Finance Department

Essays on Auditing, Banking, and Political Bargaining

Deniz Okat

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Deniz Okat

Aalto University
School of Business
Department of Finance

Main dissertation advisor
Professor Matti Keloharju, Aalto University School of Business

Co-dissertation advisor
Professor Juuso Välimäki, Aalto University School of Business

Opponent
Professor Tuomas Takalo, Hanken School of Economics

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Abstract

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Abstract

This dissertation consists of three essays and an introductory chapter.

The first essay deals with learning in dynamic audit games. I argue that the efficacy of an audit methodology reduces if it is used repeatedly. Individuals being audited potentially learn how to exploit the weaknesses inherent in any audit methodology if they face the same method many times. I show that an auditor better deters fraud by randomizing her choice of methodology over time, thereby frustrating a would-be fraudster's ability to learn. In the extreme, an auditor benefits from refusing to audit even though audits are costless to her.

In the second essay, I analyze a market failure in the banking industry. In particular, I show that the competitive market structure encourages banks to accumulate more liquid funds than is socially desirable. Banks accumulate liquid funds by selling their assets at a discount. This sale disturbs the economy and slows down growth because the buyers of the assets reduce their investments in positive NPV projects. Small banks do not internalize their own impact on prices, which encourages them to start a fire sale too early. A (relatively) small probability of a liquidity shock might trigger a fire sale, causing a real crisis. Big banks internalize their own price impact, which reduces the severity of a crisis. I show that their sale decision is more in line with that of the social planner because they are too big to rush to sell their assets.

In the third essay, I identify an inefficiency caused by the system of checks and balances. I first develop a model in which checks and balances prompt the President of the Unites States to compromise on the strength of the candidates nominated for positions in the federal government and judiciary. I test the model by using data of the nominations of the U.S. federal judges from 1989 to 2014. Because federal judges are appointed for life, appointments of competent younger judges extend the productive period they spend on the bench and improve welfare. Consistent with the predictions of the model, and controlling for each candidate's competence with the rating assigned by the American Bar Association, I find that the confirmation in the Senate is more likely and faster when the President compromises on the strength of the candidate by nominating an older individual.

Keywords Audit, learning, banking theory, fire sales, political economy, bargaining

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Contents

Introduction

In each of the three essays of my dissertation, I identify an inefficiency and offer a remedy that improves welfare. The first essay finds that an inefficiency due to informational asymmetry between a principal and a fraudster can be prevented by reducing the fraudster's value of information. The second essay argues that a market failure in the banking industry can be mitigated by reducing competition. The third essay shows that welfare can be improved if political parties agree on a sharing rule ex ante instead of bargaining ex post. Below, I explain the nature of the inefficiencies in more detail and summarize each of the three essays.

The first essay deals with learning in dynamic audit games. I show that the efficacy of an audit methodology reduces if it is used repeatedly. The essay builds on the following idea: individuals have an additional incentive to commit fraud today if they will face the same audit methodology again tomorrow. By cheating successfully today they discover how to cheat the system. The possibility of interaction tomorrow makes their discovery valuable. For individuals to benefit from their discovery, their fraud should go undetected. Therefore, the analysis in the first essay is applicable to such types of frauds that have the potential to go undetected, *e.g.,* tax evasion, financial statement manipulation, insurance fraud, and money laundering.

I show that an effective way to prevent repeated fraud is to change the audit technology each time an individual interacts with it. Switching audit technologies reduces the fraudster's incentive to cheat by eliminating the value of his discovery. Switching the audit technology even to a weaker technology helps eliminate fraud. In the extreme, the auditor can reduce fraud by looking away (*i.e.,* refusing to audit) even if the audit costs nothing.

Changing the audit methodology decreases the would-be fraudster's incentive to cheat by increasing his costs. Suppose that the individual has already made an investment to improve his ability to defeat a given auditor. When the auditor switches his technology, the fraudster has to make the investment once again. Ultimately, switching decreases the fraudster's gains. Another merit of switching is that it enables the auditor to eliminate fraud by setting a lower penalty. That is, switching is a substitute for a more severe punishment. This feature can be especially useful if the punishment is costly, for example, due to concerns about false positives.

The principles that allow one to reduce fraud can be applied to many environments. Consider a CEO monitored by the same board of directors over several years. By observing the board members' reactions to his initiatives, the CEO can discover deficiencies in their monitoring. For example, he can learn how to design and present proposals (which are not necessarily in line with shareholders' objectives) in such a way that they have a greater likelihood of being approved. Frequent renewal of board members limits such learning. Companies audited by the same firm over time might also learn how to manipulate their financial statements without being caught. Rotating audit firms reduces such opportunity.

In some environments it is possible to render the act of fraud more difficult by improving the audit technology. For example, shareholders might attract more talented individuals to the board by offering higher salaries and, thus, monitor the CEO more closely. Notice that switching audit technologies and improving a given audit technology are substitutes: switching the technology reduces the value of learning, and improving it increases the cost of cheating. In both cases the fraudster's incentive to cheat decreases.

If switching costs are large, it is better to invest in one strong audit technology instead of switching among many weak technologies. For example, if the cost of changing the existing audit firm (*i.e.,* the loss of the accumulated knowledge) outweighs the benefits of rotation, it might be more desirable to allocate a bigger budget to have a more comprehensive audit today than to hire a new audit firm tomorrow. Likewise, if the cost of the investment needed to improve the quality of audits increases, the relative benefit of changing the audit technology also increases. For example, it might be cheaper for the IRS to reduce fraud by varying the intensity of screening than by trying to make it more difficult for fraudulent applications to pass the audit.

In the second essay, I analyze a market failure in the banking industry. In particular, I show that the competitive market structure encourages banks to accumulate more liquid funds than is socially desirable. In my model, the possibility of an exogenous liquidity shock tomorrow prompts banks to raise liquid funds today. Banks raise funds by selling their assets. As the aggregate amount of sale increases, output declines because banks accumulate liquid funds which otherwise would be used in financing positive NPV projects. As a result, the economy suffers even before the liquidity shock hits. This would not happen in an economy managed by a social planner who would not demand liquidity before the realization of the shock.

Banks' total demand for cash—and, thus, the severity of the crisis—increases with the likelihood of the shock and decreases with the cost of obtaining cash. In my model the price of cash depends on the behavior of other banks and is, therefore, endogenously determined. Because the buyers of financial assets have to be compensated at an increasing rate to forego their existing positive

NPV projects, banks need to offer a greater discount if more assets are on sale. Therefore, each bank imposes a negative externality on other banks when it sells its assets to raise liquid funds.

The negative externality in obtaining cash is the main reason for the inefficiency in the second essay. Acting as price takers, banks in the competitive market do not internalize their own impact on the equilibrium terms of trade when they sell their assets. This encourages them to sell more, which leads to distortions in the allocation of funds in the economy. Big banks, on the other hand, internalize their impact and can better time when to obtain cash. They demand less liquidity and, therefore, divert a smaller amount of funds from the real assets. That is, they play the role of a moderator and facilitate a more efficient allocation of resources.

In the third essay, I identify an inefficiency caused by the system of checks and balances. Checks and balances protect minority rights by forcing the majority to compromise with the minority. I show that such compromises can lead to inefficient outcomes.

To see how a compromise can be socially inefficient, consider an economic policy expected to promote stability in the next period. For the policy to be adopted, it has to be approved by the opposition party. Although both the ruling and the opposition parties benefit from the policy, it might not be approved if the policy also implies a political transfer from the opposition party to the ruling party. In particular, if the transfer is greater than the benefit the opposition party obtains from the policy, the ruling party needs to compromise to pass the proposal. The outcome will be suboptimal.

To show how political dynamics force parties to agree on a suboptimal solution, I construct a two-party bargaining model with the ruling party making the offer. In particular, the ruling party aims to appoint a strong individual to a governmental post. Because the ruling party and its nominees tend to share the same policy preferences, an appointment of a stronger candidate also means a larger transfer from the ruling party to the opposition. As a result a strong candidate meets greater resistance, which creates an inefficient delay in reaching an agreement. In the equilibrium, the parties agree on a compromised solution, and appoint a weaker candidate than is socially optimal.

I test the predictions of my model using data on the appointments of U.S. federal judges. Appointments to the judiciary provide a particularly appropriate environment to test the model because they are for life. There is plenty of evidence that judges learn on the job but become less productive at old age, so appointments of competent younger judges extend the productive period they spend on the bench. At the same time, it is important to take into account the possibility that older judges may on average be more competent. I control for nominees' competence for the bench using the rating assigned by the American Bar Association. I find that the candidate's confirmation in the Senate is more likely and faster when the President compromises on the strength of the candidate by nominating an older individual. These findings suggest that the system of checks and balances comes with a price.

Please, note.

The essay 1 within this publication (pp. 6-35) has been omitted due to issues related with copyright.

Essay 2

Too Big to Rush

Abstract

A sudden need for liquidity prompts banks to sell their assets at a discount to obtain cash. This sale disturbs the economy and slows down growth because the buyers of the assets reduce their investments in positive NPV projects. Small banks do not internalize their own impact on prices, which encourages them to start a fire sale too early. A (relatively) small probability of a liquidity shock might trigger a fire sale, causing a real crisis. Big banks internalize their own price impact, which reduces the severity of a crisis. Their sale decision is more in line with that of the social planner because they are too big to rush to sell their assets.

Sell when you can; you are not for all markets.

– William Shakespeare, *As you like it* (Act III.5)

3.1 Introduction

Banks, at times, can be too prudent. For example, one of the most striking features of the recent financial crisis is the freeze in the credit market: instead of lending, banks built up cash reserves and accumulated safe assets.[14] Brunnermeier [2009] refers to the freeze in the interbank market as a textbook example of precautionary hoarding.

When banks hoard cash, fewer positive NPV projects than are socially optimal are financed. This hampers growth.[15] In this paper, I develop a model in which competition causes a decline in economic output by encouraging banks to hoard cash. In the model, banks face the possibility of an exogenous liquidity shock. Output in the economy declines even before the shock occurs because banks will find it optimal to divert funds from the real assets to satisfy their potential future demand for liquidity.

Hoarding cash today is optimal from the banks' perspective. However, banks' individually optimal decisions yield a socially undesirable outcome: the buyers of banks' assets need to forego their positive NPV projects. As a consequence, while the aggregate level of liquidity goes up, total investments in the economy go down. Depending on the likelihood of the shock, a real crisis might occur even before the realization of the shock. That is, banks might

[14]See, for instance, Ashcraft et al. [2011], Acharya and Merrouche [2012], and Berrospide [2013] for empirical evidence.

[15]Even representatives of two diametrically opposite schools of thought, Hayek [1932] and Keynes [1932], agree that the economy is hurt when agents hoard cash. This opinion has been echoed, among others, by Friedman and Schwartz [1963] and Bernanke [2010].

trigger a crisis endogenously by rushing to obtain liquidity. This would not happen in an economy managed by a social planner who would not demand liquidity before the realization of the shock.

Banks' total demand for cash—and, thus, the severity of the crisis—increases with the likelihood of the shock and decreases with the price of cash. In my model the price of cash depends on the behavior of other banks and is, therefore, endogenously determined. Because the buyers of the financial assets have to be compensated at an increasing rate to forego their existing positive NPV projects, banks need to offer a greater discount if more assets in the market are on sale. Therefore, each bank imposes a negative externality on other banks when it sells its assets to raise liquid funds.

The negative externality in obtaining cash is the main reason for the inefficiency in my model. In particular, acting as price takers, banks in the competitive market do not internalize their own impact on the equilibrium terms of trade when they sell their assets. This encourages them to sell more, which leads to distortions in the allocation of funds in the economy. Big banks, on the other hand, internalize their impact and can better time when to obtain cash. They demand less liquidity and, therefore, divert a smaller amount of funds from the real assets. That is, they play the role of a moderator and facilitate a more efficient allocation.

My paper contributes to the literature studying why banks might abstain from financing the real economy. Diamond and Rajan [2011] explain credit market freezes with a speculative motive. In their model, the possibility of a decrease in asset prices (*i.e.,* the anticipation of a fire sale) in the future incentivizes banks to hoard cash instead of extending new loans. Bebchuk and Goldstein's [2011] explanation of freezes relies on coordination failure. In their model, a bank's payoff from lending increases as other banks lend.

An inefficient freeze occurs because of the self-fulfilling expectations that other banks will not be lending. Their result stems from complementarity (*i.e.,* a bank's incentive to keep cash increases as others keep cash) whereas my result is drawn from substitutability (*i.e.,* a bank's incentive to sell assets decreases as others sell).

In perhaps the most closely related article, Gale and Yorulmazer [2013] study freezes in the interbank market. In their model, cash is demanded both for precautionary and speculative reasons: it helps banks satisfy their own needs when a liquidity shock hits, and at the same time allows them to make profit by providing liquidity to other banks hit by the shock. In their model, a bank provides a positive externality on other banks by keeping cash (*i.e.,* the price of cash goes down if the number of banks keeping cash goes up) whereas in my model a bank imposes a negative externality on others by demanding cash (*i.e.,* the price of cash goes up if the number of banks demanding cash goes up). Moreover, it is crucial for their results that the liquidity shock hits in three periods. There would not be any inefficiency in their model if the shock hit in only one (or two) period(s) as in my model.

My paper also contributes to the literature on bank competition. This literature can be divided into two camps: studies that find bank competition beneficial for welfare, and those that do not.[16] My paper falls into the second camp. My results suggest that a concentrated banking system improves welfare by reducing the inefficient demand for liquidity.

[16]For example, Jayaratne and Strahan [1998], De Nicole [2000], and Boyd and De Nicole [2005] argue that competition improves bank stability whereas Keeley [1990], Repullo [2004], and Beck, Demirguc-Kunt and Levine [2006] suggest that it promotes bank failures.

3.2 A Model of Perfect Competition

3.2.1 Environment

The model has three dates: $t \in \{1, 2, 3\}$. There is a continuum of financiers and a continuum of bankers. I represent the sets of each type of agents by the unit interval $[0, 1]$, where each point in the interval denotes a different agent. I measure the fraction of agents in any subset by its Lebesgue measure. The assumption of a large number of individually insignificant (*i.e.,* atomistic) bankers ensures that none has enough market power to affect the terms of trade in the economy. I will change the perfectly competitive market set-up later in Section 4 and introduce a monopolist with a competitive fringe. I dispense with financial discounting to avoid notational clutter.

Financiers are endowed with W units of a single good which can be used for consumption and investment. I refer to it as cash and count it in dollars. They are risk-neutral and they consume at date $t = 3$. Financiers have access to the following production technology: x dollars invested at date $t = 1$ yield $f(x)$ dollars at date $t = 3$. $f(\cdot)$ satisfies the usual neoclassical properties: $f'(\cdot) > 0$, $f''(\cdot) < 0$, and $f(0) = 0$. I further assume that the third derivate of the production function is positive. This assumption is innocent and does not affect my results (see footnote 8). Moreover, commonly used production functions, such as Cobb-Douglas, satisfy this condition.

Investments in the production technology are fully reversible. That is, a financier can liquidate some part of his investment (without any cost) and obtain his cash back. For example, if a financier invests one dollar at date $t = 1$ and removes 0.2 dollars from production at date $t = 2$, he would receive $0.2 + f(0.8)$ dollars at date $t = 3$. I assume that absent an additional incentive, liquidation is never efficient. That is, $f'(W) > 1$. I refer to investments in this production technology as real assets.

Bankers own financial assets which are worth $\tilde{r}$ at date $t = 3$. $\tilde{r}$ is a random variable with $E[\tilde{r}] = r$ and its exact distribution is not important. Financial assets can be interpreted as a pool of many small projects such as a loan portfolio. Bankers are financed with deposits of face value d_0 and they are solvent in the long term: $d_0 < r$.[17]

To simplify the exposition of welfare calculations, I assume that deposit contracts are owned by financiers. It would be possible to include an initial stage (*i.e.,* date $t = 0$) to the model, at which bankers collect deposits from financiers and lend to another type of agents (*i.e.,* entrepreneurs). I abstract away from this additional layer to focus on the effect of liquidity management on welfare. Similar results could also be obtained by introducing entrepreneurs and by assuming that they can pledge outputs of their projects to banks without any cost.

Bankers' investments in financial assets are not reversible. Bankers cannot liquidate their projects before date $t = 3$ to obtain cash. To ensure that bankers are able to sell their assets to financiers (if needed), I assume that the return on bankers' assets is higher than the return on the financier's production. In particular, I assume that r is greater than $f'(0)$. This assumption is sufficient but not necessary for the results. Bankers consume at date 3.

There also exists a simple storage technology available to both financiers and bankers. It allows agents to transfer their consumption goods (*i.e.,* their cash) to the next period without any loss or gain. Because financiers can liquidate their investments at no cost, they would never invest in the storage

[17]Bankers' profits in this competitive market can be justified by introducing a free-entry condition which allows financiers to become bankers at some cost, and by setting this entry cost equal to bankers' equilibrium profits.

technology. As it will be clear, the storage technology might be employed by bankers at date $t = 1$ to keep cash against a possible liquidity shock at date $t = 2$.

If I closed the model at this point, financiers would invest all their endowments and both types of agents would wait until date $t = 3$ to consume the total output in the economy. Welfare, defined as the total consumption at date $t = 3$, could be calculated as follows:

$$\begin{aligned} Welfare = & \underbrace{r - d_0}_{\text{bankers' consumption}} + \underbrace{d_0 + f(W)}_{\text{financiers' consumption}} \\ & = r + f(W). \end{aligned}$$

Now I include the possibility of a liquidity shock into the model. One way of obtaining a need for liquidity is to introduce uncertainty in the time preferences of depositors (*i.e.,* financiers). For example, many banking models include impatient individuals who, with a positive probability, would like to consume early (*e.g.,* Diamond and Dybvig [1983] and Allen and Gale [2000]). In those models the demand for liquidity by impatient depositors promts the liquidation of illiquid assets. In this paper, to create a need for liquidity, I will assume that bankers, with an exogenously given probability, need additional financing at an interim stage. Additional financing might be interpreted as an unexpected need of cash to cover the operating expenses of the current investments. Such a structure has been employed in some other banking models such as Holmstrom and Tirole [1998]. My results would not change if I introduced uncertainty in the time preferences of depositors as in Diamond and Dybvig [1983].

At date $t = 2$, with probability $p \in [0, 1]$, bankers face a common liquidity shock. In particular, some of their investments require additional financing and each banker needs to invest an additional λ dollars if the liquidity shock hits. Otherwise (*i.e.,* if this additional amount is not paid), his investment yields nothing. I assume that λ is smaller than W. This assumption ensures that there is enough cash in the economy when the liquidity shock hits so that bankers can raise funds from financiers to be able to continue financing their projects. I also assume that sinking λ dollars when the liquidity shock hits has a positive NPV. Since bankers need to offer the return $f'(W - \lambda)$ to get λ dollars from financiers, this assumption can be stated as

$$\lambda f'(W - \lambda) < r - d_0.$$

The left-hand side of the expression above represents bankers' cost of raising λ dollars from financiers. The right-hand side is bankers' (gross) profit if they raise λ dollars and sink into their investments when the liquidity shock hits. Observe that investments in real assets decrease from $f(W)$ to $f(W - \lambda)$ as a result of the liquidity shock. That is, a liquidity shock causes an economic crisis by reducing output.

I also introduce a government and allow it to intervene by providing liquidity when a shock hits. I assume that it is costly for the government to provide liquidity, perhaps, because in that case it has to divert funds from public projects. The net per dollar cost of the government's intervention on the economy is ψ. For example, if the government provides λ dollars to bankers at date $t = 2$, the welfare loss would be $\lambda\psi$ whereas it would have been $f(W) - f(W - \lambda)$ if financiers had provided λ dollars. ψ can be high or low: $\psi \in \{\psi^l, \psi^h\}$ with $\psi^l < f'(W)$ and $\psi^h > f'(W - \lambda)$. The ex ante probability that ψ is equal to ψ^h is $q \in [0, 1]$.

The government acts as a social planner and intervenes (*i.e.,* provides liquidity) only if its intervention is efficient for the economy (*i.e.,* when ψ is equal to ψ^l). When it intervenes, it sets the price of the liquidity (*e.g.,* interest rate) and bankers choose to obtain cash either from the government or financiers. When the welfare effects of several pricing strategies are the same, the government chooses the strategy that maximizes its payoff. Finally, for simplicity, I do not allow partial intervention. That is, if the liquidity shock hits at date $t = 2$, either the government or financiers provide the liquidity, not both.

3.2.2 Competitive Banker's Problem

At date $t = 1$, depending on the magnitude of p, bankers might want to keep some cash. Bankers can obtain cash by selling their assets to financiers.[18] Alternatively, they can wait until date $t = 2$ and sell their assets only if the liquidity shock hits. As it will be clear, the reason bankers want to obtain some cash at date $t = 1$ is that it will be more costly to obtain cash at date $t = 2$ if the liquidity shock hits.

Let C_1 be the amount of cash bankers demand at date $t = 1$. In order to obtain C_1 dollars, they sell the fraction μ_1 of their assets. Because financiers have an opportunity to invest in their production technology, bankers have to offer a discount to convince financiers to buy their financial assets at date $t = 1$. Let d_1 be the (gross) return financiers receive at date $t = 3$ when they buy bankers' assets at date $t = 1$. The following equality holds when the market clears:

$$C_1 d_1 = r\mu_1.$$

[18] A banker can also raise funds in other forms, for instance by collecting deposits. My results would not change if the banker obtained cash by issuing new debt contracts. In general, because the new debt will be subordinated relative to the existing debt, such a form of financing will not be possible because of the debt overhang problem. See Stein [2012] for an explanation why an asset sale is an unavoidable consequence of a liquidity shock.

To obtain C_1 dollars from financiers, bankers sell their assets worth $r\mu_1$ dollars. Bankers cannot sell their assets without offering a discount ($i.e.$, $\frac{1}{d_1}$) because the marginal return of financiers' production technology is greater than one.

Bankers' decision at date $t = 2$ is trivial: if the liquidity shock does not hit, they do not take any action. In that case, their profit at date $t = 3$ becomes $(1 - \mu_1)r + C_1 - d_0$. Otherwise ($i.e.$, if the shock hits at date $t = 2$), each banker sells fraction μ_2 of their assets to obtain $C_2 = \lambda - C_1$ dollars.[19] If the government's cost of intervention is too high, financiers buy bankers' assets. For financiers to be willing to liquidate their investments to pay $\lambda - C_1$ dollars to bankers, the marginal return of their remaining investments should be equal to the return they obtain from financial assets. The following equation pins down the return of the assets sold to financiers in the fire sale at date $t = 2$:

$$\begin{aligned} d_2 &= f'(W - C_1 - C_2) \\ &= f'(W - \lambda). \end{aligned} \tag{19}$$

Thus, the price of bankers' assets at date $t = 2$ is $\frac{1}{f'(W-\lambda)}$. Note that the government, when it intervenes, buys bankers' assets at the same price. To see that, first observe that the price cannot be lower than $\frac{1}{f'(W-\lambda)}$; otherwise bankers would prefer obtaining cash from financiers instead of the government. The price cannot be higher than $\frac{1}{f'(W-\lambda)}$ either because in that case the government could increase its payoff, without affecting welfare, by reducing price to $\frac{1}{f'(W-\lambda)}$. Therefore, regardless of who the provider of the liquidity is, d_2, the return from the fire sale at date $t = 2$, would be the same.

[19] I define μ_2 as the ratio of the value of assets sold at date $t = 2$ to r. Note also that it is not optimal to obtain more than λ dollars at any date.

Now I can derive the return of the assets sold at date $t = 1$ (*i.e.*, d_1). At date $t = 1$, a financier should be indifferent between buying the banker's assets with his last penny and investing in his production technology. With probability $1-p+p(1-q) = 1-pq$, the financier will not provide additional financing to the banker at date $t = 2$. It could be either because the liquidity shock does not hit or the liquidity shock hits but the government intervenes. In both cases, the marginal return of the financier's investment is $f'(W-C_1)$. With the complementary probability pq, the financier provides additional financing and earns d_2 on each dollar he gives to the banker at date $t = 2$. The indifference condition gives

$$d_1 = (1 - pq)f'(W - C_1) + pqf'(W - \lambda). \tag{20}$$

The inefficiency of a fire sale is evident from the expression above. A fire sale at date $t = 1$ reduces investments in real assets from $f(W)$ to $f(W - C_1)$, which is inefficient in expectation because there is a possibility that the liquidity shock will not hit.

Bankers' expected profit at date $t = 1$ is

$$(1-p)\Big[(1-\mu_1)r + C_1 - d_0\Big] + p\Big[(1-\mu_1-\mu_2)r - d_0\Big],$$

which on substituting for $\mu_1 = \frac{C_1 d_1}{r}$ and $\mu_2 = \frac{(\lambda - C_1)d_2}{r}$ simplifies to

$$r - d_0 - p\lambda d_2 + \Delta C_1,$$

where I define

$$\Delta := 1 - p - d_1 + pd_2. \tag{21}$$

Observe that bankers' profit function is linear in C_1. Therefore, the amount of cash demanded at date $t = 1$ depends on Δ, the coefficient of C_1. For example, if Δ is negative, none of the bankers will demand cash. Also observe that each competitive banker takes Δ as given. That is, an individual banker has no power to affect d_1 or d_2, and thus Δ. The following lemma uses these observations to derive the equilibrium. The proofs of the lemmas are in the Appendix.

Lemma 1. *Define* $p_1 = \frac{f'(W)-1}{qf'(W)+(1-q)f'(W-\lambda)-1}$. *If the probability of the liquidity shock is smaller than* p_1, *bankers do not demand cash at date* $t = 1$. *Otherwise, bankers' total demand for cash,* C_1, *at date* $t = 1$ *can be calculated from the equation below:*

$$f'(W - C_1) = \frac{1}{1 - pq}\Big[1 - p + p(1 - q)f'(W - \lambda)\Big].$$

Bankers in a competitive market have an incentive to obtain some cash at date $t = 1$ against the potential liquidity shock at date $t = 2$. They demand cash because if a liquidity shock hits, their cost of obtaining cash will be higher: $f'(W - C_1) < f'(W - \lambda)$. Their rush to raise funds at date $t = 1$, before a liquidity shock hits, causes misallocation of funds in the economy by reducing investments in real assets. Welfare in the economy is given below:

$$r+(1-p)\Big[f(W-C_1)+C_1\Big]+p\Big[qf(W-\lambda)+(1-q)\big(f(W-C_1)-\psi^l(\lambda-C_1)\big)\Big], \tag{22}$$

where C_1 can be obtained from Lemma 1. The analysis so far is summarized in the proposition below and illustrated in Figure 1.

Proposition 1. *Competitive bankers' demand for cash at date* $t = 1$ *increases with the probability of the liquidity shock.*

Proof. Competitive bankers' demand for cash at date $t = 1$ is zero when the probability of the liquidity shock is smaller than p_1. When this probability

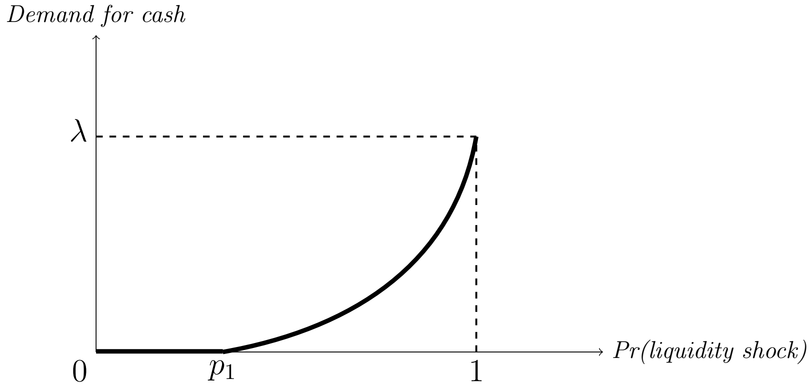

Figure 2: Competitive bankers' demand for cash at date $t = 1$ increases with the probability of the liquidity shock.

is greater than p_1, the first-order condition of the bankers' problem requires Δ to be zero. The partial derivative of C_1 with respect to p at the optimum can be obtained by applying the implicit function theorem to the first-order condition:

$$\frac{\partial C_1}{\partial p} = -\frac{(1-q)\big(f'(W-\lambda)-1\big)}{(1-pq)^2 f''(W-C_1)}.$$

Because the expression above is positive, bankers' demand for cash increases with the likelihood of the liquidity shock. □

With his demand at date $t = 1$, a banker contributes to the increase in the price of cash. That is, each banker imposes a negative externality on other bankers. One might ask why this externality is not corrected by the price system. After all, pecuniary externalities do not result in misallocation of resources.[20] A pecuniary externality causes an inefficiency in my model because the government cannot commit not to provide liquidity. In particular, the government cannot commit at date $t = 1$ not to intervene when its

[20] See, for example, Shubik [1971] and Laffont [1987] for explanations why pecuniary externalities do not lead to violations of the standard welfare theorems.

intervention is beneficial for the economy at date $t = 2$.

To see why the possibility of a government intervention creates inefficiency, assume that the probability of government intervention is zero in the model. Observe that when $1 - q$ is zero, bankers do not demand cash at date $t = 1$ because the threshold p_1 in Lemma 1 becomes one. Intuitively, the possibility of the government intervention at date $t = 2$ softens bankers' budget constraint at date $t = 1$ by preventing the fire-sale price to fall too much. In particular, when government intervention is not a possibility, the buyers of financial assets at date $t = 1$ demand a higher discount in the fire sale because they know that if the liquidity shock hits they will make a higher profit with their cash in hand. The subsequent increase in the fire-sale price deters bankers from selling their assets at date $t = 1$, and the inefficiency disappears.

3.3 Social Planner's Problem

The social planner's objective function at date $t = 1$ is given below:

$$(1-p)\Big[r+f(W-C_1)+C_1\Big]+p\Big[r+qf(W-\lambda)+(1-q)\big(f(W-C_1)-(\lambda-C_1)\psi^l\big)\Big].$$

The first part represents the output in the economy if the liquidity shock does not hit. The second part corresponds to the output if the shock hits. In the latter case the social planner also recognizes the loss in welfare due to the government's intervention. Asset sales and interest payments are transfers between agents and, thus, they do not show up in the social planner's objective function. The social planner cares only about the total production in the economy. The following proposition derives the social planner's strategy.

Proposition 2. *The social planner does not sell any of the banker's assets at date $t = 1$.*

Proof. The partial derivative of the objective function with respect to C_1 is negative:

$$(1-p)\big(-f'(W-C_1)+1\big)+p(1-q)\big(-f'(W-C_1)+\psi^l\big)<0.$$

Thus the objective function is maximized by setting C_1 to zero. □

The intuition behind this result is clear: the sale of the financial assets at date $t = 1$ reduces the investment in the real assets, which will be inefficient if the liquidity shock does not hit. The welfare under the social planner's management can be written as

$$r+(1-p)f(W)+pqf(W-\lambda)+p(1-q)\big(f(W)-\lambda\psi^l\big). \tag{23}$$

The loss in welfare (due to the rush to obtain liquidity) in the perfectly competitive market can be calculated by subtracting (5) from (4):

$$(1-p)\Big[f(W)-f(W-C_1)-C_1\Big]+p\Big[(1-q)\big(f(W)-f(W-C_1)+C_1\psi^l\big)\Big]. \tag{24}$$

For small values of p, competition does not result in any output loss. In particular, when the probability of the liquidity shock is smaller than p_1, bankers do not sell any asset at date $t = 1$ (*i.e.*, $C_1 = 0$) and the expression (24) becomes zero. When the probability of the shock is greater than p_1, bankers would like to sell their assets before others do (*i.e.*, $C_1 > 0$). Such a rush for liquidity adversely affects the output by prompting financiers to reduce their investments in real assets even before the liquidity shock hits.

3.4 Monopolist with a Competitive Fringe

The analysis in the previous sections shows that populating the economy with many small banks causes a welfare loss. The main reason for this inefficiency is that small banks do not recognize their own impact on the equilibrium terms of trade (*i.e.,* fire-sale prices at date $t = 1$). Their individually optimal decisions become suboptimal from the social planner's perspective. In this section I introduce into the model one big bank which internalizes its impact on the prices. In particular, I assume that some bankers with the total measure of $\phi > 0$ merge and establish one big bank. The rest of the banking system consists of many small bankers which, in aggregate, occupy $1 - \phi$ of the banking system.

I will denote the big bank and the small competitive bankers with superscripts "b" and "s" respectively. The total demand for cash in the economy at date $t = 1$ is the sum of demands of both types of bankers:

$$C_1 = \phi C_1^b + (1 - \phi)C_1^s.$$

Fire-sale prices at dates $t = 1$ and $t = 2$ can be obtained from (19) and (20). The big bank's expected profit at date $t = 1$ is

$$(1 - p)\left[(1 - \mu_1^b)r + C_1^b - d_0\right] + p\left[(1 - \mu_1^b - \mu_2^b)r - d_0\right],$$

which on substituting for $\mu_1^b = \frac{C_1^b d_1}{r}$ and $\mu_2^b = \frac{(\lambda - C_1^b)d_2}{r}$ simplifies to

$$r - d_0 - p\lambda d_2 + \Delta C_1^b.$$

Contrary to small bankers' objective, the big bank's objective function is not linear in its demand for cash (*i.e.,* in C_1^b) because d_1 in Δ depends on C_1^b.

That is, by demanding cash the big bank affects the fire-sale price at date $t = 1$. The partial derivative of the big bank's profit function with respect to C_1^b gives

$$\Delta + \phi C_1^b f''\big(W - \phi C_1^b + (1-\phi)C_1^s\big).$$

The second term above represents the big bank's own influence on the fire-sale price at date $t = 1$. Because $f''(\cdot)$ is negative, the big bank has less incentive to sell its assets compared to small bankers which take the fire-sale price as given.[21] The following lemma derives the equilibrium at date $t = 1$.

Lemma 2. *Define* $p_1 = \frac{f'(W)-1}{qf'(W)+(1-q)f'(W-\lambda)-1}$ *and*

$p_2 = \frac{f'(W)-1}{qf'(W)+(1-q)f'\big(W-(1-\phi)\lambda\big)-1}$.

The equilibrium at date $t = 1$ can be characterized by three regions:

- $p \in [0, p_1)$*: There is no demand for cash and, thus, no fire sale.*
- $p \in [p_1, p_2)$*: Small bankers demand some cash, but the big bank does not. The total demand for cash in the economy, $C_1 = (1-\phi)C^s$, can be computed from the expression below:*

$$f'\big(W - C_1\big) = \frac{1}{1-pq}\Big[1 + p + (1-q)f'(W-\lambda)\Big].$$

- $p \in (p_2, 1]$*: Each small banker demands λ dollars while the big bank demands C_1^b dollars. The total demand for cash in the economy, $C_1 = \phi C^b + (1-\phi)\lambda$, can be computed from the expression below:*

$$f'(W-C_1) = \frac{1}{1-pq}\Big[1+p+(1-q)f'(W-\lambda)\Big] + \frac{C_1-(1-\phi)\lambda}{1-pq}f''(W-C_1). \quad (25)$$

---

[21] Note that the second-order condition of the maximization problem is satisfied because the third derivative of the production function is positive. If the third derivative were negative, the big bank would demand even less cash. For example, in the extreme, if the third derivative were negative infinity, the big bank would not demand any cash at all.

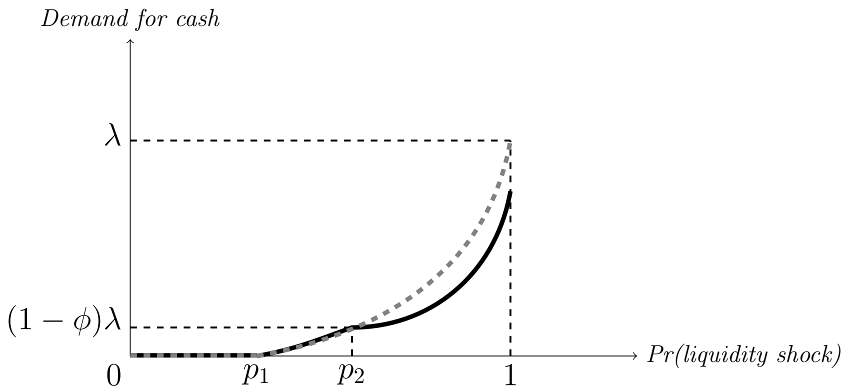

Figure 3: The black curve shows the aggregate demand for cash in the monopolistic banking structure with a competitive fringe. The red dashed curve represents the demand for cash in the competitive market.

Note that the upper threshold p_2 approaches p_1 as ϕ decreases. When the market becomes perfectly competitive (*i.e.,* $\phi = 0$), Lemma 2 is equivalent to Lemma 1.

When the probability of the liquidity shock is between p_1 and p_2, the total demand for cash in the economy is the same in both market structures. Although the big bank does not sell its assets, each small banker sells more than the amount they would sell in a perfectly competitive market. When the probability of a shock is greater than p_2, the total demand for cash is higher in the competitive market because the last term in expression (25) is negative. The following proposition summarizes the analysis and Figure 2 illustrates the result by comparing the demand for cash in the two market structures.

Proposition 3. *Introduction of a big bank into a perfectly competitive market improves efficiency by reducing the demand for cash in the economy at date* $t = 1$*.*

Proof. The welfare loss can be calculated by inserting the total demand for cash C_1 into expression (24). The partial derivative of (24) with respect to C_1 is

$$(1-p)\big[f'(W-C_1)-1\big]+p(1-q)\big[f'(W-C_1)+\psi^l\big],$$

which is positive. A decrease in the total demand for cash at date $t=1$ increases welfare. □

3.5 Conclusion

Big banks tend to take excessive risks, because they expect to receive assistance from the government if their bets go bad. The possibility of a government bailout weakens the market discipline by reducing depositors' incentives to monitor.

In this paper, I identify a market failure and argue that big banks are helpful in correcting this failure. In particular, I show that when faced with the possibility of a liquidity shock, competitive banks cause a decline in the output by removing funds from the real assets through a fire sale. They have an additional incentive to trigger a fire sale because they do not internalize their own impact on prices.

Big banks can improve welfare. They play the role of a moderator in fire sales because they internalize the effect of their own actions. Their timely sales improve efficiency by decreasing the amount of funds removed from the real assets. These results suggest that instead of blindly penalizing banks for being too big, regulators should balance the benefits and costs of having big banks.

3.6 Appendix

This appendix contains the proofs of the lemmas.

Proof of Lemma 1

Proof. The representative competitive banker's problem is given below:

$$\max_{C_1} r - d_0 - p\lambda d_2 + \Delta C_1,$$

where

$$d_1 = (1 - pq)f'(W - C_1) + pqf'(W - \lambda)$$
$$d_2 = f'(W - \lambda)$$
$$\Delta = 1 - p - d_1 + pd_2.$$

The objective function is linear in C_1. Therefore, each banker's demand for cash at date $t = 1$ depends on the sign of Δ. There are three cases to consider:

- $\Delta < 0$. In this case, none of the bankers demands any cash before a liquidity shock hits. They set $C_1 = 0$. The return on assets sold in the fire sale at date $t = 1$ becomes

  $$d_1 = (1 - pq)f'(W - \lambda) + qf'(W).$$

  The condition $\Delta < 0$ can be written as

  $$p < \frac{f'(W) - 1}{qf'(W) + (1 - q)f'(W - \lambda) - 1}.$$

  The expression on the right-hand side of the inequality above defines p_1, the threshold probability that bankers start selling their assets.

- $\Delta = 0$. In this case, at date $t = 1$ each banker is indifferent between obtaining some cash and not. In the symmetrical equilibrium each banker demands the same amount of cash C_1, which can be calculated from the equation below:

$$\Delta = 0 \Leftrightarrow f'(W - C_1) = \frac{1}{1 - pq}\Big[1 - p + p(1 - q)f'(W - \lambda)\Big].$$

  Note that because $C_1 \in [0, \lambda]$, this equilibrium is possible only if $p \geq p_1$.

- $\Delta > 0$. In this case, each bank demands $C_1 = \lambda$, the maximum amount of cash they will need if a liquidity shock hits. The returns on assets bought in the fire sales at date $t = 1$ and $t = 2$ (*i.e.,* d_1 and d_2) become equal:

$$d_1 = d_2 = f'(W - \lambda).$$

  If at date $t = 1$ a banker knows that the cost of obtaining cash will be the same at date $t = 2$, he optimally postpones his selling decision. By postponing he can be sure that he obtains cash only when he needs it. Therefore, bankers will not sell any of their assets at date $t = 1$ if d_1 is equal to d_2. This contradicts with the claim that Δ is positive in the equilibrium.

□

Proof of Lemma 2

Proof. The representative small banker's problem is given below:

$$\max_{C_1^b} r - d_0 - p\lambda d_2 + \Delta C_1^b,$$

where

$$
\begin{aligned}
d_1 &= (1-pq)f'(W-\phi C_1^b-(1-\phi)C_1^s)+pqf'(W-\lambda) \\
d_2 &= f'(W-\lambda) \\
\Delta &= 1-p-d_1+pd_2.
\end{aligned}
$$

As in the competitive market, the small banker's problem is linear in his demand for cash (*i.e.,* C_1^b). That is, small bankers base their decisions on the sign of Δ. The big bank's profit function is given below:

$$
r-d_0-p\lambda d_2+\Delta C_1^b.
$$

The partial derivative of the big bank's profit function with respect to C_1^b gives

$$
\Delta-\phi C_1^b f''\big(W-\phi C_1^b-(1-\phi)C_1^s\big), \tag{26}
$$

which is not linear. Observe that because $f''(\cdot)$ is negative, the big bank's incentive to obtain cash is smaller than that of the small banker. I use the same technique I invoke in the proof of Lemma 1 and derive the equilibrium considering the three different cases with respect to Δ.

- $\Delta<0$. In this case, none of the bankers demands cash. They set $C_1^b=C_1^s=0$. The return on the assets sold in the fire sale at date $t=1$ becomes

  $$
  d_1=(1-pq)f'(W-\lambda)+qf'(W).
  $$

  The condition $\Delta<0$ can be written as

  $$
  p<\frac{f'(W)-1}{qf'(W)+(1-q)f'(W-\lambda)-1}.
  $$

As in Lemma 1, the expression on the right-hand side of the inequality above defines p_1, the threshold probability that bankers start selling their assets.

- $\Delta = 0$. In this case, at date $t = 1$ each small banker is indifferent between obtaining some cash and not. The big bank does not demand any cash (i.e., $C_1^b = 0$). In the symmetrical equilibrium each small banker demands the same amount of cash C_1^s. The total demand for cash in the economy becomes $C_1 = (1-\phi)C_1^s$, which can be calculated from the equation below:

$$\Delta = 0 \Leftrightarrow f'(W - C_1) = \frac{1}{1-pq}\Big[1 - p + p(1-q)f'(W-\lambda)\Big].$$

Applying the implicit function theorem to the expression above yields:

$$\frac{\partial C_1}{\partial p} = -\frac{(1-q)\big(f'(W-\lambda)-1\big)}{(1-\phi)(1-pq)^2 f''(W-C_1)},$$

which is positive. That is, as p increases, small bankers' demand for cash increases. When their demand reaches λ dollars (i.e., when they are fully insured at date $t = 1$ against a liquidity shock), Δ becomes positive. This observation determines p_2, the upper threshold of the interval in which such an equilibrium is possible:

$$p_2 = \frac{f'(W)-1}{qf'(W) + (1-q)f'(W-(1-\phi)\lambda) - 1}.$$

- $\Delta > 0$. In this case, small bankers demand $C_1^s = \lambda$, the entire amount of cash they will need at date $t = 2$ if a liquidity shock hits. The big bank also demands some cash: to satisfy the first-order condition (*i.e.,* to set the expression (26) to zero), C^b must be positive. The first-order condition yields

$$(1-pq)f'\big(W-\phi C^b-(1-\phi)\lambda\big)-\phi C_1^b f''\big(W-\phi C_1^b-(1-\phi)\lambda\big)$$
$$=1-p+(1-q)f'(W-\lambda)$$

or

$$f'(W-C_1)=\frac{1}{1-pq}\Big[1+p+(1-q)f'(W-\lambda)\Big]+\frac{C_1-(1-\phi)\lambda}{1-pq}f''(W-C_1),$$

where $C_1=\phi C^b+(1-\phi)\lambda$ is the total demand for cash in the economy.

□

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Essay 3

Compromising Welfare

Abstract

The U.S. Constitution includes many checks and balances that necessitate the ruling party to compromise with the opposition. I develop a model in which this feature prompts the President to compromise on the strength of the candidates nominated for positions in the federal government and judiciary. I test the model by using data of the nominations of federal judges from 1989 to 2014. Because federal judges are appointed for life, appointments of competent younger judges extend the productive period they spend on the bench and improve welfare. Consistent with the predictions of the model, and controlling for each candidate's competence with the rating assigned by the American Bar Association, I find that the confirmation in the Senate is more likely and faster when the President compromises on the strength of the candidate by nominating an older individual. These findings suggest that the system of checks and balances comes with a price.

Parties might settle while leaving justice undone.

– Owen Fiss (1984)

4.1 Introduction

Compromises are considered as socially desirable means to reach an agreement. The general notion among scholars and in the public is that political parties should be ready to make sacrifices to settle disputes at times when disagreements and inability to reach consensus block negotiations (*e.g.,* Gutmann and Thompson [2014], Sollenberger [2008], and Smith [1942]). For example, the Founding Fathers had to compromise on numerous issues to be able to agree on a constitution that was acceptable to every state.[22]

Although compromises reduce delays in negotiations and might even be necessary to end a dispute, they might also lead to inefficient outcomes for society. Consider an economic policy—an alternative to the status quo—expected to promote stability in the next period. For the policy to be adopted, it has to be approved by both parties in the Senate. Although both parties benefit from the policy, it might not be approved if it is also redistributive (*i.e.,* if the policy also implies a political transfer from the minority party to the majority party). In particular, if the transfer is greater than the benefit the minority party obtains from the policy, the majority party needs to compromise to pass the proposal. The outcome might be a policy close to the status quo.

[22]Discussions on the representation in Congress led to establishment of two chambers: the Senate where each state is equally represented and the House of Representatives where states are represented based on population. The election procedure of the President and the rules on slavery were also agreed upon compromises (Marshall [1987]).

To show how political dynamics force parties to agree on a suboptimal solution, I construct a two-party bargaining model with one side making the offer. Parties are heterogeneous in their objectives as in Alesina [1987]. In particular, once elected, each party aims to appoint a strong individual to a governmental post. Since nominators and nominees tend to share the same policy preferences, an appointment of a stronger candidate also means a larger transfer between the parties. As a result a strong candidate meets greater resistance, which creates an inefficient delay in reaching an agreement. In the equilibrium, the parties agree on a compromised solution, and appoint a weaker candidate than is socially optimal. If parties could commit to their future actions, they would agree on a cooperative rule and the inefficiency arising from a compromise would be avoided. Thus, the model provides an argument in favor of rules rather than discretion.

Dixit, Grossman, and Gul [2000] analyze the dynamics of political compromise. In their model the ruling party is willing to compromise because it believes that its successor will do the same. They show that such a tacit cooperation (*i.e.,* making a compromise once elected) can be sustained as an efficient equilibrium. In a one-period version of their model, a compromise would not occur although it is socially desirable. In my model, on the other hand, compromise is not socially desirable, yet it arises as an outcome of the game.

It is not easy to test the predictions of my model because the econometrician generally cannot foresee the welfare implications of a compromise. When two parties debate on a policy proposal, it is hard to distinguish whether the debate is really on welfare or on the political transfer between the parties. For example, Republicans might support a tax cut to stimulate the economy or attract new voters. Likewise, Democrats might want to increase social security benefits to induce poor voters to vote or because they believe it is good for the welfare of the nation. To test the implications of the model, therefore, we need an environment where the effect of a compromise on welfare is sufficiently clear.

Appointments to judiciary provide such an environment. Recently, a great deal of attention in the media has been devoted to delays in Senate confirmations to President Obama's nominations to federal courts.[23] At the same time, less attention has been paid to the welfare implications of such delays. When the bench stays empty, dockets accumulate and justice slows down. The delay also has an indirect negative effect: a possible threat to block a nomination prompts the President to choose a candidate who is likely to be approved faster by the Senate. In other words, political dynamics might force the President to compromise on the strength of the nominee.

Appointing a strong candidate is desirable from the social planner's perspective. A strong candidate—energetic and quick to adapt to new environments—is likely to be more productive. Because these attributes are unobservable, I use the age of the nominee as a measure of her strength.[24]

To see why age is a good proxy for the strength of the nominee, consider a situation where a life-time position has to be filled for the next one hundred years and life expectancy is 80 years. Compare the following two strategies: (i) appoint a 65-year-old and replace her with another 65-year-old every 15 years. (ii) Appoint a 50-year-old and replace her with another person of the same age every 30 years. There are several reasons why the second strategy

[23]See, for example, recent articles in *Bloomberg* [2014], *Economist* [2013], *New Yorker* [2014], and *Wall Street Journal* [2013].

[24]In addition to energy and adaptability, strength also captures other (more easily observable) decision-making qualities of the candidate, such as education and experience. In the empirical analysis, I control for these attributes with the rating assigned by the American Bar Association.

generates greater welfare.

First, spending a longer time at the same position helps an individual develop the skills necessary to master his job.[25] According to John Paul Stevens, the second-longest-serving judge on the U.S. Supreme Court, learning on the job is essential to the process of judging. In his talk at a forum in his honor (Stevens [2006]), he provides several examples from his life showing how a federal judge improves his decisions over the years while serving on the bench.

Second, the life-cycle hypothesis of human productivity (see, for instance, Levin and Stephan [1991]) asserts that individuals become less productive as they age. Several pieces of evidence from the judiciary support this hypothesis. Older judges write fewer separate opinions (Buchman [2010]) and receive fewer citations (Posner [1995] and Bhattacharya and Smyth [2001]). Moreover, there are numerous examples of how mental decline and incapacity have troubled U.S. federal courts. William Douglas, the longest-serving judge on the Supreme Court, barely functioned in his last year in 1975, making the other eight judges of the Supreme Court agree to nullify any decision in which Douglas cast the deciding vote. Stephen Field, the third-longest-serving judge on the Supreme Court, became feeble after serving 27 years on the bench and lost conception of the arguments that were made before him. Garrow [2000] covers other instances that question whether judicial votes were cast by a less than fully competent justice.

Third, there is plenty of anecdotal evidence that federal judges delay their retirements strategically to prevent the appointment of a person with a different ideological view. The anti-Roosevelt Justice James McReynolds famously

[25] In his most cited paper, Arrow [1962] ascribes the improvement in the quality of the labor force over time to learning by doing. See Thompson [2010] for a review of the learning by doing literature.

said "I'll never resign as long as that crippled son-of-a-bitch is in the White House" (Shesol [2010]). Chief Justice William Rehnquist, a conservative Republican, was reluctant to retire as long as President Clinton remained in the White House (Epstein and Segal [2005]).[26] Such strategic behavior inflates the negative consequences of appointments of older candidates. Revisit the previous example. If a 65-year-old person is appointed every time the seat is vacant, over one hundred years, more people will be occupying the seat who would retire (say, because of poor health) absent such strategic behavior.

I use the data of the appointments of U.S. federal judges from 1989 to 2014 to test the implications of my model. First, I show that the nomination is more likely to be confirmed by the Senate if the President compromises on the strength of the candidate (*i.e.,* when the candidate is older). Next, I analyze the number of days an appointment waits in the Senate. I find that stronger nominees wait longer for confirmation. Moreover, the delay is longer when the redistributive effect of an appointment is greater, *i.e.,* when the parties have more divergent opinions on policy.

The rest of the article is structured as follows. The next section introduces a model of political bargaining on the appointments to the federal government. Comparative statics of the equilibrium produces three empirically testable predictions which I test in Section 3 using data from federal judge appointments. The empirical results are consistent with the predictions of the model. The last section concludes.

4.2 Model

To show how political dynamics leads to a socially inefficient outcome, I consider a one-sided bargaining game between the two parties in the U.S.

[26] See Ward [2003] for more examples.

Senate. At the beginning of the game a coin flip determines the winner of the election. The winner (*i.e.,* the first player) represents the party of the President and the loser (*i.e.,* the second player) represents the opposition party. I assume that each senator's interests completely align with the interests of the other senators in the same party. Hence the game can be considered as a bargaining game between two individuals. Time is discrete.

The game starts when the President nominates a candidate $i \in \{1, 2, ..., N\}$ for a vacant seat in the federal government or judiciary. I use $s_i \in \mathbb{R}^+$ to represent the strength of the candidate. Candidates are indexed according to their strengths: $s_1 < s_2 < ... < s_N$. I assume that candidate N is strong enough to ensure that the interval of the candidates nominated in the equilibrium is not an empty set. Otherwise the game ends without agreement between the parties.[27]

Strength is publicly observable and reflects how influential the candidate will be in making decisions. As it will be clear later, appointment of a stronger candidate increases welfare and is thus preferable from the social planner's perspective.

The second player observes nominee i and decides whether to accept or reject the nomination. Rejection can be interpreted as blocking the nomination in the Senate. A common method of preventing the Senate from voting is to extend the debate (*i.e.,* to filibuster). In principle, each senator can ask for permission to debate the proposal and can speak as long as he wants. The threat of a filibuster often is sufficient to block the nomination.[28] Another method of causing delays is to demand a quorum call (*i.e.,* to ask whether

[27] This assumption will be useful while deriving Proposition 1.

[28] Current rules allow a qualified majority (*i.e.,* 60 out of 100 senators) to block a filibuster by invoking cloture. However, the cloture attempt itself could be filibustered. In that case a more qualified majority (*i.e.,* 67 senators) is needed to end the debate.

the majority is present, which is a constitutional requirement for the Senate to conduct business). Usually the majority is not present and a quorum call suspends the proceedings.

If the second player accepts the offer, the game ends. In that case there is a transfer from the second player to the first.[29] The size of the transfer depends on the strength of the candidate and polarization $\pi > 0$ between the parties. If appointed, the nominee not only serves the society, but also affects the decisions in favor of the first party.[30] Thus a stronger candidate increases the transfer. Polarization also positively affects the transfer; when the parties have more divergent opinions on issues and when their attitudes are starkly divided along partisan lines, an appointment generates a greater transfer. A growing amount of empirical literature shows that the differences between the two parties' views on major policy issues are expanding in the Congress.[31] I denote πs_i to represent the size of the transfer from the second player to the first.[32] In addition to the transfer, both parties receive s_i upon the appointment of candidate i. Because a strong candidate is more productive, she also contributes more to welfare. Moreover, if polarization is greater than 1, the minority always receives a negative payoff upon agreement.

[29] With this formulation I implicitly assume that the nominee has the same political ideology as the President.

[30] There is no doubt that federal judges affect American politics with their decisions. For example, the Supreme Court—with the deciding votes of judges appointed by Republican presidents Ronald Reagan and George H.W. Bush—voted 5 against 4 to put a stop to the Florida recount in the presidential election in 2000. This decision allowed George W. Bush to be the next president. Many believe that the Court's decision was political, not judicial (See, for example, Dershowitz [2001] and Neumann [2003]).

[31] See Barber and McCarty [2013] and Layman, Carsey, and Horowitz [2006] for reviews of the literature on polarization in U.S. politics.

[32] There are two approaches to modeling political systems. One approach follows Downs [1957] and assumes that the sole aim of a party is to remain in office. This assumption leads parties to converge to the ideological center. The second approach assumes that parties have different intrinsic preferences on different policies (*e.g.,* Alesina [1987]). My model follows the second approach and thus precludes the convergence result.

If the second player rejects the nomination, the first player has to decide whether to keep her offer or to withdraw. If she keeps the offer, both players incur a normalized cost of 1 unit and the game moves to the next period.[33] The cost can be interpreted as suffering from the lack of public service. In the case of an appointment to the judiciary, this cost could be the delayed dockets at courts.[34] If the first player withdraws, the game ends without an agreement between the players. In that case their payoff consists only of delay costs. Ending the game absent an agreement, instead of giving the first player one more chance to make another offer, simplifies the analysis and reflects the reality. If a federal judge was not confirmed by the Senate, the President, during the 1989 to 2014 period, was able to nominate someone else for the position in only 37% of the cases.

There is a unique equilibrium if $\pi \leq 1$. In this case the first player offers s_N and the second player accepts immediately. Because polarization is not too high, the first party does not need to compromise on the strength of the candidate to convince the second. Appointment generates positive payoffs to both parties. When polarization is high, however, the second player receives a negative payoff upon agreement. For the rest of the paper, I assume that polarization is high (*i.e.,* $\pi > 1$) so that the second player has an incentive to keep the seat empty.

This game has two pure strategy equilibria where one player concedes immediately and the other never quits. However, political dynamics in the Senate do not allow any party to be the one who concedes immediately. For exam-

[33]The results of the model hold even if the players incur different delay costs.

[34]In her interview, Laurel Bellows, the former President of the American Bar Association, points out the economic consequences of delayed dockets at courts: "Our economy depends on courts to enforce contracts, protect property, and determine liability. Judicial vacancies increase caseloads per judge, creating delays that jeopardize the ability of courts to expeditiously deliver judgments. Delay translates into costs for litigants. Delay results in uncertainty that discourages growth and investment. ... vacancies are potential job-killers." (*Hill* [2013])

ple, if election of party representatives was introduced as an initial stage of the game, immediate concession would not be sustained in a subgame perfect equilibrium because a candidate who commits to concede immediately would not be elected in the first place. The observed delays in reaching agreements in the Senate confirm this insight. Therefore, I focus on the mixed strategy equilibrium where players concede with positive probabilities over time.

It is well known that in a war of attrition players concede at constant hazard rates (see, for instance, Abreu and Gul [2001]). Define p and q as the concession rates of the players. That is, in each period the first player withdraws the offer with probability p and the second player accepts the offer with probability q. The indifference conditions of the players in each period pin down p and q. The first player is indifferent between ending the game by withdrawing the offer and continuing the fight by insisting on her offer in each period. That is,

$$0 = -1 + qs_j(\pi + 1),$$

where j is the candidate nominated in equilibrium. Similarly, the second player is indifferent between accepting and rejecting the offer:

$$-s_j(\pi - 1) = (1 - p)[-s_j(\pi - 1) - 1].$$

I can then solve the equations above for p and q to obtain

$$p = \frac{1}{1 + s_j(\pi - 1)}$$

and

$$q = \frac{1}{s_j(\pi + 1)}.$$

These equations have a number of useful properties which I summarize in the following three propositions.

Proposition 1. *In equilibrium, the first player is indifferent between any candidate j, where $s_j \geq \frac{1}{\pi+1}$.*

Proof. The payoff of the first player is positive and equals to $qs_j(\pi + 1) = 1$, which does not depend on the offer or polarization. Moreover, the offer cannot be too small. In particular, when $s_i(\pi + 1)$ is smaller than 1, the first player has no incentive to keep the offer, because the per unit cost of delay exceeds her maximum reward from staying in the game. □

Intuitively, a strong candidate (*i.e.*, a high s_j) also meets higher resistance from the second party. The cost of delay of the approval balances the benefit the first party obtains from the appointment of a stronger candidate, which makes the first party indifferent between different candidates. While the first player's expected payoff (*i.e.* $V_1 = 1$) is positive, the second player's payoff (*i.e.*, $V_2 = -s_j(\pi - 1)$) is negative and affected by the offer and the degree of polarization. That is why the minority opposes confirmation of a strong candidate more vigorously.

The ex-ante total payoff of the players, V, depends on the offer:

$$\begin{aligned} V &= \frac{1}{2}V_1 + \frac{1}{2}V_2 \\ &= \frac{1 - s_j(\pi - 1)}{2}, \end{aligned}$$

which is positive if the strength of the nominee is smaller than $\frac{1}{\pi-1}$. Because the ex-ante payoff of the players decreases with the strength of the nominee, the efficient equilibrium requires the nominee to be as weak as possible:

$$k = min\{\ j \mid s_j > \frac{1}{\pi + 1}\ \},$$

where k denotes the candidate nominated in the efficient equilibrium. The partial derivative of k with respect to π is negative. Therefore, polarization reduces the strength of the candidate nominated in the efficient equilibrium. Note also that the range of equilibrium offers in Proposition 1 defines the set of available candidates for nomination. An increase in polarization shifts this interval to the left, reducing the average strength of available candidates.

The game might end without appointment. The probability that the second player will confirm the nomination (*i.e.,* the probability that an agreement will be reached) depends on the strength of the candidate and polarization. It can be calculated as follows:

$$\begin{aligned}\Pr(\textit{Success in agreement}) &= q + (1-q)(1-p)q + (1-q)^2(1-p)^2 q + ... \\ &= \frac{q}{1-(1-q)(1-p)} \\ &= \frac{1+s_j(\pi-1)}{2s_j\pi}.\end{aligned}$$

The expression above decreases with s. That is, a stronger candidate lowers the probability that an agreement will be reached.

Proposition 2. *For any given level of polarization, the probability that an agreement will be reached decreases with the strength of the nominee.*

It is important to note that the effect of polarization on the probability that an agreement will be reached is ambiguous. The partial derivative of the success probability—derived above—with respect to π is negative if and only if s_j is smaller than 1. However, there is no restriction on the strength of the nominee in the equilibrium other than the lower boundary derived in Proposition 1.

There is a delay in reaching agreement. The duration of the bargaining process depends on the concession rates p and q. The expected time a nominee spends in the Senate conditional on being confirmed can be calculated as follows:

$$\begin{aligned}
\text{D} &= \frac{Expected\ number\ of\ days\ given\ success}{\Pr(Success)} \\
&= \frac{rq + 2r^2q + 3r^3q + ...}{q + rq + r^2q + ...} \\
&= \sum_{t=0}^{\infty} t(1-r)r^t,
\end{aligned}$$

where $r = (1-q)(1-p)$ is the probability that the game does not end in any particular period. Note that the expected delay in the game (*i.e.,* the time spent in the Senate independent of the result of the bargaining) is also equal to D:

$$\begin{aligned}
\text{Expected duration of bargaining} &= (1-r) + 2r(1-r) + 3r^2(1-r) + ... \\
&= \sum_{t=0}^{\infty} t(1-r)r^t.
\end{aligned}$$

The following proposition summarizes the effect of the strength of the nominee and polarization on the time spent in the Senate.

Proposition 3. *Delay in the bargaining increases with the strength of the nominee and polarization.*

Proof. The partial derivatives of p and q with respect to s are both negative. Thus D increases with j. Both players prefer to stay in the game with a higher probability when a stronger candidate is nominated. Similarly, polarization increases players' incentives to stay in the game because the partial derivatives of p and q with respect to π are both negative. $\square$

The strength of the nominee and polarization together determine the size of the transfer between parties. A higher stake (*i.e.*, a strong candidate and/or high polarization) increases players' incentive to stay in the game and causes a longer delay.[35]

4.3 Appointment of Judges

Nominations to the federal judiciary are pivotal events in American politics. Assignments to the Supreme Court, for example, are the most high-profile appointments that a president makes (Shipan and Shannon [2003]). Such appointments are important for the political parties not only because federal judges set rules based on which society functions, but also because they promote certain political views while establishing those rules. A large body of literature shows evidence that federal judges appointed by Democrats (Republicans) tend to be more liberal (conservative) in their decisions.[36]

The federal judiciary is composed of three courts: the Supreme Court, circuit courts of appeals, and district courts. Decisions of district courts are subject to review by circuit courts, and the decisions of circuit courts are subject to review by the Supreme Court. As of 2015, there are 866 federal judgeship positions available in these courts.[37]

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[35]Legal scholars make a similar argument to support term limits over life-time appointments. For example, Calabresi and Lindgren [2006] argue that limiting life tenure would increase the efficiency of the judge appointment process by reducing the political stakes in any particular nomination.

[36]See, for instance, Epstein and Segal [2005], Songer and Haire [1992], and Goldman [1966].

[37]There are nine positions at the Supreme Court, 179 at 13 circuit courts of appeals, and 678 at 94 district courts.

When a judgeship becomes vacant in one of the federal courts, the President nominates a person to fill the position. Before the public announcement of the nomination, the President forwards the name of the nominee to the American Bar Association Standing Committee on the Federal Judiciary (ABA) for further investigation. Although there is no rule mandating presidents to have the clearance of the ABA, this additional screening process has been followed since President Eisenhower.[38] ABA reviews the candidate's professional experience, knowledge of law, and commitment to equal justice and issues a rating using three categories: "not qualified", "qualified", and "well qualified" (ABA [2009]).

The nomination is sent to the Senate Judiciary Committee which consists of 18 senators. After reviewing the nominee's qualifications, the Committee sends the nomination to the Senate. Each Committee member can influence the time spent in the Committee by several means: they might ask for additional information about the nominee, request to schedule a hearing, forward follow-up questions etc. Once the Committee completes its evaluation, the nomination is brought to the Senate floor for voting. A nomination is still susceptible to being blocked by opponents in the Senate floor. Because there is no rule on how long the consideration of a nomination may last, opponents of the nominee can extend debate to delay confirmation.

The Federal Judicial Center (FJC) keeps a biographical directory of federal judges.[39] For each of the 3831 judges appointed since 1789, the directory contains information about the judge (*i.e,* birth year, gender, race, ABA score, number of appointment) and the nomination (*i.e.,* name of the court, nomination year, senate confirmation year). FJC also reports the list of

[38] An exception was made by President George W. Bush. During his administration, ABA reviewed nominees after the announcement of their nominations.

[39] http://www.fjc.gov.

the failed nominations. The list includes information on the name of the nominee, name of the court he was nominated, the date of nomination, and the reason of failure. Failures most commonly occur when the President does not renominate the candidate at the beginning of the new Senate term. Sometimes presidents do not even wait to the end of the Senate term to end the nomination and withdraw the candidate. 349 out of 444 failures occurred because presidents either withdrew the candidate or did not renominate him in the new Senate. There are 27 cases (one since 1989) where the Senate rejected the nomination. Other reasons of failure include the nominee's death and decline of the position. Almost all of the declines occurred in 18th and 19th centuries.

FJC's list does not include the ABA scores of the failed nominees, neither does it publish birth year, gender, or race information of those candidates. However, ABA has been publishing the record of ratings of all nominees since 1989. Because the full controls are available only from 1989, I choose 1989–2014 as my sample period. For failed nominations I hand collect birth year, gender, and race information from several sources on the Internet such as White House press releases, obituary records, lawyer directories, and newspapers. Table 1 provides descriptive statistics of all but one nominee[40] from 1989 to 2014.

[TABLE 1 HERE]

Of the 1383 nominations, 10 individuals were nominated to the Supreme Court, 285 to circuit courts of appeals, and 1088 to district courts. 62% of

[40] I was not able to find the age and race for this nominee.

the nominees received the top score (*i.e.,* "well qualified") from ABA.[41] A successful appointment is typically a 50-year-old white male. His ABA score is "well qualified" and his application waits 181 days in the Senate before it is confirmed.

Polarization data is taken from the website of Keith Poole, Howard Rosenthal, and Christopher Hare.[42] They assign polarization scores to each Congress by using representatives' and senators' voting behavior, including that on judge appointments.[43] I use their "difference in party means" measure to capture the degree of divergence between the average senators in each party. To introduce polarization as an independent explanatory variable, I use polarization scores of the House of Representatives, not of the Senate.

First, I test whether a compromise on the strength of the candidate increases the probability that the nomination will be confirmed by the Senate (*i.e.,* Proposition 2). Table 2 presents the results of probit regressions. The first column includes the baseline specification with the age of the nominee as the only explanatory variable. Columns two to five gradually increase the number of controls. The marginal effect of age on the probability of approval is positive and statistically significant at the 1% level in most specifications. In the specification with full controls, a one-year increase in age is associated with a 2.3% increase in the probability of approval. Column six adds polarization to the regression. Its results confirm the prediction of the model that once age is controlled for, polarization is not associated with the suc-

[41]Three candidates, nominated by President George W. Bush, did not receive an ABA score because their nominations were withdrawn during the evaluation process. I assign the ABA score of "not qualified" to those three candidates. My results stay the same if I exclude these candidates.

[42]http://www.voteview.com/political_polarization_2014.htm

[43]See Poole and Rosenthal (1997) for the composition of polarization scores.

cess probability of the nomination. In all specifications (except the first) the nominee's suitability for the post is controlled for by his ABA score. Other controls include the type of the federal court the candidate is nominated to, the candidate's prior experience as a federal judge, gender, and race.

[TABLE 2 HERE]

Next, I analyze the number of days a nomination spends in the Senate. Proposition 3 asserts that the strength of the candidate and polarization both increase the delay. The results of the duration analysis in Table 3 are consistent with Proposition 3. The coefficients are statistically significant at the 1% level in the specification with full controls. The hazard rate decreases with the strength of the nominee and increases with polarization. That is, the probability that the nomination will be approved in each day increases with the age of the nominee and decreases with polarization.

[TABLE 3 HERE]

Endogeneity is a potential concern in Table 2 and 3. There might exist a factor unobservable to the econometrician that affects the behavior of senators and, indirectly, that of the President. In particular, the President might send a stronger (weaker) candidate during such times when the Senate is more (less) likely to accept his nominee. To address this concern, I compare the success rates and the number of days spent in the Senate of the candidates who were nominated on the same day.

During the sample period, 85% of the nominees for federal judge positions were sent in batches of at least two candidates. Each batch includes four nominees on average. There are 329 batches in total. Table 4 confirms the results obtained from the previous analysis by controlling for batch fixed effects. Probit regressions in the first two columns show that the marginal effect of age, between the two candidates who were nominated on the same day, on the probability of approval is positive and statistically significant at the 5% level. A one-year increase in age is associated with a 4.1% increase in the probability of approval. The number of observations is only 378 because most of the batches do not include any variation in success rates (*i.e.,* all the nominees in the same batch were either successful or not) and, therefore, are dropped out from the regressions.

The last two columns report the results of analogous Cox proportional hazard model regressions. The specifications do not include polarization because there is no variation in polarization among the candidates in the same batch. Consistent with the predictions of the model, the coefficients of age are positive and statistically significant at the 5% level. This suggests that older candidates spend less time in the Senate than younger candidates who are nominated on the same day.

[TABLE 4 HERE]

4.4 Conclusion

The U.S. Constitution rests on an elaborate web of checks and balances. Although it is widely praised, some scholars think that the system of checks and balances slows down the government.[44] Alesina and Rosenthal [2000] blame checks and balances for the increasing polarization between the parties. In their model the parties know that if they win the executive (*i.e.,* Presidency), they have to compromise with the legislature (*i.e.,* Congress).

[44] See, for example, Goldwin and Kaufman [1986] and Burns [1963].

The anticipated future compromise creates an incentive for the parties to run on extreme platforms.

This paper argues that checks and balances affect the quality of political appointments. The necessity to get the approval of the minority promotes inefficiency. It forces the majority to nominate candidates that the minority is willing to accept only because they are weak and therefore less effective in pursuing the majority's agenda.

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Table 1: Summary statistics

	count	mean	sd	min	max
Age	1383	50.15	6.24	35	69
Success	1383	0.86	0.35	0	1
Days	1383	195.79	174.47	2	1505
Male	1383	0.72	0.45	0	1
White	1383	0.78	0.41	0	1
ABA Score	1383	2.61	0.51	1	3
Court Type	1383	1.22	0.43	1	3
First Appointment	1383	0.93	0.26	0	1
Year	1383	2001	7.56	1989	2014
Senate Number	1383	107	3.78	101	113
Polarization	1383	0.88	0.15	0.63	1.10

Age is the age of the candidate at the time of the nomination. *Success* is 1 if the appointment is confirmed in the Senate and 0 otherwise. *Days* is the number of days the nomination spent in the Senate. *Male* is 1 if the candidate is male and 0 otherwise. *White* is 1 if the candidate is white and 0 otherwise. *ABA Score* is 1 if the score given by the American Bar Association to the candidate is "not qualified", 2 if it is "qualified", and 3 if it is "well qualified". *Court Type* is 1 if the nomination is for a district court, 2 if it is for a circuit court of appeals, and 3 if it is for the Supreme Court. *First Appointment* is 1 if the candidate is not a federal judge at the time of the nomination and 0 otherwise. *Year* is the year of the nomination. *Senate Number* is the number of the Senate to which the nomination is sent. *Polarization* is the House of Representatives polarization index at the time of the nomination. It is taken from the website of Keith Poole, Howard Rosenthal, and Christopher Hare.

Table 2: Success Probability, Explained by Age

	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.021**	0.017*	0.019**	0.019**	0.025**	0.023**
	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)
Polarization						0.453
						(0.822)
ABA Score FE	No	Yes	Yes	Yes	Yes	Yes
Court Level FE	No	No	Yes	Yes	Yes	Yes
First Appointment	No	No	No	Yes	Yes	Yes
Male	No	No	No	No	Yes	Yes
White	No	No	No	No	Yes	Yes
Mean dep. variable	0.862	0.862	0.862	0.862	0.862	0.862
Observations	1383	1383	1383	1383	1383	1383
Pseudo R-Squared	0.014	0.040	0.041	0.057	0.080	0.081

The table reports marginal effects of probit regressions. Standard errors of marginal effects are reported in parentheses. Constant terms are included but not shown. The dependent variable is *Success* which is 1 if the appointment is confirmed in the Senate and 0 otherwise. See Table 1 for the definition of the explanatory variables. Standard errors are clustered at the Senate and Court levels. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

Table 3: Number of Days Spent in the Senate, Explained by Age and Polarization

	(1)	(2)	(3)	(4)	(5)
Age	0.019**	0.016*	0.018*	0.017*	0.019**
	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)
Polarization	-2.322**	-2.360**	-2.465**	-2.455**	-2.564**
	(0.665)	(0.664)	(0.723)	(0.725)	(0.734)
ABA Score FE	No	Yes	Yes	Yes	Yes
Court Level FE	No	No	Yes	Yes	Yes
First Appointment	No	No	No	Yes	Yes
Male	No	No	No	No	Yes
White	No	No	No	No	Yes
Mean dep. variable	195.795	195.795	195.795	195.795	195.795
Observations	1383	1383	1383	1383	1383
Pseudo R-Squared	0.076	0.076	0.081	0.082	0.083

The table reports coefficients, not hazard ratios, of Cox proportional hazard regressions. Standard errors of coefficients are reported in parentheses. The dependent variable is *Days*, *i.e.,* the number of days a nomination spends in the Senate. See Table 1 for the definition of the explanatory variables. Standard errors are clustered at the Senate and Court levels. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

Table 4: Success Probability and Number of Days Spent in the Senate, Explained by Age, Controlling for Batch Fixed Effects

Dependent Variable:	Probability of Success *(Probit)*		Number of Days *(Cox)*	
	(1)	(2)	(3)	(4)
Age	0.043**	0.041*	0.021*	0.022*
	(0.014)	(0.016)	(0.008)	(0.009)
Batch FE	Yes	Yes	Yes	Yes
ABA Score FE	No	Yes	No	Yes
Court Level FE	No	Yes	No	Yes
First Appointment	No	Yes	No	Yes
Male	No	Yes	No	Yes
White	No	Yes	No	Yes
Mean dep. variable	0.669	0.669	198.133	198.133
Observations	378	378	1174	1174
Pseudo R-Squared	0.161	0.280	0.032	0.032

The first two columns report marginal effects of probit regressions. Standard errors of marginal effects are reported in parentheses. Constant terms are included but not shown. The dependent variable is *Success* which is 1 if the appointment is confirmed in the Senate and 0 otherwise. A batch is defined as a group of at least two candidates who were nominated on the same day. See Table 1 for the definition of the rest of the explanatory variables. The last two columns report coefficients, not hazard ratios, of Cox proportional hazard regressions. Standard errors of coefficients are reported in parentheses. The dependent variable is *Days*, *i.e.,* the number of days a nomination spends in the Senate. Standard errors are clustered at the batch level in all columns. **, and * indicate statistical significance at the 1%, and 5% levels, respectively.

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