Journal of International Money and Finance 91 (2019) 195–211

Contents lists available at ScienceDirect

Journal of International Money and Finance

journal homepage: www.elsevier.com/locate/jimf

Intellectual property rights reform and the cost of corporate debt ☆

Azizjon Alimov

City University of Hong Kong, Hong Kong SAR, China

ARTICLE INFO

Article history:
Available online 8 December 2018

JEL classification:
O34
G21
G30

Keywords:
Intellectual property rights
Bank loans

ABSTRACT

This paper investigates the role of intellectual property rights (IPR) protection on the cost of bank loans for firms in 48 countries. Using substantial reforms of patent rights as a source of identifying variation, the paper provides strong evidence that borrowers from countries that underwent IPR reform experience significant reductions in the cost of bank debt. Importantly, the effects of IPR reform on loan rates are significantly larger in industries that are more IP-intensive. Additional analysis shows that in the wake of reforms borrowers obtain larger size loans, which indicates that improvements in IPR are associated with greater credit availability. IPR reform also increases foreign lenders participation in loan syndicates. Overall, these findings suggest that legal protection afforded to intellectual property has a significant impact on the cost of corporate borrowing and the ability of innovative firms to raise debt capital.

1. Introduction

Intellectual property rights (IP, IPR) increasingly play a crucial role in the knowledge-based global economy by shaping firms' incentives to develop new technologies. Although there are certainly many factors that influence innovation, scholars and practitioners have long recognized that granting exclusive legal rights to IP holders can play a particularly powerful role in providing incentives for firms to develop proprietary knowledge (see, for example, Nelson (1959), Arrow (1962)). The main argument for such government intervention is that IP, that underpins innovation and knowledge, is largely intangible in nature and therefore hard for owners to protect from expropriation by competitors. Underscoring the importance of IP protection to business activity, the real effects of IPR is now one of the most active research areas in economics and finance (e.g., Branstetter et al., 2006; Bilir, 2014; Galasso and Schankerman, 2015; Lerner, 2002; Qian, 2007). While the literature has extensively examined the relation between IPR regimes and firm innovative and trade activities, we know relatively little about the effect of IPR protection on the supply and cost of external financing to corporations. This omission is surprising because a firm's ability to obtain external financing is crucial for its operations and performance. Documenting such indirect effects of IPR is also crucial to our understanding of the costs and benefits of policy reforms. The contribution of this paper is to provide a novel evidence on whether and how legal reforms that strengthen IPR affect the cost of bank loans extended to corporate borrowers around the world.

Understanding the effect of IPR protection on bank financing is important because bank credit is the most important source of external capital to firms around the world (e.g., Demirgüç-Kunt and Levine, 2001). Thus, if IPR reforms were to

☆ I thank Kai Li, Winston Wei Dou, Liu Yang, Micah Officer, and Qian Yi for helpful comments and discussions.
E-mail address: aaalimov@cityu.edu.hk

https://doi.org/10.1016/j.jimonfin.2018.12.004
0261-5606/

promote innovation and economic growth, private bank credit is the main channel through which innovative activities are likely to be funded. In addition, bank loans contracts contain both price (interest rate) and nonprice terms (such as loan amount) that reflect credit risk of borrowers and thus provide a rich laboratory for studying how private suppliers of capital deal with various risks inherent in IP assets.

This paper focuses on a key part of IPR: patent rights protection (i.e. set of regulations governing the protection of patentable inventions). Patents regulations generally allow inventors to earn monopoly profits for a fixed period of time backed by the threat of injunction for infringement. Throughout the 1990s and 2000s a number of countries undertook substantial reforms of their patent systems (IPR reform), which I exploit in this paper to empirically identify the effect of IPR. Importantly, these legal reforms allow me to avoid the endogeneity and omitted variable problems to the extent that these reforms are passed at the country-level and not directly influenced by any individual borrower or lender. Since IPR reforms were enacted by some countries in my sample and not others, such "quasi-natural" experimental design offers the opportunity to estimate the effect of IPR reform in the difference-in-difference framework.

Given that traditional economic view suggests that IP and intangible assets are poor candidates for external debt financing due to high information and moral hazard problem (Leland and Pyle, 1977), a natural question arises: Why would lenders be concerned about reforms of IPR protection? To understand the effect of IPR reform on the cost of bank debt and develop testable hypotheses, I use a simple framework in which the cost of debt is a function of a borrower's expected default risk and liquidation value of its assets. As discussed in the next section, I postulate that strengthening of IPR will facilitate the provision of bank financing by reducing lenders' concerns about borrowers' future cash flows and information-related problems and enhancing the borrowers' ability to pledge their patented inventions as collateral to secure debt. This argument yields the main difference-in-difference (DiD) hypothesis: the cost of bank debt decreases for corporate borrowers (especially those operating in IP-intensive sectors) located in countries that implement reforms strengthening patent protection compared to borrowers in countries that do not change patent laws.

I test this hypothesis on a large sample of bank loans made to firms from 48 countries (excluding United States) in the period from 1988 through 2007. Using international data allows me to exploit the larger (exogenous) variation in IPR reforms and their timing across countries, which strengthens my identification strategy. Using DiD tests, I find strong evidence that legal reforms that strengthen IPR lower the cost of bank debt for corporate borrowers. Compared to the "control" group of borrowers located in the nonreforming countries, the "treatment" group of borrowers located in the countries that strengthened IPR experience a drop in the cost of debt (as measured by loan spread) by approximately 20% or 45 basis points. In estimating this DiD effect, I include country- and year-fixed effects that absorb any time trends and persistent country characteristics and a rich set of borrower, loan, and country characteristics that could influence the terms and supply of bank credit. These demanding sets of control variables and fixed effects should help alleviate concerns that IPR reform may be correlated with other unobservable factors that also influence the cost of bank loans in a given country and time. Nevertheless, I conduct several robustness tests to address any remaining concerns about omitted and confounding factors, the timing of the effect and sample composition.

My next tests attempt to pinpoint the causal mechanism for the effect of IPR reform on the cost of debt by examining the differential impact of the reforms across industries with inherently different reliance on IP for production (following the methodology in Rajan and Zingales (1998)). The hypothesis is that if IPR indeed matters to lenders, the effect of reforms on the cost of borrowing should be stronger in sectors where intellectual assets and proprietary technologies are more important (and which thus should value reforms of IPR protection more). To test this hypothesis, I conduct a triple-differences test in which I contrast the impact of patent reforms on the cost of borrowing for firms operating in sectors with high versus low IP intensity. Consistent with the causal interpretation of results, I find that strengthening of patent rights protection has a greater negative effect on loan spreads for borrowers in industries with high IP-capital intensity (as characterized by relatively high spending on R&D and number of awarded patents).

The interpretation that strengthening of IPR protection facilitates firms' access to bank debt is strengthened by two additional findings. First, I find that following IPR reform, borrowers obtain larger size loans on average, which indicates that lenders are willing to extend more credit to companies. Second, I find that following IPR reform, foreign banks are more likely to retain a larger fraction of domestic syndicated loans, which suggests that IPR reform also aids in attracting foreign credit to the country. Collectively, these results suggest that the economic effect of IPR reform on the effective cost of borrowing is likely even greater than that implied by the loan spread decrease.

This paper contributes to a growing literature examining the effects of country-level IPR protection on corporate innovation, investment and knowledge -transfer. Allred and Park (1997) and Lerner (2002) find some evidence that patent reforms affects firms' innovation activities. Branstetter et al. (2006) find that U.S. multinationals increase technology transfers to their foreign affiliates when the affiliate host country improves IPR protection, and Bilir (2014) shows that this effect is stronger in industries with long product lifecycles and product complexity. Branstetter et al. (2011) show that IPR reforms provide the incentive for U.S. multinationals to expand production in foreign locations, and Alimov and Officer (2017) find that IPR reforms influence the volume, direction, and value effects of cross-border merger and acquisition activity. Qian (2007) shows that patent reforms increase domestic innovation but the effects is concentrated in economically developed markets. This paper contributes to this line of research by providing novel evidence suggesting that strengthening of IPR protection in a country facilitates the provision of bank financing for domestic firms. Consequently, this article extends our understanding of the economic effects of IPR by showing that strengthening of IPR protection can affect not only firms' incentives to innovate but also their ability to access external capital. Given a prominent role that IPR play in the global economy and intense

debates surrounding proposed changes in patent regimes around the world (e.g., Wall Street Journal 2011, 2015; The Economist 2015), the findings of this paper should be of importance to policy makers as well.

The findings of this paper also contribute to the international bank loan contracting literature. Previous studies have examined the role of country-level legal institutions, such as legal origin, creditor rights and rule of law, and national culture in bank debt contracting (La Porta et al., 1997; Djankov et al., 2007; Qian, 2007; Bae and Goyal, 2009; Alimov, 2015; Giannetti and Yafeh, 2012). This literature, however, largely overlooked the role of IPR protection in bank lending in part perhaps due to a traditional view suggesting that IP and intangibles are poor candidates for external debt finance (Leland and Pyle, 1977; Hall and Lerner, 2010). This paper also relates to recent U.S.-centered studies that show that patenting activity of U.S. publicly-traded firms and startups is related to the provision of bank and venture capital debt, such as Mann (2018), Hochberg et al. (2018), Chava et al. (2017), and Saidi and Zaldokas (2016). As noted above, using international data allows me to exploit the larger exogenous variation in IPR reforms and their timing across countries. In contrast, the U.S.A. did not experience any significant changes in its IPR protection during the sample (the Ginarte-Park index of patent rights for the U. S. is essentially unchanged between 1990 and 2010). The international setting therefore allows to evaluate the *role of IPR protection* on corporate debt contracting rather than then the role of patenting activity.

2. Theory and hypotheses

2.1. Analytical framework

At the outset of a lending relationship, a bank must invest in costly collection and analysis of information about a prospective borrower in order to assess her creditworthiness and set the price and non-price terms of loans accordingly. The price of debt is a function of the borrowing firm's expected default risk and the recovery rate in the event of default. In turn, default risk is determined by the likelihood that the borrower's future cash flows will be sufficient to repay all debt obligations. The recovery rate depends on the liquidation value of assets pledged as collateral (that creditors have the right to possess when the borrower defaults). Of course, the quality of information about the borrower that is available to the lender ("information risk") will affect the credit assessment as well. I postulate that there are three reasons for why strengthening of IPR protection could affect the corporate cost of borrowing by affecting the lender's assessment of the borrower's expected cash flow risk, the collateral value of its IP, and information risk.

First, by conferring stronger market power to the patent holder, stronger IPR may lead to higher and more stable profits and therefore reduce the uncertainty about borrower's future cash flows (Liu and Wong, 2011). Stronger IPR can also reduce lenders' concerns regarding the firm's ability to monetize a patented invention (for example, via licensing). Therefore, to the extent that the lenders' estimates of future cash flows affect credit risk of borrowers, stronger patent rights should improve the firm's creditworthiness and reduce its cost of borrowing.

Second, stronger IPR protection can boost the liquidity and redeployability of IP thereby enhancing firms' ability to use their patented inventions as collateral for secured debt. Collateral plays an important role in debt contracting because in the event of default banks can partially recover losses by taking a possession of pledged assets and selling them in the open market (Hart and Moore, 1994; Berger and Udell, 1990). While IP assets tend to be viewed as poor collateral due to their intangibility and concerns about redeployability (Hall and Lerner, 2010), recently lenders have been increasingly willing to accept patents as collateral (Mann, 2018). Thus, strengthening of IPR can create stronger security interests on the IP in the event of bankruptcy and therefore increase its liquidation value from the lenders' perspective. As such, increases in the collateral value of patents should reduce firms' borrowing cost and facilitate the provision of bank credit.

Finally, by granting stronger property rights on the firm's invention, IPR reform could affect the properties of "soft" information about the borrower's future prospects, which is costly to collect and thus is valuable in the lending process (Petersen and Rajan, 1994). This is especially true for borrowers with largely intangible assets, which have high information asymmetry problems. As Arrow (1962) suggests, in countries with stronger IPR, firms may be more willing to share the technical details of their patented inventions with outsiders without fear of expropriation. Therefore, strengthening of IPR could enhance the borrower's ability to securely disclose private "soft" information about its IP with the lender and thus reduce uncertainty about the firm's future prospects.

In sum, this analytical framework suggests that to the extent stronger IPR reduce creditors' concerns about the various dimensions of borrowing firms' riskiness, it is reasonable to expect that improvements in a country's IPR protection will lead to a decrease in the borrowing firms' credit risk, which will be passed along to the borrowers in the form of lower interest rates on bank loans.

This discussion leads to the following main hypothesis of the paper:

Hypothesis 1 (main hypothesis, H1): The cost of bank debt declines for corporate borrowers located in countries that implement legal reforms strengthening IPR protection compared to borrowers in countries that do not undertake reforms.

Because the causal mechanism that leads to this effect goes through the IP channel, it is natural to expect that any observed impact of IPR on the cost of loans will vary depending on the importance of IP to firms: the effect should be largest for borrowers that would value stronger IPR protection the most. Specifically, strengthening of IPR should have relatively stronger impact on the cost of debt for borrowers in industries where IP is naturally used more extensively in production, i.e. industries with inherently higher IP intensity. My second hypothesis therefore is:

Hypothesis 2 (H2): The impact of IPR reforms on the cost of bank loans will be larger when the borrowing company operates in an industry with inherently higher IP intensity.

2.2. The institutional setting: patent reforms

The patent system is arguably the most important policy lever that governments around the world used to promote innovation and technological progress (Maskus, 2000). While some provisions of the patent system differ from country to country, the underlying mechanism is largely the same: an inventor discloses detailed information about the underlying invention to the public and in return receives the right to exclude others from using that patented invention backed by the threat of injunction for a fixed period of time (typically 15–20 years).

In the years since 1990, many countries have implemented major legal reforms that strengthened various dimensions of patent laws and their enforcement. To construct my sample of significant patent reforms I started with the list of patent reforms provided by Branstetter et al., (2006), Maskus (2000) and Qian (2007). However, the list of reforms used in those papers ends in 1999 and is further restricted to pharmaceutical patent laws and to countries with significant presence of US multinationals. I therefore independently extended the list of reforms by following the procedure in Branstetter et al. (2006) and Maskus (2000). Specifically, I identified all countries with large increases (such as one full point increase) in the widely used index of patent rights developed by Ginarte and Park (1997) and updated by Park (2008). The patent index currently provides information on 120 countries and covers the period 1960–2010. Next, I checked that these episodes represent substantial reforms of patent rights by consulting two sources: (1) detailed information on each country's IP laws and treaties provided by the World Intellectual Property Organization; and (2) the special 301 annual reports on the status of IPR protection and enforcement around the world prepared by the Office of the U.S. Trade Representative.

This search identified 35 discrete reforms that could have a material impact on the level of IP protection. As discussed in Ginarte and Park (1997), each major patent reform episode corresponds to discrete shifts in one or more of the five key dimensions of patent laws: (1) Expansion in the range of eligible inventions; (2) Expansion in the effective scope of patent protection; (3) Increase in the length of patent protection; (4) Improvement in the enforcement of patent rights; (5) Improvement in the administration of the patent system. Table 1 lists these reforming countries, reform years and indicates which of the five patent rights dimensions were affected by the reform.

There is a surprising degree of similarity in these reforms, with most of the reforms extending patent protection to more products, expanding the scope of patent protection and improving the enforcement of patent rights. For example, during my sample period, China undertook two major reforms that substantially amended its first patent law enacted in 1985. The first reform in 1993 expanded the range of inventions eligible for patent protection, extended the length of patent protection from 15 to 20 years and established special courts to handle IP cases. The second reform in 2000 amended the patent laws to conform with the WTO membership requirements by strengthening judicial protection and enforcement, and improving patent application procedures. As noted by the July 2016 *Wall Street Journal* article all these reforms have significantly strengthened patent protection in China and helped China to become the world' leading issuer of patents.

From the reading of the political economy of these reforms it does not appear that by reforming their patent systems, countries directly aimed to affect domestic firms' cost of borrowing. Instead, these reforms were largely adopted because of increased domestic business interests in protecting innovation and because members of the WTO were required to comply with a set of minimum patent protection standards as set by the Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS). For example, as discussed in Maskus (2000, 2012), patent reforms in countries like South Korea and Taiwan were undertaken largely due to domestic commercial interests while reforms in Argentina, Brazil, and the Philippines were undertaken because of TRIPS obligations. As such, from the perspective of individual borrowers and lenders these reforms were likely undertaken for exogenous reasons.

Of course, I am cognizant of the fact that any economic or legal reform episodes are not randomized experiments and unlikely to be completely "clean" from confounding factors such as concurrent economic or political trends. To address any lingering endogeneity concerns, I include an extensive set of controls for any concurrent shifts in country economic and financial conditions and relevant laws and regulations. I also use a widely-used Rajan and Zingales (1998) approach and examine heterogeneous treatment effects across industries with inherently high and low IP-intensity.

3. Data and methods

3.1. Sample

I obtain information on individual loan facilities extended to firms located in 48 countries (excluding the United States) from the Loan Pricing Corporation's DealScan database-the leading global aggregator of bank loan data. The DealScan is standard database in the international bank loan research and was used in Qian and Strahan (2007), Bae and Goyal (2009), Berg et al. (2016) and others. The sample period is 1988–2007, and it starts three years before Chile, Mexico and Indonesia reformed their IPR in 1991 and ends three years after Czech Republic reformed their IPR in 2004. (I experimented extending the sample period to 2012 and found that all results continue to hold.) As is standard in this literature, I exclude loans to firms in the financial sector and public sector.

Table 1
List of countries that undertook significant IPR reforms and timing. This table provides information about major reforms of patent rights undertaken by countries around the world used in this paper to examine the effect of IPR on the cost of bank loans. Main reform attributes are based on the Ginarte and Park (1997) patent index components, Branstetter et al. (2006) and Maskus (2000).

Country	Reform Year	Main Attributes of Reforms	Ginarte-Park patent rights index	
			Before	After
Argentina	1996	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement	2.30	3.55
Australia	1991	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement	3.27	4.33
Brazil	1997	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement	1.47	3.4
Bulgaria	1993	Expansion of eligible inventions and patent law scope;	1.74	2.89
Canada	1993	Expansion of eligible inventions and patent law scope	3.28	4.34
Chile	1991	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	2.25	3.90
China	1993	New patent law: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	1.33	2.11
China	2001	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration (adopted the TRIPS Agreement requirements)	3.09	4.08
Colombia	1994	New Patent law: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	0.95	2.57
Czech Republic	2004	Improvement in patent enforcement and administration; Expansion of patent law scope	3.20	4.33
Egypt	2002	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement	1.85	2.89
Finland	1995	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	3.30	4.41
Hong Kong	1997	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	2.9	3.80
Hungary	1995	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	2.11	3.87
India	2002	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration (compliance with the TRIPS Agreement)	2.26	3.75
Indonesia	1991	Introduced first patent protection law	0.2	1.55
Indonesia	1997	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	1.55	2.46
Ireland	1992	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	2.15	4.14
Israel	2000	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration (compliance with the TRIPS Agreement)	2.97	3.95
Japan	1995	Extension of patent duration; Improvement in patent enforcement and administration replacement of Japan's pre-grant opposition system with a German style post-grant opposition system	3.88	4.41
Mexico	1991	New legal system: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	1.02	2.68
New Zealand	1994	Expansion of eligible inventions and patent law scope (adopts the Patent Co-Operation Treaty (PCT) and requirements of the TRIPS agreement)	2.36	3.67
Peru	1994	New patent legal system and administrative body are created	0.58	2.56
Philippines	1997	A new patent statute: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	2.55	3.68
Poland	1993	Adopted a Law on Inventive Activity: Expansion of eligible inventions and patent law scope	1.20	3.29
Portugal	1992	Adopted the European Patent Convention: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	1.66	3.30
Romania	1994	Adopted the European Patent Convention: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	1.33	3.35
Russian Fed	1993	Adopted its first Patent Law: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	1.40	3.47
Singapore	1994	Created a separate Singaporean patent law: Expansion of patent rights; Improvement in patent enforcement and administration	2.04	3.88
Slovakia	1993	Adopted the European Patent Convention: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	1.20	2.95
Taiwan	1992	Expansion of eligible inventions and patent rights; Improvement in patent enforcement and administration	1.25	3.16
Thailand	1993	Expansion of eligible inventions and patent rights	1.20	2.24
Turkey	1995	New patent regime: Expansion of eligible inventions and patent rights; Improvement in patent enforcement and administration	1.2	2.65
Turkey	1999	Adopted the European Patent Convention: Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	2.65	4.00
Venezuela	1994	Expansion of eligible inventions and patent law scope; Improvement in patent enforcement and administration	0.92	2.65

From DealScan I obtain detailed information on the borrowing and lending companies and the various terms of the loan contract such as the loan interest rate (spread), loan amount, the maturity of the loan, the share of each lender, whether or not the loan has collateral, the type and purpose of loan, and the Standard and Poor's long-term credit ratings at the loan origination date. Borrowers and lenders are assigned to a country as reported in DealScan.

Each observation in the DealScan represents a separate loan facility or tranche. Several loan facilities with different terms and purposes can be packaged into a single loan deal. Following empirical bank loan literature (e.g., Qian and Strahan, 2007), I use each loan facility as a separate observation since the price and non-price terms are set at the individual facility level. In unreported analysis, I find that clustering at the deal level produces similar results. Given that majority of the international loan facilities do not have data on the loan spread, to increase my sample size I only require each facility to have data on the loan amount. My final sample consists of 57,243 loan tranches, of which 9442 have information on the loan spread.

3.2. Research design and regression specification

To examine whether legal reforms of patent rights protection affect the cost of bank debt, I use a generalized difference-in-difference (DiD) methodology (see, for example, Bertrand and Mullainathan (2003)). Specifically, I estimate the difference in the cost of debt for borrowers located in a country before and after IPR reform ("treatment" group) compared to the same difference for borrowers located in countries that did not reform their IPR ("control" group). The advantage of the DiD approach is that firms from the same country during the sample period are included both in the treated and control groups, thus alleviating the concern that the treatment and control groups could differ along other dimensions aside from the change in IPR protection. The following equation describes the main regression model:

$$\begin{aligned} &Log(cost\ of\ loan) = f(Patent\ Reform,\ Country\ characteristics,\\ &Borrower\ characteristics,\ Loan\ characteristics,\\ &country,\ year,\ and\ industry\ fixed\ effects) \end{aligned} \tag{1}$$

Following the empirical bank loan literature, to mitigate the effect of skewness in the data I use the natural logarithm of all-in-drawn spread (loan spread) to measure the cost of bank loans. The loan spread is the amount in basis points that the borrower pays yearly over the London Interbank Offered Rate (LIBOR) or a similar market benchmark, inclusive of all recurring annual fees paid to the lenders. The spread therefore captures the risk level of the loan facility.

The key explanatory variable in my analysis is the *Patent Reform* indicator variable of the borrowers' countries. For a country that strengthened its patent rights in year *t,* the indicator equals one for years subsequent to the reform date and zero otherwise. For countries that did not reform their patent laws, the indicator always equals zero. For countries, which undertook more than one patent reform (such as Turkey or China), I code the indicator to be equal to two after the latest reform episode and one between the reform episodes. By design, this indicator captures the long-run effects of IPR reform on the cost of corporate loans within a country but it is not comparable across countries: that is, the fact that is greater in one country than in another does not imply that the level of IPR is greater in the first country compared with the second one.

Other independent variables (described below) include various controls for borrower characteristics, loan characteristics, and country economic, risk and legal characteristics. Importantly, all regressions include borrower country and loan initiation year fixed effects, and later also include industry effects. The country fixed effects remove the permanent unobserved country-specific factors that may affect the cost of corporate borrowing and shifts in IPR regime. The year fixed effects account for changes in aggregate economic conditions. The inclusion of country and year fixed effects thus ensures that the coefficient on *Patent Reforms* reflects the actual effects of within-country shifts in IPR protection over time, and not just cross-sectional correlations. I compute heteroscedasticity-robust standard errors clustered at the country level.

The intuition behind the DiD estimate produced by Eq. (1) can be illustrated with an example. Suppose I want to estimate the effect on loan spreads due to the IPR reform in Argentina in 1996. A naïve difference in loan spreads for firms in Argentina (treatment) before and after the reform might be affected by contemporaneous economy-wide shocks that could affect the cost of borrowing. Therefore, to control for such factors, I also estimate the same difference for borrowers in a control group country such as France, which has not undergone a patent rights change in 1996. The coefficient estimate on *Patent Reform* therefore measures the average within-country changes in the cost of loans for firms in the countries that reformed their IPR laws relative to contemporaneous changes in the cost of loans for firms in the countries that did not change their laws.

3.3. Control variables

Following the international bank loan literature (e.g., Qian and Strahan, 2007), the regressions includes a wide variety of borrower, loan, and country-specific control variables to capture various factors that might affect the cost of loans across countries and time, borrowers and tranches. Table 1A of the Appendix provides a detailed description of all the variables used in the paper and lists all the data sources. Importantly, I report specifications with and without control variables, because some of these variables could be affected by the IPR reform (and thus bias my estimates.

The first set of control variables consists of the country-level economic, financial, risk and legal trends that could correlate with changes in the cost of bank credit as well as changes in IPR. Because all regressions in this paper include country fixed effects, which fully absorb time-invariant country factors such as legal origin and sociocultural factors, I include only those

variables that exhibit some time-series variation. To control for country economic development and current performance, I include the log of yearly GDP per capita and the annual growth in real GDP. To control for the development of country credit market (and thus the availability of bank financing), I include the amount of credit extended to the private sector scaled by the GDP. Importantly, I control for the overall financial and economic risk of borrower countries using the country composite risk index provided by the International Country Risk Guide. Lower values for the country risk index indicates higher country (sovereign) risk. The country risk index is the average of financial, economic and political risk indexes and has been shown to be a good predictors of future country financial risk (Bekaert et al., 2014). The regressions also control for the strength of legal protection of creditor rights using the creditor rights index as complied by Djankov et al. (2007). All of the country-level variables, including the patent reform indicator variable, are measured as of the year prior to the loan origination date to ensure they are in the information set of lenders. In the robustness analysis, I consider several possible candidates for concurrent changes in regulatory environment and financial reform that could independently impact the terms of bank loans.

The second set of independent variables controls for loan-specific characteristics that may reflect differences in the risk level of individual loan facilities. Such variables include indicator variables (fixed effects) for loan purposes and loan types. The loan type indicators reflect whether the loan is a term loan, whether the loan is secured with collateral, and whether the loan contains performance pricing provisions (which means that the loan spread after initiation can fluctuate depending on some measure of the borrower's financial performance). Loan purposes are categorized into several groups: capital expenditures, refinancing, back-up line, working capital, mergers and acquisitions and general purposes. The loan pricing regressions also include the log of maturity and the log of loan size because banks may charge higher loan interest on longer-term debt and smaller size loans to compensate for higher liquidity risk and default risk. Since all of those loan characteristics can be set jointly with the loan spread, I estimate loan pricing specifications both with and without loan-specific controls.

The final set of control variables include borrower-specific characteristics. Following Berg et al. (2016) and Carey and Nini (2007), to maximize the sample size, my main analyses only use the borrower's credit rating score at loan initiation as the measure of overall firm credit quality. The credit ratings are computed by the Standard & Poor's (S&P), which issues ratings based on their assessment of a firm's creditworthiness (using a wide range of financial indicators). Banks commonly use credit ratings issued by the S&P and other rating agencies for screening and monitoring purposes. I convert letter ratings into *Credit rating score* ranging from 1, which corresponds to AAA rating (the highest rating and thus lowest default risk) to 7, which corresponds to CCC or worse rating (low ratings and thus high default risk). The final rating score of 8 is assigned to issuers that have no S&P rating.

I do show, however, that the results are similar when I control for a set of firm financial characteristics such as firm size, profitability, tangibility and default risk measure (Z-score). Since the Z-score already incorporates leverage, I do not include capital structure in the regression. All these accounting information for (publicly-traded) borrowers at the time of the loan origination come from Worldscope or Compustat Global databases. I manually match loan contracts to firm-level data in those databases using the borrowers' names and tickers.

3.4. Measuring industry IP intensity

I classify each borrower industry's as intrinsically high and low IP-intensive using the IP intensity measures for the same U.S. industry. As in Rajan and Zingales (1998), I assume that the IP intensity of a given U.S. industry forms a good benchmark because the U.S. has the strongest IPR protection (according to the Ginarte and Park (1997) patent index) as well as the largest and most sophisticated financial markets. Therefore, U.S. firms are likely to achieve the optimal intellectual asset intensity as required by the sector's technological characteristics. This approach also reduces the concern that a non-U.S. country's IPR and its firms' IP intensity are endogenously determined. Rajan and Zingales argue that the use of the U.S. data to construct proxies for intrinsic industry characteristics in foreign countries are a valid empirical strategy because most industries around the world are technologically similar to those in the U.S.

I use two proxies for firm IP Intensity: a stock of spending on Research and Development (R&D) and a stock of awarded utility patents. The data on R&D and patents come from the Compustat and NBER Patent database, respectively. In general, a firm's spending on R&D is considered an essential input to creation of IP while patents is a widely used measure of firm IP output (see, for example, Hall and Lerner, 2010). Following Hall et al. (2007), a firm's stock of R&D and patents is constructed by accumulating the firm's past spending on R&D and the number of awarded patents using the perpetual inventory method with 15% annual depreciation rate. The R&D and patent stocks are both scaled by the firm's book assets.

The industry-level *R&D Intensity* and *Patent Intensity* variables are calculated as the average of individual firms' R&D and patents stocks at the 3-digit SIC level over the period 1990–2010. To identify IP-intensive industries, I define two binary indicator variables-*High R&D Intensity* and *High Patent Intensity*-which take the value of one if the borrower operates in the industry with R&D and patent intensities in the top quartile of the sample distribution, and zero otherwise. Using indicator variable allow for an intuitive economic interpretation of coefficient estimates. In addition, using the indicator variable instead of exact continuous values should mitigate R&D measurement problems and differences in propensity to patent innovations across industries (e.g. Koh and Reeb, 2015).

Table 2A of the Appendix presents selected industries with the highest and lowest R&D intensity. The R&D intensity varies dramatically across industries and, reassuringly, this variation is consistent with accepted notions of what constitute IP (knowledge)-intensive industries. The R&D intensity is highest among firms that produce pharmaceuticals, computer

hardware and software products. In contrast, the R&D intensity is very low (zero) in industries that are commonly considered "low-tech", such as the transportation services and cement products industries.

3.5. Summary statistics

Panel A in Table 2 presents median values for key loan terms and country characteristics for each of the 48 countries in my sample. Panel B in Table 2 provides the deal-level summary statistics. The numbers in the Table are comparable to those reported by previous studies (e.g., Qian and Strahan, 2007). My sample mean (median) loan spread is 222 (200) basis points over the market benchmark. The mean (median) loan facility size is U.S.$198 (70) million and mean (median) loan maturity is about 5 years. There is a significant variation in all of these loan terms across countries. The median loan spread varies from 65 basis points in Japan to 300 in Peru, the median size of loans varies from $35 million in Taiwan to $177 million in Sweden.

4. Main results

4.1. IPR reform and loan pricing: Tests of Hypothesis 1

Table 3 reports the core results of this paper. Model (1) analyzes the cost of bank debt (loan spread) with the *Patent reform* indicator variable as the only independent variable. The estimates show that improvements in IPR are associated with lower loan spreads: the coefficient on *Patent reform* is negative 0.370 and significant at better than the 1% level (standard error (s.e.) is 0.117). This finding thus indicates that lenders associate strengthening of IPR protection with decreased credit risk of borrowing firms, which in turn is passed along to the borrowers in the form of lower loan spreads. Controls for country and year fixed effects ensure that these results reflect average within-country changes in loan spreads when a country enacts a major reform of IPR protection.

In Model (2), I include controls for the borrower country economic and credit market development, changing economic conditions and financial riskiness. The inclusion of these county-level controls reduces the magnitude of the coefficient estimate on *Patent reform* only slightly to −0.324 but it remains highly significant (robust s.e. of 0.097), which indicates that the effect of IPR reform on bank loan spreads appears to be distinct from any concurrent (and potentially confounding) changes in countries' financial and macroeconomic conditions.

With respect to country-specific variables in this and subsequent specifications, we can observe that economic growth, financial risk and the credit market development appear to be related to loan spreads (albeit imprecisely). Lenders charge lower interest rates in countries with higher economic growth and lower financial risk. The cost of loans and credit market development appear to be positively associated. Perhaps because there is little time-series variation in the credit rights index, the coefficient on this variable, after controlling for country and year fixed effects, does not appear to be strongly related to loan spreads.

In Model (3), I include the controls for loan characteristics and borrower credit rating that could correlate with loan pricing. This reduces the sample size and the coefficient on *Patent reform* drops to −0.229 but remains significant at better than the 1% level. The estimated effects of borrower and loan-specific characteristics on the cost of borrowing are largely similar to those found in previous studies. For example, term loans, secured loans and longer maturity loans carry higher interest rates. Firms on average pay lower spreads on larger loans and loans containing performance pricing provisions. The coefficient on *Firm credit rating score* is positive. This indicates that, as expected, lenders consider firms with lower credit ratings to be riskier and thus charge higher interest rates (note that higher values of the rating score correspond to worse credit rating).

Finally, in Model (4) I control for firm accounting characteristics using proxies for firm size, profitability, tangibility and default risk (Z-score). Because the firm-specific characteristics are available only for publicly-traded firms (with information available on Worldscope and Compustat Global), the sample size drops significantly to 2499 observations. Nevertheless, the effect of IPR reform on loan spreads continues to be large and statistically significant: the estimated coefficient on *Patent reform* equals −0.234 and is significant at the 5% level. As expected, firms with large assets size, more tangible assets, and lower default risk tend to pay lower bank loan spreads, on average.

Economic magnitudes. To estimate the economic significance of the effects of IPR reform on the cost of loans for the average firm in the sample, I use the coefficient of −0.229 estimated by Model (3) containing the full set of control variables. Note that because the dependent variable (loan spread) is in logarithmic form, the coefficient estimates represent percentage change effects of the independent variables on the loan spread. Holding all else constant, compared to the control group of borrowers in the nonreforming countries, the treatment group of borrowers in the countries that strengthened IPR experienced a drop in the loan spread by 20.5% ($=e^{-0.229}-1$). Because the sample mean loan spread is 222 basis points (from Panel B of Table 2), this translates into a reduction in the loan spread of approximately 45 basis points. Since the sample mean loan amount is $198 million, this 45 basis point reduction means that the typical borrower in a given year saves about $0.9 million in interest payments. Therefore, the relation between within-country changes in patent right protection and the cost of loans is not only statistically significant but also economically important.

Table 2
Summary Statistics This table provides summary statistics of key variables used in regressions. Sample period is Jan 1988–Dec 2007. All variables are defined in Table A1 of the Appendix.

Borrower country	N	Loan spread (basis points)	Loan size (U.S.$ mil)	Loan maturity (years)	GDP per capita (U.S.$)	Private credit to GDP	Country risk rating	Rule of Law index	Governance index
Argentina	444	250	90	3	7684	0.22	72.66	5	0.14
Australia	3064	75	113.25	5	21,918	0.92	82.25	6	1.56
Austria	93	225	94.82	7	36,693	0.91	84.9	6	1.63
Belgium	347	225	125.229	6	30,744	0.63	83.67	5	1.37
Brazil	619	200	100	3	3739	0.31	65.88	2	−0.03
Bulgaria	69	175	69.16	12.0	3853	0.39	71.67	4	0.24
Canada	3901	225	100	3	23,995	1.62	85.15	6	1.66
Chile	301	75	120	5	5367	0.72	78.71	5	1.13
China	1201	85	43	5	826	1.05	74.48	5	−0.48
Colombia	123	250	112.5	5	2472	0.33	61.38	2	−0.63
Czech republic	174	90	61.881	5	8012	0.34	77.63	5	0.82
Denmark	196	225	205.288	7	40,459	1.42	86.63	6	1.83
Egypt	88	150	142	7	1352	0.52	68.9	4	−0.41
Finland	345	60	179.835	5	26,273	0.6	87.5	6	1.87
France	3541	213.75	63.954	7	33,875	0.8	77.71	5	1.19
Germany	2464	225	100.825	7	34,166	1.05	83.1	5	1.54
Greece	393	115	93	5	13,620	0.5	75.09	3.25	0.78
Hong Kong	1735	100	64.368	4	25,092	1.49	82.56	5	1.06
Hungary	174	150	100	7	4790	0.32	75.75	4.333	0.9
India	906	94	65	5	451	0.25	68.08	4	−0.18
Indonesia	1354	200	42.962	5	1064	0.56	68.88	4	−0.77
Ireland	305	175	133.566	7	41,170	0.86	86.33	6	1.53
Israel	68	105	130	5	19,400	0.72	68.84	5	0.66
Italy	1350	195	78.956	7	31,189	0.68	77.54	4	0.71
Japan	8544	65	26.135	3	34,076	1.86	85	5	1.11
Malaysia	1902	85	46.537	5	4280	1.29	76.38	3.667	0.39
Mexico	809	150	115.818	5	6673	0.16	71.17	2.917	−0.04
Netherlands	1592	225	125	6	35,245	1.14	85.56	6	1.73
New Zealand	556	135	77.625	4	17,400	1.08	79.46	6	1.73
Norway	493	170	122.246	6	38,147	0.69	91.33	6	1.73
Pakistan	113	150	44.944	3	495	0.25	61.04	3	−0.8
Peru	55	300	70	4	2163	0.24	67.71	3	−0.35
Philippines	703	225	48.565	5	1040	0.38	68.79	3.083	−0.31
Poland	204	115	113.672	5	4981	0.25	75.94	4.25	0.6
Portugal	134	77.5	200	6.5	11,783	1.15	79.54	5	1.27
Romania	114	212.5	53	5.25	2775	0.14	70.56	4	0
Russian Fed	600	275	100	3.25	2975	0.21	72.96	4	−0.68
Singapore	1052	125	60	5	23,793	0.96	88.92	6	1.48
Slovakia	86	77.5	67.548	5	5403	0.53	76.48	5	0.52
South Africa	123	100	125	5	3728	1.3	73.06	2.5	0.38
South Korea	2637	70	50	3	12,404	1.06	80.67	4.583	0.63
Spain	1799	115	84.371	7	21,496	1.16	78.35	4.792	1.15
Sweden	699	225	177.767	5	32,587	0.91	85.73	6	1.73
Switzerland	486	200	137.633	5	41,488	1.49	89.83	5	1.77
Taiwan	3329	70	35.769	5	24,090	.	83.08	4	0.81
Thailand	1355	100	38.307	5	2213	1.05	74.56	5	0.26
Turkey	250	200	90	5	4215	0.18	59.21	4	−0.28
United Kingdom	6476	225	118.111	6.0	26,676	1.23	82.33	6	1.55
Venezuela	118	200	91.032	5	3876	0.13	67.5	4	−0.62

Panel B: Loan facility- level summary statistics of key variables used in regressions

Variable	Obs	Mean	Median	Std. Dev	25th	75th
Loan spread (basis points)	9442	221.9	200	197.76	100	275
Loan size (U.S. $ mil)	57,243	198.4	69.8	376.7	25.1	190.5
Loan maturity (years)	51,184	5.35	5	3.659	3	7
Loan fraction (share) kept by lead foreign arranger	30,448	0.353	0.2	0.331	0.1	0.5
Loan fraction (share) kept by all foreign lenders	37,684	0.721	0.769	0.285	0.5	1
Borrower book assets (U.S. $ mil)	24,993	40,212	1967.7	59,307	532.2	8912.1
Borrower Oper. Income/Assets	24,983	0.07	0.056	0.102	0.026	0.092
Borrower PP&E/Assets	25,009	0.441	0.404	0.326	0.217	0.614
Borrower Z-Score	23,140	1.232	1.111	1.064	0.625	1.715

Table 3
IPR reform and bank loan pricing. This table reports the results of regressions of the natural log of loan spreads on the borrowing firms' patent reforms indicator and control variables. All independent variables (except for loan characteristics) are lagged by one year. All variables are defined in Appendix Table A1. The standard errors given in brackets below coefficients are adjusted for heteroskedasticity and clustering at the borrowers' country level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Variables	[1]	[2]	[3]	[4]
Patent reform	−0.370***	−0.324***	−0.229***	−0.234**
	[0.117]	[0.097]	[0.080]	[0.109]
Log of GDP per capita		−0.07	−0.089	0.047
		[0.209]	[0.130]	[0.182]
GDP growth		−1.173	−0.348	−1.992
		[0.865]	[0.776]	[1.501]
Country Risk Index		−0.02	−0.015	−0.029**
		[0.013]	[0.012]	[0.012]
Private credit to GDP		0.559***	0.468***	0.432***
		[0.192]	[0.134]	[0.157]
Creditor rights		0.023	−0.048	−0.075
		[0.135]	[0.119]	[0.155]
Loan characteristics (indicators)				
Term loan indicator			0.036	0.156***
			[0.026]	[0.044]
Purpose: Capex			−0.031	−0.164
			[0.115]	[0.136]
Purpose: Refinancing			−0.085***	−0.094
			[0.026]	[0.064]
Purpose: Acquisition			0.012	0.048
			[0.053]	[0.056]
Purpose: Backup line			−0.868***	−0.746***
			[0.146]	[0.135]
Purpose: working capital			−0.200**	−0.200**
			[0.080]	[0.084]
Purpose: corporate			−0.216***	−0.079
			[0.049]	[0.058]
Secured loan indicator			0.340***	0.476***
			[0.039]	[0.075]
Performance pricing indicator			−0.193***	−0.140**
			[0.060]	[0.073]
Log of loan amount			−0.109***	−0.129***
			[0.019]	[0.015]
Log of loan maturity			0.193***	0.112***
			[0.037]	[0.029]
Borrower characteristics				
Firm credit rating score			0.399***	
			[0.033]	
Log of total assets				−0.074***
				[0.021]
Oper. Income/Assets				0.371
				[0.380]
PP&E/Assets				−0.128*
				[0.075]
Z-Score				−0.144***
				[0.028]
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	9440	9052	7278	2499
Adjusted R-squared	0.214	0.229	0.412	0.45

4.2. Robustness tests

Controlling for confounding factors Although all of the previous estimations include an extensive set of controls for shifts in a country's legal, economic and financial conditions and risk variables as well as country and year fixed effects (required to estimate the DiD effect), some readers still may have lingering concerns about omitted variables such as contemporaneous policy reforms that could independently affect bank loan spreads. To mitigate the concern that the timing of IPR reforms coincided with other policy reforms and thus better isolate the effects of IPR reforms, I investigate several candidates for potential confounding channels that have been used in prior studies. First, I add time-varying controls for the strength of legal institutions that support the overall property rights in a country using an index for the rule of law and an index for corruption of high government officials from the International Country Risk Guide (ICRG). These widely used indicators

are available for every year of the sample period and they are designed to capture perceptions of the extent to which agents have confidence in country property rights and contract enforcement. As noted by Claessens and Laeven (2003) and Bae and Goyal (2009), among many others, it is difficult for firms to use their formal property rights in a country that has a weak rule of law or has a high level of government corruption. I also use a broader proxy for the quality of a country's legal institutions using the World Governance index developed by the World Bank every year since 1996 and described in Kaufmann et al. (2009). The Governance index is the average of the six sub-indexes: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption.

I next control for financial reforms by using the indicator of large financial reforms developed by Abiad et al. (2010). This indicator captures several different dimensions of financial reform, such as openness of the banking system and capital controls, which could affect the supply of capital and thus influence the cost of borrowing to corporations.

Columns (1) through (4) of Table 4 summarize the results from the separate regressions that include these indicators for legal and financial reforms. Note that because all proxies for the quality of legal institutions are highly correlated, I include them separately. Consistent with previous findings, I continue to find in these tests that patent rights reforms are strongly related to corporate bank loan spreads: the *IPR Reform* variable enters each of the regressions with a negative and significant coefficient. In contrast, none of the proxies for potential confounding factors are significantly related to loan pricing.

Test of parallel trends (timing) A key assumption in the DiD estimation is that the estimated treatment effect is not due to pretreatment differences in the characteristics of treated and control firms, that is the treatment and control groups follow parallel patterns prior to the event. As well, there could be lingering concerns about reverse causality. For example, an argument can be made that some countries undertook a reform of IPR to provide an additional boost to economic growth (and lower cost of borrowing) that was *already* taking place due to some other simultaneous economic changes. I address these concerns by following the widely used approach in Bertrand and Mullainathan (2003) and examining the dynamics of loan spreads in the years around the IPR reform. To that end, I augment the baseline regression in equation (1) with a series of time indicators relative to the reform year. I decompose the *Patent reform* variable into five separate time periods: $Reform_{\text{year-2}}$ and $Reform_{\text{year-1}}$ capture any effects from two years and one year before the reform, $Reform_{\text{year 0}}$ capture any effects in the year of the reform, $Reform_{\text{year+1}}$ capture any effects one year after the reform and $Reform_{\text{year}\geq+2}$ capture any effects two years after the reform and beyond. If any of those two concerns about pre-treatment trends and/or reverse causality are valid, then the cost of loans should begin to decline in the years *before* the year of actual reform (instead of after). As well, there could be an anticipation bias: if lenders had anticipated IPR reform, then one might expect banks to adjust the loans spreads before the actual reform (which may thus attenuate the previously estimated effect).

Table 4
IPR reform and bank loan terms: Robustness tests. This table reports the results of regressions of the log of loan spread and loan amount on the borrowing firms' patent reform indicator and control variables. All independent variables are defined in Appendix Table A1. Model (6) drops observations from Japan and U.K. The standard errors given in brackets below coefficients are adjusted for heteroskedasticity and clustering at the borrowers' country level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Variables	[1]	[2]	[3]	[4]	[5]	[6]
Patent reform	−0.201**	−0.188**	−0.174**	−0.181**		−0.227**
	[0.080]	[0.085]	[0.081]	[0.082]		[0.086]
Rule of law index	−0.047					
	[0.047]					
Corruption index		0.032				
		[0.038]				
Governance index			−0.04			
			[0.155]			
Financial reform dummy				−0.064		
				[0.065]		
$Patent\ reform_{\text{Year-2}}$					0.012	
					[0.275]	
$Patent\ reform_{\text{Year-1}}$					0.087	
					[0.206]	
$Patent\ reform_{\text{Year 0}}$					−0.074	
					[0.060]	
$Patent\ reform_{\text{Year+1}}$					−0.189**	
					[0.080]	
$Patent\ reform_{\text{Year}\geq+2}$					−0.236***	
					[0.084]	
Country characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Borrower credit rating	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7278	7278	6708	7216	7278	5551
Adjusted R-squared	0.413	0.412	0.412	0.429	0.412	0.397

The results in Model (5) in Table 4 indicate that the coefficients on $Reform_{year-2}$ and $Reform_{year-1}$ have very large standard errors (relative to the size of coefficients) and thus are all statistically indistinguishable from zero. In contrast, the coefficient on $Reform_{year+1}$ and $Reform_{year\geq+2}$ are significant at better than the 5% and 1% level. The results thus suggest that the trends for both groups are almost identical prior to the IPR reform and that these trends start to differ in approximately the year after the law is implemented, thus mitigating the likelihood of omitted variable bias or reverse causality.

Other robustness tests I also examine whether the effects of IPR are robust to the construction of the estimation sample. Panel A of Table 1 shows that the two countries with the most deals in my sample are the United Kingdom and Japan. To ensure that my results are not driven by the observations from these two countries, I re-estimate the loan spread regressions removing the observations from those two countries and report the results in Model (6) in Table 4. I find that all of the previous results remain similar when observations from these countries are removed: the coefficient on *Patent reform* is negative 0.227 and significant at better than the 5% level. Additional tests (not reported) that main results of this paper are not unchanged when I exclude observations from the other sample countries (one country at the time).

Overall, these series of tests indicate that even after I control for a number of additional country-level policy changes used in prior literature, the results continue to hold. These findings, taken together with the inclusion of a rich of set of controls, provide further evidence that that my results are not being driven by other country-level legal, economic and financial developments that could independently affect the sensitivity of bank loan spreads to IPR reforms.

4.3. Heterogeneous effects of IPR reform: Test of Hypothesis 2

To provide further (and potentially causal) evidence that the effect of IPR reform on the cost of corporate debt indeed goes through the IP channel, in this subsection I unbundle the average treatment effect of patent reforms and examine heterogeneous treatment effects across industries with inherently high and low IP-asset intensity (H2). Importantly, this analysis also addresses concerns that some other omitted country-level factors (trends) could be driving the previous results, because such omitted variables would have to explain cross-sectional variations in the treatment effect *while not* correlating with all the control variables already used in the preceding regressions.

As discussed above, I use two proxies for innate industry-level IP intensity based on U.S. firms' stocks of R&D and patents. Table 5 reports results of modified specifications of Eq. (1) that include the interactions of the *High R&D Intensity* and *High Patent Intensity* indicator variables with *Patent reform*. All specifications include country, year, and 3-digit SIC industry fixed effects. The inclusion of the three sets of fixed effects means that I am estimating a triple DiD test, which estimates the differential effect of IPR reform across high and low IP-intensity industries within the same country. Because the regressions remove any time-invariant *unobservable industry-specific* factors, the individual effects of time-invariant industry R&D and patent intensities are not identified (they are subsumed by the industry fixed effects).

Table 5
IPR reform and bank loan pricing: Effects of Industry IP Intensity This table reports the results of regressions of the natural log of loan spreads on the borrowing firms' patent reforms indicator interacted with indicators (1/0) for borrowers operating in high R&D and patent intensity industries, and control variables. All independent variables (except for loan characteristics) are lagged by one year, and are defined in Appendix Table A1. The standard errors given in brackets below coefficients are adjusted for heteroskedasticity and clustering at the borrowers' country and industry level. ∗, ∗∗, and ∗∗∗ indicate significance at the 10%, 5%, and 1% level, respectively.

Variables	[1]	[2]	[3]
Patent reform	−0.218**	−0.093	−0.103*
	[0.108]	[0.071]	[0.060]
Patent reform × High R&D Intensity		−0.132***	
		[0.045]	
Patent reform × High Patent Intensity			−0.124***
			[0.051]
Log of GDP per capita	−0.189	−0.189	−0.198*
	[0.117]	[0.117]	[0.117]
GDP growth	−1.179	−1.141	−1.146
	[0.768]	[0.767]	[0.771]
Country Risk Index	−0.01	−0.01	−0.009
	[0.008]	[0.008]	[0.008]
Private credit to GDP	0.399***	0.407***	0.409***
	[0.101]	[0.101]	[0.102]
Creditor rights	0.081	0.069	0.079
	[0.143]	[0.141]	[0.143]
Loan characteristics	Yes	Yes	Yes
Borrower credit rating	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	6,281	6,281	6,281
Adjusted R-squared	0.471	0.473	0.472

Model (1) in Table 5 shows that addition of the industry fixed effects does not affect the main result of this paper: *Patent reform* remains negative and highly significant. The results of Model (2) and (3) provide strong support for Hypothesis 2: the estimated coefficients on *Patent reform* × *High R&D intensity* and *Patent reform* × *High Patent Intensity* are negative and significant at the 1% level. This result is consistent with Hypothesis 2 and indicates that the treatment effect is significantly stronger for borrowers that should value increased IPR protection the most. In contrast, the coefficient on *Patent reform* loses its magnitude and statistical significance in both specifications, indicating that firms in relatively low IP-intensity sectors experience significantly smaller reductions in the cost of debt. In unreported results, I experimented adding additional interaction terms of *IPR Reform* with industry-level external financial dependence measures (as in Rajan and Zingales, 1998) and found that results remain unchanged. Overall, these results further increase confidence in my empirical analysis and the documented impact of IPR reform on the firm-level cost of borrowing.

In sum, Tables 3–5 establish that a typical borrower located in a country that increases IPR protection subsequently tends to receive bank loans with lower spreads. Importantly, these effects are significantly larger among borrowers that are especially sensitive to IPR protection.

5. Additional analysis

5.1. IPR reform and access to bank debt

To provide further evidence that improvements in IPR indeed facilitate the provision of bank credit, I examine whether IPR reform is related to measures for increased access to bank debt. Since changes in a firm's access to bank debt cannot be directly measured (since the universe of potential bank loans applications cannot be observed), I use a proxy that should reflects the incremental amount of credit available for borrowing- the size of loan. It is well known that banks can limit their exposure to borrower risk by reducing the size of loans extended to riskier borrowers that rather than increasing the interest rate (Stiglitz and Weiss, 1981). Hence, to the extent that IPR reform reduces lending frictions, lenders might be more willing to extend larger size loans to corporate borrowers.

To test this conjecture, I re-estimate Eq. (1) using the natural log of the loan amount (in millions of U.S. dollars) as the dependent variable and report the results in Table 6. Model (1) estimates the regression with *Patent reform* as the only explanatory variable (along with the set of country and year fixed effects) while Model (2) includes the full set of country, borrower and loan specific variables used in Model 3 of Table 3 (excluding loan amount).

The coefficient on *Patent reform* in both specifications is positive and significant at the 1% and 5% level, respectively. This result thus indicates that the size of loans made to corporate borrowers increases in the wake of strengthened IPR. For example, the coefficient in Model (2) is 0.508, which implies that an average borrower from the countries that strengthened their IPR would be able to obtain a bank loan that is 50% larger (compared to borrowers from the nonreforming countries).

Table 6
IPR reform and bank loan amount. This table reports the results of regressions of the size of loans on the borrowing firms' patent reforms indicator and control variables. All independent variables (except for loan characteristics) are lagged by one year, and are defined in Appendix Table A1. The standard errors are given in brackets below coefficients and are adjusted for heteroskedasticity and clustered at the borrowers' country level. ∗, ∗∗, and ∗∗∗ indicate significance at the 10%, 5%, and 1% level, respectively.

Variables	Log(Loan amount) [1]	Log(Loan amount) [2]	Log(Loan amount/Assets$_{t-1}$) [3]
Patent reform	0.564***	0.508***	0.053***
	[0.101]	[0.113]	[0.013]
Log of GDP per capita		0.800**	0.012
		[0.304]	[0.017]
GDP growth		0.268	0.099
		[0.935]	[0.148]
Country Risk Index		−0.006	−0.002
		[0.013]	[0.002]
Private credit to GDP		0.350**	0.028
		[0.165]	[0.020]
Creditor rights		−0.228	0.025
		[0.236]	[0.021]
Rule of law		−0.001	0.007
		[0.061]	[0.010]
Loan characteristics	Yes	Yes	Yes
Borrower credit rating	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	50,801	42,990	18,406
Adjusted R-squared	0.12	0.211	0.287

However, this result comes from a specification that does not control for the size of borrowers, which could affect the results. In Model (3), I re-estimate the regression using the loan amount scaled by the total assets of the borrower (at the loan initiation time). While the sample size drops significantly, the inferences are unchanged. The coefficient on *Patent reform* is 0.053, implying patent reforms lead to a 5.3 percentage increase in the loan amount relative to the borrower asset size. This finding suggests that strengthening of IPR leads not only to lower loan spreads, but also to greater bank credit availability.

5.2. IPR reform and foreign bank lending

I complement the preceding finding that IPR reform positively affects lenders' willingness to extend more credit to corporate borrowers (in addition to lowering the cost of loans) by examining whether the reforms affect one increasingly important type of lenders in particular-foreign lenders. Foreign bank lending has increased dramatically in recent years as barriers to foreign bank entry and activity have been significantly lowered (Claessens and Van Horen 2014). As noted by those authors, foreign banks can increase the availability of credit to domestic firms directly by lending to them and indirectly by strengthening the domestic financial system and thus increasing the overall supply of capital in the economy. However, since foreign banks are likely to lack the information about domestic firms as well as face greater cultural constraints, they tend to refrain from lending to firms with greater information related problems such as intangible capital-intensive firms (Beck et al., 2016; Buch, 2003). Therefore, it is reasonable to expect foreign banks to be more affected by IPR reform than domestic banks. To the extent that stronger IPR may reduce these problems, stronger IPR might encourage more foreign lender participation in the domestic lending market.

Table 7 shows the results of the relation between IPR reform and the two proxies for foreign lender participation (after controlling for all other variables that could influence loan terms). In Model (1), the dependent variable is the percentage of the loan held by the lead foreign arranger. The lead arranger initiates, administers and monitors the syndicated loan made by a group of lender. In Model (2), the dependent variable is the total percentage of the loan held by all (lead and non-lead) foreign banks combined. In general, by retaining a larger portion of the loan, a foreign lender commits more capital and thus sends a credible signal of its commitment to that market.

The large positive and significant estimated coefficients on *Patent reform* in both specifications imply that strengthening of IPR is indeed associated with increased foreign bank participation. All else equal, IPR reform on average leads to a 12.5 percentage and 7 percentage point increase in the fraction of the loan retained (contributed) by foreign lead arrangers and all foreign lenders combined. Thus, the estimated effects of IPR reform on the foreign lender participation are both economically and statistically significant and suggest an increase in the supply of foreign capital to borrowers in the countries that undertake IPR reforms.

Table 7
IPR reform and foreign bank participation. This table reports the results of regressions of the proxies for foreign bank participation in syndicated loans (log of a fraction of loan retained by foreign lead arranger and all foreign bank combined) on the borrowing firms' patent reform indicator and control variables. All independent variables (except for loan characteristics) are lagged by one year, and are defined in Appendix Table A1. The standard errors given in brackets below coefficients are adjusted for heteroskedasticity and clustering at the borrowers' country level. ∗, ∗∗, and ∗∗∗ indicate significance at the 10%, 5%, and 1% level, respectively.

Variables	Log (loan share of foreign lead arranger) [1]	Log (loan share of all foreign banks) [2]
Patent reform	0.125***	0.07**
	[0.04]	[0.029]
Log of GDP per capita	−0.038	−0.142***
	[0.058]	[0.030]
GDP growth	−0.779**	−0.490***
	[0.364]	[0.174]
Country Risk Index	−0.006	0.004**
	[0.004]	[0.002]
Private credit to GDP	0.023	−0.035
	[0.053]	[0.028]
Creditor rights	−0.260***	0.088**
	[0.054]	[0.042]
Rule of law	−0.02	0.006
	[0.021]	[0.013]
Loan characteristics	Yes	Yes
Borrower credit rating	Yes	Yes
Country Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	21,394	26,318
Adjusted R-squared	0.191	0.231

6. Conclusion, discussion and contribution

The design of legal institutions that protect IPR remains front-and-center in the policy debate around the world and academic research. While the academic literature has long recognized the importance of IPR in promoting cross-border business activity and innovation, we know very little about the effect of IPR on the ability of firms to access debt financing. This issue is important because bank credit is the most importance source of financing for corporations around the world and allocating scarce capital to their most productive uses is the fundamental function of banks. This paper provides a novel and important evidence showing that legal reforms that strengthen IPR are associated with lower loan interest rates, greater credit availability, and greater participation of foreign banks in loan syndicates. Importantly, the loan pricing effects of IPR reform are significantly larger among borrowers that operate in high IP-intensity industries (and thus are especially sensitive to shifts in IPR protection). Overall, an important empirical and novel result of this paper is that strengthening of IPR protection leads to increased access to bank financing for local corporations.

The evidence provided in this paper should be of interest not only for scholars, but also for policymakers given the fact that the economic consequences of IPR is of first-order importance in both economically advanced and emerging markets. Numerous commentators and scholars have expressed concerns that strict patent rights in both developed and developing countries discourage subsequent innovations and thus stand in the way of economic growth (see, for example, Dosi and Stiglitz (2014), Wall Street Journal (2008), Economist (2015)). This paper provides new evidence suggesting that strengthening of IPR can have an important indirect effect: IPR reforms can lower domestic firms' costs of borrowing and thus improve firms' access to debt finance. These reforms might also aid in attracting foreign credit to the country.

Appendix A

See Tables A1 and A2.

Table A1
Variable descriptions and data sources.

Variable name	Variable definition
Loan information (Source: DealScan)	
Loan spread	The natural log of the drawn all-in-loan spread, which is the amount in basis points that the borrower pays over the London Interbank Offered Rate (LIBOR) or a similar benchmark, inclusive of all upfront fees prorated over the life of the loan
Loan size	The natural log of loan facility amount in millions of US dollars
Loan maturity	The natural log of loan maturity in months
Share of loan kept by foreign lead bank	The percentage of the loan kept by the foreign lead arranger. If there are more than one lead arranger, this is the average of loan shares of the lead arrangers
Lead bank	Lead banks are banks which Dealscan identifies as "lead arranger credit" or "lender role" is either "agent", "administrative agent", "arranger" or "lead bank"
Borrower credit rating score	Borrower's Standard & Poor's (S&P) long-term debt rating at the loan close, converted to an index from 1 = AAA to 7 = CCC or worse, and 8 = no rating assigned
Borrower characteristics (Source: Wordscope and Compustat Global)	
Tangibility	Net property, plant, and equipment/total assets
Assets size	The natural log of total assets in millions of US dollars
Profitability	Operating income/total assets
Z-score	=[1.2 × (current assets-current liabilities)/total assets + 1.4 × (retained earnings/total assets) + 3.3 × (pre-tax income/total assets) + 0.6 (equity/total debt) + 1 × (sales/total assets)
Industry characteristics (Source: Compustat and NBER Patent Data)	
Industry "natural" intellectual assets intensity	Industry-level average of R&D intensity and patenting intensity across all U.S. firms on Compustat in the period 1990–2010 in each three-digit SIC industry. R&D intensity is measured by the stock of past R&D expenditures to total assets. Patenting intensity is measured by the stock of total patents granted to a firm (from the NBER patent database) to its assets. Following R&D and patents stocks were obtained using a declining balance formula and the past history of spending and number of awarded patents using the 15% depreciation rate
Country (time-varying) characteristics	
Country Risk Index	The Country composite risk index is based on a possible 100 points and aggregates political, financial and economic risk indices. *(Source: International Country Risk Guide)*
Creditor rights index	A yearly index aggregating creditor rights, ranges from 0 (weak creditor rights) to 4 (strong creditor rights). A score of 1 is assigned for the following rights of secured lenders as defined in countries' bankruptcy and reorganization laws: (1) there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization; (2) secured creditors are able to seize their collateral after the reorganization petition is approved, so there is no automatic stay or asset freeze; (3) secured creditors are paid first out of the proceeds of liquidating a bankrupt firm, as opposed to other creditors such as government or workers; and (4) management does not retain administration of its property pending the resolution of the reorganization. Source: Djankov, McLiesh, and Shleifer (2007)

(*continued on next page*)

Table A1 (*continued*)

Variable name	Variable definition
Rule of Law	Index that captures perceptions of the extent to which firms have confidence in contract enforcement and property rights. Higher scores indicate weaker law and order. *(Source: International Country Risk Guide*)
Corruption Country Governance Index	A country indicator capturing perceptions of the extent to which public power is exercised for private gain. Higher scores indicate more corruption. (The International Country Risk Guide). The average of the following six governance indicators: 1. Voice and Accountability; 2. Political Stability and Absence of Violence; 3. Government Effectiveness. 4. Regulatory Quality; 5. Rule of Law. 6. Control of Corruption (*Source: World Development Indicators;* Kaufmann et al., 2009)
GDP per capita	GDP in US dollars divided by total population. *(Source: World Bank Databank*)
GDP growth Financial reform dummy	Real growth rate of gross domestic product in US dollars in year t. *(Source: World Bank Databank*) An indicator variable for a major financial reform and financial policy changes along seven different dimensions: credit controls and reserve requirements, interest rate controls, entry barriers, state ownership, policies on securities markets, banking regulations, and restrictions on the financial account (Source: Abiad et al. (2010) https://www.imf.org/en/Publications/WP/Issues/2016/12/31/A-New-Database-of-Financial-Reforms-22485)

Table A2
Selected High and Low IP-intensive Industries (in terms of R&D intensity) The table reports the R&D intensities (measured as the average of firms' stock of past R&D spending scaled by assets) for selected three-digit level SIC industries with more than 10 firm-year observations from COMPUSTAT averaged over the period 1990 to 2010.

Industry	3-Difit SIC	R&D intensity
High R&D Intensity Industries		
PHARMACEUTICALs	283	1.28914
MEDICAL INSTRUMENTS	384	0.4573
COMPUTER PROGRAMMING & SOFTWARE	737	0.4396
COMPUTER & OFFICE EQUIPMENT	357	0.43192
Telephone Equipment	366	0.42018
OPTICAL, MEASURING, AND CONTROLLING INSTRUMENTS	382	0.40605
Low R&D Intensity Industries		
JEWELRY, PRECIOUS METAL	391	0
GREETING CARD	277	0
LOCAL & SUBURBAN TRANSIT	410	0
CEMENT, HYDRAULIC	324	0.00016
SAWMILLS AND PLANING MILLS	242	0.00139

References

Abiad, A., Detragiache, E., Tressel, T., 2010. A new database of financial reforms. IMF Staff Pap. 57 (2), 281–302.
Allred, B.B., Park, W.G., 1997. Patent rights and innovative activity: Evidence from national and firm-level data. J. Int. Bus. Stud. 38 (6), 878–900.
Alimov, A., 2015. Labor protection laws and bank loan contracting. J. Law Econ. 58, 37–74.
Alimov, A., Officer, M.S., 2017. Intellectual property rights and cross-border mergers and acquisitions. J. Corp. Fin. 45, 360–377.
Bae, K.-H., Goyal, V.K., 2009. Creditor rights, enforcement, and bank loans. J. Financ. 64, 823–860.
Arrow, K.J. 1962. Economic welfare and the allocation of resources for invention. In: Nelson, R. (Ed.), The Rate and Direction of Inventive Activity. Princeton, New Jersey.
Bekaert, G., Harvey, C.R., Lundblad, C.T., Siegel, S., 2014. Political risk spreads. J. Int. Bus. Stud. 45 (4), 471–493.
Berg, T., Saunders, A., Steffen, S., Streitz, D., 2016. Mind the gap: the difference between U.S. and European loan rates. Rev. Fin. Stud. 30, 948–987.
Berger, A.N., Udell, G.F., 1990. Collateral, loan quality, and bank risk. J. Monet. Econ. 25, 21–42.
Beck, T., Ioannidou, V., Schafer, L., 2016. Foreigners vs. natives: Bank lending technologies and loan pricing. Manage. Sci.
Bertrand, M., Mullainathan, S., 2003. Enjoying the quiet life? Corporate governance and managerial preferences. J. Polit. Econ. 111, 1043–1075.
Bilir, L.K., 2014. Patent laws, product life-cycle lengths, and multinational activity. Am. Econ. Rev. 104 (7), 1979–2013.
Branstetter, L.G., Fisman, R., Foley, C.F., 2006. Do stronger intellectual property rights increase international technology transfer? Empirical evidence from U. S. firm-level panel data. Quart. J. Econ. 121 (1), 321–349.
Branstetter, L., Fisman, R., Foley, C.F., Saggi, K., 2011. Does intellectual property rights reform spur industrial development? J. Int. Econ. 83 (1), 27–36.
Buch, C.M., 2003. Information or regulation: what drives the international activities of commercial banks? J. Money, Credit Bank. 35, 851–869.
Carey, M., Nini, G., 2007. Is the corporate loan market globally integrated? A pricing puzzle. J. Fin. 62, 2969–3007.
Chava, S., Nanda, V., Xiao, S.C., 2017. Lending to innovative firms. Rev. Corp. Fin. Stud. 6 (2), 234–289.
Claessens, S., Laeven, L., 2003. Financial development, property rights, and growth. J. Fin. 58, 2401–2436.
Claessens, S., Van Horen, N., 2014. Foreign banks: Trends and impact. J. Money, Credit Bank. 46, 295–326.
Demirgüç -Kunt, A., Levine, R., 2001. Financial Structure and Economic Growth: Cross-country Comparisons of Banks, Markets, and Development. The MIT Press, Cambridge, MA.
Djankov, S., McLiesh, C., Shleifer, A., 2007. Private credit in 129 countries. J. Financ. Econ. 84, 299–329.
Dosi, G., Stiglitz, J.E., 2014. The role of intellectual property rights in the development process, with some lessons from developed countries: an introduction. In: Cimoli, M., Dosi, G., Maskus, K., Okediji, R., Reichman, J., Stiglitz, J. (Eds.), Intellectual Property Rights and Development. Oxford University Press, Oxford/New York.
Galasso, A., Schankerman, M., 2015. Patents and cumulative innovation: causal evidence from the courts. Quart. J. Econ. 130, 317–369.

Giannetti, M., Yafeh, Y., 2012. Do cultural differences between contracting parties matter? Evidence from syndicated bank loans. Manage. Sci. 58, 365–383.
Ginarte, J.C., Park, W.G., 1997. Determinants of patent rights: a cross-national study. Res. Policy 26 (3), 283–301.
Hall, B.H., Lerner, J., 2010. The financing of R&D and innovation. In: Hall, B.H., Rosenberg, N. (Eds.), Handbook of the Economics of Innovation. Elsevier, Netherlands, pp. 610–638.
Hall, B.H., Thoma, G., Torrisi, S., 2007. The market value of patents and R&D: evidence from European firms. In: Solomon, G.T. (Ed.), Best Conference Papers. 2007 Annual Meeting Proceedings. Academy of Management. ISSN: 1543-8643.
Hart, O., Moore, J., 1994. A theory of debt based on the inalienability of human capital. Quart. J. Econ. 109, 841–879.
Hochberg, Y.V., Serrano, C.J., Ziedonis, R.H., 2018. Patent collateral, investor commitment, and the market for venture lending. J. Financ. Econ. 130, 74–94.
Kaufmann, D., Kraay, A., Mastruzzi, M., 2009. Governance matters VIII: aggregate and individual governance indicators, 1996–2008. The World Bank Institute.
Koh, P.S., Reeb, D., 2015. Missing R&D. J. Acc. Econ. 60 (1), 73–94.
La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R.W., 1997. Legal determinants of external finance. J. Fin. 52, 1131–1150.
Leland, H.E., Pyle, D.H., 1977. Informational asymmetries, financial structure, and financial intermediation. J. Financ. 32, 371–387.
Lerner, J., 2002. 150 years of patent protection. Am. Econ. Rev. 92 (2), 221–222.
Liu, Q., Wong, K.P., 2011. Intellectual capital and financing decisions: evidence from the U.S. patent data. Manage. Sci. 57, 1861–1878.
Mann, W., 2018. Creditor rights and innovation: evidence from patent collateral. J. Financ. Econ. 130, 25–47.
Maskus, K.E., 2000. Intellectual Property Rights in the Global Economy. Peterson Institute for International Economics, Washington DC.
Maskus, K.E., 2012. Private Rights and Public Problems: The Global Economics of Intellectual Property in the 21st Century. Peterson Institute for International Economics, Washington DC.
Nelson, R.R., 1959. The simple economics of basic research. J. Polit. Econ. 67, 297–306.
Park, W.G., 2008. International patent protection: 1960–2005. Res. Policy 37 (4), 761–766.
Petersen, M.A., Rajan, R.G., 1994. The benefits of lending relationships: evidence from small business data. J. Fin. 49 (1), 3–37.
Qian, Y., 2007. Do national patent laws stimulate domestic innovation in a global patenting environment? A cross-country analysis of pharmaceutical patent protection, 1978–2002. Rev. Econ. Stat. 89 (3), 436–453.
Qian, J., Strahan, P.E., 2007. How laws and institutions shape financial contracts: the case of bank loans. J. Financ. 62, 2803–2834.
Rajan, R., Zingales, L., 1998. Financial dependence and growth. Am. Econ. Rev. 88 (3), 559–586.
Saidi, F., Zaldokas, A., 2016. Patents as substitutes for relationships. Working Paper.
Stiglitz, J.E., Weiss, A., 1981. Credit rationing in markets with imperfect information. Am. Econ. Rev. 71, 393–410.
The Economist, August 8, 2015. A question of utility.
Wall Street Journal, July 14, 2008. Patent Gridlock Suppresses Innovation.
Wall Street Journal, August 22, 2011. Google, Motorola and the Patent Wars.
Wall Street Journal, October 2, 2015. Rift Over Drug Protections Complicates Trans-Pacific Partnership Trade Talks.
Wall Street Journal, July 20, 2016. Stronger Chinese Patent Laws Also Help U.S. Companies.