ESSAYS IN PUBLIC ECONOMICS

YU WANG

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Supervisor of Dissertation

Holger Sieg, J. M. Cohen Term Chair in Economics

Graduate Group Chairperson

Jesus Fernandez-Villaverde, Professor of Economics

Dissertation Committee:
Holger Sieg, J. M. Cohen Term Chair in Economics
Kenneth I. Wolpin, Distinguished Research Professor and Lay Family Professor of Economics
Hanming Fang, Class of 1965 Term Professor of Economics

ESSAYS IN PUBLIC ECONOMICS

To My Parents

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ABSTRACT

ESSAYS IN PUBLIC ECONOMICS

Yu Wang

Holger Sieg

This dissertation consists of two essays. The common theme is Public Economics: to understand the effects of government policies in order to improve their design and to understand how special interest groups affect the local fiscal policies.

In the first chapter, I study the impact of student debt on the education, career, and marriage choices of female lawyers. Law students quite often take on substantial amounts of debt to finance their graduate education. There has been much concern in the legal profession and among policy-makers that this debt burden distorts career choices. The empirical analysis is based on a novel, nationally representative, longitudinal dataset. In contrast to the previous literature that has largely focused on males and finds only small effects, these new data suggest that debt has large and significant negative effects on female career and marriage outcomes. To explore the likely causes of these negative debt effects, I develop and estimate a dynamic model of education, labor, and marriage markets. My findings suggest that a large part of the debt effect on schooling and career choices comes from the diminished marriage prospects associated with the debt burden. I then focus on policies that aim to reduce the debt burden while also encouraging female lawyers to pursue careers in the public sector. My policy experiments show that subsidizing student debt repayment earlier in the career is more effective than doing so later.

In the second chapter, I study the impact of unions on municipal elections and urban

fiscal policies. The efficient decentralized provision of public goods requires that special interest groups, such as municipal unions, do not exercise undue influence on the outcome of municipal elections and local fiscal policies. I have assembled a unique data set that is based on union endorsements that are published in leading local newspapers. My empirical analysis focuses on municipal elections in the 150 largest cities in the U.S. between 1990 and 2012. I find that challengers strongly benefit from endorsements in competitive elections. Challengers that receive union endorsements and successfully defeat an incumbent also tend to adopt more union friendly fiscal policies.

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The Impact of Student Debt on the Education, Career, and Marriage Choices of Female Lawyers [1]

1.1 Motivation

Obtaining a J.D. is one of the most expensive possible investments in human capital. As a consequence, law students quite often take on substantial amounts of debt to finance their graduate education. There has been much concern in the legal profession and among policy makers that this debt burden distorts career choices. The purpose of this paper is to study the impact of student debt on the education, career, and marriage choices of female lawyers.

The empirical analysis is based on a novel, nationally representative, longitudinal dataset.

[1] The reviews and conclusions stated herein are those of the author and do not necessarily reflect the views of individuals or organizations associated with the *After the JD* or the *National Postsecondary Student Aid Study*.

In contrast to the previous literature that has focused largely on males and finds only small effects, these new data suggest that debt has large and significant negative effects on female career and marriage outcomes. Specifically, women with more debt stay longer in private sector jobs, postpone marriage, marry men with lower earnings, and delay childbearing.

These facts speak to a long-standing concern of the legal profession: does high student debt impel law graduates to eschew public service jobs in favor of more lucrative positions in private practices? The answer has important policy implications regarding the launch and design of public service loan forgiveness programs. Much of the previous literature suggests that the career choices of male lawyers are not related to student debt, and that the effects of such policies are not pronounced. However, these policies may effectively increase public service employment of females, who account for nearly half of a typical cohort.

Another part of the research question, namely how potential debt burden affects schooling choices, is particularly relevant in the legal profession. Law school costs rise substantially with school rankings and induce a palpable quality-price tradeoff for applicants. If the debt burden affects female choices post-graduation, the top law schools may be even more costly for females who resort to student debt in order to finance their education. This paper analyzes the extent to which students of equal ability but different means may choose lower-ranked, cheaper law schools in order to avoid the debt burden.

To address these questions, I develop a dynamic model of the education, labor, and marriage markets. Students first need to choose among a set of differentiated law schools to some of which they are admitted. Schools differ by costs and rankings. Upon graduation all students enter the labor market which offers a number of occupational tracks such as private law firms, private companies, and public sector jobs, in addition to the option to

stay at home. At the same time, female lawyers are active in marriage markets. Potential marriages depend flexibly on one's debt burden and individual characteristics.

Labor markets for lawyers have some special features that deserve attention. First, young lawyers employed at private law firms often face an up-or-out decision regarding promotion to partner. Promotion is highly uncertain. This system is similar to that of tenure in academia. A key feature of the model is thus a learning process which allows young lawyers to infer the likelihood of promotion based on their work experience. I show that a learning model can explain the rapidly declining prevalence of private law firm jobs during the life cycle as observed in the data. Second, this paper models differences in the required number of hours of work in addition to differences in salaries among occupational tracks. This approach is consistent with the fact that lawyers in private law firms tend to work longer hours than those in the public sector or at private companies. Finally, this model accounts for the importance of clerkships for young, aspiring lawyers who may delay entry into the job market so as to gain additional training.

The objective of the structural analysis is to evaluate the importance of alternative mechanisms that may explain why debt has such a large impact on female lawyers. In the model, debt affects the lifetime budget constraint and thus primarily influences consumption and labor supply choices over time. In addition, debt affects prospects in the marriage market.

The key empirical finding of this paper is that differences in female career choices are driven in large part by marriage market prospects. If one equalizes marriage market prospects for females with and without debt, the differences in labor market choice shrink substantially. The intuition is that females with large debt have fewer opportunities in

the marriage market, and thereby experience poorer marriage outcomes. Consequently, it takes them longer to meet a qualified spouse and to have children. The second finding is that females significantly under-invest in education quality in anticipation of the diminished marriage market prospects associated with their future debt burden.

Using the estimated parameters from the structural analysis, I finally turn to evaluating loan repayment assistance programs. My main contribution here is to show the importance of timing for such policies. The motivation is that females, on average, graduate at age 28 and, as discussed above, the debt effect through marriage prospects is large. In light of this, the existing Public Service Loan Forgiveness Program offered by the Department of Education, which requires ten years of public service for eligibility for loan forgiveness, offers potential room for improvement. I compare a loan forgiveness policy similar to the Public Service Loan Forgiveness Program to a career-contingent tuition waiver policy. The tuition waiver policy conditionally discharges a fraction of debt immediately upon graduation, which is repayable if a job in the public service is not held for a specified number of years. The main finding is that it is much more effective to subsidize debt sooner rather than later.

My work builds on the literature studying how student debt affects career choices. Using a sample consisting exclusively of male law students from University of Michigan, Sauer (1998, 2004) finds that student debt has only a modest influence on career choices during the first 15 years after graduation. I differ by focusing on career choices of female lawyers. Field (2009) exploits a natural experiment including both male and female students at NYU's law school and finds that student debt strongly discourages public sector employment in the first two years of a person's career. Rothstein and Rouse (2011) reach similar conclusion exploiting a natural experiment with a sample of undergraduate students. I complement

these studies by examining female career choices over a longer and more important horizon and by decomposing the underlying mechanisms.

The literature on the relationship between student debt and marriage choices is sparse. Addo (2014), Bozick and Estacion (2014) and Gicheva (2014) document that the amount of accumulated student debt is negatively related to the probability of first marriage using nationally representative samples of *National Longitudinal Survey of Youth 1997* (NLSY97) participants, bachelor's degree recipients, and MBA students respectively. I complement this literature by documenting differences in marriage quality in addition to differences in marriage rates. Moreover, while these studies investigate the debt effect on observed marriage outcomes, I am able to isolate the debt effect on marriage opportunities with the aid of a structural model in which the timing of marriage is a choice.

There is a large literature studying how student debt policies affect schooling decisions.[2] The main finding is that the relaxation of the borrowing limit in the schooling stage does not significantly increase college enrollment. I differ by evaluating a different set of student debt policies, namely, policies subsidizing repayments in the post-graduation stage. I also measure choice of school quality – an under-studied outcome – rather than educational attainment.

Overall, I contribute to the student debt literature by jointly analyzing the education, labor, and marriage markets. By connecting these markets, I demonstrate that policy interventions in the labor market can be designed more effectively by accounting for the debt effects in the marriage market.

[2]See, for instance, Belley and Lochner (2007); Cameron and Taber (2004); Carneiro and Heckman (2002); Johnson (2013); Keane and Wolpin (2001); Lochner and Monge-Naranjo (2011); Monge-Naranjo and Lochner (2012); Ramsey (2015); Stinebrickner and Stinebrickner (2008).

Furthermore, my modelling of the lawyer labor market builds on the literature studying the gender gap in wages and career advancement in high-paying occupations such as corporate management, law, and academia.[3] In this paper, I jointly model several elements identified as important in the literature by incorporating them into a coherent structural framework. These include the promotion structure, the time cost of childcare, and the decision to exit an occupation.

1.2 Data

1.2.1 Institutional Background

The cost of obtaining a J.D. has risen significantly during the past couple of decades. Tuition in 2014 was more than 60 percent higher in real terms than it was 15 years ago. Based on a survey by the Department of Education in 2011, the average cost of obtaining a J.D.[4] is $175,000 and remains as high as $152,000 even after including all grants. Consequently, J.D. students borrow an average of $105,000 during law school, in addition to student debt for prior education.[5]

There exists substantial heterogeneity in costs across schools, differences which are strongly correlated with school quality. In 2014, the average cost of a J.D. at a top 10 school was $257,000, which was $58,000 higher than at schools ranked in the 31-40 range and $78,000 higher than at schools ranked in the 91-100 range.[6]

[3] See, among others, Albanesi and Olivetti (2006); Azmat and Ferrer (2014); Bell (2005); Bertrand et al. (2010); Gayle et al. (2012); Ginther and Hayes (2003); Ginther and Kahn (2004); Goldin (2014); Selody (2010).

[4] Including tuition, fees, and living expenses.

[5] Calculated by author using *the 2011-12 National Postsecondary Student Aid Study* through *Powerstats*.

[6] Calculated by author using *the Official Guide to Law Schools*.

J.D. graduates have a variety of labor market choices. To facilitate the analysis, I classify the J.D. labor market into two broad occupations: the private law sector and the public/business sector. The public sector consists of lawyers who work for federal, state, and local governments, as well as public interest organizations. The business sector consists of in-house attorneys for corporations and J.D. graduates who don't practice law. This classification is consistent with the usual practice of the American Bar Association. To facilitate the analysis, I bundle the public and business sector into one category because they have similar workplace structures, salaries, and work hours, and because the latter sector is small in terms of share of employment.

The most unique feature that differentiates the private practice from the public/business sector is the partnership orientation. New J.D.s are usually hired as associates and will be evaluated for partnership promotion after six to nine years with the firm. Most large firms have an "up-or-out" policy in which associates who do not make partner are required to leave the firm.[7] Partners usually share directly in the profits of the firm and earn substantially higher salaries than associates. Partner positions can be regarded as tenured positions, as termination and forced retirement are rare. The promotion decisions usually depend on a number of factors including quality of past work, professional skills, ability to handle complex matters, and ability to originate new clients. Most law firms implement annual performance reviews of their associates. These are usually regarded as an essential part of associate development.

The private law sector also differs from the public/business sector in terms of work-life balance and pay. The private law sector is client-oriented, and profitability depends

[7]See Lehmann (2013) for more details.

critically on both the size of the client base and the number of billable hours they can charge. It is therefore commonplace for law firms to specify required minimum billable hours for associates, especially in big law firms. In addition, the work schedule in private practice can be quite inflexible in order to meet clients demands. In contrast, there is usually only one fixed client in the public/business sector, namely the government or the corporation in question. As a result, work hours are usually shorter and more regular, and the pay is much lower than in the private law sector.

There exists one special type of government job that warrants separate discussion, namely, judicial clerkships. The main task of clerks is to conduct research and draft memoranda and opinions for judges. Although regarded as intellectually stimulating and prestigious, these jobs are usually temporary and poorly paid. In that sense, they are similar to a postdoctoral position in academia. The judicial clerkship positions are usually open to new law graduates who spend a year or two clerking before embarking on their legal careers. In 2000, 11 percent of all J.D. graduates clerked after graduation. This rate was even higher among graduates of top 20 law schools at 24 percent.[8]

1.2.2 Sample

To analyze the impact of student debt on career choices and marriage outcomes, I need a dataset with measures of the debt burden, school choice, career choices, marriage outcomes, and childbearing decisions for each individual. In particular, to account for fundamental differences between sectors, the sampling period needs to be long enough to cover partnership promotions. I also need measures for individual characteristics that may affect labor market

[8]Calculated by author using *the Official Guide to Law Schools*.

decisions.

To this end, I exploit a novel dataset satisfying these requirements. *After the JD* is a nationally representative longitudinal dataset constructed by the American Bar Foundation and the National Association for Law Placement drawn from J.D. students graduating in 2000. The dataset covers the first twelve years of student careers. The estimation sample contains a total of 1193 female individuals. Appendix A.1 provides the details on sample selection. The respondents are surveyed three times: once each in 2003, 2007, and 2012. This study uses the first two waves as the third wave has not yet been released.[9]

Respondents report total student debt upon graduation and the remaining debt in 2006. They also report full employment history of organizational types and positions since 2000, as well as salary and working hours for their 2003 and 2006 jobs. Marital status in 2003 and 2006,[10] spousal salary in 2006, and the ages of all children as of 2007, are also reported. Individuals report their law school as well, but this information is censored by the American Bar Association. Instead, law schools are grouped into four tiers according to the rankings in *U.S. News and World Reports Rankings 2003*. This publication ranks the top 100 law schools in the country, and then assigns all unranked schools into one of two groups, Tier 3 or Tier 4. In the dataset, the American Bar Association bundles the top 20 schools as Tier 1 and the remaining ranked schools as Tier 2. So while I don't observe the law school that a particular individual attended, I do know which tier it belonged to.

Because debt is an endogenously chosen variable, one that is strongly related to the choice of law school, I also need data on the initial conditions of individuals when making

[9] 2012 results will be incorporated into the analysis once available.

[10] Cohabitation is counted as marriage. Cohabitation accounts for 3 percent of whole sample. The results change little by treating cohabitation as single.

law school choices. For example, it is important to have information about unpaid debt from prior education and available monetary resources. To this end, I supplement *After the JD* with the *National Postsecondary Student Aid Study*, a nationally representative survey of students conducted by the U.S. Department of Education in 2000, approximately the same cohort as the respondents in *After the JD*. The dataset contains 170 female J.D. students. The dataset provides measures of outstanding college debt, various sources of funding for law school education, tuition and expenses, and other demographics.

An empirical challenge still remains for the analysis of the tradeoff between school quality and debt, as students are constrained by the admission rules of law schools. In both datasets, I observe the student's choice but not their choice set. Without explicitly accounting for the admission rules, it is hard to separate a student's preferences from her constraints when choosing schools. I therefore exploit another novel dataset, *Law School Numbers*. *Law School Numbers* was founded in 2003 as a free, publicly accessible database of user-supplied law school applicant information. Users provide LSAT, GPA, application and later admission portfolios. I extrapolate the admission rules in 1997 based on the 15,222 observations from the 2003-2008 cycles.

Table 1.1 provides selected summary statistics. *Prior debt* represents the unpaid college debt, with an average of $\$9,400$, which is much lower than the total amount of *debt upon graduation*, which averages $\$85,200$. *Savings* represents all the non-debt monetary resources students use to finance law school education, including family transfers, own savings, grants, etc. In particular, I treat grants as exogenous because merit-based institutional grants are very limited.[11] *Unpaid debt after 6 years* is still very high, averaging $45,400. Females J.D.

[11] In the sample, students on average receive $7,000 of merit-based institutional grant, which accounts for only 6 percent of the cost of J.D. education. Only 11 percent of students receive merit-based institutional

students on average graduate at age 28, further reinforcing the importance of modelling marriage and childbearing decisions in subsequent years. The median work week in the private sector is 5 hours, or 11 percent, longer than in the public/business sector, while the pay is around 40 percent higher.[12]

Table 1.1: Descriptive Statistics

		Mean	Median	SD	N	Dataset
Background	LSAT	157.9	158.2	6.8	170	NPSAS
	$I(3.75 \geq GPA \geq 4)$	25.9			219	AJD
	$I(3.50 \geq GPA \geq 3.75)$	26.4			223	AJD
	$I(3.25 \geq GPA \geq 3.50)$	24.1			204	AJD
	Age upon graduation	28.3	27.0	4.6	1174	AJD
	Prior debt	9.4	0.0	13.7	170	NPSAS
	Monetary resources	56.3	47.5	48.8	170	NPSAS
School Cost	Tuition	65.5	59.7	11.3	170	NPSAS
	Expense	55.7	54.0	2.6	170	NPSAS
Debt	Debt upon graduation	85.2	85.3	58.3	1193	AJD
	Unpaid debt after 6 years	45.4	35.2	46.6	1166	AJD
Pay and Hours (3 years post-graduation)	Private Law					
	Annual Salary	115.9	105.5	50.8	431	AJD
	Weekly Hours	47.8	50.0	12.7	405	AJD
	Public/Business					
	Annual Salary	80.0	64.3	80.7	279	AJD
	Weekly Hours	45.3	45.0	11.9	213	AJD
Pay and Hours (6 years post-graduation)	Private Law					
	Annual Salary	131.9	117.4	64.1	376	AJD
	Weekly Hours	48.9	50.0	13.4	442	AJD
	Public/Business					
	Annual Salary	98.9	89.2	40.6	403	AJD
	Weekly Hours	44.8	45.0	13.5	452	AJD

AJD refers to *After the JD*. NPSAS refers to *the National Postsecondary Student Aid Study*.
All monetary values are in thousands of 2014 $.

grant covering 20 percent or more of the cost.

[12]It is worth mentioning that the usual impression of long hours in the private practice may be more strongly driven by males, whose median hours in private practice is 8 hours longer than in the public/business sector. It could also be driven by the associates who work in big law firms. For instance, the median hours in law firms with more than 250 lawyers are 53 for females and 57 for males, which are 8 and 12 hours longer than their peers in the public/business sector. It would be interesting to conduct a gender difference analysis or to break down the choice sets further by including types of private law firms.

1.3 Measuring the Relationship between Debt and Choices of Female Lawyers

I start the empirical analysis by documenting four facts about the relationship between debt, career choices, marriage and childbearing outcomes. These facts motivate the modelling choices.

I divide the sample into three groups of similar size by the amount of debt upon graduation. I call these groups *Low Debt*, *Medium Debt*, and *High Debt*. The average debt loads for the three groups are $18,300, $84,900 and $145,500, respectively. I then calculate work experience, marriage rates, spousal earnings and the probability of having children for each group. I also calculate the gaps in these outcomes between each group and the *Low Debt* group.[13]

Fact 1 *Females with more debt have more work experience in private law firms.*

I calculate work experience in private law firms through 7 years post-graduation for each debt group. As displayed in Table 1.2, average work experience for the three groups is 2.52 years, 3.01 years, and 3.42 years, respectively. On average, private sector work experience in the *Heavy Debt* group is 36 percent greater than in the *Low Debt* group. T-tests and F-test show these gaps are statistically significant. This fact is consistent with Rothstein and Rouse (2011), who find that student debt causes undergraduate students at a highly selective university to avoid low-paid "public interest" jobs and choose substantially higher paying jobs instead. It is worth noting that females spend less than half of their early careers in private practice on average.

[13]In the Appendix A.2 I also list the regression results including more controls. Results are unchanged.

Table 1.2: Average Work Experience in Private Practice through 7 Years Post-Graduation (in years)

Group	Group Avg	Group Diff			
Low Debt ($18,300)	2.52		Mean	S.E.	t-stat
Medium Debt ($84,900)	3.01	Medium - Low	0.49	0.20	2.45
Heavy Debt ($145,500)	3.42	Heavy - Low	0.90	0.19	4.61
No differences across groups : p-value = 0.00					

Fact 2 *Females with more debt are more likely to postpone marriage.*

I calculate marriage rates by age 34 for each debt group. Table 1.3 shows that the marriage rates for the three groups are 74 percent, 69 percent and 65 percent respectively. A *Heavy Debt* individual is 12 percent less likely to be married by age 34 than a *Low Debt* individual. These gaps are statistically significant.[14] This fact is consistent with Addo (2014), Bozick and Estacion (2014) and Gicheva (2014), all of whom document that accumulated student debt is negatively related to the probability of first marriage using national representative samples of NLSY97 participants, bachelor's degree recipients, and MBA students respectively.

Table 1.3: Marriage Rates by Age 34 (in percent)

Group	Group Avg	Group Diff			
Low Debt ($18,300)	74		Mean	S.E.	t-stat
Medium Debt ($84,900)	69	Medium - Low	4.7	3.6	1.30
Heavy Debt ($145,500)	65	Heavy - Low	8.8	3.6	2.48
No differences across groups : p-value = 0.047					

Fact 3 *Spouses of females with more debt have lower earnings.*

I also compare the spousal earnings conditional on getting married. I use spousal earnings to measure the "quality" of marriages. Table 1.4 shows that spouses of *Low Debt* females

[14] I also calculate the marriage rates by other ages, but the pattern remains roughly the same both quantitatively and statistically.

earn an average of $113,000 annually, which is $16,000, or 16.5 percent, higher than their *High Debt* counterparts. To the best of my knowledge, this is the first study documenting the relationship between student debt and spousal earnings.

Table 1.4: Spousal Earnings 6 Years Post-Graduation (in 2014$)

Group	Group Avg	Group Diff			
Low Debt ($18,300)	113,000		Mean	S.E.	t-stat
Medium Debt ($84,900)	99,000	Medium - Low	14,000	9,000	1.52
Heavy Debt ($145,500)	97,000	Heavy - Low	16,000	8,000	1.97
No differences across groups : p-value = 0.12					

Fact 4 *Females with more debt are more likely to postpone childbearing.*

Lastly, I compare the probability of having a child by age 34 across debt groups. Table 1.5 shows that *Low Debt* females are 30 percent more likely to have children by age 34 than *Heavy Debt* females. To the best of my knowledge, this is the first study documenting the relationship between student debt and the probability of having children.

Table 1.5: Probability of Having a Child by Age 34

Group	Group Avg	Group Diff			
Low Debt ($18,300)	0.49		Mean	S.E.	t-stat
Medium Debt ($84,900)	0.43	Medium - Low	0.06	0.04	1.64
Heavy Debt ($145,500)	0.38	Heavy - Low	0.11	0.03	3.19
No differences across groups : p-value = 0.007					

In summary, these facts demonstrate that females with heavy borrowing have substantially different career, marriage, and childbearing outcomes. To understand these facts and to decompose the role of debt, it is important to develop a structural model for several reasons. First, in the data I only observe marriage and childbearing outcomes instead of options. Without accounting for the option to wait, I may either overestimate or underestimate the influence of debt burden. Second, females make joint decisions in the labor and

marriage markets, and the outcomes in the two markets may interact with each other. These interactions can be exploited to design more effective policies. Third, a structural model allows me to measure how the anticipation of a future debt burden distorts investments in schooling quality.

1.4 Model

1.4.1 Environment

The model consists of two stages, the schooling stage and the post-graduation stage. There are τ periods, with $t = 1, 2, 3$ corresponding to the schooling stage, and $t = 4, ..., \tau$ corresponding to the post-graduation stage. A period is equal to one year.

There is a continuum of females. Here I consider the decision problem of a single, childless female characterized by age A_t, undergraduate grade points average GPA, LSAT scores $LSAT$, monetary resources E, and unpaid student debt from undergraduate education D^U. E consists of parental transfers, own savings, grants, and other non-debt monetary resources that can be used to pay for tuition.

I include age because it is strongly related to the marriage decisions of females. I include GPA and $LSAT$ as the measure of academic skills or initial achievements, and also because they are the two most important determinants during admissions.[15]

There are J schools. School j charges tuition T_j, requires living expenses P_j, and implements admission rules $\Psi_j(GPA, LSAT) \in [0, 1]$. Compared with undergraduate schools, law schools offer fewer merit-based grants and scholarships. Therefore, I assume a common

[15] In particular, law schools are required to publish statistics on number of applications and offers in each interval of GPA-LSAT combination.

tuition rate for all students. Also note the admission rules $\Psi_j(\cdot)$ accommodate uncertainty in the admission process, since individuals with the same GPA and $LSAT$ can have different admission results.

Individuals make joint decisions at each period t regarding the following three sets of discrete alternatives: (1) which school to attend at $t = 1$, S_j ={1: school j is chosen, 0: otherwise}, $j = 1, ..., J$, (2) occupation choices O_{lt} ={1: position l is taken, 0: otherwise} at $t = 4, ..., \tau$ out of $l = 1, ..., 5$, (3) marriage timing decisions, M_t ={1: get married at t, 0: otherwise}. In particular, occupation alternatives consist of: a private law firm associate position ($l = 1$), a partner position ($l = 2$), a public/business sector position ($l = 3$), non-employment ($l = 4$), and a judicial clerk position ($l = 5$). The clerking option is only available at $t = 4$, the first year post-graduation.

I denote the marital status for each period by $m_t \in \{0, 1\}$ to differentiate from the marriage decision M_t. I denote the presence of children in the beginning of each period by $k_t \in \{0, 1\}$, which is an exogenous stochastic outcome.

1.4.2 Investment in Legal Education

At $t = 1$, the student applies to all schools and selects one from among those to which she is admitted. She needs to finance the cost of education $T_j + P_j$ with monetary resources E. If these prove insufficient, then she must borrow D_j^G, where

$$D_j^G = \max(T_j + P_j - E, 0) \tag{1.1}$$

The total accumulated debt upon graduation from school j is

$$D_j = D_j^G + D^U \tag{1.2}$$

The student can only borrow to finance tuition and basic living expenses. She cannot borrow to boost consumption in the schooling stage. Schooling choices are only made once at $t = 1$ and are irrevocable; students cannot drop out.[16]

Her flow utility from schooling stage is:

$$U_{jt} = \zeta_j + g_j(GPA, LSAT, E) + \varepsilon_{jt}^S \tag{1.3}$$

for $t = 1, 2, 3$. ζ_j is the consumption value of attending school j, which captures direct utility from consumption and nonpecuniary benefits, including safety, environment, location and other factors. g_j allows the preferences to depend on academic skills and monetary resources. For instance, top law schools usually feature strong competition among students, so those with better academic skills may adapt to the environment more easily than those with poor academic skills. In addition, top law schools are mostly private institutions. Thus, students with more monetary resources may find it easier to fit in. ε_{jt}^S is the student's idiosyncratic preference shock for school j, following a Type I extreme value distribution.

[16] 3-year attrition rates are as low as 5 percent, as calculated by the author using the enrollment and degrees awarded data published on the American Bar Association website, `http://www.americanbar.org/content/dam/aba/administrative/legal_education_and_admissions_to_the_bar/statistics/enrollment_degrees_awarded.authcheckdam.pdf`.

1.4.3 Post-graduation Stage: Flow Utility

The flow utility in the post-graduation stage is specified as follows for $t = 4, ..., \tau$:

$$\begin{aligned} U_{lt} &= C_{lt}^{\phi} L_{lt}^{1-\phi} + \mu_1 m_t + \mu_2 m_t L_{lt} + \mu_3 k_t L_{lt} + \mu_4 k_t C_{lt} L_{lt} \\ &\quad + \sum_{j=1}^{J} \mu_{5jl} S_j + \varepsilon_{lt}^{O} + \varepsilon_t^{M} m_t \end{aligned} \tag{1.4}$$

The budget constraints for consumption C_{lt} and leisure L_{lt} are as follows:

$$C_{lt} = W_{lt}(1 - m_t) + \gamma(W_{lt} + W_t^B)m_t - dp_t(D_j) \tag{1.5}$$

$$L_{lt} = H - H_{lt} - \lambda k_t \tag{1.6}$$

where W_{lt} is labor income, H_{lt} is working hours, W_t^B is income of the husband if applicable, $dp_t(\cdot)$ is the formula for the installment of repayment,[17] and ε_{lt}^{O} and ε_t^{M} are preference shocks associated with each choice variable. Debt repayments follow a 10-year schedule with equal installments and an interest rate of 7 percent. This specification is the default schedule in the federal student loan program. *After the JD* surveys have shown that the utilization of other repayment strategies is low. I am able to fit the remaining debt in 2006 quite well using this specification.

It is worth mentioning that the J.D. cohort of 2000 had very limited access to repayment

[17] The schedule for debt repayment is as follows:

$$dp_t(D) = D\frac{r}{(1+r)(1-(1+r)^{-T_0})} \tag{1.7}$$

$$dm_t(D) = D\frac{1-(1+r)^{(t-T_0-1)}}{1-(1+r)^{-T_0}} \tag{1.8}$$

where t is the period, dp_t is the annual repayment, dm_t is the remaining debt in the beginning of period t. T_0 is the initially scheduled length of repayment. Individuals pay equalized repayments during T_0. T_0 is set to be 10 years and r to 7 percent.

subsidies. For that reason, I do not incorporate any such policy into the baseline model.[18]

I follow Keane and Wolpin (2010) by including a time cost for taking care of children denoted by λ and an intra-family transfer rule γ. If the individual is married, she receives a share γ of total household income. Individuals derive direct utility from marriage and from the presence of a child. I allow these direct utilities to interact with consumption and leisure through coefficients μ_2, μ_3 and μ_4. For instance, females with expansive monetary resources can afford to make more expensive educational investments in their children and therefore derive greater happiness from the child's development. Also, individuals with more leisure can have better rest and relaxation and may enjoy childcare duty more than their busy peers.

Individuals receive a nonpecuniary benefit μ_{5jl} from each labor market position. This captures the role of work schedule flexibility, stress, social status, and other unobserved amenities. I allow the nonpecuniary benefits to differ by school in order to capture any lingering effects. Law schools differ substantially in culture and career orientation. For example, some schools may have better alumni connections in the private law sector. If their graduates choose private practice, they may find colleagues who share common values, experiences, and interests. This may lead them to attach a higher value to these types of jobs. In contrast, other schools may promote more strongly the mission and importance of public service. Their graduating students may find public sector employment more prestigious.

U_{lt} is concave in both consumption C_{lt} and leisure L_{lt}. As a result, debt not only affects the total budget and level of consumption, but also the marginal utility from consumption

[18]There are mainly two types of loan forgiveness programs, funded by the federal governments or by the law schools. The federal program requires 10 years of public service after October 2007. The school-funded programs were generally severely under-funded when the sample graduated. See National Association for Public Interest Law (2002).

and leisure. An individual with a heavy repayment burden may derive higher utility from a high-salary-long-hours job than a regular-salary-regular-hours job. They may also value monetary transfers from spouses more strongly.

Because marital status has indirect effects on well-being, this specification admits a non-trivial tradeoff between getting married and staying single. For example, a married individual is more likely to have children, a prospect over which preferences are allowed to vary. In addition, those married to low-earning husbands may suffer consumption loss due to negative monetary transfers. Balancing these diverse concerns, individuals may find it more desirable to enter marriage, or may prefer to stay single for the current period and wait for a higher-earning marriage applicant to appear later.

1.4.4 Labor Market Decisions

Jobs differ in three aspects: the job offer distribution, nonpecuniary benefits (costs), and promotion dynamics. A job offer is two-dimensional, consisting of a salary-hour pair. A salary-hour pair is drawn from a multivariate lognormal distribution that depends on GPA, $LSAT$, S_j, private sector work experience X_t^R, and public sector work experience X_t^P. In each period, an individual receives up to one job offer for each type of job, and then decides which offer to accept.[19] In particular, private law firms feature a promotion process for associates to advance to partners, allowing for uncertainty and learning.

The student acquires a unique time-invariant match value ξ_j for the private law sector after graduating from law school j. ξ_j is not directly observed by the student. Instead, she receives experience signals s_{jt} in each period she works in private practice. These experience

[19] See Appendix A.3 for more details.

signals can be interpreted as reviews from senior partners, which impact one's probability of being promoted to partner. Individuals have prior beliefs about match values and have an incentive to learn their match values through the experience signals.

The match value is drawn from $Beta(\eta_{1j}, \eta_{2j})$ upon graduation and so $\xi_j \in (0,1)$. The individual receives signal s_{jt} about her match value at the end of t if she takes an associate position. s_{jt} is a Bernoulli random variable such that

$$Pr(s_{jt} = z) = \begin{cases} \xi_j & \text{if} \quad z = 1 \\ 1 - \xi_j & \text{if} \quad z = 0 \end{cases} \tag{1.9}$$

Binary signals can be interpreted as "good" or "bad".

I assume that the arrival rate of partner offers to private law firm associates evolves as follows:

$$Pr\Big(\text{Receives a partner offer at period } t \;\Big|\; X_t^R < 6\Big) = 0 \tag{1.10}$$

$$\begin{aligned} & Pr\Big(\text{Receives a partner offer at period } t \;\Big|\; X_t^R \geq 6\Big) \\ = \; & \frac{\exp(\sum_{j=1}^{J} \alpha_{0j} S_j + \alpha_1 GPA + \alpha_2 LSAT + \alpha_3 X_t^R + \alpha_4 (X_t^R)^2)}{1 + \exp(\sum_{j=1}^{J} \alpha_{0j} S_j + \alpha_1 GPA + \alpha_2 LSAT + \alpha_3 X_t^R + \alpha_4 (X_t^R)^2} \times \frac{\sum_{s=1}^{t-1} s_{js} O_{1s}}{\sum_{s=1}^{t-1} O_{1s}} \end{aligned} \tag{1.11}$$

Parameters α_3 and α_4 capture the idea that the promotion probability varies with experience in private law firms. Once promoted to partner, the position is secured, since in reality a partner is usually a life-tenured position. In addition, I assume individuals have to work in private law firms to receive partner offers. That is, the arrival rates of partner offers to public/business sector employees is zero.[20]

[20]These assumptions do not contradict any data. In reality, although it is possible for an experienced public defender to directly receive a partner offer, it rarely happens for young lawyers.

The individual does not know the true value of ξ_j. Instead, she has a belief about this value given by $Beta(B^1_{jt}, B^2_{jt})$, which she updates at the end of each period $t = 3, ..., \tau$. The initial belief at $t = 3$ is specified as

$$B^1_{j3} = \xi_j \exp(\eta_{0j}) \tag{1.12}$$

$$B^2_{j3} = (1 - \xi_j) \exp(\eta_{0j}) \tag{1.13}$$

Individuals update beliefs according to Bayes' rule:

$$B^1_{jt} = B^1_{j3} + \sum_{s=4}^{t-1} s_{js} O_{1s} \tag{1.14}$$

$$B^2_{jt} = B^2_{j3} + \sum_{s=4}^{t-1} (1 - s_{js}) O_{1s} \tag{1.15}$$

1.4.5 Marriage Market Decisions

The marriage market is characterized by stochastic assortative matching. The formulation builds on Keane and Wolpin (2010). In each period, the single individual receives a marriage offer with probability:

$$Pr(\text{Receives a marriage offer at period } t) = \frac{\exp(\beta^M_0 + \beta^M_1 A_t + \beta^M_2 A^2_t)}{1 + \exp(\beta^M_0 + \beta^M_1 A_t + \beta^M_2 A^2_t)} \tag{1.16}$$

I include A_t and A^2_t to describe the age effects.

The marriage offer consists of spousal earnings. A potential spouse's earnings are given

by:

$$\ln W_t^B = \sum_{j=1}^{J} \beta_{3j}^B S_j + \beta_1^B dm_t(D_j) + \beta_2^B t + \varepsilon^B \tag{1.17}$$

Spousal earnings depend on the female's outstanding debt $dm_t(D_j)$ as well as her law school S_j. This captures the idea that the quality of an individual's pool of potential husbands may depend on her own characteristics. In addition, there is an i.i.d. random component ε^B that reflects a permanent characteristic of the potential husband. This component is observed by the female at the time of meeting. After marriage, the husband's earnings grow according to a time trend.

Divorce is not modeled because divorce rates are low in the data.[21]

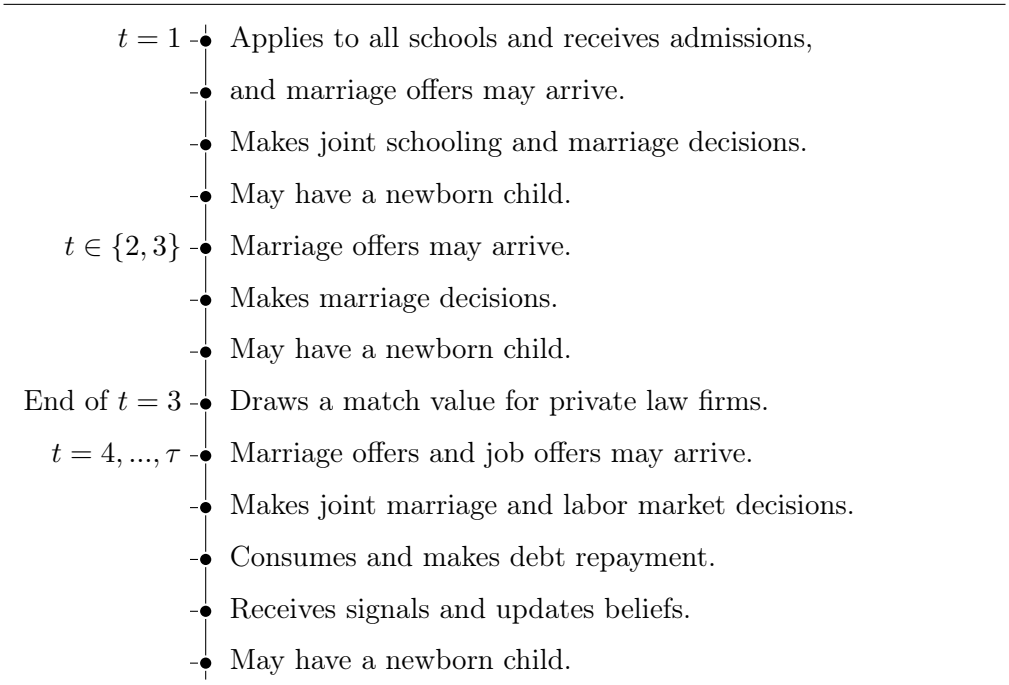
1.4.6 Childbearing

Children arrive stochastically, with arrival rates depending on A_t, A_t^2, and m_t.[22] The formulation is mainly for the purpose of replicating the patterns observed in the data. In particular, after controlling for the aforementioned variables, debt is not significantly related to the probability of having children. I model childbearing as an exogenous process rather than a direct choice. That said, being married is associated with a substantial increase in the probability of having children, so one can still treat childbearing as an indirect endogenous choice realized through marriage decisions.

[21] Only 6% of marriages end up in divorces over the sample period.

[22] I allow the arrival rates to differ by schooling stage and post-graduation stage. See Appendix A.3 for more details.

1.4.7 Timeline and Sequential of Choices



1.4.8 Terminal Values

Because the data only covers the first seven years after graduation, it is not desirable to estimate the model using an end-of-life horizon. Instead, I specify terminal value functions and solve backwards from these. To minimize the impact of functional form assumptions, I solve the model for an additional two years past the point which I have data, i.e. nine years after graduation.[23] The terminal value functions are currently set to be 0.[24].

[23]This procedure is consistent with Kaplan (2012).

[24]The specifications will be relaxed when the third wave of data is available. It is projected to be released at the end of 2015. In particular, the third wave of data is collected in the 12th year of post-graduation with partner promotions largely finished. I will then extend the horizon and specify the terminal value function to be proportional to the last period flow utility and estimate this proportionality parameter, as in Sauer (2004) and Rust (1987).

1.4.9 Value Functions

An individual maximizes expected lifetime utility by choosing one of the feasible discrete alternatives in her time-dependent choice set in each period, until a known terminal period τ.

The maximization of the objective function is achieved by a choice of an optimal sequence of feasible control variables S_j for $j = 1, ..., J$, O_{lt} for $l = 1, ..., 5$, and $M_t \in \{0, 1\}$, given current realizations of the stochastic elements of the model. The maximization problem can be recast in a dynamic programming framework by specifying the value function, $V_t(\Omega_t)$, as the maximum over alternative-specific value functions that satisfy Bellman equations. Ω_t denotes the state space at time t.

When $t = 4, ..., \tau$, the elements of Ω_t are GPA, $LSAT$, D_j, X_t^R, X_t^P, m_{t-1}, k_t, S_j, ε_{lt}^O, ε_t^M, W_t^B, B_{jt}^1, B_{jt}^2, ε_{lt}^W,ε_{lt}^H, $\{s_{js}\}_{s=1,...,t-1}$. When $t = 2, 3$, the elements of Ω_t are GPA, $LSAT$, S_j, D_j, m_{t-1}, k_t, ε_{jt}^S. When $t = 1$, the elements of Ω_t are GPA, $LSAT$, D^U, Y, ε_{jt}^S.

Define the set of choice alternatives for M_t as follows,

$$\Theta^M(\Omega_t) = \begin{cases} \{0, 1\} & \text{if} \quad m_{t-1} = 0 \\ \{0\} & \text{if} \quad m_{t-1} = 1 \end{cases} \tag{1.18}$$

such that only single individuals make marriage decisions.

Marriage is an absorbing state, thus marital status follows the law of motion:

$$m_t = m_{t-1} + M_t \tag{1.19}$$

All individuals begin their economic life as childless singles. Thus

$$m_0 = 0 \tag{1.20}$$

In the post-graduation stage, for $t = 4, ..., \tau$, the alternative-specific value function is denoted as $V_t^{l,i}(\Omega_t)$, where $l = 1, ..., 5$ corresponds to the labor market choice variable O_{lt}, and $i \in \Theta^M(\Omega_t)$ corresponds to the marriage decision M_t. Define $u_t^{l,i}(\Omega_t) = U_{lt}(M_t = i, \Omega_t)$ for $t = 4, ..., \tau$,

$$\begin{aligned} V_t(\Omega_t) &= \max_{l=1,..,5;\ i \in \Theta^M(\Omega_t)} \left\{ V_t^{l,i}(\Omega_t) \right\} && (1.21) \\ V_t^{l,i}(\Omega_t) &= u_t^{l,i}(\Omega_t) + \rho E\left(V_{t+1}(\Omega_{t+1}) \middle| O_{lt} = 1, M_t = i, \Omega_t \right) && (1.22) \end{aligned}$$

where E is the expectations operator, and ρ is the subjective discount factor. The expectation is taken over the joint distribution of the random elements of the model.

In the schooling stage when $t = 2, 3$, the alternative-specific value function is denoted as $V_t^i(\Omega_t)$, where $i \in \Theta^M(\Omega_t)$ corresponds to the marriage decision M_t. Define $u_t^j(\Omega_t) = \sum_{j=1}^{J} U_{jt}(M_t = i, \Omega_t) I(S_j = 1)$ for $t = 2, 3$,

$$\begin{aligned} V_t(\Omega_t) &= \max_{i \in \Theta^M(\Omega_t)} \left\{ V_t^i(\Omega_t) \right\} && (1.23) \\ V_t^i(\Omega_t) &= u_t^j(\Omega_t) + \rho E\left(V_{t+1}(\Omega_{t+1}) \middle| M_t = i, \Omega_t \right) && (1.24) \end{aligned}$$

In the initial period when $t = 1$, the alternative-specific value function is denoted as $V_t^{j,i}(\Omega_t)$, where $j = 1, ..., J$ corresponds to the labor market choice variable S_j, and $i \in \Theta^M(\Omega_t)$ corresponds to the marriage decision M_t. Define $u_t^{j,i}(\Omega_t) = U_{jt}(M_t = i, \Omega_t)$ for

$t = 1$,

$$V_t(\Omega_t) = \max_{j=1,..,J;\ i \in \Theta^M(\Omega_t)} \left\{ V_t^{j,i}(\Omega_t) \right\} \tag{1.25}$$

$$V_t^{j,i}(\Omega_t) = u_t^{j,i}(\Omega_t) + \rho E\left(V_{t+1}(\Omega_{t+1}) \Big| S_j = 1, M_t = i, \Omega_t \right) \tag{1.26}$$

1.5 Estimation Strategy

I estimate the model by the method of simulated moments (MSM).[25] Specifically, the MSM estimator minimizes a weighted distance measure between sample aggregated statistics and their simulated analogs. The weights are given by the inverse of estimated variances of the sample statistics. The simulated moments are generated for any given set of parameters by simulating 800 histories. Appendix A.4 lists the details of the data moments. The estimated parameter values are reported in Appendix A.5 with standard errors. In this section, I discuss why certain moments are chosen and how they help pin down parameters.

The first group of parameters relates to labor market outcomes, including the parameters of the job offer distributions and the α's in the arrival rate of partner offers. Job offer distributions depend on sector-specific human capital stocks. Human capital stocks are a function of law school quality, academic skills as measured by test scores, and sector-specific work experience. Arrival rates of partner offers depend on this same set of variables. I therefore rely on the mean and variance of accepted job offers along with observed promotion probabilities interacted with those variables to pin down the corresponding parameters. I account for the bias from self-selection by explicitly modelling occupational choices with exclusion restrictions. Exclusion restrictions are variables that affect occupational choices

[25] See McFadden (1989) and Pakes and Pollard (1989) for more details.

but do not enter the outcome equations. I choose spousal income. Spousal income contains a permanent stochastic component which affects labor market decisions by altering her budget constraint. On the other hand, it is reasonable to assume that spousal income is unseen by the employers.

The second group of parameters relates to marriage market outcomes, including the β^M's in the marriage offer arrival rates and the β^B's in the marriage offer distribution. Marriage offer arrival rates depend on age. The marriage offer distribution depends on law school rankings. I therefore pin down the related parameters by interacting the observed marriage rates and accepted spousal earnings with age and schools. A self-selection issue similar to that in the labor market arises here: the rejected marriage offers are not observed. I account for this bias by explicitly modelling the marriage choices with exclusion restrictions. Exclusion restrictions are variables that affect the marriage decision but not the marriage prospects, i.e. test scores $LSAT$ and GPA.[26] A second difficulty is to separately identify offer distributions from arrival rates, in other words, to distinguish a model with low arrival rates and a small mass of offers at the bottom of the spousal wage distribution from one with a high arrival rate and more low-quality offers. To this end, I exclude variables that affect marriage offer distributions but not offer arrival rates (i.e. schools S_j).[27]

The third group of parameters relates to post-graduation preferences, including ϕ and the μ's. These parameters are largely pinned down by interacting observed occupational choices with variables such as school, experience, test scores, debt, marital status, whether children are present, and spousal earnings. The idea is that these interacted variables may

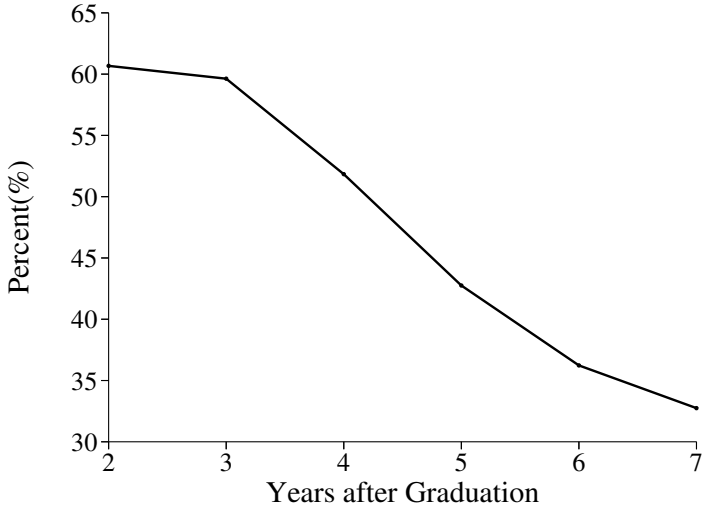
[26]The idea is that these two variables measure the stock of knowledge related to the legal skills. But they should not be related to attractiveness in the marriage market. The literature has widely recognized that graduating schools may affect the pool of potential spouses, but none has stated that particular test scores play a role, especially after the school quality has been controlled for.

[27]This specification follows Keane and Wolpin (2010).

affect occupational choices by altering the marginal utility derived from consumption and leisure.

To estimate the third group of parameters, I exploit the large observed variation in occupational choices. One particularly salient pattern concerns the high attrition rates in the private law sector. As shown in Figure 1.1, the share of employment in the private law sector shrinks by close to 50 percent for females from top schools. Similar patterns can be observed for graduates from lower ranked schools. It is worth noting that most of these attritions occur less than seven years after graduation, and thus far in advance of the partner promotion evaluations.

Figure 1.1: Choice Probability of Private Law Jobs, Top 20 School Graduates



Law school class graduating at 2000. Constructed by author from After the JD.

However, an empirical challenge arises in how to separately identify the third group of parameters from a fourth group of parameters, namely those associated with the learning process. In particular, both sets of parameters affect occupational choices and can contribute to high attrition rates in the private law sector. Consider, for example, the importance of preferences. As individuals age, they make (or don't make) transitions into marriage and

parenthood. Their salaries also increase with accumulated work experience. These changes can alter the relative attractiveness of outside options, a process governed by preference parameters. On the other hand, with the presence of learning, some associates may gradually realize that their promotion chances are small and opt out halfway. Promotion in the private law sector is highly uncertain and depends on a lot of factors that are hard to accurately predict by the new graduates. In the beginning of their careers, young lawyers tend to "experiment" with this partner-track career path and thus the choice probability is high. Those who later realize that their prospects are poor will exit.

My strategy is to include another set of moments, job transition rates by debt. When the marginal utility of consumption is not constant, increasingly attractive outside options affect females of various debt levels differently. This is because the main mechanism is the consumption-leisure tradeoff, and debt affects the marginal utility of consumption. However, the components in the learning process — the heterogeneity of "match values", the signal distribution, and the beliefs—do not vary with debt. Thus, the presence of learning narrows the gap in job transition rates between high-debt and low-debt individuals.

The overall level of job transition rates also helps. First, without the additional contribution of learning, the model is not capable of generating sufficient attritions in the private law sector. Second, introducing the permanent heterogeneity in "match values" will create a higher level of persistence in job choices, especially in later periods.

I identify the fifth group of parameters, the preference parameters in the schooling stage, by matching matriculation rates, average academic skills, monetary resources, remaining debt, and total borrowing by school.

For certain parameters, structural estimation inside the model is less crucial than others.

As such, the estimation approach involves fixing some parameters using external estimates. The subjective discount factor ρ is set equal to 0.96. Tuition T_j and living expenses P_j are set equal to the average level in NPSAS.[28] Admission rules Ψ_j are recovered using *Law School Numbers*. Arrival rates of children, assumed to be exogenous, are estimated from the *After the JD*. Lastly, based on estimates in other studies, the time cost of childcare is set equal to 600 hours a year,[29] the intra-family transfer rule is set equal to 0.55,[30] and the growth rate of spousal income over time is set equal to 5 percent.[31]

1.6 Empirical Results

This section isolates the underlying mechanisms through which debt burden affects choices. I have modeled two channels: (1) tighter budget constraints; and (2) worsened marriage prospects. Anticipation of these effects may also influence the *ex ante* schooling decisions. The existing literature has largely focused on the consumption-leisure tradeoff triggered by tighter budget constraints. However, I show that worsened marriage prospects play a more salient role, at least among females.

Section 1.6.1 shows that the model is able to match the choice outcomes observed in the data. Section 1.6.2 presents the key parameters related to the aforementioned channels and the schooling decisions. Section 1.6.3 conducts two simulation exercises by shutting down each channel respectively.

[28] As a robustness check, I compare the statistics with those in *the Official Guide to Law Schools* published by the American Bar Association. They are similar.
[29] Based on Keane and Wolpin (2010) and Hotz and Miller (1988).
[30] Based on Keane and Wolpin (2010).
[31] Based on Olivetti (2006).

1.6.1 Model Fit

Table 1.6 shows the model fit for important statistics, including career choices, marriage rates, spousal earnings, childbearing outcomes, matriculation rates, and debt loads.

First, the model reproduces differences in choices across debt levels. For instance, private sector employment of *High Debt* females is around 10 percentage points higher than that of *Low Debt* individuals in 2007. The model generates an acceptable difference of 7 percentage points. With respect to family outcomes, the model predicts the roughly 9 percentage point difference in marriage rates. The gap in accepted spousal earnings and the differential probability of having a child can be reproduced well.

Second, the model captures the important life-cycle trends. One such trend is the decline in private practice employment between 2003 and 2007. The data shows drops of 16 and 14 percentage points for the *High Debt* and *Low Debt* groups, respectively. The model produces similar declines of 17 and 16 percentage points.

Third, matriculation rates by school tier are reproduced quite accurately. The model also reflects the fact that students at top 20 schools borrow more than students at Tier 2 schools. Debt loads for students at Tier 3 and Tier 4 schools are slightly less well predicted.[32]

1.6.2 Key Parameter Estimates

Channel 1: Budget Constraints Debt repayment shrinks the budget and affects the consumption-leisure tradeoff when making decisions. This has a direct impact on labor market decisions. Consider the problem facing a new graduate. On one hand, the private

[32]The fit can be improved by including more preference parameters in the schooling stage. I choose to maintain a more parsimonious model.

Table 1.6: Model Fit

	2003		2007	
	Data	Model	Data	Model
Share of Employment in Private Practice				
Low Debt	0.47	0.49	0.31	0.32
High Debt	0.56	0.55	0.42	0.39
Marriage Rates				
Low Debt	0.59	0.64	0.76	0.78
High Debt	0.50	0.53	0.68	0.68
Spousal Earning (2006)				
Low Debt			109.4	105.3
High Debt			96.5	93.3
Presence of a Child				
Low Debt	0.13	0.18	0.51	0.53
High Debt	0.10	0.13	0.43	0.44

	Top 20		21-100		Tier 3		Tier 4	
	Data	Model	Data	Model	Data	Model	Data	Model
Enrollment	0.24	0.23	0.49	0.51	0.15	0.14	0.13	0.11
Total Debt	92.3	96.3	76.3	73.8	74.2	81.0	89.9	72.5

All the monetary values are in thousands of 2014 $.

sector offers greater financial compensation than the public/business sector. Starting salaries in the private sector are 40, 32, 8, and 25 percent higher for Tier 1, 2, 3, and 4 students, respectively. On the other hand, private sector jobs require 5 percent more hours on average, a gap that increases by 1 percentage point every year.

My model captures the consumption-leisure tradeoff with two sets of parameters. First, consumption and leisure enter the utility function through a Cobb-Douglas component, inducing diminishing marginal utility. Second, I allow the psychic value of marriage and children to depend on the levels of consumption and leisure.

Table 1.7 shows the importance of these parameters, by displaying the equivalent monetary value of leisure time by marital status, the presence of children, and debt level. To facilitate the analysis, I consider a hypothetical female from a Tier 2 school who takes a

job in the public sector at graduation. I calculate the cash transfer required for her to be indifferent between working 4 more hours per week (i.e. average private sector hours). I then examine how this monetary value changes with debt.

Those with heavy repayment burdens value leisure less than their low-debt peers. However, the effect of debt burdens on the consumption-leisure tradeoff is modest compared with that of intra-family transfers and childcare. For instance, a single female with a low debt burden is willing to work private sector hours if she is given $2,690 per period, while a high-debt female needs only $2,020. The corresponding values for a married female with children are $8,190 and $6,870. This suggests that the differences in job choices across debt levels may be more likely to result from different marriage and childbearing outcomes, instead of the budget reduction from periodical debt repayment.

It warrants attention that the aforementioned results are only intended to demonstrate the consumption-leisure tradeoff. Although the compensating cash transfer is very low, individuals don't necessarily switch to private practice because nonpecuniary benefits in the public sector are higher.

Table 1.7: Consumption-Leisure Tradeoff in Labor Market Decisions by Debt

Compensating Cash Transfer for a Typical Public Sector Employee to Work Private Sector Hours:

	Low Debt	High Debt
Single	2.69	2.02
Married w/o Children	4.16	3.50
Married w/ Children	8.19	6.87

Monetary values are in thousands of 2014 $.

Channel 2: Marriage Prospects I proceed by discussing the parameters that connect debt and marriage. First, debt has a large impact on the quality of marriage offers. Mean earnings among potential husbands decline by 3 percent for every $10,000 of outstanding

debt. The intuition is that debt reduces an individual's popularity in the marriage market.

The marriage offer distribution may affect marriage decisions through the intra-family transfer. Females receive 55 percent of household income when married. As a result, a female needs to draw a husband with earnings that, at minimum, are roughly in line with her own for marriage to raise her own consumption. Of course, there is also a psychic value to being married.

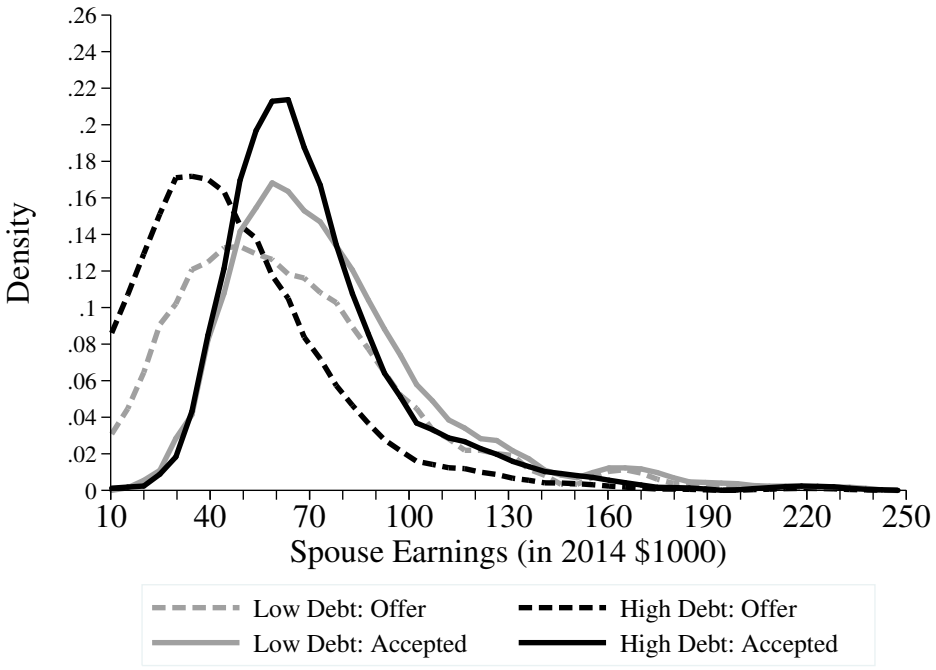
As explained in the previous section, the level of consumption also affects the psychic value of having children. This channel may affect marriage decisions because child arrival rates are found to be closely related to marital status. The probability of having a child for a married female at age 30 is 0.35 higher than that of a single peer. Therefore, females with worse marriage prospects may have an extra incentive to postpone marriage, as their utility from having children is likely to be lower.

The marriage decision is further complicated by the declining marriage offer arrival rates. For an individual of average characteristics, the arrival rate at age 27 is 46 percent, declining to 31 percent at age 30. By age 34, it drops to 8.5 percent. This decline suggests that it is very costly to postpone marriage until the debt burden is clear.

I show the importance of worsened marriage prospects by comparing marriage offers and outcomes of two groups of single individuals from Tier 2 schools in the first period of the post-graduation stage. These groups differ in debt burden but are otherwise identical. Figure 1.2 compares the distribution of offered and accepted spousal earnings. Both distributions for the *High Debt* group are to the left of those for the *Low Debt* group. In addition, the *High Debt* group has a lower marriage rate, 20 percent, relative to the *Low Debt* group, 30 percent.

One may wonder why the distributions of accepted spousal earnings are more similar across debt levels than the distributions of offers. One explanation is the aforementioned intra-family transfer. Females have incentives to maintain their level of consumption and not to choose a substantially lower-earning husband. However, once this standard is satisfied, high-debt females seem to have a greater acceptance region than their low-debt peers, which explains why their accepted offers are relatively distributed to the left. However, because the marriage offer distribution is much worse, high-debt females are still less likely to marry. This underlines the importance of using a structural model to analyze the effect of debt on marital prospects. Marriage is a choice, one that is made only when the offer is sufficiently attractive. Simply looking at realized spousal earnings can vastly understate the true differences in marriage market prospects across debt levels.

Figure 1.2: Marriage Offers and Accepted Spousal Earnings



Note: The comparison are for two groups of hypothetical single individuals from 20-100-ranked schools who differ in debt burden but identical otherwise in the initial period of post-graduation stage.

I provide external evidence to explore why the quality of marriage offers decreases with debt burden. *After the JD* asks the following question: *How many days during the last week have you have trouble getting to sleep or staying asleep?* I calculate the probability of having sleep trouble for more than the median number of days (= 1 day), and examine its relationship with debt burden. I find a statistically significant relationship between debt burdens and sleep trouble for married females but not for singles. The relationship is even stronger after controlling for job sector choice, spousal earnings, and other characteristics.[33] As sleep disorder is often an indicator of stress, this relationship suggests that females with heavy borrowing may have more pressure in their married lives than those without debt. Therefore, males may find such females less attractive as marriage partners in anticipation of later stress. This piece of evidence is consistent with findings in Field (2009) about the psychological aversion of student debt using a sample of NYU J.D. students.

Schooling Decisions Individuals balance the return to school quality versus the corresponding debt when making schooling decisions. School quality has a large impact on the job offer distribution in the labor market. In the public/business sector, the mean salary for Tier 1 graduates is 21 percent higher than for Tier 2 graduates, 23 percent higher than for Tier 3 graduates, and 40 percent higher than for Tier 4 graduates. The compensation gap is even more pronounced in the private sector, where the mean salary for Tier 1 graduates is 29 percent higher than for Tier 2 graduates, and 55 percent higher than for graduates of Tier 3 and Tier 4 schools. I also find a high degree of assortative matching in the marriage market. After controlling for other characteristics, spousal earnings for Tier 1 graduate are 35 percent higher than for Tier 2 graduates, 45 percent higher than for Tier 3 graduates,

[33]See Table A.8 in Appendix A.7 for details.

and 60 percent higher than for Tier 4 graduates.

1.6.3 Decomposition

I proceed to disentangle the net effects of these two channels. Individuals make joint decisions in various markets and the two channels are intertwined. To facilitate the analysis, I divide individuals into two groups by debt upon graduation and then calculate group differences in the share of private practice employment, marriage rates, accepted spousal earnings, and probability of having a child. I conduct this exercise three times: under the baseline model, under equalized budget constraints, and under equalized marriage prospects. In the second scenario, individuals do not need to make annual debt repayments. In the third scenario, marriage prospects are not affected by debt burden. To guarantee comparable samples across the three scenarios, I hold the schooling choices fixed at the baseline outcomes.

Figure 1.3 shows the decomposition results with respect to sector choice. In the baseline model, the share of high-debt group individuals employed in private practice is roughly 7 percentage points higher than for their low-debt peers. Under equalized budget constraints, the gap is roughly the same in the beginning, but decreases to 5 percentage points seven years later. Under equalized marriage prospects, the gap is reduced to 4 percentage points in the beginning, and further decreases to around 3 percentage points seven years later. Over the seven year span, the first channel alone can explain around 15 percent of the choice difference, while the second channel alone can explain up to 40 percent.

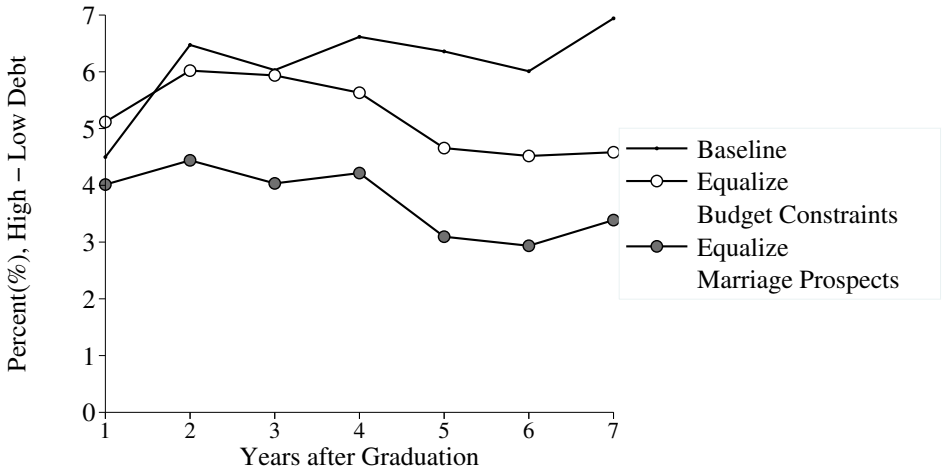
Figure 1.4 shows the decomposition results for marriage rates. The baseline marriage rates differ by around 10 percentage points between the low-debt and high-debt individuals. The gap narrows by 1 percentage point under equalized budget constraints. In contrast, the

gap narrows by around 6 percentage points under equalized marriage prospects.

Figure 1.5 shows the decomposition results for accepted spousal earnings. The baseline difference in accepted spousal earnings is \$13,000 in favor of low-debt individuals. The difference is slightly amplified when the budget constraints are equalized. When marriage prospects are equalized, however, the gap is reversed. In this case, spousal earnings for the high-debt individuals are \$5,000 to \$10,000 higher than for low-debt individuals.

Figure 1.6 shows the decomposition results for the probability of having a child. Low-debt individuals are more likely to have children than their high debt peers, with the difference in probability ranging from 0.02 in early years to 0.09 seven years later. The difference is only mildly reduced by equalizing the budget constraints. However, with equalized marriage prospects, it is reduced by more than half.

Figure 1.3: Differences in Private Practice Employment Rates by Debt Levels



The broad intuition for these results is as follows. Holding the marriage offer distributions fixed, increasing consumption under equalized budget constraints decreases the marginal utility from consumption and increases the marginal utility from having children. Individuals will then lower their acceptance threshold for spousal earnings in order to marry earlier and

Figure 1.4: Differences in Marriage Rates by Debt Levels

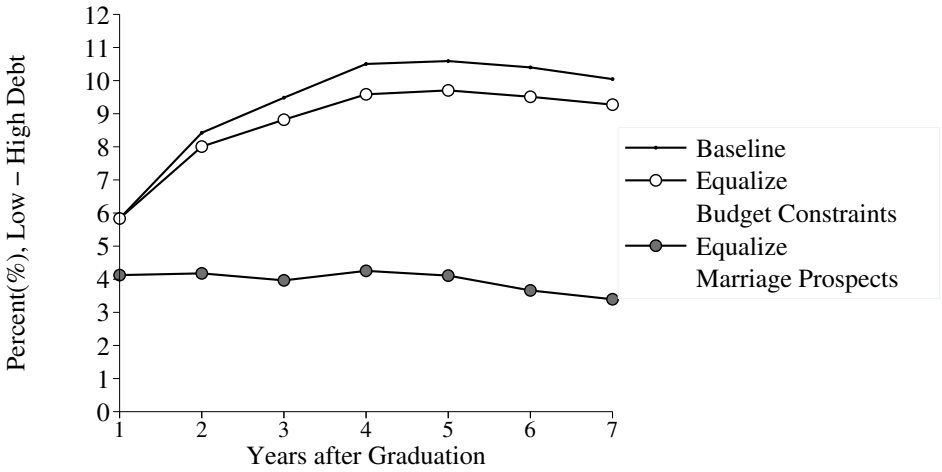


Figure 1.5: Differences in Accepted Spousal Earnings by Debt Levels

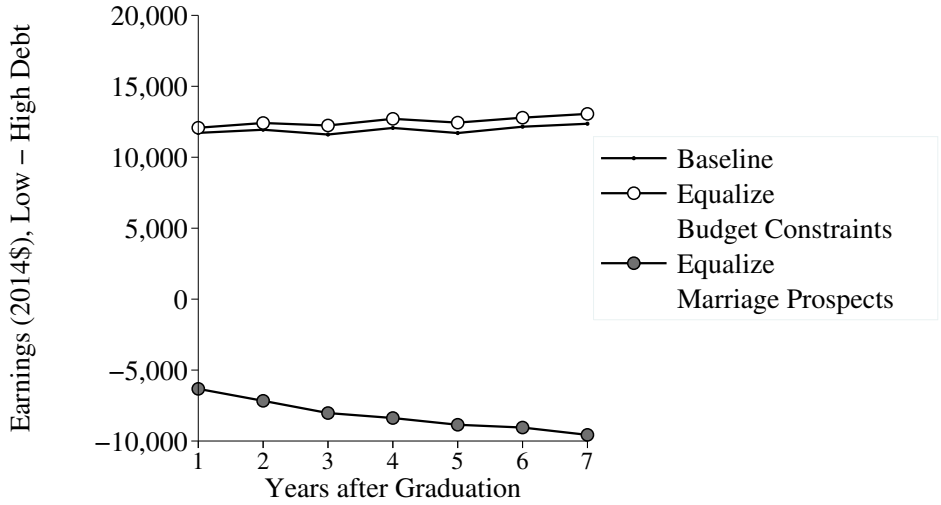
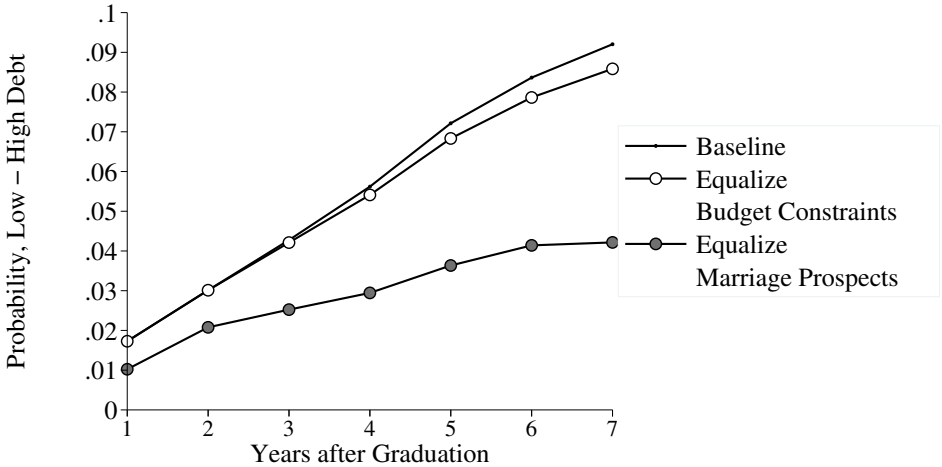


Figure 1.6: Differences in Probability of Having a Child by Debt Levels



have children earlier. Thus, we see a smaller gap in marriage rates accompanied by a wider gap in accepted spousal earnings, as in Figure 1.4 and 1.5.

The marriage prospects channel is more important than the budget constraint channel for explaining the gaps in marriage outcomes. Under equalized marriage prospects, high-debt individuals meet higher-earning marriage applicants, which leads to higher monetary transfers from their husbands. Consequently, these individuals are more likely to get married and end up with higher quality marriages.

One may ask why the second channel is particularly salient, given that both operate through consumption. The intuition is that the option value of waiting is different. In the first channel, high-debt and low-debt individuals differ in consumption by their annual debt repayment burden, which is an obligatory outlay. This part of the consumption difference will not be changed by the timing or quality of marriage. In the second channel, the consumption differs through the level of spousal earnings and the associated intra-family transfer. This part of the consumption difference is endogenously determined by marriage decisions. As a result, the second channel has a much larger effect on the timing of marriage decisions.

One may further ask why the difference in accepted spousal earnings is reversed under equalized marriage prospects in Figure 1.5. Recall that graduates of expensive top-20 schools tend to carry higher debt burdens. But these graduates also enjoy a premium in the marriage market by virtue of their educational background. Thus, they typically end up with higher-earning spouses.

In addition, one may wonder why there still exists a gap in marriage rates even under equalized marriage prospects, as shown in Figure 1.4. One possible explanation appeals to

the aforementioned selection effect. Graduates of top-20 schools have higher average debt loads, but also enjoy higher earning potential, which creates different incentives for the timing of marriage and children.

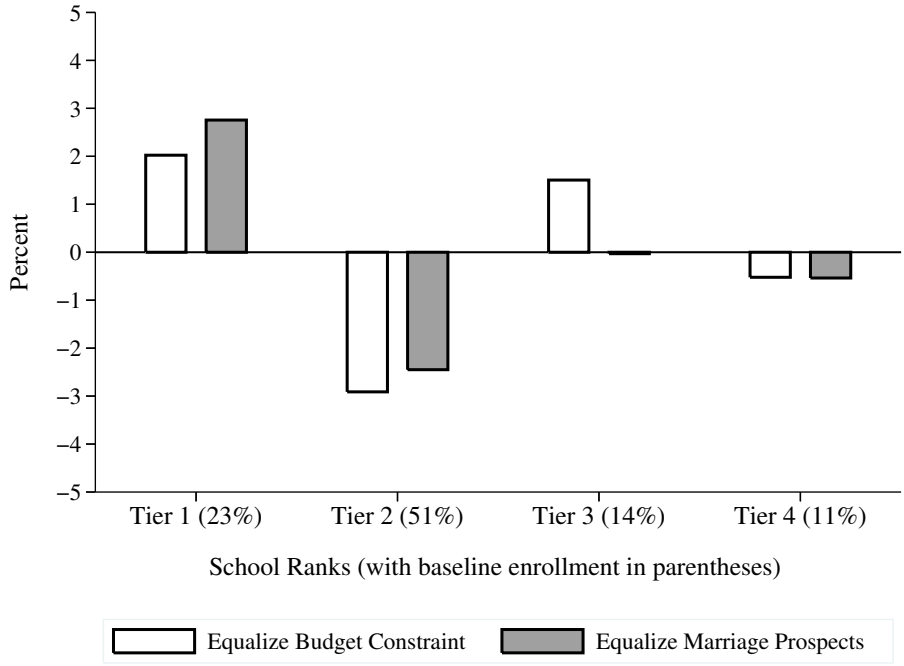
Now I proceed to explain the intuition of debt effects on labor market decisions. First, as explained above, debt has a large effect on marriage decisions and the associated childbearing outcomes. As childcare is time-costly, individuals who are more likely to marry are less likely to work in the sector requiring the longest working hours. Secondly, as debt repayment shrinks the budget, there exists a consumption-leisure tradeoff in balancing earnings and hours of labor market decisions.

In summary, worsened marriage prospects associated with debt burden have a much stronger impact on post-graduation choices than tighter budget constraints. In particular, a large part of the differences in labor market choices can be explained by high debt individuals facing worse marriage opportunities, and therefore marrying later and having children later.

Finally, I decompose how these two channels affect *ex ante* schooling choices, holding school costs and admission rules fixed. Figure 1.7 shows the results. The individuals who are affected the most are those who are admitted to top-20 schools but choose to attend Tier 2 schools. When the two debt effects are eliminated, first the budget constraint channel and then the marriage prospects channel, matriculation rates at top-20 schools rise by 2 and 3 percentage points, respectively. This corresponds to increases of 8.6 percent and 13.0 percent relative to the baseline. Matriculation rates at Tier 2 schools fall by roughly the same amount. The marriage prospects channel has a stronger effect than the budget constraint channel. Matriculation rates at Tier 3 and Tier 4 schools remain roughly unchanged, which is possibly because the admission rules are binding, and so students have limited academic

mobility.

Figure 1.7: Change in Matriculation Rate



It is worth noting that my finding is largely consistent with Sauer (1998, 2004). He accounts for the different earning profiles and nonpecuniary benefits across occupations. Debt repayment therefore affects career choices through the tradeoff between earnings and nonpecuniary benefits. This mechanism is comparable to my first channel, the consumption-leisure tradeoff. Both of us find that the effect of this channel is small.

1.7 Evaluating Loan Repayment Assistance Programs

The decomposition analysis has shown that the debt effect on career choices through marriage prospects is large. Therefore, it is important to take the marriage market features into account when designing loan forgiveness policies. Currently the *Public Service Loan Forgiveness Program* (U.S. Department of Education) entails enrolling into an income-contingent

repayment scheme. After ten years of public service, the remaining debt is discharged. However, my estimates show that marriage opportunities decline substantially with age. Therefore, younger females may be more responsive to repayment subsidies, and it may be more effective to subsidize females sooner rather than later.

To test the idea, I compare two expenditure-equivalent counterfactual policies: a public service loan forgiveness policy and a conditional tuition waiver policy. The loan forgiveness policy replicates the key features of the existing scheme. To be eligible for this plan, individuals must join an income-contingent repayment plan. Repayments are set equal to 20 percent of disposable income.[34] All outstanding debt is discharged after individuals accumulate six years of public sector work experience. The tuition waiver policy is similar in some respects, but different in others. Individuals join the same income-contingent repayment plan, but rather than waiting several years for debt forgiveness, a certain percentage of total debt is forgiven immediately upon graduation. This forgiveness is not without conditions. The discharged debt must be repaid unless a job in the public sector is held for six years subsequent to graduation. To ensure equal expenditures, the proportion of initially-forgiven debt is set to 18 percent. Individuals are not forced into either of these plans. Upon graduation, they make a one-time choice between the counterfactual policy and the 10-year standard repayment schedule.

Note that these two policies have the same requirement for loan forgiveness, namely, a specified number of years in the public sector. However, the timing of the benefits differs. The conditional tuition waiver policy gives individuals the opportunity to exploit loan forgiveness benefits before the requirement is fully satisfied.

[34]See the details of this plan on the website of the Office of Federal Student Aid, `https://studentaid.ed.gov/sa/repay-loans/understand/plans/income-driven`.

Table 1.8 shows the results. Case (A) corresponds to my baseline model when there are no repayment subsidies. In case (B), individuals have access to the loan forgiveness policy. In case (C), individuals have access to the conditional tuition waiver policy.

The average work experience in the public sector is 3.4 years when there are no repayment subsidies. The loan forgiveness policy increases public sector work experience to 3.5 years. 38 percent of individuals sign up, but only 11.7 percent accumulate enough experience to receive the benefit. A conditional tuition waiver policy increases public sector work experience to 3.8 years. It also has a wider appeal: 80 percent of individuals sign up, and 21.3 percent stay for the required six years. The tuition waiver policy spreads out the same amount of expenditure to benefit a larger population. Intuitively, as debt plays a bigger role in the marriage market when individuals are younger, a smaller early subsidy can be more attractive than a larger later one. Columns on the marriage rates and the spousal earnings provide supporting evidence. The loan forgiveness policy barely changes the marriage outcomes. In contrast, the conditional tuition waiver policy increases marriage rates by 1.1 percentage points, and the accepted spousal earning by $2,200, or 2.3 percent.

Table 1.8: Counterfactual Policy Analysis

	Avg Years in Public Sector	Marriage Rates	Spousal Earning	Enrollment (%)	Beneficiaries (%)
(A) No Policy	3.4	73.3	97.1		
(B) Loan Forgiveness	3.5	73.5	97.0	38.0	11.7
(C) Tuition Waiver	3.8	74.4	99.3	80.0	21.3

	Avg Debt (in 2014 $1,000)	School Choice (%)			
		Top 20	21-100	Tier 3	Tier 4
(A) No Policy	77.7	23.4	51.3	14.4	10.8
(B) Loan Forgiveness	77.8	23.8	50.9	14.7	10.6
(C) Tuition Waiver	77.8	23.5	51.2	14.7	10.5

[a] Loan Forgiveness: Individuals must join the income-contingent repayment plan. All outstanding debt is discharged after individuals accumulate six years of public sector work experience.

[b] Tuition Waiver: Individuals must join the income-contingent repayment plan. 18 percent of total debt is forgiven immediately upon graduation. The discharged debt must be repaid unless a job in the public sector is held for six years subsequent to graduation.

I also examine the impact of these policies on the *ex ante* schooling choice and debt accumulation. Average borrowing increases only slightly. The magnitude is small, perhaps because the policies are not overly generous.[35] The two repayment subsidies alter the trade-off between schools of different qualities. The loan forgiveness policy encourages Tier 2 students to attend Tier 1 schools. The matriculation rate at top-20 schools increases by 1.7 percent. The tuition waiver policy plays a weaker role in the schooling choices of students in the top two tiers, but a stronger role for students in the bottom two tiers. The matriculation rate at Tier 3 schools increases by 2.1 percent.

1.8 Summary

This paper studies the impact of student debt on the education, career, and marriage choices of female lawyers. Motivated by the strong correlations between student debt and outcomes observed in a new dataset, I develop a dynamic model of education, marriage and labor markets. My model accounts for several important features of the legal labor market, including partnership promotions, differences in the work hours across occupational tracks, and the clerkship choice. In particular, by introducing a learning process, my model is able to predict the important patterns observed in the data.

In the model, debt affects lifetime budget constraints and marriage prospects. I find that a large part of the differences in female career choices is driven by debt-related differences in marriage market prospects. In addition, females significantly under-invest in education quality in order to avoid the marriage market penalties associated with higher future debt burdens. The affected lifetime budget constraints, however, have a much smaller effect on

[35] In reality, there are a number of more generous policies, mostly offered by the law schools.

female choices.

This finding suggests that timing is important for loan repayment assistance programs that aim to increase public sector employment. The reason is that the effect of debt on marriage prospects is large, and marriage opportunities decline as females age. I therefore compare the effects of two counterfactual policy designs with identical expenditure levels: a public sector loan forgiveness policy and a conditional tuition waiver policy. The second policy is much more effective at increasing public sector employment because it provides repayment subsidies at an earlier age.

The methods developed in this paper and the main empirical results are promising for future research. An interesting research question would be to study the general equilibrium effects of repayment subsidies. This paper finds that females tend to choose lower-ranked, cheaper law schools to avoid debt. Loan repayment subsidies ease this aversion and increase a law student's willingness to borrow. A relevant concern for policy makers is whether schools will respond by increasing tuition.[36] It is worth noting that higher tuition is not necessarily an inefficient outcome. Schools care about education quality. Higher tuition may be used to increase educational resources and improve education quality, thereby raising labor market returns. Therefore, it is important to model the tradeoff schools face between displacing qualified but financially disadvantaged students and augmenting monetary resources by

[36]There exists a very small literature studying the general equilibrium effects of financial aid policies on the schools' tuition levels. Epple et al. (2013) estimate a general equilibrium model of the college education market and find that private schools would strategically increase tuition and offset the increased grant available to students. Turner (2014) finds that colleges capture 12 percent of their students' Pell Grant aid through price discrimination, using a regression discontinuity design. Cellini and Goldin (2014) document that the for-profit colleges eligible for federal student aid programs charge tuition that is 78 percent higher than that charged by comparable non-eligible ones. Lucca et al. (2015) find that institutions more exposed to changes in the subsidized federal loan program increased their tuition disproportionately around these policy changes. Overall, these four studies suggest that part of the aid will be captured by the schools. But the effect of policies subsidizing repayments, especially the policies that depend on labor market outcomes, have not yet been studied.

charging higher tuition.

Chapter 2

The Impact of Unions on Municipal Elections and Urban Fiscal Policies [1]

2.1 Motivation

States and local jurisdictions play essential roles in the allocation of public goods and services in the U.S. and other developed countries, that have adopted a decentralized organization of government (Oates (1972)). The efficient decentralized provision of public goods requires that special interest groups do not exercise undue influence on the outcome of municipal elections and local fiscal policies. This paper focuses on the most important local special interest group: municipal unions.[2] I provide a new model that captures the impact of local unions on the outcome of municipal elections and local fiscal policies and tests the empirical

[1]This chapter was prepared for the November 2012 Carnegie Rochester NYU Conference on Public Policy, at Carnegie Mellon University. This chapter is co-authored with Holger Sieg. Sam Gerson provided excellent research assistance. Financial support for this research is provided by the National Science Foundation (SES-0958705).

[2]According to 2011 CPS data, 43.1 percent of local public employees are union members and 46.6 percent are covered under union contract. 63.5 percent of police officers and 61.1 percent of firefighters are union members.

implications of the model using a new unique data set.

Since the early 1960's public sector unions have increasingly represented municipal workers in collective bargaining in most U.S. cities. While there is some debate in the literature about the objectives of municipal unions, there is broad agreement that municipal unions can extra rents from local governments.[3] I model the behavior of a union as seeking direct transfers from a local government to the union and its members. These transfers can take the form of higher wages and benefits, but they may also include more favorable work rules or higher levels of employment.[4] From the perspective of voters, who primarily care about the quality and the costs of providing local public goods and services, transfers to unionized workers create inefficiencies, since the city does not operate at a cost minimum.[5] Everything else equal, voters prefer that the city operates on an efficient scale and pays competitive wages and benefits avoiding unnecessary transfers to unionized workers.

Political economy reasons may prevent the city from operating efficiently since local politicians have incentives to accommodate public sector unions.[6] While there is some agreement that private companies maximize profits or shareholder value, there is less agreement about the objectives of local politicians. Local politicians care about the welfare of the citizens, but they also want to win elections. Public sector unions can affect electoral outcomes by mobilizing its members, increasing voter-turnout, endorsing a politician, and providing staffing for a campaign. I model the objective function of a local politician as

[3]For a detailed discussion of the objectives of unions see Farber (1986).

[4]Lewis (1990) suggests that municipal wages are, on average, 8 to 12 percent higher than wages in the private sector. More recently, Hoxby (2000) finds positive effects of unionization on teacher compensation. Frandsen (2016) finds similar effects for firefighters and police officers who are also studied in this paper.

[5]Feiveson (2015) shows that unions can also determine how cities spend intergovernmental transfers. Cities in states with with pro-union collective bargaining laws spend a higher fraction of transfers on increased wages than cities in other states.

[6]In the absence of market discipline, Gregory and Borland (1999) argue that the public sector outcomes are primarily determined by political considerations.

a weighted average of the objectives of voters and the objectives of a municipal workers' union. Moreover, politicians differ in the weight that they assign to the public cause. As a consequence, some politicians are more union-friendly than others.

I consider a game in extensive form in which an incumbent faces a challenger in a local election. This election can be thought of as a primary within a party that controls a city or a general election between candidates from different parties in a competitive, non-partisan environment. Voters know the preferences of the incumbent, based on his or her historical record in office. Voters face more uncertainty about the position of the challenger. One key assumption of my model is that the union is better informed about the preferences of potential challengers than the public. This assumption is plausible since unions often track politicians and have better access to candidates than individual voters.

Given these informational asymmetries, the union can convey a signal to voters by endorsing a candidate. The voters observe the endorsement decision of the union before the election. Voters also receive a common preference shock associated with each politician. The outcome of each election is, therefore, ex ante uncertain. Since politicians cannot commit to a policy or a transfer to the union prior to the election, the politician that wins the election implements his preferred policy when in office. I focus my analysis on perfect Bayesian equilibria. I provide conditions which guarantee that equilibria exist and characterize their properties.

One key finding of the theoretical analysis highlights the inherent conflict faced by the municipal union. Union support increases the chances of winning the election. This "muscle effect" depends on how well the union is organized in the city and how much support it

can generate among likely voters.[7] At the same time, the endorsement generates a negative informational externality. Voters observe the endorsement and update their beliefs about the position of the challenger. If the challenger receives the endorsement, voters will infer that the challenger places a higher weight on the objectives of the union than the incumbent. A necessary condition for the existence of an equilibrium with endorsement is that the positive "muscle effect" is larger than than the negative informational effect. This condition is not sufficient to generate an endorsement if the difference in positions between the two politicians is small or if the endorsement costs are large.

The second contribution of the paper is that I have assembled a novel data set that includes municipal elections in the largest cities in the U.S. The unique feature of my data set is that I have collected detailed information on union endorsements for each election in the sample. To my knowledge, there have been no previous empirical papers that have analyzed endorsement data. Previous empirical papers have used different measures of union strength or unions activity. One commonly used variable constructed by Freeman and Valletta (1988) measures the collective bargaining strength of unions at the state level. Other popular variables are the fraction of unionized workers or the fraction of workers that are covered by a union contract. While these are interesting outcome variables, they are not direct measures of a union's political activities. To obtain a better measure I focus on union endorsements.

I collected the information about union endorsements by searching electronic archives of local newspapers. Most cities in my sample have, at least, one large local newspaper

[7] Voter turnout is notoriously low in many municipal elections, which makes it possible that get-out-the vote campaigns of unions can be effective. Courant et al. (1979) argue that unions care about employment size to increase the political strength of the union. Bennett and Orzechowski (1983) provide some evidence that suggests that unions have a significant impact on local elections.

which covers local political events. The influence of newspapers on voting behavior has been widely studied in political economics.[8] Local newspapers provide an important forum for politicians and unions to announce their positions and are, therefore, reliable sources to obtain endorsement information.

My data set consists of general and run-off elections held in large U.S. cities during the past two decades. I supplement the election and endorsement data with U.S. Census data that characterize urban fiscal policies. My sample consists of 292 elections that pitted an incumbent mayor against a challenger in one of 92 different cities. My paper is the first paper that provides a rigorous empirical analysis of the effects of union endorsements on electoral and economic outcomes for a large sample of U.S. cities.

The third contribution of the paper is that I provide new evidence and quantify the impact of unions on local elections and fiscal policies. I find that challengers strongly benefit from endorsements in competitive elections. My model also has significant implications for the change in public policy after the election. Consider the case in which the union endorses the challenger, and the challenger defeats the incumbent in the election. In this case, my model predicts an increase in the size of the public sector following the election. My empirical analysis provides some evidence suggesting that challengers that receive a union endorsement adopt more union-friendly fiscal policies after they have defeated an incumbent.

My paper is closely related to the topic of this Carnegie Rochester NYU conference issue of the journal. It has been widely recognized that fiscal federalism and interjurisdictional competition can have a variety of positive economic effects. Tiebout (1956) argues that

[8]Snyder and Strömberg (2010) find that voters have better information about their House Representatives if there is local newspaper coverage. Chiang and Knight (2011) find that newspapers endorsements are influential in voters' decisions during presidential elections. Gerber et al. (2009) find that local newspapers affect readers' voting decisions in gubernatorial elections.

fiscal competition leads to a better tailoring of expenditure policies to local needs.[9] "Tiebout competition" may also lead to efficiency gains in the provision of public goods.[10] Besley and Case (1995) show that fiscal decentralization can lead to increased levels of efficiency due to "Yard Stick Competition." Brennan and Buchanan (1980) argue that decentralization is an effective mechanism to control governments' expansive tendencies due to increased electoral accountability. Epple and Romer (1991) show that decentralization provides an effective tool to limit potentially harmful redistribution. Finally, decentralization may also lead to more experimentation with innovative policies Rose-Ackerman (1980).

Despite these potential benefits of decentralization, some researchers and policy analysts have argued that the recent economic recession has put state and municipal finance under stress calling into question the sustainability of fiscal federalism. Some local politicians appear willing to accommodate local unions and public employees leading to an adoption of policies that are not in the interest of voters.[11] These inefficiencies in local public finance can have potentially large implications for the aggregate economy. The analysis of this paper addresses these questions by focusing on the impact of municipal unions on local fiscal policies.[12]

[9]Epple and Sieg (1999) and Epple et al. (2001) estimate and test models that formalize Tiebout's conjecture.

[10]Competition between the public and private sector may also be beneficial. Friedman (1955), suggested to use vouchers to increase competition among public and private schools to raise school quality. Hoxby (2000) provides some empirical evidence that suggests that competition among public school districts increases test scores. Calabrese et al. (2012) argue that distortions from decentralization can arise if equilibrium household sorting is not optimal.

[11]The New York Times published an article by Santos and Chen (2012) on the front page claiming that Michael Mulgrew, the president of the New York teachers' union, is a "coveted friend for the people who hope to become the next mayor."

[12]There has been little research that focuses on special interest groups at the state or local level. Ferreira and Gyourko (2009) find no evidence that political partisanship of the mayors affect the size of city government, the allocation of local public spending, or crime rates. Boustan et al. (2012) find that growing inequality is associated with an expansion in government revenues and expenditures on a wide range of services in U.S. municipalities and school districts.

2.2 Model

I develop a model to study the impact of a special interest group on electoral outcomes and fiscal policies in a city.[13]

2.2.1 Preferences and Actions

There are three types of players in my model: a large number of voters, a union, and two politicians seeking to be elected to become the mayor of a city. I distinguish between an incumbent denoted by I and a challenger denoted by C.

There is a continuum of voters with mass normalized to one. Voters care about the policy enacted after the election. Let R denote the exogenously given revenue available to the municipality and T the transfer to the union and its members.[14]

Assumption 1

The quality of public good provision is given by

$$q = q(R - T) \tag{2.1}$$

The transfer to the union thus creates an inefficiency in public good provision. Voters would prefer to set $T = 0$.

The union only cares about the magnitude of the transfer that it receives from the elected

[13] Coate and Morris (1995) study transfers to special interest groups under commitment. Grossman and Helpman (1996) study how special interest groups make contributions to affect the equilibrium policy platforms under commitment. Grossman and Helpman (1999) treat endorsements as a language of communication between well-informed interest group leaders and lesser informed members.

[14] It is straight forward to endogenize local revenues. The key results of the paper only depend on the fact the politicians can be ranked on a one-dimensional index by voters.

politician.[15]

Assumption 2

The utility function of the union is given by $u_g(T)$, which is strictly increasing in T.

Prior to the election the union can endorse, at most, one politician and provide active campaign support for the endorsed politician. Let d_g denote an indicator variable that is defined as follows:

$$d_g = \begin{cases} 1 & : \text{ if the union endorses the incumbent,} \\ 0 & : \text{ if the union endorses neither candidate,} \\ -1 & : \text{ if the union endorses the challenger.} \end{cases} \tag{2.2}$$

Endorsement costs are denoted by $c \in \{c^I, c^C\}$. The endorsement influences the outcome of the campaign by shifting voter preferences. As explained in detail below the union choses an endorsement strategy to maximize expected utility.

Voters' preferences satisfy the following conditions:

Assumption 3

a) The utility function of each voter is additively separable between the utility associated with policy q, a common preference shock for each the politician, and the endorsement effect of the union. Hence voter's preferences can be expresses as:

$$u_v(q^I) + v^I + a^I 1_{\{d_g=1\}} \tag{2.3}$$

$$u_v(q^C) + v^C + a^C 1_{\{d_g=-1\}}$$

[15] My model abstracts from the fact that unions can have a positive impact on welfare by affecting the quality of local goods and services.

where a_C and a_I measure the "muscle" effect of the endorsement.

b) $v = v^C - v^I$ is a continuous random variable with full support and distribution denoted by $F(\cdot)$.

For simplicity I assume that the utility function is the same for all voters.[16]

Politicians care about voters, but they also need to win elections. Since the union can affect the electoral outcome, politicians care about unions. I model the objective function of a politician as a weighted average of voters' preferences and union preferences. Some politicians are more "pro-union" than others. I capture this heterogeneity by assuming that politicians differ in the weight that they place on union preferences.

Assumption 4

a) A politician has a utility function that is given by:

$$(1-\theta)\, u_p(q) \;+\; \theta\, u_p(T) \tag{2.4}$$

where $\theta \in [0,1]$ is drawn from distribution $G(\cdot)$.

b) For each value of θ there exists a unique maximizer of the politician's utility, denoted by $T_0(\theta)$, where $T_0(\theta)$ is strictly increasing in θ.[17]

2.2.2 Timeline, Information, Strategies, and Equilibrium

I model the game between voters, the union, and the two politicians as a sequential game in extensive form with incomplete information. The timing of decisions is as follows:

[16] All of my main results can be extended cases with voter heterogeneity over policies.

[17] Assumption 4b implies that the function T_0 is invertible, hence the politicians type is given by $\theta = T_0^{-1}(q)$.

1. The challenger type is drawn form the distribution $G(\theta)$.

2. The type is known to the union, but unknown to the voters.

3. The union decides whether or not to endorse one of the politicians.

4. The voters observe the endorsement and update their beliefs.

5. Voters elect one of the two politicians as the mayor of the city.

6. The mayor implements his or her preferred policy.

Figure B.1 provides an illustration of the tree of this game in extensive form.

A pure strategy for the union is a mapping from the type space of challengers, denoted by $\Theta = [0, 1]$, into the endorsement space, $E = \{1, 0, -1\}$.

A pure strategy for each voter is a mapping from the endorsement space $E = \{1, 0, -1\}$ into the voting space, $V = \{1, -1\}$. Since there are only two candidates, sincere voting is a dominant strategy for each voter.

A pure strategy for a politician is mapping from Θ into the transfer space. As I have discussed above, a politician cannot commit to a policy or a transfer to the union prior to the election. Hence, the dominant strategy of a politician is to implement $T_0(\theta)$ after the election.

The equilibrium concept is Perfect Bayesian Equilibrium in pure strategies.

2.2.3 Equilibrium

For given value of θ^I, the equilibrium strategy of the union can be characterized by a partition of Θ denoted by $\{\Theta_1, \Theta_0, \Theta_{-1}\}$ such that

$$d_g = \begin{cases} 1 & : \quad \theta^C \in \Theta_1 \\ 0 & : \quad \theta^C \in \Theta_0 \\ -1 & : \quad \theta^C \in \Theta_{-1} \end{cases} \tag{2.5}$$

Given this strategy, voters will update their beliefs about the challenger according to Bayes' Rule.[18] The incumbent's probability of winning the election conditional on the endorsement strategy is, therefore, given by:

$$\begin{aligned} S_1 &= F(u_v^I - E[u_v^C \mid \theta^C \in \Theta_1] + a^I) \\ S_0 &= F(u_v^I - E[u_v^C \mid \theta^C \in \Theta_0]) \\ S_{-1} &= F(u_v^I - E[u_v^C \mid \theta^C \in \Theta_{-1}] - a^C) \end{aligned} \tag{2.6}$$

The expected utility of the union is then:

$$\begin{aligned} \pi_1 &= S_1 u_g^I + (1 - S_1)\, u_g^C - c^I \\ \pi_0 &= S_0 u_g^I + (1 - S_0)\, u_g^C \\ \pi_{-1} &= S_{-1} u_g^I + (1 - S_{-1})\, u_g^C - c^C \end{aligned} \tag{2.7}$$

Proposition 1 provides conditions that guarantee an equilibrium exists, with all three

[18] Here I implicitly assume that all Θ_j are not empty. I consider the case of corner solutions below.

actions $d_g = \{1, 0, -1\}$ arising as equilibrium outcomes:

Proposition 1 *Define the strategy of the union as:*

$$d_g = \begin{cases} 1 & : \quad \theta^C < K_1(\theta^I) \\ 0 & : \quad \theta^C \in [K_1(\theta^I), K_2(\theta^I)] \\ -1 & : \quad \theta^C > K_2(\theta^I) \end{cases}$$

with $0 \leq K_1(\theta^I) \leq \theta^I \leq K_2(\theta^I) \leq 1$. $K_1(\theta^I)$ *and* $K_2(\theta^I)$ *are the solution to the following two equations:*

$$0.95T_0^{-1}\{u_g^{-1}(u_g^I - \frac{c^I}{F(u_v^I - E[u_v^C \mid \theta^C < K_1] + a^I) - F(u_v^I - E[u_v^C \mid \theta^C \in [K_1, K_2]])})\} = K_1$$

$$0.95T_0^{-1}\{u_g^{-1}(u_g^I + \frac{c^C}{F(u_v^I - E[u_v^C \mid \theta^C \in [K_1, K_2]]) - F(u_v^I - E[u_v^C \mid \theta^C > K_2] - a^C)})\} = K_2$$

This strategy is an equilibrium strategy if the advertisement effect is sufficiently strong, i.e. if a^I *and* a^c *satisfy:*

$$\begin{aligned} E[u_v^C \mid \theta^C < K_1(\theta^I)] - E[u_v^C \mid \theta^C \in [K_1(\theta^I), K_2(\theta^I)]] &< a^I \\ E[u_v^C \mid \theta^C \in [K_1(\theta^I), K_2(\theta^I)]] - E[u_v^C \mid \theta^C > K_2(\theta^I)] &< a^C \end{aligned}$$

A proof of Proposition 1 is provided in Appendix A.

Broadly speaking, Proposition 1 shows that the union endorsement has two effects in equilibrium. First, it directly increases the probability of winning of the endorsed candidate. I denote this as the "muscle effect." In practice, the union can accomplish this by mobilizing

its members and increasing turnout of pro-union voters, a strategy also known as "mobilizing the base." Moreover, local unions sometimes provide staffing or administrative support for campaigns of politicians that are endorsed.[19]

Second, the endorsement conveys information to uninformed voters about the position of the challenger. I denote this effect as the "informational externality." In my model, the informational externality is purely negative, harming the politician that receives the endorsement. It is not difficult to extend my model in which I have a second type of voter for whom the union endorsement is a positive informational externality. I can view the second type of voter as ideological assuming that this type only turns out for an election if the union explicitly tells him to do so.

A necessary condition for the existence of an equilibrium with endorsement is that the positive "muscle effect" is larger than than the negative "informational externality." This condition is not sufficient to generate an endorsement if the difference in positions between politicians is small or if the endorsement costs are large.

Proposition 1 assumes an interior solution for the thresholds that characterize the union's strategy, i.e. $K_1, K_2 \in (0,1)$. I can extend the result in Proposition 1 and consider three special cases that arise when the solution to the system of equations that defines the thresholds has, at least, one corner solution. The first case arises when $K_1 \leq 0$, $K_2 \in (0,1)$. In this case, $\{\theta^C : \theta^C < K_1\} = \emptyset$, so $d_g = 1$ will never be selected in equilibrium. To guarantee that $d_g = 1$ is not a profitable deviation, I need to specify voters' belief off the equilibrium path, i.e. specify beliefs about θ^C when $d_g = 1$ is played off the equilibrium path.

Assumption 5 *If $\Theta_1 = \emptyset$ and voters observe $d_g = 1$, they believe that $\theta^C = 0$*

[19] I mainly abstract from campaign contributions which play a much larger role in state and federal elections.

Assumption 5 then implies that $E(u_v^C \mid d_g = 1) = E(u_v^C \mid \theta^C = 0)$. The probabilities of winning the election are now given by:

$$\begin{aligned} S_1 &= F(u_v^I - E[u_v^C \mid \theta^C = 0] + a^I) \\ S_0 &= F(u_v^I - E[u_v^C \mid \theta^C \in [0, K_2(\theta^I)]]) \\ S_{-1} &= F(u_v^I - E[u_v^C \mid \theta^C \in (K_2(\theta^I), 1]] - a^C) \end{aligned} \tag{2.8}$$

A corner solution arises if $K_1(\theta^I)$ satisfies the following condition:

$$K_1 = T_0^{-1}\{u_g^{-1}(u_g^I - \frac{c^I}{F(u_v^I - E[u_v^C \mid \theta^C = 0] + a^I) - F(u_v^I - E[u_v^C \mid \theta^C \in [0, K_2]])})\} \leq 0$$

The equilibrium strategy of the union in this case is is given by:

$$d_g = \begin{cases} 0 & : \quad \theta^C \in [0, K_2(\theta^I)] \\ -1 & : \quad \theta^C \in (K_2(\theta^I), 1] \end{cases} \tag{2.9}$$

The second case arises when $K_1 \in (0, 1)$, $K_2 \geq 1$. Similar to the first case, I need to specify voters' beliefs about θ^C when $d_g = -1$ is taken.

Assumption 6 *If $\Theta_{-1} = \emptyset$ and voters observe $d_g = -1$, they believe that $\theta^C = 1$.*

Assumption 6 implies that $E(u_v^C \mid d_g = -1) = E(u_v^C \mid \theta^C = 1)$. Again define:

$$\begin{aligned} S_1 &= F(u_v^I - E[u_v^C \mid \theta^C \in [0, K_1(\theta^I))] + a^I) \\ S_0 &= F(u_v^I - E[u_v^C \mid \theta^C \in [K_1(\theta^I), 1]]) \\ S_{-1} &= F(u_v^I - E[u_v^C \mid \theta^C = 1] - a^C) \end{aligned} \tag{2.10}$$

Let $K_2(\theta^I)$ satisfies the following equation:

$$K_2 \quad = \quad T_0^{-1}\{u_g^{-1}(u_g^I + \frac{c^C}{F(u_v^I - E[u_v^C \mid \theta^C \in [K_1, 1]]) - F(u_v^I - E[u_v^C \mid \theta^C = 1] - a^C)}) \geq 1$$

while $K_1 \in (0, 1)$. The equilibrium strategy of the union is given by:

$$d_g = \begin{cases} 1 & : \quad \theta^C \in [0, K_1(\theta^I)) \\ 0 & : \quad \theta^C \in [K_1(\theta^I), 1] \end{cases} \tag{2.11}$$

The last case arises when $K_1 \leq 0$, and$K_2 \geq 1$. Specifying off-equilibrium beliefs as before, I obtain the following probabilities:

$$\begin{aligned} S_1 &= F(u_v^I - E[u_v^C \mid \theta^C = 0] + a^I) \\ S_0 &= F(u_v^I - E[u_v^C \mid \theta^C \in [0, 1]]) \\ S_{-1} &= F(u_v^I - E[u_v^C \mid \theta^C = 1] - a^C) \end{aligned} \tag{2.12}$$

The equilibrium strategy of the union is then given by:

$$d_g = \begin{cases} 0 & : \quad \theta^C \in [0, 1] \end{cases} \tag{2.13}$$

To illustrate the main results of Proposition 1, I consider a fully parametrized numerical example of my model.[20] The optimal strategy of the union is plotted in Figure B.2. The two axes denote the type of the incumbent and the type of the challenger. The lines in the plot denote the cut-off levels, K_1 and K_2 that characterize the optimal strategy of the

[20]Details about my parameterization and calibration are available upon request from the authors.

union. The 45 degree line satisfies $\theta^I = \theta^C$ and falls between the two cutoff values K_1 and K_2. There are three subsets of the underlying type space that deserve special attention. Subset 1 is the set of θ^I in which only $d_g \in \{0, -1\}$ arise as equilibrium outcomes. Subset 2 is the set of θ^I in which $d_g \in \{1, 0, -1\}$ arise in outcomes. Subset 3 is the set of θ^I with only $d_g \in \{0, 1\}$ are chosen in equilibrium.

I have also performed some comparative static exercises. First, I investigate how the optimal strategy varies as I decrease the endorsement costs. I find that for every value of θ^I the region of θ^C with no endorsement decreases. The cheaper the endorsement is, the more active is the union. Second, I decrease the muscle effect. I find that for every value of θ^I, the region for θ^C with no endorsement increases. The intuition is that the lower muscle effect makes it harder to offset the negative signaling externality of the endorsement. Hence the union is less active.

I can also show that the equilibrium characterized in Proposition 1 is unique in the following sense.

Proposition 2 *The equilibrium characterized in Proposition 1 is the only equilibrium with all three actions $d_g = \{1, 0, -1\}$ being used as part of the union's equilibrium strategy.*

A proof of Proposition 2 is provided in Appendix A.

Equilibrium imposes strong restrictions on the change in public policy after an election. Consider the case in which the union endorses the challenger, and the challenger defeats the incumbent in the election. In that case, my model predicts an increase in the transfer to the public sector following the election. Similarly, if the union endorses the incumbent, and the challenger wins the election, the model predicts a decrease in the transfer to the union. I expect only small policy changes if nobody is endorsed. If an incumbent is reelected, the

size of the transfer does not change. Proposition 3 formalizes this result.[21]

Proposition 3

a) If $d_g = 1$ *and the challenger wins then* $\Delta T < 0$

b) If $d_g = -1$ *and the challenger wins then* $\Delta T > 0$

c) If $d_g = 0$ *and the challenger wins then* $|\Delta T| \leq \epsilon$

A proof of Proposition 3 is provided in Appendix A.

2.3 Data

My empirical analysis focuses on the most populous cities in the U.S., as classified by the 2010 U.S. Census.[22] For each city, I focus on elections that were held between 1990 and 2012. In my sample, 10.87 percent of all cities are located in the east, 34.78 percent in the west, 35.87 in the south, and 18.48 in the midwest. Cities can be classified into two types. First, there are partisan cities that require political candidates to enter a race with a party affiliation. Partisan elections are only held in 15.22 percent of all cities in the sample. The vast majority of cities are thus non-partisan. In these cities, candidates are not allowed or are not obligated to run with a party affiliation.[23] In some non-partisan elections, it is common knowledge which candidates are members of and backed by which parties. In other elections, parties are not involved.[24]

[21] Here I only consider the case of an interior solution. The corner solution cases can be analyzed using a similar logic.

[22] As explained in detail below, my sample consists of 92 out of the 150 largest cities in the U.S.

[23] Nonpartisan elections are generally held for school boards, and are also common in the election of judges.

[24] In 1915, A.C. Townley founded the Nonpartisan League in North Dakota as s backlash against partisan politics. This movement quickly spread across the Midwest and attracted much attention in large cities. More recently, Proposition 14 in California mandated that all elections for municipal offices in California have to be nonpartisan. It was approved by 54 percent of the voters in 2010.

There are two different types of elections that occur during our sample period: general elections and run-off elections. General elections have potentially more than two candidates. If the general election does not determine a winner, a run-off election is held between the two candidates that received the most votes in a general election, but failed to obtain an absolute majority of the votes. For partisan cities, I study Democratic and Republican primaries. For each election type I construct a list of candidates as well as information on vote shares, partisanship, and incumbency status. I have obtained the election data from two different data sources. First, I called the city registrar in each city and asked for historical election data. Second, I cross-checked the information with data from a website called Ourcampaigns.[25]

I constructed mayoral histories for each city going back to the 1980's. Based on this historical data, I can then classify cities into two types: cities that were primarily controlled by one party during the observed history and cities that are more competitive and have mayors from different parties. In my sample, the fraction of cities that are controlled by one party since 1990 (1980) is 27.17 (21.74) percent.

I also collected data characterizing differences in political institutions. Most cities impose some sort of term limit. In many cities mayors can only be elected for two successive periods. I find that 89.13 percent of all cities have term limits for mayors. I also characterize the strength of the office of the mayor. I consider the position of a mayor as strong if he is directly elected by majority rule and if he is at the same time the head of the administration, i.e. if there is no professional city manger at the top of the city administration. In my sample, 63.04 percent of all cities have strong mayors.

[25]The web site is http://www.ourcampaigns.com/ Ourcampaigns is a large electronic community with $8,674$ registered members and contains detailed information on $267,420$ political races.

I have obtained endorsement data from two different data sources. First, I called the different municipal unions in each city. This approach was time consuming and did not yield in a high response rate. Second, I relied on local newspaper coverage to measure endorsements. I utilize an electronic database called “Newsbank" that contains rich, searchable, full-text of international, national, regional, and local newspapers. I assign a newspaper to a city if the newspaper has the city's name in the title or if the newspaper serves the county and surrounding counties with headquarters in the city.

I consider three types of public sector unions: police unions (such as local chapters of the Fraternal Order of Police or the Police Officers' Association), firefighters' unions (such as local chapters of the Fraternal Order of Firefighters and the International Association of Firefighters) and teachers' unions (such as local chapters of American Federation of Teachers and National Education Association). If there are multiple unions in a city I aggregate unions of the same type and treat these as one union.[26] I focus on police, firefighters and teachers because these occupations have a long established tradition of unionization and are well organized in almost all cities. For instance, the Fraternal Order of Police, founded in 1915, has over $325,000$ members organized in $2,100$ local chapters. The International Association of Firefighters, founded in 1918, has $298,000$ members in more than $3,200$ locals. the American Federation of Teachers, founded in 1916, has 1.1 million members in around 600 locals.[27] Police officers (firefighters/teachers) account on average for 16.61 (11.02/33.77) percent of public sector employment in my sample as well as 20.64 (13.92/38.36) percent of

[26] In addition, I also collected data on city employee's unions such as local chapters of American Federation of State, County and Municipal Employees and local chapters of Services Employees International Union.

[27] It is noteworthy that only 11 out of 92 cities in my sample have positive expenditures on elementary and secondary school teachers' payrolls. School districts are typically independent from municipal governments. I include teacher union activities for those 11 cities only as my theory predicts that a union participates in an elections to obtain transfers from the local government.

the payroll.

For each candidate, I search the local newspapers in the election year using the following key words:

- police + candidate name + city name + mayoral election + endorsement
- firefighter + candidate name + city name + mayoral election + endorsement
- teacher + candidate name + city name + mayoral election + endorsement

The database returns the articles with specific key words. I read each article to identify whether a public sector union endorsed a candidate. Since it is hard to determine at which stage of the election process the endorsement comes, I treat each endorsement as an endorsement for the entire length of the mayoral election.

Transfers to public unions and its members are not directly observed int he data. Instead, I focus on outcomes that are closely related to potential transfers. I obtain data on public sector employment and payrolls by functions from the Annual Survey of Public Employment and Payroll collected by the U.S. Census Bureau.[28] I use full-time equivalent employees to measure employment. I adjust the payroll data by the Consumer Price Index - All Urban Consumers, published by Bureau of Labor Statistics. The base period is 1982-84. I normalize the public sector size and total payrolls by the city population. I interpolate the missing values.[29]

To construct the sample used in the empirical analysis, I start with the 150 most populous cities based on 2010 U.S. Census. First, I exclude Cincinnati and all cities in Arizona. Cincinnati adopts a different election system from my model: they elect six council members

[28] http://www.census.gov/govs/apes/

[29] An appendix is available upon request which provides details.

at one election, and the top candidate automatically becomes mayor. In Arizona, state law forbids local unions to participate in political activities in regions where they have a member. Therefore, local unions cannot make endorsement decisions as described in my model. Hence, the sample size shrinks to 141 cities. I managed to assemble election results for 723 elections in 124 cities.

The second step is to find police union, firefighter union and teacher union endorsements from local newspapers and phone conversations. That step reduces the sample to 97 cities and 499 elections. In the third step, I only keep elections with an incumbent and, at least, one challenger reducing the sample to 92 cities and 299 elections, including 294 general elections, 60 runoff elections, 9 Republican primaries, and 24 Democratic primaries. In the fourth step, I restrict my sample to elections with full public sector data reducing the sample to 92 cities and 292 elections, with 287 general elections, 59 runoff elections, 9 Republican primaries and 24 Democratic primary elections. Finally, I keep only elections with full turnout data. I delete one general election, and the rest remain the same. Table B.1 provides summary statistics for the sample used in the subsequent analysis.

2.4 Empirical Results

I investigate the impact of union endorsements on election outcomes. From the perspective of my theoretical analysis, the main outcome of interest is the probability that the incumbent is reelected. However, there is separate interest in the vote share of the incumbent which provides a continuous measure of the electoral success of the incumbent. In addition I consider the impact of endorsements on voter-turnout. This outcome measures how effectively a union can mobilize its base. Finally, I consider the impact of union endorsements

on urban fiscal policy outcomes that capture the “transfers" generated by the union. Here I focus on salaries of unionized employees as well as employment levels.[30]

2.4.1 The Impact of Unions on Elections

I can classify elections by observed endorsement status. Table B.2 summarizes the election path that mimics my game. I find that there is a strong incumbency advantage. Incumbents won 35 of 41 elections in which they received endorsements. Incumbents won 181 out 200 elections without endorsements and 24 out of 44 elections with endorsements of the challengers.[31] The mean of margin of victory is 39.99 percent in elections with no endorsements, 33.44 percent if the incumbent is endorsed, and 16.47 if the challenger is endorsed.

My model predicts that the effect of an endorsement on the endorsed politician's probability of winning the election should be positive, but potentially small. If the union endorses the incumbent, the muscle effect increases the incumbent's vote share while the signaling externality decreases the vote share. To test these predictions, I estimate Logit models to quantify the impact of an endorsement on the winning probability of the incumbent. My model specifications control for the full vector of observed heterogeneity among cities which includes geographic dummy variables, as well as variables capturing partisanship, one-party control, term limits, and mayoral strength. Table B.3 shows the results of my maximum likelihood estimates. I distinguish between general elections, run-off-elections and key elections. The key election can be a primary, a general or a run-off election. I use the one with the highest turn-out.

Table B.3 shows that the endorsement has no significant effect for incumbents. That is

[30] I do not have reliable measures of total compensation or benefits. Moreover, I am lacking data that characterize work rules or hiring and firing practices.

[31] There are 14 elections with multiple endorsements.

not surprising since most incumbents are safe and are reelected with wide margins of victory. I find that challengers benefit much more from an endorsement than incumbents. Moreover, the effect on the incumbent's reelection probability is not only negative (as predicted by my model) and statistically significant different from zero, but the effect is large in magnitude. My estimates that the probability of winning reelection is reduced by 22 to 41 percentage points if the challenger receives an endorsement.

It is important to recognize that this part of the analysis suffers from a potential endogeneity problem. Unions may decide to endorse candidates for reasons that have not been modeled thus far. For example, it is possible that candidates differ in quality or "valor," which is observed by the union, but unobserved by the econometrician. In that case a union may decide to endorse the higher quality candidate who is also more likely to win the election. In particular, challengers that receive the endorsement of the union may be better candidates. While it is not difficult to extend my theoretical model to account for differences in quality among politicians, it is more challenging to deal with these issues empirically, given that there are no obvious instruments. Alternatively, unions may have a preference for "winners" since they need to deal with successful politicians. While this is another plausible explanation for potential endogeneity, it seems to be less of an issue in my application. I observe, for example, that the vast majority of incumbents do not receive union endorsements despite the fact they are reelected with almost 90 percent probability.

The vote share of the incumbent provides an alternative measure of the electoral success of the incumbent. This measure has the advantage that it is continuous. As a consequence, I also regress the vote share of the incumbent on union endorsement controlling for observed and unobserved city characteristics. Table B.4 summarizes the main results. Note that

the base category is that nobody is endorsed. The city characteristics include geographic locations, whether to hold partisan elections, single party in power, term limit, and whether strong mayor. Overall, the findings are qualitatively and quantitatively similar to the results that are based on the Logit models. There is a large negative effect on the incumbent's vote share if a union endorses the challenger or if both candidates receive endorsements.[32]

Next I consider the impact of union endorsement on election turn-out. A union can influence the outcome of a local election by mobilizing its base including union members as well as friends and family of members. I, therefore, investigate whether there is a systematic relationship between election turnout and union endorsement.

Table B.5 summarizes the main results. Overall, I find some evidence that suggests that union endorsements increase voter turn-out. This finding is true for endorsements of incumbents as well as challengers. The effect is larger if a challenger is endorsed and in key elections.

2.4.2 The Impact of Unions on Urban Fiscal Policy

Recall that Proposition 3 predicts that transfers to the union increase if the challenger is endorsed by the union and the challenger defeats the incumbent. I can test this prediction using a difference-in-difference estimation strategy. Let y_{it} denote the outcome of interest that captures transfers to unions. Consider the following regression model:

$$y_{it} = \alpha_i + \alpha_t + \sum_{s=1}^{S} \gamma_{1s} L_{it-s} E^C_{it-s} + \epsilon_{it} \tag{2.14}$$

[32]Key elections are defined as party primary elections for cities with single party in power since 1990, and the type of election with highest voter turnout rate otherwise.

where L_{it} is a dummy that is equal to one of the incumbent lost the election at time t and zero otherwise. E_{it}^{C} is one if the challenger received a union endorsement in the election at time t and zero otherwise. I include lagged variables to account for possible adjustment costs, since it may take some time for a new administration to implement changes in fiscal policy. This identification strategy accounts for time-invariant unobserved city characteristics and aggregate shocks. I do not include a contemporaneous effect since municipal elections are typically held at the end of the calendar year.

Broadly speaking, my model implies that the public sector should grow whenever the newly elected mayor is likely to be more "pro-union" than the incumbent that lost the election. Table B.6 shows the results of my estimations for the full sample. All coefficients reported in Table B.6 are predicted to be positive.[33] I find that this is case. However, only a small subset of all coefficients are statistically significantly different from zero. I, therefore, conclude that there is some evidence that suggests that challengers that are endorsed by the union tend to increase spending and or salaries if they manage to defeat an incumbent.

Proposition 3 also predicts that spending and payrolls should decrease, if the union endorses the incumbent and the challenger wins. The corresponding regression model is given by

$$y_{it} = \alpha_i + \alpha_t + \sum_{s=1}^{S} \gamma_{2s} L_{it-s} E_{it-s}^{I} + \epsilon_{it} \tag{2.15}$$

where L_{it} is a dummy that is equal to one of the incumbent lost the election at time t and zero otherwise. E_{it}^{I} is one if the incumbent received a union endorsement in the election at

[33] Observations with no fire sector or police sector are excluded from respective regressions. Size per capita is increased by 10000.

time t and zero otherwise. All coefficients γ_{2s} are predicted to be negative. When I estimate this regression I find no evidence that supports my model. In particular, the estimates of γ_{2s} are insignificant and have both positive and negative signs. This finding is consistent with the view that it is hard to downsize the public sector in the short run. Existing contractual agreements make it virtually impossible to cut salaries. Moreover, reductions in employment can only be achieved by not filling openings that arise due to voluntary attrition.

2.5 Summary

The efficient decentralized provision of public goods requires that special interest groups do not exercise undue influence on the outcome of municipal elections or local fiscal policies. I have developed a new political economy model in which an incumbent faces a challenger in a local election. A union can endorse one of the candidates and provide political support. I have shown that there is an inherent conflict faced by the municipal union. While union support increases the chances of winning the election because the union can mobilize its members, the endorsement also generates a negative informational externality. Voters observe the endorsement and update their beliefs about the position of the challenger. Theory also predicts that unions can have a significant impact on fiscal policies by shifting policies away from the preferred policies of the voters and, thus, potentially creating inefficiencies in local public good provision and in the aggregate economy. I have tested the predictions of my model using a novel data set that focuses on municipal elections in the largest cities in the U.S. between 1990 and 2012. I have shown that challengers strongly benefit from endorsements in competitive elections. Challengers that receive union endorsements and successfully defeat an incumbent also tend to adopt more union friendly fiscal policies.

I view the findings of this paper as promising for future research. An interesting extension would be to study open elections in which there are no established incumbents. One drawback of studying open elections is that theory does not easily provide clear predictions about the sign and magnitude of the change in policy that I would expect after the election. It is, for example, possible that a unions may endorse a candidate in an open election that is less supportive of the union than the previous incumbent.[34] Another promising line of research is to consider the following two-period extension of my model. In the first period there is an open election without an incumbent. In the second period, the incumbent runs against a new challenger. I can view the analysis in this paper as pertaining to the sub-game that arises in the second period. The extended model then endogenizes the incumbency status and allows voters to (potentially) punish first round winners that adopt unpopular policies. While it is compelling to pursue this idea, extending the model to a multi-period environment is not trivial. A key problem is that the strategy spaces of politicians, unions and voters are more complicated which makes it much harder to characterize an equilibrium of the game.

[34] Another interesting idea for future research is to examine if teacher unions endorse union-friendly candidates in school board elections.

Appendix A

Appendix to Chapter 1

A.1 Sample Selection

The first wave of the AJD contains 3905 valid responses from the nationally representative sample. The second wave of AJD contains 3705 valid responses. Both waves ask about the details of current job (including sectors, salary, working hours, starting date, etc), education background, and some personal characteristics. The second wave records the details of job history, including sector, starting date, ending date, etc. The first wave also asks about the job history, but only records starting year and ending year.

Firstly, I construct the full-time job histories of respondents. The starting points are the self-retrospective histories in wave II. I reasonably impute the job characteristics (i.e. starting dates, ending dates, sector classifications) to make job histories consistent. For some respondents who report the starting year of the earliest job earlier than 2003, I use wave I information as a supplement. I delete the individuals who only report job information of 2006 and the starting year of that job is later than 2003.

Secondly, I impute class of 1999 as class of 2000. I am interested in the career choices for the class of 2000, but they may either take bar exams in 2000, 2001, or later. The dataset provides

information on the first-time bar exam takers in 2000. I assume students from class of 1999 who take exams in 2000 are approximately the same as students from class of 2000 who take exams in 2001. As the majority of students (93.75% of students in the sample graduate in 1999 or 2000) take their first bar exams within two years, I drop individuals who do otherwise.

Thirdly, I bundle the monthly job choices into annual job choices. I derive a method based on Keane and Wolpin (1997). For each year since 2001, I calculate the number of months the respondent is not working. If that number is greater than four, I treat him as not employed. If that number is less than four, I compare the sector in which he has worked for the longest time, and assign it as his job for the year. If the job has a missing sector classification for the longest spell, I treat the individual as employed for the year, but with missing information on employment. Note that I focus on full-time jobs in this research, so a spell with only part-time jobs is considered as not employed.

Fourthly, I impute the undergraduate GPA using law school GPA, law school tiers, gender, race, debt, gender, age, and graduation year for those undergraduate GPA are missing. I do this for the 747 individuals who had missing undergraduate GPA scores in my final sample.

Fifthly, I gather information on judicial clerks from Official Guide to Law Schools[1]. Judicial clerks are temporary jobs that are usually taken right after J.D. graduation. Typically the job lasts for one or two years. AJD only solicits job information excluding judicial clerks. So I rely on OG to calculate the proportion of judicial clerkship placements by each tier of schools. The judicial clerkship accounts for 17%, 10%, 9% and 6% for Tier 1, 2, 3 and 4 schools.

Table A.1 shows the statistics of sample selection process.

A.2 Robustness Check of Empirical Facts

Fact 1 *Females with more debt have more work experience in private law firms.*

Table A.2 reports the results of linear regressions with experience in private law firms, in pub-

[1]Published by the American Bar Association.

Table A.1: Sample Selection

	Obs
Full Sample	5349
With info on debt upon graduation	4935
Take first bar exam in 2000	4658
Class of 1999 or 2000	4367
With info on law school tiers	4219
With info on gender	4211
With info on dates of at least one job	2931
With complete job histories	2366
Female	1193

lic/business sector, or of being not employed as of 2007 as dependent variables, and debt as an explanatory variable. The expected experience with mean debt level ($85,200) is 2.99, 2.26, 1.73 years [2]. An increase of $10,000 debt upon graduation is associated with 0.06 years more in private law firms and 0.04 years less being not employed. One standard deviation ($58,300) more debt upon graduation is therefore associated with 12.5 percent increase in private law firms experience and 16.53 percent decrease in years of not employed.

Table A.3 reports the results of multinomial logistic regressions with dependent variables as the probabilities of each alternative in each of the year 2003-2007. All the reported estimates are the marginal effects of $1000 more debt on the choice probabilities of each of the three sectors evaluated at the mean[3]. The magnitudes are similar to that in previous specifications measured by percent changes. The relationships are strong and significant almost over the entire span.

Overall speaking, debt is strongly related to the sector choices of females, and the relationship persists at least seven years after graduation.

Fact 2 *Females with more debt are more likely to postpone marriage.*

Table A.4 reports the results of survival analysis with dependent variables as hazards of getting married. The regressions are meant to describe whether debt is related to the timing of marriages. The baseline hazard (at the mean level of debt) is around 54 percentage points. Specification (1) in

[2]I include judicial clerk experience as being not employed, as the surveys do not differentiate these two.
[3]The average marginal effects are similar in magnitude and significance levels.

Table A.2: Debt and Working Experience 7 Years After Graduation

	Private	Public/Business	Not Employed
Debt upon Graduation	6.25***	-1.91	-4.34***
(in 2014 $1,000)	(4.15)	(-1.31)	(-3.81)
Observations	1089	1089	1089

t statistics in parentheses

[a] Control variables: undergraduate gpa, age, school tier, year of bar admission, whether a parent is a lawyer, parents' education, race.

[b] All estimates are in 10^{-3}.

[c] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3: Debt and Career Choices: 2003-2007

Year	Private Law Firms	Public/Business	Not Employed
2003	0.84**	-0.42	-0.41*
2004	0.69**	-0.04	-0.65***
2005	1.17***	-0.44	-0.74***
2006	0.87***	-0.16	-0.71***
2007	1.12***	-0.23	-0.89***

[a] Reports the marginal effects in choice probability of each sector through year-by-year multinomial logistic regressions. The explanatory variable is student debt upon graduation measured in 2014 $1000.

[b] All estimates are in 10^{-3}.

[c] Control variables: undergraduate gpa, age, school tier, year of bar admission, whether a parent is a lawyer, parents' education, race.

[d] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4 shows a 0.057 percentage point decrease in the probability of getting married in the next three years conditional on being single, given $1000 more debt upon graduation. One more standard deviation of debt ($58,300) would decrease the probability by 3.32 percentage points, or 6.1 percent of the baseline. Specification (2) uses the remaining amount of debt as the explanatory variable and reaches similar estimates. One alternative mechanism is that those with more debt are more likely to work in private law firms, and long hours reduce their social life. To isolate such possible effects of labor market choices on marriage outcomes, I conduct two robustness tests by including the sector specific work experience. The results remain largely the same, as shown in specification (3) and (4).

Table A.4: Debt and Marriage Rates

	Being Married			
	(1)	(2)	(3)	(4)
Debt upon Graduation	-0.057**		-0.049**	
(in 2014 $1000)	(-2.49)		(-2.16)	
Remaining Debt		-0.067***		-0.063**
(in 2014 $1000)		(-2.64)		(-2.49)
Sector-Specific Work Exp			yes	yes
Observations	1622	1607	1622	1607

t statistics in parentheses

[a] Conditional log-log models for discrete time proportional hazard, time is bundled in 2 periods, each period corresponds to 3 years.
[c] Reports the marginal effects on Probability of (Event happens in current period given it has not happened before) evaluated at mean. Average marginal effects are similar.
[d] Clusters by individual, Control variables: undergraduate gpa, age, school tier, year of bar admission, whether a parent is a lawyer, parents' education, race.
[e] In data, only marital status in 2003 and 2006 are observed.
[f] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Fact 3 *Spouses of females with more debt have lower earnings.*

Table A.5 reports the Tobit regression results with dependent variables as accepted spousal earnings for the year 2006, and the explanatory variable as debt upon graduation. As shown in specification (1), with one more dollar of debt, the accepted salary of the spouse decreases by 16 cents. One alternative mechanism is that those with more debt are more likely to work in private law firms,

and long hours prevent them from finding and dating high-earning spouses. To isolate this possible effect of labor market choices on marriage outcomes, I conduct two robustness tests. In the first test shown in specification (2), I control for the work experience in each sector as of 2005. In the second test shown in specification (3), I control for the working hours reported for 2006. The estimates do not change much.[4]

Table A.5: Debt and Spousal Salary of Year 2006

	Accepted Spousal Salary		
	(1)	(2)	(3)
Debt upon Graduation	-0.157**	-0.125*	-0.128*
	(-2.20)	(-1.75)	(-1.83)
Sector-Specific Work Exp by 2005		yes	
Work Hours in 2006			yes
Observations	723	723	723

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[a] Control variables: undergraduate gpa, age, school tier, year of bar admission, whether a parent is a lawyer, parents' education, race

Fact 4 *Females with more debt are more likely to postpone childbearing.*

Table A.6 reports the results of survival analysis with the dependent variable as the hazard of having a child. The average hazard in the data is 8.7 percentage points. Specification (1) in Table A.4 shows a 0.004 percentage point decrease in probability of having a child in the next year conditional on having no children, given $1000 more debt upon graduation. One more standard deviation of debt ($ 58,300) would decrease the probability by 0.23 percentage points, or 2.6 percent relative to the sample average. The estimate is not statistically significant, though. Specification (2) includes marital status. Results suggest that married individuals are substantially more likely to have a child than singles, with the marginal effect as large as 8.9 percentage points. It also reduces the magnitude of the coefficient of debt.

[4]Ideally, I should include the working hours and working experiences immediately before marriages, and should use spousal earnings upon marriages as the dependent variable. Unfortunately in the data I do not observe the exact date of marriages or the spouse's earnings in every period.

Table A.6: Debt and Childbearing

	Having a Child	
	(1)	(2)
Debt upon Graduation	-0.004	-0.002
(in 2014 $1000)	(-0.88)	(-0.66)
Being Married		8.90***
		(16.73)
Observations	7013	6061

t statistics in parentheses

[a] Conditional log-log models for discrete time proportional hazard, time is bundled in 7 periods, each period corresponds to 1 year.
[c] Reports the marginal effects on Probability of (Event happens in current period given it has not happened before) evaluated at mean. Average marginal effects are similar.
[d] Clusters by individual, Control variables: undergraduate gpa, age, school tier, year of bar admission, whether a parent is a lawyer, parents' education, race.
[e] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.3 Exact Functional Forms

This appendix lists the exact functional forms not shown in the main text.

A.3.1 Arrival Rates of Children

The arrival rates of children are specified as follows in the post-graduation stage,

$$Pr(\text{Has a newborn child at period } t) = (\beta_1^K A_t + \beta_2^K A_t^2) m_t + \beta_3^K (1 - m_t) \tag{A.1}$$

and in the schooling stage,

$$Pr(\text{Has a newborn child at period } t) = (\sum_{j=1}^{J} \beta_{0j}^K S_j + \beta_1^K A_t + \beta_2^K A_t^2) m_t + \beta_3^K (1 - m_t) \tag{A.2}$$

A.3.2 Job Offer Distribution

The vector of initial job offer probabilities for school j graduates is specified as

$$P_j^I = \{\beta_1^I, 0, \beta_3^I, 1, \beta_5^I\} \times \theta_j \tag{A.3}$$

for the five alternatives, where $\beta_l^I \times \theta_j$ denotes the probability of receiving an offer to work in position l immediately after graduation from law school j. θ_j captures the school differences in initial job arrival rates.

Each job offer is two dimensional, consisting of salary and working hours requirement. Job offer in position $l = 1, 2, 3$ at year t is specified as

$$\ln(W_{lt}) = \sum_{j=1}^{J} \beta_{1jl}^W S_j + \beta_{2l}^W GPA + \beta_{3l}^W LSAT + \beta_{4l}^W X_t^R + \beta_{5l}^W X_t^P + \varepsilon_{lt}^W \tag{A.4}$$

$$\ln(H_{lt}) = \beta_{0l}^H + \beta_{1l}^H (X_t^R + X_t^P) + \varepsilon_{lt}^H \tag{A.5}$$

where X_t^R denotes the working experience in private law firms, and X_t^P denotes the working experience in public/business sector,

$$X_t^R = \sum_{s=1}^{t-1} (O_{1s} + O_{2s}) \tag{A.6}$$

$$X_t^P = \sum_{s=1}^{t-1} O_{3s} \tag{A.7}$$

The two distributions are independent from each other and serially uncorrelated. Income and hours in position $l = 4, 5$ are specified as parameters β_4^W and β_4^H.

A.3.3 Preference in the Schooling Stage

The flow utility function is specified as follows:

$$U_{jt} = \begin{cases} \zeta_1 + \zeta_5 LSAT + \zeta_6 LSAT^2 + \zeta_7 LSAT + \zeta_8 LSAT^2 + \zeta_9 E + \varepsilon_{1t}^S & \text{if} \quad j = 1 \\ \zeta_j + \varepsilon_{jt}^S & \text{if} \quad j = 2, 3 \\ \varepsilon_{4t}^S & \text{if} \quad j = 4 \end{cases} \tag{A.8}$$

A.3.4 Initial Conditions

The moments come from a combination of two datasets, *AJD* and *NPSAS*. The major challenge in specifying initial conditions is that *AJD* does not have $LSAT$, and *NPSAS* does not have GPA. I assume these two variables follow a truncated joint normal distribution and set their correlation based on application profiles in dataset *Law School Numbers*.

A.4 Moments to Match

Age is divided into $N_{age} = 2$ categories, debt is divided into $N_{debt} = 2$ categories, experience in private law firms is divided into $N_{private} = 2$ categories, experience in public sector/business sector is divided into $N_{public} = 2$ categories, GPA is divided into $N_{GPA} = 4$ categories, LSAT is divided into $N_{LSAT} = 3$ categories, spousal earnings is divided into $N_{spouse} = 2$ categories. There are $N_{school} = 4$ schools, $N_{position} = 3$ positions (private associate, private partner, public/business), $N_{sector} = 2$ sectors (private, public/business).

I compute the following 492 moments,

- Marital Status (24)
  - Marital Status in 2003 and 2006, by school, age, debt and GPA: $2 \times (N_{school} + N_{age} + N_{debt} + N_{GPA}) = 24$

- Spouse Salary (9)
  - Spouse Salary in 2006, by school, age, and debt: $N_{school} + N_{age} + N_{debt} = 8$
  - Variance of spouse salary in 2006: 1
- Job Choices (270)
  - Sector choice probabilities by years after graduation, school, experience, debt categories, 2006 marital status, 2006 kids status, GPA, spousal earnings: $(N_{position} + (N_{position} - 1) \times 3 + N_{position} \times 2) \times (N_{school} + N_{debt} + N_{private} + 2 + 2 + N_{GPA} + N_{spouse}) = (3 + 6 + 6) \times (4 + 2 + 2 + 2 + 2 + 4 + 2) = 270$
- Salary (76)
  - Mean accepted salary in 2003 and 2006 by position×school, position×experience, position×GPA: $2 \times N_{position} \times (N_{school} + N_{private} + N_{public} + N_{GPA}) = 72$
  - Variance of accepted salary in 2003 and 2006 by sector: $2 \times N_{sector} = 4$
- Hour (28)
  - Mean accepted hours in 2003 and 2006 by position: $2 \times N_{position} \times N_{school} = 24$
  - Variance of accepted hours in 2003 and 2006 by sector: $2 \times N_{sector} = 4$
- Sector Transitions (48)
  - Transition Probability (two-period) in 2003 and 2005 across sectors by school and debt: $2 \times N_{sector} \times N_{sector} \times (N_{school} + N_{debt}) = 2 \times 2 \times 2 \times (4 + 2) = 48$
- School Choices (37)
  - Choice Probability of schools by GPA: $(N_{school} - 1) \times N_{GPA} = 12$
  - Choice Probability of schools by LSAT: $(N_{school} - 1) \times N_{LSAT} = 9$
  - Average LSAT in schools: $N_{school} = 4$

- Average family contribution in schools: $N_{school} = 4$
- Average remaining college debt in schools:$N_{school} = 4$
- Average debt upon graduation in schools: $N_{school} = 4$

A.5 Estimates and Standard Errors

Table A.7: Parameter Estimates and Standard Errors

Labor Market							
β^W_{111}	β^W_{121}	β^W_{131}	β^W_{141}	β^W_{21}	β^W_{31}	β^W_{41}	β^W_{51}
2.25	−0.29	−0.55	−0.55	0.04	0.00	0.10	0.00
(0.02)	(0.03)	(0.06)	(0.05)	(0.06)	(0.06)	(0.01)	(0.00)
β^W_{112}	β^W_{122}	β^W_{132}	β^W_{142}	β^W_{22}	β^W_{32}	β^W_{42}	β^W_{52}
2.25	−0.29	−0.42	−0.55	0.04	0.00	0.10	0.00
(0.45)	(0.10)	(0.36)	(0.26)	(0.06)	(0.06)	(0.04)	(0.00)
β^W_{113}	β^W_{123}	β^W_{133}	β^W_{143}	β^W_{23}	β^W_{33}	β^W_{43}	β^W_{53}
1.85	−0.21	−0.23	−0.40	0.01	0.00	0.06	0.11
(0.01)	(0.03)	(0.06)	(0.07)	(0.05)	(0.05)	(0.01)	(0.00)
β^H_{01}	β^H_{11}	β^H_{02}	β^H_{03}	σ^W	σ^H	β^W_4	β^H_4
0.90	0.01	0.90	0.85	0.60	0.37	30.00	1.20
(0.02)	(0.00)	(0.14)	(0.02)	(0.21)	(0.013)	(0.24)	(0.12)
α_{01}	α_{02}	α_{03}	α_{04}	α_1	α_2	α_3	α_4
−24.00	−7.00	−7.00	−10.40	0.40	0.02	10.00	−0.71
(1.55)	(0.76)	(1.36)	(1.50)	0.52	0.02	(0.13)	(0.07)
β^I_1	β^I_3	β^I_5	θ_2	θ_3	θ_4		
0.70	0.47	0.47	0.85	0.78	0.64		
(0.03)	(0.03)	(0.07)	(0.06)	(0.09)	(0.09)		

Marriage Market								
β^M_0	β^M_1	β^M_2	β^B_1	β^B_{31}	β^B_{32}	β^B_{33}	β^B_{34}	σ^B
1.80	−0.04	−0.00	−0.03	1.85	1.50	1.40	1.25	0.50
(0.12)	(0.00)	(0.00)	(0.00)	(0.07)	(0.07)	(0.04)	(0.05)	0.07

Preference in the Post-Graduation Stage							
ϕ	μ_1	μ_2	μ_3	μ_4	σ^O	σ^M	σ^J
0.70	1.50	0.01	0.08	0.06	0.01	0.01	1.50
(0.01)	(0.31)	(0.00)	(0.06)	(0.02)	(0.05)	(0.06)	(0.39)
μ_{511}	μ_{521}	μ_{531}	μ_{541}	μ_{512}	μ_{522}	μ_{532}	μ_{542}
−6.26	−5.35	−3.11	−5.07	12.60	7.80	5.82	−1.50
(0.26)	(0.25)	(0.34)	(0.40)	(2.63)	(1.77)	(2.14)	(0.78)
μ_{513}	μ_{523}	μ_{533}	μ_{543}				
−4.30	−4.10	−2.75	−4.70				
(0.20)	(0.15)	(0.35)	(0.19)				

Learning							
η_{01}	η_{02}	η_{03}	η_{04}	η_{11}	η_{12}	η_{13}	η_{14}
3.00	3.00	6.00	0.00	1.00	1.00	1.00	1.00
(0.33)	(0.36)	(4.91)	(0.00)	(0.02)	(0.01)	(0.03)	(0.08)
η_{21}	η_{22}	η_{23}	η_{24}				
18.00	9.00	9.00	1.00				
(4.23)	(0.31)	(0.69)	(0.06)				

Preference in the Schooling Stage							
ζ_1	ζ_2	ζ_3	ζ_5	ζ_6	ζ_7	ζ_8	ζ_9
−59.00	46.50	37.70	0.10	0.00	0.01	2.10	0.10
(5.84)	(3.54)	(1.39)	(0.03)	(0.00)	(0.01)	(0.49)	(0.05)

A.6 External Evidence

Table A.8: Debt and Probability of Having Sleep Trouble

Explanatory Var: *Debt upon Graduation*, in 2014 $10,000 Dependent Var: Pr(# of Days with Sleep Issues Last Week > 1)		
	Single Sample	Married Sample
Without Controls	0.001	0.006*
	(0.18)	(1.79)
With Controls	0.003	0.007**
	(0.68)	(1.98)
Average Prob	0.40	0.41

Logistic regressions with average marginal effects reported.
Controls: Job sectors, school tiers, age, race, undergraduate gpa.
Spousal income is also included for the married sample.

Appendix B

Appendix to Chapter 2

B.1 Proofs

Proof of Proposition 1:

Assume that $S_1 > S_0 > S_{-1}$. We will provide conditions later on which guarantee that this condition holds. For $d_g = 1$ to be equilibrium outcome, we need that unilateral deviations by the union are not profitable. Hence we need that $\pi_1 > \pi_{-1}$ which implies that

$$u_g^c \quad < \quad u_g^I - \frac{c^I - c^C}{S_1 - S_{-1}} \tag{B.1}$$

Moreover, we need that and $\pi_1 > \pi_{-0}$ which implies

$$u_g^C \quad < \quad u_g^I - \frac{c^I}{S_1 - S_0} \tag{B.2}$$

Note that equation (B.2) implies equation (B.1). Hence we have:

$$\theta^C \quad < \quad T_0^{-1}\{u_g^{-1}(u_g^I - \frac{c^I}{S_1 - S_0})\} \equiv K_1(\theta^I) \tag{B.3}$$

Similarly, for $d_g = -1$ to be equilibrium outcomes, we need $\pi_{-1} > \pi_0$ which implies

$$u_g^C > u_g^I + \frac{c^C}{S_0 - S_{-1}} \tag{B.4}$$

as well as $\pi_{-1} - \pi_1 > 0$, which implies as seen above:

$$u_g^C > u_g^I + \frac{c^C - c^I}{S_1 - S_{-1}} \tag{B.5}$$

Since equation (B.4) implies equation (B.5), we have:

$$\theta^C > T_0^{-1}\{u_g^{-1}(u_g^I + \frac{c^C}{S_0 - S_{-1}})\} \equiv K_2(\theta^I) \tag{B.6}$$

Moreover, we have

$$\begin{aligned} S_1 &= F(u_v^I - E[u_v^C \mid \theta^C < K_1(\theta^I)] + a^I) \\ S_0 &= F(u_v^I - E[u_v^C \mid \theta^C \in [K_1(\theta^I), K_2(\theta^I)]]) \\ S_{-1} &= F(u_v^I - E[u_v^C \mid \theta^C > K_2(\theta^I)] - a^C) \end{aligned} \tag{B.7}$$

Thus $K_1(\theta^I)$ and $K_2(\theta^I)$ solves the system of equations:

$$\begin{aligned} T_0^{-1}\{u_g^{-1}(u_g^I - \frac{c^I}{F(u_v^I - E[u_v^C \mid \theta^C < K_1] + a^I) - F(u_v^I - E[u_v^C \mid \theta^C \in [K_1, K_2]])})\} &= K_1 \\ T_0^{-1}\{u_g^{-1}(u_g^I + \frac{c^C}{F(u_v^I - E[u_v^C \mid \theta^C \in [K_1, K_2]]) - F(u_v^I - E[u_v^C \mid \theta^C > K_2] - a^C)})\} &= K_2 \end{aligned}$$

Finally, $S_1 > S_0 > S_{-1}$ requires that

$$E[u_v^C \mid \theta^C < K_1(\theta^I)] - E[u_v^C \mid \theta^C \in [K_1(\theta^I), K_2(\theta^I)]] < a^I \tag{B.8}$$

$$E[u_v^C \mid \theta^C \in [K_1(\theta^I), K_2(\theta^I)]] - E[u_v^C \mid \theta^C > K_2(\theta^I)] < a^C \tag{B.9}$$

Q.E.D.

Proof of Proposition 2:

Given $S_1 > S_0 > S_{-1}$, there can be only one equilibrium as shown in equilibrium analysis. To have other equilibrium, one of the following inequalities must be true: $S_0 > S_{-1} > S_1, S_{-1} > S_1 > S_0, S_{-1} > S_0 > S_1, S_1 > S_{-1} > S_0$ or $S_0 > S_1 > S_{-1}$. We will rule them out by contradictions. Suppose at equilibrium, $S_0 > S_1 > S_{-1}$. Then, to have $d_g = 1$ rather than $d_g = 0$, $\pi_1 - \pi_0 > 0$ and hence:

$$\theta^C \quad > \quad T^{-1}\{u_g^{-1}(u_g^I + \frac{c^I}{S_0 - S_1})\} \equiv \hat{K}$$

So the strategy must have the form

$$d_g = 1 \text{ if } \theta^C \in (\hat{K}, \bar{K}]$$

$$d_g = 0 \text{ if } \theta^C \in [\underline{K}, \hat{K}]$$

for some $\underline{K}, \bar{K} \in [0, 1]$.

If $\hat{K} \geq 1$ or $\hat{K} < 0$, then this is trivially not an equilibrium with all three actions $d_g = \{1, 0, -1\}$ arising in equilibrium outcomes.

If $\hat{K} \in [0, 1)$, then the vote size would be

$$S_1 \quad = \quad F(E[u_v^I - u_v^C \mid \theta^C \in (\hat{K}, \bar{K}]] + a^I)$$

$$S_0 \quad = \quad F(E[u_v^I - u_v^C \mid \theta^C \in [\underline{K}, \hat{K}]])$$

and hence $S_1 > S_0$ which is a contradiction.

The other four cases ($S_0 > S_{-1} > S_1, S_{-1} > S_1 > S_0, S_{-1} > S_0 > S_1, S_1 > S_{-1} > S_0$) can be

ruled out by the same method. Q.E.D.

Proof of Proposition 3:

For the interior solution, by assumption $S_1 > S_0$,

$$\begin{aligned} K_1 &= T_0^{-1}\{u_g^{-1}(u_g^I - \frac{c^I}{F(u_v^I - E[u_v^C \mid \theta^C < K_1] + a^I) - F(u_v^I - E[u_v^C \mid \theta^C \in [K_1, K_2]])})\} \\ &< T_0^{-1}\{u_g^{-1}(u_g^I)\} = \theta^I \end{aligned} \tag{B.10}$$

Similarly, by assumption $S_0 > S_{-1}$,

$$\begin{aligned} K_2 &= T_0^{-1}\{u_g^{-1}(u_g^I + \frac{c^C}{F(u_v^I - E[u_v^C \mid \theta^C \in [K_1, K_2]]) - F(u_v^I - E[u_v^C \mid \theta^C > K_2] - a^C)})\} \\ &> T_0^{-1}\{u_g^{-1}(u_g^I)\} = \theta^I \end{aligned} \tag{B.11}$$

Therefore, we have $K_1 < \theta^I < K_2$. Since $d_g = 1$ if $\theta^C < K_1 < \theta^I$, we have $T_0(\theta^C) < T_0(\theta^I)$, and thus if the challenger wins, $\Delta T < 0$.

Similarly, because $d_g = -1$ iff $\theta^C > K_2 > \theta^I$, we have $T_0(\theta^C) > T_0(\theta^I)$, and thus if the challenger wins, $\Delta T > 0$.

For the third case, since $d_g = 0$ iff $\theta^C \in [K_1, K_2]$, then $T_0(\theta^C) \in [T_0(K_1), T_0(K_2)]$, $T_0(\theta^C) - T_0(\theta^I) \in [T_0(K_1) - T_0(\theta^I), T_0(K_2) - T_0(\theta^I)]$, define $\epsilon = \max\{|T_0(K_1) - T_0(\theta^I)|, |T_0(K_2) - T_0(\theta^I)|\}$, we have $\mid T_0(\theta^C) - T_0(\theta^I) \mid \leq \epsilon$.

Q.E.D.

B.2 Tables and Figures

Figure B.1: Timeline and Game Predictions

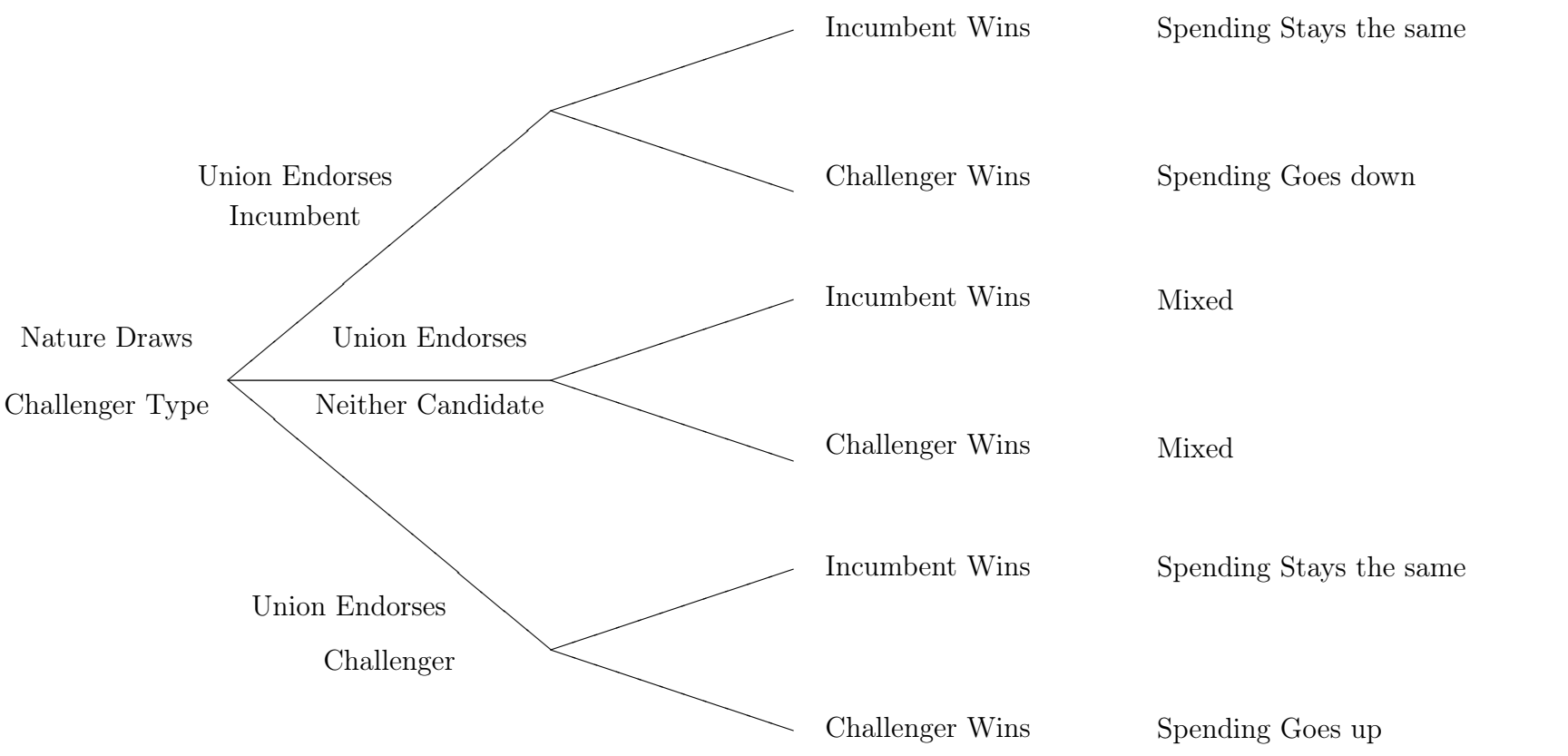
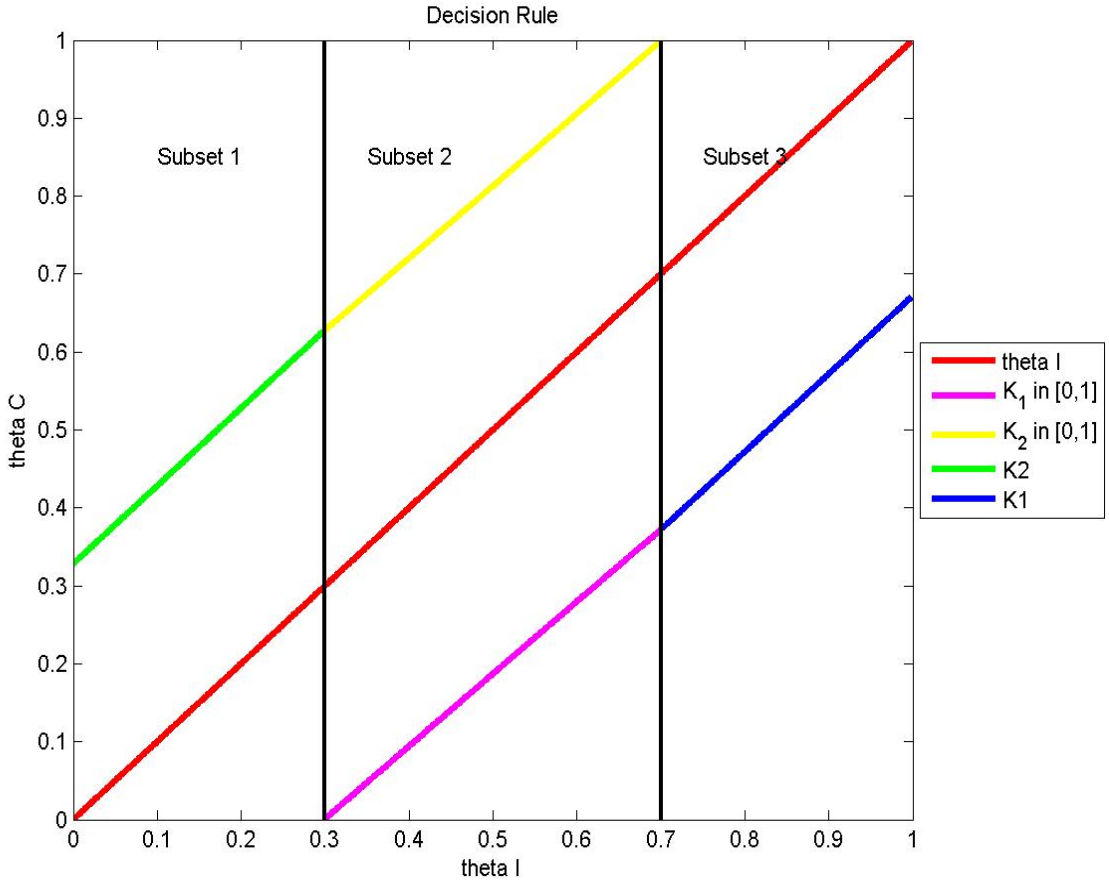


Figure B.2: The Optimal Strategy of the Union



The optimal strategy of the union is plotted in Figure 2. The two axes denote the type of the incumbent and the type of the challenger. The lines in the plot denote the cut-off levels that characterize the optimal strategy of the union. The 45 degree line satisfies $\theta^I = \theta^C$ and falls between the two cutoff values.

Table B.1: Summary Statistics

	Mean	SD	10%	90%	Cities	Elections
Population	546197.22	909826.76	158137.51	867688.35	92	292
Public Sector Size/ Population	0.02	0.01	0.01	0.04	92	292
Payroll/Population	413.94	288.34	201.42	816.53	92	292
Police Size/Public Sector Size	16.61	5.70	8.50	22.99	92	292
Fire Size/Public Sector Size	11.02	3.78	6.09	16.21	91	290
Teacher Size/Public Sector Size	33.77	8.04	25.99	44.21	11	36
Police Payroll/Public Sector Payroll	20.64	6.97	11.02	28.40	92	292
Fire Payroll/Public Sector Payroll	13.92	4.82	7.64	20.53	91	290
Teacher Payroll/Public Sector Payroll	38.36	9.85	26.29	50.04	11	36
Turnout Rate in General Elections%	15.49	8.08	6.24	25.00	92	286
Turnout Rate in Runoff Elections%	21.77	8.67	12.61	33.49	31	59
Turnout Rate in Repub Primaries%	4.32	2.70	1.88	8.29	5	9
Turnout Rate in Dem Primaries%	13.70	6.69	3.63	20.86	10	24

Note: The table above provides summary statistics for the key variables in the data set. We report the mean, the standard deviation, the 10th and the 90th percentile. We also report the number of cities and elections for which we observe the variables.

Table B.2: Path Analysis

	Endorse Incumbent Only			Incumbent Wins
	Marginal Victory	33.44		Wins
	Obs	41		35
				Challenger Wins
				6
	Endorse Nobody			Incumbent
	Marginal Victory	39.99		Wins
	Obs	200		181
				Challenger Wins
Total				
299				19
	Endorse Challengers Only			Incumbent Wins
	Marginal Victory	16.47		
	Obs	44		24
				Challenger Wins
				20
	Endorse Both			Incumbent
	Marginal Victory	16.60		Wins
	Obs	14		7
				Challenger Wins
				7

Note: This table reports the number of times the different strategies were played in my sample. It illustrates the frequency of union endorsements and their impact on election outcomes in our sample.

Table B.3: Incumbent's Probability of Winning

Dependent Variable: Incumbent Wins			
Sector	Police, Firefighter or Teacher Unions		
Election Type	General	Runoff	Key Election
incumbent endorsed	-0.091	-0.094	-0.068
	[0.067]	[0.147]	[0.064]
challenger endorsed	-0.345***	-0.218	-0.401***
	[0.065]	[0.175]	[0.074]
both endorsed	-0.518***	-0.464**	-0.491***
	[0.135]	[0.226]	[0.120]
City characteristics	YES	YES	YES
Obs	294	60	299

Note: This table reports results from logit regressions of incumbents' win probabilities on endorsements. We distinguish between general elections, run-off-elections and key elections. The key election can be a primary, a general or a run-off election. We use the one with the highest turn-out.

Table B.4: Endorsements and Incumbents' Share

Dependent Variable: Incumbent Share						
Sector	Police, Firefighter or Teacher Unions					
Election Type	General		Runoff		Key Election	
incumbent endorsed	-4.81	-3.90	-1.72	1.34	-2.80	-1.81
	[3.13]	[5.20]	[5.41]	[8.55]	[2.91]	[4.85]
challenger endorsed	-22.42***	-23.31***	-8.90*	-11.45	-22.17***	-23.36***
	[2.92]	[3.86]	[5.15]	[10.06]	[2.73]	[3.59]
both endorsed	-17.81***	-23.90***	-8.95	-5.20	-17.32***	-23.05***
	[3.16]	[5.51]	[6.08]	[19.76]	[2.48]	[4.98]
City characteristics	YES		YES		YES	
City and Year Dummies		YES		YES		YES
Obs	294	294	60	60	299	299
R-Square	0.237	0.573	0.261	0.832	0.238	0.594

Note: The vote share of the incumbent provides an alternative measure of the electoral success of the incumbent. We regress the vote share of the incumbent on union endorsement controlling for observed and unobserved city characteristics. The results are summarized in the table above.

Table B.5: Endorsement and Voter Turnout

Dependent Variable: Turnout Rate						
Sector	Police, Firefighter or Teacher Unions					
Type	Key	General	Runoff	Key	General	Runoff
incumbent endorsed	2.77**	0.66	1.55	2.66**	0.83	3.69
	[1.10]	[0.94]	[2.25]	[1.25]	[0.93]	[5.35]
challenger endorsed	4.89***	3.63***	0.76	3.67***	1.83	4.14
	[1.24]	[1.22]	[2.54]	[1.05]	[1.48]	[4.45]
both endorsed	9.45***	8.14**	5.24	7.19***	3.89	2.34
	[3.22]	[3.26]	[4.29]	[1.60]	[2.55]	[4.47]
City characteristics	YES	YES	YES			
City and Year Dummies				YES	YES	YES
Obs	292	286	59	292	286	59

Note: A union can influence the outcome of a local election by mobilizing its base including union members as well as friends and family of members. We regress election turnout on union endorsement controlling for observed and unobserved city characteristics. The results are summarized in the table above.

Table B.6: Urban Fiscal Policies

Dependent Variables	Size/Population			Payroll/Population		
Sector	Total	Police	Fire	Total	Police	Fire
Incumbent Loss * Challenger endorsed: t-1	0.51	1.47	4.12	8.39	2.91	8.86
	[4.16]	[1.25]	[3.34]	[11.74]	[2.83]	[6.31]
Incumbent Loss * Challenger endorsed: t-2	0.41	1.82	4.12	13.45	2.17	10.94*
	[3.44]	[1.28]	[3.55]	[10.37]	[3.07]	[6.03]
Incumbent Loss * Challenger endorsed: t-3	5.03	2.24	1.39*	21.04*	3.12	3.95*
	[3.92]	[1.67]	[0.75]	[12.07]	[3.89]	[2.29]
Incumbent Loss * Challenger endorsed: t-4	8.209*	2.480	0.384	18.250	4.134	0.931
	[4.65]	[1.73]	[1.12]	[14.05]	[3.72]	[3.68]
City and Year Dummies	YES	YES	YES	YES	YES	YES
Obs	1,365	1,365	1,361	1,365	1,365	1,361
R-square	0.97	0.91	0.84	0.97	0.88	0.83

Note: This table reports results from regressions of fiscal policy variables interactions between endorsements and election outcomes to test whether more union friendly politicians increase the share of transfers to union members.

Bibliography

Addo, F. R. (2014). Debt, cohabitation, and marriage in young adulthood. *Demography*, 51(5):1677–1701.

Albanesi, S. and Olivetti, C. (2006). Gender and dynamic agency: Theory and evidence on the compensation of female top executives. Boston University-Department of Economics-Macroeconomics Working Papers Series WP2006-061.

Azmat, G. and Ferrer, R. (2014). Gender Gaps in Performance: Evidence from Young Lawyers. Working Paper.

Bell, L. A. (2005). Women-Led Firms and the Gender Gap in Top Executive Jobs. IZA Discussion Paper No. 1689.

Belley, P. and Lochner, L. (2007). The Changing Role of Family Income and Ability in Determining Educational Achievement. *Journal of Human Capital*, 1(1):37–89.

Bennett, J. T. and Orzechowski, W. P. (1983). The voting behavior of bureaucrats: Some empirical evidence. *Public Choice*, 41(2):271–283.

Bertrand, M., Goldin, C., and Katz, L. F. (2010). Dynamics of the Gender Gap for Young

Professionals in the Financial and Corporate Sectors. *American Economic Journal: Applied Economics*, 2(3):228–55.

Besley, T. and Case, A. (1995). Incumbent Behavior: Vote-Seeking, Tax-Setting, and Yardstick Competition. *The American Economic Review*, 85(1):25–45.

Boustan, L., Ferreira, F., Winkler, H., and Zolt, E. M. (2012). The Effect of Rising Income Inequality on Taxation and Public Expenditures: Evidence from U.S. Municipalities and School Districts, 1970–2000. *Review of Economics and Statistics*, 95(4):1291–1302.

Bozick, R. and Estacion, A. (2014). Do student loans delay marriage? Debt repayment and family formation in young adulthood. *Demographic Research*, 30(69):1865–1891.

Brennan, G. and Buchanan, J. M. (1980). *The Power to Tax*. Cambridge University Press.

Calabrese, S. M., Epple, D. N., and Romano, R. E. (2012). Inefficiencies from Metropolitan Political and Fiscal Decentralization: Failures of Tiebout Competition. *The Review of Economic Studies*, 79(3):1081–1111.

Cameron, S. V. and Taber, C. (2004). Estimation of Educational Borrowing Constraints Using Returns to Schooling. *Journal of Political Economy*, 112(1):132–182.

Carneiro, P. and Heckman, J. J. (2002). The Evidence on Credit Constraints in Post-Secondary Schooling. *The Economic Journal*, 112(482):705–734.

Cellini, S. R. and Goldin, C. (2014). Does Federal Student Aid Raise Tuition? New Evidence on For-Profit Colleges. *American Economic Journal: Economic Policy*, 6(4):174–206.

Chiang, C.-F. and Knight, B. (2011). Media Bias and Influence: Evidence from Newspaper Endorsements. *The Review of Economic Studies*, 78(3):795–820.

Coate, S. and Morris, S. (1995). On the Form of Transfers to Special Interests. *Journal of Political Economy*, 103(6):1210–1235.

Courant, P. N., Gramlich, E. M., and Rubinfeld, D. L. (1979). Public Employee Market Power and the Level of Government Spending. *The American Economic Review*, 69(5):806–817.

Epple, D., Romano, R., Sarpça, S., and Sieg, H. (2013). The U.S. Market for Higher Education: A General Equilibrium Analysis of State and Private Colleges and Public Funding Policies. Working Paper 19298, National Bureau of Economic Research.

Epple, D. and Romer, T. (1991). Mobility and Redistribution. *Journal of Political Economy*, 99(4):828–858.

Epple, D., Romer, T., and Sieg, H. (2001). Interjurisdictional Sorting and Majority Rule: An Empirical Analysis. *Econometrica*, 69(6):1437–1465.

Epple, D. and Sieg, H. (1999). Estimating Equilibrium Models of Local Jurisdictions. *Journal of Political Economy*, 107(4):645–681.

Farber, H. S. (1986). Chapter 18 The analysis of union behavior. volume 2, pages 1039–1089. Elsevier.

Feiveson, L. (2015). General revenue sharing and public sector unions. *Journal of Public Economics*, 125(C):28–45.

Ferreira, F. and Gyourko, J. (2009). Do Political Parties Matter? Evidence from U.S. Cities. *The Quarterly Journal of Economics*, 124(1):399–422.

Field, E. (2009). Educational Debt Burden and Career Choice: Evidence from a Financial Aid Experiment at NYU Law School. *American Economic Journal: Applied Economics*, 1(1):1–21.

Frandsen, B. R. (2016). The Effects of Collective Bargaining Rights on Public Employee Compensation Evidence from Teachers, Firefighters, and Police. *ILR Review*, 69(1):84–112.

Freeman, R. B. and Valletta, R. (1988). The Effects of Public Sector Labor Laws on Labor Market Institutions and Outcomes. *NBER*, pages 81–106.

Friedman, M. (1955). *The role of government in education*. Rutgers University Press.

Gayle, G.-L., Golan, L., and Miller, R. A. (2012). Gender Differences in Executive Compensation and Job Mobility. *Journal of Labor Economics*, 30(4):829–872.

Gerber, A. S., Karlan, D., and Bergan, D. (2009). Does the Media Matter? A Field Experiment Measuring the Effect of Newspapers on Voting Behavior and Political Opinions. *American Economic Journal: Applied Economics*, 1(2):35–52.

Gicheva, D. (2014). Student Loans or Marriage? A Look at the Highly Educated. Working Paper.

Ginther, D. K. and Hayes, K. J. (2003). Gender Differences in Salary and Promotion for Faculty in the Humanities 1977-95. *The Journal of Human Resources*, 38(1):34–73.

Ginther, D. K. and Kahn, S. (2004). Women in Economics: Moving Up or Falling Off the Academic Career Ladder? *Journal of Economic Perspectives*, 18(3):193–214.

Goldin, C. (2014). A Grand Gender Convergence: Its Last Chapter. *American Economic Review*, 104(4):1091–1119.

Gregory, R. and Borland, J. (1999). Recent developments in public sector labor markets. Handbook of Labor Economics, Elsevier.

Grossman, G. M. and Helpman, E. (1996). Electoral Competition and Special Interest Politics. *The Review of Economic Studies*, 63(2):265–286.

Grossman, G. M. and Helpman, E. (1999). Competing for Endorsements. *The American Economic Review*, 89(3):501–524.

Hotz, V. J. and Miller, R. A. (1988). An Empirical Analysis of Life Cycle Fertility and Female Labor Supply. *Econometrica*, 56(1):91–118.

Hoxby, C. M. (2000). Does Competition among Public Schools Benefit Students and Taxpayers? *American Economic Review*, 90(5):1209–1238.

Johnson, M. T. (2013). Borrowing Constraints, College Enrollment, and Delayed Entry. *Journal of Labor Economics*, 31(4):669–725.

Kaplan, G. (2012). Moving Back Home: Insurance against Labor Market Risk. *Journal of Political Economy*, 120(3):446–512.

Keane, M. P. and Wolpin, K. I. (1997). The Career Decisions of Young Men. *Journal of Political Economy*, 105(3):473–522.

Keane, M. P. and Wolpin, K. I. (2001). The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment. *International Economic Review*, 42(4):1051–1103.

Keane, M. P. and Wolpin, K. I. (2010). The Role of Labor and Marriage Markets, Preference Heterogeneity, and the Welfare System in the Life Cycle Decisions of Black, Hispanic, and White Women. *International Economic Review*, 51(3):851–892.

Lehmann, J.-Y. K. (2013). Job Assignment and Promotion Under Statistical Discrimination: Evidence from the Early Careers of Lawyers. Working Paper.

Lewis, H. G. (1990). Union/Nonunion Wage Gaps in the Public Sector. *Journal of Labor Economics*, 8(1):S260–S328.

Lochner, L. J. and Monge-Naranjo, A. (2011). The Nature of Credit Constraints and Human Capital. *American Economic Review*, 101(6):2487–2529.

Lucca, D. O., Nadauld, T., and Shen, K. (2015). Credit Supply and the Rise in College Tuition: Evidence from the Expansion in Federal Student Aid Programs. Federal Reserve Bank of New York Staff Reports no. 733.

McFadden, D. (1989). A Method of Simulated Moments for Estimation of Discrete Response Models Without Numerical Integration. *Econometrica*, 57(5):995–1026.

Monge-Naranjo, A. and Lochner, L. (2012). Credit and Insurance for Human Capital Investments. Working Paper, Society for Economic Dynamics.

National Association for Public Interest Law (2002). Financing the Future: NAPIL's 2000 Report on Law School Loan Repayment Assistance and Public Interest Scholarship Programs.

Oates, W. E. (1972). *Fiscal federalism*. Harcourt Brace Jovanovich, New York.

Olivetti, C. (2006). Changes in women's hours of market work: The role of returns to experience. *Review of Economic Dynamics*, 9(4):557–587.

Pakes, A. and Pollard, D. (1989). Simulation and the Asymptotics of Optimization Estimators. *Econometrica*, 57(5):1027–1057.

Ramsey, D. (2015). The Effects of College Loans and Subsidies on College Attendance and Later Life Outcomes. Working Paper.

Rose-Ackerman, S. (1980). Risk Taking and Reelection: Does Federalism Promote Innovation? *The Journal of Legal Studies*, 9(3):593–616.

Rothstein, J. and Rouse, C. E. (2011). Constrained after college: Student loans and early-career occupational choices. *Journal of Public Economics*, 95(1–2):149–163.

Rust, J. (1987). Optimal Replacement of GMC Bus Engines: An Empirical Model of Harold Zurcher. *Econometrica*, 55(5):999–1033.

Santos, F. and Chen, D. W. (2012). Michael Mulgrew, Teachers' Union Chief, Is Wooed by Mayor Candidates. *The New York Times*.

Sauer, R. M. (1998). Job Mobility and the Market for Lawyers. *Journal of Political Economy*, 106(1):147–171.

Sauer, R. M. (2004). Educational Financing and Lifetime Earnings. *The Review of Economic Studies*, 71(4):1189–1216.

Selody, K. (2010). Is the Risk Worth the Reward for Top Women Executives? Working Paper.

Snyder, J. and Strömberg, D. (2010). Press Coverage and Political Accountability. *Journal of Political Economy*, 118(2):355–408.

Stinebrickner, R. and Stinebrickner, T. (2008). The Effect of Credit Constraints on the College Drop-Out Decision: A Direct Approach Using a New Panel Study. *American Economic Review*, 98(5):2163–84.

Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy*, 64(5):416–424.

Turner, L. J. (2014). The Road to Pell is Paved with Good Intentions: The Economic Incidence of Federal Student Grant Aid. Working Paper.