Choosing Your Pond: A Structural Model of Political Power Sharing

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Abstract

I develop a model of party formation in which politicians share their political rents with party leaders in exchange for accessing parties' club goods. Bigger parties provide greater club goods but tax politicians' rents more upon entry. Therefore, politicians with more assets prefer smaller parties. I estimate my model for Turkey with a dataset of all listed politicians between 1995 and 2014. I find that the right-wing parties accumulate club goods more easily than they produce rents, which leads to ever stronger party control. Counterfactual exercises provide a novel explanation for the differences in party-size distributions across political systems.

JEL Classifications: D71, D72, J4, J410

Keywords: Clubs, Rent-Seeking, Coalitions, Particular Labor Markets, Matching Models

*selcencakir1@gmail.com. An online appendix with data and derivation details can be found in here. This paper is an updated version of my Ph.D. dissertation at the University of Virginia and it was previously circulated with the title "Party Formation in Parliamentary Democracies". I am grateful to my advisers John McLaren, Leora Friedberg, and especially Steven Stern for insightful suggestions. I would also like to thank Simon Anderson, Marina Azzimonti, Abdurrahman Aydemir, Hugo Benitez-Silva, Çağatay Bircan, Meta Brown, Sandra Brusco, Federico Cilberto, Kerem Coşar, Peter Debaere, Siddharth George Eapen, Maxim Engers, İlhan Güner, Guillermo Hausmann Guil, William Johnson, Murat Güray Kırdar, Konstantinos Matakos, Toshihiko Mukoyama, Edgar Olsen, Sheetal Sekhri, Aslı Şenkal, Eric Young, and seminar and conference participants at Boğaziçi, ITU, Koç, TED, TOBB ETU, Sabancı, Stony Brook, Virginia, Royal Economic Society, 1st LSE Workshop on Political Economy of Turkey, and Trans-Atlantic Doctoral Conference for their helpful comments. I gratefully acknowledge the Bankard Fund for Political Economy and Bynum funds for quantitative research for financial support. All errors are mine.

1 Introduction

Political parties and party leaders are at the center of political and electoral systems. How they operate matters for how power is distributed and whether the executive power can be constrained. As recent research has emphasized the importance of executive constraints for development, it has become increasingly important to understand how the liberal democracies can be vulnerable to the concentration of political power (Acemoglu and Robinson 2006, 2012, Aghion, Alesina, and Trebbi 2004, 2007, Besley and Mueller 2017, 2018a, 2018b). Across countries, there is considerable variation in how parties operate and how much of a say parties, party leaders, and politicians have. In the closed-list electoral systems of Argentina, Israel, Italy, Spain, and Turkey, for example, parties and party leaders have a lot more clout than, say, in the more candidate-centered systems of the United States, Canada, and other countries, and politicians typically switch party affiliation a lot more frequently in such systems (Heller and Mershon 2009). In this paper, I build a theoretical model of party formation and the effect of electoral institutions on the power distributions in parties while focusing on the interaction of party leaders and politicians in a labor search framework. I then estimate my model with a dataset I constructed for Turkey of 35,000 listed politicians, 2,000 politicians who gained access to parliament, and 33 parties between 1995 and 2014.

Political arenas in all countries can be considered as markets for rent production, which embody the ability to influence government institutions. Political rents, such as winning a seat in parliament or a party primary election, decisive power over the use of government budget, or employing supporters in public institutions, are private and exclusive. During the process of producing political rents, party control over government functions also generates valuable club goods. Club goods, such as the non-pecuniary rewards of a party's political success or the security gained by affiliating with a strong team, are shared among party members. A politician may relegate the use of his electoral power to party authorities when the benefits of affiliating with the party exceed the rewards from acting independently.[1] Accordingly, to the extent that the electoral institutions allow party leaders to use members' political power in exchange for supplying other membership benefits, politicians' ability to act independently in a party will be limited. In political systems that yield extensive party control, the legislative activities, the appointment of the judges, and the allocation of government spending are largely determined by a few strong leaders instead of by the elected politicians as a whole, which can distort the separation of powers.

The extent to which a party leader can use the party's club goods to exploit members' rents is determined by electoral institutions. In candidate-centered systems where voters can

[1]Throughout the paper, I refer to a politician and a leader with male and female pronouns, respectively.

show a preference for a candidate, each politician produces rents with more independence. This independence in rent production gives politicians more bargaining power during membership negotiations with a party leader. In a party-centered system such as a closed-list proportional representation system, on the other hand, voters can vote only for the party as a whole, which gives a party leader monopsonistic power while recruiting politicians. Accordingly, in a party-centered system, parties function as entities that produce political rents and politicians provide their parties the political assets for rent production. The party competition for rents then brings about a competition for productive politicians, just like in a labor market. Party-switching by politicians resembles workers' transitions among firms, and the parties' competition over their services highlights the importance of outside options. This paper constructs an equilibrium model of party formation which incorporates these features of team production. The model can be applied to labor markets, in which a worker trades off compensating differentials and wages he earns in a firm engaged in team production. Similar to the compensating-differentials literature, in a Nash equilibrium, a small party pays higher rents to a politician to compensate for his disutility in lacking club goods (Mogstad, Setzler, and Thibaut 2019, Rosen 1986, Sorkin 2018).

I model the political arena as a labor market in which a party is represented by a leader, who has the exogenous ability to lead a party of a certain capacity that produces political benefits, i.e., rents and club goods.[2] A leader aggregates the assets of heterogeneous politicians to produce political benefits and seeks new members through a random matching process when there is a vacancy. Accordingly, I model the unstable party structures that are common in party-centered systems as resulting from frictions that prevent ideal matches of politicians and leaders.[3] Once brought together in pairwise matches, a leader and a politician bargain over a share of the politician's rent production in the party. The provision of club goods allows a leader to attract members who accept joining the party by receiving less rents than what they produce. In equilibrium, a leader makes acceptable offers to only the most profitable politician-types who ask for the smallest rents. As a result, depending on the primitives that describe the heterogeneous abilities of the leaders and the amounts of politicians' assets, party governance may function either as a democracy or as a dicta-

[2]By assuming exogenously determined leadership capacities and studying the stationary equilibrium, my paper shuts off inter-party competition for votes. The validity of this assumption is discussed in section 2.

[3]Other possible explanations for the unstable party structures are changes in politicians' tastes and parties' votes over time. These explanations can be studied in a dynamic discrete choice framework (Artuc, Chaudhuri, and McLaren 2010, Berkovec and Stern 1991, Keane and Wolpin 1994, Kennan and Walker 2011, Lee 2005). However, many politicians switch parties within a few weeks of being elected, which suggests that they may have not started politics in their most-preferred parties. For example, out of 476 completed spells of elected politicians, 33 ended within 10 weeks, and 94 ended within a year. Also, the importance of outside options and the general equilibrium effects render a matching model suitable to study party formation.

torship. The power distribution in parties may also translate into the power distribution in parliament. For example, if one party's leader can accumulate more club goods, she can fill her party with members who join without receiving any rents. In this extreme case, only one party is able to produce a sizeable amount of political rents, and the party's leader decides how to use those rents all by herself, which resembles a dictatorship. At the other extreme, when all leaders have similar abilities for leadership and all politicians have large assets, members across different parties would have comparable amounts of rents, which correspond to egalitarian governance.

My model builds on Burdett and Mortensen (1998) and Cahuc, Postel-Vinay, and Robin (2006) and contributes to the theory of on-the-job search in two ways.[4] First, a politician's ranking of the parties' membership values is endogenously determined by the capacity-constrained leaders' rent maximization problem. A party leader, who ranks the politicians vertically, aims to fill her party with politicians who would join the party with the smallest rent shares. However, match frictions prevent her from making membership offers to only the most profitable politician types. Instead, a leader solves her rent maximization problem by choosing the maximum rent share she is willing to offer to each politician-type. The extent to which a leader is willing to negotiate a politician's rent share determines the party's value ranking for the politicians. Pushing up the rent share schedule attracts more members to the party and results in greater rent production, but the leader shares a greater proportion of the party's increased rents with members. This trade-off jointly determines the offers a leader makes to the potential party members and the party's value ranking for each politician-type. The leaders' sorting of members differs from the sorting by firms in the theoretical assignment literature, as the latter arises due to supermodularities in production.[5]

The second contribution to search-theoretic models of labor markets is that politicians differ in their rankings of parties because a party's value has two components that have different returns to party size. Club goods are increasing in party size, so, if they were all that mattered, the payoff from joining a party would increase in party size. This is the case if a politician has very little in private assets. On the other hand, the payoff from private rents is decreasing in party size since richer parties demand a higher tax on private assets to join. If that were all that mattered, the payoff from membership would be a decreasing function of party size. The decreasing returns to party size dominate if a politician has high private assets. If a politician has intermediate levels of private assets, the

[4]For a survey of the search-theoretic models of the labor market, see Rogerson, Shimer, and Wright (2005) and Eckstein and Van der Berg (2007).

[5]See Becker (1973), Burdett and Coles (1997), Eeckhout and Kircher (2010), Shimer and Smith (2000), Lopes de Melo (2013), Lise, Meghir, and Robin (2016), among others.

payoff is a combination of the two, and the politician may rank two parties with different sizes equally. The heterogeneity in politicians' value-ranking of parties depends on their heterogeneous contributions to a party's rents. Accordingly, my model differs from the theoretical assignment literature, where the heterogeneity in workers' most preferred firms stems from complementarities in production (see de Melo (2013) for a review).

This paper is also related to the literature on coalition formation and politicians' career choices (Aldrich and Bianco 1992, Anderson and Meagher 2012, Diermeier, Keane, and Merlo 2005, Diermeier, Eraslan, and Merlo 2003, Morelli 2003). This paper contributes to these literatures by studying party membership in general equilibrium, considering the outside options of both the leaders and the politicians and comparing the rewards from party membership across different systems. To my knowledge, Desposato (2006) is the first to model the benefits of party membership as the sum of a politician's rent share and the party's club goods and a party's club goods as a function of the members' resources. In his model, a politician's rent share is approximated by his ideological match with his party. My model differs by endogenizing the rent shares of the politicians and considering dynamics, outside options, and match frictions, while abstracting from ideological match.[6]

I estimate the model using a dataset I constructed on the Turkish political arena from 1995-2014. During the data period, 28.5% of the members of parliament switched their parties at least once. Altındağ and Mocan (2015) construct a similar data set on elected Turkish politicians and investigate the causes of party switching.[7] Their results are consistent with the main assumptions of this paper. First, politicians who have a narrow victory for winning a seat, which may be because of a bad initial match, are more likely to switch a party. Second, politician characteristics, which determine a politician's assets in my model, are related to their tendency for switching a party. Third, party switching by politicians increases (decreases) the local vote shares of their new (initial) parties, which implies that members provide the productive assets to their parties.[8]

Unlike the conventional search models which use observed wages in estimation, the estimation procedure in this paper cannot use politicians' rent shares since they are not observed.

[6]A party's ideological position can be considered as a particular club good to which the politicians attach heterogeneous values. Although modeling a politician's ideological match with a party is straightforward, there are very few politicians who switch between parties with different ideologies, which makes it infeasible to identify politicians' ideologies. However, I estimate my model separately for the right- and left-wing parties by considering them as separate labor markets, which matches well to the data.

[7]My data set differs by covering the political party choices of the universe of listed politicians during the sample period and the exact date of party switching by elected politicians.

[8]My model assumes that a party's total assets remain constant over time, but it does not impose a restriction on how these assets are distributed across districts. This assumption is especially valid for the 2002-2014 period, where the total vote shares of the parties are more stable than the 1995-2002 period. Estimating the model separately for the 2002-2014 period does not alter the qualitative results.

However, the high party-switching rate across parties of different sizes and (observationally unequivalent) politicians' heterogeneous valuations of the two types of political benefits in the model provide the necessary information to identify the model. The major identification challenge involves the distribution of unobserved heterogeneity, which enters the party-switching hazard rate nonseparably. I show that the results of Evdokimov (2010, 2011) can be applied for nonparametric identification of the distribution of unobserved heterogeneity.

Using my data, I find that the right-wing parties accumulate club goods more easily than they produce political rents. Interestingly, the estimates show that politicians with better labor market options are less productive to their parties. I provide two possible explanations for interpreting these results. First, specialization in a highly-respected occupation may prevent a politician from engaging in rent-seeking. Second, party leaders may have selected the politicians with little political skills to share lesser rents.[9]

In counterfactual exercises, I compare the within-party rent distribution across different electoral systems. To do this, I distinguish different systems along two dimensions: a rent production mechanism and politicians' bargaining power.[10] Arguably, an electoral system's rent-accumulation process can be inferred from its party-centeredness. In a party-centered system, members aggregate their assets to collaboratively produce their party's rents. In a candidate-centered system, on the other hand, individual candidates organize their own campaigns to produce votes independent of their parties. In both cases, the bargain between a politician and a leader reflects a politician's trade-off between benefiting from a party's club goods in exchange for his supply of rents, and the outcome of the bargain depends on the politician's bargaining power. I find that, keeping politicians' bargaining power constant, members of small (big) parties earn higher rents in a party (candidate)-centered system, where their assets are more productive compared to a candidate (party)-centered system. This finding is consistent with the Duverger's law, which observes that the effective number of parties under plurality voting should be no greater than two (Morelli 2003). For example, my model suggests that, in the candidate-centered system of the United States, a politician who has the capacity to form a small party is better off if he instead joins a bigger party. This is because he produces the same amount of rents in all parties but benefits from larger club goods in bigger parties. When all politicians act this way, only 2 parties of the same size can survive in equilibrium. My findings are also consistent with the Duverger's hypothesis, which states that there is a tendency for multipartyism in proportional representation (PR)

[9]Since the model endogenizes politicians' rents, my results are complementary to the literature on the relationship between rewards from holding a public office and citizens' selection into the political market (Besley 2004, Caselli and Morelli 2004, Dal Bo et al. 2017, Mattozzi and Merlo 2008, Ferraz and Finan 2009, Bernheim and Kartik 2011, Mocan and Altındağ 2013).

[10]Grofman (2005) classifies the electoral systems in their party-centeredness.

systems (Morelli 2003). Team production in PR systems allows a politician to become more influential in smaller parties, which are in greater need for his assets. Moreover, the leaders with monopsonistic recruiting power can more easily exploit the party members' rents in such systems. As a result, a politician who leads a small party does not prefer to join a bigger one. The majority of the literature on fragmented politics explain the Duverger observations by appealing to growing polarization or incentives to target small slices of voters (Morelli 2003, Persson and Tabellini 2005). My paper suggests an alternative explanation by focusing on the labor-market incentives of politicians, which can also explain the existence of multiple parties with the same ideology.

2 Data

The data set covers the universe of parties and listed politicians in Turkey between 1995 and 2004. In the sample, there are 33 parties and 35,648 politicians of whom about 1,900 won a seat in parliament. I construct this dataset by digitizing the information in the Official Gazette of Turkey, which provides information on each candidate's occupation, education level, electoral district, and the ranking in his party's list about two months before an election.[11] If a politician wins a seat, a more detailed resume is published in Parliament's website.[12] Moreover, the archives of the daily newspapers provide the exact date at which a member of the parliament, henceforth MP, switches his party. About 4% of the entire sample and 28% of the MPs switched parties at least once during their political careers. The estimated party-switching rate in the entire sample may be downward biased because of censoring in the data. A large majority of the politicians in the sample appeared in a party's ballot lists only once, partly because many parties participated in only one election. As the elections are party-centered, politicians who do not win seats rarely appear in the media. Therefore, it is not possible to observe their party choices late in their careers after running for office. The online appendix explains the construction of the dataset and presents the details on politician and party characteristics. In this section, I briefly summarize the data and the Turkish political system and discuss the validity of my model's main assumptions.

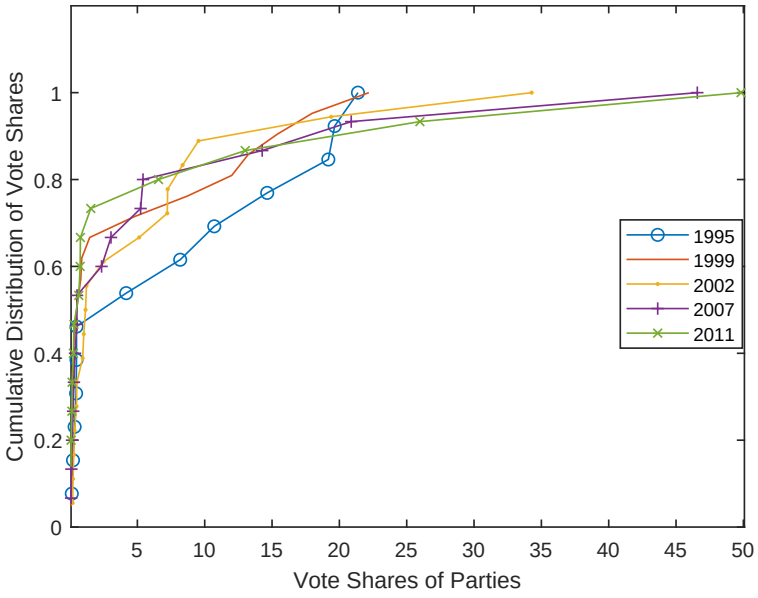
2.1 Institutional details

Turkey uses a closed-list proportional representation system to distribute 550 parliamentary seats to the parties. Each party lists its candidates, in order of priority, for each of the 85

[11] http://www.resmigazete.gov.tr/

[12] https://www.tbmm.gov.tr/TBMM_Album.htm

Figure 1: Cumulative distribution of vote shares



electoral districts before an election. Each voter observes the ballot lists, and s/he can vote for a party as a whole rather than for individual candidates. To win a seat in parliament, a party has to gain at least 10% of the national votes. The seats are distributed to the parties that clear the electoral threshold via the d'Hondt method (Bormann and Golder 2013).

2.2 Stationary distribution of party sizes

This paper focuses on the stationary equilibrium where the distribution of political parties is constant. The stationarity assumption holds either when no party changes over time or when the parties that dissolve get immediately replaced with similar parties. This section discusses the empirical validity of this assumption.

During 1995-2014, 5 elections were held to distribute parliamentary seats to the parties. 33 parties competed in these elections, but only 3 participated in all 5. The number of parties that participated in a given election ranged from 13 to 21. Due to the electoral threshold, at most 5 parties gained seats in the parliament in an electoral term. To investigate the evolution of parties, Figure 1 plots the distribution of party vote shares in each of 5 elections. We see that in contrast to the smaller parties' steady (and low) vote shares, the bigger parties' vote shares are highly volatile over time. In particular, the bigger parties' vote shares are distributed very differently before and after 2000. During the 1990s, the bigger parties' vote shares were close to each other, which resulted in a series of coalition governments. In contrast, during the 2000s, one party received a remarkably high share of votes and formed

a majority government in 3 consecutive terms. Because of the different outlook of Turkish politics after 2000, I estimate my model separately for the post-2000 period.[13]

Table 1: Mean values for politician characteristics

	All	**Switchers**	**MPs**	**Switcher MPs**
College	0.50	0.70	0.91	0.88
Female	0.16	0.07	0.08	0.05
Architecture and engineering	0.09	0.15	0.18	0.17
Arts, design, entertainment, sports, and media	0.03	0.06	0.04	0.06
Bureaucracy	0.02	0.04	0.07	0.08
Business	0.33	0.32	0.18	0.21
Business and financial operations	0.06	0.05	0.05	0.05
Community	0.01	0.02	0.03	0.02
Construction	0.02	0.03	0.02	0.03
Education, training, and library	0.07	0.09	0.15	0.13
Farming	0.02	0.03	0.16	0.03
Health practitioners and technical	0.05	0.08	0.11	0.11
Legal	0.06	0.11	0.16	0.16
Life, physical, and social sciences	0.03	0.08	0.09	0.10
Management	0.03	0.05	0.04	0.05
No occupation	0.00	0.01	0.00	0.00
Office	0.01	0.00	0.00	-
Other	0.01	0.00	-	-
Production	0.09	0.05	0.01	0.01
Retired	0.06	0.01	0.01	0.00
# of party switches	0.05	1.17	0.385	1.36
# of winning a seat	0.08	0.63	1.44	1.69
# of participating in an election	1.19	2.39	2.07	2.62
N	35,648	1,449	1,912	540

Notes: Occupational categories are constructed by following the 2010 Standard Occupational Classification system of the US Bureau of Labor Statistics. Fractions are rounded to the nearest hundredth.

2.3 Politicians' characteristics and choices

This section summarizes the data on politician's characteristics and party choices and discusses the empirical validity of model's assumptions on politician behavior. Table 1 shows the mean values of the observed characteristics for the entire sample as well as separately for

[13]Since estimation requires having data on at least 3 electoral terms, it is not possible to estimate the pre-2000 period separately.

the MPs and compares the party switchers to the whole sample. There are 35,648 politicians, and some of them entered the ballot lists multiple times. There are 1,449 party switchers in the entire sample and 540 among the MPs. Note that most of the politicians appeared on the ballot lists only once as indicated by an average number of participating in an election that is slightly above 1. The information related to the political careers of these politicians is limited to a very short duration, and it is not possible to observe whether they switched a party late in their careers after running for office. The average number of times a party switcher switches his party is 1.169 (1.364) in the entire sample (sample of MPs). Finally, the switchers are more likely to reappear in the ballot lists and win seats.

Table 2 shows the observed matrix of switches across the categories of the political spectrum (far-left FL, center-left CL, center-right CR, and far-right FR), where each politician's party choice from one year to the next is counted as a separate observation. According to the table, there are transitions between all categories of the political spectrum; however, the majority of the switches occurred between the parties with similar ideologies. The lack of party-switching across parties with different ideologies suggests that we can consider the right- and left-wing parties as separate labor markets.

Lastly, I focus on a stationary equilibrium where the value of a party to a politician does not depend on other politicians' choices. In the data, however, there are examples of both correlated and uncorrelated politician movements. In particular, there are 2 cases where a large number of a party's members resigned to form a new party. Nevertheless, since the number of parties is very small to conduct an empirical study, I do not model inter-party competition. However, because the correlated politician movements occurred before 2002, the assumption of uncorrelated politician behavior is valid for the post-2002 period.

3 Model

To develop a model that can be adjusted to different systems, I consider the common and divergent career incentives provided by different political systems to politicians. First, following Desposato (2006), I assume that all political systems offer two types of benefits to politicians: political rents and club goods. While political rents are private and exclusive, the club goods are non-exclusively provided to the party members.[14] Next, I argue that the career incentives provided by different electoral systems diverge in two ways. First, the means to achieve political power, i.e., the rent production mechanism differs across systems.

[14]The theory of club goods identifies the club goods as locally public goods that are excludable to non-group members (Buchanan 1965, Scotchmer 2002, Chen 2010). Dey and Flinn (2008) also study the effect of a public good (health insurance of spouses) in a search environment.

Second, electoral systems differ in the bargaining power they assign to politicians during party membership negotiations.

Table 2: The observed matrix of party switches

To:	**Stay**	**New FL**	**New CL**	**New CR**	**New FR**	**New Indep.**
From:						
Old FL	8,546	125	13	13	0	25
Old CL	9,762	20	184	63	23	57
Old CR	24,076	4	51	689	76	114
Old FR	6,318	1	6	35	28	25
Old Indep.	1,261	20	33	69	19	-

Notes: The cell (x, y) presents the total number of switches from a party in category x in year t to a party in category y at year $t + 1$.

This section derives the equilibrium of the most party-centered system where parties produce rents as entities and party leaders have monopsonistic recruiting power. In section 7, I adjust my model to other systems and study their equilibrium properties.

3.1 The environment

Time is continuous. The politicians and the political parties live forever. There is a measure M of politicians of whom a fraction φ are independents and a fraction $(1 - \varphi)$ have a party affiliation. The politicians are heterogeneous in their infinitesimal resources, denoted by z, that produce political benefits. The distribution of the politicians' resources $L(z)$ is constant over time, with density $\ell(z) > 0$ over $[0, z^{max}]$. A party has an identity of its own rather than a collection of like-minded politicians. A party is represented by a leader, who is distinguished from other politicians by having the ability to lead a party of a certain size. There is a continuum of leaders with a mass normalized to 1. The leaders are heterogeneous in the size of the party that they are capable of leading, denoted by $\tilde{x}$. The party-leading capacities of the leaders are distributed $\tilde{x} \sim \Upsilon(\tilde{x})$, which is constant over time. A party's size is given by the sum of its members' resources. It is assumed that the total assets of the politicians are sufficient for all party leaders to fill their parties up to their leading capacities. However, a leader fills her party-leading capacity only when it is profitable, which, in turn, depends on her prospects of finding members who would join the party with the smallest rent shares. So, the distribution of the party sizes can be different from the distribution of the leaders' capacities. Let x denote the size of a party, distributed $x \sim \vartheta(x)$ with $\frac{d\vartheta(x)}{dx} > 0$

on $[x_{min}, x^{max}]$. Let Z_x denote the set of politicians in type-x parties.[15] Since a party's size is equal to the sum of its members' resources, the law of large numbers implies

$$x\frac{d\vartheta(x)}{dx} = \int_{z\in Z_x} z dz.$$

All members of a party combine their resources to produce political rents and club goods. Political rents are private and exclusive and are defined as the ability to influence government institutions in one's interest. The total seats in the parliament and the government offices controlled by the party are a few examples of a party's rents. Note that one member's use of the party's rents, such as gaining a seat, becoming a governor, or employing one's supporters in the municipalities, prevents the other members from using it. A party of size x produces rents according to $\theta(x)$, which has diminishing returns to scale, i.e., $\theta'(\cdot) > 0$ and $\theta''(\cdot) < 0$.

The club goods of a party are the benefits of belonging to a team, which are provided to all members non-exclusively. While the total seats of a party are its political rents, the pride or the security gained by affiliating with a strong team are the party's club goods. A party of size x produces club goods according to $\psi(x)$, with $\psi'(\cdot) > 0$ and $\psi''(\cdot) < 0$. Independent politicans can produce rents on their own, but accumulation of the club goods requires leadership, and hence club goods can be produced only within a party.

3.2 Matching

A party leader searches for new members when there is a vacancy through the identical, random, pairwise, time-consuming, and sequential matching process of Burdett and Mortensen (1998). This process can bring a leader together with a politician who may or may not have a party affiliation. The distribution of the politicians' and the parties' types are common knowledge. However, a politician and a leader see each others' types, and the leader observes the politician's party membership status after the match occurs. When a match is formed, the leader makes a monopsonistic offer to the politician over a share of the politician's rent contribution to the party. When a member receives an offer from an outside party, the two parties' leaders enter into the Bertrand competition of Cahuc, Postel, and Vinay (2006), henceforth CPR, over the membership value they offer to the politician. Accordingly, although otherwise monopsonist, a leader also has an incentive to renegotiate when the politician is poached by an outside party. The degree to which the leaders have incentives to renegotiate a politician's share in the party determines the value-ranking of the parties for that politician. Similar to CPR, this competition resembles a sequential auction

[15] The set Z_x consists of densities of each type of politician in a type-x party, which is derived later.

game, which results in the politician joining the party that he ranks better, and he receives a membership value that is equal to the last value offered by the losing party. Both agents' types and the politician's outside option at the time of the match jointly determine the offer a leader makes to a politician and the politician's ranking of the party, which is described in section 3.4, after presenting the agents' preferences in the next section. A match can also exogenously dissolve due to disputes between a politician and a leader.

3.3 The political arena

An independent politician produces rents using his resources. The utility flow to a type-z independent politician is

$$u_0(z) = \theta(z).$$

When a type-z politician joins a type-x party, the politician's contribution to the party's rent production is $\frac{z}{x}\theta(x)$, so that his productivity is proportional to his relative resources in the party.[16] The leader's offer gives the politician a share $\phi \leq 1$ of his contribution to the party rents. The politician also benefits from the party's club goods. Hence, the utility flow to a type-z politician who gets a share ϕ of his rent production in a type-x party is

$$u(z, \phi, x) = \phi \frac{z}{x}\theta(x) + \psi(x).$$

I temporarily assume and later show that $\frac{d}{dx}\left\{\frac{z}{x}\theta(x)\right\} < 0$ and $\frac{d^2}{dx^2}\left\{\frac{z}{x}\theta(x)\right\} > 0$.[17] Since $\psi'(x) > 0$, membership benefits have two components with different returns to party size.

A leader receives all the rents that are not paid to the members. Thus, when a type-z politician joins a type-x party with rent share ϕ, the leader's payoff from this contract is

$$w(z, \phi, x) = (1 - \phi)\frac{z}{x}\theta(x).$$

This paper does not elaborate on how a politician or a leader use their rents. However, I assume that a party with a greater influence on government institutions has more rents

[16] Assuming that a politician's rent production in a party is proportional to his relative resources is compatible with the idea of collective "team" bargaining (Stole and Zwiebel 1996, Rajan and Zingales 1998). In section 3.8, I find that, the maximum rents a politician can earn in a given party is linearly increasing in the politician's assets. So, if a member has twice the assets of another member, a leader is willing to pay him twice as much rents to keep him in the party. This outcome is the asymmetric Nash bargaining solution in a frictionless environment where a politician's bargaining power is equal to his relative assets in the party (Roth 1979). Thus, this specification is consistent with a subgame in which the politicians multilaterally bargain in their party.

[17] A sufficient condition to achieve this is to have $\theta(x) = x^\eta$, with $0 < \eta < 1$.

for pork-barrel spending such as creating public employment, investing in infrastructure, and designing policies to maintain its electoral support. Accordingly, the value of voting for a type-x party for voter i, v_{ixt}, is equal to the sum of the party's rents, the electorate's unobserved, zero-mean, stationary preference shock for the party at time t, ξ_{xt}, and an idiosyncratic taste shock, ϵ_{ixt}.[18] Formally, the value of voting for a type-x party is

$$v_{ixt} = \theta(x) + \xi_{xt} + \epsilon_{ixt}.$$

3.4 Stationary decision rules

This paper studies the stationary equilibrium and abstracts from the dynamics of the transition to the steady-state. The equilibrium is characterized by the following properties.

Uncorrelated politician choices: Given the exogenous, constant distribution of the leader and the politician types, $\Upsilon(\tilde{x})$ and $L(z)$, the flows into and outflows from a party of each politician type balance out. As a result, each party's size is constant, which yields a constant sampling distribution, $F(x)$.[19] Since the benefits of affiliating with a party depend only on a politician's type, his outside option, and the party's type, a politician's decision to join or leave a party is independent of the other politicians' behaviors.

Stationary decision rules of a party leader: A party leader maximizes her share of the party rents subject to filling the party. So, a leader's optimal offer to convince a politician to join the party gives the politician the value of his outside option. However, convincing a politician to join the party may not be optimal when a leader expects to fill the vacancy with a more profitable politician. This occurs, for example, if the leader expects to match with a politician who has the same amount of assets but a worse outside option after not making an acceptable offer to the politician she is currently matched. Similarly, when a party member receives an offer from an outside party, it would not be optimal to renegotiate an acceptable offer when the leader expects to fill his vacancy with another politician of the same type with a worse outside option. Thus, a leader's offer depends on both the politician's assets and his outside option. In a stationary equilibrium, a leader's optimization problem for filling the party reduces to deciding the maximum rent share up to which she is willing to renegotiate each type of politicians' share as his outside option improves. Then, the leader offers each politician the value of his outside option as long as providing this value does not require

[18] Similar to labor search models that estimate firm productivity levels through an auxiliary production function, a voting model is included in this paper solely for estimation of the party sizes. Since explaining inter-party competition is beyond the scope of this paper, I assume a simple voting model that allows me to rank the sizes of parties according to their vote shares. See Ashworth and de Mesquita (2007), Degan and Merlo (2009, 2011), and Merlo and de Paula (2016) for formulation and estimation of voting models.

[19] The sampling distribution, $F(x)$, may be different from the distribution of leaders' capacities, $\Upsilon(\tilde{x})$.

paying more rents than the maximum she has decided to pay. Given each party's size and the upper-bound of the rent share the other party leaders are willing to pay, the maximum share a leader is willing to pay to a politician anchors the overall ranking of the party values for the politician. This is because the other components of the value of membership in a party are either predetermined as a function of its size (i.e., rents and the club goods) or pinned down by the maximum rents the politician can earn in the party (since, given the club goods and the value of membership in other parties, it determines which parties could win the Bertrand competition over his services when he gets an outside offer, as explained below). This aspect of the model distinguishes it from CPR, who assume a firm's outside option to be zero on each match (which would arise from free entry to and exit from a market with CRS technology). Thus, while a firm is willing to renegotiate a worker's wage up to the match surplus as his outside option improves in CPR, it is possible for a leader to not make an acceptable offer to a politician even in the presence of a match surplus in this paper. The maximum rent share a leader is willing to offer to a politician, in turn, depends on the frictions in the labor market. In a frictionless market, a leader would make acceptable offers to only the most profitable politician types that are just sufficient to fill the party. As the friction level increases, filling the party requires making acceptable offers to less profitable types, too, due to the decreased chances of meeting the most preferred types. Given a friction level, a leader chooses these upper-bounds to attract members who are just sufficient to fill her party.

Formally, let c denote the indicator function that equals to 0 if the politician's outside option is to be an independent and 1 if he has an offer from a type-x' party. Since, all else constant, a leader's offer depends on the politician's outside option, she considers each (z, cx') pair as a different type. Let $\phi^{l^*}(z,x)$ denote the maximum share a type-x leader offers to a type-z politician and $\phi^p(z, x, cx', \phi^{l^*}(z,x), c\phi^{l^*}(z,x'))$ denote the share that provides the politician the value of his outside option. The only relevant characteristics of the outside offer are the poaching party's size and the maximum share it pays to the politician because a party's equilibrium value for a politician is pinned down by these two objects. Then, a type-x leader's offer to a type-(z, cx') politician, $\phi^l(z, x, cx', \phi^{l^*}(z,x), c\phi^{l^*}(z,x'))$, solves

$$\underbrace{V(z, \phi^l(\cdot), \phi^{l^*}(z,x), x)}_{\substack{\text{Offer of a type-}x\text{ leader}\\ \text{to a type-}(z,cx')\text{ politician}}} = min\Big\{ \underbrace{V(z, \phi^p(\cdot), \phi^{l^*}(z,x), x)}_{\substack{\text{minimum value that convinces}\\ \text{a type-}(z,cx')\text{ politician to join }x}} , \underbrace{V(z, \phi^{l^*}(z,x), \phi^{l^*}(z,x), x)}_{\substack{\text{the maximum value }z\text{ can}\\ \text{receive in a type-}x\text{ party}}} \Big\}. \quad (3.1)$$

Equation 3.1 states that, when a type-x leader meets a type-(z, cx') politician, the offer she makes to the politician is just the minimum value that can convince him to join the

party, $V(z, \phi^p(\cdot), \phi^{l^*}(z,x), x)$. When convincing the politician to accept the offer requires paying him a greater share than the maximum share the leader is willing to pay, $\phi^{l^*}(z,x)$, the leader instead offers $V(z, \phi^{l^*}(z,x), \phi^{l^*}(z,x), x)$, which the politician rejects.

In a stationary equilibrium, the maximum share a leader offers to each politician type takes into account her prospects of filling the party.[20] Let $\Phi^{l^*}(\phi^{l^*}(z,x))$ denote the distribution of the upper bound of the rent shares the leaders offer to a type-z politician. A politician type's density in a party depends on this distribution as it anchors this politician type's overall value ranking of the parties by their sizes. Let $\mu_{z,x'|x}(z,x'|x, \Phi^{l^*}(\phi^{l^*}(z,x)))$ and $\mu_{z,0|x}(z,0|x, \Phi^{l^*}(\phi^{l^*}(z,x)))$ denote the equilibrium densities of type (z,x') and $(z,0)$ politicians in a type-x party, respectively, and $g_{z|x}(z|x, \Phi^{l^*}(\phi^{l^*}(z,x)))$ denote the density of type-z politicians in the party. The formal statement of a type-x leader's optimization problem is

$$\max_{\substack{\phi^{l^*}(z,x),\\ \phi^l(\cdot),\\ \forall z, cx'}} \int_0^{z^{max}} \int_{x_{min}}^{x^{max}} \underbrace{(1-\phi^l(z,x,x',\phi^{l^*}(z,x),\phi^{l^*}(z,x')))\frac{z}{x}\theta(x)}_{\substack{\text{payoff to a type-}x\text{ leader when a type-}(z,x')\\ \text{politician joins the party with share } \phi^l(\cdot)}} \times \underbrace{\mu_{z,x'|x}(z,x'|x,\Phi^{l^*}(\phi^{l^*}(z,x)))}_{\substack{\text{equilibrium density of type-}(z,x')\\ \text{politicians in a type-}x\text{ party}}} dx'dz$$
$$+ \int_0^{z^{max}} \underbrace{(1-\phi^l(z,x,0,\phi^{l^*}(z,x),0))\frac{z}{x}\theta(x)}_{\substack{\text{payoff to a type-}x\text{ leader when a type-}(z,0)\\ \text{politician joins the party with share } \phi^l(\cdot)}} \underbrace{\mu_{z,0|x}(z,0|x,\Phi^{l^*}(\phi^{l^*}(z,x)))}_{\substack{\text{equilibrium density of type-}(z,0)\\ \text{politicians in a type-}x\text{ party}}} dz$$
$$\text{subject to } \underbrace{x}_{\text{party size}} = \underbrace{\int_0^{z^{max}} z g_{z|x}(z|x,\Phi^{l^*}(\phi^{l^*}(z,x))dz}_{\text{equilibrium party size}}, \tag{3.2}$$

which is solved by her stationary decision rules given in equations 3.1.

Low, medium, and high politician types: I temporarily assume and later show that, in equilibrium, the maximum private rents a politician can earn in a party, $\phi^{l^*}(z,x)\frac{z}{x}\theta(x)$, is decreasing in party size. As a result, the benefits of party membership have two components with different returns to party size: while the rents a politician can earn in a party are decreasing, the club goods a politician accesses in a party are increasing in party size. Section 3.6 shows that this feature of the model divides the continuous types of politicians into three categories, named *low, medium*, and *high*. A politician's preference ordering of the parties by their size is increasing, U-shaped, and decreasing for the low, medium, and high types, respectively. As a result, the low (high)-type politicians switch only to the bigger (smaller) parties, while a medium-type politician may switch to either a smaller or a bigger party.

Stationary decision rules of independent politicians: Given the decision rules of the leaders, an independent medium-type politician behaves according to his own stationary

[20] I assume that a party leader commits to not lowering rents once a politician accepts.

decision rule. Due to the U-shaped returns to party size, two parties with different sizes may have the same value for a medium-type politician. Let x_{a0} and x_{b0} denote the types of the smaller and the bigger parties, respectively, that make him equally well-off as being an independent. Note that these thresholds exist only when the politician's value of being an independent is greater than the lowest point of his U-shaped returns to party size. When these thresholds do not exist, the politician joins any party upon receiving an offer. When the thresholds exist, he is strictly better-off in all parties that are smaller than x_{a0} and bigger than x_{b0}, compared to being in the threshold-type parties. Therefore, the stationary decision rule of an independent medium-type politician is to join party x' if $x' \in \{[x_{min}, x_{a0}] \cup [x_{b0}, x^{max}]\}$ upon receiving an offer. Party-joining thresholds solve

$$V_0(z) = V(z, \phi^{l^*}(z, x_{a0}), \phi^{l^*}(z, x_{a0}), x_{a0}) = V(z, \phi^{l^*}(z, x_{b0}), \phi^{l^*}(z, x_{b0}), x_{b0}) \tag{3.3}$$

where $V_0(z)$ and $V(z, \phi^{l^*}(z, x), \phi^{l^*}(z, x), x)$ are the values of being an independent and being a member of a type-x party with share $\phi^{l^*}(z, x)$ for a type-z politician, respectively. Accordingly, $x_{a0}(\cdot)$ and $x_{b0}(\cdot)$ are continuously differentiable functions of z, x_{a0}, $\phi^{l^*}(z, x_{a0})$ and z, x_{b0}, $\phi^{l^*}(z, x_{b0})$, respectively. The low and the high politician types' stationary decision rules when independent are constructed similarly to that of a medium politician type. The only difference is that, since the low (high) type politicians switch only to the bigger (smaller) parties, they do not have smaller (bigger) party switching thresholds.

Stationary decision rules of party members: Given the decision rules of the leaders, each politician with a party membership behaves according to his own decision rule. In equilibrium, a medium type-z politician in a type-x party switches his party if he gets an offer from party x' such that $x' \in \{[x_{min}, x_a) \cup (x_b, x^{max}]\}$, where $x_a(\cdot)$ and $x_b(\cdot)$ solve

$$V(z, \phi^{l^*}(z, x), \phi^{l^*}(z, x), x) = V(z, \phi^{l^*}(z, x_a), \phi^{l^*}(z, x_a), x_a) = V(z, \phi^{l^*}(z, x_b), \phi^{l^*}(z, x_b), x_b) \tag{3.4}$$

and, hence, $x_a(\cdot)$ and $x_b(\cdot)$ are continuously differentiable functions of z, x, x_a, $\phi^{l^*}(z, x)$, $\phi^{l^*}(z, x_a)$, and z, x, x_b, $\phi^{l^*}(z, x)$,$\phi^{l^*}(z, x_b)$, respectively. Similarly, upon receiving an offer, a low-type politician in a type-x party switches to party x' when $x' \in (x, x^{max}]$ and a high-type politician in party x switches to party x' when $x' \in [x_{min}, x)$.

3.5 The value functions

In this section, I present the closed forms of the value functions of the politicians and the party leaders using their stationary decision rules. To simplify presentation, let $\psi_{z,x,0}$ and $\psi_{z,x,x'}$ denote the state variables that determine the value of a type-z politician in a type-

x party whose outside option is to be an independent and a member of a type-x' party, respectively (equations 3.1 - 3.4). All agents in the model discount time at rate ρ. An independent politician receives an offer from a political party at rate λ. Given his stationary decision rule in equation 3.5, the lifetime utility of an independent type-z politician is

$$\underbrace{V_0(z)}_{\substack{\text{value of being}\\ \text{an independent}}} = \underbrace{\tau\theta(z)}_{\text{flow payoff}} + \underbrace{\frac{1}{1+\rho\tau}}_{\text{discounter}} \Big\{ \underbrace{\tau\lambda}_{\text{offer}} \Big[\underbrace{\int_{x_{min}}^{x_{a0}} V(\psi_{z,m,0})dF(m)}_{\text{join a small party}} + \underbrace{\int_{x_{b0}(\cdot)}^{x_{max}} V(\psi_{z,m,0})dF(m)}_{\text{join a big party}} + \underbrace{\int_{x_{a0}(\cdot)}^{x_{b0}(\cdot)} V_0(z)dF(m)}_{\text{reject offer}} \Big] + \underbrace{(1-\tau\lambda)V_0(z)}_{\text{no offer}} + o(\tau) \Big\}, \tag{3.5}$$

where $F(\cdot)$ is the sampling distribution with density $f(\cdot) > 0$ on $[x_{min}, x^{max}]$. Reading from left to right, a type-z independent politician receives value $V_0(z)$. This value consists of a flow payoff and a continuation value that he receives for an infinitesimally small period of time τ, plus a term $o(\tau)$ with the property that $\lim_{\tau\to 0} \frac{o(\tau)}{\tau} = 0$. The flow payoff is equal to the politician's own rent production. The continuation value, which he discounts at rate ρ, weights the expected value of randomly matching with a party and not matching with any party. When the politician matches with a party, he either accepts or rejects the leader's offer following his stationary decision rule in equation 3.3. When he joins a type-x' party, he receives a value of $V(z, \phi^l(\cdot), \phi^{l^*}(z, x'), x')$, which depends on the leader's offer $\phi^l(z, x', 0, \phi^{l^*}(z, x'), 0)$. When the politician either rejects an offer or does not receive any offer, he continues to receive the value of being an independent.

Substituting the leaders' stationary decision rules for independent politicians given in equation 3.3 into equation 3.5 and taking the limits as $\tau \to 0$, a politician's lifetime utility of being an independent in a stationary equilibrium solves as

$$V_0(z) = \frac{1+\rho}{\rho}\theta(z). \tag{3.6}$$

A party member receives offers from outside parties at rate λ. The stationary decision rules described in equation 3.4 determine the ranges of parties that induce him to switch his party. However, when he is not paid the maximum share that his party pays to the politician's type, an offer from an outside party may improve his share without inducing him to switch his party. This occurs when a type-z politician in a type-x party with share ϕ gets an offer from party x' such that $x' \in \{[x_a(\cdot), q_a(\cdot)] \cup [q_b(\cdot), x_b(\cdot)]\}$, where the threshold values

for having a share improvement in the party, $q_a(\cdot)$ and $q_b(\cdot)$, solve

$$V(z,\phi,\phi^{l^*}(z,x),x) \;=\; V(z,\phi^{l^*}(z,q_a),\phi^{l^*}(z,q_a),q_a) = V(z,\phi^{l^*}(z,q_b),\phi^{l^*}(z,q_b),q_b),$$

and, hence, $q_a(\cdot)$ and $q_b(\cdot)$ are continuously differentiable functions of x, ϕ, $\phi^{l^*}(z,x)$, q_a, $\phi^{l^*}(z,q_a)$, and x, ϕ, $\phi^{l^*}(z,x)$, q_b, $\phi^{l^*}(z,q_b)$, respectively.

When a match breaks exogenously, which occurs at rate δ, the politician becomes an independent and receives the lifetime utility associated with that state, $V_0(z)$. Given the politician's stationary decision rule and the ranges of the parties that cause a share improvement, the lifetime utility of a type-z politician in a type-x party with share ϕ is

$$\begin{aligned}
\underbrace{V(z,\phi,\phi^{l^*}(z,x),x)}_{z\text{'s value in } x \text{ w/ share } \phi} \;=\;& \tau\Big(\underbrace{\phi\frac{z}{x}\theta(x)+\psi(x)}_{\text{flow payoff}}\Big) + \underbrace{\frac{1}{1+\rho\tau}}_{\text{discounter}}\Big\{\underbrace{\tau\lambda}_{\text{offer}}\Big[\underbrace{\int_{q_a(\cdot)}^{q_b(\cdot)} V(z,\phi,\phi^{l^*}(z,x),x)dF(m)}_{z \text{ does not report the offer}} \\
&+ \underbrace{\int_{x_{min}}^{x_a(\cdot)} V(\psi_{z,m,x})dF(m) + \int_{x_b(\cdot)}^{x_{max}} V(\psi_{z,m,x})dF(m)}_{z \text{ switches to either a smaller or a bigger party}} \\
&+ \underbrace{\int_{x_a(\cdot)}^{q_{a(\cdot)}} V(\psi_{z,x,m})dF(m) + \int_{q_b(\cdot)}^{x_b(\cdot)} V(\psi_{z,x,m})dF(m)\Big]}_{z\text{'s share in party } x \text{ increases}} \\
&+ \underbrace{\tau\delta V_0(z)}_{\text{exog. break-up}} + \underbrace{(1-\tau\lambda-\tau\delta)V(z,\phi,\phi^{l^*}(z,x),x)}_{\text{no offer, no exogenous match break-up}} + o(\tau)\Big\}. \qquad (3.7)
\end{aligned}$$

Reading from left to right, a type-z politician in a type-x party with share ϕ has value $V(z,\phi,\phi^{l^*}(z,x),x)$. This value consists of a flow payoff and a continuation value that he receives for an infinitesimally small time period τ, plus a term $o(\tau)$. The flow payoff is the sum of the politician's share of party rents and the party's club goods. The continuation value weights the expected value of three mutually exclusive possibilities. If the match breaks up exogenously, he receives the value of being an independent. If the politician gets an offer from a party, which occurs at rate λ, he follows his stationary decision rules to either accept or reject the offer. Lastly, when the politician neither gets an offer nor the match breaks up exogenously, he continues to receive the value of being a member of party x with share ϕ.

3.6 The low, medium, and high types of politicians

In this section, I show that the continuous distribution of the politician types are divided into three categories in their rankings of the parties. Substituting the stationary decision

rules of the party leaders in equation 3.1 into the lifetime utility of a type-z politician in a type-x party in equation 3.7, taking the limits, and evaluating ϕ at $\phi^{l^*}(z,x)$ shows that the maximum value a type-z politician can earn in a type-x party is[21]

$$V(z,\phi^{l^*}(z,x),\phi^{l^*}(z,x),x) = \frac{\phi^{l^*}(z,x)\frac{z}{x}\theta(x)+\psi(x)+\delta V_0(z)}{\rho+\delta} \tag{3.8}$$

with derivative,

$$\frac{dV(z,\phi^{l^*}(z,x),\phi^{l^*}(z,x),x)}{dx} = \frac{1}{\rho+\delta}\Big[z\underbrace{\frac{d}{dx}\Big\{\phi^{l^*}(z,x)\frac{\theta(x)}{x}\Big\}}_{<0}+\underbrace{\psi'(x)}_{>0}\Big]. \tag{3.9}$$

Equation 3.9 characterizes the returns to party size for a type-z politician. The maximum value the politician can earn in a type-x party, $V(z,\phi^{l^*}(z,x),\phi^{l^*}(z,x),x)$, has two components that have different returns to party size: while the upper bound of the rents a politician can earn in a party is decreasing, the club goods provided by a party are increasing in party size. This feature of the model divides the continuous distribution of the politician types into three categories in their ranking of the parties, named *low, medium*, and *high*.

The low types of politicians have very little resources. Thus, their loss in terms of the private rents is always dominated by their gains in club goods as party size increases. As a result, they rank the bigger parties better. Let $\underline{z}$ denote the threshold politician type that separates the low and medium types of politicians. For all $z \leq \underline{z}$, the second term in equation 3.9 always dominates the first term, and hence, the returns to party size are increasing on $[x_{min}, x^{max}]$. The threshold type, $\underline{z}$, receives the same marginal utility from the club goods and the private rents in the smallest party, x_{min}. All richer politicians value the private rents more, and, thus, have $\frac{dV(z,\phi^{l^*}(z,x_{min}),\phi^{l^*}(z,x_{min}),x_{min})}{dx} < 0$.[22] So, the threshold type $\underline{z}$ solves

$$\underline{z}\frac{d}{dx}\Big\{\phi^{l^*}(\underline{z},x_{min})\frac{\theta(x_{min})}{x_{min}}\Big\} = -\psi'(x_{min}). \tag{3.10}$$

Let $\bar{z}$ denote the threshold politician type that separate the medium and high types of politicians. For all $z \geq \bar{z}$, the first term in equation 3.9 dominates the second term in all parties, and hence, the returns to party size are decreasing on $[x_{min}, x^{max}]$. The politicians whose assets are within the range $[\bar{z}, z^{max}]$ are very rich in resources so that their loss in private rents is never dominated by their gain in club goods as party size increases. So, the high-type politicians rank the smaller parties better. The threshold type $\bar{z}$ receives the same

[21] These derivation steps follow CPR.

[22] Since the support of x is $[x_{min}, x^{max}]$, at x_{min} (at x^{max}), only the right (the left) derivative exists.

marginal utility from the party's club goods and the upper-bound of the private rents he can receive in the biggest party type, x^{max}. All higher politician types value the private rents more, and, therefore, have $\frac{dV(z,\phi^{l^*}(z,x^{max}),x^{max})}{dx} < 0$. Accordingly, the threshold type $\bar{z}$ solves

$$\bar{z}\frac{d}{dx}\Big\{\phi^{l^*}(\bar{z},x^{max})\frac{\theta(x^{max})}{x^{max}}\Big\} = -\psi'(x^{max}).$$

Finally, the politicians with assets within range $(\underline{z},\bar{z})$ have a nonmonotonic returns to party size. Note that, since $\psi'(x) > 0$ and $\psi''(x) < 0$, a sufficient condition for the medium-type politicians to have a U-shaped returns to party size is that $\frac{d}{dx}\Big(\frac{\phi^{l^*}(z,x)\theta(x)}{x}\Big) < 0$ and $\frac{d^2}{dx^2}\Big(\frac{\phi^{l^*}(z,x)\theta(x)}{x}\Big) > 0$. I temporarily assume and later show that this condition holds.

Let $x_0(z)$ denote the lowest point of a medium type-z politician's U-shaped returns to party size. The politician considers all parties that are smaller than $x_0(z)$ as "small" because over this range, the loss in private rents dominates the gain in club goods as party size increases. Similarly, he considers all x such that $x > x_0(z)$ as "big."

3.7 The share equation

This section presents the closed-form solution of a politician's rent share in a party. I derive this equation in the online appendix by following the exact same steps in CPR. Suppose that a type-(z,x') politician joins party x. His rent share, $\phi^l(z,x,x',\phi^{l^*}(z,x),\phi^{l^*}(z,x'))$, solves

$$\begin{aligned}\phi^l(\cdot) = \frac{x}{z\theta(x)}\Big\{&\phi^{l^*}(z,x')\frac{z\theta(x')}{x'} + [\psi(x') - \psi(x)] \\ &- \lambda\Big(\int_{q_b(\cdot)}^{x_b(\cdot)} \underbrace{\frac{dV(\psi_{z,x,m})}{dm}}_{>0}\bar{F}(m)dm - \int_{x_a(\cdot)}^{q_a(\cdot)} \underbrace{\frac{dV(\psi_{z,x,m})}{dm}}_{<0}F(m)dm\Big\}\Big).\end{aligned} \tag{3.11}$$

Equation 3.11 shows that, in an environment with frictions ($\lambda > 0$), the rent share which convinces a politician to stay in the party is decreasing in the rate of offer arrival. This equation differs from CPR by not allowing the politicians to have bargaining power and including the possibilities of having an outside offer from both the smaller and the bigger parties in the option value effect.

3.8 Steady-state equilibrium

This section presents the steady-state equations, which are derived in the online appendix by adjusting the steps taken in CPR for the possibility of a U-shaped returns to party size.

- *The proportion of independent politicians is*

$$\varphi_z = \frac{\delta}{\delta + \lambda[F(x_{a0}(\cdot)) + \bar{F}(x_{b0}(\cdot))]}. \tag{3.12}$$

- *The joint density of type-z politicians in type-x parties is*

$$g(z, x|\Phi^{l^*}(\phi^{l^*}(z, x)) = \frac{\delta(\delta + \lambda)}{[\delta + \lambda[F(x_a(\cdot)) + \bar{F}(x_b(\cdot))]]^2}\tilde{\ell}(z)f(x) \tag{3.13}$$

  where

$$\tilde{\ell}(z) = \frac{\ell(z)}{\delta + \lambda[F(x_{a0}(\cdot)) + \bar{F}(x_{b0}(\cdot))]} \tag{3.14}$$

  is defined to be *the effective density* of type-z politicians, as it weights the density of a politician type by its demand from the parties.

- *The joint density of type-$(z, q_b(\cdot))$ politicians and type-x parties is*

$$\mu_{z,q_b(\cdot),x}(z, q_b(\cdot), x|\Phi^{l^*}(\phi^{l^*}(z, x)) = 2\frac{\delta(\delta + \lambda)\lambda f(x)f(q_b(\cdot))\tilde{\ell}(z)}{[\delta + \lambda[\bar{F}(q_b(\cdot)) + F(q_a(\cdot))]]^3}. \tag{3.15}$$

- *The joint density of type-$(z, 0)$ politicians and type-x parties is*

$$\mu_{z,0,x}(z, 0, x|\Phi^{l^*}(\phi^{l^*}(z, x)) = \frac{\delta}{[\delta + \lambda[F(x_{a0}(z) + \bar{F}(x_{b0}(z))]]}\tilde{\ell}(z)f(x). \tag{3.16}$$

- *The within-party share distribution of type-z politicians in type-x parties is*

$$\Gamma_{\phi|z,x}(\phi|z, x, \Phi^{l^*}(\phi^{l^*}(z, x)) = \Big(\frac{\delta + \lambda[\bar{F}(x_b(\cdot)) + F(x_a(\cdot))]}{\delta + \lambda[\bar{F}(q_b(\cdot)) + F(q_a(\cdot))]}\Big)^2. \tag{3.17}$$

- *Equilibrium party size is*

$$x \;=\; \int_0^{z^{max}} zg(z, x|\Phi^{l^*}(\phi^{l^*}(z, x)))dz. \tag{3.18}$$

Equation 3.12 is slightly different from its counterpart in CPR. Because firms' outside options are taken to be zero in CPR, a firm is willing to renegotiate each worker's share of the match surplus up to the match productivity as his outside option improves. As a result, a worker accepts any firm's offer, and hence the unemployment rate does not vary across worker types. In this paper, on the other hand, sorting by leaders results in variation in the

proportion of independents across politician types. Similarly, equations 3.13-3.18 differ from CPR by allowing for politicians to switch parties of different sizes.

I assume that an equilibrium exists and characterize the Nash equilibria of the model. Theorem 1 states that there is no Nash equilibrium in which a party leader does not negotiate a member's rent share in the party up to the match surplus.

Theorem 1. *Let $\tilde{z}(x)$ be the least profitable politician type a type-x party leader needs to hire to fill her party when $\phi^{l^*}(z,x) = 1, \forall z$. Let $\Pi(z, \phi^{l^*}(z,x), x)$ denote the profitability of type-z politicians to a type-x leader when the maximum rent share she pays to type-z politicians is $\phi^{l^*}(z,x)$. In a Nash equilibrium, $\phi^{l^*}(z,x) = 1$ for all z such that $\Pi(z, \phi^{l^*}(z,x), x) \geq \Pi(\tilde{z}(x), \phi^{l^*}(\tilde{z}(x),x), x)$, and $\phi^{l^*}(z,x) \leq \phi^{l}(z,x,0,\phi^{l^*}(z,x),0)$ for all other z.*

Proof. A party leader solves her rent-maximization problem in equation 3.2 by following the stationary decision rule in equation 3.1, i.e., she chooses $\phi^l(\cdot)$ that gives the politician the value he receives in his outside option as long as providing this value does not require paying him a greater rent share than the maximum the leader has decided to pay, $\phi^{l^*}(z,x)$. Equation 3.13 shows that the density of type-z politicians in type-x parties, $g(z,x|\Phi^{l^*}(\phi^{l^*}(z,x))$, depends on $\phi^{l^*}(z,x)$ through a type-z politician's party-switching thresholds, $x_a(\cdot)$ and $x_b(\cdot)$. However, as long as the politician values the type-x party more highly than the type-x' party, the density of type-(z,x') and type-$(z,0)$ politicians in a type-x party does not change with $\phi^{l^*}(z,x)$ (equations 3.15 and 3.16). Noting these, we can write the total profitability of type-z politicians to a type-x party leader as

$$\begin{aligned}\Pi(z,\phi^{l^*}(z,x),x) &= \frac{z\theta(x)}{x}\Big\{\int_{x_a(\cdot)}^{x_b(\cdot)}(1-\phi^l(\cdot)\mu_{z,x'|z}(z,x'|x,\Phi^{l^*}(\phi^{l^*}(z,x))dx' \\ &+ (1-\phi^l(\cdot))\mu_{z,0|}(z,0|x,\Phi^{l^*}(\phi^{l^*}(z,x))\Big\} \qquad (3.19)\end{aligned}$$

with $\frac{d\Pi(z,\phi^{l^*}(z,x),x)}{d\phi^{l^*}(z,x)} > 0$ as long as $\phi^{l^*}(z,x) \leq 1$ because we have that

$$\frac{d\mu_{z,x'|x}(z,x'|x,\Phi^{l^*}(\phi^{l^*}(z,x))}{d\phi^{l^*}(z,x)} = 0, \frac{d\mu_{z,0|x}(z,0|x,\Phi^{l^*}(\phi^{l^*}(z,x))}{d\phi^{l^*}(z,x)} = 0, \text{ and } \frac{d\phi^l(\cdot)}{d\phi^{l^*}(z,x)} < 0.$$

Suppose that, given all other leaders' stationary decision rules, a type-x party leader follows the rule $\phi^{l^*}(z,x)$. As the party leader seeks the most profitable politician types, she makes acceptable offers to only the most profitable politician types. Let $\tilde{z}(x)$ be the least profitable politician type that the leader has to hire to fill her party under the rule she follows.

Consider a type-z politician such that $\Pi(z, \phi^{l^*}(z,x), x) > \Pi(\tilde{z}(x), \phi^{l^*}(\tilde{z}(x), x), x)$ and suppose that $\phi^{l^*}(z,x) \neq 1$. This cannot be an equilibrium, as setting $\phi^{l^*}(z,x) = 1$ would make a type-z politician even more profitable. The Nash equilibria is setting $\phi^{l^*}(z,x) = 1$, $\forall z$ such that $\Pi(z, \phi^{l^*}(z,x), x) > \Pi(\tilde{z}(x), \phi^{l^*}(\tilde{z}(x), x), x)$, and $\phi^{l^*}(z,x) \leq \phi^p(z, x, cx', \phi^{l^*}(z,x), c\phi^{l^*}(z,x'))$ for all other z, where $\phi^p(\cdot)$ is the minimum share that convinces a type-(z, cx') politician to join a type-x party and $\tilde{z}(x)$ denote the least profitable type that needs to be hired to meet the constraint in equation 3.2 after setting $\phi^{l^*}(z,x) = 1$ for all members of the party.

□

4 Identification

The identification of the model uses data on each party's vote share in each district in each of five elections as well as politician characteristics, the duration of each spell with no party affiliation, and the duration of each spell with a party affiliation.

Appendix A shows identification of the structural parameters and functions. To summarize, the transition parameters (λ, δ) are mapped to the duration of party membership as these parameters pin down the rate at which a politician leaves a party. Next, the results of Evdokimov (2011) can be used to prove that a politician's time-invariant hazard of leaving a party is nonparametrically identified. The derivatives of the hazard of leaving a party with respect to the observed politician characteristics, in turn, identify the contribution of these characteristics to a politician's assets. Since a party aggregates all members' resources, using the equilibrium equations in my model, I can calculate each party's total assets, which yields the sampling distribution from which the politicians draw membership offers, $F(x)$.

Given each party's assets, the rent production function, $\theta(\cdot)$, and the distribution of the voters' time-varying preferences for a party, $\Xi(\xi_{1t}, \xi_{2t}, ..., \xi_{Kt})$, are mapped into the vote shares via Hotz and Miller (1982) inversion of the voters' choice probabilities. Having identified the rent production function and given each agent's type, the club goods production function, $\psi(\cdot)$, is identified from the conditional likelihood of observing a party affiliation duration. Intuitively, since the richer politicians value the private rents more than the club goods, given a party's rents, the variation in the hazard of leaving the party across different politicians identifies the party's club goods. Similarly, the discount rate can be identified from the unconditional likelihood of joining a party from the pool of independents. This is because the value of being an independent is equal to the discounted value of the politician's rent production on his own, and, hence, the hazard of joining a party is determined by the discount rate when all the other relevant objects are given.

5 Estimation

There are three main challenges in estimation. First, unlike the conventional search models which use observed wages in estimation, the estimation procedure in this paper cannot use politicians' unobserved rent shares. Second, a party's total assets is not observed. Third, some important components of a politician's assets, such as valence, are not observed and the unobserved heterogeneity enters the hazard rate nonseparably.

Fortunately, the one-to-one relationship between the voters' party-specific value functions and the vote shares allows for estimating the party sizes and the distribution of the voters' preferences for each party after assuming a functional form for the rent production function.[23][24] Having estimated the party sizes, the rich party-switching patterns generated by the model allow for undertaking the duration analysis in the framework of a finite mixture model. The remaining parameters are estimated parametrically using this formulation.

Table 3: Restrictions on primitives during estimation

Primitive		**Restriction**	**Estimated form**
$\theta(x)$	Rent production function	Fixed	$\theta(x) = log(x)$
$\psi(x)$	Club goods production function	Parameterized	$\psi(x) = x^{\eta_1}$, with $0 < \eta_1 < 1$
$\{\Xi_k(\xi_{kct})\}_{k=1}^{K}$	Distribution of voters' preferences	Parameterized	$\xi_{kct} \sim iidN(0, \sigma^2_{\xi_k})$
z	Politician type	Parameterized	$log(z_i) = \sum_m y_{im}\beta_m + \epsilon_i$.
$H(\epsilon)$	Distribution of unobserved het.	Parameterized	$\epsilon_i \sim iidN(0, \sigma^2_\epsilon)$
(λ, δ)	Transition parameters	Unchanged	-
$\{x_k\}_{k=1}^{33}$	Party sizes	Discretized	-
$F(x)$	The sampling distribution	Unchanged	-

5.1 Estimation procedure

The observable variables I use in estimation are $\{\{y_{im}\}_{m=1}^{M}, \{t_{il}, \{s_{ilk}\}_{k=1}^{K}, d^n_{il}, d^i_{il}, d^r_{il}\}_{l=1}^{L_i}\}_{i=1}^{N}$, and $\{\nu_{0ct}, \nu_{kct}\}_{k=1}^{K}{}_{c=1}^{C}{}_{t=1}^{T}$ where y_{im} is the mth characteristic of politician i, t_{il} is the length

[23] This procedure is similar to recovering a firm's unobserved productivity level by estimating its production function as in CPR.

[24] Throughout estimation, the rent production function is normalized to be of the form $\theta(x) = log(x)$. Evdokimov (2010, 2011) show that, when there is a complete spell for each individual, the hazard rate can be identified and estimated nonparametrically. In the absence of a complete spell for each politician, the rent production function, which is a determinant of the hazard rate, can be identified only up to a scale normalization. The rent production function connects the two parts of estimation, i.e., recovering the party sizes from the vote shares and using the estimated party sizes for estimation of the other parameters. Scaling the rent production function in the first part results in scaled estimates of party sizes. Using these scaled estimates in the second part, in turn, it is possible to scale the other parameters to obtain the exact same likelihood value as the one that was obtained before scaling.

of politician i's lth spell, s_{ilk} is a dummy variable that is equal to 1 if the lth spell of politician i is in party k, $d^n_{il}, d^i_{il}, d^r_{il}$ are indicator variables for the uncensored, interval-censored, and right-censored observations that are equal to 1 if the lth spell of politician i has the relevant type of censoring, ν_{0ct} and ν_{kct} are the shares of the voters who did not vote for any party and who voted for party k in district c at time t, respectively. Although the model is nonparametrically identified, I estimate it parametrically using the formulation that is summarized in Table 3. In what follows, I explain the estimation procedure.

5.1.1 The labor market transition parameters

The labor market transition parameters, (λ, δ), are estimated by maximizing the unconditional likelihood of the observed party-membership durations, a procedure developed by Ridder and van den Berg (2003). This likelihood function is given by

$$p(t) = \frac{1+\kappa}{\kappa}\Big(\delta \int_1^{1+\kappa} \frac{e^{-\delta a t}}{a} da\Big)^{d_n} \Big(\int_1^{1+\kappa} \frac{e^{-\delta a t}}{a^2} da\Big)^{d_r} \Big(\int_1^{1+\kappa} \frac{e^{-\delta a t_1} - e^{-\delta a t_2}}{a^2} da\Big)^{d_i}, \qquad (5.1)$$

where a is the hazard of switching a party and $\kappa = \frac{\lambda}{\delta}$. The intuition behind identification is as follows. Although the hazard rate conditional on politician type is constant, the unobserved heterogeneity makes the unconditional hazard rate a decreasing function of membership spell duration. Thus, while the slope of the membership spell duration identifies κ, δ is identified as $t \to \infty$. Equation 5.1 is derived in the online appendix by adjusting Ridder and van den Berg (2003)'s procedure for the possibility of U-shaped returns to party size.

5.1.2 Estimation of party sizes

Appendix A derives the one-to-one relationship between the voters' choice specific value functions and the parties' vote shares (equation A.10),[25]

$$\underbrace{log(\nu_{kct})}_{\substack{\text{log of the vote share of party } k \\ \text{in city } c \text{ at time } t}} - \underbrace{log(\nu_{0ct})}_{\substack{\text{log of the proportion of people who} \\ \text{did not vote in city } c \text{ at time } t}} = \theta(x_k) + \xi_{kct} - \xi_{0ct}.$$

I assume that the utility a voter derives from not voting for any party is the same across different districts and constant over time, i.e., $\xi_{0ct} = \eta_0$, $\forall t$.[26] Assuming $\xi_{kct} \sim iidN(0, \sigma^2_{\xi_k})$,

[25] This specification follows the IO literature on market demand estimation (Berry, Levinsohn, and Pakes 1995, Nevo 2001, Petrin 2002).

[26] This normalization is common in estimation of static games of strategic interactions, where one inverts the equilibrium choice probabilities for nonparametric identification of the choice specific value functions. See Bajari, Hong, Krainer, and Nekipelov (2010). To ensure positive estimates for party sizes, I set $\eta_0 =$

the probability of observing $\{\nu_{kct}, \nu_{0ct}\}_{k=1,c=1,t=1}^{K \quad C \quad T}$ is

$$\prod_{k,c,t} p(\xi_{kct}) = \prod_{k,c,t} \frac{1}{\sigma_{\xi_k}} \phi\Big(\frac{log(\nu_{kct}) - log(\nu_{0ct}) - log(x_k) + \eta_0}{\sigma_{\xi_k}}\Big) \tag{5.2}$$

where $\phi(\cdot)$ denotes the standard normal density function. The likelihood function in equation 5.2 is maximized with respect to $\{x_k, \sigma_{\xi_k}\}_{k=1}^{K}$. The estimate of the sampling distribution, $F(x)$, is the cumulative distribution of the estimated party sizes.

5.1.3 Duration analysis

The equilibrium equations in the model allow me to undertake the duration analysis in a finite mixture model framework. This is because the time-invariant hazard rate varies over the politician types in a systematic way. A politician may leave a party either through exogenous separation, which occurs at rate δ, or by receiving an offer from a party that he ranks more highly and accepting it. A low-type politician in a type-x party gives higher rank to the bigger parties, and, hence, his probability of getting an acceptable offer is $\lambda\bar{F}(x)$. Similarly, a high-type politician in a type-x party ranks the smaller parties more highly than x, and, thus, his probability of getting an acceptable offer is $\lambda F(x)$. A medium-type politician's probability of getting an acceptable offer depends on whether his current party is bigger than the lowest point of his U-shaped returns to party size, denoted $x_0(z)$. If $x > x_0(z)$, then the type-x party must be on the right side of his U-shaped returns to party size. Since his returns to party size are increasing in this region, the politician values all bigger parties more highly than x. This politician may also have a lower party switching threshold. For example, suppose that a type-x_1 party such that $x_1 < x$ provides the same value to him as he obtains in a type-x party. Then, the type-x_1 party should be on the left side of his U-shaped returns to party size. Since the smaller parties are ranked more highly in this region, the politician values all parties that are smaller than x_1 more highly than x_1 and, in turn, x. Thus, his probability of getting an acceptable offer is $\lambda[F(x_1) + \bar{F}(x)]$. Because there are 33 parties, there are only 34 possible hazard rates a party member can have. So, the members of a party can be divided into a finite number of groups, each having a different hazard rate.

Formally, suppose that the party sizes are sorted in increasing order, i.e., $x_1 < x_2 < .... < x_K$. A member of party k may have any of K+1 possible hazard rates, $a_{k1}, a_{k2}, ..., a_{kK+1}$. Let $z_{k1}, z_{k2}, ..., z_{kK}$ denote the threshold politician types that separate different hazard groups.

$min_{k,c,t}\{log(\nu_{kct} - log(\nu_{0ct}))\}$.

A type-z_{kj} politician obtains the same value in parties x_k and x_j, i.e.,

$$V(z_{kj}, \phi^{l^*}(z_{kj}, x_j), \phi^{l^*}(z_{kj}, x_j), x_j) = V(z_{kj}, \phi^{l^*}(z_{kj}, x_k), \phi^{l^*}(z_{kj}, x_k), x_k),$$

which, after substituting the equilibrium value that $\phi^{l^*}(z_{kj}, x_j) = \phi^{l^*}(z_{kj}, x_k) = 1$, boils down to $z_{kj}\frac{\theta(x_j)}{x_j} + \psi(x_j) = z_{kj}\frac{\theta(x_k)}{x_k} + \psi(x_k)$. Moreover, a type-$z_{kk}$ politician's lowest point of the U-shaped returns to party size is a type-x_k party. This implies that the derivative with respect to party size of the value of membership in a type-x_k party for a type-z_{kk} politician is 0, i.e., $z_{kk}\frac{d}{dx}\left(\frac{\theta(x_k)}{x_k}\right) + \psi'(x_k) = 0$ (equation 3.9). Assuming that $\theta(x) = log(x)$ and $\psi(x) = x^{\eta_1}$, the threshold politician types can be written as

$$z_{kj} = \begin{cases} \frac{x_k^{\eta_1} - x_j^{\eta_1}}{log(x_j)/x_j - log(x_k)/x_k} & \text{if } j \neq k \\ \frac{-\eta_1 x_k^{\eta_1 - 1}}{(1 - log(x))/x_k} & \text{if } j = k. \end{cases}$$

Next, I assume that $log(z_i) = \sum_m y_{im}\beta_m + \epsilon_i$ and $\epsilon \sim i.i.d.N(0, \sigma_\epsilon^2)$. Then, the probability that politician i's hazard rate in party k is equal to a_{kj} is equal to the probability of the event $z_{kj-1} \leq z_i \leq z_{kj}$.[27] This probability, denoted π_{ikj}, is given by

$$\begin{aligned} \pi_{ikj} &= Prob(z_{kj-1} \leq z_i \leq z_{kj}) \\ &= \Phi\Big(\frac{log(z_{kj}) - \sum_{m=1}^{M} y_{im}\beta_m}{\sigma_\epsilon}\Big) - \Phi\Big(\frac{log(z_{kj-1}) - \sum_{m=1}^{M} y_{im}\beta_m}{\sigma_\epsilon}\Big) \end{aligned}$$

where $\Phi(\cdot)$ denotes the standard normal distribution function.[28]

Conditional on having a certain hazard rate, the probability of observing a particular membership duration for a politician has the exponential form. The likelihood function for observing a given membership duration integrates out the unobserved heterogeneity in politicians' hazard rates. Formally, the likelihood contribution of politician i's lth spell is

$$\begin{aligned} L_{il}(t_{il}|x_k, \{y_{im}\}_{m=1}^{M}) &= \sum_{j,k} s_{ilk}\pi_{ikj} \\ &\times \Big[f(t_{il}|a_{kj})^{d_{il}^n} S(t_{il}|a_{kj})^{d_{il}^r} [S(t_{1il}|a_{kj}) - S(t_{2il}|a_{kj})]^{d_{il}^i}\Big]. \end{aligned} \quad (5.3)$$

The likelihood of observing the entire data is the product of the likelihood contribution

[27] If $j = 1$ ($j = K + 1$), then the politician is a low (high)-type, and $z_{kj-1} = z_{min}(z_{kK+1=z^{max}})$.

[28] A politician type does not exist in a party if the value of being an independent is greater than the value of party membership. During estimation, I compute the probability that someone's assets fall into a certain interval conditional on valuing party membership more highly than being an independent.

of each spell of each politician, which is maximized with respect to $\{\beta_m\}_{m=1}^{M}$, η_1, and σ_ϵ.

Table 4: Estimates of the labor market transition parameters

		All	Left	Right	2002-2014
Exog. layoff rate	δ	0.005 (0.000)***	0.005 (0.000)***	0.004 (0.000)***	0.005 (0.000)***
Offer arrival rate	λ	0.014 (0.002)***	0.015 (0.003)***	0.013 (0.002)***	0.007 (0.001)***
Time until layoff	κ	3.05 (0.38)***	2.88 (0.59)***	3.14 (0.49)***	1.67 (0.36)***
Time between 2 offers	$1/\lambda$	73 (8)***	69 (4.8)***	78 (11)***	133 (24)***
# offers until layoff	$1/\delta$	222 (5)***	198 (12)***	242 (5)***	221 (7.4)
$\frac{1}{N}\sum_i logL_i$		-0.68	-0.65	-0.69	-0.53
N		35,781	14,297	21,484	21,790

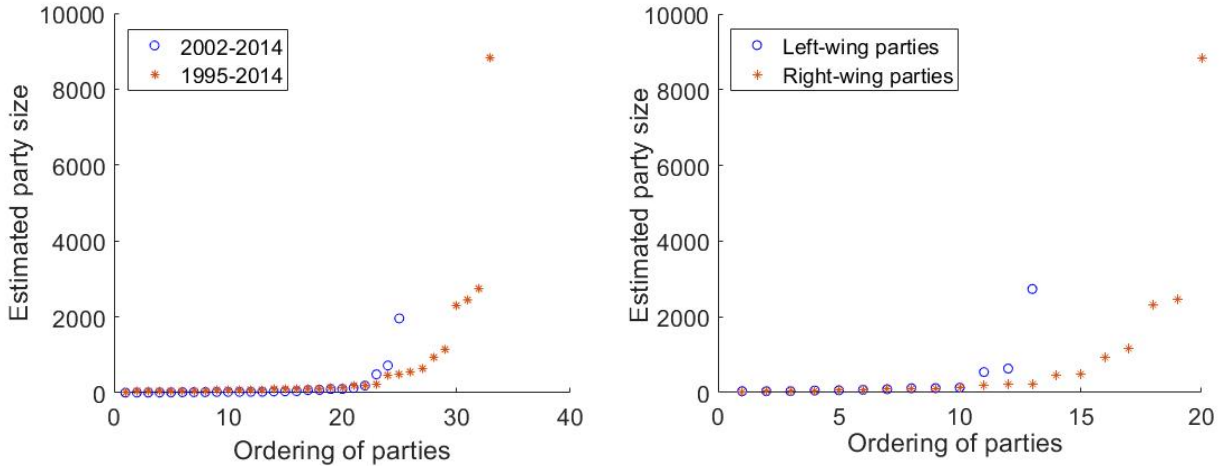
Notes: Estimates are per week. Standard errors are in parentheses. *,**, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Fractions are rounded to the nearest significant digit.

6 Results

This section presents the results. Table 4 shows the estimates of the labor market transition parameters for all, the right- and left-wing parties during 1995-2014 and separately for all parties during 2002-2014. In all samples, the estimated match formation rate, λ, is bigger than the rate at which a match exogenously breaks, δ. During the 1995-2014 period, on average, a politician is poached 3.05 times by outside parties before his membership ends exogenously. The average length of a party affiliation spell implied by the model, $\int_0^\infty tp(t)dt = \frac{1}{2}[\frac{1}{\delta} + \frac{1}{\delta+\lambda}]$, is about 138 weeks or 2.66 years.[29] Compared to the right-wing parties, members of the left-wing parties have a higher exogenous layoff rate, which may be because of the higher dissolution frequency of the left parties. The left-wing party members are also more frequently contacted by other parties, which may be because either of the replacement of the dissolving parties with similar ones or the better ideological cohesion and the lower costs of meeting potential members among the left parties.

In comparison to the entire sample, the estimated rate of exogenous match dissolution for the 2002-2014 period is about the same but the estimated number of outside offers is almost halved. The lower match formation rate may be because of the existence of fewer competing parties (33 vs. 25) or the increased monopsonistic power of party leaders that arise from the higher costs of part switching in a highly polarized political atmosphere.

[29]The mean party membership duration is estimated to be much lower than the mean employment duration estimated by CPR, reflecting the instability in party structures.



(a) All parties

(b) Left- and right-wing parties

Figure 2: Estimated Party Sizes

Panel (a) in Figure 2 plots the maximum likelihood estimates of the party types for the 1995-2014 and 2002-2014 periods. The correlation between the vote shares and the estimated party sizes is 0.98. Thus, the ordering of the estimated party sizes is highly consistent with the ordering of the parties' vote shares. In the entire sample, there are 23 small parties whose sizes are estimated to be within the 26-213 band and 9 parties whose sizes are distributed within the 458-2,736 band. There is one outstandingly large party, with an estimated size of 8,830, which formed a majority government in 3 consecutive terms between 2002 and 2014. The distribution of smaller parties is similar in the 2002-2014 period to the entire sample. However, there are fewer medium-sized parties during 2002-2014. Panel (b) shows that the distribution of the smaller parties are similar for the right- and left-wing of the political spectrum. However, there are more medium- and large-sized parties on the right.

Table 5 presents the estimates of the structural parameters. Throughout estimation, the parameter characterizing the club goods production, η_1, is restricted to be between 0.01 and 0.99.[30] The estimate of η_1 is 0.99, 0.68, 0.98, and 0.91 in the sample of all, left, right, and the 2002-2014 period parties, respectively.[31] Because the rent production function is assumed to have the form $\theta(x) = log(x)$, given a party's total resources, the estimated value of η_1 indicates the relative ease of the production of club goods and private rents. The estimates show that club goods are produced more easily than rents in all samples. However, the estimated club goods parameter is not significant in the sample of the left-wing parties.

[30]The upper (lower) bound of η_1 in MATLAB's fmincon function is chosen to be 0.99 (0.01) because the likelihood function behaves badly when η_1=1 (0). In all samples, different configurations of initial parameter values converge to the same parameter estimates.

[31]The categories of other and bureaucracy are omitted due to multicollinearity.

Table 5: Maximum likelihood estimates of the structural parameters

	Entire	Left	Right	2002-2014
Parameters				
η (club goods)	0.99*** (0.04)	0.65 (0.40)	0.98*** (0.05)	0.91*** (0.02)
σ_ϵ	2.68*** (0.25)	0.96** (0.43)	3.75*** (0.56)	0.01*** (0.04)
Characteristics				
Constant	9.98*** (0.56)	7.96** (3.36)	8.73*** (0.63)	7.18*** (0.05)
Architecture and engineering	-1.16*** (0.36)	-1.12** (0.53)	-1.77 (0.70)	-0.32 (0.18)
Arts, sports, and media	0.29 (0.39)	-0.55* (0.33)	0.36 (0.87)	0.68** (0.26)
Business	-0.14 (0.23)	-0.96** (0.45)	0.87* (0.46)	0.25** (0.11)
Business and financial operations	0.15 (0.32)	-1.76** (0.38)	0.57 (0.60)	0.25** (0.12)
College	-0.69*** (0.23)	-0.36 (0.22)	-0.64 (0.39)	-0.48* (0.08)
Community and social service	-0.07 (0.51)	-0.29 (0.37)	0.12 (0.93)	-0.37 (0.72)
Construction and extraction	-0.62 (0.46)	-1.54* (0.82)	0.53 (0.88)	0.47 (0.38)
Education, training, and library	-0.10** (0.29)	-0.60* (0.22)	-0.58* (0.41)	-0.68*** (0.12)
Farming, fishing, and forestry	0.08 (0.46)	0.21 (0.31)	-2.08* (1.09)	0.36 (0.31)
Female	0.43 (0.27)	0.04 (0.16)	1.10*** (0.55)	-0.13 (0.09)
Healthcare	-1.95*** (0.50)	-1.60** (0.76)	-2.32** (0.95)	0.18 (0.27)
Legal occupations	-1.29 *** (0.40)	-1.12** (0.53)	-2.22** (0.83)	-0.92*** (0.12)
Life, physical, and social sciences	-1.08*** (0.41)	-0.66* (0.38)	-1.83** (0.77)	-0.33* (0.19)
Management	-1.31 *** (0.44)	-1.33 (0.83)	-2.20*** (0.69)	-0.36 (0.31)
No occupation	-2.26*** (0.56)	-1.80** (0.85)	1.74 (1.22)	-0.27 (0.42)
Office	-0.59 (0.99)	-1.64* (1.94)	0.83 (1.72)	0.53 (0.41)
Production	2.12*** (0.39)	0.21 (0.20)	3.15*** (0.94)	1.14*** (0.26)
Retired	0.66 (0.56)	0.11 (0.35)	0.85 (1.00)	-0.41 (0.31)
N	35,781	14,297	21,484	21,790
$\frac{1}{N}\sum_i logL_i$	-0.663	-0.637	-0.674	-0.492

Notes: Standard errors are in parentheses. *,**, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. Fractions are rounded to the nearest significant digit.The unit is the standard deviation of voters' taste shock for not voting any party. Since different party size estimates are used, the unit of the last column is different from the units of the other three.

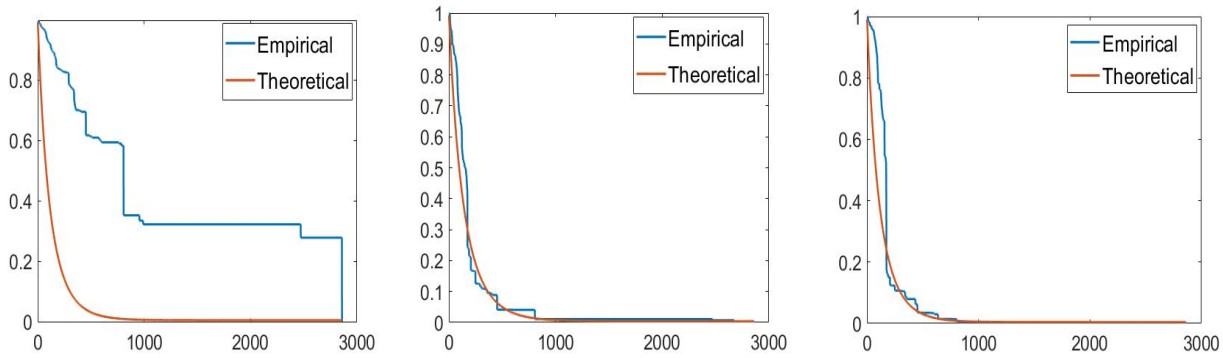
In the entire sample, out of twenty observable politician characteristics, only female, retired, other, and production have positive coefficient estimates. Among these four characteristics, only production has a statistically significant coefficient estimate. These results may seem striking, especially because having a college degree, or an occupation in business, bureaucracy, healthcare, management, engineering, education, life sciences, bureaucracy, and the legal sector all have statistically significant negative coefficient estimates. To interpret

these results, recall that there is large heterogeneity in politicians in the sample. Bigger parties have many members, which makes it difficult to get into the lists. As a result, politicians who get priority in the ballot lists tend to have stronger political assets and outside options compared to other members. Smaller parties, on the other hand, have fewer members. Because of the lack of within-party competition, a politician who has little in political assets can enter a small party's ballot list. Since I estimate the contribution of politician characteristics on their assets on average, the richer politicians' large assets may be captured by the mean of unobserved heterogeneity. Separating the sample into the right- and left-wing parties provides some evidence in favor of this argument. The average size of a party is larger for the right-wing parties, and the coefficient estimates of the politician characteristics are typically larger for the members of the right-wing parties. The exceptional cases where the coefficient estimates for the right-wing politicians is significantly lower than that of the left are life, physical, and social sciences, healthcare, legal occupations, and management. About 6% to 9% of all politicians in these categories are in the largest party which is four times as big as the next biggest party (see the online appendix for details). Since the largest party is a distinct outlier, it is possible for the party to have the majority of the low-type politicians who demand little private rents, which can explain these results. The second way that we can interpret these results is as follows. Having a college degree or specialization in a prominent occupation may prevent a politician from engaging in activities to influence government institutions in his interest, such as employing one's supporters in municipalities, which would explain the negative coefficient estimates of these variables.

The last column of Table 5 presents the results for the 2002-2014 period. Note that since I use the 2002-2014 estimates of the party sizes, the unit of these estimates is different from the unit of the estimates for the entire sample. Although the 2002-2014 period was dominated by a party that formed a majority government in 3 consecutive terms, the results are qualitatively similar to those for the entire sample.

6.1 Model fit and specification tests

In this section, I compare the frequency of party switching implied by the model to the observed frequency of party switching. The results of various specification tests are provided in Appendix B. Figure 3 plots the theoretical and empirical survival functions for the duration of a politician's party membership spell for the entire sample as well as separately for members of right- and left-wing parties. The empirical survival function is estimated by modifying the Turnbull estimator to account for the right- and interval-censored observations (Turnbull 1976, Klein and Melvin 2005). The theoretical survival function is plotted



(a) The entire sample (b) Members of right parties (c) Members of left parties

Figure 3: Goodness of fit: Comparison of empirical and estimated survival functions

after substituting the estimated labor market transition parameters into the likelihood of observing a given membership duration (equation 5.1).

The figure shows that the model significantly overestimates the rate at which politicians switch their parties in the whole sample. The higher inertia in data can be due to at least two phenomena that are not accounted for in the model. First, politicians who approve their parties' ideological positions may be less interested in switching to parties that provide greater political benefits. Indeed, when I consider the right- and the left wing of the political spectrum as separate labor markets, the model fit improves significantly. Still, the hazard rate of leaving a party after a short duration is overestimated in both samples, especially for the left-wing parties. Second, elected politicians and politicians who never gain access to the Parliament may have different offer arrival rates, which I do not account in my model.

7 Counterfactual exercises

7.1 Adjusting the model to different political systems

The model described in section 3 studies a party-centered democracy. In this section, I argue that it can be adjusted to other political systems by preserving the entire structure but altering the rent production mechanism and politicians' bargaining power.

7.1.1 Rent production mechanism

In contrast to a party-centered system, a candidate-centered democracy allows a politician to produce rents with more independence (because voters can vote for individual candidates who campaign for themselves). Thus, while all party members aggregate their assets to

collaboratively produce their party's rents in a party-centered system, a politician produces rents using his own resources without the help of the other party members in a candidate-centered system. Formally, when a type-z politician matches with a type-x leader, they bargain over a share ϕ over the politician's rent production, $\theta(z)$.[32] The online appendix derives the equilibrium of this system by following the same steps in sections 3.4-3.9.

7.1.2 Politicians' bargaining power

In addition to party-centeredness, political systems also differ in the bargaining power they assign to politicians during membership negotiations. For example, in the open-list systems of Belgium, Finland, and Sweden, among others, the party leaders select candidates and order them in priority for winning seats. However, voters can also vote for their preferred candidates, and a candidate may take priority over the party's other candidates who are listed more highly if he gets sufficient preference votes. As a result, open-list systems can be considered as a market where parties produce rents as a team but the politicians have more bargaining power during the membership process. Similarly, to the extent that candidates need the approval of party authorities, a politician' bargaining power in a candidate-centered system would be limited. The equilibrium rent share of a politician with bargaining power in either a candidate- or party-centered democracy is derived by allowing him to get a share $\beta \in (0, 1)$ of the match surplus (following CPR), which is shown in the online appendix.

7.1.3 Classifying different systems along two dimensions

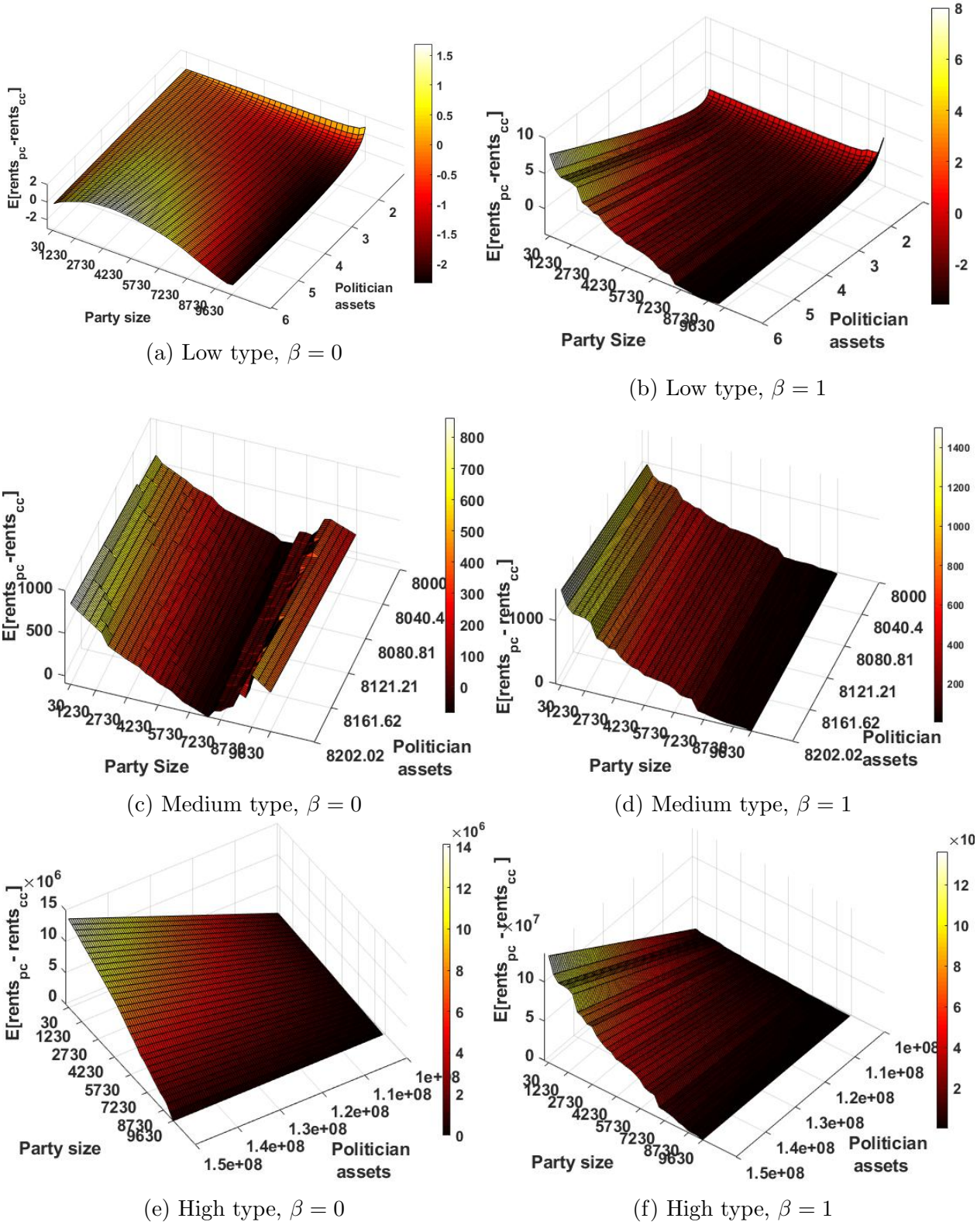
In the most party-centered system, a party produces rents as an entity and a politician, who needs the approval of a party leader to get into the ballot list, have no bargaining power. The closed-list systems of Argentina, Israel, and Turkey can be considered as exemplifying such a system. In the most candidate-centered system, on the other hand, a politician produces his own rents, and he has the entire bargaining power. This can arise, for example, if he does not have to share his rents with the party leader to join a party as in the United States. I argue that we can model all systems as a combination of these two extremes (see footnote 32). Politicians have more bargaining power in systems where they can easily join a party. On the other hand, the systems where politicians can produce votes independently are more candidate-centered. In section 7, I compare the equilibrium of different systems.

[32] In some electoral systems, a politician's rent production may depend on both his individual campaign and his contribution to his party's campaign. In this case, the rent production mechanism might be of the form $\alpha_1\theta(z) + \alpha_2\frac{z}{x}\theta(x)$, for $\alpha_1, \alpha_2 \in [0, 1]$, where z and x are the politician's and his party's assets, respectively. Adjusting the model to such systems is straightforward. For brevity, this paper focuses only on the fully candidate ($\alpha_2 = 0$)- or party-centered ($\alpha_1 = 0$) systems.

7.2 Comparison of power distribution in parties across different systems

This section compares the rents a politician earns in a party across different political systems. The difference between the rents a politician earns in a party across different systems is determined by three elements of the model. First, unlike party-centered systems where a politician's assets are more productive in smaller parties, candidate-centered systems allow a politician to produce the same amount of rents in all parties. This implies that, a politician is more productive in small (large) parties in a party (candidate)-centered system. If that were all that mattered, politicians in small (large) parties would earn more (less) rents in a party (candidate)-centered system. However, the productivity difference across the two types of systems translates into a difference in the option value of party membership. In both systems, a politician with limited bargaining power would be willing to forgo today's rents in expectation of earning higher rents in the future (which would arise from receiving lucrative outside offers). Depending on the difference in the values of the parties that would improve the politician's rents, this option value effect may be either smaller or bigger in a candidate-centered system. Third, differences in party values across the two systems translate into a difference in the value of politicians' outside options. If the parties that a politician ranks more lowly than his party are more valued in a party-centered system, then, on average, he would have better outside options and earn higher rents in that system.

Since low, medium, and high types of politicians differ in their ranking of the parties, in what follows, I analyze the difference between a politician's rents across the two political systems for each subgroup of politicians. Figure 4 shows the expected rents a politician earns in a party-centered system in excess of his rents in a candidate-centered system. Panel (a) shows that, when a low-type politician has no bargaining power, he earns more rents in smaller (bigger) parties in a party (candidate)-centered system. This is because a low-type politician ranks the parties vertically in both systems and he is more productive in smaller (bigger) parties in a party (candidate)-centered system. Moreover, the expected rent difference is hump-shaped, which reflects the differences in the expected value of a politician's outside option as well as the option value of party membership across the two systems. In medium-sized parties, there are more politicians with better outside options, compared to, say, the first party in which all low-type members' outside option is to be an independent. However, the option value of membership in a candidate-centered system is bigger in larger parties where the politician is more productive. As a result, the expected rent difference increases in party size as long as the effect of the outside option dominates the effect of the option value and decreases afterwards. When politicians have more bargaining power,



(a) Low type, $\beta = 0$

(b) Low type, $\beta = 1$

(c) Medium type, $\beta = 0$

(d) Medium type, $\beta = 1$

(e) High type, $\beta = 0$

(f) High type, $\beta = 1$

Figure 4: Comparison of the rents of a politician across party-centered and candidate-centered systems

since they are able to extract more out of the match surplus, the negative option value effect disappears. For example, when the politician is able to extract the entire match surplus, as in Panel (b), the effect of the outside option vanishes and the extra rents a politician earns in a party-centered system decreases monotonically in party size.

Because a medium-type politician's ranking of the party values differs across the two systems, the expected rent difference is not monotone in party size. Panel (c) shows that, when a politician has no bargaining power, on average, the rents he earns in a party-centered system in excess of the rents he earns in a candidate-centered system are decreasing in party size from the smallest party to his lowest-ranked party and increasing afterwards. This is because, in party-centered systems, the average value of a politician's outside option decreases in party size over the first part of his U-shaped returns to party size and increases afterwards. When the politician is able to extract the entire match surplus, as in Panel (d), the effect of the outside option disappears and the difference between the rents the politician earns across the two systems decreases monotonically.

A high-type politician prefers a party-centered system independent of his degree of bargaining power. This is because the effects of outside options, option value, and productivity all work in the same direction and make the smaller parties more attractive to him, as shown in panels (e) and (f).

7.3 Comparison of party-size distribution across different systems

The counterfactual exercises in the previous section provide a new perspective to understand the differences in party-size distributions across countries. The results suggest that there will be fewer parties as candidate-centeredness and politicians' bargaining power in a political system increases. For example, in a candidate-centered system where politicians can easily join a party, a politician who has the ability to form a small party would instead prefer to join a bigger one. This is because he produces the same amount of rents in all parties but bigger parties provide more club goods. When all politicians act this way, only 2 parties of the same size can survive in equilibrium. In a party-centered system, on the other hand, a politician who has the ability to form a small party may prefer it over joining a bigger party. This is because by aggregating all members' assets, a party leader can produce greater rents than what she could produce on her own. Moreover, when politicians have little bargaining power, she can control the use of the majority of party's collaboratively produced rents.

8 Concluding Remarks

In this paper, I develop and estimate an equilibrium model of team production in a labor search environment. Team production is characteristic of many industries, including the high-tech industry, academia, the healthcare provision industry, and the political arena. The workers' career choices and the distribution of production surplus in each of these industries depend on the characteristics of the industry as well as the features of team production. In each of these industries, a smaller team produces a lower amount of output but gives its members the opportunity to be more influential by using their skills more productively. In the high-tech industry, for example, we observe skilled engineers leaving giant tech companies to establish their start-ups, where the more productive use of their skills translates into higher earnings. In academia, we frequently observe established professors moving to smaller institutions where their skills play transformative roles. Similarly, in the political arena of a parliamentary democracy, we observe politicians who switch to smaller parties and gain more say in party politics due to the smaller parties' greater needs for their political assets.

The effects of the distribution of production surplus in political arena extend beyond the agents in the political arena. This is because the political arena is a market for producing political power, and policy choices of a country depend on how power is distributed. Party-centered systems that yield monopsonistic recruiting power to the leaders are especially vulnerable to strong party leaders. Moreover, I find evidence that party control over government functions in these systems generates valuable club goods, which increases the value of party membership. In this environment, politicians may relegate the use of their political power to party authorities when membership is more valuable than acting independently. This implies that the political power, and, in turn, the determination of all social and economic policies, may be left to a few strong party leaders instead of a broader set of representatives. This result is especially important for understanding how liberal democracies can be vulnerable to power concentration.

The dynamic analysis of the interactions between politicians and party leaders provides an estimable framework to think about how to design electoral institutions to prevent the concentration of political power. Term limits, party-switching costs, and other career-constraints decrease a politician's expected future gains from politics, which would cause him to demand greater power for joining a party.

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Appendix A Identification

This section shows that the model is nonparametrically identified. Throughout the section, I focus on equilibrium where the maximum rent share a leader pays to a politician, $\phi^{l^*}(z,x)$, is 1. As a result, the arguments of the party-switching threshold functions, $x_a(\cdot)$ and $x_b(\cdot)$, defined in equation 3.6, reduce to the types of a politician and his party, z and x. Similarly, the arguments of the functions defining the thresholds for joining a party from the pool of independent politicians, $x_{a0}(\cdot)$ and x_{b0}, defined in equation 3.5, are the politician's type, z.

A.1 The hazard function and the agents' types

The distribution of the politicians' types is recovered from the hazard of leaving a party, which, in turn, is nonparametrically identified. Suppose that we observe M characteristics

of politician i's private assets, $\{y_{im}\}_{m=1}^{M}$. There is also an unobserved component of politician i's assets, ϵ_i, distributed $H(\cdot)$ with $h(\epsilon) > 0$ on $(-\infty, \infty)$. Politician i's assets are equal to

$$z_i \quad = \quad exp(\sum_{m=1}^{M} y_{im}\beta_m + \epsilon_i). \tag{A.1}$$

Accordingly, identification of the distribution of politicians' types is equivalent to identification of the contribution of the observed characteristics to a politician's assets and the distribution of the unobserved heterogeneity, which are shown in the next subsections.

A.1.1 Application of Evdokimov (2011)

This section discusses the applicability of Evdokimov (2011) for the identification of the hazard function and the distribution of the unobserved heterogeneity. Let $y_i = [y_{i1}\ y_{i2}\ \ldots\ y_{iM}]$ be the vector of politician i's observable characteristics. Denote a politician's type as

$$log(z_i) = \bar{z}(y_i, \beta) + \epsilon_i. \tag{A.2}$$

Since all party transition processes are Poisson, all corresponding durations are exponentially distributed conditional on a politician's and his party's types. The stationary decision rules in equation 3.6 imply that the hazard of a type-z politician leaving a type-x party is

$$a(y, x, \epsilon) \quad = \quad \delta[1 + \kappa[F(x_a(\bar{z}(y_i, \beta), \epsilon_i, x)) + \bar{F}(x_b(\bar{z}(y_i, \beta), \epsilon_i, x)]] \tag{A.3}$$

with corresponding survivor function

$$S(t|\tilde{z}, x) = \int_0^{\infty} e^{-\int_0^t a(y,x,\epsilon)ds} h(\epsilon)d\epsilon. \tag{A.4}$$

The left-hand side of equation A.4 is identified from data given x. The hazard function $a(y, x, \epsilon)$ and the conditional distribution of the unobserved heterogeneity, $h(\epsilon|y, x)$, on the right-hand side are also identified by theorem 5 in Evdokimov (2011). This theorem shows the sufficient conditions for the identification of the transformation models of the form

$$\Lambda_j(t_j, y, x_j) = m(y_j, x_j, \epsilon) + u_j. \tag{A.5}$$

The hazard function in equation A.3 is a special case of the models defined by equation A.5, where $F(u_j|y, x_j) = 1 - exp(-e^u)$, $exp(\Lambda_j(t_j))$ is the integrated baseline hazard of spell j of length t_j, and $a(y, x_j, \epsilon) = exp(-m(y, x_j, \epsilon))$.

The types of models that Evdokimov considers are more general than the model in equation A.3, and, in general, the required conditions for identification include a random sample of two spells for each individual. In particular, for time-variant hazard models, two spells for a subsample with time-invariant covariates are required for identification of the time-varying component of the hazard function in a fashion similar to Honore (1993). Identification of the time-invariant component of the hazard function, on the other hand, requires a subsample with time-variant covariates, the necessity of which stems from the need for a scale normalization for the unrestricted distribution of the unobserved heterogeneity. With time-variant covariates and two spells for each individual, it is possible to normalize the value of the time-invariant component of the hazard function for a specific covariate in a given spell. Then, the value of the hazard function for all possible covariates in the other spell can be identified up to this normalization. Since he requires two spells for each individual, he chooses the covariate to impose a normalization on as one that each individual can obtain in their second spell independent of what their covariates were in their first spell. Note that, two spells for each individual is not a requirement for applying Evdokimov's theorem to a time-invariant hazard function, as one only needs to normalize the value of the hazard function for a specific covariate. In this paper, the politicians' types are constant over time, but their party affiliations may change. Accordingly, Evdokimov's result applies after normalizing the value of the hazard function for an arbitrarily chosen party type.

A.1.2 The types of the agents

Having identified the structural hazard function conditional on the agents' observed characteristis, the contribution of the observables to a politician's private assets can be identified from the derivatives of equation A.4 with respect to β_m for $m = 1, 2, ..., M$. Then, the types of the parties are also identified using the equilibrium density of each politician type in a party which was derived in equations 3.17. Formally,

$$x = \int_0^{z^{max}} z g(z|x, \Phi^{l^*}(\phi^{l^*}(z,x))dz) = \int_0^{z^{max}} z \frac{\delta(\delta+\lambda)}{\Big[\delta + \lambda[F(x_a(z,x)) + \bar{F}(x_b(z,x))\Big]^2} \tilde{\ell}(z)dz \quad (A.6)$$

where the denominator is the square of the hazard of leaving a type-x party for a type-z politician, which is nonparametrically identified. Moreover, the effective distribution of politician types, $\tilde{L}(z)$, is the convolution of the distributions of $\sum_m y_m\beta_m$ and ϵ. Since the distribution of $\sum_m y_m\beta_m$ is identified from the data and $h(\epsilon|y,x)$ is derived nonparametrically, $\tilde{\ell}(z)$ can be derived by straightforward algebra.

A.2 Rent production function

This section discusses the identification of the rent production function and the voters' time-varying preferences for political parties using the vote shares. To do this, I deviate from the model in section 3 in two ways. First, although the assumption of constant party rents is preserved, I deviate from stationarity by assuming that the voters have unobserved preferences for each party that is common among the voters but varies over time.[33] Second, although the model assumes the existence of a continuum of parties, in the empirical section, I assume that there are $k \in \{1, 2, ..., K\}$ parties participating in an election.

In section 3.3, the value of voting for party k for voter i in district c, v_{ikct}, is given by

$$v_{ikct} = \theta(x_k) + \xi_{kct} + \epsilon_{ikct} \tag{A.7}$$

where ξ_{kct} is the electorate's unobserved preference for party k in district c at time t and ϵ_{ikct} is an idiosyncratic taste shock. When ϵ_{ikct} is generated from an extreme value distribution as in the logit model (Anderson, de Palma, and Thisse 1992, Berry, Levinsohn, and Pakes 1995), the vote share of party k in district c at time t is

$$\nu_{kct} = \frac{exp(\theta(x_k) + \xi_{kct})}{\sum_{k=0}^{K} exp(\theta(x_k) + \xi_{kct})} \tag{A.8}$$

where $k = 0$ is the outside option, i.e., not voting for any party. Let voter i's value of not voting be $v_{i0ct} = \xi_{0ct} + \epsilon_{i0ct}$. Then the probability of not voting for any party is

$$\nu_{0ct} = \frac{exp(\xi_{0ct})}{\sum_{k=0}^{K} exp(\theta(x_k) + \xi_{kct})}. \tag{A.9}$$

The inversion theorem in Hotz and Miller (1993) implies that the vote shares, ν_{kct}, have a one-to-one relationship to the choice specific value functions, $\theta(x_k) + \xi_{kct}$. To see this, one can take the logs of each sides in equations A.8 and A.9 to obtain

$$log(\nu_{kct}) - log(\nu_{0ct}) = \theta(x_k) + \xi_{kct} - \xi_{0ct}. \tag{A.10}$$

We can identify the rent production function and the distribution of the voters' preferences for a party from equation A.10 conditional on having identified $x_k, \forall k$.

[33] Recall that the political rents were defined as the ability to influence the government institutions. I assume that the change in the vote share of a party does not influence how a team with certain assets can affect the decision makers in the government institutions. Time-varying preferences are included into the model solely for explaining the variation in the vote shares over time. Accordingly, I assume that the non-stationarity in voter preferences does not affect the equilibrium conditions derived in section 3.

A.3 Club goods production function

Given the types of politicians and parties, the conditional likelihood of the observed membership durations contains the necessary information to identify both the rent and club goods production functions. To see this, consider the probability of observing a membership duration of t for a type-z politician in a type-x party,

$$p(t|z,x) \;=\; \delta[1+\kappa[\bar{F}(x_b(z,x))+F(x_a(z,x))]]e^{-\delta[1+\kappa[\bar{F}(x_b(z,x))+F(x_a(z,x))]]t}. \quad \text{(A.11)}$$

The hazard out of a party, and, in turn, a politician's transition across parties contains information about the parties' rents and club goods only if the politician is a medium type. This is because, the hazard rate of leaving a type-x party increases in politician type on $(\underline{z}, z_0(x))$ and decreases on $(z_0(x), \bar{z})$, as $z_0(x)$ is the politician type who considers a type-x party as the worst. So, the derivative of the likelihood of a membership duration with respect to politician type should be decreasing on $(\underline{z}, z_0(x))$ and increasing on $(z_0(x), \bar{z})$. Then, the variation in the hazard of leaving a party across politician types identifies the club goods production function. Intuitively, one can think of the change in politician type as providing a variation in the demand for club goods, which identifies the supply of club goods. Moreover, given a politician type, the variation in the hazard of leaving a party across different parties identifies the overall ranking of party values, and, hence, enables one to identify the rent production function given club goods production function.

A.4 Discount rate

Having identified the primitive functions and the other parameters, the discount rate can be identified from a politician's spell of being an independent. Recall that, the lifetime utility of being an independent for a type-z politician is $V_0(z) = \frac{1+\rho}{\rho}\theta(z)$ (equation 3.6), and he accepts the membership offers of the parties that provide a lifetime utility that is at least as much as that of being an independent. Suppose that the politician accepts the offer of a type-x party when $x \in [x_{min}, x_a(z)] \cup [x_b(z), x^{max}]$, where the thresholds $x_a(z)$ and $x_b(z)$ are the types of two parties that provide the same lifetime utility to the politician as that of being an independent. Accordingly, these threshold party types solve

$$\begin{aligned} &V_0(z) = V(z,1,1,x_a(z)) = V(z,1,1,x_b(z)) \\ &\implies (1+\rho)\theta(z) = \frac{z\theta(x_a(z))}{x_a(z)} + \psi(x_a(z)) = \frac{z\theta(x_b(z))}{x_b(z)} + \psi(x_b(z)). \end{aligned} \quad \text{(A.12)}$$

An independent type-z politician joins a party at rate $\lambda[F(x_a(z)) + \bar{F}(x_b(z))]$. So, the conditional probability of observing a spell of being an independent of length t_0 is

$$p(t_0|z) = \lambda[F(x_a(z)) + \bar{F}(x_b(z))]e^{-\lambda[F(x_a(z))+\bar{F}(x_b(z))]t_0}. \tag{A.13}$$

The derivatives of equation A.13 with respect to t_0 and z provide two equations that identify the hazard of joining a party for different types of politicians. Identifying the hazard of joining a party, in turn, identifies the discount rate because having identified z, $\theta(x)$, and $\psi(x)$, equation A.12 depends only on ρ.

Appendix B Specification Tests

This section presents the results of two specification tests. First, I conduct a Wald test for the hypothesis that the contribution of all observed characteristics of a politician to his political assets is zero. This test yields a p-value less than 10^{-5}. Thus, the coefficient estimates of the politician characteristics are jointly significantly different from zero.

Second, I conduct a Wald test for the hypothesis that a party that forms a majority government cannot produce additional club goods. To do this, I reestimate the model by allowing the party that formed a majority government during 2002-2014 to have additional club goods production.[34] Formally, if a type-z politician joins the governing party x_M with share ϕ, then the politician's payoff from this membership is given by

$$u(z, \phi, x_M) = \frac{z\phi\theta(x_M)}{x_M} + \psi(x_M) + x_M^{\alpha}, \tag{B.1}$$

where x_M^{α} is the club goods that arise from party control over government functions. Testing $H_0 : \alpha = 0$ yields a p-value of 0.74. Thus, I fail to reject that party control over government functions do not generate additional club goods. Note that some of these additional club goods may be associated with winning seats in parliament. If this is true, then other parties that win seats in parliament should also be allowed to produce additional club goods. However, I cannot test this hypothesis because the model is identified only when at least 3 electoral terms are used in the estimation sample and there are no three consecutive terms in which the same subset of parties won seats in parliament.

[34]Note that, in the new estimation sample, I only included the last three electoral terms in my dataset, during which a party formed a majority government consecutively. Nevertheless, the restricted model's estimates are fairly similar for the 1995-2014 and 2002-2014 terms.