The Rise of a Network: Spillover of Political Patronage and Cronyism to the Private Sector[*]

Terry Moon[†] David Schoenherr[‡]

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Abstract

We document that networks that gain access to political power and use it for patronage appointments also gain control over resource allocation in the private sector. Specifically, following a presidential election in Korea, the president appoints members of his network into important positions in government, and private banks respond by appointing executives from the same network to establish links to the administration. Consequently, firms linked to the network obtain more credit at a lower rate from government and private banks alike, despite higher default rates. Micro-level data on loans and variation in network links for the same firm across lenders over time sharpen the interpretation of our results. In a parsimonious model, we show that efficiency costs are higher when government and private banks are controlled by the same group rather than different groups: in-group firms invest in more unprofitable projects, whereas out-group firms lack funding for highly profitable investments.

JEL Codes: D61, D72, G21, L14, P16.
Keywords: allocative efficiency, banks, networks, patronage, rent-seeking.

1 Introduction

Patronage and cronyism are widely perceived to be major impediments to economic growth. A common channel through which patronage and cronyism are manifested is the appointment of related individuals to government posts based on attributes, such as ethnicity, race, gender, or social ties (Grindle 2012).[1] Once in office, political appointees use their power to transfer rents to fellow group members at high social costs.[2] Private markets are not immune to distortive influences of cronyism either (Haselmann, Schoenherr, and Vig 2018). The existing literature treats cronyism in the government and private sectors as independent sources of inefficiencies. For example, Khwaja and Mian (2005) argue that changes in political power affect credit allocation by government, but not by private banks.

In this paper, we show that, in fact, cronyism in the government and private sectors is linked in a way that drastically amplifies allocative distortions. The link is indirect and subtle. The government does *not* intervene directly in the allocation of resources controlled by the private sector. Instead, we document that control over resource allocation for a group that gains access to political power spills over to resource allocation in private markets through a network channel. Specifically, we observe that after the election of Lee Myung Bak (MB) as President of Korea in 2007, the new president appoints of people from his networks into important positions in the administration (chief political advisers, ministers, prosecutors, CEOs of state-owned firms, etc.). Private banks respond by also appointing executives with links to the new president's networks. As a consequence, firms whose executives have personal links to the new president's networks benefit from better access to credit at a lower rate from government *and* private banks despite higher realized default rates.

When financial institutions fail to provide efficient intermediation, deadweight loss is borne by society in the form of resource misallocation and foregone growth opportunities (Gurley and Shaw, 1955). In a parsimonious model of credit allocation and investment, we show that a world in which government and private bank biases are correlated towards the same group of firms generates vastly higher distortions than a world in which their biases are uncorrelated. Intuitively, if government *and* private banks share the same bias, in-group firms can finance highly inefficient investments, whereas out-group firms are forced to forego highly profitable investment opportunities. In contrast, when government and

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[1]For example, Xu (2018), Xu, Bertrand, and Burgess (2018), and Colonnelli, Teso, and Prem (2020) document that politicians hand out government jobs to individuals in social proximity with adverse effects on government performance.

[2]Rent-transfers take various forms, for example favorable access to credit (Khwaja and Mian 2005; Claessens, Feijen, and Laeven 2008; Li, Meng, Wang, and Zhou 2008), government funds (Faccio, Masulis, and McConnell 2006; Duchin and Sosyura 2012), and government contracts (Kim 2018; Baltrunaite 2019; Schoenherr 2019), or laxer enforcement of regulations (Fisman and Wang 2015).

private banks' biases are not positively correlated, in-groups firms are less likely to be able to invest in the inefficient projects, and out-group firms are more likely to be able to secure financing for profitable projects. Empirically, we observe that after the election in-group firms increase investment and growth relative to out-group firms, but exhibit a relative decline in profitability.

Establishing whether private banks distort lending in favor of firms linked to politically powerful groups poses several challenges. Links to politically powerful groups affect firms in myriad ways. For example, better access to government resources could boost in-group firms' demand for credit or make them better borrowers from banks' perspective (Houston, Jiang, Lin, and Ma 2014). Moreover, what may look like taste-based discrimination in credit allocation may in fact be the result of better screening or monitoring of in-group firms.

Overcoming these challenges requires micro-level data on bank and firm executives and contract-level data on bank loans; a combination that is not available in most settings. Access to such data, combined with an institutional setting that provides variation in network links for the same firm across lenders over time, makes Korea an ideal setting to explore the channels through which political power influences resource allocation in private markets.

Upon his election as President in December 2007, Lee Myung Bak (MB), appoints people from his networks into important positions in the administration, thereby concentrating political power with members of his networks.[3] Private banks respond by also appointing members of the new president's networks to executive positions. Anecdotally, banks appointed executives from the new president's network to receive favorable treatment from the government consistent with Acemoglu, Johnson, Kermani, Kwak, and Mitton (2016). We focus on the Korea University (KU) alumni network, for which comprehensive data are available. The number of private banks with executives and board members from the KU network increases from 2 to 8 (out of 15) after the election (see Section 2 for details).

Crucially for our identification strategy, while presumably all banks appoint executives from MB's networks, not all banks appoint executives from the KU network. This variation allows us to explore changes in credit allocation by banks that appoint executives from the KU network (in-group banks) and banks that appoint executives from other networks (out-group banks) to firms with a CEO from the KU network (in-group firms) and firms without a CEO from the KU network (out-group firms). This triple-difference estimation allows us to include firm-time and bank-time fixed effects, which rules out confounding factors based

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[3]Patronage appointments, called parachutes in Korea, are common. DongA.com, Dec. 27, 2010: "Some advisers hold the theory of "inevitability of parachute appointments," arguing that 1) it is a practice that has been done by past administrations, 2) the administration has to repay people who have helped the president during the election and 3) has to secure allies for the next presidential election."

on changes in credit demand or supply at the firm and bank levels, respectively.

We start our analysis by documenting that in-group firms experience a 29.78 percent higher increase in credit from private banks after the election and an 18 basis-point greater decline in interest rates. The increase in credit and the decline in interest rates are driven by banks that appoint executives from the KU network after the election. In-group firms experience an 80.44 percent higher increase in loan volume, and a 38 basis points greater decrease in interest rates from in-group relative to out-group banks. Additionally, relative to out-group firms, in-group firms are 14.30 percentage points more likely to retain or start a lending relationship with an in-group bank than with an out-group bank.

This interpretation is further supported by changes in private banks' executive appointments and credit allocation after MB's exit from government. After serving one term, MB is succeeded by Park Geun Hye, who is a member of the same party, but not from the KU network. Following her inauguration in 2013, we observe that most private banks cease to appoint executives from the KU network and in-group firms experience a drop in credit volume and an increase in interest rates back to levels seen before MB's presidency.

In addition, we find that firms with weaker balance sheets (higher leverage, lower net income, and lower interest coverage) benefit more from alumni network links to banks than do firms with stronger balance sheets. Furthermore, we refine our connections measure to obtain a narrower measure of connections based on executives' and CEOs' age. We find that the effects of links to the KU network on lending volumes are about twice as strong when newly-appointed bank executives and firm CEOs are of similar age, and are therefore more likely to know each other personally. This suggests that links based on personal connections are at least twice stronger than broader network links without personal connections.

Next, we seek to understand how private bank executives from the KU network influence the allocation of credit to in-group firms. One possibility is that members of the president's network are subject to direct political pressure to allocate more credit to in-group firms. Two pieces of evidence suggest that this is not the case. First, two private banks have executives from the KU network before and after the election. These banks allocate more credit at a lower rate to in-group firms at similar magnitudes before and after the election. This is more consistent with a network channel independent of direct political influence, as political pressure should only affect post-election lending. Second, we find that banks allocate more credit at a lower rate to firms that have executives from the same alumni network, even for other alumni networks that are not linked to the president. Altogether, these results suggest that the government does not directly interfere with credit allocation. Instead, the president affects credit allocation by triggering an increase in appointments of executives

from his network as private bank executives. Once these executives are in place, it is the network links between bank and firm executives that shape credit allocation.

Network links have been shown to affect credit allocation through different channels. They can distort credit allocation by inducing taste-based discrimination (Banerjee and Munshi 2004; Haselmann, Schoenherr, and Vig 2018), or improve credit allocation by generating more soft information to better identify high quality borrowers (Herpfer 2018; Karolyi 2018) or through better enforcement of contracts (Kandori 1992; Guiso, Sapienza, and Zingales 2004; Karlan, Möbius, Rosenblat, and Szeidl 2009).

We find no evidence supporting an information or enforcement channel. Better information helps banks to better differentiate between good and bad type borrowers. This should lead to higher dispersion in lending decisions and better loan performance (Rajan, Seru, and Vig 2015). We observe neither. Additionally, in-group banks engage in more debt restructurings with in-group firms. Moreover, when links between in-group banks and in-group firms are terminated after MB leaves office, default rates increase sharply. This suggests that in-group banks extend riskier loans to in-group firms and protect them from default through renegotiations. Once KU executives leave and cease to protect in-group firms, the adverse effects of credit misallocation surface through higher default rates. Altogether, this evidence is most consistent with taste-based discrimination consistent with evidence in Haselmann, Schoenherr, and Vig (2018) that even for private banks, social ties lead bankers to allocate more credit to in-group firms and generate lower returns on these loans. Bankers' benefits of treating socially connected firms favorably may include reciprocity in the network or private utility from supporting fellow network members and enjoying social prestige.

Our results cannot be explained by different characteristics of in-group and out-group banks, for example inferior screening or monitoring technologies, as these would apply to all of a bank's lending decisions and are absorbed by bank-time fixed effects.[4] Similarly, different shocks to in-group and out-group firms should affect the lending decisions of all banks, not only in-group banks, and are absorbed by firm-time fixed effects.

The main remaining concern is that banks' appointment of KU executives is endogenous in a way that affects lending between in-group banks and firms through channels other than network links. Private banks may appoint executives from the KU network after the election, because they have expertise related to MB's agenda. At the same time, in-group firms may benefit from more government investment due to their CEO's expertise in the same area. In this case, better expertise would induce in-group banks to finance in-group firms' investments after the election. However, alternative explanations based on shared

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[4]We also ensure that the results are not driven by endogenous CEO appointments in private firms by redefining in-group firms as those having a CEO from the KU network five years before MB's election.

characteristics or expertise of in-group banks and in-group firms are inconsistent with the poor performance of in-group loans. Their return is lower than the risk-free rate. Hence, even if banks were not funding-constrained, or if unobservable costs, such as search costs, were lower for in-group loans, banks would be better off investing in the risk-free asset.[5]

Finally, we verify that government banks exhibit the same bias towards in-group firms after the election. Since virtually all government banks appoint KU network executives after MB's election we compare firm-level changes in government bank credit allocation around the election. In-group firms experience a 24.26 percent increase in credit volume and an 18 basis point drop in interest rates from government banks after the election compared with out-group firms. These magnitudes are similar compared to what we observe for private banks, suggesting that network links between bank and firm executives operate similarly in the private bank and government bank sectors.

The novel insight from our analysis is not that government and private banks favor connected firms, which has been documented by Khwaja and Mian (2005) and Haselmann, Schoenherr, and Vig (2018), respectively. Instead, our novel insight is that cronyism in the government and private sector are not independent sources of distortions, but are linked in a way that aggravates allocative inefficiencies and magnifies economic costs.

In a parsimonious model of credit allocation and investment, we show that a joint bias of government and private banks toward the same group of firms amplifies efficiency costs. Intuitively, if government banks are biased towards in-group firms, these firms inefficiently overinvest. If both government *and* private banks are biased towards in-group firms, in-group firms overinvest even more in even less efficient projects, whereas out-group firms are forced to forego even more efficient projects. Instead, if government and private banks' biases are not positively correlated, in-group firms' overinvestment and out-group firms' underinvestment are not equally amplified.[6] Thus, a positive correlation between government and private bank bias towards the same group of firms generates the largest distortions.

Since a large fraction of resources is allocated through private markets, understanding whether and how firms' links to politicians' networks affect the allocation of resources in private markets is important. Our analysis suggests that privatizing resource allocation is not a panacea to keep the distortive forces of political patronage and cronyism at bay.[7] Our findings that groups with access to political power gain influence over resource allocation in

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[5]Lower returns on in-group loans also cannot be justified by cross-selling of other services, as fees on alternative services would need to exceed plausible rates to justify the low returns on loans.

[6]If government and private banks' biases are negatively correlated some of the inefficiencies in credit allocation and investment may even be undone.

[7]Our findings also imply that using private markets as a counterfactual (e.g., Khwaja and Mian 2005) may underestimate the effect of links to politicians on access to government resources.

private markets through a social network channel imply that favorable access to resources in the economy is concentrated with specific groups, which we show to have adverse effects on allocative efficiency.

Beyond the context of the paper, concentration of resource allocation in favor of one group may have important implications for other outcomes such as market power, barriers to entry, inequality, poverty, social mobility, or political stability. While we focus on an alumni network for which comprehensive data are available, groups that gain control over resource allocation in private markets due to access to political power could be based on other characteristics, such as race, ethnicity, gender, faith, or socio-economic factors.

The main insight from our model is that the more banks share a bias toward the same group of firms, the larger the distortions in credit allocation and investment. Allowing politicians to appoint a large number of individuals through different branches of government can lead to higher concentration of individuals from a specific group and increase the incentive for the private sector to hire individuals from the same group. An alternative system in which appointments are more merit-based may reduce the concentration of power with members of a specific group. Additionally, in Korea, private bank lending is controlled by just fifteen banks. Thus, eight members of the KU network are sufficient to capture more than half of the private banks in the economy. A more dispersed market would make it harder for a group with links to political power to capture institutions with such a large market share.

In our data, the magnitude of the bias toward in-group firms is similar for government and private banks. Haselmann, Schoenherr, and Vig (2018) find that favorable treatment of socially connected firms is stronger for government than for private banks, highlighting the role of governance and incentives. A potential reason why governance and incentives may not curb private banks' favorable treatment of connected firms in the context of politically powerful groups could be that incentives of in-group bankers are weak. They are hired for their links to the group in power and laid off when the group in power changes. Thus, governance and incentives may not be a powerful tool to curtail favorable access to private bank credit for firms linked to politically powerful groups.

Our findings also provide new insights to the literature examining the implications of social networks on bank lending. Existing evidence is mixed. While Haselmann, Schoenherr, and Vig (2018) find that social links between banks and firms lead to misallocation of credit, Engelberg, Gao, and Parsons (2012), Herpfer (2018), and Karolyi (2018) argue that they lead to better outcomes. Data on debt renegotiations allow us to disentangle the effects of network links on ex ante loan allocation and ex post outcomes. We show that banks issue riskier loans to linked firms and protect connected firms from default ex post by renegotiating connected

firms' debt. This suggests that a positive relationship between firm-bank connections and loan outcomes could be driven by banks ex post embellishing outcomes for connected loans. Additionally, while existing studies take the network structure as given, our analysis helps us understand *which* networks control resource allocation in private markets.

Finally, the evidence in the paper has implications for how firms select CEOs. If links to networks with access to political power are valuable, firms have a strong incentive to hire CEOs based on their connections rather than other skills that may contribute to firms' productivity (Gabaix and Landier 2008, Starmans 2018). Since network links reallocate rents across firms rather than improving productivity, this implies that the importance of CEOs' network links may crowd out management skills that increase productivity.

While a unique combination of micro-level data on executive networks and contract-level loan data allows us to examine how access to political power affects credit allocation by private banks in Korea, the insights from our analysis are likely to be relevant beyond this specific context. Extensive powers of the executive branch to appoint people into important positions in the administration are ubiquitous[8] and evidence of patronage appointments dates back to the British Empire (Xu 2018). While the financial sector may be particularly vulnerable to spillovers from patronage appointments due to high exposure to government regulation and interventions, evidence from firms' lobbying efforts suggests that links to politicians are valuable for other industries as well (Bertrand, Bombardini, and Trebbi 2014). In addition, we document spillover of patronage and cronyism from the government to the private sector in a developed country with distinct barriers between the government and the private sector. In a developing country context where those barriers are weaker, spillover effects could be even more common.

2   Institutional Background

In this section we describe the institutional setting that we exploit for our empirical analysis.

2.1   Definition of In-Group Firms

We exploit the election of Lee Myung Bak (MB) as President of Korea on December 19, 2007 as variation in firms' links to politically powerful networks. We focus on the Korea University alumni network (KU network), for which comprehensive data are available.

We define a firm as an in-group firm if it has a CEO from the KU network at the time of MB's election in 2007. Many firms have one CEO over the entire sample period, often

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[8]For example, the President of the U.S. has the power to fill more than 300 positions without, and more than 1200 positions with Senate approval.

family-controlled firms. Other firms appoint CEOs in fixed cycles of one to three years. Repeated reappointments of the same CEO are common. To mitigate concerns about the endogeneity of CEO appointments with respect to loan applications, we define in-group firms as a sticky measure that is not updated. That is, firms with a KU network CEO at the time of MB's election are classified as in-group firms for the full sample period. In robustness tests, we reclassify in-group firms as those with a KU network CEO in 2004.

2.2   Network Channel

The Korean president has a dominant role in government and the power to appoint a wide range of senior public officers. Table A.2 lists articles from the popular press about appointments of people from MB's networks as auditors, state firm CEOs, public prosecutors, ambassadors, and roles in the National Intelligence Service, the police, the National Tax Service, and the National Research Council. Additionally, we find that after MB's election, the number of chief prosecutors from Korea University more than doubled from 5 to 11, the fraction of ministers from Korea University increased from 11.7% to 13.3%, and the share of chief political advisers (senior secretaries in the Blue House) increased from 14.7% to 22.9%. Senior officials in turn decide about appointments and promotions at lower levels of the administration, leading to a trickle-down effect of appointments and promotions of individuals from MB's networks.

Private financial firms appoint executives and board members without taking directions from the government. However, they responded to the changes in the administration by appointing executives and board members from MB's networks (see Table A.2).[9] Among the fifteen private banks in Korea, two had executives from the KU network before MB's election. This number increased to eight after MB took office in early 2008. Anecdotally, banks appointed executives from the new president's network with the expectation to receive favorable treatment from the government, consistent with Acemoglu, Johnson, Kermani, Kwak, and Mitton (2016). Other factors, e.g. expertise on the new administration's policies, may also have contributed to the appointment of the executives. The validity of and insights from our analysis hold regardless of the underlying reason. Ultimately, what is relevant for our analysis is that appointing executives from the new president's networks provides members of his networks with the power to affect private banks' credit allocation.

To understand the scale and scope of the influence of links to the KU alumni network, it

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[9]Among the listed private banks for which ownership data are available, one bank has government ownership of 22 percent during our sample period. This bank does not appoint an executive from the KU network and our results are robust to dropping the bank from the sample. For all other banks, average government ownership is below 5 percent.

is important to note that graduates feel responsibility towards their fellow alumni in Korea, even across different cohorts. Alumni networks are actively nurtured and expanded during graduates' professional careers, for example through regular gatherings of alumni in the same institution or in the same profession. As a consequence, KU graduates personally know fellow alumni across cohorts and are actively involved in the network on a regular basis. In Table A.1, we provide supporting evidence from articles on the importance of the KU network and alumni networks in Korea in general. Specifically, the articles document that links to the KU network are considered as important for business success, promotions, mutual aid, and that "resources are mobilized and distributed to networks connected by alumni" (Article 2). The articles also document that alumni network links do not just operate through direct personal connections, but that networks members support each other even in the absence of direct personal connections, e.g. "Professor Lee said: I gave advice so that my juniors can grow in a certain organization, and I watched them with more affection than those from other universities" (Article 2).

In Table I, we examine the difference in stock returns for firms with and without a CEO from the KU network in response to MB's election as his party's candidate for the presidential election in 2007, in which MB defeated Park Geun Hye by 1.5 percentage points.[10] This provides an independent market assessment of the value of links to the KU network through firms' CEOs. In column I, we compare the returns of KU and non-KU firms on the day after MB's victory in the GNP nomination election. The results show a 1.67 percent higher return for firms with a CEO from the KU network. In Korea, the price of a stock may only change by 15 percent in a given trading day, which became binding for many firms on the day after the election. Thus, we also examine the difference in returns in the three days (column II) and five days (column III) after the election to allow to stock prices to fully incorporate the information from the election. We find that firms with a CEO from the KU network experience an about 3-3.5 percent higher return in the three to five days after MB's election. These results suggest that the market viewed CEOs' links to the KU network as valuable.

Finally, for executive appointments to be relevant for credit allocation, executives need to be able to influence the allocation of loans. In practice, they can intervene directly in lending decisions in which in-group firms are involved, they can explicitly or implicitly encourage loan officers to increase lending to in-group firms, or they can influence lending to in-group firms by hiring and promoting loan officers from their network.

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[10]Since his party (GNP) was widely expected to win the presidential election, his nomination effectively determined that he would become the new President of Korea.

3 Data

For our empirical analysis we merge data from different sources. From the Korea Information Service (KIS) we acquire accounting data, data on CEOs' educational and professional backgrounds, and data on bankruptcy filings and private debt renegotiations. For banks, we complement the data on CEOs' educational backgrounds with data from multiple issues of the Annual Dictionary of Korean Business Magnate published by Mailnet & Biz. Data on executive appointments are available from the Commercial Registration System governed by the Supreme Court of Korea. We build a new firm-bank relationship level database on bank loans in Korea by extracting information on firms' loans from their annual reports.

3.1 CEO Data

Korean companies are legally required to report information about their board members to the Commercial Registration System supervised by the Supreme Court of Korea. The register lists the appointment, reappointment, and end of term dates. We collect this information for all commercial banks and private firms in Korea and match the data between 2003 and 2015 with data from the Annual Dictionary of Korean Business Magnate published by Mailnet & Biz and the CEO data set provided by KIS, using CEOs' name, date of birth, and employer. The Financial Supervisory Service (FSS) classifies fifteen private lenders in Korea as commercial banks. For these banks, comprehensive time-series information on their CEOs is available. Private banks provide about two-thirds of corporate lending in Korea during our sample period and are responsible for almost seventy percent of total loans extended to the firms in our sample. Eight banks have an executive or board member from the KU network after MB's election, two of these also have an executive or board member from the KU network before the election. We can match 9,280 of the private firms for which we can extract loan information with the CEO database. In 2007, 2.36% of firms have a CEO from the KU network. In 2004, 2.35% of firms have a CEO from KU. Since CEO turnover is low our sample which is dominated by family-owned firms, the group of firms with links to the KU network through their CEOs in 2004 is virtually identical to the group of firms with a KU CEO in 2007. *After* MB's election, we observe an increase in the number of CEOs from KU in private firms, with a maximum of 2.71 percent of firms appointing a KU CEO in 2010 (Figure 1).

3.2 Loan Data

To gather information on loans, we start by collecting annual reports of private firms in Korea between 2003 and 2015, released by the FSS. Next, we extract the information on

all outstanding loans and their interest rates.[11] The final loan sample comprises all firms for which loan data can be merged with data on CEOs' educational backgrounds using a corporate identification number that is allocated to all registered corporations in Korea. Descriptive statistics on loans are depicted in Panel C of Table II. The average loan amount is about 4,384m KRW for in-group firms, and 2,630m KRW for out-group firms.[12] Interest rates are slightly lower for in-group firms: 5.91 percent compared to 6.18 percent for out-group firms. The average in-group firm borrows from 2.49 private banks, while the average out-group firm borrows from 2.18 private banks. The median firm in both groups borrows from two private banks. The total annual loan volume for the average firm is 11,826m KRW for in-group firms and 8,147m KRW for out-group firms.

3.3 Accounting and Bankruptcy Data

Accounting data are available for 8,588 or 88.27 percent of firms and listed in Panel D. Average firm size in terms of total assets is 77,861m KRW for in-group firms and 53,381m KRW for out-group firms, and the average number of employees is 169 and 114, respectively. This suggests that, on average, in-group firms are larger than out-group firms. In addition, in-group firms exhibit higher net incomes in line with their larger size. Tangible assets as a fraction of total assets are similar for in-group and out-group firms. Data on bankruptcy filings and private workouts, including the filing date and the identity of the firm, are available from KIS. We obtain data on bankruptcy and workout filings between 2003 and 2015. Workouts are initiated by a firm's primary bank, defined as the bank with the highest exposure. Before starting a workout, the primary bank organizes a meeting with other creditors to decide about initiating a workout. A workout starts if creditors holding three-quarters of the total claims agree. A reorganization plan is accepted if creditors holding at least three quarters of the claims agree. Dissenting creditors may ask assenting creditors to purchase their debt at a fair price, which is determined by a mediation committee.

3.4 Bank Financials

We obtain data on bank financials from the Korea Listed Companies Association. In Panel E, we list the data separately for banks that appoint an executive from the KU network (in-group banks) and for banks that do not appoint a KU network CEO (out-group banks) after the election. Appointing an executive from the KU network is an endogenous decision that may be correlated with other bank characteristics. While in-group banks are somewhat smaller on average with assets of 77bn KRW compared to 94bn for out-group banks, they

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[11]A subset of loans also report the usage of funds.
[12]As a rule of thumb, one million KRW is worth slightly less than one thousand US dollar.

look similar based on other relevant characteristics: cash flows, net income, revenues, equity ratio, and leverage. Overall, this suggests that banks that appoint a KU executive after the election are not fundamentally different from banks that do not appoint a KU executive. It is important to note that while some banks do not appoint a KU executive, they appoint executives linked to the new president's other networks. The fact that in-group and out-group banks look similar based on observable characteristics does not guarantee that they are similar in terms of unobservable characterisitcs. Our empirical strategy takes great care of controlling for potential unobservable differences between in-group and out-group banks.

4   Empirical Analysis

This section describes our empirical strategy for assessing whether firms with ties to the KU network benefit from better access to private bank credit and presents the results.

4.1   Firm-Level Changes

We start our analysis with a graphical depiction of changes in loan volumes and interest rates for private bank loans to in-group (black lines) and out-group (gray lines) firms around MB's election in Figure 2. Both plots show parallel trends for in-group and out-group firms before MB's election. During MB's tenure from 2008 to 2012, credit to in-group firms increases relative to out-group firms, whereas interest rates relatively decline for in-group firms.

To confirm the insights from the graphical analysis statistically, we examine changes in credit allocation to in-group and out-group firms around the election by estimating

$$log(loans)_{it} \quad = \quad \alpha_i + \alpha_t + \beta \cdot KU_i * election_t + \epsilon_{it}, \tag{1}$$

where the dependent variable is the log of firm i's total private bank credit in year t, the dummy variable $election_t$ takes the value of one after the election (2008-2012) and zero before the election (2003-2007). KU_i is a dummy variable that takes the value of one for in-group firms and zero for out-group firms. To assess changes in the cost of credit, we replace the dependent variable in equation (1) with IR_{it} firm i's average interest rate on private credit in year t. Firm fixed effects α_i ensure that we compare outcomes for the same firm over time, and time fixed effects α_t control for time-series trends in private bank credit and interest rates. Standard errors are clustered at the firm level.

The results are shown in Table III, columns I to III. In-group firms experience a 29.78 percent higher increase in private bank credit after the election (column I), and a relative increase in leverage by 2.86 percentage points (column II). In addition, in-group firms experience an 18 basis points greater decline in interest rates after the election (column III).

4.2 Network Channel

The firm-level changes documented in the previous section could be driven by various channels. Firms may benefit from links to politicians' networks in many ways, for example, government bailouts (Faccio, Masulis, and McConnell 2006), government subsidies (Duchin and Sosyura 2012; Cingano and Pinotti 2013), better access to state bank credit (Khwaja and Mian 2005; Claessens, Feijen, and Laeven 2008), more government contracts (Tahoun 2014; Baltrunaite 2019; Schoenherr 2019), and more lenient enforcement of regulations (Fisman and Wang 2015). These benefits could make politically connected firms better borrowers from private banks' perspective, which could explain why they provide more credit to in-group firms at a lower rate. Additionally, politically connected firms may systematically benefit from the new president's political agenda, for example if the government increases investment in sectors in which in-group firms operate.

Relationship-Level Analysis To differentiate between potential channels, we zoom in to the firm-bank relationship level. Figure 3 plots the time-series of average annual credit volumes allocated to in-group (black lines) and out-group (gray lines) firms by banks that become connected to the KU network by appointing an executive from KU after the election (in-group banks, top panel) and for all other banks (out-group banks, bottom panel). The top panel shows that, for out-group banks, credit growth is almost identical for in-group and out-group firms.[13] The bottom panel shows that credit from in-group banks grows significantly more for in-group firms than for out-group firms during MB's presidency. Figure 4, shows the same plots for interest rates. The top panel shows that, for out-group banks, interest rates grow at the same rate for in-group and out-group firms, whereas the bottom panel shows that for loans from in-group banks interest rates relatively decline for in-group firms during MB's presidency.

We confirm the insights from the graphical analysis statistically by estimating

$$log(loans)_{ijt} = \alpha_{it} + \alpha_{jt} + \alpha_{ij} + \beta \cdot KU_i * KU_j * election_t + \gamma \cdot alum\ link_{ijt} + \epsilon_{ijt}, \quad (2)$$

where the dependent variable is the log of firm i's loan amount from bank j in month t, KU_j is a dummy variable that takes the value of one for in-group banks and zero for out-group banks. The variable $alum\ link_{ijt}$ takes the value of one if firm i and bank j have a CEO and executive from the same alumni network (other than the KU network) in year t. Omitting $alum\ link_{ij}$ would induce an estimation bias. Intuitively, if banks appoint an executive from the KU network, this affects in-group firms, but also firms linked to the network of the

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[13]Two banks classified as out-group banks have a CEO from the KU network before and after the election, which is why out-group banks lend more to KU firms before the election.

replaced executive. Without *alum link$_{ij}$* both of these effects would be captured by β.

Zooming in on the firm-bank relationship level has the advantage of absorbing time-series changes in credit supply and demand at the firm and bank levels. Specifically, equation (2) allows us to include firm-time fixed effects (α_{it}) to control for changes in credit or interest rates due to firm-level effects such as access to government resources, investment opportunities, or credit demand (Khwaja and Mian 2008) and bank-time fixed effects (α_{jt}) to control for time-series changes in credit supply for a given bank. Firm-bank fixed effects (α_{ij}) ensure that we compare outcomes for the same firm-bank pair over time.

The results are displayed in Table III, columns IV to VII. Lending from in-group banks increases 80.44 percent more for in-group firms than for out-group firms (column IV). Additionally, interest rates on loans from in-groups banks decline by 38 basis points more for in-group firms compared with out-group banks (column VI). In column VII, we replace the dependent variable with a variable that takes the value of one if firm i establishes a new relationship with bank j in month t, minus one if a relationship is terminated in month t, and zero otherwise. We find that, compared to out-group firms, in-group firms are 14.30 percentage points more likely to start or maintain a lending relationship with an in-group bank than with an out-group bank after the election.

What fraction of the increase in in-group firms' private bank credit can be explained by the higher increase in credit from in-group banks? The average in-group firm has 2.49 lending relationships, of which 0.77 relationships are with an in-group bank. Thus, 31 percent of in-group firms' lending relationships are with in-group banks. Multiplying the extra relationship level increase in credit and decrease in interest rates from in-group banks predicts a firm-level increase in total credit by (0.31*80.44=)24.94 percent and a firm-level decrease in interest rates by (0.31*38=)12 basis points. This accounts for most of the firm-level estimates in columns I and III of Table III and suggests that the increase in credit supply to in-group firms is mostly driven by in-group banks.

This interpretation of the results is supported by changes in private banks' credit allocation after MB's term ends. In Korea, the president is only allowed to serve for one term. MB's successor, Park Geun Hye, is from the same party but not linked to the KU alumni network. After she replaces MB in office, most private banks cease to reappoint executives from the KU network, leading to a drop in banks with links to the KU network from eight to three (see Table A.3).[14]

The graphical evidence in Figure 2 suggests that in-group firms experience a decrease in

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[14]Some banks appoint executives from the Sogang University alumni network, the school that Park graduated from, albeit on a smaller scale reflecting the smaller size of the Sogang University network and its lower prominence among Park Geun Hye's networks (Table A.4).

total credit and an increase in interest rates after Park's election back to levels seen before MB's term in office. Figures 3 and 4 show that both effects are driven by changes in credit allocation by banks that cease to appoint executives from the KU network under Park.

Applying equations (1) and (2) to the period from 2010 to 2015 confirms these insights statistically. The results are shown in Table IV.[15] In-group firms experience a decrease in total credit after MB leaves office (columns I and II) and an increase in interest rates (column III). The drop in lending and the increase in interest rates are driven by the banks that cease to appoint executives from the KU network after Park's election (columns IV to VII).

Heterogeneous Treatment Effects   Next, we examine whether the effects of networks on private bank lending are heterogeneous across different types of firms. Specifically, we assess whether firms that appear more credit constrained (higher leverage, lower net income, and lower interest coverage) benefit more from network links to bank executives than do firms with stronger balance sheets.

The results are reported in Table V. Overall the estimates suggest that in-group firms with higher leverage, lower net income, and lower interest coverage experience a higher increase in lending volume from in-group banks after the election (columns I-II, V-VI, and IX-X). This is consistent with the view that links to bank executives from the same alumni network are particularly beneficial for firms with characteristics that might make it harder for them to obtain credit otherwise. Consistent with this interpretation of the results, we observe similar patterns for other alumni network as well (*alumni link*). For interest rates, the difference is economically smaller and not statistically significant (columns III-IV, VII-VIII, XI-XII).

Overall, the results in Table V suggest that the network effect on lending volumes is stronger for firms with weaker balance sheets, whereas for interest rates the difference is weaker. This is consistent with Haselmann, Schoenherr, and Vig (2018), who document that personal connections mainly affect credit allocation through a quantity rather than a price channel and for firms that are closer to default.

Narrower Measure of Connections   Finally, we refine our connection measure to assess whether the effects of the alumni network links are stronger when they are based on personal connections. Since individuals that attended KU around the same time are more likely to know each other personally, for each bank that appoints an executive from the KU network after MB's election, we define a dummy variable $cohort_{ij}$ that takes the value of one for firms whose CEOs were born within three years of the newly-appointed KU executive and zero

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[15]The last year for which we were able to collect loan data is 2015. We choose the 2010-2015 time window to have a symmetric window around Park's election.

for other firms. It is important to note that the $cohort_{ij}$ measure is a lower bound on the difference of a personal connection compared with a pure network effect since some CEOs born within three years of a newly-appointed KU executive may not know the executive personally, whereas some CEOs that are born more than three years apart from the executive may still know the executive personally.

The results are shown in Table VI. We find that the broader network effect on lending at the firm-bank level is 55.44 percent (column I). For firms with a KU network CEO whose age is within three years of the newly appointed KU executive, the *additonal* lending effect is 60.36. This implies that when the firm and bank executive know each other personally, the lending effect is at least twice stronger than the broader network effect: (55.44+60.36=)115.80 percent compared to 55.44 percent. We observe similar effects for the loans to asset ratio where the braoder network effect is 4.60 percent, and the personal connection effect is (4.60+9.28=)13.86 percent (column II). For interest rates, we find that the broader network effect is 31 basis points and the personal connection effect is (31+15=)46 basis points (column III). For new lending relationship, the broader network effect is 10.89 percent, and the personal connections effect is (10.89+9.92=)20.81 percent (column IV). Columns V to VIII show very similar effects for the post-MB era consistent with the main results in the paper.

These results suggest that the effects of links to the alumni network are at least twice as strong for lending volumes when based on personal connections compared to a braoder network effect, whereas for interest rates the difference is smaller.

4.3   Underlying Mechanism

The results in the previous section show that the increase in private bank credit and the decrease in interest rates for in-group firms are driven by in-group banks. In this section, we explore the underlying mechanisms explaining these findings.

Direct Government Interference   First, we explore whether the government directly influences private banks' credit allocation in a way that benefits in-group firms. One piece of evidence against direct government interference is provided by the estimates for links between bank executives and firm CEOs from other alumni networks ($alum\ link_{ijt}$) in Table III, columns IV to VII. Since these alumni networks have no special access to political power, the estimates suggest that network links between bank executives and firm CEOs affect private bank credit allocation independent of whether the president is from the same network.

To further assess whether MB or his administration directly intervene in private banks'

credit allocation, we conduct a placebo test. Two banks have a KU network CEO before and after MB's election. If network links between bank and firm executives were driving the observed differences in private bank lending, we would expect these banks to lend more to in-group firms even before the election. In contrast, if bank lending decisions are affected by direct government influence, lending to in-group firms should be higher after the election. We estimate

$$log(loans)_{ijt} \quad = \quad \alpha_{it} + \alpha_{jt} + \beta \cdot KU_i * KU_j^{pre} + \epsilon_{ijt}, \tag{3}$$

where KU_j^{pre} is a dummy variable that takes the value of one for banks that have an executive from KU before and after MB's election and zero for all other banks. For this test, we exclude all in-group banks, since they would bias the estimation in equation 3 towards finding no direct government intervention effect.

The results are collected in Table VII. We find that in-group firms receive more credit from banks that have an executive from the KU network before and after the election, both before (column I) and after (column II) the election by 33.25 percent and 37.95 percent, respectively. Accordingly, there is no significant change in lending to in-group firms for these banks around the election (column III). Similarly, we find that in-group firms pay lower interest rates on loans from banks that have an executive from the KU network before and after the election, both before (column IV) and after (column V) the election by 28 and 34 basis points, respectively. Accordingly, there is no significant change in interest rates on loans to in-group firms for these banks around the election (column VI).

Altogether, these results suggest that higher lending at lower rates from in-group banks to in-group firms after the election is not driven by direct government interference. Instead, alumni network links between private bank executives and private firm CEOs determine credit allocation. What sets in-group firms apart from firms linked to other alumni networks is that they benefit from an extensive margin network effect following MB's election. While firms generally benefit from better access to private bank credit through their CEOs' alumni network links to bank executives, in-group firms are unique in experiencing a 300 percent increase in the number of alumni network connections to private banks after MB's election.

Soft Information, Enforcement, and Taste-Based Discrimination Having established that credit allocation to in-group firms is driven by network links between bank and firm executives, we seek to understand the underlying mechanisms. Network links between banks and firms may improve the allocation of credit by facilitating screening and monitoring. Bank executives from the KU network may possess superior soft information about firms with a CEO from the same network (Herpfer 2018; Karolyi 2018), or network links may generate social collateral, improving enforcement for loans allocated to in-group firms

(Guiso, Sapienza, and Zingales 2004; Karlan, Möbius, Rosenblat, and Szeidl 2009). Alternatively, links between bank and firm executives may lead to a misallocation of credit due to favorable treatment of in-group firms based on taste-based discrimination (Banerjee and Munshi 2004; Haselmann, Schoenherr, and Vig 2018).

A prediction of better soft information is that it allows banks to better differentiate between good-type and bad-type borrowers. In this case, we should see higher dispersion in loan allocation and interest rates for loans from in-group banks to in-group firms (Rajan, Seru, and Vig 2015). Figures A.1 and A.2 depict the distribution of the log of loans and interest rates at the firm-bank relationship level, respectively. Black lines indicate the distribution for in-group firms, and gray lines for out-group firms. The left panels show the distributions for out-group banks, the right panels for in-group banks. The top panels show the distributions before the election, and the bottom panels show the distributions after the election.

Overall, we observe that the distribution of loan amounts and interest rates does not become more dispersed for loans from in-group banks to in-group firms after the election (Figures A.1 and A.2). If anything, dispersion seems to decline. For loan amounts, we observe a rightward shift of the distribution and for interest rates we observe a leftward shift, consistent with the increase in credit and decrease in interest rates for loans allocated from in-group banks to in-group firms. While these findings suggest that changes in private banks' credit allocation are not driven by better information generated by network links between executives, a potential reason for seeing low dispersion for in-group loans could be adjustments at the extensive margin. If in-group banks are able to identify the worst borrowers, they may cease lending to them. However, our previous results indicate that in-group banks are *less* likely to terminate lending relationships with in-group firms after the election.

To confirm the interpretation of the graphical evidence from Figures A.1 and A.2 statistically, we follow Rajan, Seru, and Vig (2015) in estimating

$$\sigma(Y)_{ijt} = \alpha_{it} + \alpha_{jt} + \alpha_{ij} + \beta \cdot KU_i * KU_j * election_t + \epsilon_{ijt}, \qquad (4)$$

where $\sigma(Y)_{ijt}$ is defined as the standard deviation of interest rates or loan volumes for loans from bank j to the groups of in-group and out-group firms, respectively, in month t. Here, KU_i takes the value of one for the portfolio of loans made to in-group firms and zero for the portfolio of loans made to out-group firms.

The results from estimating equation (4) are displayed in columns I and II in Table VIII. They show no sign that the dispersion in interest rates (column I) and loan amounts (column

II) for loans from in-group banks to in-group firms increase after the election.[16] These results confirm that increased lending from in-group banks to in-group firms after the election is unlikely to be driven by better information transmission.

Next, we assess whether higher credit supply from in-group banks to in-group firms may be driven by better enforcement. Lower interest rates for in-group loans could be justified if in-group firms are less likely to default on loans from in-group banks. This could also explain the lower dispersion in lending decisions documented above. To assess whether network links improve enforcement, we exploit data on bankruptcy filings and private workouts and compare changes in default rates around MB's election.

Figure 5 depicts information about bankruptcy filings and private workouts. The top panel depicts the probability of a firm filing for bankruptcy (solid lines) or workout (dashed lines) while having an outstanding loan from an out-group bank. The bottom panel depicts the same information for loans from in-group banks. Black lines depict information for in-group firms and gray lines for out-group firms. From 2003 to 2007, before MB's term, defaults are rare.[17] After the election, we observe similar patterns in bankruptcy filings for in-group and out-group firms for all loans. However, we observe drastically different patterns for private workouts. The probability of in-group firms engaging in a private workout with an in-group bank increases to about 3-4 percent per year, whereas we do not observe a similar increase for out-group firms or for loans from out-group banks to in-group firms.

We confirm this observation statistically by estimating

$$
\begin{aligned}
default_{ijt} \;=\; & \alpha_{jt} + \beta_1 \cdot KU_i + \beta_2 \cdot KU_i * KU_j + \beta_3 \cdot KU_i * election_t \\
& + \beta_4 \cdot KU_i * KU_j * election_t + \epsilon_{ijt},
\end{aligned}
\tag{5}
$$

where $default_{ijt}$ takes the value of one if firm i defaults on a loan from bank j in year t and zero otherwise, where default is defined as either a bankruptcy or a workout filing.

The results are shown in Table VIII, columns III to V. Bankruptcy filings for in-group and out-group firms change at the same rate around the election for in-group and out-group bank loans (column III). In contrast, workout filings increase by 2.39 percentage points more for loans from in-group banks to in-group firms after the election (column IV). Overall, in-group firms are 2.41 percentage points more likely to experience a default on a loan from an in-group bank after the election (column V). These results suggest that in-group banks are more willing to renegotiate credit with in-group firms after the election.

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[16]Changes in the dispersion of lending decisions and interest rates are not driven by changes in the composition of firms. When we restrict the post-election portfolios to firms that borrowed from the same bank before the election, we observe qualitatively identical effects.

[17]The low number of bankruptcy filings before the election is driven by the macro-economic environment and a bankruptcy regime that discouraged bankruptcy filings before 2006 (Schoenherr and Starmans 2019).

This interpretation of the results is supported by examining differences in the usage of credit around the election. For a subset of loans, information on the usage of credit is available. We split loans into those used for investment and those used for financing-related purposes, for example refinancing of existing loans. We find that in-group firms experience a 6.78 percentage point increase in the fraction of loans being used for financing-related purposes rather than investment after the election (Table VIII, column VI). This increase in the rate of loans used for financing rather than investment is entirely driven by loans from in-group banks that become 21.04 percentage points more likely to be used for financing-related purposes by in-group firms after the election (0.31*0.2104=6.52) (column VII).

While the higher aggregate number of bankruptcy and workout filings for in-group loans is suggestive of in-group banks providing riskier credit to in-group firms, the evidence is not conclusive. For example, higher workout rates may prevent defaults in the long-run. To shed more light on how network links affect loan outcomes, we exploit the fact that MB leaves office after one term. Loans from in-group banks to in-group firms are subject to potential distortions in the ex ante allocation of loans when banks and firms are linked through their executives, but no longer subject to ex post effects of network links when banks terminate appointments of KU network executives.

Figure 5 shows that after in-group banks no longer appoint KU executives workout rates with in-group firms decline consistent with ex post loan outcomes no longer being affected by network links between firms and banks. Instead, bankruptcy filing rates increase for in-group loans after 2012 to about five percent. This suggests that once network links between banks and firms are cut, the higher riskiness of ex ante loan allocation to in-group firms leads to higher bankruptcy filing rates.

Taken together, the results in this section are most consistent with taste-based discrimination underlying the network channel of credit allocation from private banks to firms connected to the same network.

Bank and Banker Incentives Our analysis shows that bank executives favor borrowers linked to their alumni network through their CEOs. This observation is not unique to the Korean context; for example, Haselmann, Schoenherr, and Vig (2018) document similar network effects for private bank directors in Germany. Several factors may explain the sustainability of taste-based discrimination in private bank lending. Providing socially connected firms with favorable access to credit involves costs and benefits for bank executives. On the cost side, generating lower returns on in-group loans may have adverse career or income effects. However, in our setting, banks hire executives from the new president's alumni network mainly for their links to the new administration and their tenure is expected to last for one

presidential term. This suggests that the impact of engaging in inefficient in-group lending on the executives' careers is limited. Benefits from providing access to credit at a lower rate to in-group firms arise from different sources. Social norms may require individuals to support fellow alumni network members and refusal may risk social penalties. In contrast, providing favors to fellow network members may improve an individual's standing in the network, which may lead to social rewards. For example, firms controlled by fellow network members may reciprocate by providing career opportunities for bank executives after their tenure or by offering employment opportunities for bank executives' family members.[18]

From the perspective of banks, generating lower returns on their loan portfolio is costly. However, the decision to punish or fire the executive for such activities depends on a trade-off. The executive is not only employed to maximize the return on the loans that they are involved in allocating, but provides value to the bank through other means. In the specific case of KU network executives during MB's tenure, they may generate value to the bank through their network links to the new administration. For example, Acemoglu, Johnson, Kermani, Kwak, and Mitton (2016) show that the stock prices of financial firms with connections to Timothy Geithner relatively increased by 6 percent following his appointment as Treasury Secretary in the U.S.[19] If the benefits outweigh the costs generated by in-group lending, the bank is willing to tolerate some inefficient lending decisions.

4.4 Government Banks

Finally, we examine whether firms with links to the KU network benefit from better access to state bank credit after MB's election. Since we lack a group of government banks that does not appoint KU executives after the election, we perform a simple difference-in-difference estimation comparing changes in government bank lending to KU and non-KU firms in Table IX. Government banks relatively increase lending to KU firms by 36.57 percent after the election (column I). Since they account for a smaller share of the credit market than private banks in Korea, as a fraction of firms' assets the increase in lending from state banks to KU firms is smaller than for private banks and statistically insignificant (column II). Government banks also charge 18 basis points lower rates on loans to KU firms after MB's election (column III). These results suggest that firms with links to the group in power benefit from better access to credit both from private and government banks.

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[18]We do not observe that in-group firms hire former bank executives from the KU network in the two years after MB's presidency. However, this does not rule out that those executives have and value the option to seek employment in in-group firms or that other forms of reciprocation may occur.

[19]Channels through which politicians have discretion in the treatment of different banks include the implementation of regulations (Agarwal, Lucca, Seru, and Trebbi, 2014) or in bank bailouts (Liu and Ngo, 2014). Other potential benefits of network links to the administration are better access to information about planned regulations or impending audits.

5 Discussion

In this section, we develop a stylized model to illustrate how correlated biases of government and private banks toward the same group of firms affect the efficiency of credit allocation and investment. The aim is to highlight the main mechanism in a transparent manner. Thus, we make several simplifying assumptions that allow us to abstract from other frictions that may interact with the mechanism.

5.1 Model

There are two groups of firms, denoted by $j \in I, O$ where I indexes in-group firms and O indexes out-group firms. Each firm has one investment project that requires an investment of F today and yields a payoff $F(1+r)$ in the future, where r is uniformly distributed with support $[\underline{r}, \bar{r}]$, and independent across firms. There is no time discounting.

Firms have no internal funds and need to borrow F from banks. There are two groups of banks, denoted by $k \in G, P$, where government banks are indexed by G and private banks are indexed by P. Each firm faces a bank-specific lending limit $\bar{F} = F/2$. Introducing lending limits allows us to focus on the interesting cases in which firms borrow from multiple banks and the correlation in banks' biases becomes relevant. Internal lending limits are ubiquitous in commercial lending (Ivashina, 2009; Lim, Minton, and Weisbach, 2014). Borrowing from multiple banks is a persistent feature of credit data and can be motivated by diversification motives of banks, regulatory constraints, or product differentiation. On the demand-side borrowing from multiple banks can be motivated by hold-up problems or diversification motives. In our data, the mode and median firm borrows from two banks. Thus, borrowing from multiple banks is relevant for the majority of firms.

Banks can raise capital at the interest rate ρ. This implies that from an efficiency perspective any project with $r \geq \rho$ should be financed. We further assume that capital markets are competitive and banks break even in equilibrium. Banks may be biased towards one group of firms in which case firm group-specific interest rates are subject to a bias parameter γ, which takes a value $\gamma_I > 0$ for firms that are favored by a bank, such that those firms' face an interest rate of $f - \gamma_I$ and firms that are discriminated against face and interest rate $f + \gamma_O$. While γ_I is a fixed parameter, the equilibrium value of γ_O is determined endogenously by banks' break-even constraint. We assume that the interest rates bank set are on the support of r, specifically $\underline{r} < f - \gamma_I < f + \gamma_O < \bar{r}$.

We assume that each firm is randomly matched with exactly two banks. For simplicity, in the base model presented in this section, we assume that there is one in-group and one out-group firm as well as one government and one private bank. In Appendix B we extend

the model to the general case of multiple firms and banks of each type. Banks set interest rates for both groups of firms before they are matched to firms. This ensures that banks solve their break even constraint in expectation and the rates they set are not conditional on the matching outcome. After being matched, r is realized and firms decide whether to invest at the rate offered to them by the banks that they are matched with.

Thus, the timing is as follows:

1. Banks set interest rates.

2. Banks and firms are matched.

3. The project's return r is realized.

4. Firms decide whether or not to borrow and invest.

We study four cases: A) all banks are unbiased, B) the government bank G is biased towards in-group firms I, C1) both banks are biased towards the in-group firm I, and C2) the government bank G is biased towards the in-group firm I and the private bank P is biased towards the out-group firm O.

Case A: Case A is our baseline case in which no bank exhibits a bias. Since no bank is biased, both offer an interest rate ρ to all firms. Due to the lending limits, each firm borrows $F/2$ from each bank, and for a given return r, a firm's profit is given by:

$$(1+r)F - (1+\rho)F/2 - (1+\rho)F/2 = (r-\rho)I$$

Thus, a firm is willing to invest if and only if $r - \rho \geq 0 \Leftrightarrow r \geq \rho$. As a result, the probability p that a firm invests is given by $p = \mathbb{P}(r \geq \rho)$. Since all efficient projects are realized and no inefficient projects gets financed, Case A corresponds to the efficient allocation in the economy.

Case B: In Case B, the government bank is biased towards the in-group firm, that is the cost of borrowing from the government bank is $f - \gamma_I$ for in-group firms and $f + \gamma_O^B$ for out-group firms. The private bank is unbiased.

Due to the lending limits, each firm borrows $F/2$ from either bank. For the in-group firm, the participation constraint becomes:

$$(1+r)F - (1+\rho-\gamma_I)F/2 - (1+\rho)F/2 \geq 0$$

Thus, the in-group firm is willing to invest if and only if $r \geq \rho - \frac{\gamma_I}{2}$ and investment occurs with probability $p_I^B = \mathbb{P}(r \geq \rho - \frac{\gamma_I}{2})$.

For the out-group firm, the participation is given by:

$$(1 + r)F - (1 + \rho + \gamma_O^B)F/2 - (1 + \rho)F/2 \geq 0$$

Thus, the out-group firm is willing to invest if and only if $r \geq \rho + \frac{\gamma_O^B}{2}$ and investment occurs with probability $p_O^B = \mathbb{P}(r \geq \rho + \frac{\gamma_O^B}{2})$.

Intuitively, the bias of the government bank generates a wedge between firms' cost of capital and banks' cost of raising capital. As a consequence, the in-group firm overinvests in projects that have a lower return than the cost of capital in the economy, whereas the out-group firm underinvests by foregoing projects that have a higher return than the cost of capital in the economy. This makes capital allocation and investment less efficient than in the base case.

Finally, we can derive the equilibrium value of γ_O^B from the government bank's break-even constraint:

$$\rho(p_I^B \cdot F/2 + p_O^B \cdot F/2) = p_I^B \cdot (\rho - \gamma_I)F/2 + p_O^B \cdot (\rho + \gamma_O^B)F/2.$$

Solving for γ_O^B yields $\gamma_O^B = \frac{p_I^B}{p_O^B}\gamma_I$. For the private bank the break-even constraint is trivially satisfied since the rate it charges to all firms equals its cost of capital.

Case C1: In Case $C1$, the government bank and the private bank are biased toward in-group firms, that is the cost of borrowing from any bank is $\rho - \gamma_I$ for the in-group firm and $\rho + \gamma_O^{C1}$ for the out-group firm.

For the in-group firm, the participation constraint becomes:

$$(1 + r)F - (1 + \rho - \gamma_I)F/2 - (1 + \rho - \gamma_I)F/2 \geq 0$$

Thus, the in-group firm is willing to invest if and only if $r \geq \rho - \gamma_I$ and investment occurs with probability $p_I^{C1} = \mathbb{P}(r \geq \rho - \gamma_I)$.

For the out-group firm, the participation is given by:

$$(1 + r)F - (1 + \rho + \gamma_O^{C1})F/2 - (1 + \rho + \gamma_O^{C1})F/2 \geq 0$$

Thus, the out-group firm is willing to invest if and only if $r \geq \rho + \gamma_O^{C1}$ and investment occurs with probability $p_O^{C1} = \mathbb{P}(r \geq \rho + \gamma_O^{C1})$.

Comparing the participation constraints under Case C1 and Case B reveals that the correlated bias of the government and private banks generates an even larger wedge between the cost of capital in the economy and firms' costs of capital. As a consequence, the in-group firm overinvests even more than in Case B and the out-group firm underinvests even more than in Case B, which further increases the efficiency loss in the economy.

Since both banks behave identically, they share the same break even constraint

$$\rho(p_I^{C1} \cdot F/2 + p_O^{C1} \cdot F/2) = p_I^{C1} \cdot (\rho - \gamma_I)F/2 + p_O^B \cdot (\rho + \gamma_O^{C1})F/2.$$

which implies that $\gamma_O^{C1} = \frac{p_I^{C1}}{p_O^{C1}}\gamma_I$.

Case C2: In Case $C2$, the government bank is biased towards the in-group firm, the private bank is biased towards the out-group firm.

First, note that with negatively correlated bias the investment problem is symmetric for both types of firms and banks. Thus, solving the problem for the in-group firm provides us with the solution for the out-group firm with the roles of the government and private banks reversed. The in-group firm's participation constraint is given by:

$$(1 + r)F - (1 + \rho - \gamma_I)F/2 - (1 + \rho + \gamma_O^{C2})F/2 \geq 0$$

Thus, the in-group firm (and by symmetry the out-group firm) invests if and only if $r \geq \rho - 1/2 \cdot \gamma_I + 1/2 \cdot \gamma_O^{C2}$ and the probability of investment is given by $p_I^{C2} = p_O^{C2} = \mathbb{P}(r \geq \rho - \gamma_I + \gamma_O^{C2})$.

The break-even constraint for both banks is also symmetric with the roles of the in-group and out-group firms reversed. The government bank's break-even constraint is given by:

$$\rho(p_I^{C2}F/2 + p_O^{C2}F/2) = (\rho - \gamma_I)p_I^{C2}F/2 + (\rho + \gamma_O^{C2})p_O^{C2}F/2,$$

which implies that $\gamma_O^{C2} = \frac{p_I^{C2}}{p_O^{C2}}\gamma_I = \gamma_I$.

From this it follows that the condition for firms to invest becomes $r \geq \rho$. Thus, with perfectly negatively correlated bank biases the distortions in borrowing costs cancel out such that firms' average costs of capital equal the average cost of capital in the economy, and firms' investment decisions are not distorted. More generally, the correlation between private and government bank bias determines the level of efficiency loss in the economy. The more positive the correlation, the higher the efficiency cost in the economy.

Comparing Cases Our model allows us to evaluate under which scenario investment distortions in the economy are the highest. In the absence of other frictions, perfectly negative correlation of lending biases does not lead to investment distortions. Intuitively, when firms are positively discriminated by one bank but negatively discriminated by another bank the biases offset each other. In our case with equal levels of biases and equal numbers of in-group and out-group firms the distortions are eliminated. In the more general case with varying shares of in-group and out-group firms and government and private banks in Appendix B, we show that while distortions may persist even with negatively correlated biases of government and private banks, they are lower than in the case in which biases of government and private banks are positively correlated.

The only cases in which investment distortions occur in the base model are Case B under which the government bank is biased towards the in-group firm and Case C1 under which both banks are biased towards in-group firms. Let π^B and π^{C1} denote the average investment distortions per firm under cases B and C1, respectively. Distortions occur whenever a firm invests despite having a project that yields a return $r < \rho$ or if a firm with a project that yields a return $r > \rho$ does not invest. Based on this insight, we can compute the respective distortions under both cases as

$$\pi^B = 1/2 \cdot \mathbb{P}[\rho - 1/2 \cdot \gamma_I < r < \rho] * \mathbb{E}[r | \rho - 1/2 \cdot \gamma_I < r < \rho]$$
$$+ 1/2 \cdot \mathbb{P}[\rho < r < \rho + 1/2 \cdot \gamma_O^B] * \mathbb{E}[r | r < \rho < \rho + 1/2 \cdot \gamma_O^B]$$
$$\pi^{C1} = 1/2 \cdot \mathbb{P}[\rho - \gamma_I < r < \rho] * \mathbb{E}[r | \rho - \gamma_I < r < \rho]$$
$$+ 1/2 \cdot \mathbb{P}[\rho < r < \rho + \gamma_O^{C1}] * \mathbb{E}[r | r < f < \rho + \gamma_O^{C1}].$$

Computing the probabilities of distortions occurring and the conditional expectations yields

$$\pi^B = 1/2 \cdot \frac{1/2 \cdot \gamma_I}{\bar{r} - \underline{r}} * 1/4 \cdot \gamma_I$$
$$+ 1/2 \cdot \frac{1/2 \cdot \gamma_O^B}{\bar{r} - \underline{r}} * 1/4 \cdot \gamma_O^B$$
$$= 1/16 \cdot (\gamma_I + \gamma_O^B)$$
$$\pi^{C1} = 1/2 \cdot \frac{\gamma_I}{\bar{r} - \underline{r}} * 1/2 \cdot \gamma_I$$
$$+ 1/2 \cdot \frac{\gamma_O^{C1}}{\bar{r} - \underline{r}} * 1/2 \cdot \gamma_O^{C1}$$
$$= 1/4 \cdot (\gamma_I + \gamma_O^{C1}).$$

Proposition 5.1 $\pi^{C1} > \pi^B$.

Proof: From the values of γ_O^B and γ_O^{C1}, it follows that $\frac{p_O^B}{p_I^B} \gamma_O^B = \gamma_O^{C1}$. Since $p_I^{C1} = \mathbb{P}[r \geq \rho - \gamma_I] = \frac{\bar{r} - \rho + \gamma_I}{\bar{r} - \underline{r}} > \frac{\bar{r} - \rho + 1/2 \cdot \gamma_I}{\bar{r} - \underline{r}} = \mathbb{P}[r \geq \rho - 1/2 \cdot \gamma_I] = p_I^B$, it must be true that $p_O^{C1} \gamma_O^{C1} > p_O^B \gamma_O^B$. This implies that $(\bar{r} - \rho - \gamma_O^{C1})\gamma_O^{C1} > (\bar{r} - \rho - 1/2 \cdot \gamma_O^B)\gamma_O^B$, which can be simplified to $(\bar{r} - \rho)(\gamma_O^{C1} - \gamma_O^B) > (\gamma_O^{C1})^2 - 1/2 \cdot (\gamma_O^B)^2$. There is no value $\gamma_O^B \leq (\bar{r} - \rho)$ that satisfies this inequality for $\gamma_O^B > \gamma_O^{C1}$. Plugging in the lowest (γ_O^{C1}) and highest $(\bar{r} - \rho)$ values for γ_O^B reveals that the inequality is not satisfied for either corner solution. Furthermore, since the right-hand side is a concave function of of γ_O^B whereas the left-hand side is a linear function of γ_O^B, the values of the right-hand side and left hand-side do not cross between the corner solutions. Thus, it must hold that $\gamma_O^{C1} \geq \gamma_O^B$, which further implies that $\pi^{C1} = 1/4 \cdot (\gamma_I + \gamma_O^{C1}) > 1/16 \cdot (\gamma_I + \gamma_O^B) = \pi^B$.

5.2 Investment, Growth and Profitability

In the data, we observe that in-group firms experience a 20.50 percent higher increase in investment (Table X, column I) and an 8.42 percent higher growth rate (column II) after the election. At the same time, we find that in-group firms' profitability (return on assets) relatively decreases by 1.16 percentage points (column III) after the election. While these patterns are consistent with the insights from the model, they have to be interpreted with caution, since in-group firms' investment and profitability may be affected through various channels.

5.3 Costs of Biased In-Group Lending

Overall, our findings suggest that private banks earn lower returns on lending to in-group firms compared to loans to out-group firms. In this section, we provide an estimate of the aggregate losses from engaging in lending that favors in-group firms. Computing these losses requires us to make assumptions and our estimates should therefore only be viewed as an approximation that is informative about the order of magnitude of the costs.

The higher numbers of workouts and lower collateralization of in-group loans suggest that recovery rates are likely to be lower for in-group loans. As a conservative choice, we nevertheless apply the same recovery rates to in-group and out-group loans and assume recovery rates in workouts to be high with 0.8.

Based on these assumptions, the return on in-group banks' loans is $ret = (1 - P_{default} - P_{workout}) * (1 + r) + P_{default} * rec_B + P_{workout} * rec_W - 1 = (1 - 0.0340 - 0.0291) * 1.0582 + 0.0340 * 0.1927 + 0.0291 * 0.8 - 1 = 0.0213$ for in-group loans, and $(1 - 0.0131 - 0.0010) * 1.0613 + 0.0131 * 0.1927 + 0.0010 * 0.8 - 1 = 0.0497$ for out-group loans. If in-group banks could generate the same average return on the funds provided to in-group firms as for their loans to out-group firms, they could generate 2.84 percentage points higher returns.[20]

In the data, 10.11 percent of in-group banks' loans are allocated to in-group firms. Thus, in-group banks generate $0.0284 * 0.1011 = 0.287$ percentage points or $0.284/4.97 = 5.78$ percent lower returns on their loan portfolio.[21] The aggregate annual lending of private banks to firms in Korea amounts to 28 percent of GDP.[22] In our data, in-group banks account for 32 percent of all private bank lending. Thus, the loss of 0.287 percentage points of in-group

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[20]Relative to the risk-free rate the return wedge is 1.95 percentage points.

[21]Across all private banks, 6.21 percent of loans go to firms with links to the same alumni network through their executives. Assuming the same return differential between in-group and out-group loans for all alumni networks, private bank lending is $0.0284 * 0.0621 = 0.176$ percentage points or $0.176/4.97 = 3.54$ percent less profitable due to links to firms based on alumni networks.

[22]Data on private bank lending are available from the Financial Supervisory Service in Korea.

banks' returns on corporate loans translates into a loss of $0.287 * 0.28 * 0.32 = 0.026$ percent of GDP.

An additional important cost is the misallocation of capital across firms, as allocative efficiency is a major determinant of productivity (Baqaee and Farhi, 2020). Investment distortions on the firm-side are harder to quantify since firm-level investment is affected by various factors. In-group firms increase investment by 20.50 percent and show a decrease in return on assets by 1.16 percentage points after the election (Table X). One way to interpret these estimates is that if private banks had allocated credit to out-group firms instead of allocating more credit to in-group firms after the election, return on investment would have been 1.16 percentage points higher.

Corporate investment as a share of GDP is around 11.2 percent during our sample period. In-group firms account for 6.83 percent of firms' investment in our data. Thus, if returns from investment would have been 1.16 percentage points higher, total returns on investment in the economy would have been 0.0116*0.0683*0.112=0.009 percent of GDP higher.

Combining both estimates suggests that the costs of lending distortions amount to 0.035 percent of GDP each year. These are the costs of distortions in private credit markets for one network that controls 2.36 percent of firms in the economy. If we were able to observe all of the new president's networks in the data, aggregate distortions would likely be much larger. Additionally, in a different context, groups with links to political power may be larger, for example in cases of groups based on race or ethnicity.

6 Alternative Explanations

In this section we discuss potential alternative explanations for our findings.

6.1 Endogenous CEO Appointments

Firms that anticipate applying for loans from a particular bank may endogenously appoint a CEO from the KU network leading to a correlation between firms becoming in-group firms and their demand for credit from in-group banks. To ensure that endogenous classification of in-group and out-group firms does not affect our results, we reclassify in-group firms based on whether a firm's CEO in 2004 was already from Korea University before MB's election was anticipated.

The results are reported in Table A.5. We find almost identical results. Mostly, this is driven by the fact that for most firms in Korea, CEOs have a long tenure and we observe only a small number of CEO appointments in the years before MB's election. These results ensure that our findings are not affected by firms endogenously appointing Korea University

CEOs in anticipation of MB's election.

6.2 Differences in Firm Characteristics

While the previous results suggest that our results are not driven by endogenous CEO appointments, in-group and out-group firms may differ in terms of characteristics that could explain differences in lending patterns around MB's election. In fact, our descriptive statistics suggest that in-group firms differ from out-groups firms based on some observable characteristics, for example firm size.

To a large extent, our empirical strategy takes care of this type of concern. The inclusion of firm-time fixed effects absorbs any time-series differences in firms' demand for credit or time-series changes in firm-level credit supply. Intuitively, if in-group firms experience higher demand for credit after the election, they should demand more credit from all banks.[23] Similarly, if characteristics of in-group firms make them safer borrowers from banks' perspective, all banks should be willing to lend more to in-group firms.

Thus, differences in firm characteristics could only affect our results if they differently affect credit supply for in-group banks after the election, but not for out-group banks. We discuss this possibility in detail in Section 6.4 below.

6.3 Differences in Bank Characteristics

While all banks are likely to share the same incentives to establish links to the new administration through executive appointments, the decision to hire an executive from Korea University rather than another one of MB's networks is endogenous and could be correlated with bank characteristics that affect lending decisions around the election. For example, banks with lower financial expertise may prefer to hire an executive from Korea University Business School than a former politician who has less expertise in finance. In this case, banks that become in-group banks may be worse banks, which could explain why they misallocate credit.

From the outset, it should be noted that the descriptive evidence in Table II shows that KU banks and non-KU banks look very similar in terms of observable characteristics. Our empirical strategy further takes care of concerns related to unobservable differences between both groups of banks. The inclusion of bank-time fixed effects absorbs any differences in banks' credit supply, including credit volumes, prices, and the efficiency of credit allocation. In the example above, if in-group banks are worse banks, they should misallocate credit to

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[23]Also note that our results indicate that changes in credit allocation are driven by higher credit supply to in-group firms rather than higher credit demand.

in-group and out-group firms. Similarly, if they charge lower interest rates or are able to allocate more credit after the election, for example because they are treated differently by the government, we should observe these effects for both in-group and out-group firms.

The main concern related to endogenous KU executive appointments by banks is that they might be correlated with bank characteristics or even change bank characteristics in a way that differently affects banks' credit supply to in-group and out-group firms after the election. We discuss this possibility next.

6.4 Endogenous Firm-Bank Matching

Since executive appointments by banks are endogenous, a potential alternative explanation for an increase in loans from in-group banks to in-group firms after MB's election is that KU alumni share common expertise. For example, KU alumni may be experts in infrastructure projects. If the MB administration increases spending on infrastructure projects, more banks are compelled to hire executives from the KU alumni network who have expertise in financing infrastructure projects. If firms with a CEO from KU are more engaged in infrastructure projects, this shared focus may naturally lead to more loans being allocated from in-group banks to in-group firms after the election.

The main argument against this and similar explanations based on an endogenous matching between in-group banks and in-group firms is that they would imply *better* loan allocation and performance. For example, an explanation based on common expertise should lead in-group banks to be able to better evaluate in-group firms and allocate credit more efficiently. This is contradicted by the poor performance of in-group loans documented in Section 4.3. Additionally, the results in columns VI and VII in Table VIII imply that rather than using the additional funding from in-group banks for investment, in-group firms use a larger fraction of these loans for refinancing existing credit. Together, these findings are inconsistent with an explanation based on endogenous matching of in-group banks and in-group firms, such as shared expertise.

6.5 Renegotiation Frictions

Next, we turn to alternative interpretations for our results on the mechanism underlying higher credit allocation at lower rates from in-group banks to in-group firms.

Higher default rates on loans from in-group banks to in-group firms, despite lower interest rates, could be justified by higher recovery rates for connected loans in the event of default. In-group loans may be better collateralized, or banks may be better able to renegotiate debt with in-group firms leading to higher recovery rates.

While higher recovery rates could justify higher default rates and lower interest rates for in-group loans, loans from in-group banks to in-group firms yield lower returns than loans to out-group firms during the 2008 to 2015 period for *any* recovery rate. Returns on loans from in-group banks to in-group and out-group firms can be computed as: $ret = (1 - P_{bankruptcy} - P_{workout}) * (1 + r) + P_{default} * rec_B + P_{workout} * rec_W - 1$, where $P_{bankruptcy}$ is the probability of a firm filing for bankruptcy, $P_{workout}$ is the probability of a workout filing, rec_B is the recovery rate in bankruptcy, rec_W is the recovery rate in workouts, and r is the interest rate. When we plug in the average annual values for all these variables from the data, in-group loans yield $ret_{in-group} = (1 - 0.0340 - 0.0291) * 1.0582 + 0.0340 * rec_B + 0.0291 * rec_W - 1$, and for out-group firms $ret_{out-group} = (1 - 0.0131 - 0.0010) * 1.0613 + 0.0131 * rec_B + 0.0010 * rec_W - 1$. Due to the lower interest rates (0.0582 vs. 0.0613), there are no values for rec_B and rec_W between zero and one, such that $ret_{in-group} \geq ret_{out-group}$.

Additionally, evidence on collateral for loans for which such information is available shows that in-group loans are less collateralized. Loans from in-group banks to in-group firms are slightly more collateralized than loans from out-group banks to in-group firms before the election (46.95 percent vs. 45.64 percent). After the election collateral relatively declines for in-group bank loans (36.41 percent vs. 42.42 percent). For loans to out-group firms, we observe similar rates of collateral for in-group and out-group banks before (43.50 percent vs. 43.68 percent) and after (43.51 percent vs. 41.58 percent) the election.

Our evidence on loan outcomes is also inconsistent with network ties reducing renegotiation frictions. Loans from in-group banks to in-group firms depict similar bankruptcy rates despite higher workout rates, which is inconsistent with network ties preventing bankruptcy filings by reducing renegotiation frictions. Additionally, a large fraction of the loans that are renegotiated in workouts during MB's term default later.

6.6   Unlimited Funding

Even if in-group banks' return on loans to in-group firms is lower than for loans to out-group firms, in-group lending may be profitable if in-group banks are not funding constrained and additional loans to in-group firms generate a positive return. Since banks have the outside option to invest in the risk-free asset, a lower bound for in-group lending to be justifiable is the risk-free rate.

For in-group banks to earn a return on in-group loans in excess of the average risk-free rate from 2008 to 2015 (4.08%), the following inequality needs to be satisfied: $ret_{in-group} = 1.0582 * (1 - 0.0340 - 0.0291) + 0.0340 * rec_B + 0.0291 * rec_W - 1 \geq 0.0408$. While there is no publicly available data on recovery rates in workouts, the Korea Financial Investment

Association publishes value-weighted recovery rates for firms with assets above 7bn KRW. During our sample period, the recovery rate in bankruptcy (rec_B) is 19.27 percent. With this recovery rate, in-group loans yield a return of 1.37 percentage points below the risk-free rate even if we assume rec_W to be one. To earn returns on par with the risk-free rate, the recovery rate rec_B would need to be 60 percent, which is implausible given observed recovery rates in bankruptcy cases in Korea. Thus, in-group banks would be better off investing in the risk-free asset rather than lending to in-group firms between 2008 and 2015.

6.7 Unobserved Costs

In computing returns on loans, we omit unobservable costs that could be lower for in-group loans. For example, screening and monitoring costs may be lower for in-group loans. However, while this may bias the comparison of returns on loans allocated to in-group and out-group firms, transaction costs for investing in the risk-free asset are low. Hence, given that for plausible levels of recovery rates, in-group loans generate returns below the risk-free rate, adding additional costs would make in-group loans even less profitable relative to the risk-free rate.

6.8 Cross-Selling

In-group banks may be willing to accept lower returns on in-group loans, if they are able to profit from related business transactions, for example advisory fees. For all major banks in Korea, fees for consulting services are included in interest rates and not charged separately. The main alternative source of income from lending relationships is to sell additional financial products, e.g. derivatives. Given an average loan size of 4,384m KRW, the additional income from selling other financial products would need to amount to (4,384*0.0166=)72.77m KRW per in-group firm to at least match the risk-free rate given the 1.66 percentage points lower return on in-group lending.

While some of the larger firms in the sample rely on additional financial products, the majority of firms do not list other financial assets on their balance sheet. From their balance sheets, we find that the average KU firm has outstanding derivatives of 18.15m KRW in a given year. Even if all of this were provided by in-group banks, the profits from the sales would not recover the 72.77m KRW wedge in returns between in-group loans and the risk-free rate. While there might be additional products other than consulting and derivatives that are not visible on the balance sheet, the volume that would be required to generate sufficiently high profits to increase overall returns to the level of the risk-free rate is implausible.

6.9 Credit Reallocation and Estimation Bias

Since our estimates are derived from a difference-in-differences and a triple difference specification, respectively, the measured increase in credit allocated to in-group relative to out-group firms is the sum of changes in credit allocated to in-group and out-group firms. If banks reallocate some credit from out-group to in-group firms, our estimates capture both effects and therefore could be biased upwards.

While it is not possible for us to explore whether the additional credit allocated to in-group firms would have been allocated to out-group firms, we can compute how much our estimates would be biased under the most conservative assumption of reallocating all extra credit allocated to in-group firms to out-group firms. For our main test in Table III, column I, since in-group firms constitute 2.36 percent of all firms in the sample, credit to out-group firms would be 0.2978*(0.0236/0.9764)=0.0072 higher if credit was not reallocated to in-group firms. This implies that under the most conservative assumption, our estimate would decline only slightly from 0.2978 to 0.2906. Similarly, our estimate at the firm-bank relationship level in column IV would decline from 0.8044 to 0.7850. Thus, concerns about potential estimation biases due to credit reallocation from out-group to in-group firms would affect our estimates only mildly, even under the most conservative assumptions.

7 Conclusion

The existing literature treats patronage and cronyism in the government and private sectors as distinct and independent sources of inefficiencies. In this paper, we document that they are linked in a way that amplifies allocative inefficiencies and thereby leads to higher welfare costs. Changes in political power combined with patronage appointments in government have important spillover effects on resource allocation in private markets. We show that private banks increase the number of executives linked to the president's alumni network to obtain better connections to the government. This increases the alumni network's influence over credit allocation in private banks. As a consequence, private firms linked to the alumni network benefit from better access to private bank credit through an executive network channel. We find that the dominant mechanism underlying better access to private bank loans for firms with network links to banks is taste-based discrimination. Private banks allocate more credit at a lower price to in-group firms and protect them from default through debt renegotiations.

In a parsimonious model of credit allocation and investment, we show that a positive correlation between government and private bank bias towards the same group of firms has strong amplification effects. Intuitively, if government banks favor in-group firms whereas

private banks favor different firms, in-group firms overinvest inefficiently, but out-group firms sustain access to credit from private banks to finance profitable investments. However, if government and private banks share the same bias, in-group firms can finance even less efficient investments, whereas out-group firms lack access to unbiased funding and are forced to forego highly profitable investments. By allocating capital to ailing in-group firms which we find use a larger fraction of the credit for refinancing than for investment, banks withhold capital from more productive usage with adverse effects on economic growth (Caballero, Hoshi, and Kashyap 2008). Altogether this implies that correlated biases of government and private banks reduce the efficiency of capital allocation in the economy and generate large welfare losses from a reduction in productivity.

While we focus on the president's alumni network in Korea, the economic mechanism that we document is plausibly applicable to networks based on other characteristics such as race, ethnicity, partisanship, gender, social class, etc. and in other countries. Appointments of people to important positions in the administration by powerful politicians are not unique to Korea, but ubiquitous around the world for countries at different stages of development. In countries with weaker institutions where boundaries between the government and private sectors are more blurred, the spillover effects we document are likely to be more prevalent. However, evidence on patronage appointments in government has been documented in the context of developed countries beyond Korea (Xu 2018) and are thought to be pervasive around the world. Similarly, evidence from firms' lobbying efforts in the U.S. suggest that it is common for private firms to try to establish links to politicians' networks by hiring individuals with personal links to these networks (Bertrand, Bombardini, and Trebbi 2014).

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Figure 1: **KU Network CEOs in Private Firms**
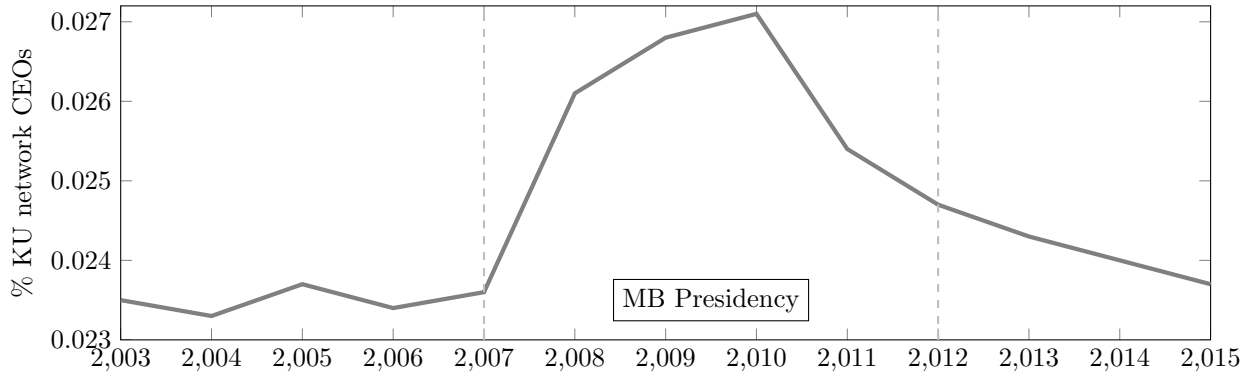
This figure depicts the fraction of firms that have a CEO from the KU network.

Figure 2: **Change in Credit and Interest Rates - Firm-Level**
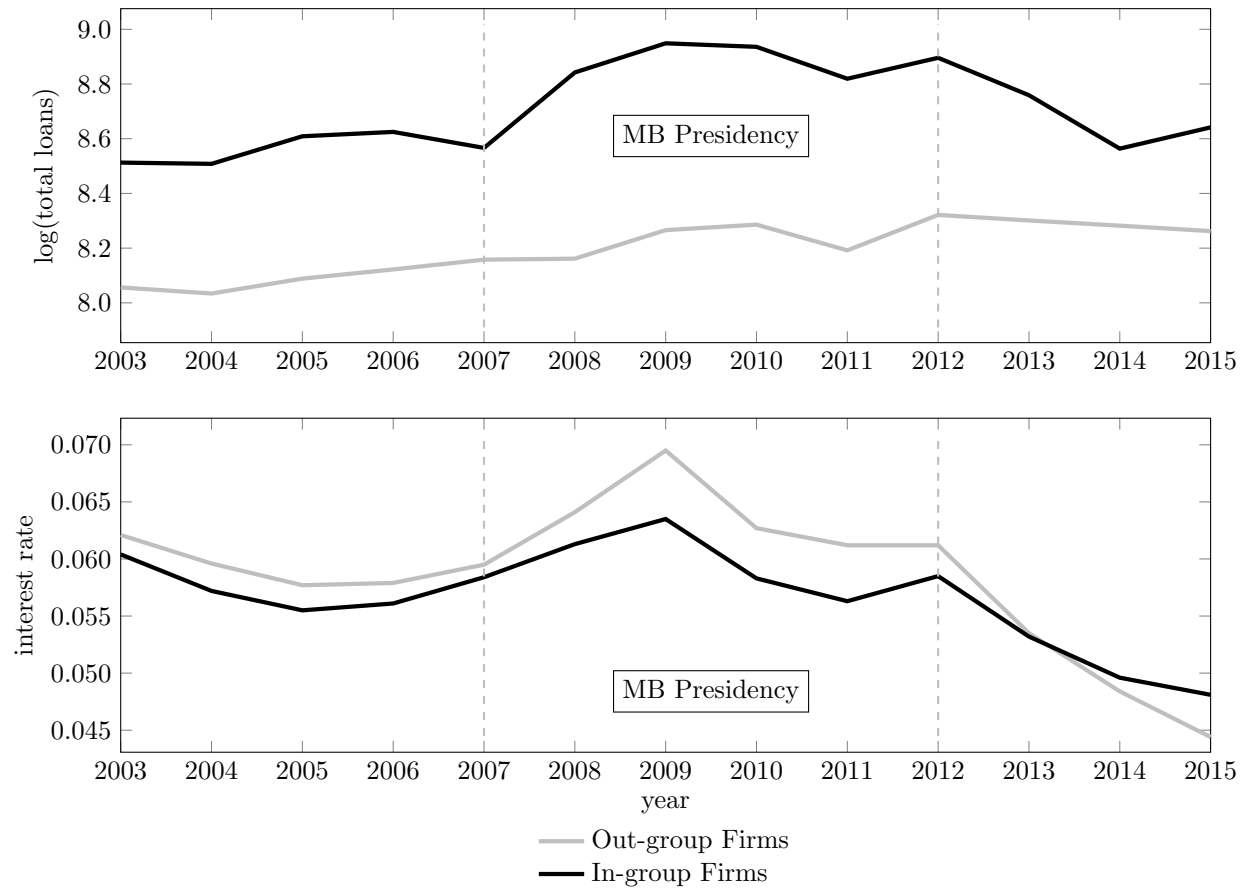
This figure depicts the average log of annual loans in the top panel and the average interest rate in the bottom panel, separately for in-group (black lines) and out-group (gray lines) firms.

Figure 3: **Change in Credit - Relationship-Level**

Out-group banks
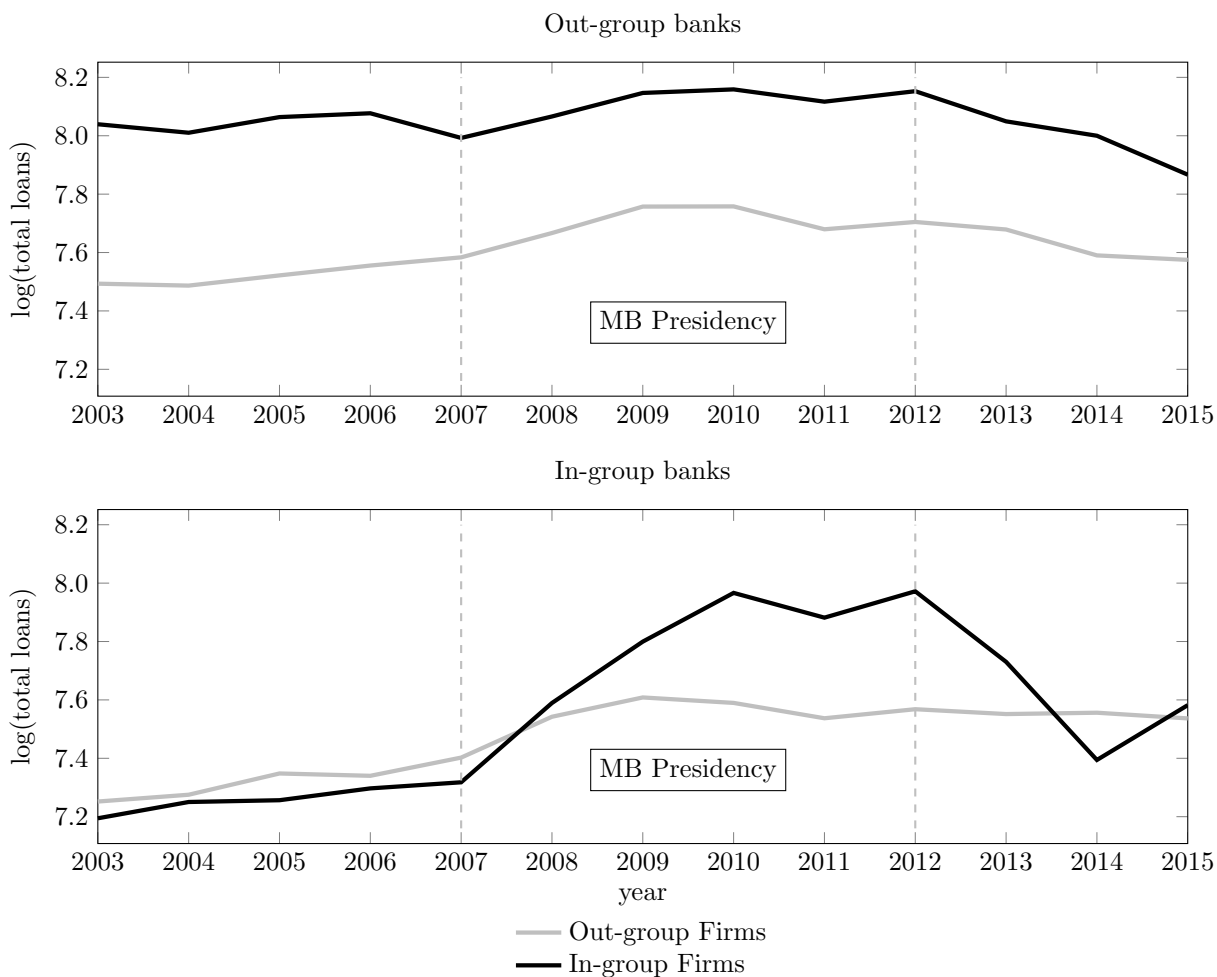
In-group banks

This figure depicts the average log of annual loans for in-group (black lines) and out-group (gray lines) firms. The top panel plots the graph for out-group banks, and the bottom panel plots the graph for in-group banks.

Figure 4: **Change in Interest Rates - Relationship-Level**

Out-group banks
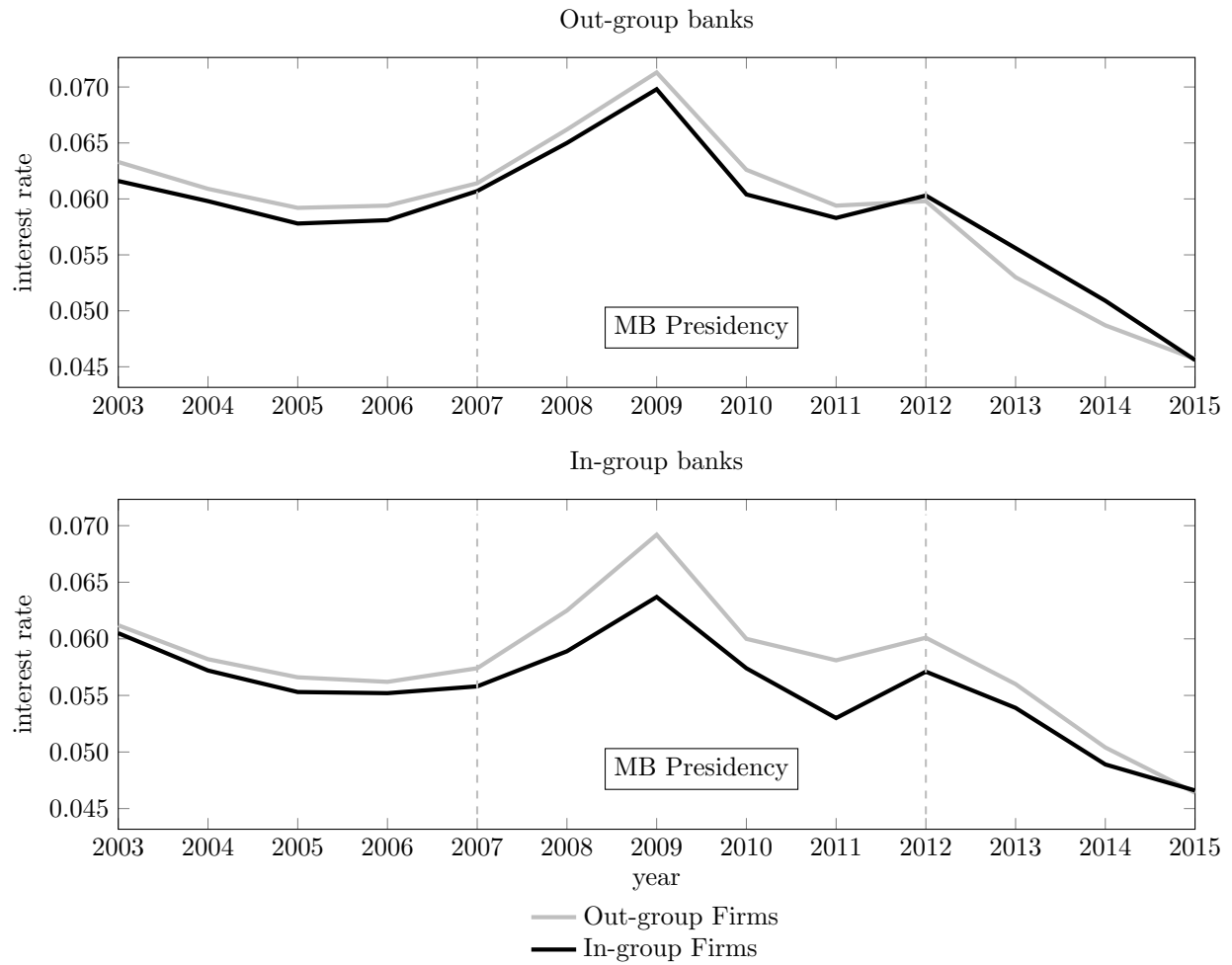
In-group banks

This figure depicts the average interest rates for in-group (black lines) and out-group (gray lines) firms. The top panel plots the graph for out-group banks, and the bottom panel plots the graph for in-group banks.

Figure 5: **Defaults**
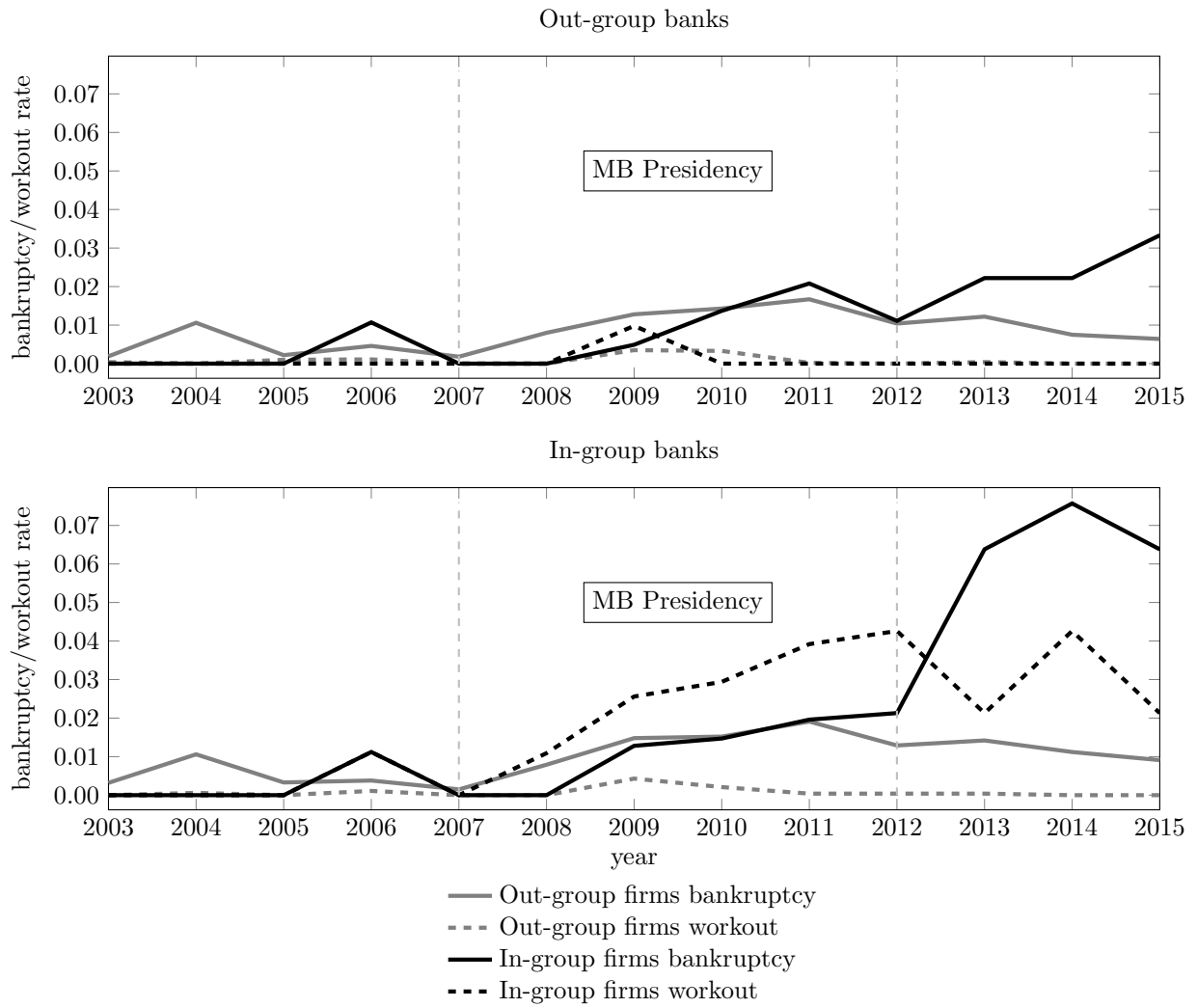
This figure depicts the fraction of firms borrowing from in-group (bottom panel) and out-group (top panel) banks that file for bankruptcy (solid lines) or workout (dashed lines) among in-group (black lines) and out-group (gray lines) firms.

Table I: **Stock Returns**

Dep. Var.: $cumret_i$	I (1)	II (1,3)	III (1,5)
KU_i	0.0167***	0.0356***	0.0302***
	(0.0038)	(0.0097)	(0.0107)
Observations	820	820	820
R-squared	0.013	0.015	0.009

This table examines cumulated returns around the election of Lee Myung Bak's appointment as his party's presidential candidate. The dependent variable is the cumulated return on the day after the election in column I, the three days after the election in column II and the five days after the election in column III. The variable KU_i takes the value of one for firms that have a CEO from Korea University and zero otherwise. Standard errors are reported in parentheses. *** denotes statistical significance at the 1% level.

Panel A: Sample				
Number of firms	9,729			
Number of firms with accounting data	8,588			

Panel B: CEO & Network Data	in 2007	in 2004		
Korea University firms	2.36%	2.35%		

Panel C: Loan Data	Obs.	Mean	Median	Std.
Individual loans (in million KRW)				
In-group firms	3,515	4,384	1,515	4,352
Out-group firms	95,132	2,630	1,100	3,610
Interest rates				
In-group firms	3,428	0.0591	0.0593	0.0165
Out-group firms	92,867	0.0618	0.0618	0.0165
Lending relationships				
In-group firms	401	2.49	2.00	1.60
Out-group firms	13,077	2.18	2.00	1.36
Total annual loan amount (in million KRW)				
In-group firms	1,146	11,826	5,469	13,845
Out-group firms	33,055	8,147	3,959	10,572

Panel D: Accounting Data	Obs.	Mean	Median	Std.
Assets (in million KRW)				
In-group firms	838	77,861	42,426	80,239
Out-group firms	30,367	53,381	26,526	63,676
Employees				
In-group firms	849	169	107	153
Out-group firms	29,614	114	70	125
Net income (in million KRW)				
In-group firms	838	1,471	160	3,805
Out-group firms	30,367	1,014	470	3,917
Tangible Assets/Assets				
In-group firms	838	0.3619	0.3249	0.2458
Out-group firms	30,008	0.3655	0.3416	0.2675

Panel E: Bank Financials	Obs.	Mean	Median	Std.
Assets (in bn KRW)				
In-group banks	36	76,711	36,073	94,890
Out-group banks	54	93,596	44,272	104,461
Cash Flows/Assets				
In-group banks	36	0.0018	0.0002	0.0118
Out-group banks	54	0.0018	0.0005	0.0099
Net Income/Assets				
In-group banks	36	0.0117	0.0061	0.0139
Out-group banks	54	0.0132	0.0065	0.0144
Revenues/Assets				
In-group banks	36	0.0688	0.0579	0.0419
Out-group banks	54	0.0664	0.0586	0.0374
Equity/Assets				
In-group banks	36	0.0633	0.0269	0.0881
Out-group banks	54	0.0594	0.0233	0.0734
Debt/Assets				
In-group banks	36	0.7044	0.9208	0.3433
Out-group banks	54	0.7099	0.9230	0.3454

This table provides descriptive statistics. Panel A shows information on the number of firms, Panel B on firms' links to the KU network, Panel C on loan data, Panel D on accounting data, and Panel E data on bank financials.

Table III: **Credit Volumes and Interest Rates**

Dep. Var.:	I	II	III	IV	V	VI	VII
	Firm-Level			Relationship-Level			
	$\log(loans)_{it}$	$\left(\frac{loans}{assets}\right)_{it}$	IR_{it}	$log(loans)_{ijt}$	$\left(\frac{loans}{assets}\right)_{ijt}$	IR_{ijt}	rel_{ijt}
$KU_i * election_t$	0.2978**	0.0286*	-0.0018**				
	(0.1297)	(0.0168)	(0.0008)				
$KU_i * KU_j * election_t$				0.8044***	0.0656***	-0.0038***	0.1430**
				(0.2047)	(0.0188)	(0.0012)	(0.0682)
$alum\ link_{ijt}$				0.4405***	0.0309**	-0.0041***	0.1470***
				(0.1116)	(0.0155)	(0.0011)	(0.0447)
Firm FE	yes	yes	yes	-	-	-	-
Firm-Time FE	-	-	-	yes	yes	yes	yes
Bank-Time FE	-	-	-	yes	yes	yes	yes
Clustered SE	firm	firm	firm	firm	firm	firm	firm
Observations	33,516	31,205	32,993	61,618	58,123	60,105	61,618
R-squared	0.716	0.706	0.755	0.944	0.958	0.944	0.934

This table shows the results from estimating equation (1) in columns I to III, and equation (2) in columns IV to VII. The dependent variable is the log of firm i's total loans in year t in column I, firm i's loans to assets ratio in column II, firm i's average interest rate in column III, the log of loans from bank j to firm i in column IV, the ratio of loans from bank j to firm i and firm i's assets in column V, the average interest rate on loans from bank j to firm i in column VI, and a variable that takes the value of one if a lending relationship between firm i and bank j starts in year t, minus one if a lending relationship between firm i and bank j ends in year t, and zero in other years in column VII. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable KU_j takes the value of one if bank j becomes connected to the KU network by appointing an executive from Korea University after the election and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007. The variable $alum\ link_{ijt}$ takes the value of one if firm i's CEO and a bank j executive are from the same alumni network, other than Korea University, in year t and zero otherwise. Standard errors are reported in parentheses.

Table IV: **Credit Volumes and Interest Rates - Post-MB Era**

	I	II	III	IV	V	VI	VII
	Firm-Level			Relationship-Level			
Dep. Var.:	$log(loans)_{it}$	$\left(\frac{loans}{assets}\right)_{it}$	IR_{it}	$log(loans)_{ijt}$	$\left(\frac{loans}{assets}\right)_{ijt}$	IR_{ijt}	rel_{ijt}
$KU_i * election_t$	-0.5442**	-0.0330	0.0042**				
	(0.2402)	(0.0280)	(0.020)				
$KU_i * KU_j^{term} * election_t$				-0.7495**	-0.0331**	0.0065***	-0.2280**
				(0.3170)	(0.0147)	(0.0016)	(0.1157)
$alum\ link_{ijt}$				0.5468*	0.0358	-0.0056*	0.1673
				(0.2938)	(0.0339)	(0.0034)	(0.1292)
Firm FE	yes	yes	yes	-	-	-	-
Firm-Time FE	-	-	-	yes	yes	yes	yes
Bank-Time FE	-	-	-	yes	yes	yes	yes
Clustered SE	firm	firm	firm	firm	firm	firm	firm
Observations	24,414	22,804	24,456	46,603	43,987	46,722	46,603
R-squared	0.798	0.770	0.832	0.954	0.968	0.958	0.928

This table shows the results from estimating equation (1) in columns I to III, and equation (2) in columns IV to VII. The dependent variable is the log of firm i's total loans in year t in column I, firm i's loans to assets ratio in column II, firm i's average interest rate in column III, the log of loans from bank j to firm i in column IV, the ratio of loans from bank j to firm i and firm i's assets in column V, the average interest rate on loans from bank j to firm i in column VI, and a variable that takes the value of one if a lending relationship between firm i and bank j starts in year t, minus one if a lending relationship between firm i and bank j ends in year t, and zero in other years in column VII. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable KU_j^{term} takes the value of one if bank j is unconnected from the KU network by ceasing to appoint an executive from Korea University after the election of Park Geun Hye and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2013 to 2015 and zero for the pre-election period from 2010 to 2012. The variable $alum\ link_{ijt}$ takes the value of one if firm i's CEO and a bank j executive are from the same alumni network, other than Korea University, in year t and zero otherwise. Standard errors are reported in parentheses.

Table V: **Credit Volumes and Interest Rates – Heterogeneous Treatment Effects**

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
	Leverage				Net Income				Interest Coverage			
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dep. Var.:	$log(loans)_{ijt}$		IR_{ijt}		$log(loans)_{ijt}$		IR_{ijt}		$log(loans)_{ijt}$		IR_{ijt}	
$KU_i * KU_j * election_t$	0.5538**	1.1948***	-0.0044***	-0.0043**	1.3587***	0.5969**	-0.0046***	-0.0030*	0.4883**	1.3431***	-0.0030*	-0.0037**
	(0.2449)	(0.2975)	(0.0016)	(0.0020)	(0.3922)	(0.2454)	(0.0016)	(0.0017)	(0.2142)	(0.4073)	(0.0016)	(0.0017)
$alum\ link_{ijt}$	0.4059***	0.4594***	-0.0039**	-0.0036**	0.5146***	0.3813**	-0.0048***	-0.0036**	0.3354**	0.6023***	-0.0031*	-0.0052***
	(0.1404)	(0.1642)	(0.0017)	(0.0015)	(0.1442)	(0.1690)	(0.0016)	(0.0016)	(0.1609)	(0.1500)	(0.0017)	(0.0015)
$p-value$	0.11		0.97		0.10		0.49		0.08		0.79	
Firm-Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bank-Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Clustered SE	firm	firm	firm	firm	firm	firm	firm	firm	firm	firm	firm	firm
Observations	31,251	26,690	30,367	26,148	26,633	32,278	26,037	31,415	31,040	27,766	30,254	27,189
R-squared	0.940	0.944	0.940	0.933	0.950	0.936	0.943	0.934	0.942	0.942	0.938	0.937

This table shows the results from estimating equation (2) where the sample is split into below- and above median levels of firm chracteristics as indicated in the second line of each column. The dependent variable is the log of loans from bank j to firm i in columns I, II, V, VI, IX, and X, and the average interest rate on loans from bank j to firm i in columns II, IV, VII, VII, XI, and XII. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable KU_j takes the value of one if bank j becomes connected to the KU network by appointing an executive from Korea University after the election and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007. The variable $alum\ link_{ijt}$ takes the value of one if firm i's CEO and a bank j executive are from the same alumni network, other than Korea University, in year t and zero otherwise. Standard errors are reported in parentheses. The line labelled "$p-value$" reports the results from a t-test on the difference of the estimates $KU_i * KU_j * election_t$ between firms with above- and below-median levels of the respective firm characteristic.

Table VI: **Credit Volumes and Interest Rates - Cohort Effects**

	I	II	III	IV	V	VI	VII	VIII
		MB Era				Post-MB Era		
Dep. Var.:	$log(loans)_{ijt}$	$\left(\frac{loans}{assets}\right)_{ijt}$	IR_{ijt}	rel_{ijt}	$log(loans)_{ijt}$	$\left(\frac{loans}{assets}\right)_{ijt}$	IR_{ijt}	rel_{ijt}
$KU_i * KU_j * election_t$	0.5544***	0.0460***	-0.0031***	0.1089**	-0.5310*	-0.0259*	0.0055***	-0.1824
	(0.1561)	(0.0159)	(0.0009)	(0.0552)	(0.3226)	(0.0156)	(0.0019)	(0.1251)
$KU_i * KU_j * election_t * cohort_{ij}$	0.6036**	0.0928**	-0.0015	0.0992	-0.6480	-0.0531**	0.0024	-0.1265
	(0.3042)	(0.0411)	(0.0017)	(0.0837)	(0.4108)	(0.0219)	(0.0017)	(0.1371)
$election_t * cohort_{ij}$	0.0432	0.0022	0.0002	-0.0105	0.0058	-0.0002	0.0002	0.0097
	(0.1978)	(0.0184)	(0.0012)	(0.0639)	(0.3468)	(0.0174)	(0.0015)	(0.1302)
$alum\ link_{ijt}$	0.4516***	0.0311**	-0.0041***	0.1482***	0.5531*	0.0360	-0.0057*	0.1693
	(0.1127)	(0.0157)	(0.0011)	(0.0450)	(0.2941)	(0.0340)	(0.0034)	(0.1295)
Firm-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Bank-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Clustered SE	firm	firm	firm	firm	firm	firm	firm	firm
Observations	61,618	58,123	60,105	61,618	46,603	43,987	46,722	46,603
R-squared	0.945	0.958	0.945	0.935	0.955	0.968	0.958	0.929

This table shows the results from estimating equation (2). The dependent variable is the log of loans from bank j to firm i in columns I and V, the ratio of loans from bank j to firm i and firm i's assets in columns II and VI, the average interest rate on loans from bank j to firm i in columns III and VII, and a variable that takes the value of one if a lending relationship between firm i and bank j starts in year t, minus one if a lending relationship between firm i and bank j ends in year t, and zero in other years in columns IV and VIII. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable KU_j takes the value of one if bank j becomes connected to the KU network by appointing an executive from Korea University after the election and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007 in columns I to IV and takes the value of one for the post-election period from 2013 to 2015 and zero for the pre-election period from 2010 to 2012 in columns V to VIII. The variable $cohort_{ij}$ takes the value of one if the CEO of firm i in 2007 is born within three years of a KU-linked executive of bank j, who was appointed after MB's election and zero otherwise. The variable $alum\ link_{ijt}$ takes the value of one if firm i's CEO and a bank j executive are from the same alumni network, other than Korea University, in year t and zero otherwise. Standard errors are reported in parentheses.

Table VII: **Credit Volumes and Interest Rates - Pre-Connected Banks**

	I	II	III	IV	V	VI
Dep. Var.:	$log(loans)_{ijt}$			IR_{ijt}		
	pre	post		pre	post	
$KU_i * KU_j^{pre}$	0.3325**	0.3795*		-0.0028**	-0.0034**	
	(0.1576)	(0.2254)		(0.0013)	(0.0017)	
$KU_i * KU_j^{pre} * election_t$			-0.0946			-0.0013
			(0.1866)			(0.0016)
Firm-Time FE	yes	yes	yes	yes	yes	yes
Bank-Time FE	yes	yes	yes	yes	yes	yes
Firm-Bank FE	no	no	yes	no	no	yes
Clustered SE	firm	firm	firm	firm	firm	firm
Observations	26,146	23,382	49,528	25,732	22,604	48,336
R-squared	0.756	0.809	0.956	0.782	0.845	0.957

This table shows the results from estimating equation (3). The dependent variable is the log of loans from bank j to firm i in year t in columns I to III, and the average interest rate on loans from bank j to firm i in columns IV to VI. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable KU_j^{pre} takes the value of one if bank j has a CEO from Korea University before and after the election and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007. Standard errors are reported in parentheses.

Table VIII: **Underlying Mechanism**

	I	II	III	IV	V	VI	VII
Dep. Var.:	IR_{ijt}	$log(loans)_{ijt}$	$bankruptcy_{ijt}$	$workout_{ijt}$	$default_{ijt}$	$fin\ share_{it}$	$fin\ share_{ijt}$
KU_i			-0.0013	-0.0005*	-0.0005*		
			(0.0026)	(0.0003)	(0.0003)		
$KU_i * KU_j$			-0.0005	0.0001	0.0002		
			(0.0008)	(0.0002)	(0.0002)		
$KU_i * election_t$			-0.0027	0.0015	0.0016	0.0678**	
			(0.0047)	(0.0020)	(0.0020)	(0.0289)	
$KU_i * KU_j * election_t$	-0.0014	-0.0916**	0.0030	0.0239***	0.0241***		0.2104***
	(0.0029)	(0.0429)	(0.0059)	(0.0079)	(0.0080)		(0.0660)
Time FE	-	-	-	-	-	yes	-
Firm FE	-	-	no	no	no	yes	-
Firm-Time FE	yes	yes	no	no	no	no	yes
Bank-Time FE	yes	yes	yes	yes	yes	no	yes
Firm-Bank FE	yes	yes	no	no	no	no	yes
Clustered SE	firm	firm	firm	firm	firm	firm	firm
Observations	285	285	63,283	63,283	63,283	14,305	26,325
R-squared	0.589	0.657	0.005	0.005	0.007	0.734	0.961

This table shows the results from estimating equation (4) in columns I and II, equation (5) in columns III to V, equation (1) in column VI, and equation (2) in column VII. The dependent variable in this table is the standard deviation of the log of loans and interest rates of the portfolios of in-group and out-group firms, respectively, for bank j in year t in columns I and II, a dummy variable that takes the value of one if firm i files for bankruptcy in year t and zero otherwise in column III, a dummy variable that takes the value of one if firm i files for workout in year t and zero otherwise in column IV, and a dummy variable that takes the value of one if firm i files for either bankruptcy or workout in year t and zero otherwise in column V, the fraction of loans that firm i uses to refinance existing loans in column VI, and the fraction of loans from bank j to firm i used for refinancing existing loans in column VIII. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable KU_j takes the value of one if bank j becomes connected to the KU network by appointing an executive from Korea University after the election and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007. Standard errors are reported in parentheses.

Table IX: **Credit Volumes and Interest Rates - Government Banks**

	I	II	III
Dep. Var.:	$log(loans)_{it}$	$\left(\frac{loans}{assets}\right)_{it}$	IR_{it}
$KU_i * election_t$	0.2426*	0.0307	-0.0018*
	(0.1416)	(0.0188)	(0.0010)
Time FE	yes	yes	yes
Firm FE	yes	yes	yes
Clustered SE	firm	firm	firm
Observations	28,614	26,108	28,676
R-squared	0.737	0.691	0.783

This table shows the results from estimating equation (1) for government bank credit. The dependent variable is the log of firm i's total loans in year t in column I, firm i's loans to assets ratio in column II, and firm i's average interest rate in column III. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007. Standard errors are reported in parentheses.

Table X: **Firm-Level Investment and Profitability**

	I	II	III
Dep. Var.:	$log(capex)_{it}$	$log(assets)_{it}$	ROA_{it}
$KU_i * election_t$	0.2050**	0.0842**	-0.0116**
	(0.1032)	(0.0382)	(0.0048)
Time FE	yes	yes	yes
Firm FE	yes	yes	yes
Clustered SE	firm	firm	firm
Observations	30,840	31,205	31,205
R-squared	0.749	0.938	0.583

This table shows the results from estimating equation (1) for different firm level outcomes. The dependent variable is the log of firm i's capital expenditures in year t in column I, the log of firm i's assets in column II, and firm i's return to assets ratio in column III. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2007 and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007. Standard errors are reported in parentheses.

Appendix A.   Additional Tables and Figures

Figure A.1: **Loan Distribution**
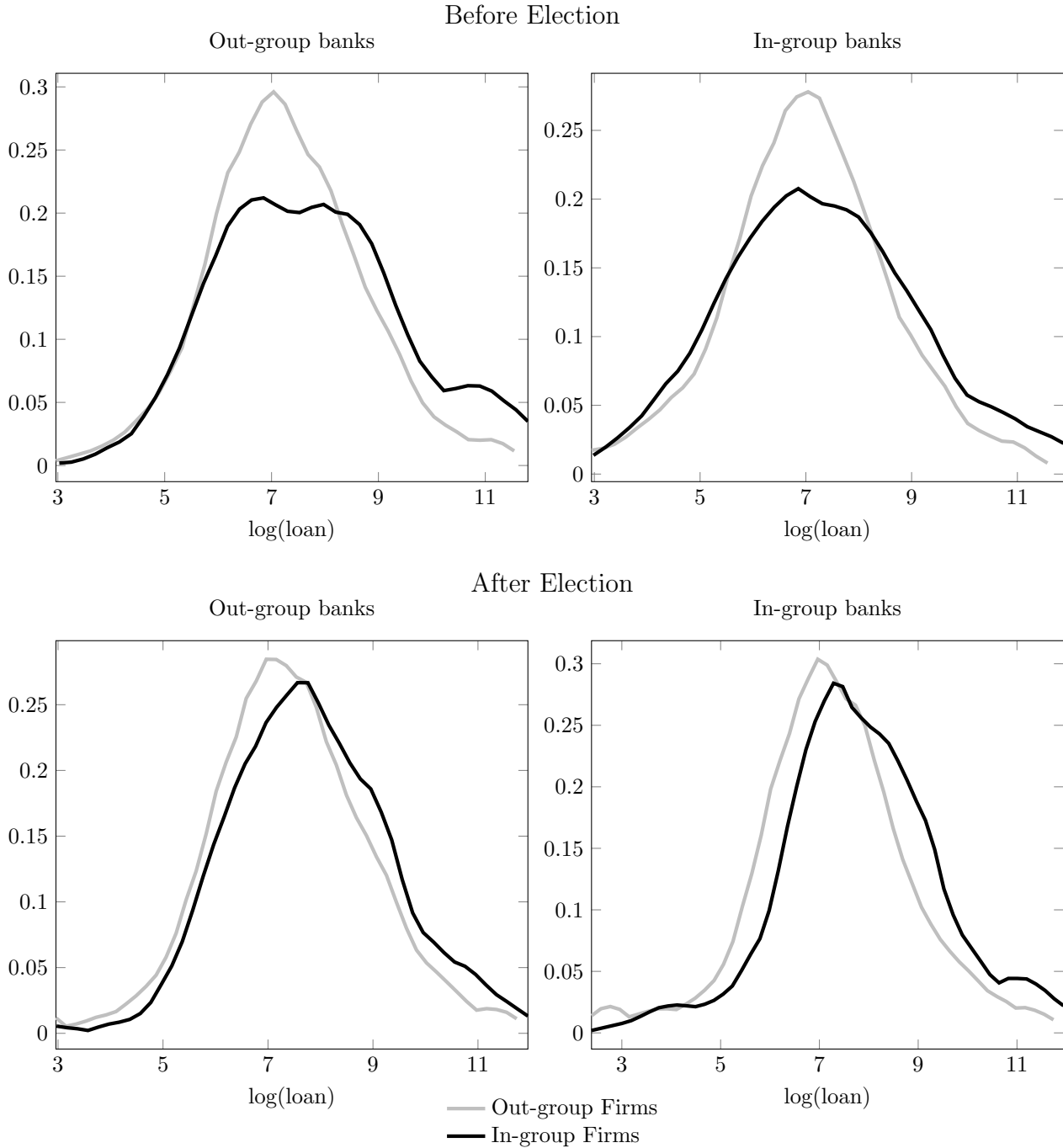
Before Election

This figure shows kernel density plots of the log of loans on the firm-bank relationship level for the pre-election (top panel) and the post-election (bottom panel) periods for in-group (right panel) and out-group (left panel) banks, and for in-group (black lines) and out-group (gray lines) firms.

Figure A.2: **Interest Rate Distribution**
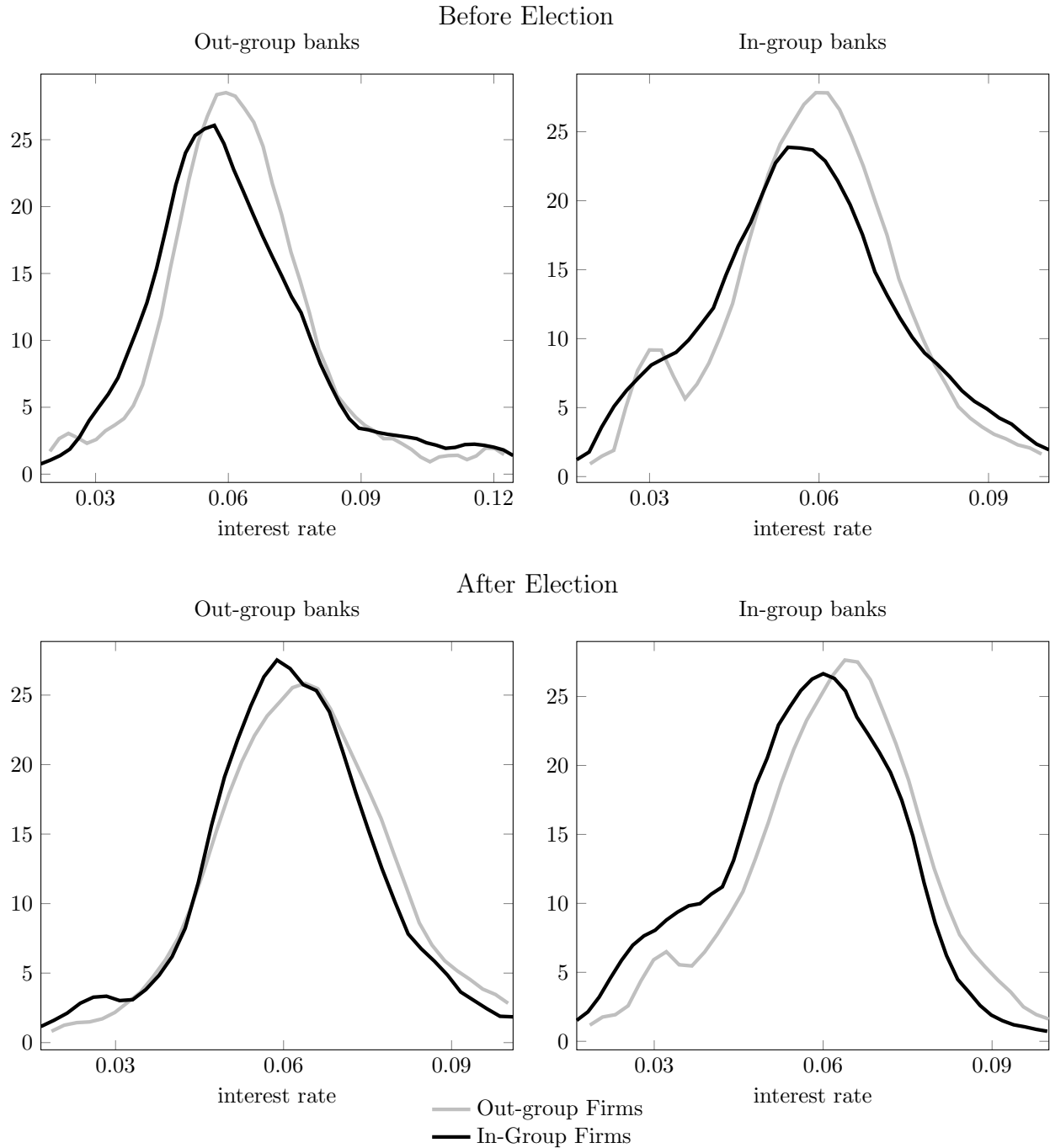
This figure shows kernel density plots of interest rates on the firm-bank relationship level for the pre-election (top panel) and the post-election (bottom panel) periods for in-group (right panel) and out-group (left panel) banks, and for in-group (black lines) and out-group (gray lines) firms.

Table A.1: Articles on the Culture of the Korea University and other Alumni Networks

Date	Paper, Headline	Content
October 7, 2008	Jugan Kyunghyang "South Korea's Personal Connections: A Shortcut to 'Korea Univerity Alumni' ''	After the inauguration of Lee Myung-Bak, a lot of Korea University alumni have been promoted to the heads to the departments in the Blue House, government agencies, and economic institutions. This is because the free ride ticket called Korea University alumni plays a big role in the success of ones business. The Honam Alumni Association, the Marine Corps Veterans Association, and the Korea University Alumni Association are the top three of the strongest connections in Korea. Among them, the solidarity between alumni at Korea University is unequaled.
Feb. 28, 2011	Wolgan Chosun "President Lee Myung Bak, please be sure to enter Korea University"	Outsiders often denigrate Korea University graduates as "Korea University mafia" and "gangster culture", but on the other hand, they are very envious of the collective consciousness that "we have to unite in some way to live." The Korea University alumni group has developed into a self-sustaining network for mutual aids. The Alumni Association, which started as the first reunion of Korean universities in 1907, already boasts a 100-year history. It reminds us of the 'snowballing effect'. When you roll a small snowball, it's not very big at first, but it gets bigger the more you roll it. Resources are mobilized and distributed to networks connected by alumni. Tolerance, trust, and mutual aid make 'us' strong. Professor Daehee Lee (law: the class of 83) at Korea University Law School is a typical 'Korea University man'. He attends four Korea University-related alumni meetings. Professor Lee said, "After work is over if the other party reveals that he is a junior who has graduated from Korea University and has a drink, I will always pay for the drink" He also confessed, "I gave advice so that my juniors can grow in a certain organization, and I watched them with more affection than those from other universities."
Oct. 4, 2018	E-Today "Tenacious Academic Connections Cartel - Seniority is Ignored and Easy Positions are Given to Juniors"	The Ministry of Strategy and Finance is a key ministry responsible for the overall economy of the Republic of Korea. It manages the budget, taxation, economic policy, and public institutions. There may be many from Seoul National University, but the problem is not there. The problem is that a strong inner circle (internal faction centered on personal connections) is formed around them. They take turns taking on key positions and play a power game over policy making and implementation, creating harm in attracting and pushing each other. As a result, within the Ministry of Strategy and Finance, it is said that "I will not be able to entrust my work to those who are not from Seoul National University." In the Ministry of Foreign Affairs, graduates from Seoul National University's Department of Foreign Affairs share major positions, and the Ministry of Maritime Affairs and Fisheries is mainly made up of personal connections from Pukyong University, the former Busan Fisheries University, and connections from Korea Maritime University and Mokpo Maritime University. In the Ministry of Education, graduates from the Department of Education at Seoul National University, and in the National Tax Service, graduates from the Tax College occupy good positions. "There are times when I feel ashamed to see seniors who only take care of juniors from the same university or department," pointed out a secretary A, who works at an economic department. "It is a big problem that they talk about the school from which they graduated in the personnel management within the department."
Oct. 21, 2019	Munhwa Ilbo "Korean Society's Fairness Opinion Poll: When Important Decisions are Made, Blood, Hometown, and Academic Connections Come Into Play"	83.3% of the respondents said that when important issues are decided in the Korean society, connections such as blood, hometown, and academic connections play a role.

Table A.2: News Articles Concerning Appointments of Lee Myung Bak-Related Individuals

Date	Paper, Headline	Content
Jul. 18, 2010	Kyunghang Business "Major Appointments in Financial Sector Have Parachute Appointments Without Question Regardless of Their Expertise"	In the non-governmental financial sector, numerous MB figures with KU, Hyundai, presidential campaign, and presidential transition team ties have been appointed. In fact, 3 out of 4 CEOs of major financial share holding companies (KB, Hana, and Woori) in Korea have all graduated from Korea University.
Dec. 27, 2010	DongA.com "The Sword of Justice Passes Over Public Firms' Parachute Auditors"	Out of 23 auditor positions that were replaced in public firms, 14 (60.8%) had backgrounds in President Lee's presidential election campaign, work experience in the Blue House, and outside organizations in conservative factions. The Blue House is refusing to give a clear feedback on this concern. Some advisers even hold the theory of "inevitability of parachute appointments," arguing that 1) it is a practice that has been done by past administrations, 2) realistically, the administration has to repay the people who have helped the president during the election and 3) the administration has to secure allies for the next presidential election.
Jun. 2, 2011	Yonhap News "Democrats: 53 People Connected to the Government Appointed in the Financial Sector"	53 people with MB ties (presidential transition team, Korea University, Somang Church) were appointed in the financial sector as chairmen, board members, external directors, etc.
Sep. 1, 2011	Pressian "MB's Continued Love for Hyundai Engineering & Construction..."	The opposition Democratic Party vehemently protested against the appointment of Kim Joong-Kyum as Korea Electric Power CEO. Kim had previously been CEO of Hyundai Engineering and Construction. Chang Byung-Wan of the Democratic party pointed out that, faced with difficulty in business operations, what Korea Electric Power needed was someone with great expert knowledge in the relevant field (and/or has a broad, international network of personal connections to leverage), and not someone like Kim who comes from a very different background. Five more appointments of former Hyundai Engineering & Construction employees as CEOs of SEOs.
Oct. 4, 2011	Kyunghang Shinmun "Many Promotions of People from KU and the TK Region in the Prosecutor's Office During MB's Administration"	Senior executives in the public prosecutor's office during MB administration have shown a tendency to be promoted if they graduated from Korea University or are from TK (Taegu & Kyeongbuk) regions. According to the Department of Justice's report of promotions, 17.6% of chief prosecutors who have been promoted (9 out of 51) for the last 4 years have graduated from Korea University. This is about twice the rate during President Roh Moo-hyun's administration. Last August, Mr. Choi Gyo-il, former Department of Justice's director of public prosecutions, was appointed with promotion as Director of Seoul Central District Prosecutor's Office, a position that is referred to as "the flower of the prosecutor's office." He is both from Kyeongbuk region and Korea University.
Oct. 6, 2011	Hankyoreh "MB's Parachute Appointments 332 People"	At a congressional strategic meeting, Kim Jin-Pyo noted that in the most recent inspection of government offices, there were as many as 332 unfair/preferred appointments to key government and public company positions. Kim added that even the mass power outage in September could have been caused by the prevalence of such biased appointments. Congress' Land, Transport and Maritime Affairs Committee governs 20 public companies, and 70.5% of the non-executive directors at these companies had been identified as being pro-MB, had endorsed the Hannara Party, had graduated from Korea University, or were from Yeongnam.
Jan. 16, 2012	Pressian "Privatization of KTX, It Was MB's Korea University Figures Controlling After All"	Dongbu (Chairman from KU), Daewoo (Chairman from KU), Saneun that lead the privatization are all on the side of MB. The firms that are widely agreeing on the administration's KTX partial privatization plan all have special connections to President Lee.
Feb. 21, 2012	Media Today "Until the End of the Administration, Appointments Based on Revolving Doors/Parachutes"	Using Social Network Analysis, JoongAng Daily announced that one additional tie with the president would lead to a 43% increase in the chance to be appointed in a high position again. JoongAng Daily also reported that most of 76 officers who were appointed in the "4 major authority institutions" – National Intelligence Service, prosecution, police, National Tax Service – are from Yeongnam region or Korea University. All institutions generally increased the number of officers who are from Yeongnam region or that graduated from Korea University as time passed. The newspaper also pointed out that it is an unprecedented event that three Seoul Central District Prosecutors in a row are from Korea University.

Table A.2: News Articles Concerning Appointments of Lee Myung Bak-Related Individuals (continued)

Date	Paper, Headline	Content
Mar. 20, 2012	eDaily "4 Years of MB Administration Changed Financial Power Structure"	Since the very beginning of his term as President, there has been controversy surrounding appointments to key government posts – in particular, the administration established very strong ties with alumni of Korea University, Christians who go to Somang Church, and those from the Yeongnam region. These biased appointments were not just restricted to government roles, however. For example, the financial sector was heavily influenced by the MB administration's preference for Korea University, Somang Church, and Yeongnam personnel. In its analysis, E Daily News found evidence of a major transformation in the power structure among managers of major banks since '08. KB financial group's chairman was previously vice-head of MB's special committee on economic recovery. Similarly, Lee Pal-Sung of Woori, and Kim Seung-Yoo of Hana were graduates of Korea University. Saneun financial chairman Kang Man-Su was known to be MB's "economic adviser".
Apr. 16, 2012	Segye Daily News "Supposed to Have Hired Experts to Lead Educational Organizations; In Reality 66% Are Unqualified Parachute Appointments"	In June of 2009, President Lee Myung-Bak had promised to pay more attention to fair appointments, with the ministers being held responsible rather than the president intervening in the appointment process. According to Sekye Daily News' comprehensive survey of 10 organizations supervised by the Ministry of Education and Science, 66% of the appointees had political ties to the President. Even those institutions requiring higher levels of expertise in science were led by unqualified appointees.
May. 14, 2012	Sedaily "Banks Parachute Kingdom During the MB Administration"	As the current administration's poor performance was publicized through the investigation of major firms, it was also discovered that 73 out of 207 non-executive directors who were appointed during 4 years and 3 months of MB administration are MB figures or from the MB administration. Knowing that over one-third of the commercial bank system is filled with people appointed for their ties, we can assume a serious loophole in the bank's checking system. One high official from the financial sector has pointed out that the institution of non-executive directors is being used as a means of lobbying for the government, not for the intended purpose of checking and balancing power.
Jul. 24, 2012	news1Korea "80% of Leaders of National Research Council for Economics, Humanities, and Social Sciences Dubious of Being Parachutes"	Representative Sung Wan-jong of Advancement Unification Party criticized the National Research Council for Economic, Humanities, and Social Sciences for appointment corruption, saying its objectivity and impartiality have been disrupted from the activity. He announced that "Out of 23 chief directors under National Research Council, 13 are from President Lee's Presidential Transition Committee and Policy Advisory Committee. If you add Ko-So-Yeong (Korea University – Somang Church – Yeongnam) ties, the number becomes 18."
Oct. 9, 2012	Nocutnews "Media Industry Controlled by MB Loyalist Parachutes"	Broadcasting industry, dominated by MB's special broadcasting advisers and Korea University people... During a parliamentary inspection of the Korea Communications Commission, criticisms arose that the media's independence and impartiality have been disrupted and freedom of press has been diminished after the start of President Lee's administration. Congressman Kang Dong-won announced that as soon as MB administration was established, the press special advisers during MB's presidential candidate days and people from Korea University have dominated the press, deteriorating Korea's freedom of press.
Jan. 1, 2013	Seoul Shinmun "1 Out of 2 Public Institution Auditors is Parachute"	118 out of 250 auditors in government institutions and public institutions worked in Blue House or government institutions or had other political backgrounds.
Jan. 2, 2013	Media Today "During 5 Years of MB Government Journalism Was Devasted With Korea University Parachutes"	The three major broadcasting companies MBC, KBS, and SBS were all led by Korea University graduates. Korea University student leaders noted that such bias in the media is shameful, and that even conservatives would criticize the state of affairs.

This table lists articles from the financial press related to the appointment of people from Lee Myung Bak's networks in different places in the administration and the appointment of people from his networks in private banks. The first column shows the date of publication, the second column states the source of the article, and the last column summarizes the relevant passages of the article.

Table A.3: News Articles Concerning the Fate of Lee Myung Bak-Related Individuals under Park Geun Hye

Date	Paper, Headline	Content
Feb. 20, 2013	Kyunghang Shinmun "Financial MB Man, Board Chairman of Smile Credit Resigns"	Kim Seung-yu [entered Korea University Finance major in same year as MB], board chairman of Smile Credit, has resigned, leaving one year in his term after resigning from the chairman position of Hana Financial Group. Because the board chairman position of Smile Credit is appointed by the president, he said, "I thought it was reasonable to resign after the new president has been elected." With strong ties to President Lee, Board Chairman Kim has been considered one of the 4 major leaders of financial sector, along with Uh Yoon-dae [Korea University alumni], chairman of KB Financial Group, Lee Pal-sung [Korea University alumni], chairman of Woori Financial Group and Kang Man-su [First Minister of Strategy and Finance under MB], chairman of Saneun Financial Group.
March. 23, 2013	Money Today "MB Man Kang Man-Su Resigns... April Mass Resignation Starts"	Chairman Kang Man-su of KDB Saneun Financial Group, representative MB figure, and Chairman Lee Ji-Song of Korea Land and Housing Corporation, the leader of the biggest public corporation, have resigned. Chairman Kang was considered as a symbol of MB-nomics as President Lee's first minister of Ministry of Strategy and Finance. Even though he indicated that he will not step down immediately because of the works like Saneun Bank privatization and KDB Financial University, he seems to have been pressured by President Park's words on replacement. Chairman Uh Yoon-Dae of KB Financial Group and Chairman Lee Pal-Sung of Woori Financial Group might not be able to complete their terms either. The cascade of replacement seems to have already started with Chairman Lee's resignation, following resignation of Chairman Kim Kun-ho of Korea Water Resources Corporation.
March. 28, 2013	Newspim "MB Men in Public Enterprises Are Resigning One After Another Creating a Domino Effect"	Chairman Kang Man-su of KDB Financial Group, the most influential person of President Lee's administration, has resigned. He has shown signs that he will resign, regardless of his term (1 year left), as the new administration starts. His decision seems to be in line with President Park's recent remarks on selecting officers who follow the philosophies of the new administration. Public officers, like Chairman Kang, from financial sector and public corporations who have ties to President Lee have already resigned or are predicted to resign soon.
Apr. 1, 2013	Newspim "20 CEOs of Financial Public Enterprises Are Changed"	As the major leaders from financial sector who took office during MB administration are resigning without finishing their terms, the public is predicting that stock firms' CEOs will follow. The leaders of public corporations affiliated with the stock market are also considered to be in the list of resignation. Chairmen of major financial groups that showed major ties to President Lee are resigning. While Saneun Financial Group has already chosen Hong Gi-taek as the next chairman following ex-Chairman Kang Man-su, KB and Woori financial groups are in the processes of choosing their next leaders.
Apr. 10, 2013	Newspim "Board Members of FSS Resign Together, Mass Resignation from 2008 Repeated?"	All 9 board members of Financial Supervisory Service have resigned, making the public wonder whether mass resignation from 2008 would be repeated. On the year 2008, when President Lee's administration started, 11 board members have resigned and 6 people were replaced with people from outside. MB administration was distinct in that it specifically elected members to be replaced, rather than following the traditional move to simply investigate the members.
Apr. 19, 2013	Seoul Finance "Are MB Men Financial Sector Chairmen Followed by Public Companies?"	As many representative MB figures start to resign, leaders in the stock market have fears that they might be next in line for replacement. Some of the four major finance leaders, like Chairman Lee Pal-sung of Woori Financial Group and Chairman Kang Man-su of KDB Financial Group, who had ties to President Lee with their schools and hometown already resigned. The public is predicting that the people next in line to be replaced are leaders in securities businesses.

Table A.3: News Articles Concerning the Fate of Lee Myung Bak-Related Individuals under Park Geun Hye (continued)

Date	Paper, Headline	Content
Sep. 23, 2013	Ilyosisa "Park Geun-Hye Administration is Erasing MB Before and After"	The Park administration tries to erase all memories of MB administration by developing investigations of last administration's controversies and scandals and replacing the people who were appointed from MB years. A good example would be the "Financial Big 4" appointed during MB who have resigned one after another. Numerous CEOs of public firms have been pressured to resign, like Mr. Jang Tae-pyung, CEO of the Korean Horse Affairs Association who resigned, leaving 1 year and 2 months left in his term. Mr. Jung Jeong-kil, director of the Academy of Korean Studies, also resigned. Both of them share the fact that they are widely known as "MB men."
Nov. 11, 2013	Seoul Shinmun "Weeding Out MB Parachute Appointments in Park Administration... Appointment Cruelty Every 5 Years"	Even though there are legal processes and organizations to prevent the measure, public firms face a mass change in their leaders every 5 years, especially the ones who were appointed by the past administration. During the first 9 months of Park administration, many MB men whose terms have been extended by one year have received the full impact of this change, including Korea Gas Corporation, Korea District Heating Corp., and Korea Exchange. Many officials of the public firms, for this reason, have resigned themselves first, like Korea Technology Finance Corporation, Koscom, and Korea Securities Depository. Also, many Hyundai figures and past participants of presidential transition team resigned, expecting the tide of mass personnel change.
Nov. 12, 2013	Sedaily "End of MB Men in Financial Sector Speeds Up"	Leaders in the financial sector from past administration are getting nervous as the Park administration tries to expand its effort to cut off influences of MB ... For example, Kim Bong-soo, the chief director of Korea Exchange, resigned as one of the representative MB figures who graduated from the Law School of Korea University. Mr. Kim was replaced by Mr. Choi Kyung-soo, the former chairman of Hyundai Securities, whose appointment created some controversies as he himself was involved in President Park's election campaign. Other leaders of financial sector, like Mr. Kim Jung-guk, chief director of Korea Technology Finance Corporation, Mr. Kim Kyung-dong, chairman of Korea Securities Depository, Mr. Woo Ju-ha, chairman of Koscom, all expressed their desire to resign as MB men who received pressures from the new administration. Also, Kang Man-su, Lee Pal-sung, Uh Yun-dae, and Kim Seung-yu who were called the Big 4 of the financial sector during MB administration all resigned. One representative of the financial sector commented, "Until now every time the administration changes, the financial sector has repeated its parachute appointments, which in most cases ended negatively. I am worried as the new administration tries to erase the influences of the past administration completely, a big tornado will arise in the financial sector at the end of this year.

This table lists articles from the financial press related to resignations of people from Lee Myung Bak's networks in different places in the administration and from private banks following the election of Park Geun Hye. The first column shows the date of publication, the second column states the source of the article, and the last column summarizes the relevant passages of the article.

Table A.4: News Articles Concerning the Appointment of Park Geun Hye-Related Individuals in Banks

Date	Paper, Headline	Content
Apr. 5, 2013	Seoul Shinmun "The Repayment Appointment of People From Sogang University"	The new appointment of Mr. Hong Gi-taek, professor of Chung-Ang University, as the president of Saneun Financial Group is interpreted as a strong move to change the tide of finance by placing personnel at the front who share the governmental management philosophy with the president. Mr. Hong, considered as a typical "Sogang School" man was a member of the 1st Economics Department of the Commission on the 18th Presidential Transition. Mr. Hong has been known in the field of international finance. He is also a founding member of National Future Research Institute, a presidential think tank of President Park. He has served as the assistant of economics and finance policies to President Park who went to the same university. He is known for his preciseness and his early adopting for IT. However, he does not have any tangible finance experiences. He once served both in transition team and as the nonexecutive director of Nonghyup Financial Group, but stopped once a controversy arose. He was also known for his peculiar actions and words while he served in the transition team. Saneun is expressing both concerns about his lack of experience and excitement for his political ties.
Sep. 1, 2014	Kyunghang Shinmun "Even the Auditor of Export-Import Bank in Controversy of Pro-Park Parachute"	Controversies are rising as Mr. Gong Myung-jae, a person from President Park Geun Hye's presidential election campaign, is appointed as the auditor of Export-Import Bank. He is pro-Park personnel and graduated from Sogang University with an economics degree just like President Lee Duk-hoon. Since the beginning of the Park administration, personnel who graduated from Sogang University are being appointed in finance companies. Former president of Woori Bank Lee Duk-hun who graduated from Sogang University took office last March as president of Export-Import Bank. He has been considered as one of the main ties of "So-Kum-Hoi" as the center of economic ties of Sogang University. President of Saneun Financial Group, Mr. Hong Gi-taek- is also from Sogang University.
Dec. 2, 2014	Kyunghang Shinmun "So-Kum-Hoi"	One of the most dynamic seats after a change in administration is the personnel department of banks. During the term of President Roh Moo-hyun, Busan Commercial High School was referred to as the "Harvard Commercial High School". However, with the administration of President Lee Myung-bak, this group lost its power. Dongji Commercial High School, however, did not have as many graduates – only Choi Won-Byung, president of Nonghyup or Lee Hyu-won, president of Shinhan Investment, were selected. Instead, graduates from Korea University took over the seats of leadership position in the banks. There was the age of the 4 Great Kings with Kim Seung-yoo (Hana), Lee Pal-sung (Woori), Uh Yoon-dae (KB) and Kang Man-su (the Korea Development Bank) as presidents. Now, the financial industry is being controlled by graduates from Sogang University with President Park Geun-hye's arrival. Lee Kwang-gu, the appointee for the next president of Woori Bank and newly appointed president of KDB Daewoo Securities Hong Sung-guk are all members of "So-Kum-Hoi" (a group of financiers who graduated from Sogang University). Both of the firms are owned by the government, and even though there is a recommendation committee, it is useless if the central power appoints someone. Even though it did not look powerful initially, president of Export-Import Bank, president of Koscom, president of LIG Insurance, president of Shinhan Capital have all come from this group, increasing in its dominance.
Mar. 16, 2017	E-Today "Appointments Based on Alumni or Regional Networks Will Destroy the Financial Sector in Korea"	A bank executive stated that there are still many people who attempt to enter into important positions in the financial sector using their alumni or regional networks. Lately, there have been controversies regarding the appointments based on these networks. For example, "So-Keum-hui" is an association of people in the financial sector that graduated from Sogang university (where President Park graduated from). For example, Lee Kwang-gu (Woori bank CEO), Lee Duk-hoon (Import-Export bank executive), and Hong Ki-Taek (Industrial bank CEO) are all from "So-Keum-hui".

This table lists articles from the financial press related to the appointment of people from Park Geun Hye's networks in private and government banks. The first column shows the date of publication, the second column states the source of the article, and the last column summarizes the relevant passages of the article.

Table A.5: **Credit Volumes and Interest Rates - Long-Connected Firms**

	I	II	III	IV	V	VI	VII
	Firm-Level			Relationship-Level			
Dep. Var.:	$\log(loans)_{it}$	$\left(\frac{loans}{assets}\right)_{it}$	IR_{it}	$\log(loans)_{ijt}$	$\left(\frac{loans}{assets}\right)_{ijt}$	IR_{ijt}	rel_{ijt}
$KU_i * election_t$	0.4560**	0.0501***	-0.0019*				
	(0.1822)	(0.0191)	(0.0010)				
$KU_i * KU_j * election_t$				0.5083**	0.0738***	-0.0031**	0.1659*
				(0.2530)	(0.0231)	(0.0014)	(0.0857)
$alum\ link_{ijt}$				0.4352***	0.0304**	-0.0040***	0.1439***
				(0.1118)	(0.0154)	(0.0011)	(0.0446)
Firm FE	-	-	-	yes	yes	yes	yes
Bank FE	-	-	-	yes	yes	yes	yes
Clustered SE	-	-	-	firm	firm	firm	firm
Observations	33,516	31,205	32,993	61,618	58,123	60,105	61,745
R-squared	0.716	0.706	0.755	0.944	0.958	0.944	0.933

This table shows the results from estimating equation (1) in columns I to III, and equation (2) in columns IV to VII. The dependent variable is the log of firm i's total loans in year t in column I, firm i's loans to assets ratio in column II, firm i's average interest rate in column III, the log of loans from bank j to firm i in column IV, the ratio of loans from bank j to firm i and firm i's assets in column V, the average interest rate on loans from bank j to firm i in column VI, and a variable that takes the value of one if a lending relationship between firm i and bank j starts in year t, minus one if a lending relationship between firm i and bank j ends in year t, and zero in other years in column VII. The variable KU_i takes the value of one for firms that have a CEO from Korea University in 2004 and zero otherwise. The variable KU_j takes the value of one if bank j becomes connected to the KU network by appointing an executive from Korea University after the election and zero otherwise. The variable $election_t$ takes the value of one for the post-election period from 2008 to 2012 and zero for the pre-election period from 2003 to 2007. The variable $alum\ link_{ijt}$ takes the value of one if firm i's CEO and a bank j executive are from the same alumni network, other than Korea University, in year t and zero otherwise. Standard errors are reported in parentheses.

Appendix B.   Model Extension

We extend the model from Section 5.1 to show that the economic insights hold in the case of multiple firms and banks of each type. We denote the fraction of in-group firms in total firms as α, and the fraction of government banks in total banks as β. Firms are randomly matched with two banks. We hold all other assumptions from Section 5.1 constant.

For each firm, there are three scenarios:

- Scenario 1: The firm is matched with two government banks.

- Scenario 2: The firm is matched with two private banks.

- Scenario 3: The firm is matched with one government and one private bank.

We subsequently use superscripts to refer to the different scenarios S1 to S3.

We assume that when firms meet two banks the probability with which they meet a specific type of bank in their second draw is unaffected by the type of the first bank they meet, i.e. $N_{typeA}/(N_{typeA}+N_{typeB}) \approx (N_{typeA}-1)/(N_{typeA}+N_{typeB}-1)$. Thus, the probability to meet two government banks is β^2, the probability to meet two private banks is $(1-\beta)^2$ and the probability to meet one bank of each type is $2\beta(1-\beta)$. We make this assumption purely to simplify notation and it does not affect the qualitative insights.

Case A: In Case A government and private banks are unbiased. Since both types of firms and banks behave identically nothing changes when we allow for multiple firms and banks compared to the basic model in Section 5.1. Thus, all projects that yield positive returns are realized and projects that yield negative returns are not financed.

Case B: In Case B government banks are biased towards the in-group firm. That is, the cost of borrowing from a government bank is $\rho - \gamma_I$ for in-group firms and $\rho + \gamma_O$ for out-group firms. Private banks are unbiased.

From firms' perspective each scenario corresponds to one of the cases in the basic model in Section 5.1. For example, for an in-group firm meeting two government banks that are biased in favor of in-group firms is identical to meeting a government and a private bank that are both biased in favor of in-group firms. Thus, we already know the solutions to the firms' investment problem from the basic model.

Firms' participation constraints under the different scenarios are

$$r \geq \rho - \gamma_I \qquad\qquad (PC_I^{B,S1})$$

$$r \geq \rho \qquad\qquad (PC_I^{B,S2})$$

$$r \geq \rho - 1/2 \cdot \gamma_I \qquad\qquad (PC_I^{B,S3})$$

for in-group firms, and

$$r \geq \rho + \gamma_O^B \qquad\qquad (PC_O^{B,S1})$$

$$r \geq \rho \qquad\qquad (PC_O^{B,S2})$$

$$r \geq \rho + 1/2 \cdot \gamma_O^B \qquad\qquad (PC_O^{B,S3})$$

for out-group firms.

Banks' participation constraints differ from the basic model since banks take into account lending to all firms and their behavior across all scenarios. Since private banks do not discriminate between firms, their participation constraint is trivially satisfied. For the government bank the participation constraint changes to:

$$\rho\frac{F}{2} = \alpha\frac{F}{2}[\beta p_{I,GG}^B + (1-\beta)p_{I,GP}^B](\rho - \gamma_I) + (1-\alpha)\frac{F}{2}[\beta p_{O,GG}^B + (1-\beta)p_{O,GP}^B](\rho + \gamma_O^B)$$

which implies that $\gamma_O^B = \gamma_I \frac{\alpha}{1-\alpha}\frac{\beta p_{I,GG}^B + (1-\beta)p_{I,GP}}{\beta p_{O,GG}^B + (1-\beta)p_{O,GP}}$. Note that γ_O is increasing in α. Intuitively, the more in-group firms there are, the more losses government banks need to make up for by charging out-group firms a higher rate. This effect is amplified by the fact that the less out-group firms they meet, the more losses government banks have to recover per out-group firm.

Case C1: In Case $C1$ both government and private banks are biased toward in-group firms. That is, the cost of borrowing from any bank is $f - \gamma_I$ for in-group firms and $f + \gamma_O^{C1}$ for out-group firms.

Firms' participation constraints are the same as in Case C1 in the basic model for all scenarios with

$$r \geq \rho - \gamma_I \qquad\qquad (B1)$$

for in-group firms, and

$$r \geq \rho + \gamma_O \qquad\qquad (B2)$$

for out-group firms. Distortions are independent of the share of government banks β, but increase with the share of in-group firms α.

For banks the break-even constraint is given by:

$$\rho(\alpha\frac{F}{2} + (1-\alpha)\frac{F}{2}) = \alpha p_I^{C1}(\frac{F}{2})(\rho - \gamma_I) + (1-\alpha)p_O^{C1}(\frac{F}{2})(\rho + \gamma_O^{C1})$$

which implies that $\gamma_O^{C1} = \gamma_I \frac{\alpha}{1-\alpha} \frac{p_I^{C1}}{p_O^{C1}}$. The more in-group firms banks face, the more losses they make due to lending to them at favorable rates and the higher the rate on out-group firms has to be. Additionally, if there are fewer out-group firms, the rate increase per out-group firm needs to be higher.

Case C2: In Case $C2$ while government banks are biased towards in-group firms, private banks are biased towards out-group firms. We further assume that out-group firms consist of heterogeneous groups, and a given private bank is not biased in favor of all out-group firms, but only out-group firms controlled by the same network as the private bank. We denote private banks controlled by the same network as a firm by Ps and private banks controlled by a different network by Pd. The probability that a given private bank is controlled by the same network as a given firm is δ. We assume that all groups, in-group and out-group firms, are of equal size, i.e. $\alpha = (1 - \alpha) \cdot \delta$. This ensures that differences in distortions across cases are driven by the correlation between banks' biases rather than differences in group size, which would be a discussion beyond the scope of this paper.

Given that out-group firms experience different lending terms depending on whether they meet a favorable or unfavorable private bank, Scenarios 2 and 3 need to be split up into five sub-scenarios:

- Scenario 2a: The out-group firm is matched with two private banks, both of which are controlled by a different group.

- Scenario 2b: The out-group firm is matched with two private banks, both of which are controlled by the same group.

- Scenario 2b: The out-group firm is matched with two private banks, one of which is controlled by the same group and one of which is controlled by a different group.

- Scenario 3a: The out-group firm is matched with one government and one private bank that is controlled by a different group.

- Scenario 3b: The out-group firm is matched with one government and one private bank that is controlled by the same group.

Based on the insights from the basic model, we can derive firms' participation constraints

under the different scenarios as

$$r \geq \rho - \gamma_I \qquad\qquad (PC_I^{C2,S1})$$

$$r \geq \rho + \gamma_{OP} \qquad\qquad (PC_I^{C2,S2})$$

$$r \geq \rho - 1/2 \cdot \gamma_I + 1/2 \cdot \gamma_{OP} \qquad\qquad (PC_I^{C2,S3})$$

for in-group firms, and

$$r \geq \rho + \gamma_{OG} \qquad\qquad (PC_O^{C2,S1})$$

$$r \geq \rho + \gamma_{OP} \qquad\qquad (PC_O^{C2,S2a})$$

$$r \geq \rho - \gamma_I \qquad\qquad (PC_O^{C2,S2b})$$

$$r \geq \rho - 1/2 \cdot \gamma_I + 1/2 \cdot \gamma_{OP} \qquad\qquad (PC_O^{C2,S2c})$$

$$r \geq \rho + 1/2 \cdot \gamma_{OG} + 1/2 \cdot \gamma_{OP} \qquad\qquad (PC_O^{C2,S3a})$$

$$r \geq \rho - 1/2 \cdot \gamma_I + 1/2 \cdot \gamma_{OG} \qquad\qquad (PC_O^{C2,S3b})$$

for out-group firms.

The government bank's break-even constraint is given by:

$$\rho \frac{F}{2} = \alpha \frac{F}{2} [\beta p_{I,GG}^{C2} + (1-\beta) p_{I,GP}^{C2}](\rho - \gamma_I)$$
$$+ (1-\alpha)\frac{F}{2}[\beta p_{O,GG}^{C2} + (1-\beta)(\delta p_{O,GPs}^{C2} + (1-\delta)p_{O,GPd}^{C2})](\rho + \gamma_{OG})$$

implies that $\gamma_{OG} = \gamma_I \frac{\alpha}{1-\alpha} \frac{\beta p_{I,GG}^{C2} + (1-\beta)p_{I,GP}^{C2}}{\beta p_{O,GG}^{C2} + (1-\beta)(\delta p_{O,GPs}^{C2} + (1-\delta)p_{O,GPd}^{C2})}$.

The private bank's participation constraint is given by:

$$\rho \frac{F}{2} = \frac{F}{2}(\alpha[\beta p_{O,GPs}^{C2} + (1-\beta)p_{O,PdPd}^{C2}]$$
$$+ (1-\alpha)(1-\delta)[\beta p_{O,GPd}^{C2} + (1-\beta)\delta p_{O,PsPd}^{C2} + (1-\beta)(1-\delta)p_{O,PdPd}^{C2}])(\rho + \gamma_{OP})$$
$$+ (1-\alpha)\delta\frac{F}{2}[\beta p_{O,GPs}^{C2} + (1-\beta)\delta p_{O,PsPs}^{C2} + (1-\beta)(1-\delta)p_{O,PdPs}^{C2}](\rho - \gamma_I)$$

which implies $\gamma_{OP} = \gamma_I \frac{(1-\alpha)\delta[\beta p_{O,GPs}^{C2} + (1-\beta)\delta p_{O,PsPs}^{C2} + (1-\beta)(1-\delta)p_{O,PdPs}^{C2}]}{\alpha[\beta p_{O,GPs}^{C2} + (1-\beta)p_{O,PdPd}^{C2}] + (1-\alpha)(1-\delta)[\beta p_{O,GPd}^{C2} + (1-\beta)\delta p_{O,PsPd}^{C2} + (1-\beta)(1-\delta)p_{O,PdPd}^{C2}]}$.
If all groups are of equal size implies we can replace $(1-\alpha)\delta$ by α.

Thus, $\gamma_{OP} = \gamma_I \frac{\alpha}{1-\alpha} \frac{\beta p_{O,GPs}^{C2} + (1-\beta)\delta p_{O,PsPs}^{C2} + (1-\beta)(1-\delta)p_{O,PdPs}^{C2}}{\delta[\beta p_{O,GPs}^{C2} + (1-\beta)p_{O,PdPd}^{C2}] + (1-\delta)[\beta p_{O,GPd}^{C2} + (1-\beta)\delta p_{O,PsPd}^{C2} + (1-\beta)(1-\delta)p_{O,PdPd}^{C2}]}$.

Comparing Cases The aggregate distortions in each case depend on the distortions in each of the three scenarios and the probability with which they occur. Thus, to compute the aggregate investment distortions, we identify the scenarios in which investment distortions occur, and multiply the probability of them occurring with the expected magnitude of the investment distortions for a given scenario.

Case A: Since all banks are unbiased and firms only invest in projects that are higher

than or equal to banks' costs of providing capital, there are no distortions in Case A.

Case B: Distortions occur whenever a government bank is involved (Scenarios 1 and 3), since the government bank exhibits a bias towards in-group firms, which introduces a wedge between banks' and firms' cost of capital. Weighted by the probability of each scenario occurring, aggregate investment distortions can be computed as: $\Sigma^B = \alpha\beta^2 \cdot \mathbb{P}[\rho - \gamma_I \le r < \rho] \cdot \mathbb{E}[r | \rho - \gamma_I \le r < \rho] + 2\alpha\beta(1-\beta) \cdot \mathbb{P}[\rho - 1/2\gamma_I \le r < \rho] \cdot \mathbb{E}[r | \rho - 1/2\gamma_I \le r < \rho] + (1-\alpha)\beta^2 \cdot \mathbb{P}[\rho < r \le \rho + \gamma_O^B] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_O^B] + 2(1-\alpha)(1-\beta)\beta \cdot \mathbb{P}[\rho < r \le \rho + 1/2\gamma_O^B] \cdot \mathbb{E}[r | \rho < r \le \rho + 1/2\gamma_O^B]$, which yields: $\Sigma^B = \frac{1}{\bar{r}-\underline{r}}[\frac{1}{2}\alpha\gamma_I^2 + \frac{1}{2}(1-\alpha)(\gamma_O^B)^2](\beta^2 + \frac{1}{2}\beta(1-\beta))$.

Intuitively, distortions are generated whenever in-group firms meet government banks. In cases in which an in-group firm meets two government banks, the distortions are twice as large than in cases in which an in-group firm meets only one government banks. Since government banks need to break even, favorable lending to in-group firms leads to additional distortions since government banks charge out-group firms a rate that is higher than the cost of capital in the economy to recover their losses from lending to in-group firms below the cost of capital.

Case C1: Distortions occur in all scenarios since all banks exhibit a bias towards in-group firms and aggregate investment distortions can be computed as: $\Sigma^{C1} = \alpha \cdot \mathbb{P}[\rho - \gamma_I \le r < \rho] \cdot \mathbb{E}[r | \rho - \gamma_I \le r < \rho] + (1-\alpha)\beta^2 \cdot \mathbb{P}[\rho < r \le \rho + \gamma_O^{C1}] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_O^{C1}]$, which yields: $\Sigma^{C1} = \frac{1}{\bar{r}-\underline{r}}[\frac{1}{2}\alpha\gamma_I^2 + \frac{1}{2}(1-\alpha)(\gamma_O^{C1})^2]$.

Intuitively, distortions are generated whenever in-group firms meet any banks. Since banks need to break even, favorable lending to in-group firms leads to additional distortions since banks charge out-group firms a rate that is higher than the cost of capital in the economy to recover their losses from lending to in-group firms below the cost of capital.

Case C2: Distortions occur in all scenarios since all banks exhibit a bias and aggregate investment distortions can be computed as: $\Sigma^{C2} = \alpha\beta^2 \cdot \mathbb{P}[\rho - \gamma_I \le r < \rho] \cdot \mathbb{E}[r | \rho - \gamma_I \le r < \rho] + \alpha(1-\beta)^2 \cdot \mathbb{P}[\rho < r \le \rho + \gamma_{OP}^{C2}] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_{OP}^{C2}] + 2\alpha\beta(1-\beta) \cdot \mathbb{P}[\rho < r \le \rho + \gamma_{OP}^{C2} - \gamma_I] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_{OP}^{C2} - \gamma_I] + (1-\alpha)\beta^2 \cdot \mathbb{P}[\rho < r \le \rho + \gamma_{OG}^{C2}] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_{OG}^{C2}] + 2(1-\alpha)\beta(1-\beta)(1-\delta) \cdot \mathbb{P}[\rho < r \le \rho + \frac{1}{2}\gamma_{OG}^{C2} + \frac{1}{2}\gamma_{OP}^{C2}] \cdot \mathbb{E}[r | \rho < r \le \rho + \frac{1}{2}\gamma_{OG}^{C2} + \frac{1}{2}\gamma_{OP}^{C2}] + (1-\alpha)(1-\beta)^2(1-\delta)^2 \cdot \mathbb{P}[\rho < r \le \rho + \gamma_{OP}^{C2}] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_{OP}^{C2}] + (1-\alpha)(1-\beta)^2\delta^2 \cdot \mathbb{P}[\rho - \gamma_I \le r < \rho] \cdot \mathbb{E}[r | \rho - \gamma_I \le r < \rho] + 2(1-\alpha)(1-\beta)^2\delta(1-\delta) \cdot \mathbb{P}[\rho < r \le \rho + \gamma_{OP}^{C2} - \gamma_I] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_{OP}^{C2} - \gamma_I] + 2(1-\alpha)\beta(1-\beta)\delta \cdot \mathbb{P}[\rho < r \le \rho + \gamma_{OG}^{C2} - \gamma_I] \cdot \mathbb{E}[r | \rho < r \le \rho + \gamma_{OG}^{C2} - \gamma_I]$, which yields: $\Sigma^{C2} = \frac{1}{\bar{r}-\underline{r}}[\frac{1}{2}(\alpha\beta^2 + \alpha(1-\beta)^2\delta)\gamma_I^2 + \frac{1}{2}(\alpha(1-\beta)^2 + (1-\alpha)(1-\beta)^2(1-\delta)^2)(\gamma_{OP}^{C2})^2 + \frac{1}{2}((1-\alpha)\beta^2)(\gamma_{OG}^{C2})^2 + \frac{1}{4}((1-\alpha)\beta(1-\beta)(1-\delta))(\gamma_{OP}^{C2} + \gamma_{OG}^{C2})^2 + \frac{1}{4}(\alpha(1-\beta)^2(1-\delta) + \alpha\beta(1-\beta))(\gamma_{OP}^{C2} - \gamma_I)^2 + \frac{1}{4}(\alpha\beta(1-\beta))(\gamma_{OG}^{C2} - \gamma_I)^2]$.

Intuitively, distortions are generated whenever in-group firms meet government banks

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and when out-group firms meet a private bank controlled by the same network. In cases in which an in-group firm meets two government banks or out-group firms meet two private banks from their group, the distortions are twice as large than in cases in which an in-group firm meets only one government banks or an out-group firm meets only one private bank linked to their group. Since banks need to break even, favorable lending to one group of firms leads to additional distortions since banks charge other groups of firms a rate that is higher than the cost of capital in the economy to recover their losses from lending to in-group firms below the cost of capital. In addition, if firms meet one bank that is biased in favor of them and one bank that is biased unfavorably, some of the distortions offset each other.

Comparing Cases   Finally, we compare the size of aggregate investment distortions across different cases to demonstrate that distortions are largest when government and private banks are biased towards the same group of firms (Case C1).

Proposition B.1 $\Sigma^{C1} \geq \Sigma^B$.

The intuition underlying this proposition is that under Case B distortions are only generated when government banks are involved, whereas under Case C1 distortions are generated for each bank's involvement. Thus, distortions are larger under Case C1, except for the case in which all banks are government banks in which case both cases converge and distortions are equal across both cases.

Proof.

$\Sigma^{C1} \geq \Sigma^B \Leftrightarrow \alpha \frac{1}{2}\gamma_I + (1-\alpha)\frac{1}{2}\gamma_O^{C1} \geq \alpha\frac{1}{2}(\beta^2 + \frac{1}{2}\beta(1-\beta))\gamma_I + (1-\alpha)\frac{1}{2}(\beta^2 + \frac{1}{2}\beta(1-\beta))\gamma_O^B$

First, note that $\beta^2 + \frac{1}{2}\beta(1-\beta) \leq 1$. Thus, $\alpha\frac{1}{2}\gamma_I + (1-\alpha)\frac{1}{2}\gamma_O^B \geq \alpha\frac{1}{2}(\beta^2 + \frac{1}{2}\beta(1-\beta))\gamma_I + (1-\alpha)\frac{1}{2}(\beta^2 + \frac{1}{2}\beta(1-\beta))\gamma_O^B$. Hence, $\alpha\frac{1}{2}\gamma_I + (1-\alpha)\frac{1}{2}\gamma_O^{C1} \geq \alpha\frac{1}{2}\gamma_I + (1-\alpha)\frac{1}{2}\gamma_O^B$ implies $\Sigma^{C1} \geq \Sigma^B$. Consequently, what remains to be shown is that $\gamma_O^{C1} \geq \gamma_O^B$.

Since $p_I^{C1} = p_{I,GG}^B > p_{I,GP}^B$ and $p_O^{C1} = p_{O,GG}^B < p_{O,GP}^B$, it follows from the solutions for γ_O^B and γ_O^{C1} that $\gamma_O^B < \gamma_O^{C1}$.

Proposition B.2 $\Sigma^{C1} \geq \Sigma^{C2}$.

The intuition underlying this proposition is that while under Case C1 distortions are generated whenever a bank meets an in-group firm, and under Case C2 distortions are generated whenever a government bank meets an in-group firm and whenever an out-group firm meets a friendly private bank, when an in-group firm meets a government and a private bank or when an out-group firms meets a friendly private banks and another bank some of the distortions are offset under Case C2.

Proof.

After simplifying algebra, it follows that $\Sigma^{C1} \geq \Sigma^{C2} \Leftrightarrow \alpha\frac{1}{2}\gamma_I^2 + (1-\alpha)\frac{1}{2}(\gamma_O^{C1})^2 \geq \alpha\frac{1}{2}\gamma_I^2[\beta + (1-\beta)^2\delta - \frac{1}{2}(1-\beta)^2(1-\delta) + \beta(1-\beta)] + (1-\alpha)\frac{1}{2}(\gamma_{OP}^{C2})^2[(\delta + (1-\delta)^2 + \frac{1}{2}\delta(1-\delta))(1-\beta)^2 + \frac{1}{2}\beta(1-\beta)] + (1-\alpha)\frac{1}{2}(\gamma_{OG}^{C2})^2[\beta^2 + \frac{1}{2}\beta(1-\beta)] + (1-\alpha)\frac{1}{2}\gamma_{OG}^{C2}\gamma_{OP}^{C2}[\beta(1-\beta)(1-\delta)]$.

For the inequality to be true, we need to show three things: First, the terms in brackets need to be smaller or equal to one individually and jointly for all brackets multiplied with either of the γ_O^{C2}. Second, $\gamma_O^{C1} \geq \gamma_{OP}^{C2}$. Third, $\gamma_O^{C1} \geq \gamma_{OG}^{C2}$.

Regarding the first condition, it can be verified that all of the brackets have a maximum value of one individually and jointly for all brackets multiplied with either of the γ_O^{C2} by simple algebra.

From the definitions of γ_O^{C1} and γ_{OG}^{C2} it follows that
$\frac{\beta\mathbb{P}[r\geq\rho+\gamma_{OG}^{C2}]+(1-\beta)(1-\delta)\mathbb{P}[r\geq\rho+\frac{1}{2}\gamma_{OP}^{C2}+\frac{1}{2}\gamma_{OG}^{C2}]+(1-\beta)\delta\mathbb{P}[r\geq\rho+\frac{1}{2}\gamma_{OG}^{C2}-\frac{1}{2}\gamma_I]}{\beta\mathbb{P}[r\geq\rho-\gamma_I]+(1-\beta)\mathbb{P}[r\geq\rho-\frac{1}{2}\gamma_I+\frac{1}{2}\gamma_{OP}^{C2}]}\gamma_{OG}^{C2} = \frac{\mathbb{P}[r\geq\rho+\gamma_O^{C1}]}{\mathbb{P}[r\geq\rho-\gamma_I]}\gamma_O^{C1}$. Since $\mathbb{P}[r \geq \rho - \gamma_I] > \mathbb{P}[r \geq \rho - \frac{1}{2}\gamma_I + \frac{1}{2}\gamma_{OP}^{C2}]$, it has to be true that $\beta\mathbb{P}[r \geq \rho + \gamma_{OG}^{C2}] + (1-\beta)(1-\delta)\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OP}^{C2} + \frac{1}{2}\gamma_{OG}^{C2}] + (1-\beta)\delta\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OG}^{C2} - \frac{1}{2}\gamma_I] < \mathbb{P}[r \geq \rho + \gamma_O^{C1}]\gamma_O^{C1}$.

This implies that $\beta\mathbb{P}[r \geq \rho + \gamma_{OG}^{C2}] + (1-\beta)(1-\delta)\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OP}^{C2} + \frac{1}{2}\gamma_{OG}^{C2}] + (1-\beta)\delta\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OG}^{C2} - \frac{1}{2}\gamma_I] < \mathbb{P}[r \geq \rho + \gamma_O^{C1}]\gamma_O^{C1} \Leftrightarrow (\bar{r} - \rho)(\gamma_O^{C1} - \gamma_{OG}^{C2}) > (\gamma_O^{C1})^2 + \beta(\gamma_{OG}^{C2})^2 + \frac{1}{2}(1-\beta)(1-\delta)\gamma_{OG}^{C2}\gamma_{OP}^{C2} - \frac{1}{2}(1-\beta)\delta\gamma_{OG}^{C2}\gamma_I$. There is no value for γ_{OG}^{C2} with $\gamma_O^{C1} < \gamma_{OG}^{C2} \leq (r-\rho)$ for which this inequality is satisfied. Plugging in the lowest (0) and highest (γ_{OG}^{C2}) values for γ_O^{C1} reveals that the inequality is not satisfied for either corner solution. Furthermore, since the right-hand side is a convex function of of γ_O^{C1} whereas the left-hand side is a linear function of γ_O^{C1}, the values of the right-hand side and left hand-side do not cross between the corner solutions. Hence, it cannot be true that $\gamma_{OG}^{C2} > \gamma_O^{C1}$.

From the definitions of γ_O^{C1} and γ_{OP}^{C2} it follows that
$\frac{\beta\mathbb{P}[r\geq\rho+\frac{1}{2}\gamma_{OP}^{C2}-\frac{1}{2}\gamma_I]+(1-\beta)(\delta+(1-\delta)^2)\mathbb{P}[r\geq\rho+\gamma_{OP}^{C2}]+\beta(1-\delta)\mathbb{P}[r\geq\rho+\frac{1}{2}\gamma_{OG}^{C2}+\frac{1}{2}\gamma_{OP}^{C2}]+(1-\beta)(1-\delta)\delta\mathbb{P}[r\geq\rho+\frac{1}{2}\gamma_{OP}^{C2}-\frac{1}{2}\gamma_I]}{\beta\mathbb{P}[r\geq\rho+\frac{1}{2}\gamma_{OG}^{C2}-\frac{1}{2}\gamma_I]+(1-\beta)\delta\mathbb{P}[r\geq\rho-\gamma_I]+(1-\beta)(1-\delta)\mathbb{P}[r\geq\rho+\frac{1}{2}\gamma_{OP}^{C2}-\frac{1}{2}\gamma_I]}\gamma_{OP}^{C2} = \frac{\mathbb{P}[r\geq\rho+\gamma_O^{C1}]}{\mathbb{P}[r\geq\rho-\gamma_I]}\gamma_O^{C1}$.

Since $\mathbb{P}[r \geq \rho - \gamma_I] > \mathbb{P}[r \geq \rho - \frac{1}{2}\gamma_I + \frac{1}{2}\gamma_{OG}^{C2}]$, it has to be true that $\beta\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OP}^{C2} - \frac{1}{2}\gamma_I] + (1-\beta)\delta\mathbb{P}[r \geq \rho + \gamma_{OP}^{C2}] + \beta(1-\delta)\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OG}^{C2} + \frac{1}{2}\gamma_{OP}^{C2}] + (1-\beta)(1-\delta)\delta\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OP}^{C2} - \frac{1}{2}\gamma_I] + (1-\beta)(1-\delta)^2\mathbb{P}[r \geq \rho + \gamma_{OP}^{C2}]\gamma_{OP}^{C2} < \mathbb{P}[r \geq \rho + \gamma_O^{C1}]\gamma_O^{C1}$.

From this, it follow that $\beta\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OP}^{C2} - \frac{1}{2}\gamma_I] + (1-\beta)\delta\mathbb{P}[r \geq \rho + \gamma_{OP}^{C2}] + \beta(1-\delta)\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OG}^{C2} + \frac{1}{2}\gamma_{OP}^{C2}] + (1-\beta)(1-\delta)\delta\mathbb{P}[r \geq \rho + \frac{1}{2}\gamma_{OP}^{C2}] - \frac{1}{2}\gamma_I + (1-\beta)(1-\delta)^2\mathbb{P}[r \geq \rho + \gamma_{OP}^{C2}]\gamma_{OP}^{C2} < \mathbb{P}[r \geq \rho + \gamma_O^{C1}]\gamma_O^{C1} \Leftrightarrow (\bar{r} - \rho)(\gamma_O^{C1} - \gamma_{OP}) > (\gamma_O^{C1})^2 + \frac{1}{2}\beta(\gamma_{OP}^{C2} - \gamma_I)\gamma_{OP}^{C2} + (1-\beta)((1-\delta)^2 + \delta)(\gamma_{OP}^{C2})^2 + \frac{1}{2}(1-\delta)\beta(\gamma_{OP}^{C2} + \gamma_{OG}^{C2})\gamma_{OP}^{C2} + \frac{1}{2}(1-\beta)(1-\delta)\delta(\gamma_{OP}^{C2} - \gamma_I)\gamma_{OP}^{C2} \Leftrightarrow (\bar{r} - \rho)(\gamma_O^{C1} - \gamma_{OP}) > (\gamma_O^{C1})^2 + (1 - \frac{1}{2}\delta + \frac{1}{2}\delta^2 - \frac{1}{2}\beta\delta^2)(\gamma_{OP}^{C2})^2 - \frac{1}{2}(\beta + (1-\beta)(1-\delta)\delta)\gamma_I\gamma_{OP}^{C2} + \frac{1}{2}\beta(1-\delta)\gamma_{OG}^{C2}\gamma_{OP}^{C2}$. There is no value for γ_{OP}^{C2} with $\gamma_O^{C1} < \gamma_{OP}^{C2} \leq (r-\rho)$ for which this inequality is satisfied. Plugging in the lowest (0) and highest (γ_{OP}^{C2}) values for γ_O^{C1} reveals that the inequality is not satisfied

for either corner solution. Furthermore, since the right-hand side is a convex function of of γ_O^{C1} whereas the left-hand side is a linear function of γ_O^{C1}, the values of the right-hand side and left hand-side do not cross between the corner solutions. Hence, it cannot be true that $\gamma_{OP}^{C2} > \gamma_O^{C1}$.