Social ideology and taxes in a differentiated candidates framework*

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Abstract

Many observers have argued that political polarization, particularly on social and cultural issues, has increased in the United States. How does this influence the political competition between candidates on economic issues? We analyze this question using a differentiated candidates framework in which two office-motivated candidates differ in their fixed ideological position and choose a level of government spending and implied taxes to maximize their vote share. In equilibrium, candidates choose their tax rates to cater to a mix of swing voters who contain socially-conservative and economically liberal voters, as well as socially-liberal and economically-conservative voters. We analyze how economic positions are influenced by the cultural positions of candidates and the distribution and intensity of non-economic preferences in the electorate.

Keywords: Differentiated candidates, policy divergence, ideology.

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1 Introduction

Many observers have argued that polarization between the two major parties in the U.S., particularly on non-economic "cultural" matters, has increased. This is reflected both at the elite level, in particular in Congress (Poole and Rosenthal 1984, 1985, 2000) and among Democratic and Republican activists and voters (Abramowitz and Saunders 2008, Harbridge and Malhotra 2011). In the American National Election Survey, respondents report their own ideological position on a scale from 1 (very liberal) to 7 (very conservative). The number of respondents who report one of the extreme positions (1,2, 6 or 7) has grown from 20 and 21 percent in 1972 and 1976 to 31 and 30 percent in the 2004 and 2008, respectively. Moreover, liberal and conservative voters have become considerably more reliable supporters of Democrats and Republicans, respectively, over the last generation.[1] If we accept the widespread view that Reagan's "conservative revolution" has created a cultural wedge between the parties that only widened in the 1990s and 2000s, what consequences for the parties' economic policies should we expect?

In this paper, we develop a theory of candidate competition that accounts for a strong influence of both economic and cultural issues on individual voting behavior, and helps us understand how ideological polarization (i.e., an intensification of the voters' party preferences based on cultural issues) influences the candidates' positions on economic issues.

In our model, candidates are exogenously committed to their cultural positions, while they choose a position on economic issues to maximize their vote share.[2] Voters care about both candidates' cultural and economic positions. In equilibrium, voter behavior is determined by both economic and cultural preferences, because both the candidates' immutable positions on cultural issues and their equilibrium platforms on economic issues differ: Social conservatives who happen to be sufficiently keen on government spending may vote for the Democrat, and social liberals who are sufficiently opposed to high taxation may vote for the Republican.

[1] For example, whether a voter regularly goes to church (a proxy for cultural preferences) has become a strong predictor of voting intentions. According to the exit polls of the 2008 U.S. presidential election, voters who attended church weekly voted for McCain 55-43, while occasional church-goers voted for Obama 57-42, and those who never go to church voted for Obama 67-30.

[2] This is plausible: It may be very difficult for a candidate to credibly change a position on issues such as abortion, the death penalty or gun control, while there is no comparable constraint that prevents a politician who favored a 5 percent sales tax in a previous campaign to credibly advocate a 6 percent or a 4 percent rate in the current campaign. A reason for this difference is also that the optimal economic policy (for any preference type) depends on the state of the economy and thus naturally changes over time, while one's view of the desirability of abortion restrictions is more likely to be fairly constant over time.

In equilibrium, candidates compete for different *swing voter* types. Swing voters are voters who are indifferent between candidates, and therefore must strictly prefer the economic platform of the candidate whose cultural position they dislike. Among social conservatives, swing voters are economically liberal (i.e., prefer substantial government spending), while among social liberals, swing voters are economically conservative. Thus, a key feature of our model (driven by the fact that the policy space is two-dimensional) is that there is a continuum of swing voters with different cultural and economic preferences, rather than a single swing voter as in the standard one-dimensional spatial model.

Candidates focus their equilibrium economic policies to appeal to a weighted average of these swing voters. They propose tax rates that are higher than the rates preferred by the most socially liberal swing voter and smaller than the one preferred by the most socially conservative swing voter. A candidate who marginally increases his proposed tax rate gains votes among social conservatives, but loses some liberals, and those gains and losses exactly balance in equilibrium for each candidate.[3]

Comparative statics effects can be derived from the effect of the exogenous change on the composition of swing voters. For example, more intense cultural preferences among social conservatives imply that the new socially conservative cutoff voters are more economically liberal than before, and both candidates adjust their platforms accordingly by increasing their respective proposed spending. Similarly, cultural polarization of candidates affects their equilibrium economic platforms. A radicalization of the Republican candidate leads to decreased spending by both the Democratic and the Republican candidate, and a radicalization of the Democratic candidate has the opposite effect.

We also show that cultural polarization of voters that preserves mean and median may affect economic policies because they can change the average ideological and economic composition of swing voters. Our model thus provides insights about spillovers from ideology to economic policy that can only be obtained in a multidimensional setting. Furthermore, with plausible income distributions, we show that a society that on average has no net ideological bias has swing voters that culturally prefer the Republican and economically the Democrat.

[3]Note that the statement that more government spending increases the set of conservatives who vote for the candidate does *not* imply that higher tax rates are on average popular with social conservatives as a group. Clearly, at least some social conservatives (and quite possibly a majority of them) dislike higher taxes, but those are not the swing voters that the candidates focus on.

2 Related literature

The standard models in political economy are ill-equipped to analyze how economic and cultural factors interact in political competition. If the simple one-dimensional policy model is interpreted as one of economic policy, there is, by definition, no cultural dimension, and voters split according to their economic preferences even if there is only slight differentiation between the economic platforms proposed by the candidates.

In the probabilistic voting model (PVM; e.g., Hinich 1978; Lindbeck and Weibull 1987), voters have cultural and economic preferences like in our model. However, because candidates in the standard PVM have exactly the same ability to implement any economic policy, both candidates choose the same economic policy in equilibrium, and thus, voting behavior is determined only by the voters' position on the cultural dimension in which candidates are exogenously fixed. In contrast, there are economic differences between candidates' equilibrium positions in our model, and thus voting behavior depends on both economic and cultural preferences, and this dual dependence generates the most interesting effects in our model.

Specifically, in the PVM, equilibrium platforms are a weighted maximum of the economic utility of voter groups, where the weight of each group is proportional to the value of its density of cultural preferences at zero (i.e., to the number of "swing voters" in the respective group who are culturally indifferent between the candidates. Thus, a proportional increase of the importance of cultural issues for all voters, or even of just liberals or conservatives, has no effect whatsoever on equilibrium platforms in the PVM because it neither changes the preferences of swing voters nor their numbers. In contrast, intensification of cultural preferences does affect the identity of swing voters in our model, and this channel is what drives changes in equilibrium economic platforms.

Similarly, in the standard citizen candidate model of Besley and Coate (1997), polarization of the electorate (in the sense of a median-preserving spread in the distribution of voter ideal points) has no effect on the set of one- or two-candidate equilibria because these only depend on the position of the median.

Our model is based on the differentiated candidates framework developed in Krasa and Polborn (2010a, 2010b, 2012b), in which the two competing candidates have some exogenously fixed characteristics, and choose a position on some flexible issues in order to maximize their respective probability of winning. Voters care about both fixed characteristics and flexible positions in a general, not necessarily separable way. This is the main difference to classical valence models or the PVM in which utility is additively separable in cultural ideology and utility from policy.

The most closely related article from this literature is Krasa and Polborn (2010b) where we analyze a setting in which candidates compete by proposing how to allocate spending between two public goods, and each candidate has an advantage in providing one of these goods. In equilibrium, candidates compete for the support of a cutoff voter with moderate policy preferences, but do so by proposing different platforms that cater to their respective strengths. While that model and the present one also differ in several other aspects, the main difference is that the focus of the present paper is on how ideological polarization on cultural issues influences the candidates' positions on economic issues – a question that cannot be addressed in the Krasa and Polborn (2010b) model because voters there care only about economic issues.

There are a number of different variations on the spatial model that analyze how increasing diversity of voter preferences affects the size of government (Austen-Smith and Wallerstein 2006; Lizzeri and Persico 2001, 2004; Fernández and Levy 2008; Levy 2004). Preference diversity in all of these models is "economic", i.e., politicians have different types of economic policies at their disposal, voters are interested in both general interest and some special interest policies, and they only care about their total economic benefit from the bundle of policies that are enacted by the election winner. In contrast, our model has a simpler economic policy (as it contains only the choice of one parameter, the tax rate), but it analyzes how this choice is affected by preference diversity on cultural issues, which are non-existent in these models. Finally, Roemer (1998) analyzes redistributional policy in a two-dimensional model to address the question why the poor do not expropriate the rich.

3 Model

Two candidates, $j = D, R$, compete in an election. There are two major components of policy, "economics" and "cultural issues" (such as abortion or gun control). On cultural issues, candidates are exogenously committed to distinct positions $\delta_D < 0 < \delta_R$; due to their own history or their party label, they cannot credibly change this position. In contrast, economic positions are more flexible. Each candidate proposes a level g of public goods that is supported by a tax rate t. All voters prefer higher g and lower t, but the rate at which they trade these off differs between individual voters.

The utility of a voter with income, m and cultural position $\delta \in \mathbb{R}$ from candidate j is

$$u_\delta(x, g, \delta_j) = x + w(g_j) - (\delta - \delta_j)^2, \tag{1}$$

where x is the voter's (private) consumption; g_j is the amount of public good provided by candidate j, and δ_j is his cultural position. Each candidate j proposes an income tax rate t_j. Normalizing the size of the population and the citizens' average income to one, the tax revenue if candidate j is elected is t_j and is used to pay for the provision of a public good g. Note that, with preferences given by (1), richer voters prefer a lower tax rate than poor voters, so they are "economically conservative." In reality, voters may also differ in how much they value public goods (say, the utility from public goods could be $\theta w(g_j)$, with voters differing in θ). How one models the reason for economic conservatism is qualitatively irrelevant for our main results.

The ability to provide the public good differs among candidates, and is given by a production function, $g_j = g_j(t_j)$, where $g'_j \geq 0$ and $g''_j \leq 0$. Specifically, candidates have different fixed costs (i.e., there exist $\underline{t}_j$ such that candidate j must use $t \geq t_j$ and $g_j(\underline{t}_j) = 0$), and different marginal productivity. For concreteness, we analyze situations in which candidate R has an advantage in fixed costs (so $\underline{t}_R < \underline{t}_D$), while candidate D has a higher marginal productivity and thus an advantage providing a high level of public goods. We provide a possible microfoundation of this assumption in Section 3.1 below. The assumption is responsible for the Democrat proposing higher taxes in equilibrium than the Republican.

Since the variable in which candidates compete is their respective tax rate, it is useful to define functions $W_j(t) \equiv w(g_j(t))$, for $j \in \{D, R\}$. We make the following assumptions on these functions.

Assumption 1. *1. The minimum feasible tax rate of the Republican, $\underline{t}_R$, is lower than that of the Democrat, $\underline{t}_D$.*

2. For all $t > \underline{t}_D$, the marginal productivity of a tax dollar is higher for the Democrat: $W'_D(t) > W'_R(t)$, for all $t \in [\underline{t}_D, 1]$.

3. For all $t > \underline{t}_j$, $W'_j > 0$ and $W''_j < 0$.[4]

Candidates choose their platforms to maximize their vote shares.[5] The timing is as follows:

Stage 1 Candidates $j = D, R$ simultaneously announce tax rates $t_j \in [0, 1]$.[6]

[4]Note that it does not matter whether this concavity in t comes from the concavity of the utility function or the production function, or both.

[5]Vote-share maximization is equivalent to probability of winning maximization if, in addition to the voter types that we deal with in our model, there is a random number of "noise voters." To maximize his probability of winning the election in such an augmented model, a candidate should maximize his vote share among rational voters.

[6]Note that all government expenditures in our model have to be financed by contemporaneously raised taxes, and we therefore use "higher taxes" and "more government spending" as synonymous.

Stage 2 Citizens vote for their respective preferred candidates.[7]

3.1 A microfoundation for differential production functions

The notion that candidates have differential abilities that are complements to the policy to be implemented is a key assumption in the differentiated candidates model (see also Krasa and Polborn 2010b, 2012b). One way of justifying different production functions for the Democrat and the Republican is that, once elected, a candidate has to rely on managers recruited from his party to implement policy. These party elite members are (in part) policy motivated, and endowed with ability γ which also determines their wage in the private sector. An elite member thus has utility $w(g) + (1 - t)\gamma$ if he works in the private sector, and $w(g) + (1 - t)S + z_i(t)$ if he works in the public sector, where γ is the private sector wage, S is the salary of a public employee.

The term $z_i(t)$ captures the policy motivation of elite members of party $i \in \{D, R\}$. For simplicity, we make this term just a function of t. In reality, those who join a managerial position in government often give up private sector jobs that pay more and have better job security. So, there must be something else that motivates them. These benefits could either be direct — the warm glow that comes from implementing a policy that the manager approves of —, or indirect, as a springboard for elective office. However, the extent of these non-monetary benefits depends on which policy the government implements — a policy that one thinks is not ideal gives lower benefits, and association with a government that implements policies that are unpopular with the party base is less helpful when the manager seeks elective office in the future.

For this reason, it is plausible to assume that, while z_D and z_R are both concave, they have different maximizers that correspond to the "ideal" Democratic and Republican positions. Setting the utilities with a private sector job and a public sector one equal yields that the marginal elite party i member is $\gamma_i^* = S + \frac{z_i(t)}{1-t}$. This is a function of t, so we can write $\gamma_i^*(t)$.

If candidate i wins with a platform of tax rate t_i, he will be able to hire managers of quality $\gamma_i \leq \gamma_i^*$ to work in his administration. Assuming that the election winner hires the best available candidates for his administration, each γ_i^* maps into an average quality of managers working for the administration, $\overline{\gamma}_i(\gamma_i^*)$. Clearly, $\overline{\gamma}_i$ is an increasing function of γ_i^*.

[7] We assume that all citizens vote for their preferred candidate, independent of the strength of their preference. This implies that candidates will focus exclusively on "swing voters" who are (almost) indifferent between them, while taking the votes of their core supporters for granted. This is a standard assumption in most candidate competition models in particular in the standard Downsian model and in the PVM.

Finally, assume that the public good production of candidate i is an increasing function of the tax rate (i.e., the monetary resources put into public good production) and the average quality of managers, $\overline{\gamma}_i$. Specifically, $g_i = \tilde{g}(t_i, \overline{\gamma}_i)$. Since $\overline{\gamma}_i(\gamma_i^*(t_i))$, we can define a function $g_i(t) = \tilde{g}(t_i, \overline{\gamma}_i(\gamma_i^*(t_i)))$ that maps the tax rate of candidate i into a level of public good production. Note that, although the function $\tilde{g}(t, \gamma)$ is the same for both candidates, the functions g_i depend on the average managerial quality $\overline{\gamma}_i(\gamma_i^*(t_i))$ that candidate i can attract with tax rate t_i, and that quality will generally differ between candidates.

In the Online Appendix, we provide a numerical example of this microfoundation that generates two production functions such that the Republican has an advantage for low levels of taxation, while the Democrat has a higher marginal product and is eventually better than the Republican in terms of public good production for sufficiently high levels of taxation.

4 Equilibrium

4.1 The effect of economic policy on swing voters

A voter with income m and cultural position δ prefers candidate D over candidate R if and only if

$$(1 - t_D)m + W_D(t_D) - (\delta - \delta_D)^2 \geq (1 - t_R)m + W_R(t_R) - (\delta - \delta_R)^2. \tag{2}$$

If $t_D \neq t_R$, rearranging (2) implies that an indifferent voter with position δ must have income

$$m_\delta^* = \frac{W_D(t_D) - W_R(t_R) + (\delta_R^2 - \delta_D^2) - 2(\delta_R - \delta_D)\delta}{t_D - t_R}. \tag{3}$$

In Proposition 1 we show that, in equilibrium, the Democrat chooses a higher tax and spending, i.e., $t_D > t_R$. For this case, the left panel of Figure 1 illustrates the negatively-sloped cutoff line, i.e., the different cultural and income types of swing voters. Voters below and to the left of the line such as B in the left panel (that is, socially-liberal or poor, i.e., economically-liberal voters) vote for the Democrat, those to the right of the line such as A in the left panel vote for the Republican.

The voters who are located exactly on the cutoff line (3) are what we call *swing voters*. A crucial feature of our two-dimensional model is that there is a whole continuum of swing voter types for whom their cultural preference for one candidate and their economic preference for his opponent cancel out. Socially liberal swing voters prefer the Democrat's ideology, but the Republican's economic platform. Socially conservative swing voters are their mirror image in that they like the Republican's ideological position, but at the same time prefer the Democrat's economic position.

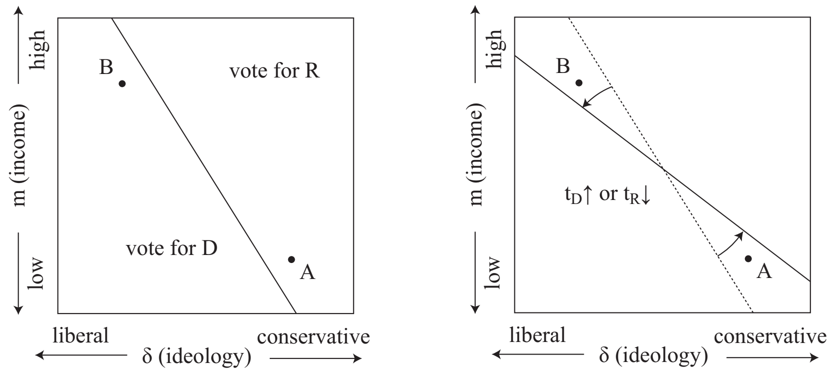

Figure 1: The effect of tax changes on cutoff voters

Hence, socially conservative *swing voters* are necessarily economically liberal, and the more socially conservative they are, the more economically liberal they must be in order to remain swing voters. The reverse holds for socially liberal swing voters. The swing voters on the cutoff line are the voters that candidates are going to focus on when they decide which policy platform to campaign on, and understanding swing voters' behavior is crucial for understanding the comparative statics of the model.

How does a change in the candidates' proposed tax rates affect the location of the cutoff line? Intuitively, an increase in the tax difference $t_D - t_R$ must increase voters' focus on economic issues. More formally, inspection of (3) immediately reveals that the cutoff line in Figure 1 flattens.

Furthermore, in an equilibrium, the intercept in income of the cutoff line must decrease as t_D increases or t_R decreases. If it did not, a tax increase by the Democrat would have only positive effects for the Democrat: If the whole new cutoff line were to lie above the old one, then the set of voter types who now vote for the Democrat is a superset of the corresponding set before the change. Hence, the original situation cannot have been an equilibrium. Rather, in an equilibrium, any tax change by a candidate must imply a pivot around some interior point, so that the candidate would win some voter types and lose others.

Such a situation is depicted in the right panel of Figure 1. Specifically, a more economically liberal policy by the Democrat ($t_D \uparrow$) will attract economically liberal swing voters, such as A in the right panel; remember that economically liberal swing voters are socially conservative. On the other hand, for a socially liberal, economically conservative swing voter such as B, a more economically liberal policy makes the Democrat less appealing. A tax decrease by the Republican leads to the same change in the cutoff line, i.e., makes the Democrat more attractive for socially conservative swing voters such as A, and the Republican more attractive for socially liberal swing voters such as B. Conversely, a tax increase by the Republican or a tax decrease by the Democrat turns the cutoff line in a clockwise direction, making the Republican more attractive for socially conservative swing voters, and the Democrat more attractive for socially liberal swing voters.

A short empirical analysis in the Appendix shows two results for U.S. presidential elections from 1972 to 2008. First, voter behavior in these elections is consistent with the behavior depicted in Figure 1, in the sense that given any level of income, socially conservative voters are more likely to vote Republican than social liberals, and given any cultural position, the propensity to vote Republican increases in income. Second, the slope of the cutoff line appears to have increased in the second half of these elections relative to the first half, in the sense that voter separation has become stronger with respect to cultural positions, and more diluted with respect to income.

It is useful to describe the cultural preference type distribution in the electorate by a cdf $H(\delta)$, and conditional cdfs for the income distribution given δ, $F_\delta(m)$. Then the vote-share of candidate D is given by $V_D = \int F_\delta(m^*_\delta)\, dH(\delta)$. Candidate D chooses t_D to maximize V_D, while candidate R chooses t_R to minimize V_D. The first-order conditions are

$$\int f_\delta(m^*_\delta)\frac{\partial m^*(\delta)}{\partial t_D}\, dH(\delta) = 0, \text{ and } \int f_\delta(m^*_\delta)\frac{\partial m^*(\delta)}{\partial t_R}\, dH(\delta) = 0, \tag{4}$$

where f_δ is the pdf corresponding to the cdf F_δ. Define

$$\overline{\delta} = \frac{\int f_\delta(m^*_\delta)\delta\, dH(\delta)}{\int f_\delta(m^*_\delta)\, dH(\delta)}, \tag{5}$$

which is the average cultural preference *of voters on the cutoff line*. Solving the first order conditions in (4), and taking into account the second order conditions we can characterize pure strategy equilibria (in short, “equilibria”) of the game.

Proposition 1.

1. *Any interior equilibrium* $0 < t^*_D, t^*_R < 1$ *is unique and must satisfy*

$$W'_D(t^*_D) = W'_R(t^*_R) = \frac{W'_D(t^*_D) - W'_R(t^*_R) + (\delta_R^2 - \delta_D^2) - 2\overline{\delta}(\delta_R - \delta_D)}{t^*_D - t^*_R}. \tag{6}$$

   Furthermore, $t^*_D > t^*_R$.

2. *Conversely, if* t^*_D, t^*_R *satisfy* (6), *are strictly between 0 and 1, and if* $f'_\delta(m^*(\delta)) \leq 0$ *for all* δ, *then* t^*_D, t^*_R *is a local equilibrium.*[8]

[8] That is, there exist two open sets T_D and T_R such that $t^*_D \in T_D$ and $t^*_R \in T_R$ such that, if D is restricted to choose t_D from T_D and R is restricted to choose t_R from T_R, then t^*_D, t^*_R is a Nash equilibrium.

Proofs of all propositions are in the Appendix.

The first equality in (6), $W_D'(t_D^*) = W_R'(t_R^*)$, means that the marginal (gross) utility from an additional dollar of tax revenue must be equal when the Democrat is in charge and when the Republican is in charge. If, for example, it were larger for the Democrat than for the Republican, then either the Democrat could increase his vote share by increasing t_D, or the Republican could increase his vote share by decreasing t_R (or both). Neither case would be consistent with equilibrium.

Note that the condition in the second item of Proposition 1 that $f_\delta'(m^*(\delta)) \leq 0$ is a sufficient, but not necessary condition for the existence of a local equilibrium. It means that, at the cutoffs, the income distribution is non-increasing. This assumption appears very plausible. For the United States, the income density $f(m)$ is strictly decreasing in m for all income levels between 10,000 and 200,000 Dollars (see Census Bureau (2011)).

An immediate consequence of (6) is that, if the candidates' exogenous cultural positions, or the distribution of voters' cultural preferences change, then both candidates agree on the direction of the economic policy change (though not necessarily on its size).

Corollary 1. *If the distribution of voters' cultural preferences changes, or the candidates' cultural positions change, then both parties' proposed economic policies change in the same direction.*

To interpret the third term in (6), start with the case that the terms involving cultural preference parameters are zero. For example, if the candidates' cultural positions are identical, $\delta_R = \delta_D$, or if all voters have no cultural bias for one of the candidates (so that $\overline{\delta} = 0$), then (6) simplifies to

$$W_R'(t_R) = W_D'(t_D) = \frac{W_D(t_D) - W_R(t_R)}{(t_D - t_R)} \tag{7}$$

The left panel of Figure 2 displays W_R and W_D as functions of the respective tax rates. The last term in (7) is the slope of the straight line that connects (t_R^*, w_R^*) and (t_D^*, w_D^*). In equilibrium, this slope is equal to both the slope of W_D and that of W_R.

Equation (7) also has an economic interpretation. Inspection of (2) shows that the slope of a voter's indifference curve in a $t - w$–space is $dw/dt = -(-m)/1 = m$. Thus, the straight line that connects (t_R^*, w_R^*) and (t_D^*, w_D^*) is the indifference curve of the swing voter, the one who is indifferent between both candidates. Voters with higher income have steeper indifference curves than the swing voter and thus prefer (t_R^*, w_R^*) over (t_D^*, w_D^*); those with lower incomes have flatter indifference curves and prefer (t_D^*, w_D^*) over (t_R^*, w_R^*).

The fact that both candidates' feasible sets are tangent to the swing voter's indifference curve implies that both candidates choose the policies from their respective feasible sets that maximize

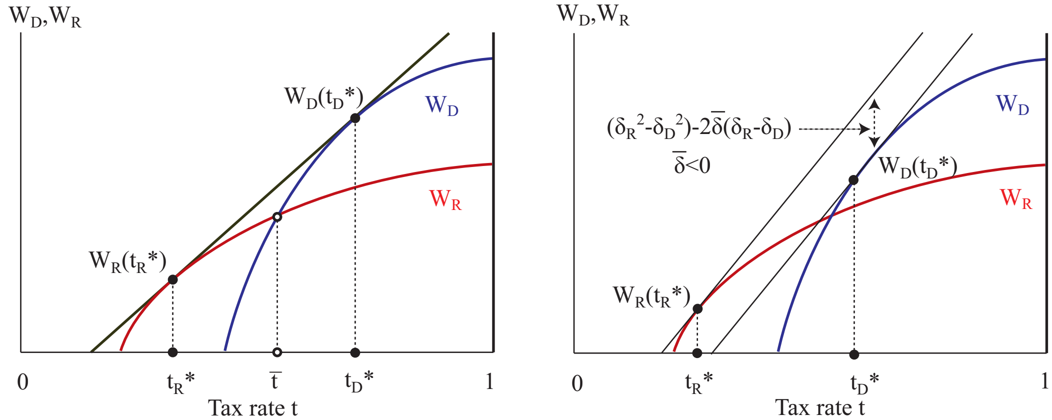

Figure 2: Existence of equilibrium policies t_R^*, t_D^*

the swing voter's utility. Thus, in the absence of cultural preferences, the swing voter resembles the standard median voter. However, there is no policy convergence here because candidates have different marginal productivities. Also, in a standard model, both candidates catering to the median voter implies that *all* voters become indifferent between the candidates, which is not the case here.

Note that the identity of the swing voter here is not determined by his position in the preference distribution of the electorate, but rather by the candidates' capabilities: Due to the differentiated production functions, the Democrat has a natural advantage in appealing to poorer voters as he is particularly good in delivering the high level of public good provision that poor voters appreciate. Conversely, the Republican has an advantage in appealing to richer voters. The swing voter is the voter type for which none of the candidates has a strict advantage, and so they both *can* compete for this voter's support.[9]

How does this situation described in the left panel of Figure 2 change when voters have cultural preferences for one of the candidates? For concreteness, suppose that all voters have the same $\delta = \overline{\delta} < 0$ (i.e., a cultural preference for the Democrat). In this case, the previous swing voter income type now strictly prefers the Democrat. A voter will only vote for the Republican if his economic utility from the Republican's plan is at least $-2\overline{\delta}(\delta_R - \delta_D)$ larger than his economic utility from the Democrat's plan. This is the distance between the two indifference curves in the right panel.

[9]See Krasa and Polborn (2010b) for a more thorough discussion of the nature of the candidate competition equilibrium in a differentiated candidates framework when voters do not have ideological preferences.

The candidates still choose platforms where their marginal productivity, in terms of utility generated by additional tax revenue, is equal. However, because the Democrat is culturally popular with voters, he can now successfully compete for more economically-conservative voter types. As a consequence of the shift in the swing voter's type, both candidates adjust their equilibrium platforms to appeal to this economically more conservative voter. Conversely, if all voters culturally prefer the Republican, both candidates' economic platforms change to increased spending.

4.2 Comparative statics: Polarization

Electoral polarization can have two fundamental causes: First, policy divergence by candidates provides for a starker choice for voters. Second, voters themselves may become, on average, more ardent ideological supporters of Democrats or Republicans.[10] We now analyze how these two effects influence the economic platforms. We start with candidate polarization.

Proposition 2. *Let t_D, t_R be the tax rates in a local equilibrium. Suppose that (i) the distribution over m is uniform and independent of δ; (ii) voters of all cultural preference types are contested (do not vote for the same candidate); and (iii) $\delta_D < E[\delta] < \delta_R$, where $E[\delta]$ is the average voter's cultural preference. Then,*

1. *The cultural preference of the average cutoff voter and the average voter are the same, i.e., $\bar{\delta} = E[\delta]$.*

2. *If the Republican's cultural position δ_R becomes more moderate, or if the Democrat's cultural position becomes more extreme, both candidates' equilibrium tax rates increase. Conversely, an increase of δ_R or δ_D decreases both candidates' equilibrium tax rates.*

3. *If both candidates become symmetrically more extreme ($\Delta\delta_R = -\Delta\delta_D > 0$), then tax rates increase if and only if $\bar{\delta} > \frac{\delta_D+\delta_R}{2}$, i.e. the average cutoff voter is a social conservative.*

The intuition for these results builds on the one discussed above. Consider the swing voter who has an average cultural preference type $\bar{\delta}$. If the Republican's position becomes more culturally

[10] In Krasa and Polborn (2012a), we develop an empirical methodology that separates these two effects. We find that (i) there is a substantial increase in electoral polarization since 1972 and (ii) both effects contribute to this increase, with a majority coming from candidates' ideological policy divergence.

Also, in a richer model in which parties choose their cultural position, the two effects need not be independent; for example, voter radicalization may influence equilibrium cultural policy divergence. In the present paper, we do not need to take a stand on how these two effects are related.

moderate, then this voter now strictly prefers the Republican, and the new swing voter with average ideology is economically more liberal. Candidates therefore adjust to this shift with higher spending. Conversely, after a moderation of the Democrat or a radicalization of the Republican, the swing voter type is economically more conservative, and candidates choose lower tax rates.

If both candidates become symmetrically more extreme, then the location of the average swing voter determines which effect dominates. Intuitively, if the average cutoff voter is culturally conservative, he suffers a larger disutility from the Democrat becoming more extreme (because cultural disutility is convex in distance). Thus, the previous swing voter now strictly prefers the Republican, and the new swing voter is economically more liberal. As candidates cater to the new swing voter, equilibrium taxes increase.

We now turn to changes in the distribution of voters. In Section 4.1, we already discussed the effect that arises if all voters develop the same preference for one of the candidates so that the effect on the average cutoff voter is clear because there is only one cultural preference type. Specifically, if $\overline{\delta}$ increases (i.e., moves in the Republican direction), then the marginal public goods utility of an additional dollar tax revenue needs to decrease for both candidates to maintain an equilibrium, and so equilibrium spending increases. Proposition 3 shows that a conservative ideology shift in the electorate also leads to higher taxes when there is a distribution of preference types and the same assumptions as in Proposition 2 hold.

Proposition 3. *Suppose that (i) the distribution over m is uniform and independent of δ; (ii) all cultural preference types are contested (do not vote for the same candidate); and (iii) $\delta_D < E[\delta] < \delta_R$.*

If $E[\delta]$ increases, then both candidates' equilibrium tax rates increase.

Analyzing the consequences of shifts in the distribution of cultural preferences becomes a bit harder when there is a non-uniform income distribution because in this case, changes of the preference distribution of the electorate as a whole do not necessarily translate into the same changes among the average preferences of *cutoff voters*. We are particularly interested in analyzing the effect of cultural polarization (i.e., an increase in the standard deviation of the distribution of δ in the electorate) on equilibrium policies. To do this, we start with a symmetric distribution of δ with median and mean δ_m, and assume that the income distribution is independent of δ.

Suppose that $w(x) = \ln(x)$, and that g_D and g_R have constant marginal products, i.e., $g_D(t) = a_D(t - b_D)$, and $g_R(t) = a_R(t - b_R)$. Then Proposition 1 implies that $\frac{a_D}{g_D(t_D)} = \frac{a_R}{g_R(t_R)}$, which yields

$t_D = t_R + (b_D - b_R)$, and $g_D/g_R = a_D/a_R$. Substituting in (6) implies

$$\frac{b_D - b_R}{t_R - b_R} = \log(a_D) - \log(a_R) + (\delta_R^2 - \delta_D^2) - 2\overline{\delta}(\delta_R - \delta_D). \tag{8}$$

For simplicity, suppose there are three cultural preference types δ_l, δ_m, and δ_c (liberals, moderates, and conservatives), and set $\delta_m = 0$ and $-\delta_l = \delta_c$. Let π denote the proportion of types δ_l and δ_c, respectively, so that $1 - 2\pi$ is the proportion of moderate types δ_m. Denote by $m_c^* < m_m^* < m_l^*$ the income levels of the cutoff voters of the three cultural types. Note that m_c^*, m_m^* and m_l^* depend only on the difference $t_D^* - t_R^*$, which we have shown above is equal to $b_D - b_R$ and thus independent of any change in electoral polarization. Thus, the average cultural preference of cutoff voters is

$$\overline{\delta} = \frac{\delta_l \pi f(m_l^*) + \delta_c \pi f(m_c^*)}{\pi f(m_c^*) + (1 - 2\pi) f(m_m^*) + \pi f(m_l^*)}. \tag{9}$$

For the United States, the income density $f(m)$ is strictly decreasing in m for all income levels between 10,000 and 200,000 Dollars (see Census Bureau (2011)). Under this assumption, $f(m_l^*) < f(m_c^*)$, i.e., there are fewer socially liberal and rich cutoff voters than there are socially conservative and poor cutoff voters. Thus, if cultural polarization (i.e., π) increases, $\overline{\delta}$ increases, and (8) implies that t_R and t_D increase. Note that this effect occurs because the average swing voters becomes more socially conservative, although $E[\delta]$ remains unchanged. The extent of this effect is likely to be larger in more unequal societies because the density of the income distribution in those societies is larger at low levels and lower at high levels of income.

Our example features an ideologically balanced electorate at-large ($E[\delta] = 0$ when taking the average over all voters) and no correlation between cultural preferences and income, but decreasing income densities imply that the *cutoff voters'* average cultural preference is for the Republican candidate. This is a general consequence of decreasing income densities: More cutoff voters are poor rather than rich, and for them to be cutoff voters requires a socially conservative position. To offset the swing voters' average cultural preference for the Republican, they necessarily have (on average) an economic preference for the Democrat.[11]

It is also interesting to compare the result in our example above with the effect of ideological polarization in standard probabilistic voting models, in which the equilibrium policy (of both candidates) maximizes a weighted average of voter utilities. If the ideological type distribution in that model is independent of m, then all income types are weighed in proportion to the number of voters

[11] To test empirically the prediction that, on average, swing voters are socially conservative and economically liberal is certainly feasible, but beyond the scope of this note because it requires a method to identify swing voters.

in them, and therefore, no change in the ideological distribution (that preserves the independence of δ and m) will affect the candidates' equilibrium platforms.

The effect is different in our model because, in contrast to the probabilistic voting model, differentiated candidates implement different equilibrium platforms, and therefore income types differ in their respective cutoff voter cultural preferences. Thus, even if income and cultural preferences are independently distributed, a change in the cultural preference distribution may well lead to a change in the average cultural preference of cutoff voters, and thus to a change in equilibrium policies.

5 Discussion and empirical implications

While our main contribution in this paper is to provide a tractable theoretical framework in which one can analyze the influence of cultural polarization on economic platforms in candidate competition, several implications of our model are also, in principle, empirically testable. In Appendix 6.3, we analyze how voter behavior in U.S. presidential elections from 1972 to 2008 is affected by cultural preferences and income. For a more thorough analysis of the model's predictions about swing voters, one needs a method that identifies swing voters. For example, using the methods developed by Krasa and Polborn (2012a) one could identify voters in the American National Election Survey whose estimated probability of voting Republican is around 50 percent, and it would be interesting to look at this group's ideological and demographic makeup.

Our comparative static results provide predictions for how the candidates' cultural positions are related to their tax rates that can be compared to historical events. For example, Ronald Reagan's election and the contemporaneous integration of evangelicals into the main stream of the Republican party is widely interpreted as the starting point of a clearer ideological differentiation between parties. If one accepts this argument of a cultural radicalization of the Republican party under Reagan, and similarly later under George W. Bush, Proposition 2 predicts that it should be accompanied by a decrease in proposed tax rates (by both parties).[12] Of course, since federal tax rate changes are rare and also affected by exogenous shocks, it is impossible to formally distinguish between the explanation provided by our model and competing ones. Thus, for a serious empirical test of the equilibrium tax rate predictions of the model, it would be preferable to focus on U.S. states.

[12] A problem for the historical interpretation is whether to focus on tax rates or spending, which are decoupled when the federal government runs a deficit. For example, Reagan slashed taxes and simultaneously increased spending.

6 Appendix (for online publication only)

6.1 Proof of propositions

Proof of Proposition 1. First, suppose that $t_D \neq t_R$. Note that

$$\frac{\partial m^*_\delta}{\partial t_D} = \frac{W'_D(t_D)}{t_D - t_R} - \frac{W_D(t_D) - W_R(t_R) + (\delta_R^2 - \delta_D^2) - 2\delta(\delta_R - \delta_D)}{(t_D - t_R)^2}, \tag{10}$$

$$\frac{\partial m^*_\delta}{\partial t_R} = -\frac{W'_R(t_R)}{t_D - t_R} + \frac{W_D(t_D) - W_R(t_R) + (\delta_R^2 - \delta_D^2) - 2\delta(\delta_R - \delta_D)}{(t_D - t_R)^2}. \tag{11}$$

Inserting these partial derivatives into the first order conditions and adding them implies that $W'_R(t_R) = W'_D(t_D)$. Furthermore, using the definition of $\bar{\delta}$ we get the right-hand side of (6).

We next show that $t_D = t_R$ cannot occur in equilibrium. To do this, we write the cutoff δ as a function of m (rather than the other way around as we do in the main text). Solving for δ in (2), we get

$$\delta^*_m = \frac{(W_D(t_D) - W_R(t_R)) - (t_D - t_R)}{2(\delta_R - \delta_D)} + \frac{(\delta_R + \delta_D)}{2m} \tag{12}$$

Denote by $J_m(\delta)$ the cumulative distribution of δ given m, and by $F(m)$ the marginal distribution of m. Then candidate D's vote share is given by

$$V_D = \int J_m(\delta^*(m))\, dF(m). \tag{13}$$

Taking the derivatives with respect to t_D and t_R provides the first order conditions. Adding the first order conditions again implies $W'_R(t_R) = W'_D(t_D)$. By assumption $W'_D(t_R) > W'_R(t_R)$. Concavity of W_D implies that $W'_D(t)$ is decreasing in t. Thus, $W'_D(t_D) = W'_R(t_R)$ implies that $t_D > t_R$.

We next show that any interior solution to the first order conditions is unique. Let $t_R(t) = W_R'^{-1}(W'_D(t))$. Note that since $W''_R < 0$, W'_R is strictly decreasing and hence the inverse $W_R'^{-1}$ exists. Now define

$$h(t) = \frac{W_D(t) - W_R(t_R(t)) + (\delta_R^2 - \delta_D^2) - 2\bar{\delta}(\delta_R - \delta_D)}{t - t_R(t)} - W'_D(t). \tag{14}$$

Clearly, if $h(t^*) = 0$ then $t_D = t^*$ and $t_R = t_R(t^*)$ satisfy the first order condition. Hence, the number of solutions of the first order conditions equals the number of zeros of function h in $[\underline{t}_D, 1]$. We next show that $h'(t) > 0$ for any t with $h(t) = 0$.

$$\begin{aligned} h'(t) &= \frac{W'_D(t) - W'_R(t_R(t))t'_R(t)}{t - t_R(t)} - (1 - t'_R(t))\frac{W_D(t) - W_R(t_R(t)) + (\delta_R^2 - \delta_D^2) - 2\bar{\delta}(\delta_R - \delta_D)}{(t - t_R(t))^2} - W''_D(t) \\ &= \frac{1 - t'_R(t))}{t - t_R(t)}\left(W'_D(t) - \frac{W_D(t) - W_R(t_R(t)) + (\delta_R^2 - \delta_D^2) - 2\bar{\delta}(\delta_R - \delta_D)}{t - t_R(t)}\right) - W''_D(t). \end{aligned}$$

Evaluated at $t = t^*$, the term in the parentheses in the second line is zero since $h(t^*) = 0$, so that $h'(t^*) = -W_D''(t^*) > 0$. Intuitively, the result now follows since h cannot have strictly positive derivatives if there is more than one t with $h(t) = 0$.

Formally, let $\underline{t}_D < t_{\min} \leq t_{\max} < 1$ be the minimum and maximum, respectively over the set $\{t \mid h(t) = 0, \underline{t}_D < t < 1\}$. Let $\underline{t}$ be marginally smaller than $t_{\min}$ and $\overline{t}$ be marginally larger than $t_{\max}$. Then $h'(\underline{t}), h(\overline{t}) > 0$ implies $h(\underline{t}) < h(\overline{t})$. Let $\hat{h}$ be a the affine (linear) function on $T = [\underline{t}, \overline{t}]$ defined by $\hat{h}(t) = (1/(\overline{t} - \underline{t}))[h(\underline{t})(\overline{t} - t) + h(\overline{t})(t - \underline{t})]$. Then the degree of $\hat{h}$ at any value y of $\hat{h}$ is 1 because $\sum_{t \in \hat{h}^{-1}(y)} \operatorname{sign}(\hat{h}'(t)) = \operatorname{sign}(\hat{h}'(\hat{h}^{-1}(y))) = \operatorname{sign}((h(\overline{t}) - h(\underline{t}))/(\overline{t} - \underline{t})) = 1$. Since $\hat{t}$ is homotopic to h via $H(x, t) = xh(t) + (1 - x)\hat{h}(t)$ it follows that h has degree 1. Let n be the cardinality of the set $Z = \{t \in T \mid h(t) = 0\}$. Since $h'(t) > 0$ for all $t \in Z$ it follows that the degree of h at 0 is $\sum_{t \in Z} \operatorname{sign}(h'(t)) = n$. Therefore $n = 1$, i.e., there exists at most one solution to the first order conditions.

We now derive sufficient conditions for a local equilibrium. Taking the derivative of the first order condition of candidate D in (4) with respect t_D yields

$$\int f_\delta'(m_\delta^*) \left(\frac{\partial m_\delta^*}{\partial t_D} \right)^2 dJ(\delta) + \int f_\delta(m_\delta^*) \frac{\partial^2 m_\delta^*}{\partial t_D^2} dJ(\delta). \tag{15}$$

The first term is non-positive by the assumption that $f_\delta' \leq 0$.[13] We now prove that the second summand is strictly negative. Note that

$$\frac{\partial^2 m_\delta^*}{\partial t_D^2} = \frac{W_D''(t_D)}{t_D - t_R} - \frac{2}{(t_D - t_R)} \frac{\partial m_\delta^*}{\partial t_D}. \tag{16}$$

The first term in (16) is strictly negative, and hence the integral that weighs this function with the joint density (i.e., $f_\delta(m_\delta^*) dJ(\delta)$) is strictly negative. Integrating over the second summand in (16), we get

$$\int f_\delta(m_\delta^*) \frac{2}{(t_D - t_R)} \frac{\partial m_\delta^*}{\partial t_D} dJ(\delta) = \frac{2}{(t_D - t_R)} \int f_\delta(m_\delta^*) \frac{\partial m_\delta^*}{\partial t_D} dJ(\delta) = 0, \tag{17}$$

because the first order condition is satisfied. Thus, (15) is strictly negative, i.e., the second order condition for maximization is satisfied.

The proof that the second order conditions are also satisfied for candidate R is analogous and omitted (note, though, that candidate R *minimizes* V_D, and therefore the second order condition is that the second derivative of V_D with respect to t_R is positive). □

We next use Proposition 1 to derive necessary and sufficient conditions for the existence of solutions to the first order conditions.

[13] Note that we only need the weaker condition that f_δ' *evaluated at the cutoff* $m^*(\delta)$ is nonpositive for this conclusion.

Proposition 4. *Let h be the function on $[\underline{t_D}, 1]$ defined in* (14). *Suppose that W_D and W_R are bounded from below and that the Inada conditions $W_D'(\underline{t}_D) = W_R'(\underline{t}_R) = \infty$ are satisfied. Then:*

An interior solution of the first order condition exists if and only if $h(1) > 0$.

Proof. The Inada condition implies that $\lim_{t \downarrow \underline{t}_d} h(t) = -\infty$. If $h(1) > 0$ then the intermediate value theorem implies that there exists a t^* with $h(t^*) = 0$, i.e., t^* is a solution to the first order condition.

It remains to prove to no interior solution exists if $h(1) \leq 0$.

Suppose by way of contradiction that $h(1) = 0$ and that an interior equilibrium t^* exists. If $h(1) = 0$ then the argument in the proof of Proposition 1 implies that $h'(1) > 0$. Therefore there exists $\overline{t}$ with $t^* < \overline{t} < 1$ and $h(\overline{t}) < 0$. Since $h'(t^*) > 0$, there exists $\underline{t}$ with $t^* < \underline{t} < \overline{t}$ and $h(\underline{t}) > 0$. The intermediate value theorem implies that there exists $\hat{t} \in [\underline{t}, \overline{t}]$ with $h(\hat{t}) = 0$. Since $t^* < \hat{t} < 1$ this contradicts the result on the uniqueness of interior solutions. Hence, no interior solution exists if $h(1) = 0$.

Finally, suppose by way of contradiction that $h(1) < 0$ and an interior solution t^* to the first order condition exists. Then the argument in the proof of Proposition 1 implies that $h'(t^*) > 0$. Hence there exists $\hat{t} > t^*$ with $h(t^*) > 0$. The intermediate value theorem implies that there exists a t with $t^* < t < 1$ with $h(t) = 0$, i.e., a second solution to the first order condition exists, which contradicts the uniqueness result of Proposition 1. □

Proof of Proposition 2. Equation 5 implies that $\overline{\delta}$ corresponds to the population average $E[\delta]$, and hence does not change when policies are changed (as long as the types are contested, i.e., $f(m_\delta^*) > 0$ for all δ).

Let $\psi = 2\overline{\delta}(\delta_R - \delta_D) - (\delta_R^2 - \delta_D^2)$. Note that (6) can be written as

$$(t_D - t_R + \psi)W_R'(t_R) = W_D(t_D) - W_R(t_R). \tag{18}$$

Denote the derivatives of t_D and t_R with respect to ψ by t_D' and t_R', respectively. Taking the implicit derivative in (18) with respect to ψ yields

$$(t_D' - t_R' + 1)W_R'(t_R) + (t_D - t_R + \psi)W_R''(t_R)t_R' = t_D'W_D'(t_D) - t_R'W_R'(t_R).$$

Since $W_D'(t_D) = W_R'(t_R)$ because of (6), we get $W_R'(t_R) + (t_D - t_R + \psi)W_R''(t_R) = 0$, which implies that

$$\frac{\partial t_R}{\partial \psi} = -\frac{W_R'(t_R)}{W_R''(t_R)(t_D - t_R + \psi)} > 0. \tag{19}$$

Thus, increasing $\psi = 2\overline{\delta}(\delta_R - \delta_D) - (\delta_R^2 - \delta_D^2)$ increases t_R. It follows immediately from the first equality in (6) that increasing ψ also increases t_D.

Now consider how ψ changes as δ_D and δ_R change as stipulated in the proposition. The first claim follows because $\partial\psi/\partial\delta_R = 2(\bar{\delta} - \delta_R) < 0$ and $\partial\psi/\partial\delta_D = 2(\delta_D - \bar{\delta}) < 0$; note that, if the Democrat becomes more extreme or the Republican becomes more moderate, then the change in their respective positions is negative.

If both candidates become more extreme by h, then ψ changes by $h(4\bar{\delta} - (\delta_R + \delta_D))$. Thus, ψ increases (and taxes increase) if $\bar{\delta} > (\delta_R + \delta_D)/2$, and ψ decreases (and taxes decrease) if $\bar{\delta} < (\delta_R + \delta_D)/2$. □

6.2 Numerical example for differential production functions

Here, we briefly present a numerical example illustrating our microfoundation for why Democratic and Republican candidates have different production functions. Let $g = \sqrt{\gamma t} - 1$ be the production function. The wage in the public sector is $S = 2$, and the intrinsic benefits for Democrats and Republicans are $z_D(t) = 1.5 - 20(t - 0.3)^2$ and $z_R = 2 - 20(t - 0.2)^2$, respectively. That is, Republican managers have a lower "ideal" tax rate than Democrats. Assume furthermore that $\bar{\gamma}(\gamma_i^*) = \gamma_i^* - 0.02$.[14]

This example creates the two production functions displayed in Figure 3. Note that these two functions have the properties that we assume directly in the main text. The Republican has an advantage for low levels of taxation, while the Democrat has a higher marginal product and is eventually better than the Republican in terms of public good production for sufficiently high levels of taxation.

6.3 Empirical analysis

We now present a short empirical analysis that shows the following two results for U.S. presidential elections from 1972 to 2008. First, voter behavior in these elections is consistent with the behavior depicted in Figure 1, in the sense that given any level of income, socially conservative voters are more likely to vote Republican than social liberals, and given any cultural position, the propensity to vote Republican increases in income. Second, the slope of the cutoff line in Figure 1 appears to have increased over time, in the sense that voter separation has become stronger with respect to

[14] Remember that candidate i can only hire managers whose productivity is below γ_i^*, so the average productivity $\bar{\gamma}_i$ is lower than γ_i^*. This particular assumption (i.e., that $\bar{\gamma}(\gamma_i^*) = \gamma_i^* - 0.02$, independent of the value of γ_i^* can be derived from a uniform distribution of potential manager productivities, combined with the requirement to hire all applicants with productivity in $[\gamma_i^* - 0.04, \gamma_i^*]$ in order to fill the available positions.

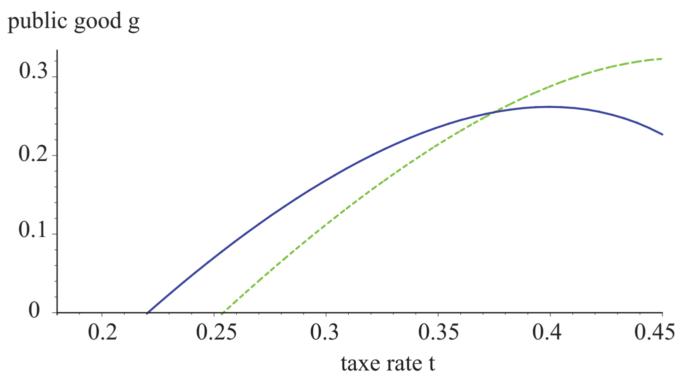

Figure 3: Differentiated production functions derived via policy-motivated managers

cultural preferences, and more diluted with respect to income.

We consider the NES question on abortion (VCF0837/0838) as a measure for the respondent's cultural position; answer 1 that abortion should never be permitted is identified as the conservative position, while response 4 that abortion should always be permitted is the most liberal response. Further, we identify the voters from the lowest third and the highest third of the income distribution, using question VCF0114, and denote them as "poor" and "rich."

Table 1 contains the probabilities that different voter types (in terms of their cultural and income positions) vote for the Democratic candidate in a Presidential election. To smooth out idiosyncratic variations between elections, we pool the data from the years 1972-1988 and those from 1988-2008.

Table 1: Fraction of Population Voting for Democrat

Voter Type (Ideology, Income)	**Vote Share 1972–1988**	**Vote Share 1992-2008**
(Liberal, Poor)	63.0%	77.9%
(Liberal, Rich)	41.1%	65.8%
(Conservative, Poor)	59.0%	29.8%
(Conservative, Rich)	55.5%	24.2%

We expect that, for both time periods, the following relationships must hold for the Democratic vote shares: (Liberal, Poor) > (Liberal, Rich), (Conservative, Poor) > (Conservative, Rich), (Liberal, Poor) > (Liberal, Rich), (Liberal, Poor) > (Conservative, Poor). These four inequalities are indeed satisfied in Table 1. Moreover, except for the relationship that (Liberal, Poor) > (Conservative, Poor) for 1972–1988, all relationships are significant at the 99% level. In addition, income became a worse predictor and ideology a better predictor for voting in the second period compared to the first one. This corresponds to a clockwise turn of the separating line in the right panel of Figure 1, resulting in the steeper separating line in the second half of the observation period.

We have argued above that the average cultural position of swing voters is to the right of the average cultural position of all voters. We now argue that this bias has increased as cultural preferences become more important.

Consider again the case where $w(x) = \ln(x)$ and public goods are provided at constant marginal costs, i.e., $g_D(t) = a_D(t - b_D)$, and $g_R(t) = a_R(t - b_R)$. We have shown that $t_D - t_R = b_D - b_R$. Hence, the slope of the separating line (3) becomes steeper as the cultural difference between candidates $\delta_R - \delta_D$ increases. Suppose that income, m, follows an exponential distribution $\lambda e^{-\lambda m}$.[15] Let k be the slope of the separating line, and m_0 the intercept. Suppose that δ is uniformly distributed on $[-1, 1]$. For simplicity we further assume that the distributions of income and cultural preferences are independent.[16] Then as long as $m_0 - k \geq 0$, the average swing voter is given by

$$\overline{\delta} = \frac{\int \lambda e^{-\lambda(k\delta + m_0)} \delta \, d\delta}{\int \lambda e^{-\lambda(k\delta + m_0)} \, d\delta} = \frac{\int e^{-\lambda k\delta} \delta \, d\delta}{\int e^{-\lambda k\delta} \, d\delta} = \frac{-e^{\lambda k} + \lambda k e^{\lambda k} + e^{-\lambda k} + \lambda k e^{-\lambda k}}{\lambda k(-e^{\lambda k} + e^{-\lambda k})}. \tag{20}$$

Note that if $k = 0$, i.e., if cultural preferences do not matter and the separating lines is horizontal, then (20) is zero, i.e., there is no difference between the average ideology of the swing voter and of the whole population. We next show that (20) increases if k is decreased.

$$\frac{\partial \overline{\delta}}{\partial k} = \frac{2 + 4\lambda^2 k^2 - (e^{2\lambda k} + e^{-2\lambda k})}{\lambda k^2 (e^{\lambda k} - e^{-\lambda k})^2}. \tag{21}$$

Note that

$$e^{2\lambda k} + e^{-2\lambda k} = \sum_{n=0}^{\infty} \frac{(2\lambda k)^n}{n!} + \sum_{n=0}^{\infty} (-1)^n \frac{(2\lambda k)^n}{n!} = 2 \sum_{n=0}^{\infty} \frac{(2\lambda k)^{2n}}{(2n)!} \geq 2 + 2\frac{(2\lambda k)^2}{2!},$$

where the inequality is strict if $\lambda k \neq 0$. Hence, (21) is strictly negative for $\lambda k \neq 0$.

In summary, if candidates' cultural positions diverge, then the separating line becomes steeper (more negative) which in turn means that the cultural preference of the average swing voter, $\overline{\delta}$, becomes more conservative relative to the population average.

[15]Note that this is a particularly simple form of an income distribution with a decreasing density.

[16]For example, the actual correlations between income and the abortion questions VCF0837 and VCF0838 in NES are -0.157 for 1972–1988, and -0.108 for 1992–2008 with confidence intervals of $[-0.182, -0.132]$ and $[-0.135, -0.081]$, respectively (if we recode the answers such that 1 is the most liberal, and 4 the most conservative position on this question). That is, wealthier people have slightly more liberal views on abortion.

Table 2 indicates, there has been a shift to a more liberal view on abortion, in the population, while the fraction of those who are completely opposed to abortion has stayed roughly the same at about 10%. Thus, if the position of the average voter mattered, we should have seen a liberalization of the policies on abortions. In contrast, many states have moved in the opposite direction, imposing tighter restriction on abortion. This is compatible with our model, since the steeper slope of the separating line resulted in a right shift of $\bar{\delta}$ which can in turn outweigh the effect of the left-shift of the views of the population as a whole. In addition, politicians cater to swing voters who have more conservative positions, and the shift of preferences may have occurred primarily among non-swing voters.

Table 2: Fraction of Respondents on Question VCF0837 and VCF0838 about abortion

Years	**Never Legal**	**Mostly Illegal**	**Mostly Legal**	**Always Legal**
1972–1988	10.3%	39.8%	18.8%	31.1%
1992–2008	10.8%	29.5%	16.1%	43.4%

Note the median answer to the abortion question has become more liberal, shifting from "abortion should be mostly illegal" to "abortion should be mostly legal."[17] Thus, in a Downsian model, where candidates can freely choose their position and are ex-ante identical, both would select a more liberal position on abortion, which contradicts the empirical evidence.

[17]For the exact wording of the question see the codebook of the NES.

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