

ONLINE APPENDIX

Securing Debt in the Knowledge Economy:

Evidence from Intellectual Property Registers

Laurie Ciaramella

David Heller

Leo Leitzinger

Appendix A : Additional Tables and Figures

Table IA1: Definition of IP rights: Trademarks, patents, and designs

IP right	Trademark	Patent	Design
Subject matter	Disinct signs that distinguish firms (i.e., brands, words, drawings, and/or symbols)	Technical invention	Aesthetic creative forms and non-functional product features
Conferred rights	Exclusive right to use the trademark and prevent its use for similar goods/services	Exclusive right to make, use, and sell the patented invention	Exclusive right to use the design
Requirement	Distinctiveness, use in commerce	Novelty, material, non-obviousness, industrial application	Similar to patents (lower threshold)
Protection length	10 years	1 year	1 year
Max. protection	indefinite	20 years	25 years
Maintenance/ activation costs	low	high	high
Benefits	Promotes quality and competition; information provider	Incentive to innovate; Knowledge protection and diffusion	Provides means for product differentiation

Notes: The table defines the three most common IP right types: trademarks, patents, and designs. For comparison, uniformly applicable definition criteria are displayed, such as the object which is subject to protection, the basic requirements that need to be fulfilled to obtain the right, the actual procedural steps needed for activation, the protection length without renewals after grant, the maximum protection length, and a qualitative assessment of the average costs to activate and maintain the IP right. These definitions comprise IP rights filed and registered in Europe, i.e., at the EPO, EUIPO, or national IP offices. Most features also apply in other main IP jurisdictions, such as the United States, Japan, or Korea. Notably, unlike in the United States, design rights are not patented in Europe but are they registered IP rights that protect the whole or part of a product and may arise from aesthetic forms and non-functional product features.

Table IA2: List of variables

Firm-level variables:	
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Main regressors:	
<i>IP</i>	Dummy = 1 for any firm that pledges an IP right at any point in time and zero for matched comparison group firms.
<i>Pledge</i>	Dummy = 1 for any firm-year observation after the first IP collateral event (within matched strata), and zero otherwise.
<i>Post^{Ord.}</i>	Dummy = 1 for firms (and their matched partner) with a first IP pledge after the implementation of the Ordonnance 2006-346 into French law, i.e., in 2006 or later, and zero otherwise.
<i>Tan^{high}</i>	Dummy = 1 for firms with above-median levels of <i>Tangibility</i> , as defined below, and zero otherwise. Following (Aretz <i>et al.</i> , 2020), firms with levels of tangible assets are disproportionately responsive to the legal changes of the Ordonnance and, thus, this variable indicates firms in the treated group.
<i>Pledge^{posts}</i>	Dummy = 1 for any firm-year observation s ($\in [1,6]$) after the first use of IP collateral (within matched strata), and zero otherwise.
<i>Pledge^{pres}</i>	Dummy = 1 for any firm-year observation s ($\in [-6,-1]$) before the first use of IP collateral (within matched strata), and zero otherwise.
<i>Independence</i>	Dummy=1 if firms that did not have at least one shareholder with >50% ownership share at some point in time between 2007-2018 and zero otherwise.
 Main financial outcome variables (Orbis code):	
<i>LongTermDebt</i>	Long-term debt (<i>ltdb</i>) referring to loans outstanding with a maturity of at least one year
<i>LongTermDebt^{ratio}</i>	Long-term debt (<i>ltdb</i>) divided by total assets (<i>toas</i>)
<i>LongTermDebt^{NoLoans}</i>	Dummy = 1 for any firm-year observation in which a firm does not have any long-term debt (<i>ltdb</i>) outstanding at the end of the period, and zero otherwise.
<i>LongTermDebt</i>	Short-term debt (<i>loan</i>) referring to loans outstanding with a maturity of one year or less.
<i>ShortTermDebt^{ratio}</i>	Short-term debt (<i>loan</i>) divided by total assets (<i>toas</i>).
<i>ShortTermDebt^{NoLoans}</i>	Dummy = 1 for any firm-year observation in which a firm does not have any short-term debt (<i>loan</i>) outstanding at the end of the period, and zero otherwise.
<i>InterestBurden</i>	Total interest expenses throughout the period t (<i>interest</i>)
<i>InterestBurden^{ratio}</i>	Interest expenses (<i>interest</i>) divided by the average total debt holdings during t , defined as the average of current (<i>culi</i>) and non-current liabilities (<i>ncli</i>) held in t and $t-1$ or $((culi_t + culi_{t-1} + ncli_t + ncli_{t-1})/2)$.
 Main IP-level outcome variables:	
<i>I(PatentPledge)</i>	Dummy = 1 for each IP pledge with at least one patent used as collateral; denoted as “Binary” in the regression output tables
$\log(PatentPledge)$	Logarithm of the number of patents pledged as collateral in the focal IP loan
<i>I(TMpledge)</i>	Dummy = 1 for each IP pledge with at least one trademark used as collateral; denoted as “Binary” in the regression output tables
$\log(TMpledge)$	Logarithm of the number of trademarks pledged as collateral in the IP loan
Share of portfolio	The share of patents or trademarks pledged as loan collateral among total patents or trademarks, respectively
<i>FwdCits</i>	Average number of total forward citations received by pledged patents.
<i>FamilySize</i>	Average number of jurisdictions patents are active in at the time of their pledge
<i>IPC4Classes</i>	Average count of different main patent IPC technology classes (4-digit level) of pledged patents
<i>BwdCits_pat</i>	Average number of backward citations to patent literature of pledged patents

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Table IA2: List of variables (*continued*)

<i>PatentAge</i>	Average number of years patents have been active at the time of their pledge
<i>Applicants</i>	Average number of applicants in the patent filing of pledged patents
<i>I(AnyCit)</i>	Dummy equals one if pledged patents received at least one forward citation.
<i>Originality</i>	Citation-based index that captures how broadly a patent draws on prior technological fields by measuring the dispersion of the technological classes of the patents it cites.
<i>Generality</i>	Citation-based index that captures how broadly a patent's impact spreads across technological fields by measuring the dispersion of the technological classes of the later patents that cite it.
<i>Corporate</i>	Dummy = 1, if the corporate trademark is among the pledged trademarks
<i>Renewal</i>	Average number of renewed trademarks among pledged trademarks
<i>NiceClasses</i>	Average count of different registered NICE classes of trademarks pledged
<i>Transferred</i>	Average number of trademarks that have been transferred before being pledged
<i>ConsGoods</i>	Dummy = 1, if at least one of the pledged trademarks protects a consumer good
<i>IndicationUse</i>	Average number of pledged trademarks with at least one notes of a legal change prior to the pledge

Firm-level control variables (Orbis code):

<i>log(ttlAssets)</i>	Logarithm of total assets (<i>toas</i>), as measure of firm size
<i>Profitability</i>	Return on assets (RoA) measured as total earnings before interest and taxes (<i>ebit</i>) divided by total assets (<i>toas</i>)
<i>Tangibility</i>	Share of fixed tangible assets (<i>tfas</i>) over total assets (<i>toas</i>)
<i>CashFlow</i>	Total cash flow (<i>cf</i>) scaled by total assets (<i>toas</i>)
<i>CurrentRatio</i>	Liquidity risk: total current assets (<i>cuas</i>) over current liabilities (<i>culi</i>)

Other firm-level financial variables (Orbis code):

<i>SME</i>	Dummy = 1 for firms with less than 250 employees (<i>empl</i>), and a maximum turnover (<i>turn</i>) of 50 million Euro or a maximum balance sheet total (<i>toas</i>) of 43 million Euro.
<i>LimitedLiabilityFirm</i>	Dummy = 1 for with <code>Standardised_legal_form</code> equal to "Private limited companies" and zero otherwise.
<i>Listed firm</i>	Dummy = 1 for firms listed on the stock market (<i>Listed</i>) and zero otherwise.
<i>FirmAge</i>	Time (full years) since incorporation date (<i>Date_of_incorporation</i>) and the balance sheet reporting date (<i>Closing_date</i>)
<i>TotalDebt</i>	Total liabilities (<i>culi+ncli</i>) divided by total assets (<i>toas</i>)
<i>LongDebtIssuance</i>	Year-to-year growth in long-term debt (<i>D.ltdb/L.ltdb</i>)
<i>ShortDebtIssuance</i>	Year-to-year short-term debt growth (<i>D.loan/L.loan</i>)
<i>RZindex</i>	Firms dependence on external financing, measured as the difference between capital expenditures (<i>exp_mat</i>) and cashflows (<i>cf</i>): $(exp_mat - cf) / cf$.
<i>Employees</i>	Number of employees at end of period (<i>empl</i>)
<i>AssetGrowth</i>	Year-to-year growth in total assets (<i>D.toas/L.toas</i>)
<i>log(sales)</i>	Logarithm of total sales (<i>sale</i>)

Notes: The table lists and defines all variables used in this paper. Throughout the analysis several variables are measured using the natural logarithm; these specifications are not explicitly listed. Firm-level variables are obtained from Orbis; IP-level data is obtained from INPI and PATSTAT. For firm-level variables, corresponding mnemonics provided by Bureau van Dijk are stated in parentheses, such as the code *toas* abbreviating total assets in the Orbis data.

Table IA3: Detailed descriptive statistics on IP-pledging firms**Panel A:** Detailed variable distributions

	Obs.	Mean	SD	p10	p25	p50	p75	p90	min.	max.
<i>TotalDebt^{ratio}</i>	17,194	0.644	0.260	0.303	0.481	0.647	0.806	0.964	0.012	1.197
<i>LongTermDebt^{ratio}</i>	17,183	0.087	0.170	0	0	0.001	0.103	0.279	0	1.133
$\log(\text{LongTermDebt})$	17,185	7.242	7.483	0	0	4.234	14.592	16.663	0	22.871
<i>LongTermDebt^{NoLoan}</i>	17,185	0.499	0.500	0	0	0	1	1	0	1
<i>LongTermDebt^{growth}</i>	7,900	0.228	1.492	-1	-0.631	-0.114	0.296	1.839	-1	5.314
$\log(\text{ShortTermDebt})$	17,159	10.209	6.003	0	6.908	12.581	14.750	16.277	0	16.674
<i>ShortTermDebt^{NoLoan}</i>	17,153	0.224	0.417	0	0	0	0	1	0	1
<i>InterestBurden</i>	11,449	0.026	0.021	0.002	0.009	0.021	0.037	0.057	0	0.079
$\log(\text{ttlAssets})$	17,269	16.743	2.146	13.971	15.417	16.902	18.175	19.350	0	24.496
<i>Tangibility</i>	17,192	0.125	0.159	0.001	0.015	0.064	0.178	0.331	0	0.939
<i>Profitability</i>	17,096	0.066	0.186	-0.058	0.012	0.071	0.142	0.233	-1.283	0.750
<i>CashFlow</i>	16,526	0.049	0.179	-0.082	0.016	0.061	0.118	0.193	-0.094	0.654
<i>CurrentRatio</i>	17,163	1.582	1.115	0.549	0.912	1.285	1.851	3.025	0.184	4.961
<i>FirmAge</i>	17,259	24.654	16.157	5	11	21	38	51	0	53
<i>Employees</i>	11,843	387.9	1076.9	9	30	105	352	867	1	45,072
<i>SME</i>	14,570	0.776	0.417	0	1	1	1	1	0	1
<i>LimitedLiabilityFirm</i>	17,269	0.552	0.497	0	0	1	1	1	0	1
<i>ListedFirms</i>	17,269	0.058	0.234	0	0	0	0	0	0	1

Panel B: Differentiating IP-pledging firms by IP type

IP pledges	Any combination			Trademarks			Patents		
	Obs.	Mean	SD	Obs.	Mean	SD	Obs.	Mean	SD
<i>TotalDebt^{ratio}</i>	2,372	0.618	0.248	15,569	0.645	0.258	3,935	0.628	0.261
<i>LongTermDebt^{ratio}</i>	2,372	0.093	0.175	15,558	0.087	0.169	3,935	0.091	0.177
$\log(\text{LongTermDebt})$	2,372	7.659	7.817	15,560	7.307	7.539	3,935	7.225	7.479
<i>LongTermDebt^{NoLoan}</i>	2,372	0.491	0.500	15,560	0.499	0.500	3,935	0.498	0.500
<i>LongTermDebt^{growth}</i>	1,126	0.250	1.493	7,167	0.226	1.487	1,826	0.245	1.507
$\log(\text{ShortTermDebt})$	2,369	10.037	6.212	15,534	10.29217	6.019	3,932	9.748	6.067
<i>ShortTermDebt^{NoLoan}</i>	2,367	0.243	0.429	15,529	0.222	0.415	3,929	0.245	0.430
<i>InterestBurden</i>	1,572	0.025	0.019	10,345	2.587	2.128	2,652	2.415	1.995
$\log(\text{ttlAssets})$	2,380	17.327	2.119	15,637	16.838	2.115	3,950	16.732	2.271
<i>Tangibility</i>	2,372	0.144	0.155	15,567	0.124	0.160	3,935	0.144	0.153
<i>Profitability</i>	2,370	0.075	0.205	15,489	0.071	0.176	3,915	0.054	0.232
<i>CashFlow</i>	2,308	0.054	0.197	14,945	0.052	0.172	3,839	0.043	0.212
<i>CurrentRatio</i>	2,367	1.785	1.147	15,540	1.571	1.111	3,928	1.748	1.145
<i>FirmAge</i>	2,380	26.203	16.4375	15,627	25.204	16.257	3,950	23.413	15.845
<i>Employees</i>	1,718	538.886	1379.518	10,763	402.054	1119.9	2,763	430.292	1130.668
<i>SME</i>	1,950	0.628	0.483	13,076	0.770	0.421	3,383	0.714	0.452
<i>LimitedLiabilityFirm</i>	2,380	0.567	0.496	15,637	0.551	0.497	3,950	0.558	0.497
<i>ListedFirms</i>	2,380	0.054	0.226	15,637	0.053	0.223	3,950	0.078	0.269

Notes: This table presents details on the descriptives from Table 2 by presenting the actual distributions of the variables more granularly. Panel A repeats the statistics presented before for the full sample and displays detailed statistics on the distributions of the variables. Panel B is similar to before but displays statistics for firms that pledge at least two different types of IP rights as collateral (*Any combination*), those that pledge trademarks (and potentially also other IP rights), and those that pledge patents (and potentially also other IP rights).

Table IA4: Comparing IP-pledging and comparison group firms' main characteristics

	Mean		Differences in means	<i>(t-values)</i>
	IP-pledging firm	Matched counterparty		
<i>LongTermDebt^{ratio}</i>	0.054	0.049	0.005	(1.206)
<i>log(ttlAssets)</i>	16.584	16.473	0.111	(1.557)
<i>Tangibility</i>	0.118	0.119	-0.001	(-0.194)
<i>Profitability</i>	0.092	0.088	0.004	(0.845)
<i>CurrentRatio</i>	1.903	1.901	0.002	(0.023)
<i>CashFlow</i>	0.067	0.067	-0.000	(-0.050)
Manova test results:				
	Statistic	F(df1, df2)	F	Prob>F
<i>Wilks' lambda</i>	0.9979	6.0 2948.0	1.04	(0.398)
<i>Lawley-Hotelling trace</i>	0.0021	6.0 2948.0	1.04	(0.398)

Notes: This table displays statistics on main dependent variable and other financial characteristics used as control variables in all regressions for of the matched sample described in Section 2.4. The top part of the table displays the mean values of these characteristics for IP-pledging firms and firms from the matched group for the three years preceeding the initial IP pledge. The last two columns show the differences in means and the corresponding t-values in parentheses. The bottom of the table presents test results on the joint significance of these using the Wilks' lambda and the Lawley-Hotelling trace tests. The results suggest that the overall mean vector of the displayed variables does not differ between the two groups.

Table IA5: Robustness tests to Table 3

Panel A: Displaying all control variables

Dep. variable	<i>LongTermDebt</i>			<i>ShortTermDebt</i>			<i>InterestRate</i>	
	ratio	log.	<i>NoLoans</i>	ratio	log.	<i>NoLoans</i>	ratio	log.
	I	II	III	IV	V	VI	VII	VIII
IP × Pledge	0.033*** (0.006)	1.388*** (0.306)	-0.082** (0.028)	-0.007 (0.004)	-0.156 (0.240)	-0.038 (0.040)	0.186* (0.001)	0.283** (0.111)
<i>FirmSize</i>	0.005 (0.003)	1.056*** (0.164)	-0.021* (0.011)	0.012*** (0.003)	1.504*** (0.146)	-0.086*** (0.018)	0.187*** (0.053)	1.314*** (0.079)
<i>Tangibility</i>	0.110*** (0.029)	6.003*** (1.324)	-0.194* (0.112)	0.027 (0.019)	0.778 (1.061)	-0.309* (0.176)	1.295** (0.415)	3.067*** (0.598)
<i>Profitability</i>	-0.031 (0.021)	0.950 (0.703)	-0.135** (0.058)	-0.032** (0.014)	-1.436** (0.648)	0.064 (0.090)	0.355 (0.274)	-0.220 (0.384)
<i>CashFlow</i>	-0.041** (0.016)	-0.777 (0.589)	0.026 (0.049)	-0.047*** (0.012)	-0.888 (0.603)	0.030 (0.082)	-0.788** (0.261)	-0.910** (0.332)
<i>CurrentRatio</i>	0.003*** (0.001)	0.132*** (0.030)	-0.006* (0.003)	-0.003*** (0.000)	-0.250*** (0.025)	0.013*** (0.002)	0.006 (0.010)	-0.038** (0.012)
Constant	-0.048 (0.057)	-12.667*** (2.745)	1.169*** (0.186)	-0.128** (0.043)	-13.712** (2.429)	1.734*** (0.294)	-1.084 (0.009)	-10.537*** (1.322)
Additional controls:								
Industry-Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.407	0.558	0.405	0.449	0.452	0.422	0.604	0.785
N	10,856	10,855	6,317	10,838	10,838	3,115	8,440	8,424

Panel B: Distinguishing firms with different ownership structures

Dep. variable	<i>LongTermDebt</i>			<i>ShortTermDebt</i>			<i>InterestRate</i>	
	ratio	log.	<i>NoLoans</i>	ratio	log.	<i>NoLoans</i>	ratio	log.
	I	II	III	IV	V	VI	VII	VIII
IP × Pledge	0.027** (0.009)	1.582** (0.498)	-0.098** (0.041)	-0.009 (0.007)	-0.047 (0.362)	-0.045 (0.057)	0.002 (0.001)	0.213 (0.144)
Pledge × Independence	0.004 (0.007)	0.457 (0.457)	-0.044 (0.042)	-0.004 (0.006)	-0.316 (0.339)	0.035 (0.062)	-0.000 (0.001)	0.027 (0.163)
IP × Pledge × Independence	0.009 (0.012)	-0.279 (0.646)	0.029 (0.058)	0.007 (0.009)	0.071 (0.0487)	0.010 (0.080)	-0.000 (0.002)	0.138 (0.222)
Additional controls:								
Industry-Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.419	0.562	0.411	0.444	0.449	0.418	0.602	0.776
N	10,213	10,212	5,813	10,198	10,198	2,968	7,908	7,893

Notes: Panel A displays the estimates equivalent to Table 3, only here the regression output displays also the estimates on the firm-level control variables. The interest burden ratio in Column VII is expressed in percentage points to better illustrate these effects. Panel B is similar to the estimation in Table 3, only here we deploy a triple interaction of the IP-Pledge interaction with a dummy, *Independence*, which is equal to one for all firms that did not have at least one shareholder with >50% ownership share at some point in time between 2007-2018, and zero otherwise. The regressions also control for the individual components of the interaction term. Robust standard errors are clustered at the firm-level and displayed in parentheses below coefficients. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table IA6: Robustness test on the role of tangible assets as alternative collateral

Panel A: Alternative collateral and debt ratios						
Dep. variable	<i>LongTermDebt^{ratio}</i>					
	I	II	III	IV	V	VI
IP × Pledge	0.033 ^{***} (0.008)	0.024 ^{**} (0.010)	0.036 [*] (0.020)	0.031 ^{***} (0.008)	0.034 ^{***} (0.008)	0.030 ^{***} (0.008)
Pledge × Tan ^{high}					0.003 (0.007)	0.029 (0.029)
IP × Pledge × Tan ^{high}					-0.002 (0.011)	0.021 (0.047)
Sample: Tangibility	< P50	< P33	< P10	> P50	all	all
Tan ^{high} definition:	-	-	-	-	binary	continuous
Firm-level	yes	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
R^2	0.491	0.520	0.534	0.491	0.480	0.480
N	5,294	3,377	893	5,551	10,856	10,856

Panel B: Alternative collateral and interest burden						
Dep. variable	<i>InterestBurden^{ratio}</i>					
	I	II	III	IV	V	VI
IP × Pledge	0.206 (0.145)	0.115 (0.194)	0.253 (0.363)	0.141 (0.129)	0.221 (0.147)	0.063 (0.133)
Pledge × Tan ^{high}					0.024 (0.131)	-0.579 (0.508)
IP × Pledge × Tan ^{high}					-0.065 (0.196)	1.009 (0.702)
Sample: Tangibility	< P50	< P33	< P10	> P50	all	all
Tan ^{high} definition:	-	-	-	-	binary	continuous
Firm-level	yes	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
R^2	0.643	0.633	0.633	0.691	0.658	0.658
N	3,940	2,539	687	4,475	8,440	8,440

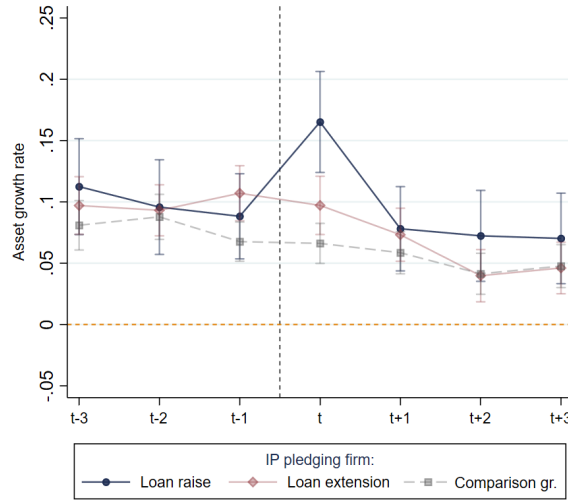
Notes: The table displays estimates explaining the effect of IP pledges on firms long-term debt-to-asset ratios and the complementary importance of alternative collateral, i.e., tangible assets. In Panel A, the first four columns estimate the same specification as defined in Equation (1), using different subsamples out of the matched sample of IP-pledging firms and their non-pledging counterparts for the years 1995-2018 depending on firms' tangible fixed-assets-to-total asset ratio: firms in the bottom half (Column I), bottom tercile (Column II), bottom decile (Column III), and top half (Column IV) of the asset tangibility distribution, respectively. Column V is run on the full sample but adds a triple interaction term $IP \times Pledge \times Tan^{high}$ and the base value of $Pledge \times Tan^{high}$. The level variables are dropped because of perfect multicollinearity due to the inclusion of the fixed effects. Tan^{high} is equal to one if a firm has above median levels of tangible assets, and zero otherwise. Column VI is similar to Column V but uses the continuous tangible asset ratio, *Tangibility* instead of Tan^{high} . To avoid reverse causality issues, all tangibility ratios are measured in the year before the initial IP pledge. Columns I-IV include controls equivalent to those specified before. Columns V and VI do not additionally control for asset tangibility. Panel B is similar to the first panel, only here, the dependent variable is firm-level interest burden. Robust standard errors are clustered at the firm-level and displayed in parentheses below coefficients. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table IA7: Assessing borrower quality

Panel A: Matched sample estimates on loan renewals, new debt issues, and growth

Dep. variable	log(<i>t</i> tl <i>Assets</i>)		log(<i>Sales</i>)		log(<i>Employees</i>)	
	I	II	III	IV	V	VI
IP × Pledge	0.231** (0.084)	0.085* (0.051)	0.435** (0.204)	0.136 (0.145)	0.245** (0.100)	0.030 (0.058)
Raising/renewing debt:	Raising	Renewing	Raising	Renewing	Raising	Renewing
Additional controls:						
Firm-level	yes	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes	yes	yes
R^2	0.941	0.947	0.752	0.751	0.900	0.924
N	3,096	7,728	3,096	7,728	2,088	5,631

Panel B: Asset growth rates relative to the pledge



Notes: The table displays the effect of IP pledges on subsequent growth patterns of firms, by estimating of Equation (1). Specifically, it compares the average year-to-year asset growth rates of IP-pledging firms that raise more debt, IP-pledging firms that rollover debt, and non-IP-pledging firms. The specifications are equivalent to those in Table 3, using the matched sample of IP-pledging firms and their non-pledging counterparts for the years 1995-2018. The dependent variables relate to firm-level growth, namely the natural logarithms of total assets (Columns I and II), total sales (Columns III-IV), and the number of employees (Columns V-VI) as defined in Table IA2 (Appendix). Further, regressions are separately estimated for firms that pledge IP and significantly raise their debt financing after the initial use of IP collateral (Columns I, III, and V) and those that do not extend their debt financing (Columns II, IV, and VI). Standard errors (in parentheses below coefficients) are clustered at the firm level. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$). In this context, obtaining new loans should mostly stimulate firm-level investment and growth if firms raise additional financing, instead of renewing loans, i.e., rolling over debt at constant levels. The graph in Panel B confirms this notion by showing that firms that pledge IP and raise their debt financing have significantly higher growth rates in the year of their use of IP collateral. Specifically, it plots mean values of the year-to-year growth rate in firms' total assets, using the matched sample of IP-pledging firms and their non-pledging counterparts for the years 1995-2018. Means are displayed for each year in a symmetrical time window around the initial use of IP as collateral. It distinguishes firms that pledged IP collateral and increased their debt ratios ("loan raise"), those that pledge IP but roll-over debt, i.e., do not increase their debt ratios ("loan renewal"), and the matched control group of non-IP-pledging firms ("comparison group"). Whiskers span the 95 percent confidence intervals.

Table IA8: Robustness tests: the *Ordonnance 2006-346* and the relevance of IP collateral**Panel A:** Full sample, 1995-2018

Dep. variable	<i>LongTermDebt</i>			<i>InterestBurden</i>	
	ratio	log.	<i>NoLoans</i>	ratio	log.
	I	II	III	IV	V
Tan ^{high} × Pledge × Post ^{Ord.}	-0.021 (0.020)	0.048 (0.760)	0.006 (0.051)	0.040 (0.065)	-0.020 (0.255)
Pledge × Post ^{Ord.}	0.025* (0.015)	1.046** (0.561)	-0.081** (0.038)	-0.028 (0.032)	-0.201 (0.201)
Tan ^{high} × Post ^{Ord.}	0.035* (0.018)	1.898** (0.749)	-0.121** (0.050)	-0.066 (0.063)	-0.163 (0.239)
Tan ^{high} × Pledge	-0.014 (0.011)	-0.692 (0.476)	0.047 (0.032)	-0.003 (0.008)	-0.258* (0.153)
Tan ^{high}	0.004 (0.009)	0.354 (0.441)	-0.027 (0.029)	0.004 (0.006)	0.302* (0.155)
Additional controls:					
Firm-level	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes
R^2	0.128	0.310	0.303	0.100	0.658
N	6,995	6,993	6,993	5,010	5,003

Panel B: The *Ordonnance* and short-term debt patterns

Dep. variable	<i>ShortTermDebt</i>					
	ratio	log.	<i>NoLoans</i>	ratio	log.	<i>NoLoans</i>
	I	II	III	IV	V	VI
Tan ^{high} × Pledge × Post ^{Ord.}	0.069** (0.032)	0.701 (0.791)	-0.005 (0.057)	0.066*** (0.025)	0.321 (0.634)	-0.000 (0.046)
Pledge × Post ^{Ord.}	-0.050** (0.023)	-0.962* (0.583)	0.056 (0.042)	-0.053*** (0.020)	-0.852* (0.482)	0.049 (0.035)
Tan ^{high} × Post ^{Ord.}	-0.039 (0.027)	-0.419 (0.684)	-0.022 (0.050)	-0.021 (0.023)	-0.240 (0.603)	-0.013 (0.044)
Tan ^{high} × Pledge	-0.060*** (0.021)	-1.278*** (0.489)	0.060* (0.034)	-0.049*** (0.018)	-0.727* (0.403)	0.042 (0.029)
Tan ^{high}	0.051*** (0.020)	1.454*** (0.466)	-0.065** (0.032)	0.033** (0.016)	0.967*** (0.366)	-0.051** (0.025)
Additional controls:						
Firm-level	yes	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes
R^2	0.198	0.154	0.056	0.189	0.157	0.067
N	4,712	4,712	4,709	6,988	6,988	6,984

Notes: This table presents robustness tests for estimations displayed in Table 4. All specifications are equivalent to before. Only here, Panel A uses the full sample timeframe from 1995-2018. Panel B repeats the first three specifications of Table 4 but uses short-term instead of long-term debt as dependent variables (Columns I-III) and repeats these estimations using the full observation period of 1995-2018 (Column IV-VI). Standard errors (in parentheses below coefficients) are clustered at the firm level. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table IA9: The average shares of IP pledges containing patents and trademarks as collateral before and after the *Ordonnance 2006-346*

		Mean		Differences in means	<i>t-values</i>
		Before	After		
High tangible assets (Treated)	Patent pledge	0.230	0.352	0.121***	(2.686)
	TM pledge	0.877	0.846	-0.031	(0.887)
Low tangible assets (Control)	Patent pledge	0.180	0.131	-0.049	(1.644)
	TM pledge	0.899	0.909	0.010	(0.419)

Notes: The table reports the share of IP pledge events that contain at least one patent or one trademark, distinguishing between firms with high and low ex-ante asset tangibility, before and after the implementation of the 2006 collateral reform. The sample is all pledges between 2000 and 2012. Differences in means are reported with corresponding *t-values* in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table IA10: Robustness tests: the *Ordonnance 2006-346* and IP collateralization patterns

Panel A: Full sample, 1995-2018

Dep. variable	<i>PatentPledge</i>			<i>TMPledge</i>		
	Binary	log(Pats.)	Share of portfolio	Binary	log(TMs)	Share of portfolio
	I	II	III	IV	V	VI
$\text{Tan}^{\text{high}} \times \text{Post}^{\text{Ord.}}$	0.033*** (0.010)	0.079*** (0.027)	0.009* (0.0005)	-0.001 (0.014)	0.007 (0.035)	0.001 (0.007)
Firm-level controls	yes	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes
R^2	0.187	0.125	0.1224	0.648	0.432	0.416
N	7,000	7,000	7,000	7,000	7,000	7,000

(Continued on next page)

Table IA10: Robustness tests (*continued*)

Panel B: Timeframe as in Aretz *et al.* (2020), 2002-2009

Dep. variable	<i>PatentPledge</i>			<i>TMPledge</i>		
	Binary	log(Pats.)	Share of portfolio	Binary	log(TMs)	Share of portfolio
	I	II	III	IV	V	VI
$\text{Tan}^{\text{high}} \times \text{Post}^{\text{Ord.}}$	0.036** (0.015)	0.070** (0.031)	0.014* (0.007)	0.003 (0.020)	0.017 (0.047)	-0.007 (0.011)
Firm-level controls	yes	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes
R^2	0.200	0.138	0.128	0.645	0.452	0.424
N	3,080	3,080	3,080	3,080	3,080	3,080

Panel C: Logistic regressions

Dep. variable	$I(\text{PatentPledge})$			$I(\text{TMPledge})$		
	I	II	III	IV	V	VI
$\text{Tan}^{\text{high}} \times \text{Post}^{\text{Ord.}}$	1.409** (0.634)	1.295* (0.724)	1.385** (0.592)	-0.134 (0.407)	-0.146 (0.482)	-0.234 (0.381)
Timeframe	2000-2012	2002-2009	1995-2018	2000-2012	2002-2009	1995-2018
Firm-level controls	yes	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes	yes
N	2,236	1,578	2,984	2,799	1,845	3969

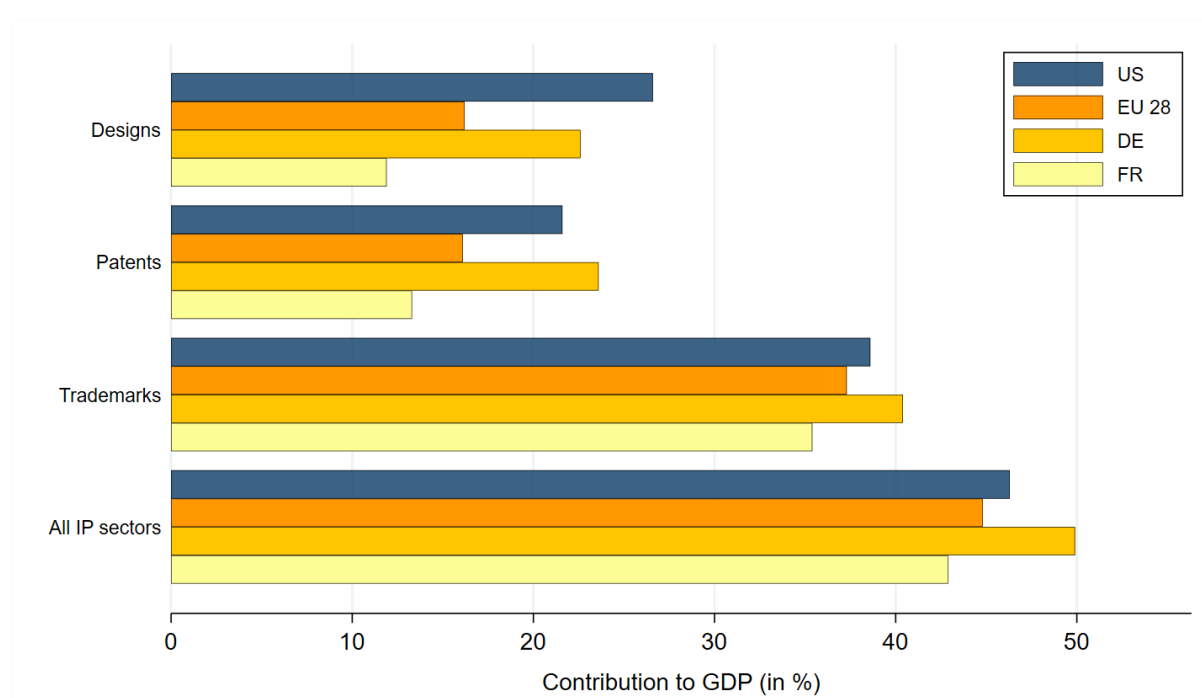
Notes: The table reports robustness tests to the estimates displayed in Table 5. All variables and model specifications are defined accordingly. Panel A is equivalent to before but uses the full sample. Panel B restricts the sample to 2002–2009, following Aretz *et al.* (2020). Panel C reports logistic regressions for patent and trademark pledges as in Columns I and IV of Table 5, i.e., using an indicator of patent and trademark pledge as dependent variable. The specifications are estimated for each of the three different sample periods as indicated at the bottom of the table. Standard errors (in parentheses below coefficients) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table IA11: Robustness tests: alternative patent value measures

Dep. variable	I(<i>AnyCit</i>)	<i>FwdCits(5yrs.)</i>	<i>FwdCits(12yrs.)</i>	<i>Originality</i>	<i>Generality</i>
	I	II	III	IV	V
$Tan^{high} \times Post^{Ord.}$	0.045* (0.025)	0.590* (0.308)	1.214** (0.540)	1.779** (0.691)	0.022** (0.011)
Additional controls:					
Firm-level	yes	yes	yes	yes	yes
Industry-Year FE	yes	yes	yes	yes	yes
Timing FE	yes	yes	yes	yes	yes
R^2	0.582	0.112	0.189	0.214	0.387
N	1,119	1,119	1,119	1,119	1,119

Notes: The table reports robustness tests to the estimates displayed in Panel B of Table 5. All variables and model specifications are defined accordingly, only here, we use different dependent variables to measure patent quality, i.e., value. Originally, we used the total number of forward citations and the size of the patent family as two commonly applied measures of patent value. Now, we use a dummy equal to one if the patents have received a citation (Column I), the total number of forward citations received within 5 and 12 years (Columns II and III) and a measure of patent originality and generality (Columns IV and V). As before, all values are averaged on over the patent portfolio. Standard errors (in parentheses below coefficients) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure IA1: Contribution of IP-intensive sectors to GDP in selected economies



Notes: The graph shows the contribution of IP-intensive sectors (designs, patents, trademarks and overall) to the overall GDP in the United States, the EU, Germany, and France in 2016. Industries are classified as IP-intensive, if the industry average of IP types per employee exceeds the overall average. We obtain information on the industry-classifications from USPTO (2016) and EPO-EUIPO (2022) for the United States and European countries, respectively.

Figure IA2: Form sheet of IP-related legal changes at INPI



15 rue des Minimes - CS 50001 - 92677 COURBEVOIE Cedex
 Pour vous informer : INPI Direct 0820 210 211

**BREVETS D'INVENTION, CCP, TPS,
 MARQUES, DESSINS ET MODÈLES**

Code de la propriété intellectuelle - Livres V, VI et VII

DEMANDE D'INSCRIPTION AU REGISTRE NATIONAL D'UN ACTE
 AFFECTANT LA PROPRIÉTÉ OU LA JOUISSANCE D'UN DÉPÔT



N° 11602*03

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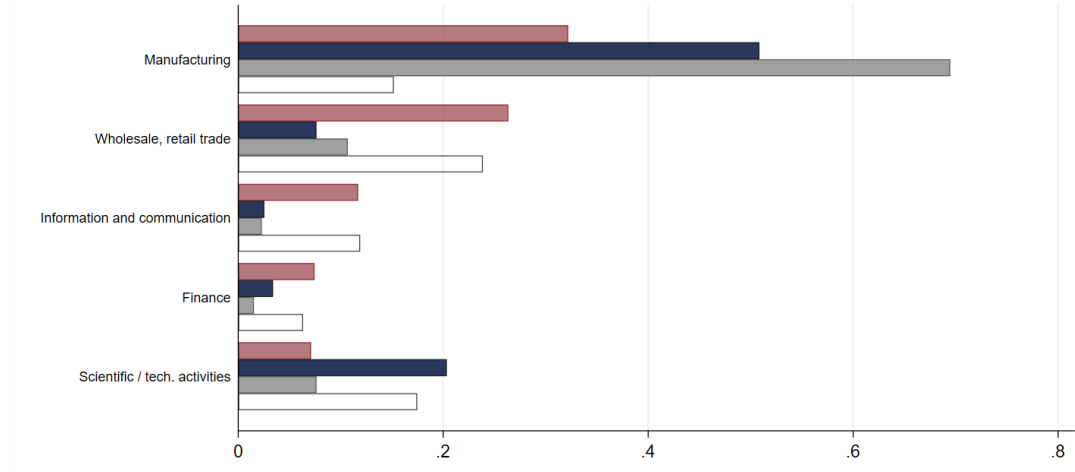
Veillez remplir ce formulaire à l'encre noire DRT RN 41-1/01-2014

<p style="text-align: center; border: 1px solid black; padding: 2px;">Réservé à l'INPI</p> <p>DATE D'INSCRIPTION N° D'INSCRIPTION</p> <p>DATE DE RÉCEPTION LIEU DE RÉCEPTION N° D'ORDRE</p>	<p>1 NOM ET ADRESSE DU DEMANDEUR OU DU MANDATAIRE À QUI LA CORRESPONDANCE DOIT ÊTRE ADRESSÉE</p> <div style="border: 1px solid black; height: 60px; width: 100%;"></div>
<p><input type="checkbox"/> Veillez cocher la case si le traitement accéléré est requis (un supplément de redevance doit alors être acquitté)</p>	
<p>Vos références pour ce dossier (facultatif)</p>	
<p>2 DEMANDEUR DE L'INSCRIPTION <input type="checkbox"/> S'il y a d'autres demandeurs, cochez la case et utilisez l'imprimé «Suite»</p>	
<p>Nom ou dénomination sociale</p>	
<p>Prénoms</p>	
<p>Forme juridique</p>	
<p>N° SIREN <input style="width: 100px;" type="text"/></p>	
<p>Adresse</p>	
	<p>Rue</p>
	<p>Code postal et ville <input style="width: 100px;" type="text"/></p>
	<p>Pays</p>
<p>N° de téléphone (facultatif)</p>	
<p>N° de télécopie (facultatif)</p>	
<p>Adresse électronique (facultatif)</p>	
<p>3 AUTRE PARTIE À L'ACTE <input type="checkbox"/> S'il y a d'autres demandeurs, cochez la case et utilisez l'imprimé «Suite»</p>	
<p>Nom ou dénomination sociale</p>	
<p>Prénoms</p>	
<p>Forme juridique</p>	
<p>N° SIREN <input style="width: 100px;" type="text"/></p>	
<p>Adresse</p>	
	<p>Rue</p>
	<p>Code postal et ville <input style="width: 100px;" type="text"/></p>
	<p>Pays</p>
<p>4 NATURE DE L'OPÉRATION CONSTATÉE PAR L'ACTE À INSCRIRE Cochez la case si cette demande d'inscription est déposée simultanément à :</p>	
<p><input type="checkbox"/> une déclaration de renouvellement de marque</p>	
<p><input type="checkbox"/> un recours en restauration ou une demande de relevé de déchéance</p>	
<p>Transmission totale de propriété <input type="checkbox"/></p>	
<p>Transmission partielle de propriété <input type="checkbox"/></p>	
<p>Concession de licence <input type="checkbox"/></p>	
<p>Résiliation de licence <input type="checkbox"/></p>	
<p>Constitution d'un droit de gage <input type="checkbox"/></p>	
<p>Radiation d'un droit de gage <input type="checkbox"/></p>	
<p>Saisie <input type="checkbox"/></p>	
<p>Autre (à préciser) <input type="checkbox"/></p>	

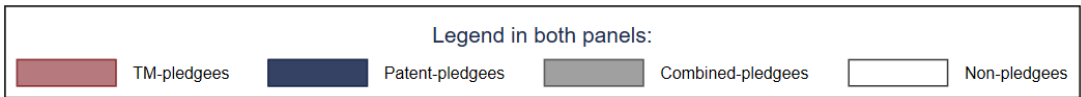
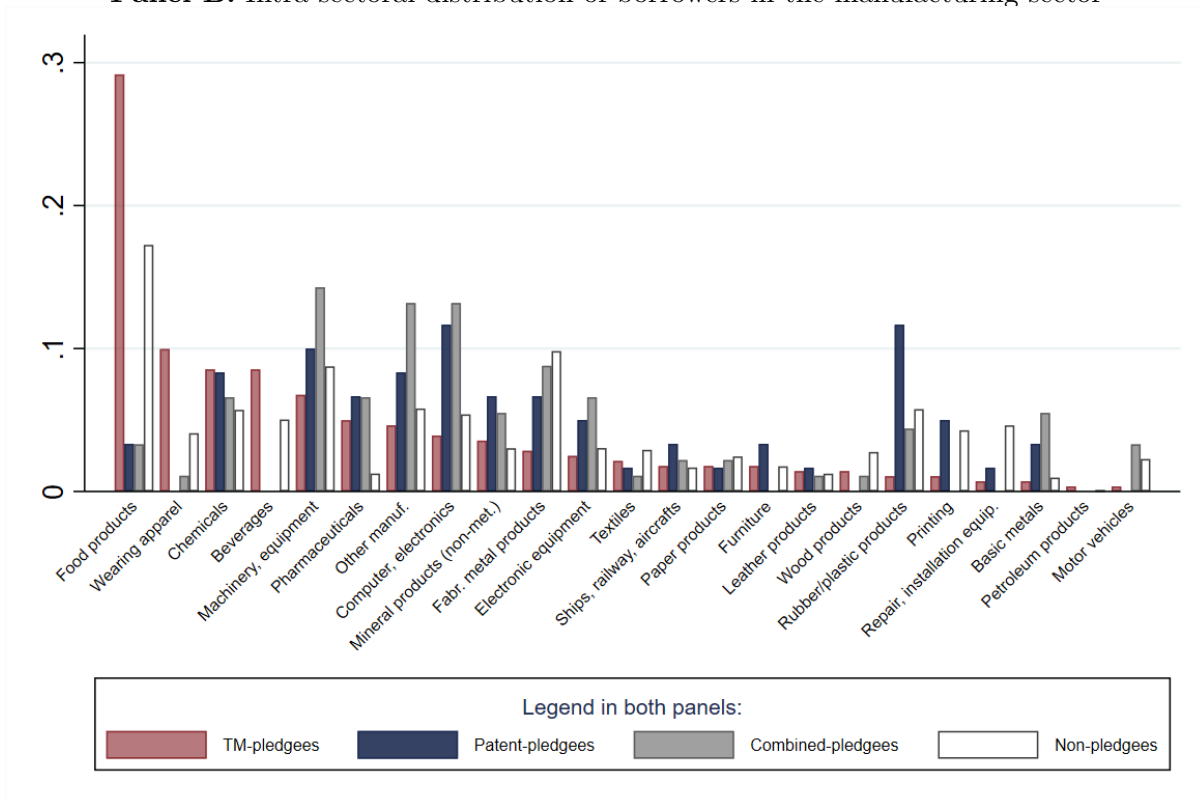
Notes: The figure displays the first page of the form sheet for IP-related legal changes at the French IP office (INPI). IP owners are asked to indicate any changes in ownership, which are specified under point 4. Specifically, pledges of trademarks, patents, and designs are indicated by *Constitution d'un droit de gage*.

Figure IA3: Borrower characteristics: Industries, lenders, and locations,

Panel A: Five sectors with the highest share of IP-pledging firms, by main NACE class



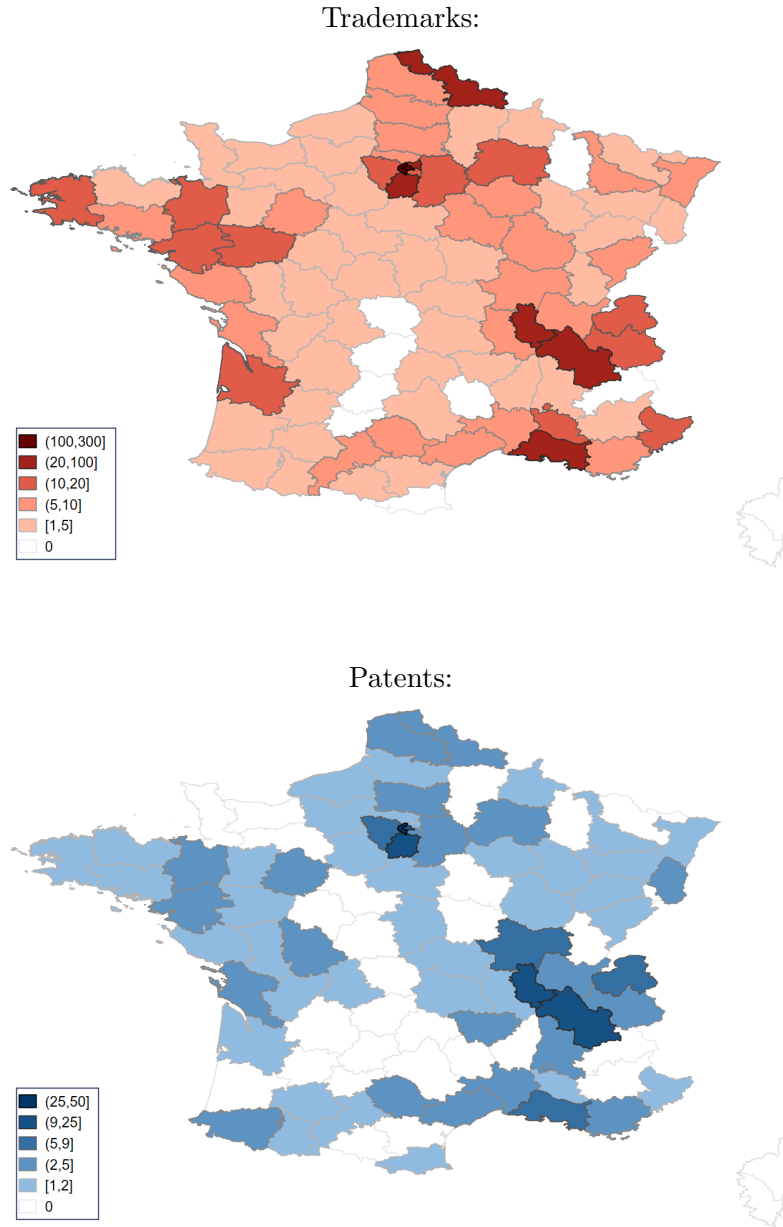
Panel B: Intra-sectoral distribution of borrowers in the manufacturing sector



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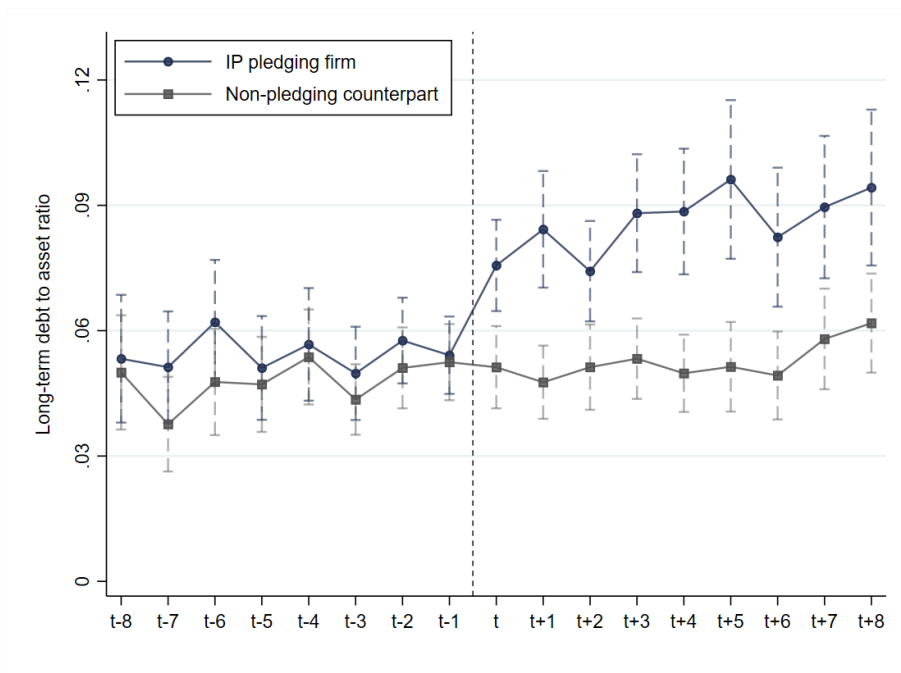
Figure IA3 (continued)

Panel C: Locations of trademark- and patent-pledging firms



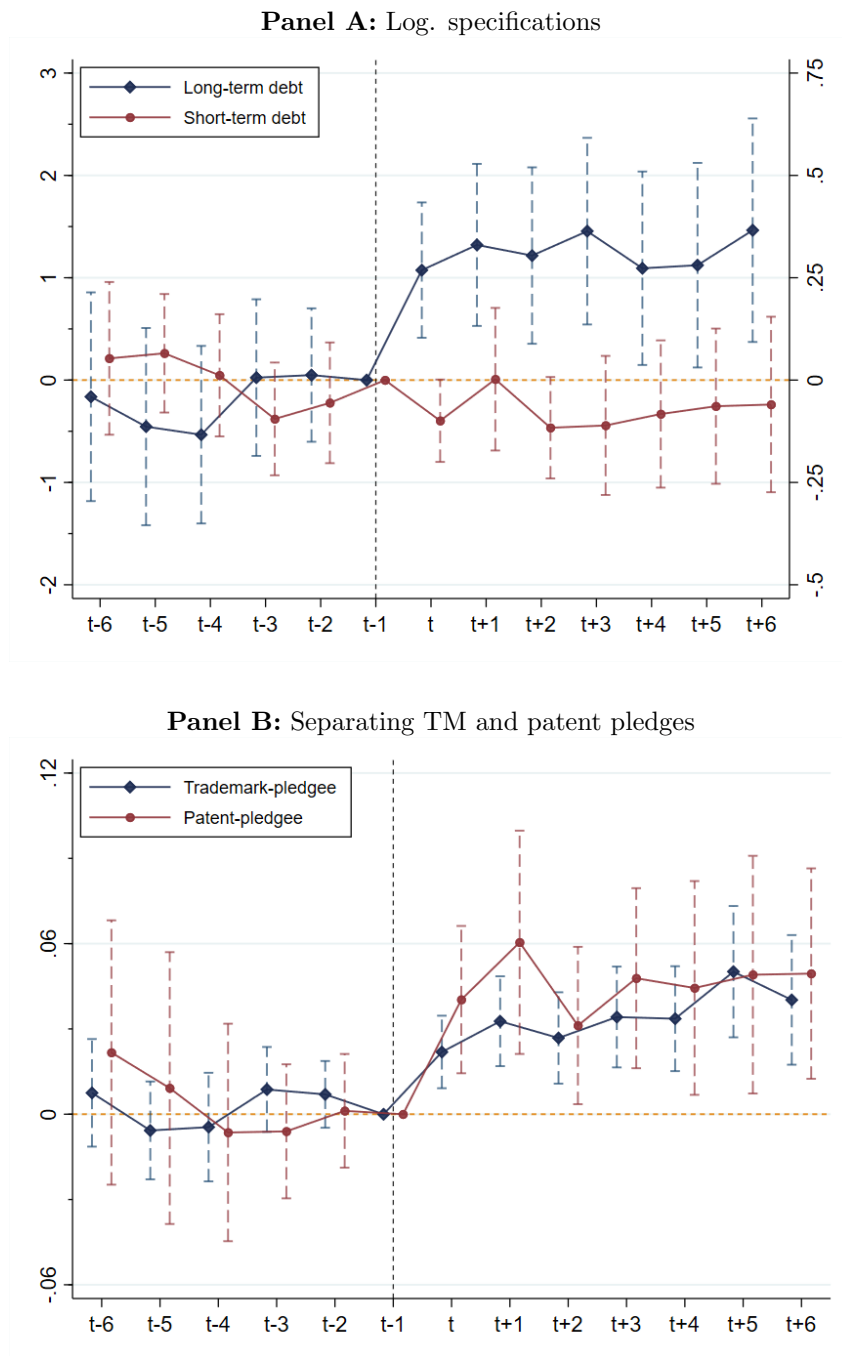
Notes: These figures reports general characteristics of IP-pledging firms. Panel A reports the five NACE sectors with the highest share of IP-pledging firms, distinguishing between trademark, patent, combined, and non-pledges. Panel B reports the intra-sectoral distribution of borrowers within manufacturing, by the same pledge categories. Panel C reports the locations of French firms pledging trademarks (left) and patents (right).

Figure IA4: Mean plots of long-term debt-to-asset ratios relative to pledge year



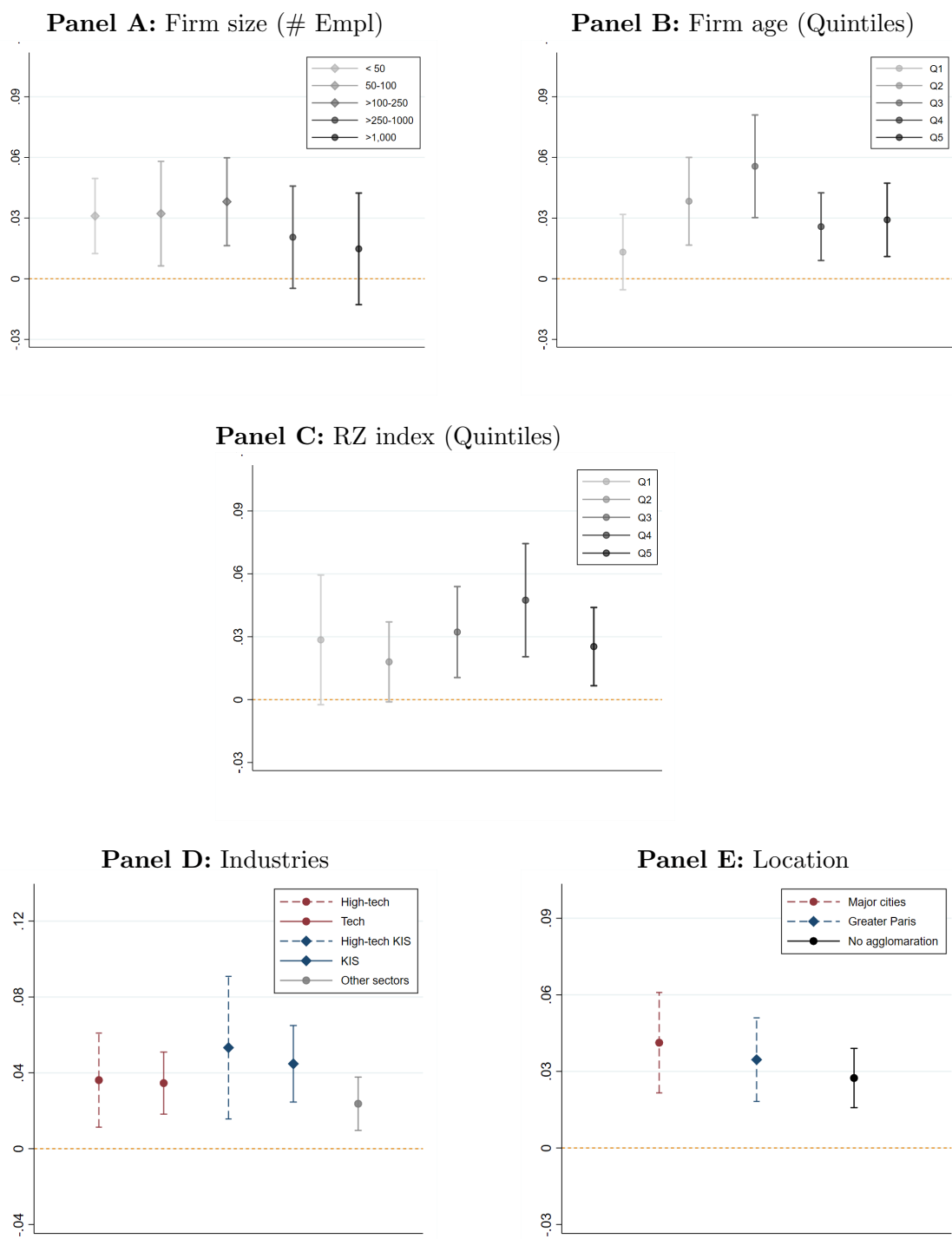
Notes: The figure plots mean values of firms' total debt-to-asset ratios in a symmetric time window of eight years around the initial pledge. The graphs differentiate between IP-pledging firms and matched non-pledging firms from the comparison group. The whiskers span the 95 percent confidence intervals.

Figure IA5: Event-study regression design: Robustness tests



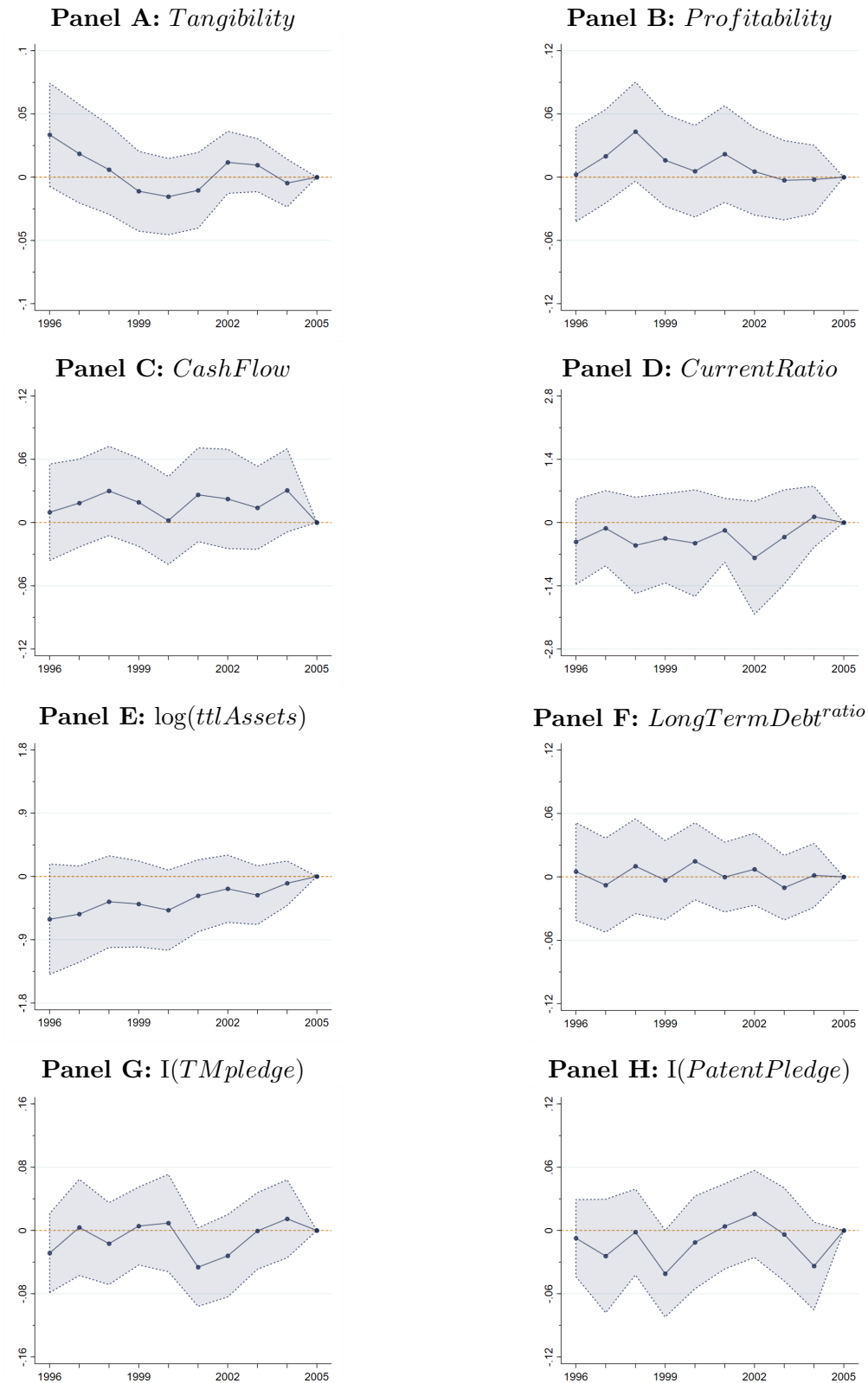
Notes: The graph plots the dynamic treatment effects similar to Figure 3. In Panel A, the dependent variables are the log. specifications (instead of the asset-ratios). Long-term (short-term) debt is indexed on the left (right) y-axis. In Panel B, the dependent variable is again the long-term debt-to-asset ratio but coefficients are estimated separately for IP pledges that include trademarks and patents, respectively. Whiskers span the 95 percent confidence intervals.

Figure IA6: Plausibility test—differential effects of IP pledges across firm-types



Notes: The figures plot the coefficients of the interaction term $IP \times Pledge$, capturing the effect of IP pledges on firms' long-term debt-to-asset ratios, as defined in Equation (1). Each panel presents estimates on different subsamples that are based on the firm-level categories: size (measured as the number of employees), age (splitting the age distribution into quintiles), dependence on external financing (splitting the RZ index distribution into quintiles), different industry sectors, and firm locations; all of which are measured in the year prior to the initial IP collateralization. The RZ index is defined in Rajan and Zingales (1998) and measures the wedge between total capital expenditures and total net cash flow in the year before its first use of IP collateral (or of its matched firm). Sectors are defined as proposed by the European Statistical Office, Eurostat: 1) high-tech sectors, 2) tech sectors, 3) high-tech knowledge intensive services, 4) knowledge intensive services, and 5) all sectors not classified in 1-4. Locations refer to firms headquarters, using three groups of urban versus rural areas: 1) Paris, Lyon, or Marseille; 2) the Greater Paris area; and 3) locations not classified in 1-2. In all panels, the whiskers span the 90 percent confidence intervals.

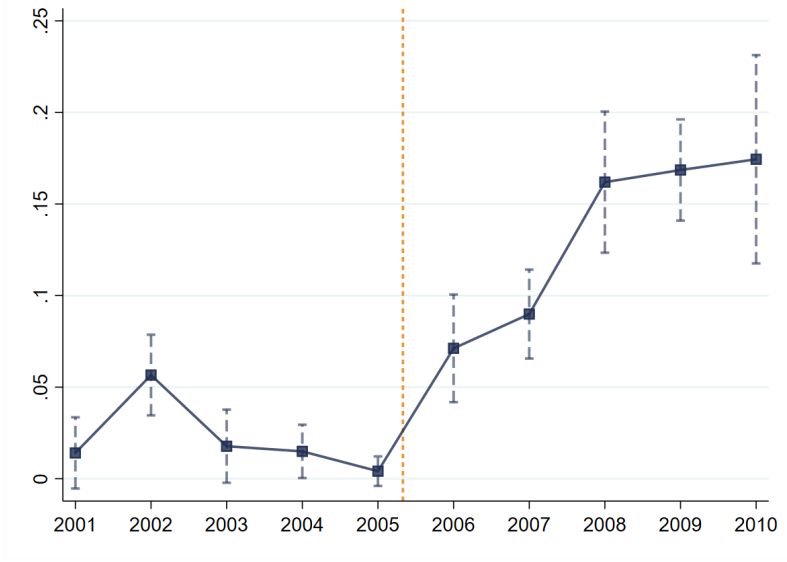
Figure IA7: Testing parallel trends of key variables before the Ordinance



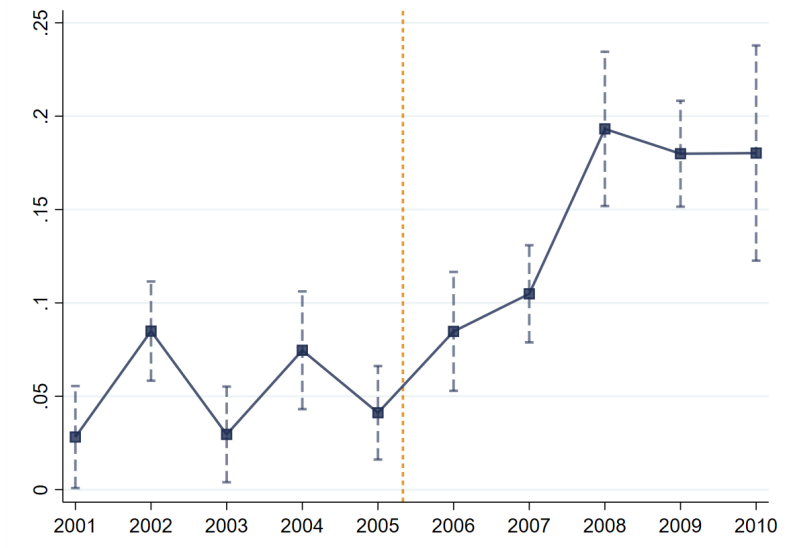
Notes: The figure displays coefficient plots from event study type regressions, testing the parallel trends assumption in the context of the adoption of the Ordinance in 2006. The Panels A–H plot 10-year pre-reform trends for the main outcome and control variables: tangibility, profitability, cash flow, current ratio, firm size (\log . assets), long-term debt, trademark pledges, and patent pledges. All variables are defined in Table IA2 (Appendix). Estimates are based on Equation (2) using the sample period 1996–2005 each year-dummy is interacted with the Tan^{high} indicator. All specifications include timing fixed effects and industry-year fixed effects as well as time-variant balance sheet and IP characteristics as controls. Shaded areas indicate 95% confidence intervals.

Figure IA8: The share of patents used as collateral related to machinery and equipment

Panel A: Patent collateral with CPC technology classes on machinery and equipment



Panel B: Alternative CPC definitions, including other tangible fixed assets



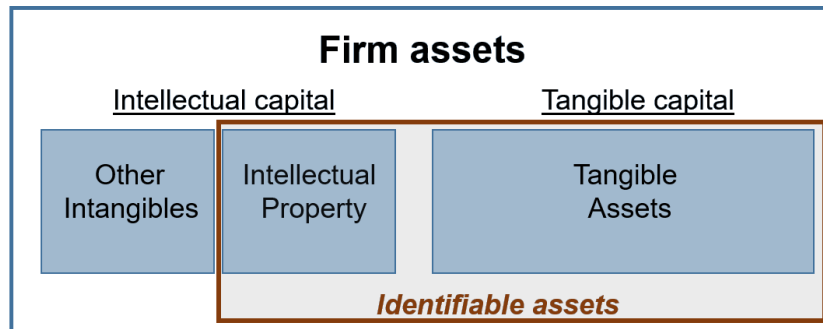
Notes: The figure displays the patent collateral composition before and after the Ordonnance. Specifically, it plots the share of patents used as collateral that have at least one CPC technology class related to machinery and equipment among all patents used as collateral for each of the five years before and after the implementation of the Ordonnance in March 2006. In Panel A, the corresponding classes are F01, F02, F03, F04, F15, F16B, F16C, F16D, F16F, F16H, F16M, and F16P. Panel B uses a broadened definition and additionally considers the CPC classes B21, B23, B24, B27, and B30. The whiskers span the 95% confidence intervals.

Appendix B:

Monetization strategies of IP: As outlined in the main part, identifiability of assets is the fundamental criterion, determining whether an asset can potentially be used in contractual agreements. However, identifiability does not directly imply pledgeability, or, more generally, usability of IP for monetization strategies. Instead, inherent characteristics of IP assets determine the degree of usability. Overall, there are three main strategies for monetizing IP, summarized in Table B1.

Table B1: Monetizing IP: the strategic options to exploit IP for financing purposes

Panel A: Terminology of identifiable (i.e., bankable) assets



Panel B: Summary of the three main monetization strategies

	Monetizing strategy		
	Selling/transfer	Licensing	Collateral
Form of payment	Selling price	Royalty payment	External debt
Contracting partner	Competitor/partner	Competitor/partner	Loan provider (unlikely competitor)
Contracting term	Permanent	Temporally	Temporally (typically long-term)
Main costs	Loss of ownership	Loss of tacit knowledge	Interest payment
Main advantage	Lump sum payment	Maintain ownership, no repayment	Preserve tacit knowledge, lump sum payment

Notes: This table provides a conceptual overview of monetizing IP rights. Panel A illustrates the terminology of identifiable (i.e., bankable) assets, distinguishing IP from other intangibles and tangible assets. Panel B summarizes and compares the key characteristics across the three main monetization strategies—transfers, licensing, and collateralization.

First, selling IP has the benefit of obtaining a lump sum fee that may help firms to cover financing demands on the spot. It is a rational option for IP owners once the transfer price

exceeds the expected private return to its owner. Still, selling comes at particular costs, all of which are based on the irreversible loss of ownership of the IP: owners forgo the option to use the subject matter protected by the respective IP right (see Serrano, 2010; Ciaramella *et al.*, 2017). If the selling firm operates on the downstream market, buyers are likely to be competitors. They can also be non-practicing entities (NPEs) that generate revenues from monetizing IP to practicing firms (see, Cohen *et al.*, 2019). A strategy to maintain the opportunity to use the IP even after transfer would be a sale-and-license back clause. Yet, like in a sale transaction, tacit knowledge would have to be displayed and control rights are lost.

Second, IP owners (i.e., licensors) can grant a license to a licensee to use the IP in exchange for payment. Licensing of IP is well-documented in the economic literature, in particular patent licensing (e.g., Arora and Gambardella, 2010). The obvious benefit for the licensor is to maintain the monopoly right of exploiting the IP while satisfying financial needs. At the same time, in licensing agreements, the licensor often obtains royalty payments that accrue only over time and thus may not satisfy ad hoc financing demands. Still, even if lump-sum royalties would be negotiated, disclosure of tacit knowledge remains one key disadvantage of licensing. As such, licensing is not limited to granting the use of an IP; rather, the tacit knowledge required for proper use of the right is also transferred (Arora *et al.*, 2001). Hence, similar to IP right transfers, in licensing contracts the original IP owner obtains financing at the cost of displaying tacit knowledge, potentially of strategic importance. This is crucial once licensees and licensors are competitors (see Kelchtermans *et al.*, 2022).

Third, an IP owner can use the respective rights as collateral to obtain payment in the form of a loan from a creditor, typically a bank. Just like in any other form of loans, IP collateral may serve the classical functions of mitigating adverse selection issues in external financing transactions by both providing asset values that can be liquidated in case of loan default and acting as signaling device for borrowers' willingness and capability to repay the debt (Holmstrom and Tirole, 1997; Jimenez *et al.*, 2006). Further, any loan agreement comes at the cost of paying

interest on the granted loan, including a full repayment of debt at maturity. Unlike IP transfers and licensing, however, using IP as collateral in loan contracts combines the benefits of receiving lump-sum financing without suffering from the aforementioned costs of loss of ownership or tacit knowledge. Specifically, IP collateral does not require the borrower to display any tacit knowledge to other market participants, nor does it mean losing control and ownership. Firms may also exploit IP rights (via signaling) to raise external equity financing, such as venture capital. Unlike for external debt financing, external equity financing is mostly relevant for high-growth startups and implies a dilution of their equity stakes (see Robb and Robinson, 2014). Given these considerations, IP collateralization appears as a promising monetization strategy, which is applicable for a wide range of firms, does not threaten loss of tacit knowledge or ownership stakes, and warrants the future appropriation of respective IP rights.

IP-level pledgeability determinants: Next, we outline distinct IP-level characteristics that are key determinants for the pledgeability of trademarks and patents. Specifically, we outline measurement approaches for the redeployability, cash flow attribution, and value of IP rights.¹ In this context, we do not consider design rights as they are exclusively pledged together with other rights and are not considered in the main empirical analyses.

Although the implications of these attributes are similar across trademarks and patents, these asset types have conceptual differences such that their distinct legal specificities require us to use different measurement approaches. Still, the intuition behind the pledgeability determinants is mostly comparable across the two IP types and distinct dimensions necessary for collateralization can be assigned to them. Below, we describe in detail different ways on how to approximate the value, redeployability, and cash flow attribution of trademarks and patents. These attributes are certainly not mutually exclusive but rather overlapping concepts. For example, a previous IP transfer indicates the availability of a secondary market for that specific

¹Additionally, the registration of a trademark and the grant of a patent validates their status as an identifiable asset. As a baseline requirement, one must therefore distinguish between registered and not-yet-registered trademarks (*TM_Registered*) as well as granted and pending patent applications (*Granted*).

asset (i.e., its redeployability), while transfers provide actual market prices, facilitating their actual valuation. Table B2 summarizes the key concepts and measurement approaches.

Table B2: Overview on the key IP characteristics and pledgeability determinants

Determinant	Approximation concept	Variable name (hyp. relationship)
<u>Trademarks:</u>		
Identifiability	Formal establishment via registration	<i>TM_Registered</i> (+)
Value	Commercial value as indicated by its relevance to the owner	<i>CorporateMark</i> (+), <i>Renewal</i> (+)
Redeployability	The breadth of the legal right and availability of market values	<i>Transferred</i> (+), <i>NiceClasses</i> (+)
Cash flow	Trademark types determining cash flow link and indication of use in commerce	<i>ConsGoods</i> (+), <i>IndicationUse</i> (+)
<u>Patents:</u>		
Identifiability	Formal establishment upon grant	<i>Granted</i> (+)
Value	Technological and commercial value	<i>FwdCits</i> (+) , <i>FamilySize</i> (+)
Redeployability	Breadth of the legal right and ease of reassigning ownership rights,	<i>IPC4Classes</i> (+), <i>BwdCits_pat</i> (+)
Cash flow	Ability to assign cash flows, value relevance, and technological complexity	<i>PatentAge</i> (+), <i>Applicants</i> (-)

Notes: The table summarizes the different determinants of pledgeability and lists the IP-level measures described in this section. The signs in the parentheses next to the measures display the assumed relationship.

Measures of value: We first consider different measures for IP value. Starting with trademarks, it is possible to explore differences in value depending on the specific trademark type. As such, corporate trademarks represent the organization that stands behind the products or services provided to consumers and are highly value relevant (Sandner and Block, 2011; Agostini *et al.*, 2015). Their pledgeability should be particularly high relative to other types of trademarks. This logic does not apply for patents, which protect inventions embodied in tangible assets, such as machinery and equipment.

As an alternative value measure for trademarks, we build on the fact that IP rights have to be renewed on a regular basis in order to extend their validity. Renewed IP rights thus most likely have some value to their owner and have an existing track record that facilitates

the evaluation of revenue streams arising from the underlying product or service and it directly indicates that an IP rights is used in commerce (Heath and Mace, 2020; Nasirov, 2020; Hsu *et al.*, 2022). In Europe, trademark renewals are due every ten years. To operationalize their use in commerce, it is possible to count the number of previous renewals (*Renewal*).

For patents, a common approach to measure technological quality and, hence, value is the impact on subsequent innovation. The intuitive measure for this is the number of forward citations used to quantify this impact (see e.g., Hall *et al.*, 2005). Moreover, prior research on patent pledges in the U.S. document that patents receiving more citations are more likely to be used in financial transactions (Mann, 2018; Farre-Mensa *et al.*, 2020). Hence, we conjecture that patents with more citations are still significantly more likely to be pledged. Note that we do not consider citations in the case of trademarks. While this approach is certainly promising from trademarks from some jurisdictions, such as the U.S. (Chiu *et al.*, 2022), in the case of European trademarks, such measures cannot be generated since they do not contain information on prior senior registrations.

As an alternative measure of patents value, it is possible to count the number of active jurisdictions, i.e., the family size. Patent protection is a jurisdiction-based right. The number of jurisdictions a patent is active in can be referred to as the patent's family size (*FamilySize*). Importantly, patents seeking protection in several legal jurisdictions are likely to be of higher relevance of the underlying technology for many markets and larger associated revenues. Therefore, a larger family size indicates a higher economic value of a patent (see Harhoff *et al.*, 2003).

Measures of redeployability: Next, we consider different measures for asset redeployability. In general, prior use in market transactions reflect the redeployability of trademarks and patents. In line with prior literature (e.g., Hochberg *et al.*, 2018), such transactions can refer to prior transfers. To operationalize this feature, we use a dummy variable equal to one for trademarks already transferred before the first IP pledge (*Transferred*), and zero otherwise. Since patent transfers are often not well documented, we refrain from using this measure for patents.

Furthermore, it is possible to approximate the potential of IP rights to be transferred in the future. As a direct measure, the number of product or service categories (trademarks) or technology classes (patents) of trademarks and patents, respectively, can be used. They measure captures the legal boundaries of IP rights and reflect the limits of exploitation of the exclusive right (Cabral, 2000; Graham *et al.*, 2018). Broader trademarks and patents should be transacted on secondary markets more easily, i.e., have a higher redeployability. The number of product/service classes or technology classes should indicate IP breadth, i.e., relate positively to their pledgeability. To operationalize this, it is possible to count the number of different NICE classes of trademarks (*NiceClasses*) or the number of distinct technology classes of patents (*IPC4Classes*). As an alternative patent-related measure of technological breadth, it is also possible to count the number of backward citations in the patent literature (*BwdCits_pat*).

Measures of cash flow attribution: The attribution of an IP right to cash flows should vary depending on whether the subject matter is more or less closely linked to revenues. For example, prior research shows that product trademarks can be directly linked to sales while linking service trademarks to revenues is difficult (Block *et al.*, 2015). In fact, the NICE classes explicitly differentiate service and product trademark classes. With these classes, one can distinguish service trademarks from product trademarks and, in particular, consumer goods trademarks which likely have disproportionately high cash flow attribution (*ConsGoods*), e.g., by using a dummy variable equal to one if a trademark is listed in any service mark category and zero otherwise.

As another dimension of cash flow attribution applicable for both trademarks and patents is their potential use in commerce. For trademarks, an indicator on their use in commerce is information on adjustments to their legal status. Specifically, it is possible to count the number of changes in the owner's address, legal oppositions, and licensing agreements (*IndicationUse*). These entries provide a good indication of whether the trademark is used in commerce (Sandner and Block, 2011). For patents, their age (*PatentAge*) is a direct indicator of the certainty about

the associated cash flows. In Europe, patents have to be renewed each year after filing. Due to the more frequent renewal of patents relative to trademarks, we can track the precise age of patents, which have a limited lifespan of usually 20 years. Patents are filed at the early stages of the inventive process (Hsu *et al.*, 2022), rendering younger patents especially unlikely to be relevant for cash flows. Conversely, older patents have a longer track record of past revenue streams associated with them.

In addition to this, the number of distinct patent co-applicants (*Applicants*) can serve as important patent-level measures of cash flow attribution. A higher number of applicants significantly raises the complexity of legal ownership (Kuhn *et al.*, 2020). Hence, it is unlikely that a bank would accept a jointly owned patent, as it significantly reduces the ability to resell the patent on the secondary market. Indeed, for this reason, French law does not allow pledges of co-owned trademarks, whereas no such law exists for patents. The number of patent applicants should thus negatively relate to pledgeability.

Appendix C: Perfecting IP loans in France

Establishing the contract: According to Riffard (2016), the French system is “*extremely rigorous, particularly with regard to the form*”, as creditors can only enforce their rights if the collateral transaction is “*duly registered, containing the statement of the amount of the secured claim, as well as the species and nature of the encumbered asset*” (p. 371). In this context, IP pledges are governed by the combination of the general security law concerning incorporeal property in the Code Civil (CC) and the Intellectual Property Code (IPC). A pledge of IP is defined by CC article 2355 as the allocation of a movable or a set of movable properties as security for an obligation. It provides the lender, who accepts the respective IP as collateral, with the right to receive payment on the collateral in case of default (Séjean and Binctin, 2020). In this context, it is explicitly stated by law that it is possible to pledge different types of IP as collateral, including patents (L. 613-8 CPI), trademarks (L. 714-1, CPI), designs (L. 513-2 and L. 513-3, CPI), and copyrights (L. 131-2, CPI). Excluded from pledgeable IP are collective trademarks, that is, trademarks owned by a group of associated firms and that indicate they belong to the respective associations, such as alliances in the airline industry.

For all loan agreements, the contract must contain a written description of the quantity, type, designation and nature of the collateral in order to legally establish the loan agreement (CC 2336). In the explicit context of IP-backed loans, it is further necessary to include a detailed description of the IP collateral. Unless otherwise specified, the borrower is obliged to carry out due maintenance of the IP collateral. Maintenance entails, for example, the obligation to pay annual renewal fees at the respective IP offices as long as the loan agreement is not terminated. Further, in case of right infringement, the original owner of the IP has to defend their ownership right in court.

Resolving the contract: There are generally three possible scenarios for ending a loan agreement, each of which has different implications in the case of IP-backed loan contracts. First, the

loan is repaid in full, resulting in a release of any obligations attached to the IP collateral back to the original owner. Second, in the case of a default without insolvency the lender has the right to obtain a court order allowing the sale at auction (CC 2346) or to keep the respective IP as a form of payment (CC 2347). In practice, the latter case is unlikely, since the lender is typically a bank and, hence, with an unrelated business field compared to the borrower. Once the selling value in case of default exceeds the required outstanding repayments, the borrower receives the excess amount. In the third scenario, after a default caused by an insolvency of the borrower, a collective proceeding is opened aiming to satisfy the claims of all affected creditors, including the lender of the respective IP-backed loan. Depending on the seniority, the lender will be repaid or has to write off the loan. In any case, the lender can no longer claim the exclusive IP ownership (Code de Commerce L.641-3), which is very similar to loan agreement resolutions in other jurisdictions with strong enforcement regimes, like the United States.

References

- AGOSTINI, L., FILIPPINI, R. and NOSELLA, A. (2015). Brand-building efforts and their association with SME sales performance. *Journal of Small Business Management*, **53**, 161–173.
- ARETZ, K., CAMPELLO, M. and MARCHICA, M.-T. (2020). Access to collateral and the democratization of credit: France’s reform of the Napoleonic Security Code. *Journal of Finance*, **75** (1), 45–90.
- ARORA, A., FOSFURI, A. and GAMBARDELLA, A. (2001). Markets for technology and their implications for corporate strategy. *Industrial and Corporate Change*, **10** (2), 419–451.
- and GAMBARDELLA, A. (2010). The market for technology. *Handbook of the Economics of Innovation*, **1**, 641–678.
- BLOCK, J. H., FISCH, C. O., HAHN, A. and SANDNER, P. G. (2015). Why do SMEs file trademarks? Insights from firms in innovative industries. *Research Policy*, **44** (10), 1915–1930.
- CABRAL, L. M. (2000). Stretching firm and brand reputation. *RAND Journal of Economics*, pp. 658–673.
- CHIU, W.-C., HSU, P.-H. and WANG, C.-W. (2022). Legal Protection of Brand Names and Creditworthiness: Evidence from the 1996 Federal Trademark Dilution Act. *Working Paper*, available at SSRN 3418210.
- CIARAMELLA, L., MARTÍNEZ, C. and MÉNIÈRE, Y. (2017). Tracking patent transfers in different European countries: methods and a first application to medical technologies. *Scientometrics*, **112** (2), 817–850.
- COHEN, L., GURUN, U. G. and KOMINERS, S. D. (2019). Patent trolls: Evidence from targeted firms. *Management Science*, **65** (12), 5461–5486.
- EPO-EUIPO (2022). Intellectual property rights intensive industries and economic performance in the European Union. *Industry-Level Analysis Report*, 4th edition, (ISBN: 978-3-89605-310-7).
- FARRE-MENSA, J., HEGDE, D. and LJUNGQVIST, A. (2020). What is a patent worth? Evidence from the US patent “lottery”. *Journal of Finance*, **75** (2), 639–682.
- GRAHAM, S. J. H., MARCO, A. C. and MYERS, A. F. (2018). Monetizing marks: Insights from the USPTO Trademark Assignment Dataset. *Journal of Economics & Management Strategy*, **27** (3), 403–432.
- HALL, B. H., JAFFE, A. and TRAJTENBERG, M. (2005). Market value and patent citations. *RAND Journal of Economics*, pp. 16–38.
- HARHOFF, D., SCHERER, F. M. and VOPEL, K. (2003). Citations, family size, opposition and the value of patent rights. *Research Policy*, **32** (8), 1343–1363.
- HEATH, D. and MACE, C. (2020). The strategic effects of trademark protection. *Review of Financial Studies*, **33** (4), 1848–1877.
- HOCHBERG, Y. V., SERRANO, C. J. and ZIEDONIS, R. H. (2018). Patent collateral, investor commitment, and the market for venture lending. *Journal of Financial Economics*, **130** (1), 74–94.

- HOLMSTROM, B. and TIROLE, J. (1997). Financial intermediation, loanable funds, and the real sector. *The Quarterly Journal of Economics*, **112** (3), 663–691.
- HSU, P.-H., LI, D., LI, Q., TEOH, S. H. and TSENG, K. (2022). Valuation of new trademarks. *Management Science*, **68** (1), 257–279.
- JIMENEZ, G., SALAS, V. and SAURINA, J. (2006). Determinants of collateral. *Journal of Financial Economics*, **81** (2), 255–281.
- KELCHTERMANS, S., LETEN, B., RABIJNS, M. and RICCABONI, M. (2022). Do licensors learn from out-licensing? Empirical evidence from the pharmaceutical industry. *Technovation*, **112**, 102405.
- KUHN, J., YOUNGE, K. and MARCO, A. (2020). Patent citations reexamined. *RAND Journal of Economics*, **51** (1), 109–132.
- MANN, W. (2018). Creditor rights and innovation: Evidence from patent collateral. *Journal of Financial Economics*, **130** (1), 25–47.
- NASIROV, S. (2020). Trademark value indicators: Evidence from the trademark protection lifecycle in the US pharmaceutical industry. *Research Policy*, **49** (4), 103929.
- RAJAN, R. G. and ZINGALES, L. (1998). Financial dependence and growth. *American Economic Review*, **88** (3), 559–586.
- RIFFARD, J.-F. (2016). The still uncompleted evolution of the french law on secured transactions towards modernity. *Secured Transactions Law Reform (eds.) Louise Gullifer and Orkun Akseli*, pp. 369–389.
- ROBB, A. M. and ROBINSON, D. T. (2014). The capital structure decisions of new firms. *Review of Financial Studies*, **27** (1), 153–179.
- SANDNER, P. G. and BLOCK, J. H. (2011). The Market Value of R&D, Patents and Trademarks. *Research Policy*, **40** (7), 969–985.
- SERRANO, C. J. (2010). The dynamics of the transfer and renewal of patents. *RAND Journal of Economics*, **41** (4), 686–708.
- SÉJEAN, M. and BINCTIN, N. (2020). Security rights in intellectual property in france. In *Security Rights in Intellectual Property*, Springer, pp. 373–393.
- USPTO (2016). Intellectual Property and the U.S. Economy: 2016 Update. <https://www.uspto.gov/sites/default/files/documents/IPandtheUSEconomySept2016.pdf>, (accessed: 2021/20/09).