasty allowed for a progressive replacement of bypass surgery) the average amount spent per heart attack case increased nearly \$10,000 per case in real terms, or 4.2 percent per year (e.g., Cutler and McClellan).

<sup>7</sup>On the rationale of this argument, Cutler (2004) states that, even though we spend more on health care today, we also obtain more in return. He supports this statement with three case studies (cardiovascular diseases, low-birth-weight infants and mental illnesses) among which any two suffice to justify the *entire* increase in medical spending over time (even with a conservative estimation of the benefits of medical advance).

<sup>8</sup>The fact that technological change influences health status (and, ultimately, individual utility) also appears in the model of Hall and Jones (2007). Jones (2004) presents another (more accurate and specific) model to account for this fact.

<sup>9</sup>Note then that  $p(\mu) = p$ .

## 2.2 The political process

We assume there are two political parties: Left ( $L$ ) and Right ( $R$ ). Each party proposes a policy triple  $(t, q, c)$  and then citizens vote for one of the parties. Citizens are assumed to vote sincerely, i.e., each citizen votes for the party whose policy leads her to a higher individual utility.

Party  $L$  represents the agents with income levels below a certain income level  $\hat{y} \in [\underline{y}, \bar{y}]$  and party  $R$  represents the agents with income levels above  $\hat{y}$ . We call  $\hat{y}$  the separating income or the *pivot income*.

Both parties have preferences on policies. We assume that the utility function of each party  $(V^L, V^R)$  coincides with the utility function of its average constituent.<sup>10</sup> Formally,

$$V^J(t, q, c) = U(t, q, c; y^J),$$

for  $J = L, R$ , where

$$y^L = \frac{\int_{\underline{y}}^{\hat{y}} y dF}{F(\hat{y})}, \text{ and } y^R = \frac{\int_{\hat{y}}^{\bar{y}} y dF}{1 - F(\hat{y})}.$$

We say:

*An income level  $\hat{y}$  is the **pivot income** for a pair of policies  $(t^1, q^1, c^1)$  and  $(t^2, q^2, c^2)$ , if*

$$\begin{aligned} y < \hat{y} &\rightarrow U(t^1, q^1, c^1; y) > U(t^2, q^2, c^2; y) \\ y > \hat{y} &\rightarrow U(t^1, q^1, c^1; y) < U(t^2, q^2, c^2; y) \end{aligned}$$

We now define:

*A triple  $((t^L, q^L, c^L); (t^R, q^R, c^R); \hat{y})$  is an **ideological equilibrium** if  $(t^J, q^J, c^J)$  maximizes the utility function of party  $J = L, R$ , where  $V^J$  is defined with respect to  $\hat{y}$ , and  $\hat{y}$  is the pivot income for those policies.<sup>11</sup>*

In the ideological equilibrium concept, parties do not compromise, in the sense that each party proposes its constituency's ideal policy. We presume that the observed policy in a society will be some compromise between the two policies of the ideological equilibrium. We do not attempt to model this compromise here: to do so, the natural tool to use would be 'party unanimity

<sup>10</sup>This is similar to the model of endogenous parties with multidimensional competition presented in Roemer (2001, chapter 13).

<sup>11</sup>In fact, the strategic aspect of the 'game' between the parties is minimal: each party possesses a unique dominant strategy.



Nash equilibrium (PUNE)' in which parties are modeled as being concerned not only with constituent welfare but also with winning elections.<sup>12</sup> With PUNE, however, we would have a two dimensional manifold of equilibria, and would have to rely on simulations; with 'ideological equilibrium,' as defined here, we have a unique equilibrium, and our results are entirely analytical. In our empirical application, presented later in the text, we will compute the ideological equilibrium for a set of countries, and will deem that the model is explaining reality successfully if we find that the observed policy, in each country, is indeed a compromise between the policies predicted in the computed ideological equilibrium.

### 3 Static results

#### 3.1 Ideological equilibrium

Assume that at date  $\tau$ , the most expensive available technology for health care costs  $z_\tau = \zeta$ . We now introduce a piece of notation. For each  $x \in [\underline{y}, \bar{y}]$ , let

$$a(x) = x^R(1 + \alpha); b(x) = \zeta(1 + \alpha - p(x^R)) - x^R(1 + 2\alpha); d(x) = \alpha(x^R - \zeta),$$

where

$$x^R = \frac{\int_{\underline{x}}^{\bar{y}} y dF}{1 - F(x)}.$$

Then, let

$$t(x) = \frac{-b(x) - \sqrt{(b(x))^2 - 4a(x)d(x)}}{2a(x)},$$

and

$$\Gamma(x) = \frac{\zeta}{1 - t(x^R)} \frac{1}{1 - \left( \left( \frac{\mu - p\zeta}{(1 + \alpha)\mu} \right)^{1 + \alpha} \left( \frac{1}{1 - t(x^R)} \right) \left( \frac{\alpha}{t(x^R)} \right)^\alpha \right)^{\frac{1}{p(x^R)}}},$$

We now consider the following technical assumption on  $\Gamma$ :

**Assumption 0.**

$$(\Gamma(\underline{y}) - \underline{y})(\Gamma(\bar{y}) - \bar{y}) < 0.$$

Assumption 0 guarantees the existence of a fixed point of  $\Gamma$  within the domain  $[\underline{y}, \bar{y}]$ . Let  $\hat{y}$  be such a fixed point, i.e.,

$$\hat{y} \in [\underline{y}, \bar{y}] \text{ is such that } \hat{y} = \Gamma(\hat{y}). \quad (1)$$

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<sup>12</sup>See Roemer (2001).

We now state the main assumptions on  $\hat{y}$ , as well as on the treatment function  $\varphi$ , and the parameter configuration of the model, for the existence of ideological equilibrium.

The first assumption says two things. On the one hand, it says that the average constituent of the Left party (assuming  $\hat{y}$  is the pivot income) has to be a citizen with a relatively low income (at least, if we accept the plausible assumption that the probability function of getting sick is non-increasing in income). On the other hand, it says that the average cost of the most expensive technology cannot be above the mean income of the population. Formally,

**Assumption 1.**

$$\frac{\mu}{p} \geq \max \left\{ \frac{\hat{y}^L}{p(\hat{y}^L)}, \zeta \right\},$$

where

$$\hat{y}^L = \frac{\int_{\hat{y}}^{\hat{y}} y dF}{F(\hat{y})}.$$

The second assumption, in contrast with Assumption 1, says that the average constituent of the Right party (assuming  $\hat{y}$  is the pivot income) has to be a citizen with a relatively high income, as it imposes a lower bound for her net income. Formally,

**Assumption 2.**

$$(1 - t(\hat{y}^R))\hat{y}^R - \zeta \geq \frac{p(y)t(\hat{y}^R)\mu}{\alpha p},$$

where

$$\hat{y}^R = \frac{\int_{\hat{y}}^{\bar{y}} y dF}{1 - F(\hat{y})}.$$

Thus, the two assumptions can be interpreted as consistency conditions regarding the underlying assumption of perfectly representative democracy by which the Left (Right) party represents the citizens with low (high) income levels.

Finally, the third assumption requires that the returns of health care expenditures in health status do not increase too slowly. More precisely, this assumption imposes a lower bound for the derivative of the logarithmic transformation of the treatment function  $\varphi$ . This bound depends on the relative salience of the public good, the probability of getting sick, the

difference between the mean income and the average cost of the most expensive medical technology, and the net income of the average constituent of the Right party (again, assuming that  $\hat{y}$  is the pivot income). Formally,

**Assumption 3.**

$$(1 - \alpha) \frac{\varphi'(\zeta)}{\varphi(\zeta)} \geq \max \left\{ \frac{(1 + \alpha)p}{(\mu - p\zeta)p(\hat{y}^L)}, \frac{1}{(1 - t(\hat{y}^R))\hat{y}^R - \zeta} \right\},$$

where

$$\hat{y}^R = \frac{\int_{\hat{y}}^{\bar{y}} y dF}{1 - F(\hat{y})}.$$

We now have the following result:

**Proposition 1** *Let  $\hat{y}$  satisfy (1). Then, under assumptions 1, 2 and 3, the triple  $((t^L, q^L, c^L), (t^R, q^R, c^R); \hat{y})$  in which*

$$(t^L, q^L, c^L) = \left( \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu}, \frac{(1 + \alpha)p\zeta}{p\zeta + \alpha\mu}, 0 \right),$$

and

$$(t^R, q^R, c^R) = (t(\hat{y}), 0, \zeta),$$

*constitutes an ideological equilibrium.*

The proof of Proposition 1 is presented in the Appendix. From the statement of the proposition, it is straightforward to show that

$$z^L = c^L + \frac{t^L \cdot q^L}{p} \mu = \zeta = c^R + \frac{t^R \cdot q^R}{p} \mu = z^R,$$

which says that both parties propose, in the equilibrium, policies that are at the technological frontier of medical care at each date.

Before computing the equilibria for several parameter configurations, it is worth commenting on the robustness of Proposition 1. As we observe from its statement, the equilibrium policies do not depend directly on the treatment function  $\varphi$ . This function appears, however, in one of the assumptions (Assumption 3) leading to the proposition. Assumption 3 seems complex, but its meaning can be understood by examining the proof of the proposition. It is the key postulate in our analysis and its meaning is the following. The first inequality in Assumption 3 states, essentially, that the elasticity of expected health gained for the average member of the  $L$  party with respect

to an increase in health expenditures, at the frontier of medical technology, is greater than unity, so it makes sense, for that citizen, to reduce expenditures on non-medical consumption and increase expenditures on medical consumption, when new technologies become available. The second inequality states that, for the average member of the  $R$  party, even if all medical expenditures are privately financed, the elasticity of expected health gained with respect to expenditures on new technologies, as they become available, is greater than unity. So Assumption 3 is what guarantees that both parties will advocate the adoption of medical technologies at the frontier of knowledge. We find that this assumption is not too restrictive: we have obtained ideological equilibria, like those in the statement of Proposition 1, for general parameter configurations of the model (see, for instance, next section), as well as several treatment functions. Instances of treatment functions are  $\varphi(z) = \exp(z)$ , or  $\varphi(z) = 1 - \delta \exp(-\eta z)$  for  $(\delta, \eta) = (5, 0.5)$ .<sup>13</sup>

### 3.2 Cross-national results

We now compute the ideological equilibrium of Proposition 1 for a set of countries and show that our model provides reasonably accurate static predictions. As mentioned above, our model is only suitable for countries in which there is little private insurance. We therefore consider a sample of eight countries in which prepaid health care plans do not play an important role. Actually, in some of the countries in the sample such as Norway, Sweden or the Czechia, prepaid health care plans are simply non-existing, according to the data of the World Health Organization.

**Table 1.** Cross-national data

<b>Countries</b>	Gini	$\mu$	$m$	$t$	$z$	priv	prep	$q$	$c$
Czechia	40.4	15.108	11.4062	38.4	1.118	8.6	0.0	14.7	0.10
Denmark	35.5	29.231	23.6406	49.8	2.583	17.1	9.4	13.1	0.40
Finland	37.1	26.495	20.9793	46.1	1.943	24.3	9.8	11.0	0.43
Italy	45.6	25.610	17.722	42.0	2.166	24.4	3.7	13.3	0.51
Japan	36.2	26.852	21.5198	27.3	2.133	18.3	1.5	17.0	0.38
Norway	36.3	35.516	28.4258	43.3	3.409	16.5	0.0	18.1	0.56
Portugal	43.3	18.434	13.2799	33.5	1.702	29.3	4.3	14.2	0.48
Sweden	37.5	27.265	21.471	51.4	2.512	14.7	0.0	13.5	0.37

Sources: Förster and Mira d’Ercole (2005); OECD; WHO;

<sup>13</sup>More details about these and other examples of treatment functions can be provided upon request.

The data for the sample of countries we are considering are summarized in Table 1. The table reads as follows:

1. the first column shows the Gini coefficient of market income among the working-age population,<sup>14</sup>
2. the second column shows the per capita GDP using current prices and current PPs (reference period 2002) to be interpreted as the mean of the income distribution of each country ( $\mu$  in our model),
3. the third column shows an estimate of the median of the income distribution of each country. We assume a lognormal distribution of income. Given its Gini coefficient and its mean, we can compute the parameters of this distribution, and hence its median. To do so, one only has to note that, if  $F$  ( $f$ ) denotes the cumulative distribution (density) function of the income distribution, then:

$$Gini[F] = 1 - \frac{2}{\mu} \int_0^\infty \int_0^y t \cdot f(t) \cdot f(y) \cdot dt \cdot dy,$$

e.g., Cowell (2000),

4. the fourth column shows the total tax receipts as a percent of GDP (reference period 2001) to be interpreted as the tax rate of each country ( $t$  in our model),
5. the fifth column shows the per capita total expenditure on health in international dollars for each country (reference period 2002) to be interpreted as the parameter  $z$  in our model,
6. the sixth column shows the private expenditure on health as a percent of total expenditure on health of each country (reference period 2002).
7. the seventh column shows the prepaid plans as a percent of private expenditure on health of each country (reference period 2002),
8. the eighth column shows the general government expenditure on health as a percent of total general government expenditure for each country, to be interpreted as  $q$  in our model (reference period 2002),
9. the last column shows the per capita copayment in each country ( $c$  in our model).<sup>15</sup>

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<sup>14</sup>Data refer to the year 2000 in all countries except 2002 for the Czech Republic.

<sup>15</sup>More precisely,  $c = \frac{priv}{100} \cdot z \cdot (1 - \frac{prep}{100})$ .

We now assume that, for each country,  $F$  is a lognormal distribution with mean  $\mu$  and median  $m$ , as reflected in Table 1. We consider that the probability function of getting sick is given by the function  $p(y) = \min\{1, \frac{50}{50+y-\mu}\}$ .<sup>16</sup> We then obtain the values that our model predicts for each country, under this specification. Note that, exogenous to our model, there is a taste for the public good in each country. This is determined by the history of the country, a subject which is beyond our present scope. Therefore, we allow the observed equilibrium in the country to tell us what the particular taste for the public good is. Our procedure, then, is to choose  $\alpha$  for each country so that our model gives the best prediction of the observed equilibrium.

Table 2 shows, for each country, the policies proposed for each party in the equilibrium, the observed policy, as well as the relative salience of the public good. In Figure 1 we graph, for each country, the policies proposed for each party in the equilibrium and the observed policy. We see from these figures that, for each country, the observed policy appears to be a compromise of the predicted policies for each party.<sup>17</sup> Therefore, our model provides a rationale for the existing cross-national differences in health care financing documented by Wagstaff and van Doorslaer (1992) and the World Health Organization Statistical Information System (2004).

**Table 2.** Cross-national results

<b>Countries</b>	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	$(\hat{t}, \hat{q}, \hat{c})$	$\alpha$
Czechia	(0.421, 0.176, 0)	(0.363, 0, 1.118)	(0.384, 0.147, 0.10)	0.6
Denmark	(0.507, 0.174, 0)	(0.442, 0, 2.583)	(0.498, 0.131, 0.40)	0.85
Finland	(0.485, 0.151, 0)	(0.431, 0, 1.943)	(0.461, 0.110, 0.43)	0.8
Italy	(0.462, 0.183, 0)	(0.400, 0, 2.166)	(0.420, 0.133, 0.51)	0.7
Japan	(0.292, 0.272, 0)	(0.223, 0, 2.133)	(0.273, 0.170, 0.38)	0.3
Norway	(0.452, 0.212, 0)	(0.379, 0, 3.409)	(0.433, 0.181, 0.56)	0.65
Portugal	(0.395, 0.234, 0)	(0.321, 0, 1.702)	(0.335, 0.142, 0.48)	0.5
Sweden	(0.522, 0.176, 0)	(0.455, 0, 2.512)	(0.514, 0.135, 0.37)	0.9

Insert **Figure 1** about here

<sup>16</sup>This models the fact that poor citizens always get sick, whereas rich citizens decrease the probability of getting sick as a function of their (gross) income.

<sup>17</sup>As we observe from Figure 1, the Left party seems to have a higher ‘bargaining power’ in the compromise leading to the observed copayment. An explanation for this fact might be that the share of the vote, in an ideological equilibrium, is typically higher for the Left party, provided that the mean income is greater than the median. This is indeed the case of all countries in our sample, which might explain why the observed policies of countries tend to be tilted toward the Left policies.

It is worth remarking, nonetheless, that our purpose in this paper is not to explain precisely what we can expect with regard to the political equilibrium in any given country. Rather, we present these results to confirm that our model is a reasonable one. If it is, then we have some confidence that the general predictions we make in the next section about what will occur over time, as technology develops, are sound.

## 4 Comparative statics

We showed in the previous section that our model is consistent with static equilibrium observations. In this section, we use the model to provide some dynamic predictions and therefore to offer some explanation of what has happened and/or will happen in the finance of health care.

More precisely, we tackle the following question: what happens to fiscal policy and health expenditures as technology advances? To answer this question, we perform a comparative statics analysis in which we model a technology advancement by increasing the cost of the most expensive available technology (the parameter  $\zeta$  in our model). We then observe the effects of this change over the endogenous variables of the model, keeping all other exogenous variables of the model constant.

### 4.1 The effect of technology on health expenditures

We have:

**Proposition 2** *Under the premises stated in Proposition 1, as technology advances, both public and private health expenditures increase.*

**Proof.**

By Proposition 1, if at date  $t$ ,  $z_t = \zeta$ , the Left party proposes in the ideological equilibrium the policy

$$(t^L, q^L, c^L) = \left( \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu}, \frac{(1 + \alpha)p\zeta}{p\zeta + \alpha\mu}, 0 \right).$$

It is straightforward to show that both  $t^L$  and  $q^L$  are increasing with respect to  $\zeta$ , which shows that the public health expenditures proposed by the Left party increase, as technology advances. On the other hand, the copayment remains constant (and equal to zero), as technology advances.

By Proposition 1, the Right party proposes a policy involving  $(q^R, c^R) = (0, \zeta)$ . Thus, as  $\zeta$  increases,  $q^R$  remains constant (and equal to zero) and

$c^R$  increases. In other words, as technology advances, the public health expenditures proposed by the Right party remain constant, whereas the copayment increases.

Now, if we assume that the implemented policy in a country is a compromise between the policies proposed by both parties in the ideological equilibrium, then it follows from the above that, as technology advances, both public and private health expenditures increase. ■

The interpretation of this result is the following. In each period, more advanced technologies are discovered. These new technologies advance treatment possibilities, but are obviously more expensive than the existing (and less advanced) technologies. Proposition 2 tells us that consumers are willing to pay for the new capabilities in health care available to them, albeit to a different extent. On the one hand, rich citizens advocate increasing private health expenditures given their opposition to redistribution. On the other hand, poor citizens wish to increase public health expenditures, as they oppose private health expenditures. Since we also assume that the implemented policy in a country is a compromise between the policies proposed by both parties in the ideological equilibrium, then the statement of the proposition follows.

In other words, Proposition 2 is providing support, from a political-economy perspective, to the role of technological change and the increased capabilities of medicine in explaining the increase of health care expenditures. In order to be more precise about this role, we present some data released by the World Health Organization for our sample of countries. More precisely, the next tables provide the trends, for our sample of countries, of the per capita total, and private, expenditure on health in international dollars, and the government expenditure on health as percentage of total government expenditure, to be interpreted as the variables  $z$ ,  $c$  and  $q$ , respectively, in our model. We observe from these tables that there is an almost unanimous pattern across countries: all variables have been increasing in the 5-year period that goes from 1998 to 2002.

Insert **Tables 3,4,5** about here

## 4.2 The effect of technology on other public expenditures

We now turn to the results of the comparative statics analysis regarding public (non-health) expenditures.

First, we note that the effect of technology on fiscal policy remains ambiguous. By Proposition 1, if at date  $t$ ,  $z_t = \zeta$ , the Left party proposes, in



the ideological equilibrium, the fiscal policy

$$t^L = \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu},$$

which is increasing with respect to  $\zeta$ , and therefore shows that, as technology advances, the tax rate proposed by the Left party increases. This is not the case, however, for the Right party. In Tables 6c–6s, we compute the equilibria for each country, when we vary the parameter  $\zeta$  across the range of values that are indicated by the values (for each country) that appear in Table 3. We observe from Tables 6c–6s that the tax rate proposed by the Right party decreases as  $\zeta$  increases. Since we assume that the observed policy in a country is a compromise between the policies that both parties propose in the ideological equilibrium, we say that the effect of technology on fiscal policy remains ambiguous.

Insert **Tables 6c–6s** about here

We now move to the effect of technology on public expenditures in issues that do not concern health care. By Proposition 1, if at date  $t$ ,  $z_t = \zeta$ , the Left party proposes, in the ideological equilibrium, the policy

$$(t^L, q^L, c^L) = \left( \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu}, \frac{(1 + \alpha)p\zeta}{p\zeta + \alpha\mu}, 0 \right),$$

It is then straightforward to show that

$$t^L \cdot (1 - q^L) = \frac{\alpha(\mu - p\zeta)}{(1 + \alpha)\mu},$$

which is decreasing with respect to  $\zeta$ . This shows that the public investment (in issues that do not concern health care) proposed by the Left party decreases, as technology advances. Similarly, by Proposition 1, the public investment (in issues that do not concern health care) proposed by the Right party is given by

$$t^R \cdot (1 - q^R) = t^R,$$

which, as mentioned above, decreases when we vary the parameter  $\zeta$  across the range of values that are indicated by the values (for each country) that appear in Table 3. Thus, we can confidently say that, as technology advances, both parties propose a lower public investment (in issues that do not concern health care).

## 5 Final remarks

In most advanced countries, health costs are increasing much more rapidly than is national income. We have attempted to explain this phenomenon from a political-economy perspective. By means of a theory of political competition, on a multi-dimensional policy space and with policy-oriented candidates, we have analyzed the problem of health care finance showing the key role of technological change in explaining the increase of health care expenditures. More precisely, our results show that there is an equilibrium in which parties propose policies that implement the latest (and most expensive) medical techniques that are available and that (public and private) health expenditures increase as technology advances.

To the best of our knowledge, our paper is the first work addressing the issue of health care finance in advanced democracies by means of a political economy model in a multi-dimensional policy space and with policy-oriented candidates. There is, nonetheless, some related literature linking the issues of health care and political economy (besides the literature on the political economy of publicly provided private goods described in the introduction). For instance, Costa (1995) investigates why the United States did not adopt European style health insurance in the 1910s by examining voting determinants on the 1918 referendum on state-provided health insurance in California. Breyer (1995) presents a model of direct democracy in which the size of the social health insurance plan is determined in a popular referendum using simple majority rule. Kifmann (2005) shows that public health insurance systems which combine redistribution from the rich to the poor and from the healthy to the sick can be supported from a constitutional perspective, provided that insurance markets are incomplete and that income inequality is neither too low nor too high. In a somewhat related work, De Donder and Hindricks (2006) study the political economy of social insurance in a model with heterogeneous voters (both in income and risk levels). Their model shows that, in equilibrium, there is policy differentiation with the Left party proposing more social insurance than the Right party.

Clearly, the key postulate in our analysis is Assumption 3, and as we have explained in the text, that assumption is what is needed to generate citizen unanimity on adopting the most expensive and most advanced medical technologies. We have argued that the recent experiences of advanced countries –both from the observed fiscal histories, and from common perceptions about the adoption of medical technologies on the frontier– suggest that Assumption 3 is true. We did not subject Assumption 3 to a direct econometric test, however, and surely doing so would be a useful project.

As we acknowledge in the text, our model is only applicable to countries that mainly finance their health care expenditures from general taxation and out-of-pocket payments and, therefore, for which prepaid health care plans do not play an important role. Examples of countries not described by our model are France and the US, where prepaid plans constitute 55% and 65% of private expenditure on health, respectively (e.g., World Health Organization Statistical Information System, 2004). An obvious extension to this work would be to study a model in which individuals could opt for private health insurance, therefore capturing the French and American case, among others. This is left for future research.

## 6 Appendix

### Proof of Proposition 1

#### Step 1: Ideal policies

Assume that at date  $\tau$ , the most expensive available technology costs  $z_\tau = \zeta$ . Then, the ideal policy for an individual with income  $y$  at this date is obtained by solving the following optimization problem:

$$\max_A U(t, q, c; y), \quad (2)$$

where  $A = \{(t, q, c) \in [0, 1] \times [0, 1] \times \mathbb{R}_+ \text{ such that } c \leq \min\{(1-t)y, \zeta - \frac{t \cdot q}{p} \mu\}\}$ .

The Lagrangian associated to Program (2) is given by

$$\begin{aligned} \mathcal{L}(\cdot) = & U(t, q, c; y) + \lambda_1 t + \lambda_2 (1-t) + \lambda_3 q + \lambda_4 (1-q) + \\ & + \lambda_5 c + \lambda_6 ((1-t)y - c) + \lambda_7 \left( \zeta - c - \frac{t \cdot q}{p} \mu \right). \end{aligned}$$

The gradient of  $U(\cdot)$  is:

$$\begin{aligned} \nabla_t U(t, q, c; y) &= \frac{\alpha}{t} - \frac{1-p(y)}{1-t} + p(y) \left( \frac{1-\alpha}{p} \frac{\varphi' \left( c + \frac{t \cdot q}{p} \mu \right)}{\varphi \left( c + \frac{t \cdot q}{p} \mu \right)} \mu q - \frac{y}{(1-t)y-c} \right) \\ \nabla_q U(t, q, c; y) &= p(y) \left( \frac{1-\alpha}{p} \frac{\varphi' \left( c + \frac{t \cdot q}{p} \mu \right)}{\varphi \left( c + \frac{t \cdot q}{p} \mu \right)} \mu t \right) - \frac{\alpha}{1-q} \\ \nabla_c U(t, q, c; y) &= p(y) \left( (1-\alpha) \frac{\varphi' \left( c + \frac{t \cdot q}{p} \mu \right)}{\varphi \left( c + \frac{t \cdot q}{p} \mu \right)} - \frac{1}{(1-t)y-c} \right) \end{aligned}$$

We consider two types of solutions to Program (2) for which the last constraint binds, i.e., solutions  $(t, q, c)$  such that  $\zeta = c + \frac{t \cdot q}{p} \mu$ . In the first case, the so-called “zero-copayment case”, these solutions satisfy that  $c = 0$ . In the second case, the so-called “zero-governmental-contribution case”, these solutions satisfy that  $q = 0$ .<sup>18</sup> Formally,

- **Case 1.**  $\lambda_j = 0$  for all  $j \in \{1, \dots, 6\} \setminus \{5\}$  (the zero-copayment case).

In this case, we would have to solve the following system of equations:

$$\begin{aligned} p \cdot \nabla_t U(t, q, c; y) &= \mu \cdot q \cdot \lambda_7 \\ p \cdot \nabla_q U(t, q, c; y) &= \mu \cdot t \cdot \lambda_7 \\ \nabla_c U(t, q, c; y) &= \lambda_7 - \lambda_5 \\ \frac{t \cdot q}{p} \mu &= \zeta \\ c &= 0 \end{aligned}$$

From the first two equations (and the last one), it follows that

$$t \cdot \nabla_t U(t, q, 0; y) = q \cdot \nabla_q U(t, q, 0; y),$$

or, equivalently, upon rearranging terms and assuming that  $y \neq 0$ ,

$$t(1 - q) = \alpha(1 - t).$$

This equation, together with the fourth equation in the system above, provides a system of two equations in the unknowns  $t$  and  $q$ , that is easily solved to obtain:

$$(t, q) = \left( \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu}, \frac{(1 + \alpha)p\zeta}{p\zeta + \alpha\mu} \right).$$

Note that  $0 < t, q < 1$  if and only if

$$\mu > p\zeta$$

From the other equations of the system we obtain the value of the Lagrange multipliers:

$$(\lambda_5, \lambda_7) = \left( \left( \frac{p(y)\mu}{y} - p \right) \frac{1 + \alpha}{\mu - p\zeta}, (1 - \alpha)p(y) \frac{\varphi'(\zeta)}{\varphi(\zeta)} - \frac{(1 + \alpha)p}{\mu - p\zeta} \right),$$

---

<sup>18</sup>Typically, interior solutions where  $c > 0$  and  $q \in (0, 1)$  are not likely to exist.

which are positive if and only if

$$\frac{\mu}{p} > \max\left\{\frac{y}{p(y)}, \zeta\right\}$$

and

$$\varphi'(\zeta)(1 - \alpha)(\mu - p\zeta)p(y) \geq \varphi(\zeta)(1 + \alpha)p,$$

Thus, by the Kuhn-Tucker theorem (e.g., Mas-Colell et al., 1995),

$$(t, q, c) = \left( \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu}, \frac{(1 + \alpha)p\zeta}{p\zeta + \alpha\mu}, 0 \right)$$

will be an ideal policy, provided that the above two conditions hold.<sup>19</sup>

- **Case 2.**  $\lambda_j = 0$  for all  $j \in \{1, \dots, 6\} \setminus \{3\}$  (the zero-governmental-contribution case).

In this case, we would have to solve the following system of equations:

$$\begin{aligned} \nabla_t U(t, q, c; y) &= 0 \\ \nabla_q U(t, q, c; y) &= \frac{\mu \cdot t}{p} \lambda_7 - \lambda_3 \\ \nabla_c U(t, q, c; y) &= \lambda_7 \\ c &= \zeta \\ q &= 0 \end{aligned}$$

The first equation can be expressed as

$$\alpha y(1 - t)^2 - (1 - t)(\alpha\zeta + yt) + \zeta(1 - p(y))t = 0,$$

Thus,

$$t(y) = \frac{-b \pm \sqrt{b^2 - 4ad}}{2a},$$

where

$$a = y(1 + \alpha); \quad b = \zeta(1 + \alpha - p(y)) - y(1 + 2\alpha) \quad \text{and} \quad d = \alpha(y - \zeta)$$

---

<sup>19</sup>It is straightforward to show that imposing  $p(y)$  to be a non-increasing function and the condition

$$\mu \geq p\zeta + \frac{1 + \alpha}{1 - \alpha} \frac{\varphi(\zeta)}{\varphi'(\zeta)},$$

then  $(t, q, c)$  is indeed an ideal policy for all citizens below the mean.

It is straightforward to see that the upper solution violates the condition  $y(1-t) > c$ . Thus, we focus on the lower solution, i.e.,

$$t(y) = \frac{-b - \sqrt{b^2 - 4ad}}{2a},$$

for which the inequality  $y(1-t(y)) > c$  is true if and only if  $y > \zeta$ . Note that this is also the necessary condition to ensure that  $t(y) > 0$ . Thus, by the Kuhn-Tucker theorem,  $(t(y), 0, \zeta)$  is an ideal policy provided that the condition

$$y > \zeta$$

holds and both Lagrange multipliers are positive, i.e., the following two conditions hold:

$$\varphi'(\zeta)(1-\alpha) \geq \frac{\varphi(\zeta)}{(1-t(y))y - \zeta}$$

and

$$\alpha p \geq \frac{p(y)t(y)\mu}{(1-t(y))y - \zeta}.$$

Since we also need to impose  $(1-t(y))y - \zeta > 0$  to guarantee that the solution belongs to  $A$ , then the above conditions can be summarized as

$$(1-t(y))y - \zeta \geq \max \left\{ \frac{p(y)t(y)\mu}{\alpha p}, \frac{\varphi(\zeta)}{(1-\alpha)\varphi'(\zeta)} \right\}. \quad (3)$$

Thus, provided  $y$  satisfies (3),  $(t(y), 0, \zeta)$  is an ideal policy for the agent with income  $y$ .

## Step 2: Ideological equilibrium

Let  $\Gamma : [\underline{y}, \bar{y}] \rightarrow \mathbb{R}_+$  be the function such that, for  $y \in [\underline{y}, \bar{y}]$ , yields

$$\Gamma(y) = \frac{\frac{\zeta}{1-t(y^R)}}{1 - \left( \left( \frac{\mu - p\zeta}{(1+\alpha)\mu} \right)^{1+\alpha} \left( \frac{1}{1-t(y^R)} \right) \left( \frac{\alpha}{t(y^R)} \right)^\alpha \right)^{\frac{1}{p(y^R)}},$$

where

$$y^R = y^R(y) = \frac{\int_{\underline{y}}^{\bar{y}} y dF}{1 - F(y)}.$$

By Assumption 0, there exists a fixed point of  $\Gamma$ :  $\hat{y}$ . Formally,  $\hat{y} \in [\underline{y}, \bar{y}]$  is such that  $\hat{y} = \Gamma(\hat{y})$ . Then, it is straightforward to show that

$$U \left( \frac{p\zeta + \alpha\mu}{(1+\alpha)\mu}, \frac{(1+\alpha)p\zeta}{p\zeta + \alpha\mu}, 0; \hat{y} \right) = U(t(\hat{y}^R), 0, \zeta; \hat{y}) \quad (4)$$

where

$$\widehat{y}^R = y^R(\widehat{y}) = \frac{\int_{\widehat{y}}^{\bar{y}} y dF}{1 - F(\widehat{y})}.$$

Let

$$\widehat{y}^L = y^L(\widehat{y}) = \frac{\int_{\underline{y}}^{\widehat{y}} y dF}{F(\widehat{y})}.$$

Then, the assumptions in the statement of the proposition, and the above argument in Step 1 of this proof, guarantee that

$$\left( \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu}, \frac{(1 + \alpha)p\zeta}{p\zeta + \alpha\mu}, 0 \right)$$

is an ideal policy for the agent with income  $\widehat{y}^L$  and that

$$(t(\widehat{y}^R), 0, \zeta)$$

is an ideal policy for the agent with income  $\widehat{y}^R$ . Thus, by (4),

$$\left( \left( \frac{p\zeta + \alpha\mu}{(1 + \alpha)\mu}, \frac{(1 + \alpha)p\zeta}{p\zeta + \alpha\mu}, 0 \right), (t(\widehat{y}^R), 0, \zeta); \widehat{y} \right)$$

constitutes an ideological equilibrium. ■

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## Tables

**Table 3.** Per capita total expenditure on health ( $z$ )

<b>Countries/Years</b>	1998	1999	2000	2001	2002
Czech Republic	0.916	0.932	0.977	1.083	1.118
Denmark	2.141	2.297	2.353	2.520	2.583
Finland	1.607	1.640	1.698	1.841	1.943
Italy	1.800	1.853	2.001	2.107	2.166
Japan	1.742	1.829	1.958	2.077	2.133
Norway	2.313	2.561	2.747	3.258	3.409
Portugal	1.290	1.424	1.570	1.662	1.702
Sweden	1.960	2.118	2.241	2.366	2.512

**Table 4.** Per capita private expenditure on health ( $c$ )

<b>Countries/Years</b>	1998	1999	2000	2001	2002
Czech Republic	0.075	0.079	0.085	0.093	0.096
Denmark	0.386	0.409	0.413	0.437	0.441
Finland	0.381	0.405	0.422	0.452	0.473
Italy	0.507	0.514	0.527	0.505	0.527
Japan	0.335	0.346	0.367	0.381	0.391
Norway	0.354	0.379	0.412	0.542	0.564
Portugal	0.424	0.462	0.479	0.489	0.501
Sweden	0.278	0.302	0.339	0.358	0.368

**Table 5.** Govt. exp. on health as % of total govt. exp. ( $q$ )

<b>Countries/Years</b>	1998	1999	2000	2001	2002
Czech Republic	15.8	15.6	15.0	15.1	14.7
Denmark	11.9	12.4	12.6	12.9	13.1
Finland	10.0	10.0	10.2	10.7	11.0
Italy	11.1	11.5	12.8	13.0	13.3
Japan	14.0	15.9	16.1	16.9	17.0
Norway	15.6	16.3	16.5	18.1	18.1
Portugal	12.8	13.0	14.1	14.3	14.2
Sweden	11.8	12.0	12.5	13.1	13.5

**Table 6c.** Comparative statics for the **Czech Republic**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
0.75	(0.406023, 0.122249, 0)	(0.366796, 0, 0.75)	15.1662
0.80	(0.408091, 0.129738, 0)	(0.366246, 0, 0.80)	15.1701
0.85	(0.410159, 0.137152, 0)	(0.365696, 0, 0.85)	15.174
0.90	(0.412227, 0.144491, 0)	(0.365146, 0, 0.90)	15.1779
0.95	(0.414295, 0.151757, 0)	(0.364595, 0, 0.95)	15.1818
1.00	(0.416363, 0.158951, 0)	(0.364043, 0, 1.00)	15.1858
1.05	(0.418432, 0.166074, 0)	(0.363492, 0, 1.05)	15.1897
1.10	(0.4205, 0.173126, 0)	(0.36294, 0, 1.10)	15.1937
1.15	(0.422568, 0.18011, 0)	(0.362388, 0, 1.15)	15.1977
1.20	(0.424636, 0.187025, 0)	(0.361835, 0, 1.20)	15.2017
1.25	(0.426704, 0.193874, 0)	(0.361282, 0, 1.25)	15.2057

**Table 6d.** Comparative statics for **Denmark**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
2.10	(0.498294, 0.14418, 0)	(0.445273, 0, 2.10)	29.4258
2.15	(0.499219, 0.147339, 0)	(0.44493, 0, 2.15)	29.4306
2.20	(0.500143, 0.150487, 0)	(0.444587, 0, 2.20)	29.4355
2.25	(0.501068, 0.153623, 0)	(0.444244, 0, 2.25)	29.4404
2.30	(0.501993, 0.156748, 0)	(0.443901, 0, 2.30)	29.4454
2.35	(0.502917, 0.159861, 0)	(0.443557, 0, 2.35)	29.4503
2.40	(0.503842, 0.162963, 0)	(0.443213, 0, 2.40)	29.4552
2.45	(0.504766, 0.166053, 0)	(0.442869, 0, 2.45)	29.4602
2.50	(0.505691, 0.169132, 0)	(0.442525, 0, 2.50)	29.4651
2.55	(0.506616, 0.1722, 0)	(0.44218, 0, 2.55)	29.4701
2.60	(0.50754, 0.175256, 0)	(0.441835, 0, 2.60)	29.4751

**Table 6f.** Comparative statics for **Finland**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
1.60	(0.477987, 0.126316, 0)	(0.433112, 0, 1.60)	26.6473
1.65	(0.479036, 0.129978, 0)	(0.432754, 0, 1.65)	26.6521
1.70	(0.480084, 0.133624, 0)	(0.432395, 0, 1.70)	26.6569
1.75	(0.481132, 0.137255, 0)	(0.432037, 0, 1.75)	26.6617
1.80	(0.48218, 0.14087, 0)	(0.431678, 0, 1.80)	26.6666
1.85	(0.483229, 0.144469, 0)	(0.431319, 0, 1.85)	26.6714
1.90	(0.484277, 0.148052, 0)	(0.430959, 0, 1.90)	26.6762
1.95	(0.485325, 0.15162, 0)	(0.4306, 0, 1.95)	26.6811
2.00	(0.486373, 0.155172, 0)	(0.43024, 0, 2.00)	26.686
2.05	(0.487421, 0.15871, 0)	(0.42988, 0, 2.05)	26.6909
2.10	(0.48847, 0.162232, 0)	(0.429519, 0, 2.10)	26.6958

**Table 6i.** Comparative statics for **Italy**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
1.75	(0.45196, 0.151192, 0)	(0.40231, 0, 1.75)	25.799
1.80	(0.453109, 0.155117, 0)	(0.402037, 0, 1.80)	25.8046
1.85	(0.454257, 0.159023, 0)	(0.401763, 0, 1.85)	25.8103
1.90	(0.455406, 0.162909, 0)	(0.40149, 0, 1.90)	25.816
1.95	(0.456554, 0.166776, 0)	(0.401216, 0, 1.95)	25.8217
2.00	(0.457703, 0.170623, 0)	(0.400942, 0, 2.00)	25.8274
2.05	(0.458851, 0.174451, 0)	(0.400668, 0, 2.05)	25.8332
2.10	(0.46, 0.178259, 0)	(0.400393, 0, 2.10)	25.8389
2.15	(0.461148, 0.182049, 0)	(0.400119, 0, 2.15)	25.8447
2.20	(0.462296, 0.18582, 0)	(0.399844, 0, 2.20)	25.8505
2.25	(0.463445, 0.189572, 0)	(0.39957, 0, 2.25)	25.8563

**Table 6j.** Comparative statics for **Japan**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
1.70	(0.279469, 0.226537, 0)	(0.224485, 0, 1.70)	26.9088
1.75	(0.280902, 0.23201, 0)	(0.224298, 0, 1.75)	26.9106
1.80	(0.282334, 0.237428, 0)	(0.224111, 0, 1.80)	26.9123
1.85	(0.283766, 0.242792, 0)	(0.223924, 0, 1.85)	26.9141
1.90	(0.285199, 0.248102, 0)	(0.223736, 0, 1.90)	26.9158
1.95	(0.286631, 0.253358, 0)	(0.223549, 0, 1.95)	26.9176
2.00	(0.288063, 0.258562, 0)	(0.223361, 0, 2.00)	26.9193
2.05	(0.289496, 0.263715, 0)	(0.223174, 0, 2.05)	26.9211
2.10	(0.290928, 0.268817, 0)	(0.222986, 0, 2.10)	26.9229
2.15	(0.29236, 0.273869, 0)	(0.222798, 0, 2.15)	26.9246
2.20	(0.293793, 0.278872, 0)	(0.22261, 0, 2.20)	26.9264

**Table 6n.** Comparative statics for **Norway**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
2.00	(0.428064, 0.131537, 0)	(0.385179, 0, 2.00)	35.6665
2.20	(0.431477, 0.143546, 0)	(0.38429, 0, 2.20)	35.6817
2.40	(0.434889, 0.237428, 0)	(0.383399, 0, 2.40)	35.6971
2.60	(0.438302, 0.167004, 0)	(0.382506, 0, 2.60)	35.7125
2.80	(0.441714, 0.178461, 0)	(0.381611, 0, 2.80)	35.7281
3.00	(0.445127, 0.189742, 0)	(0.380713, 0, 3.00)	35.7438
3.20	(0.448539, 0.200852, 0)	(0.379813, 0, 3.20)	35.7596
3.40	(0.451952, 0.211794, 0)	(0.378911, 0, 3.40)	35.7755
3.60	(0.455364, 0.222572, 0)	(0.378006, 0, 3.60)	35.7915
3.80	(0.458777, 0.23319, 0)	(0.3771, 0, 3.80)	35.8077
4.00	(0.462189, 0.24365, 0)	(0.376191, 0, 4.00)	35.824

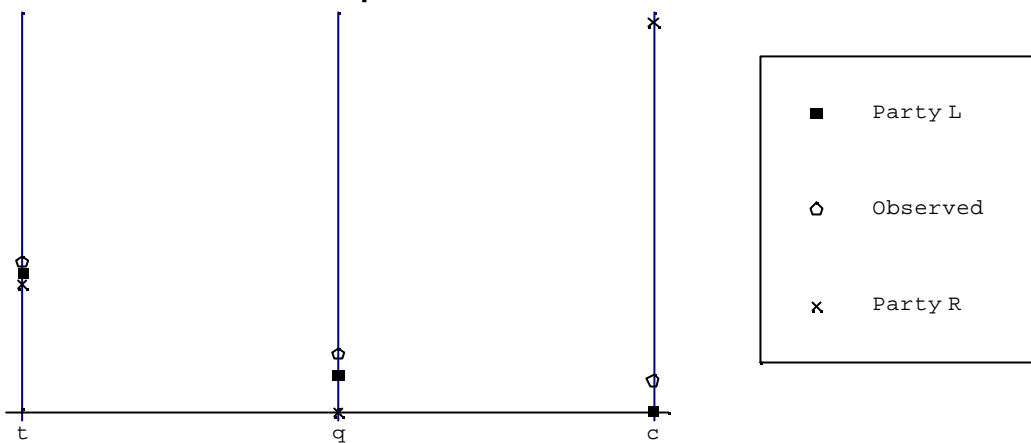
**Table 6p.** Comparative statics for **Portugal**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
1.00	(0.369506, 0.146843, 0)	(0.326233, 0, 1.00)	18.5003
1.10	(0.373124, 0.159961, 0)	(0.325517, 0, 1.10)	18.5076
1.20	(0.376741, 0.172828, 0)	(0.324801, 0, 1.20)	18.515
1.30	(0.380358, 0.185449, 0)	(0.324084, 0, 1.30)	18.5224
1.40	(0.383975, 0.197833, 0)	(0.323366, 0, 1.40)	18.5298
1.50	(0.387593, 0.209986, 0)	(0.322646, 0, 1.50)	18.5374
1.60	(0.39121, 0.221914, 0)	(0.321926, 0, 1.60)	18.5449
1.70	(0.394827, 0.233623, 0)	(0.321205, 0, 1.70)	18.5525
1.80	(0.398445, 0.24512, 0)	(0.320484, 0, 1.80)	18.5602
1.90	(0.402062, 0.25641, 0)	(0.319761, 0, 1.90)	18.568
2.00	(0.405679, 0.267499, 0)	(0.319037, 0, 2.00)	18.5757

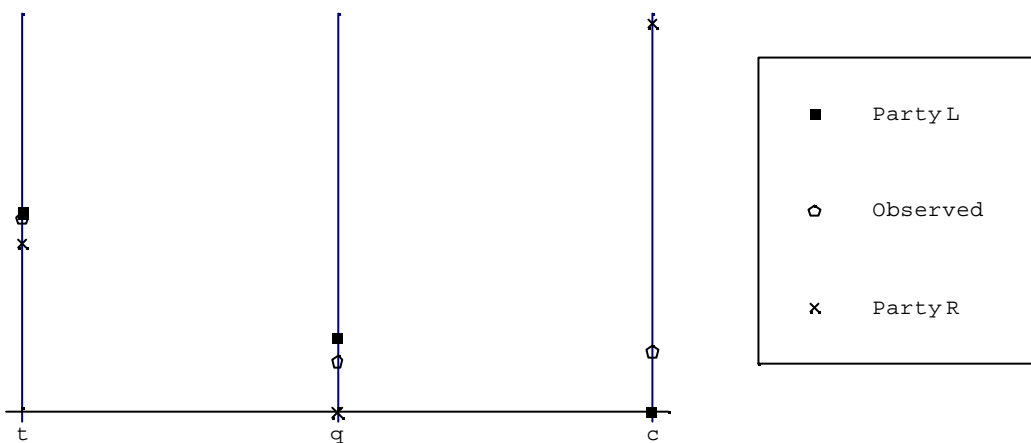
**Table 6s.** Comparative statics for **Sweden**

$\zeta$	$(t_L, q_L, c_L)$	$(t_R, q_R, c_R)$	pivot
1.80	(0.508437, 0.12987, 0)	(0.460718, 0, 1.80)	27.4508
1.90	(0.510368, 0.136567, 0)	(0.459988, 0, 1.90)	27.4618
2.00	(0.512299, 0.143212, 0)	(0.459257, 0, 2.00)	27.473
2.10	(0.514229, 0.149809, 0)	(0.458525, 0, 2.10)	27.4842
2.20	(0.51616, 0.156355, 0)	(0.457793, 0, 2.20)	27.4954
2.30	(0.518091, 0.162853, 0)	(0.457059, 0, 2.30)	27.5068
2.40	(0.520022, 0.169303, 0)	(0.456324, 0, 2.40)	27.5181
2.50	(0.521952, 0.167004, 0)	(0.455589, 0, 2.50)	27.5296
2.60	(0.523883, 0.182059, 0)	(0.454852, 0, 2.60)	27.5411
2.70	(0.525814, 0.188367, 0)	(0.454115, 0, 2.70)	27.5526
2.80	(0.527745, 0.194629, 0)	(0.453377, 0, 2.80)	27.5642

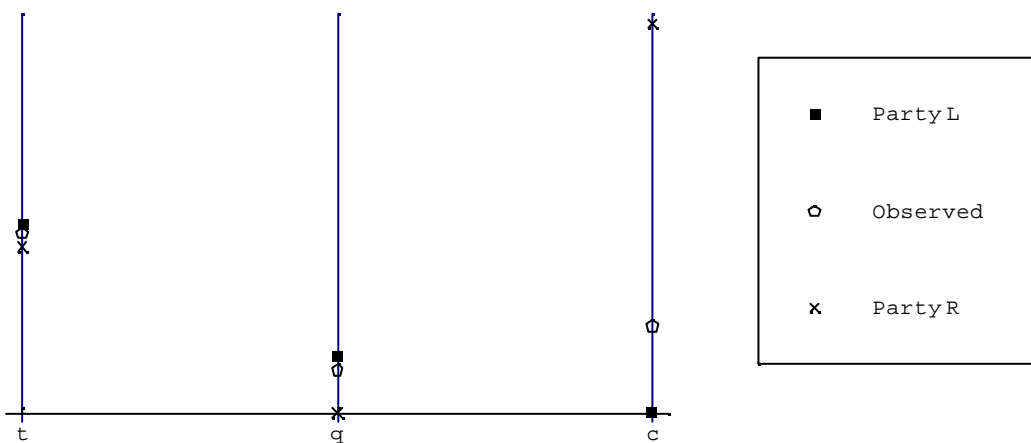
### Czech Republic

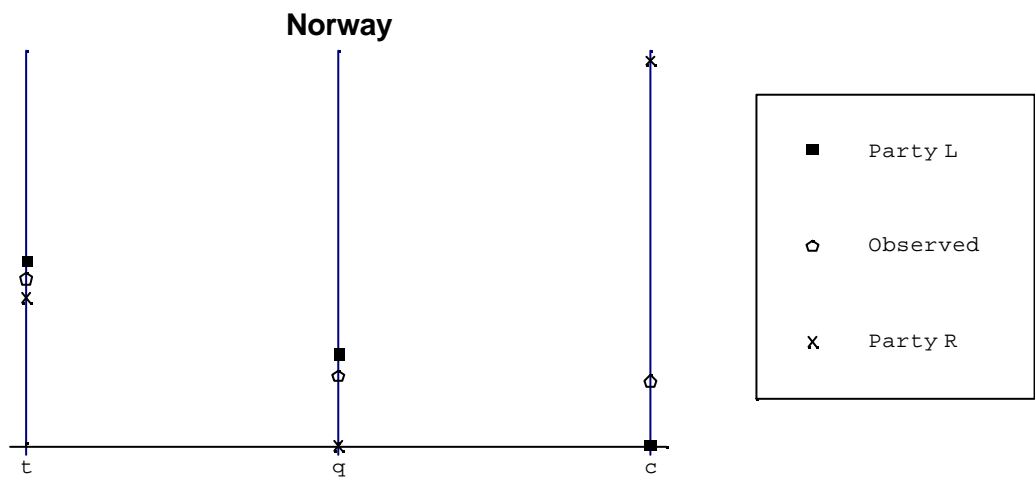
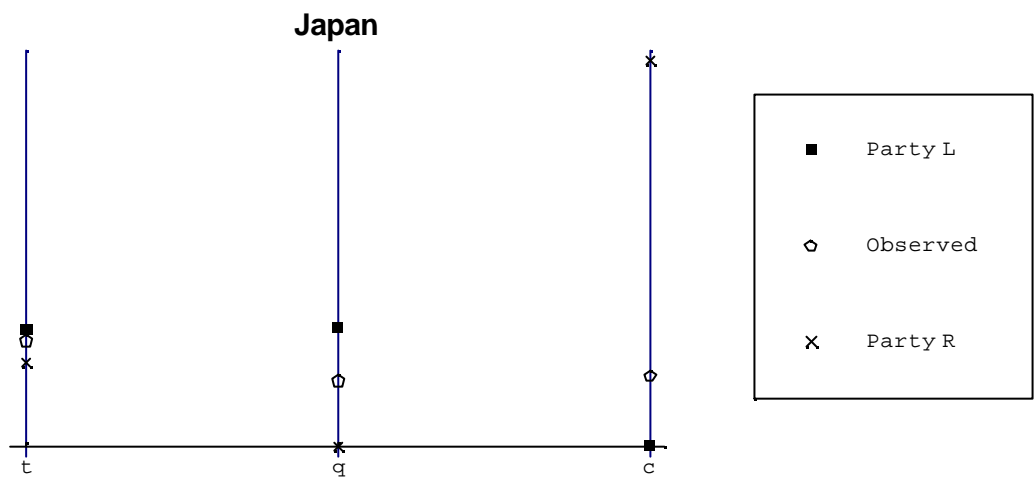
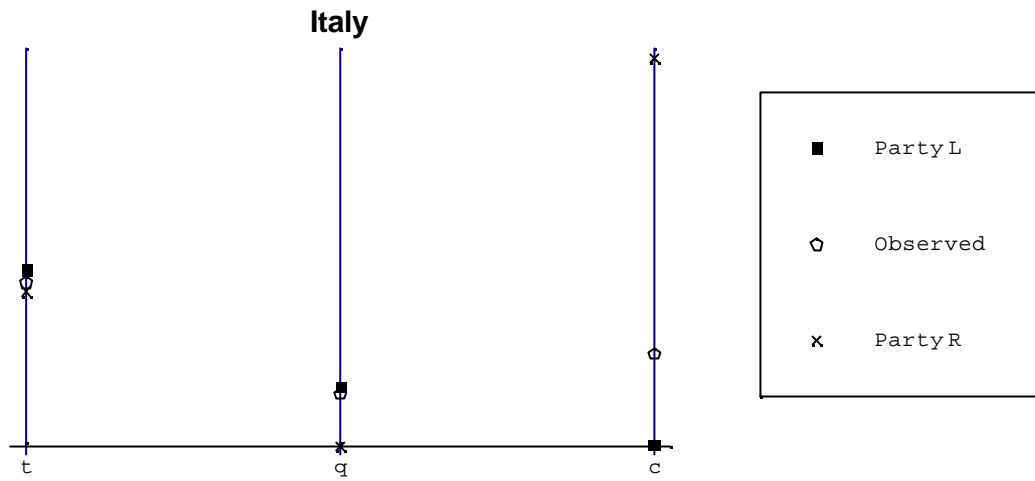


### Denmark



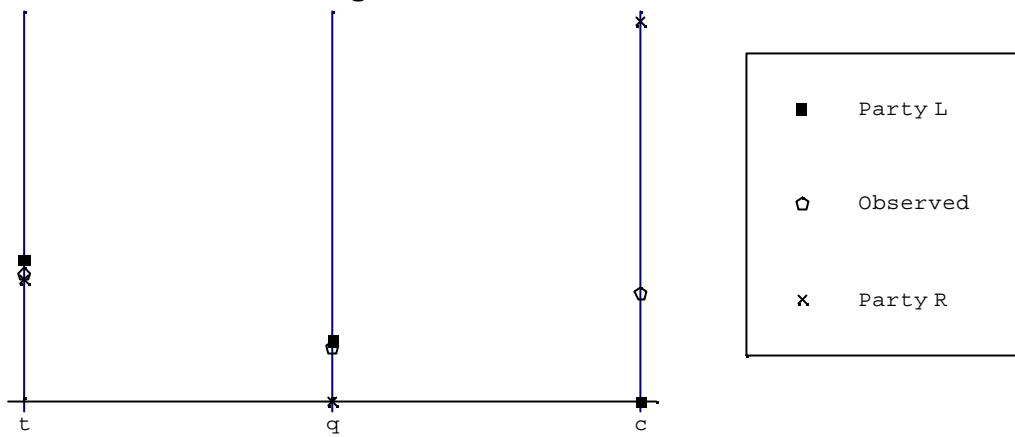
### Finland







### Portugal



### Sweden

